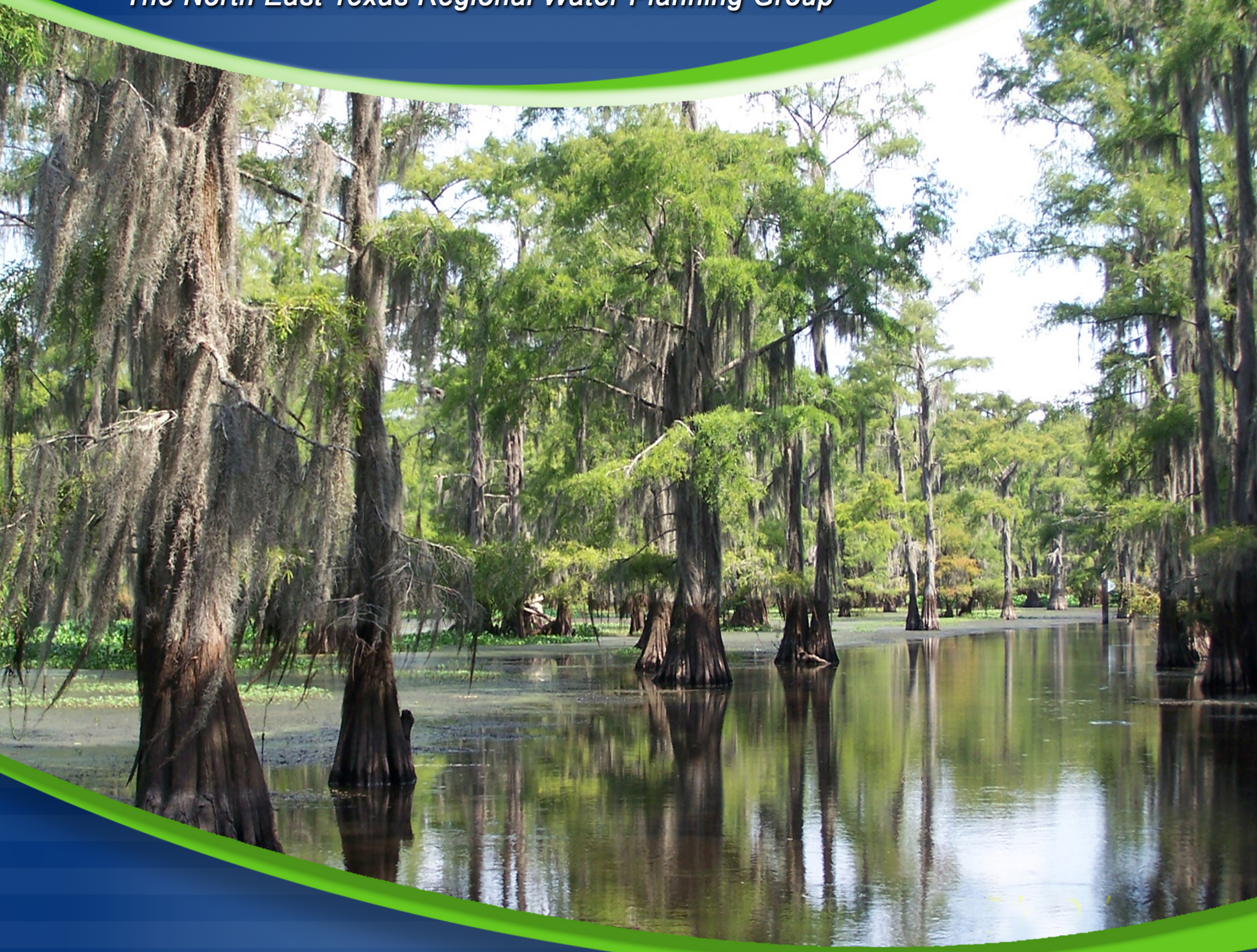
2016 REGION D WATER PLAN VOLUME I

Prepared for
The North East Texas Regional Water Planning Group



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2016 REGION D
REGIONAL WATER PLAN

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The North East Texas
Regional Water Planning Group

December 1, 2015

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NORTH EAST TEXAS REGIONAL WATER PLANNING GROUP 2015

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LIST OF ACRONYMS

ac-ft	acre-feet
ac-ft/yr	acre-feet per year
afy	acre-feet per year
BBEST	Basin and Bay Expert Science Team
BEG	Bureau of Economic Geology
BMP	Best Management Practice
cfs	cubic feet per second
CO	County Other
COG	Council of Governments
CWP	Consensus Water Planning
DFC	Desired Future Conditions
DO	Dissolved Oxygen
DOR	Drought of Record
DPC	Drought Preparedness Council
FCWD	Franklin County Water District
FWSD	Fresh Water Supply District
gpm	gallons per minute
gpcpd	gallons per capita per day
gpcd	gallons per capita daily
GAM	Groundwater Availability Models
GCD	Groundwater Conservation District
GMA	Groundwater Management Area
IPP	Initially Prepared Plan
LCWSD	Lamar County Water Supply District
MAG	Modeled Available Groundwater
MCL	Maximum Contaminant Level
MGD	million gallons per day
mg/l	milligrams per liter
MTBE	Methyl Tertiary Butyl Ether
MUD	Municipal Utility District
NETMWD	Northeast Texas Municipal Water District
NETRWP	North East Texas Regional Water Plan
NETRWPG	North East Texas Regional Water Planning Group
NRCS	Natural Resources Conservation Service
NTMWD	North Texas Municipal Water District
PMF	Probable Maximum Flood
RRAD	Red River Army Depot
RRCP	Red River Commerce Park
RRRA	Red River Redevelopment Authority
RWP	Regional Water Planning
RWPG	Regional Water Planning Group
RWRD	Riverbend Water Resources District
PET	Potential Evapotranspiration

SB	Senate Bill
SRA	Sabine River Authority
SRBA	Sulphur River Basin Authority
SaRMWD	Sabine River Municipal Water District
SuRMWD	Sulphur River Municipal Water District
SUD	Special Utility District
SWQM	Surface Water Quality Monitoring
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TCFWSD	Titus County Fresh Water Supply District
TDA	Texas Department of Agriculture
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Limits
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TSDC	Texas State Data Center
TSSWCB	Texas State Soil and Water Conservation Board
TWC	Texas Water Code
TWDB	Texas Water Development Board
UCM	Unified Costing Model
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WAM	Water Availability Models
WCD	Water Conservation District
WMS	Water Management Strategy
WSC	Water Supply Corporation
WUG	Water User Group
WWP	Wholesale Water Provider

EXECUTIVE SUMMARY

The North East Texas Regional Water Planning Group (NETRWPG) represents the North East Texas Regional Water Planning Area (here after referred to as the North East Texas Region). This region is made up of all or part of 19 counties in North East Texas (See Figure 1.1), including Bowie, Camp, Cass, Delta, Franklin, Gregg, Harrison, Hopkins, Hunt, Lamar, Marion, Morris, Rains, Red River, Smith, Titus, Upshur, Van Zandt and Wood. This RWPG includes representatives of eleven (11) key public interest groups; in addition, there is at least one representative from each of the 19 counties. The administrative agent for the group is the Northeast Texas Municipal Water District, located in Hughes Springs, Texas.

The ultimate goal of the State Water Plan is to identify those policies and actions that may be needed to meet Texas' near- and long-term water needs based on a reasonable projected use of water, affordable water supply availability, and conservation of the state's natural resources.

The Regional Water Planning Groups have been charged with addressing the needs of all water users and suppliers within their respective regions. Groups are to consider socioeconomic, hydrological, environmental, legal and institutional aspects of the region when developing the regional water plan. Specifically, the groups are to address three major goals. These goals include:

- Determine ways to conserve water supplies;
- Determine how to meet future water supply needs; and
- Determine strategies to respond to future droughts in the planning area

This executive summary provides an overview of the eleven (11) chapters of the 2016 Regional Water Plan (RWP) for the North East Texas Region (Region D).

Chapter 1: Description of the Regional Water Planning Area

The Planning Process

The Texas Water Development Board (TWDB) has developed a set of twelve tasks that the regional groups are to accomplish in the regional water plan. This report addresses these tasks in the following manner:

Chapter 1 presents a description of the planning region including the region's physical characteristics, demographics and economics. Other information included in this description are the sources of surface and groundwater, major water suppliers and demand centers, current water uses, and water quality conditions. Finally, an initial assessment of the region's preparations for drought is discussed, as well as the region's agricultural and natural resources and potential threats to those resources.

Chapter 2 addresses population and water demand projections. Population and water demand projections have been completely revised from previous planning rounds, utilizing 2010 U.S. Census data. TWDB, in conjunction with Texas Commission on Environmental Quality (TCEQ), Texas Parks and Wildlife Department (TPWD), and Texas Department of Agriculture (TDA), has prepared population and water demand projections for all water demands and all Water User Groups (WUGs). Draft population and water demand projections were provided to the RWPGs for review, with requested changes to the projections made where provided by the RWPG. The population and water demand projections were formally adopted for use in development of the 2016 RWPs.

Chapter 3 is an evaluation of current water supplies in the North East Texas Region, including surface and groundwater. It also presents the available supplies for each user group.

Chapter 4 of the report presents identified water needs (i.e., shortages) and surpluses in the region and lists shortages by county and river basin. It also includes a comparison of supply and demand for each wholesale water provider.

Chapter 5 of the plan presents the identification of potentially feasible water management strategies for solving each shortage, evaluations of these potentially feasible strategies, and recommended and alternative water management strategies, along with implementation evaluations, cost estimates, and environmental analyses. This chapter establishes criteria to be applied in the evaluation of water management strategies, and includes a sub-section regarding conservation recommendations and a model water conservation plan.

Chapter 6 of the plan presents a discussion on the impacts of the plan, with consideration of water quality and the movement of water between rural and urban areas, and provides a description as to how this plan is consistent with the long-term protection of the State's water resources, agricultural resources, and natural resources. Additionally, this chapter also addresses the potential impact of the Marvin Nichols I Reservoir on the long-term protection of the State's water resources, agricultural resources, and natural resources.

Chapter 7 consolidates existing information on droughts of record and drought preparations in the region and presents a variety of recommendations developed by the RWPG in this regard. Additionally, this chapter includes a region-specific model drought contingency plan.

Chapter 8 identifies policy recommendations regarding designation of unique reservoir sites and unique streams. Other policy recommendations include interbasin transfers, conversion of water supplies from groundwater to surface water, Texas Commission on Environmental Quality (TCEQ) regulations, and improvements to the regional water supply planning process.

Chapter 9 constitutes a reporting of financing mechanisms for water management strategies in the plan.

Chapter 10 consists of a summary of public involvement throughout the planning process, including comments on the IPP and responses, and documentation of the 2015 Conflict Resolution process for Region C and D.

Chapter 11 provides a description of the level of implementation of previously recommended WMSs for meeting needs, and a summary comparison of the present 2016 plan to the previous 2011 plan.

Physical Description of the Region

The North East Texas Region is located in the northeast corner of Texas. It is bordered on the east by the Texas/Louisiana/Arkansas border and on the north by the Texas/Oklahoma/Arkansas border. The western boundary of the region is approximately 110 miles west of the eastern edge of Texas, and the southern boundary is located approximately 100 miles south of the northern boundary. The region encompasses approximately 11,500 square miles (refer to Figure 1.1).

Regional Entities

The North East Texas Region includes all or a part of the following counties (refer to Figure 1.2 for the Water Planning Area Map):

Bowie County	Camp County	Cass County
Delta County	Franklin County	Gregg County
Harrison County	Hopkins County	Hunt County
Lamar County	Marion County	Morris County
Rains County	Red River County	Smith County (partial)
Titus County	Upshur County	Van Zandt County
Wood County		

Natural Resources

Soils within the North East Texas Region are good for crop production and cattle grazing. In early Texas history, the soils in the Blackland Prairies Belt were considered well suited for row-crop farming, and farmers, realizing the potential of the area, brought their families there to work the land. Soils in the Piney Woods support fruit crops, especially peaches, blueberries and strawberries. The Piney Woods is also abundant in timber and supports a large timber industry.

Livestock is another important economic resource in Northeast Texas. Cattle in Northeast Texas are raised for stocker operations, cow-calf operations, beef production and dairies. Northeast Texas is home to major poultry processing plants, and many farmers raise poultry for eggs and broilers. Finally, hogs and horses are significant in some counties, but are raised less extensively region wide.

Socioeconomic Characteristics of the Region

Historical and Current Population

Population in the North East Texas Region has both increased and declined in the past 100 years due to economic (primarily agricultural) change. Much of the economy in northeast Texas has historically been based on agriculture, and many large on-farm families lived in the area until the 1930's. The region as a whole grew 54 percent compared from 1970 to 2000, compared to an 86 percent growth in Texas and a 38 percent growth in the United States.

Demographics

The North East Texas Region is largely rural. Most towns within the region have populations of less than 10,000, and there are many small, unincorporated areas within counties. The 2010 U.S. Census identifies totals of ethnic categories, including black, white, and other (Asian, American Indian, Hispanic, etc.). The graph in Figure 1.13 illustrates ethnic percentages in the North East Texas Region compared to the state. Populations are projected to increase from approximately 762,000 in 2010 to over 1.3 million in 2070.

Economic Activity

The North East Texas Region's main economic base is agribusiness. Crops are varied, and include vegetables, fruits, and grains. Cattle and poultry production are important – cattle for dairies and cow-calf operations, and poultry for eggs and fryers. In the eastern half of the region, the timber, oil and gas industries are important, as is mining. Many residents on the western border of the region are employed in the Dallas-Ft. Worth Metroplex.

Descriptions of Water Supplies and Water Providers in the Region

The Carrizo-Wilcox and Trinity aquifers are two major aquifers in the North East Texas Region. Minor aquifers in the region are Blossom, Nacatoch, Queen City and Woodbine aquifers. The Region contains portions of the Red, Sulphur, Cypress and the Sabine River Basins. Groundwater is limited in quality and quantity in large portions of the North East Texas Region, and, consequently a majority of the Region relies on surface water supplies. For example, of the estimated 2020 supplies in the Sulphur Basin, 95 percent of the water is surface water; 89 percent of water supplied in the Cypress Creek Basin is surface water, and in the Sabine River Basin, some 81 percent of the need is met by surface water. In the portion of the Red River Basin in the Region, 83 percent of the water supply used is surface water.

Wholesale Water Providers

TWDB rules define a wholesale water provider as any person or entity that has contracts to sell more than 1000 acre-feet of wholesale water in any one year during the five years immediately preceding the adoption of the last Regional Water Plan. Based upon this explanation, the NETRWPG identified 17 wholesale water providers, as follows:

Wholesale Water Provider	Municipal Water Suppliers
Cherokee Water Company	City of Emory
Commerce Water District	City of Greenville
Lamar County Water Supply District	City of Longview
Franklin County Water District	City of Marshall
Northeast Texas Municipal Water District	City of Mt. Pleasant
Sabine River Authority	City of Paris
Sulphur River MWD	City of Sulphur Springs
Titus County FWD #1	City of Texarkana
Cash SUD	

<u>Description of Water Demand in the Region</u>

Historical and current uses in the North East Texas Region include municipal, manufacturing, recreation, irrigation, mining, power generation and livestock. Manufacturing is the predominant use category, exceeding all others combined.

In 2012, total estimated usage in the North East Texas Region – both ground and surface – was 351,784 acre-feet. By 2070, projections developed in this plan indicate usage will reach 956,972 ac-ft, a 172 percent increase from 2012.

Water in the region is also used for recreational demands and environmental demands. The lack of perennial streams limits the viability of navigation projects in Northeast Texas.

<u>Existing Water Planning in the Region</u>

A number of major suppliers in the North East Texas Region maintain regional plans. Among these are the Sabine River Authority, the City of Longview, the City of Paris in conjunction with the City of Irving, Northeast Texas Municipal Water District, Lamar County Water Supply District and the City of Greenville. The Texas Water Development Board completed the development of Groundwater Availability Models (GAMs) of the northern part of the Carrizo-Wilcox, the Queen City, the Woodbine, the Nacatoch, and the Blossom aquifers. The Sulphur River Basin Authority is in the process of developing the "Sulphur River Feasibility Study", in cooperation with the United States Corps of Engineers.

Chapter 2: Population and Water Demand Projections

In each planning cycle, the Regional Water Planning Groups are required to revisit past planning efforts and revise population and water demand projections to reflect changes that have occurred since the previous round of planning and to incorporate any newly available information. Per the Texas Water Development Board's (TWDB) "Guidelines for Regional Water Plan Development (Fourth Cycle of Regional Water Planning)", the population and water demand projections have been completely revised from previous planning rounds, utilizing 2010 U.S. Census data. TWDB, in conjunction with Texas Commission on Environmental Quality (TCEQ), Texas Parks and Wildlife Department (TPWD), and Texas Department of Agriculture (TDA), has prepared population and water demand projections for all water demands and all Water User Groups (WUGs). Draft population and water demand projections were provided to the RWPGs for review, with requested changes to the projections made where provided by the RWPG. The population and water demand projections have been formally adopted for use in development of the 2016 RWPs. The new population projections used in the 2016 RWPs increase population projections in some locations while decreasing population projections in other locations, relative to the population projections in the 2011 RWPs.

As shown in the Executive Summary Appendix, Table ES.1, population is projected to grow by approximately 65% from the years 2020 to 2070. Total annual water demand is expected to increase approximately 51%, or 322,800 ac-ft/yr, from 2020 to 2070. The increase in regional water demand will be due to increases in steam electric, manufacturing and municipal water demand. The largest percentage of water is currently used for manufacturing and municipal uses. In the future, demand for steam electric power generation is expected to grow substantially as greater needs for electric utilities powering this region and other regions within the state increase through 2070.

Cass, Harrison, Morris and Titus Counties currently have, and are projected to continue to have the highest overall water demand through 2070. Due to population growth (municipal demand), manufacturing and to a lesser extent steam electric power generation growth, the Sabine River Basin is projected to have the highest overall water demand of the six river basins within the region. Approximately 168,000 acre-feet of water will be needed in 2070 for the portion of the Sabine River Basin that is in this Region.

Approximately 20% of the total regional water demand is for municipal purposes. Municipal water demand for the North East Texas Region is projected to increase by approximately 74,000 acre-feet, or 55% over the fifty year planning period (2020 to 2070). Municipal water demand is currently concentrated in Gregg, Bowie and Hunt Counties. Driven by the large population growth, Hunt County municipal water demand is projected to grow by over 210% through the year 2070.

Over the fifty year period from 2020 to 2070, 52% to 48% of the total water demand in the North East Texas Region is projected to be manufacturing demand. Manufacturing water demand for the region is projected to grow approximately 38% in the period from 2020 to 2070. Harrison, Cass, and Morris counties currently have the greatest demand for water used for manufacturing purposes. These three counties are also projected to have the greatest incremental manufacturing water demand growth through 2070. The three largest water using industries in the region, in order of size, are: International Paper , U.S. Steel, and Eastman Chemical Company.

Annual steam electric water demand is projected to increase 131% from the year 2020 to 2070. The majority of this increase is expected to occur in Hunt, Harrison, Titus and Lamar counties as steam electric power generation facilities are expanded and additional facilities are anticipated to come on-line to supply the power generation needs of Region D and surrounding regions. In 2020, steam electric power generation projections represent approximately 15% of water demand for this Region. By 2070 steam electric is anticipated to require 23% of the region's water demand.

Irrigation, Livestock, and Mining water demand represent relatively small portions of water demanded within the region. They represent 6%, 4% and 1% of water demanded in the North East Texas Region in the year 2020, respectively. Irrigation, Livestock, and Mining water demand is expected to remain relatively constant over the 50 year planning period, with a reduction in percentage of total water demanded to just over 4%, 2%, and 1% of Regional water demand, respectively.

Chapter 3: Water Supply Analysis

A key task in the preparation of the water plan for the North East Texas Region is the determination of the amount of water that is currently available to the Region. As part of the evaluation of current water supplies in the region, the water planning group was charged with updating the water availability numbers from the 2011 Regional Water Plan through the use of the newly completed Water Availability Models (WAM) for surface water and Groundwater Availability Models (GAM) for groundwater sources.

The North East Texas Regional Water Planning Region includes all or a portion of 19 counties that encompass major portions of four river basins: the Cypress Creek Basin, the Red River Basin, Sulphur River Basin and the Sabine River Basin. Relatively small portions of the Neches River Basin and the Trinity River Basin also extend into the North East Texas Region. Surface water sources within the region include rivers, streams, lakes, ponds, and tanks.

As required by TWDB rules, for the 2016 Regional Water Plan, the most recently available TCEQ Water Availability Models (WAM) for reservoirs and river systems were utilized. The WAM was developed to account for water availability during drought of record conditions and considers factors such as reservoir firm yield, run-of-river diversions, direct reuse from currently installed wastewater reclamation practices and indirect use (return flow) and assumed full exercise of senior water rights within a system. Table ES.2 in the Executive Summary Appendix displays the water supply determined to be available by WUG category.

Six aquifers were identified within the North East Texas Region. Major aquifers, as classified by the Texas Water Development Board, include the Carrizo-Wilcox and Trinity aquifers. The Blossom, Nacatoch, Queen City and Woodbine aquifers are four minor aquifers present in the North East Texas Region.

Groundwater availability was based on the Modeled Available Groundwater (MAG) volumes that may be produced on an average annual basis to achieve Desired Future Conditions (DFC) as adopted by Groundwater Management Areas (GMAs) (per Texas Water Code §36.001. Groundwater availability is not limited by permits currently issued. MAG volumes for each aquifer were provided by TWDB, and split into discrete geographic-aquifer units by: Aquifer/Region/County/Basin.

Chapter 4: Identification of Water Needs

The objective of this chapter is to compare the water demands within the North East Texas Region, as presented in Chapter 2, with currently available water supplies, as presented in Chapter 3. This chapter compares the demands and supplies of each Water User Group (WUG) within the Region to determine which entities are projected to encounter demands greater than their projected supplies, or water supply shortages. Water shortages for all six user group categories (municipal, manufacturing, mining, steam electric, irrigation, and livestock) are presented in three ways. First, shortages are presented at the county level. WUG's that span two or more counties are listed in each of the counties in which they are located. Second, shortages are shown by river basin. WUG's are listed in the river basin where the demands occur, rather than the basin where the supplies are located. If a WUG demand spans two or more river basins, it is divided proportionately between the appropriate basins. Finally, water shortages are presented for major water providers. If an entity obtains water from more than one major water provider, it is listed under each of its water sources. Tables ES.3 and ES.4 in the Executive Summary Appendix display the water needs and second tier water needs by WUG category, respectively. Table ES.5 presents a source water balance indicating no overallocation of source availability in the Region.

Within the North East Texas Region, five general strategies have been identified to meet water shortages. The first strategy is advanced water conservation, when identified as appropriate considering TCEQ regulatory minimums. The second strategy is the voluntary reallocation of existing supply sources to more efficiently meet an identified need. The third strategy is to increase the amount of an existing surface water contract. This strategy is used when a WUG has an existing contract and the surface water source has an adequate supply of surface water. Alternatively, several such strategies necessitate contingency upon strategies developed by a Water Provider. The fourth strategy is for the WUG to enter into a new contract with a Wholesale Water Provider (WWP) or WUG Seller to provide an adequate supply for the system. The fifth strategy is to drill a new well or multiple wells to meet the demand of the WUG.

Chapter 5: Identification and Evaluation of Potentially Feasible, Recommended, and Alternative Water Management Strategies

The NETRWPG's approach to the evaluation of water management strategies focused on the modeled water supply yield, cost, the anticipated environmental impact of each water management strategy, and local information developed from the individual WUGs. In accordance with TWDB guidelines, yield is the quantity of water that is available from a particular strategy under drought-of-record hydrologic conditions.

The cost of implementing a strategy includes the estimated capital cost (including construction, engineering, legal, and other costs), the total annualized cost, and the unit cost expressed as dollars per acre-foot of yield. As indicated, cost estimates include the cost of water delivered and treated for end user requirements. Cost estimates were prepared utilizing the TWDB Unified Costing Model (UCM), in accordance with TWDB guidelines regarding interest rates, debt service, and other project costs (e.g., environmental studies, permitting, and mitigation). Treated and raw water rates at the time of publication were acquired, when possible, from regional water providers, and are to be used solely for comparative purposes of the various strategies considered herein. These costs represent a snapshot indicative of the order of magnitude of potential present contract costs, and are not intended to be indicative of future rates for raw or treated water; as such rates are individually negotiated and will likely vary in the future. In addition to environmental considerations included in estimates of cost for each strategy, environmental impacts were considered and assessed at a reconnaissance level.

The North East Texas Regional Water Planning Group (NETRWPG) recognizes that a wide variety of proposals could be brought before TCEQ and TWDB. For example, TCEQ considers water right applications for irrigation, hydroelectric power, and industrial purposes, in addition to water right applications for municipal purposes. It also considers other miscellaneous types of applications, such as navigation or recreational uses. Many of these applications are for small amounts of water, often less than 1,000 acre-feet per year. Some are temporary. Small applications to the TCEQ of this nature are consistent with the 2016 North East Texas Regional Water Plan, when the surface water uses will not have a significant impact on the region's water, even though not specifically recommended in the regional water plan.

The NETRWPG has identified a total of 71 Water User Groups with shortages during the 2020 – 2070 planning period which will require strategies in this plan. A total of 98 Water Management Strategies are recommended herein to meet these projected shortages. There are many instances wherein multiple strategies are recommended to meet the projected demands for a given WUG. 37 shortages will be resolved by simply renewing, extending, or increasing existing water purchase contracts, and will not require capital expenditure or new sources of supply. As noted previously, 13 shortages will be resolved with the implementation of Advanced Water Conservation measures. 32 shortages will be resolved with additional groundwater supplies. There are six (6) instances of recommended voluntary reallocations of existing supplies, recommended to WWP and WUG sellers in the region to meet projected customer needs. These comprise a portion of a total of 12 "seller" strategies have been recommended for six (6) of the WWPs and WUG sellers that provide water in to customers in the North East Texas Region. There are 12 water management strategies that have been recommended that entail more significant development of infrastructure or implementation of practices (in the case of dredging) to develop additional supplies utilizing existing surface water resources in the region.

In general, most of the projected water supply needs within the North East Texas Region are associated with manufacturing, steam electric power generation, and relatively small municipal water user groups. Overall, the recommended strategies for meeting these needs involve the development of additional groundwater supplies in areas where Modeled Available Groundwater (MAG) availability is not a constraint, the acquisition of surface water supplies from existing sources, and advanced water conservation. Significant major water supply development projects are as follows (in no priority order):

1. Texarkana/Riverbend Water Resources District - Riverbend Strategy - Replacement of Existing Water Treatment Plant (2020);
2. City of Texarkana/Riverbend Water Resources District, Texas - Dredge Wright Patman (2060);
3. Manufacturing and Steam Electric, Harrison County – Toledo Bend Intake and Raw Water Pipeline (2020);
4. Irrigation, Hopkins County – Lake Sulphur Springs Raw Water Pipeline (2020);
5. County-Other, Hunt County – Greenville Tie-In Pipeline (2070;
6. City of Greenville, Hunt County – WTP Expansion (2020)
7. City of Greenville, Hunt County – Chapman Raw Water Pipeline and New WTP (2050);
8. City of Greenville, Hunt County – Toledo Bend Tie-In Pipeline (2070);
9. North Hunt SUD, Hunt County – Delta County Pipeline (2060);
10. Irrigation, Lamar County – Pat Mayse Raw Water Pipeline (2020);
11. City of Clarksville – Wright Patman Pipeline (2040);
12. City of Canton - Direct/Indirect Reuse (2020).

With the exception of the above listed strategies, no other major water supply development projects are recommended to meet needs within the North East Texas Region. Please refer to Chapter 5 of Appendix C for detailed analyses of all proposed strategies. The regional solutions proposed for localized water supply problems will not adversely impact other water resources of the state, will not aggravate or increase threats to agricultural and natural resources (see Chapter 1), and will not result in adverse socioeconomic impacts to third parties from voluntary redistribution of water (e.g., contractual water sales).

Four needs have been identified as remaining unmet in the North East Texas Region for the purposes of the 2016 Plan. A summary of these unmet needs, by category, is presented in Table ES.6 in the Appendix to the Executive Summary.

Summary tabulations of the recommended and alternative Water Management Strategies are presented in Tables ES.7 and ES.8 within the Appendix to the Executive Summary.

Advanced Water Conservation

The 77th Texas Legislature amended the Water Code to require water conservation and drought management strategies in Regional Water Plans. The plan is to include water conservation strategies for each water user group to which Texas Water Code (TWC) 11.1271 applies, and must consider conservation strategies for each water user group with a need. The planning group must also consider drought management for each identified need.

TAC §357.34(g) requires that planning groups "shall include a subchapter consolidating the RWPG's recommendations regarding water conservation." Also required is the inclusion of model water conservation plans pursuant to Texas Water Code §11.1271. The Texas Water Code §11.002(8) (1) defines conservation as "the development of water resources; and those practices, techniques, and technologies that will reduce the consumption of water, reduce the loss or waste of water, improve 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."

Existing Water Conservation & Drought Planning

Current TCEQ regulations require that all water users having an existing permit, certified filing, or certificate of adjudication for surface water in the amount of 1000 acre feet or more, create and submit a water conservation plan. All water user groups are required to have a drought contingency plan. For entities serving over 3300 connections, or for wholesale water suppliers, these drought contingency plans are to be on file with TCEQ. For a number of years the TWDB has required such planning for entities borrowing more than $500,000 through its various programs.

In a survey conducted to obtain data for development of this plan, each WUG was asked if it had a current water conservation or drought management plan. While a substantial number of entities responded positively, there continue to be a number of entities which either do not have a plan, or are not actively pursuing any implementation of their plan.

Water Conservation Strategies

The NETRWPG recommends that a minimum consumption of 115 gallons per capita per day (gpcpd) should be established for all municipal water user groups, and that a reasonable upper municipal level – a goal but not a requirement –be established at 140 gpcpd. The 140 gpcpd target was selected to coincide with recommendations of the TWDB's statewide water conservation taskforce. Using these concepts, a decision matrix was developed (Figure 6.1) to guide consideration of water conservation strategies.

For all municipal use entities, water savings are anticipated in the regional water plan due to plumbing code requirements for low flow fixtures and water saving toilets. Homes built after 1992 should be equipped with low flow toilets and fixtures due to the implementation of the Texas Plumbing Efficiency Standards.

Entities for which this plan's demand projections are greater than 140 gpcpd were considered candidates for additional conservation strategies beyond plumbing code requirements. The strategies for Region D included:

- Single family clothes washer rebates
- Single family irrigation audits
- Single family rainwater harvesting
- Single family rain barrels
- Multi-family clothes washer rebates
- Multi-family irrigation audits
- Multi-family rainwater harvesting
- Commercial clothes washer rebates (coin-operated)
- Commercial irrigation audits
- Commercial rainwater harvesting

For each WUG with a shortage and consumption greater than 140 gpcpd, a water conservation strategy was considered, and a water conservation worksheet for the entity has been included in Chapter 4. After evaluation, the advanced water conservation scenario was only considered as an applicable strategy for a single municipality, the City of Texarkana, whereby savings of of up to approximately 6,815 ac-ft/yr were determined. These amounts are significant due to abnormally high per capita usage developed by TWDB from reported 2011 usage. The conservation savings are adequate to alleviate the shortage for Texarkana, pending development of the proposed new water treatment facility to replace existing infrastructure. Advanced conservation measures recommended by other RWPGs (Region C and Region I) are included herein for consistency.

The criteria for evaluating water conservation measures for manufacturing uses was limited to counties showing a need in this sector during the planning period with use greater than 5,000 ac-ft per year. The counties meeting these criteria include Cass, Harrison, Lamar, Morris, and Titus County.

TWDB Report 362 lists fourteen best management practices for industrial users. Application of each of these practices to the manufacturing industries in these counties is not practical at present. However, the industrial water audit practice is a feasible alternative to consider for implementation. The TWDB Report 362 determined that an audit could result in savings of 10 to 35 percent if an audit has not been performed. The expected savings of implementation of this water conservation strategy is based on a savings of 10 percent, resulting in a total savings of up to approximately 44,159 ac-ft/yr.

Water conservation strategies for other users (irrigation, livestock and mining) were not developed. Irrigation demand is projected to decline from 6% to 4% of the demand over the planning period. Livestock and mining comprise a total of 3% to 5% of the demand. The cost of water in these industries comprises a small percentage of the overall business cost and it is not expected these industries will see a significant economic benefit to water conservation.

TWDB's Water Conservation Best Management Practices (BMP) Guide provides information on measures that can be used to reduce the amount of water used in electric power generation plant's cooling towers. The measures include: improved system monitoring and operation, optimal contaminant removal, use of alternative sources for make-up water, and reducing heat load to evaporative cooling. The demand for steam-electric use is projected to grow from 15% to 23% of the demand during the 50-year period. The projections for steam-electric use were provided by the

TWDB. Most of the demand will be consumed by increasing existing contracts, which include conservation in the projected water use. In this round of planning, estimates were not made for steam-electric power water conservation in general because data on operating strategies for each power plant was not available, and many plants have currently implemented conservation measures already. However, advanced conservation was evaluated as a potential strategy for steam-electric use in Hunt County, where information available from the Bureau of Economic Geology (BEG) has identified a range of potential water use using more conservative approaches to power generation that are applicable to present plans in that county.

Model Water Conservation Plan

The planning group has developed and provided in a subchapter to Chapter 5 (and in an appendix) a model water conservation plan for use by holders of 1000 acre feet or more of water rights. A model drought contingency plan for use by wholesale and retail public water suppliers and irrigation districts is presented in Chapter 7 of this plan.

Water Conservation and Drought Management Recommendations

The Regional Water Planning Group offers the following water conservation and drought management recommendations:

1. The State Water Conservation Implementation Task Force recommended a statewide goal for municipal use of 140 gpcpd. Systems which experience a per capita usage greater than 140 gpcpd should perform a water audit to more clearly identify the source of the higher consumption. 140 gpcpd should not be considered an enforceable limit, but rather a reasonable target, which may not be appropriate for all entities. Among other tasks, the audit should establish record management systems that allow the utility to readily segregate user classes. A water audit worksheet prepared by the TWDB (http://www.twdb.texas.gov/conservation/municipal/waterloss/) can be used along with the Task Force's Best Management Practices Guide in performing an audit. The BMP Guide can be downloaded from the TWDB's website on the conservation webpage at (http://www.twdb.texas.gov/conservation/BMPs/index.asp).

2. Higher per capita consumption figures are often related to "unaccounted-for" water – water which is produced or purchased, but not sold to the end user. Systems with a water "loss" greater than 15% should be encouraged to perform physical and records surveys to identify the sources of this unaccounted-for water. TWDB will provide assistance in the form of on-site review of the worksheet, water loss workshops, and the loaning of water loss detection equipment. More information can be obtained on the TWDB website, www.twdb.state.tx.us.

3. The planning group encourages funding and implementation of educational water conservation programs and campaigns for the water-using public; and continued training and technical assistance to enable water utilities to reduce water losses and improve accountability.

Chapter 6: Impacts of the Regional Water Plan, and Description of How the Regional Water Plan is Consistent with Long-Term Protection of the State's Water, Natural, and Agricultural Resources

The strategies recommended herein to address actual shortages are primarily to address shortages in municipal suppliers. Municipal water suppliers are governed by regulations of the TCEQ, primarily Chapter 290 of the Texas Administrative Code. Key parameters of water quality are therefore those regulated by the TCEQ.

Impacts on Water Quality

The 39 strategies utilizing groundwater involve the drilling of additional wells by smaller systems, generally in the 50 to 200 gpm production range. Each of the region's aquifers has been assessed in Chapter 3, using defined capacities of the aquifer that have been determined adequate by the TWDB (via identified Modeled Available Groundwater, i.e. MAG, amounts) to accommodate the additional pumping. Should overdrafting occur, or should wells not be properly completed, degradation of water quality in the aquifer could occur. Possible sources would include brine intrusion from lower levels of the aquifer, or breakthrough from upper, poorly separated strata.

The 37 surface water strategies for entities with actual shortages, involving increasing contractual supplies from existing, adequate surface impoundments should result in no measurable change in the long-term water quality in the existing impoundments. There are four strategies related to the expansion and/or replacement of a WUG's Water Treatment Plants (WTP) and raw water intakes and/or reuse. These strategies include recommendations for the City of Texarkana's WTP, referred to herein as the Riverbend strategy, expansion of the City of Greenville's WTP, an eventual new WTP for Greenville, and indirect reuse for the City of Canton. These strategies are not anticipated to result in measurable changes in the water quality of existing impoundments. One recommended strategy for the City of Texarkana calls for the dredging of Lake Wright Patman. Although the dredging process can have short-term effects on reservoir water quality, no long term detrimental impacts to the water quality of Wright Patman should occur. There are thus eight (8) surface water strategies (for 9 WUGs) involving the movement of water within the North East Texas Region, three (3) of which are contingent upon the importation of water by pipeline from Toledo Bend Reservoir in the lower Sabine River Basin (Region I) to either Harrison County, or to Lake Tawakoni or Lake Fork in the upper Sabine (Region D). The remaining strategies represent recommendations for the movement of supplies within the North East Texas Region.

While it is anticipated that detailed environmental and water quality studies will be performed by project sponsors during the development of a project, for planning purposes the recommended withdrawals of the reservoir contents in terms of overall capacity can be considered minimal to moderate. the comparative evaluations of water quality parameters for sources identified for utilization in the recommended water management strategies suggest minimal impacts to the water quality of the source supplies. The sources under consideration herein presently exist, and when considered in the context of WUGs' existing supplies, are comparable in terms of water quality.

Impacts of Moving Water from Rural and Agricultural Areas

Chapter 357.34 rules require that the plan include an analysis of the impacts of strategies which move water from rural and agricultural areas. As previously noted, a total of 98 strategies were identified for 69 entities in the NETRWPG area. There are 31 of strategies involving the drilling of wells for use in the immediate vicinity of the well. There are 33 strategies involving contractual movements of surface (or groundwater) supplies which are taken from a supply source within the same proximity as the WUG. There are 13 Advanced Water Conservation Strategies, 6 strategies entailing the voluntary reallocation of existing supplies, and 3 strategies involve the expansion of an existing water treatment plant, development of new water treatment plant, and/or the development of new raw water intakes to utilize existing surface water supplies. One strategy entails dredging of a reservoir to address a significant accumulation of sediment that is projected to result in significant future losses of available supply.

There are eight (8) strategies recommending the movement of surface water supplies within the North East Texas Region. With the exception of strategies related to the utilization of water from the Toledo Bend Transfer, these recommended strategies move water either between rural areas, or from urban to rural areas. The three remaining strategies move water from the Toledo Bend Reservoir, which would be considered a rural and agricultural area, to the North East Texas Region. The recommended intake and pipeline for the Harrison County Manufacturing and Steam Electric WUGs would move water to a similar rural and agricultural area in Harrison County.

Recommended projects contingent upon the Toledo Bend Transfer would be moving water from Toledo Bend Reservoir to Lake Tawakoni and/or Lake Fork, for use in Hunt County, which is also a rural and agricultural area. The water remains in the same river basin, and under control of the same river authority. The amount being moved for use in Region D is less than 5% of the capacity of Toledo Bend, and are presently understood to be in excess of the needs of Region I in which Toledo Bend is located. The impacts of moving the proposed quantity of water would be minimal on agricultural interests in the Toledo Bend area.

Socioeconomic Impacts of Unmet Needs

The Texas Administrative Code (31 TAC §357.40(a)) requires that regional water plans 'include a quantitative description of the socioeconomic impacts of not meeting the identified water needs' in the planning area for water users. At its March 18, 2015 meeting, the North East Texas Regional Water Planning Group formally requested that TWDB perform this analysis. The TWDB subsequently performed and submitted the results of this socioeconomic impact assessment to the NETRWPG. This assessment is included in its entirety in the Appendix of this plan.

Protection of Water Resources

The water resources in the North East Texas Region include four river basins providing surface water and six aquifers providing groundwater. The four major river basins within the North East Texas Regional Water Planning Group area boundaries include the Cypress Creek Basin, the Red River Basin, the Sabine River Basin, and the Sulphur River Basin. The respective boundaries of these basins are depicted in Figure 1.19, in Chapter 1. The region's groundwater resources include, primarily, the Carrizo-Wilcox Aquifer, the Trinity Aquifer, the Queen City Aquifer, the Nacatoch Aquifer, the Blossom Aquifer, and the Woodbine Aquifer. Lesser amounts of water are also available from localized shallow aquifers and springs.

Surface water accounts for the majority of the total water use in the Region. Of the estimated 2020 supplies in the Sulphur River Basin, 95 percent of the water used is surface water; in the Cypress

Creek Basin, 89 percent of the water used is surface water; and in the Sabine River Basin, 81 percent of the need is met by surface water. In the portion of the Red River Basin in the region, 83 percent of the water supply used is surface water. Surface water sources (Table 1.6 Existing Reservoirs, Chapter 1) include 10 reservoirs in the Cypress Creek Basin, 2 in the Red River Basin, 11 in the Sabine River Basin, and 11 in the Sulphur River Basin. There are no planned additional reservoirs by the NETRWPG other than Prairie Creek Reservoir. Currently, the majority of the available surface water supply in North East Texas Planning Area comes from the Sabine River Basin. The most recently available TCEQ Water Availability Models (WAM) for each river basin have been utilized to assess the firm availability of surface water under drought conditions.

The Carrizo-Wilcox Aquifer is the most important groundwater resource in the North East Texas Regional Water Planning Group area, accounting for a total of 72% of the available groundwater. Recent groundwater level observations indicate there are significant water level declines in the Carrizo-Wilcox Aquifer in Smith and Cass Counties. The City of Tyler has made significant investments to reduce their dependency on groundwater in Smith County. Modeled Available Groundwater amounts developed by TWDB via Groundwater Availability Models have been used by the NETRWPG to establish available groundwater supplies in the region.

Protection of Natural Resources

The North East Texas Regional Water Planning Group area contains many natural resources that must be considered in water planning. Natural resources include threatened or endangered species; local, state, and federal parks and public land; and energy/mineral reserves. The North East Texas Regional Water Plan is consistent with the long-term protection of these resources. The recommended water management strategies will have little or no impact on the State's natural resources.

Protection of Agricultural Resources

Agriculture is a significant contributor to local economies in the Planning Area. Irrigation is a critical component of successful agriculture operations in the region. Irrigation plays a significant role in numerous nurseries in the Sabine Basin and numerous row crop operations in the Red River Basin. Many dairy and beef cattle operations utilize groundwater from the Carrizo-Wilcox and Queen City Aquifers.

The WAMs indicate adequate availability of surface water to meet the projected irrigation demands for the planning period in all but a single case. Where insufficient reliabilities have been identified, water management strategies have been developed in accordance with TWDB guidelines to provide adequate supplies to meet identified agricultural needs where possible.

The single instance of an agricultural unmet need is for the Irrigation WUG within Red River County. The construction of raw water pipelines to available surface supplies was not considered cost effective, and groundwater availability in Red River County is restricted by the use of Modeled Available Groundwater (MAG) limits employed for the purpose of the 2016 planning process. Given there is no regulatory entity to enforce such limitations within Region D, the reality is that agricultural entities in the county would likely continue to develop groundwater supplies. Thus, no recommended strategy has been identified for the Red River County Irrigation WUG. To reflect the reality of no Groundwater Conservation Districts in Region D, an alternative water management strategy has been identified reflecting estimates of potentially available supply beyond the MAG limitation. However, even when exceeding the MAG limitation, the best available information suggest inadequate groundwater supplies to meet the entirety of the projected irrigation demands for Red River County over the 2020 – 2070 planning period (although roughly 75-percent of the demands are projected to be met). While the NETRWPG has not had time or resources to consider the full range of options it might propose to protect and enhance the agricultural resources of the region, and, thus, the state, by protecting or enhancing instream flow considerations, the NETRWPG has identified studies that provide a basis for including voluntary goals and proposals for such efforts in the Sulphur and Cypress basins.

Consistency with State Water Planning Guidelines

The information, data evaluations, and recommendations included in Chapters 1 through 12 of the North East Texas Regional Water Plan collectively comply with these regulations.

Impacts of Marvin Nichols I Reservoir proposed by Region C in Protecting Region D Resources

Although not a recommended water planning strategy for the North East Texas Regional Water Planning Group for this round of planning, Marvin Nichols I Reservoir was a recommended water management strategy for Region C in 2011 and was included in the 2012 State Water Plan. A similar Marvin Nichols reservoir has also been included in the 2016 Region C Plan as a proposed alternative water management strategy for this round of planning in the year 2070. Since all proposals for Marvin Nichols reservoirs would be located exclusively in the North East Texas Region, and the impacts to agricultural and natural resources would be greatest in this Region, the NETRWPG feels it is important and necessary to review the impacts that any such Marvin Nichols reservoir would have to this area. This is particularly true since the spirit of Texas' regional water planning process includes a ground up, localized approach to the planning process. The discussion below will apply to the Marvin Nichols I/IA Reservoir, since it was included in the 2012 State Water Plan, but the approach applies to any proposed reservoir in the Sulphur River Basin.

It has been the position of the NETRWPG that due to the significant negative impacts upon environmental factors, agricultural resources/rural areas, other natural resources, and third parties, Marvin Nichols I Reservoir should not be included as a water management strategy in any regional water plan or the State Water Plan. In referencing Marvin Nichols I, the North East Texas Regional Water Plan incorporates Marvin Nichols I, Marvin Nichols IA, and any major dam sites on the main stem of the Sulphur River.

It is further the position of the NETRWPG that the reallocation of Wright Patman Reservoir provides a viable potential water management strategy to assist in meeting the needs for Region C. Although the approach may be potentially more expensive to Region C (in terms of the unit costs of water) to meet that region's growing needs, the reallocation of Wright Patman may produce less of a potential impact to the agricultural and natural resources of Region D, while providing greater socioeconomic benefits to North East Texas.

Pursuant to an October 5, 2015 mediation process underwent by designees of the Region C and D planning groups, and subsequently approved by both of the full Region C and D planning groups, the North East Texas RWPG does not challenge Marvin Nichols Reservoir as a unique reservoir site for the purposes of the 2016 Region D Plan and the 2017 State Water Plan.

Chapter 7: Drought Response Information, Activities, and Recommendations

For the purpose of this planning cycle, the drought of the 1950s is declared the Drought of Record (DOR). However, drought is a frequent and inevitable factor in the climate of Texas. Therefore, it is vital to plan for the effect that droughts will have on the use, allocation and conservation of water in the State. Through the regional water planning process, requirements for drought management planning are found in Title 31 of the Texas Administrative Code (TAC), Part 10, Chapter 357, Subchapter D. Drought contingency plans provide a structured response that is intended to minimize the damaging effects caused by water shortage conditions. A common feature of drought contingency plans is a structure that allows increasingly stringent drought response measures to be implemented in successive stages as water supply or water demand conditions intensify. This measured or gradual approach allows for timely and appropriate action as a water shortage develops. Demand management focuses on temporary reductions in use in response to temporary shortages in water supply or other emergencies. The onset and termination of each implementation stage should be defined by specific 'triggering' criteria. Drought response triggers should be specific to each water supplier and should be based on an assessment of the water user's vulnerability. Surface water triggers are widely used in the NETRWPG, typically in conjunction with other triggers based on system demands. Triggering criteria are intended to ensure that timely action is taken in response to a developing situation and that the response is appropriate to the level of severity of the situation.

The NETRWPG does not support the provision of drought management measures as a WMS in the 2016 RWP. Drought management measures vary within the Region, and are temporary strategies intended to conserve supply and reduce impacts during drought and emergency times, and are not implemented in the Region to address long-term demands.

Chapter 8: Unique Stream Segments and Reservoir Sites and Legislative Recommendations

The Regional Water Planning Groups (RWPG) are to include legislative recommendations in the regional water plan with regard to legislative designation of ecologically unique river and streams segments, unique sites for reservoir construction, and legislative recommendations. RWPGs may include in the adopted regional water plans recommendations for all or parts of river and stream segments of unique ecological value located within the regional water planning area. The RWPGs are also authorized to make recommendations of unique sites for reservoir construction and prepare specific legislative recommendations in these two areas. The NETRWPG has elected to make comments in these two areas and in specific cases has elected to consider recommendations to the legislature, which are presented in Chapter 8.

Legislative Designation of Ecologically Unique Stream Segments

The NETRWPG, at the April 15, 2015 meeting, considered nominating stream segments for the designation as an Ecologically Unique Stream Segment. After due deliberation, the NETRWPG elected to forgo unconditionally recommending the designation of any of the considered stream segments as ecologically unique. However, the NETRWPG did recommend the designation of three streams as ecologically unique conditioned upon the Legislature providing for such designation to contain six specific clarifying provisions as follows:

1. A provision affirming that the only constraint that may result from the ecologically unique stream segment designation is that constraint described in Subsection 16.051(f) Texas Water Code which prohibits a state agency or political subdivision of the state from financing the construction of a reservoir in a designated stream segment.

2. A provision stating that the constraint described in Subsection 16.051(f) Texas Water Code does not apply to a weir, diversion, flood control, drainage, water supply, or recreation facility currently owned by a political subdivision.

3. A provision stating that this designation will not constrain the permitting, financing, construction, operation, maintenance, or replacement of any water management strategy recommended, or designated as an alternative, to meet projected needs for additional water supply in the 2010 Regional Water Plan for the North East Texas Water Planning Region.

4. A provision affirming that this designation is not related to the "wild and scenic" federal program or to any similar initiative that could result in "buffer zones," inadvertent takings, or overreaching regulation.

5. A provision stating that all affected landowners shall retain all existing private property rights.

6. A provision recognizing that the unique ecological value of the designated segment is due, in part, to the conscientious, voluntary stewardship of many landowners on the adjoining properties.

The NETRWPG has recommended that the following three (3) stream segments be designated as Ecologically Unique Stream Segments provided that the above reference stipulations are followed:

- **Black Cypress Creek** - From the confluence with Black Cypress Bayou East of Avinger in southern Cass County upstream to its headwaters located four miles northeast of Daingerfield in the eastern part of Morris County.
- **Black Cypress Bayou** - From the confluence with Big Cypress Bayou in south central Marion County upstream to the confluence of Black Cypress Creek east of Avinger in south Cass County.
- **Pecan Bayou** – This Red River Basin Stream extends from two miles south of Woodland in northwestern Red River County east to the Red River approximately one mile west of the eastern Bowie County line.

Voluntary Instream Flow Goals and Proposals

The NETRWPG recognizes the importance of integrating the environmental water needs of the region into the water planning process. One approach would be to treat environmental water needs like other water needs. Healthy river systems need flows that mimic natural conditions, but not all the water that has historically flowed in them. Thus, once the goals of the river basins for healthy instream flow are identified, voluntary strategies can be developed to meet those goals for environmental water needs over time if the goals are not being met.

Current TWDB rules and guidance do not treat environmental water needs in the same fashion as other water needs; however, these rules do authorize regional water planning groups to use a different process to consider how such environmental flow needs are necessary to maintain or enhance the agricultural and natural resources of the region.

In the 2011 Region D Regional Water Plan, the NETRWPG stated that it was taking steps to protect environmental flow goals, such as instream flows. Senate Bill 3 provided for development of environmental flow "standards" for a number of river basins, but did not include an established schedule for the Cypress or Sulphur River basins. Nor has TWDB obtained the funds from the Legislature, as it has for the basins specifically identified in Senate Bill 3, for development of such standards.

Senate Bill 3 does, however, provide that in those basins not listed, voluntary development of environmental flow goals and proposals can proceed.[1] That voluntary approach is taking place in the Cypress Creek Basin.

Over the past 10 years, a number of stakeholders have worked with the U.S. Army Corps of Engineers (USACE) and the Northeast Texas Municipal Water District (NETMWD) to develop a set of environmental flow regimes in the Cypress Basin. Over the past 4 years, USACE and NETMWD have worked to meet those flow regimes through voluntary changes in the water release patterns from Lake O' the Pines. Because of the success of this project to date, NETRWPG considers those regimes as voluntary goals for instream flows for the purposes of this 2016 Region D Plan. The NETRWPG recognizes that, as with other aspects of the planning process, new information in the future may change the position of the NETRWPG on these instream flow goals. The strategies to meet future water needs of regional water plans and the State Water Plan are not to be limited by these voluntary goals for instream flows. Rather, such goals are presented herein as a point of reference for the consideration of whether strategies are consistent with the protection of the agricultural and natural resources of the Cypress Creek Basin and the state that rely upon such flows. The flow regimes for the Cypress Basin report are incorporated in this regional water plan as the voluntary goals for instream flows in that basin.

While a process similar to that used in the Cypress Basin has not yet been developed for the Sulphur Basin, a potential first step has been taken that is important to the NETRWPG. This step is described in more detail in Trungale (2015).

As noted in Trungale (2015), the identified flow regime therein “reflects the historic instream flow conditions that continue to exist today.” The regime has not, however, been subject to review and revision by scientists or stakeholders to determine the extent of this flow regime that is needed to maintain the ecological health of the fish and wildlife habitat and the economic and other values currently provided. Thus, this flow regime serves as only a first attempt at identifying voluntary instream flow goals for the Sulphur River Basin. The NETRWPG proposes and supports the development of a stakeholder process, similar to that of the Cypress Creek Basin, to develop such goals in the future.

1 See Section 11.02362(e), Tex. Water Code , the Senate Bill 3 provision for the "voluntary consensus-building process" for basins not scheduled for the formal environmental flow process

Although the flows identified in Trungale (2015) are not presented herein as requirements to be implemented on regional water management strategies, the flow regime identified therein does provide additional information for consideration of potential impacts on the agricultural and natural resources of the region and the state. This initial work provides a point of reference for considering the pulse flows previously discussed in Chapter 6 as necessary for the floodplain forests below the Marvin Nichols reservoir site.

It is the position of the NETRWPG that there be no development of new reservoirs in the Sulphur River Basin within Region D nor transfer of water out of the basin for that part that is within Region D until the flow needs for a sound ecological environment are defined for the Sulphur River Basin through the process established in Senate Bill 3, 2007 Regular Session of the Texas Legislature. Those flow needs are defined as the low, pulse, and flood flows.

The flow needs assessment for the Sulphur River has not yet begun. No development should take place until the State has identified the flow needs for the Sulphur River and established a demand for the environmental flows for the basin. The NETRWPG recognizes that other regional water planning groups may include recommendations for new reservoirs in the Sulphur River Basin or for the transfer of water out of the Sulphur River Basin to basins in other regions, as part of their recommended water management strategies or as alternate strategies. It is the position of the NETRWPG that such proposed reservoirs or transfers include explicit recognition that the needs for environmental flows in the North East Texas Region must be satisfied first consistent with Senate Bill 3.

Development of new reservoirs prior to determination of the water demands required for environmental flows in the Sulphur River Basin would be premature. It is the position of the NETRWPG that proposed reservoirs or transfers need to be consistent with the protection of significant agricultural and natural resources of Region D and the State.

Reservoir Sites

The TWDB rules allow a Regional Water Planning Group to recommend sites of unique value for construction of reservoirs by including descriptions of the sites, reasons for the unique designation and expected beneficiaries of the water supply to be developed at the site. The NETRWPG has reviewed the 2012 State Water Plan, has reconsidered the 2001 North East Texas Regional Water Plan, specifically the information from the Reservoir Site Assessment Study (Appendix B) of that plan, the most recently available information from the ongoing Sulphur River Basin Feasibility Study currently being performed for the Sulphur River Basin Authority (SRBA) and the U.S. Army Corps of Engineers (USACE), and local studies developed by WUGs within Region D, and has commented on the reservoir sites identified in those documents. The approximately 17 reservoir sites identified are as follows:

Cypress Creek Basin
Little Cypress (Harrison)

Red River Basin
Barkman (Bowie)
Big Pine (Lamar and Red River)
Liberty Hills (Bowie)
Pecan Bayou (Red River)
Dimple (Red River)

Sabine River Basin
Big Sandy (Wood and Upshur)
Carl Estes (Van Zandt)
Carthage (Harrison)
Grand Saline Creek
Kilgore II (Gregg and Smith)
Prairie Creek (Gregg and Smith)
Waters Bluff (Wood)

Sulphur River Basin
George Parkhouse I (Delta and Hopkins)
George Parkhouse II (Delta and Lamar)
Marvin Nichols I/IA (Red River & Titus)
Marvin Nichols II (Titus)

The NETRWPG recommends that any new reservoirs in NETRWPG area be pursued only after all other viable alternatives have been exhausted. The NETRWPG further recommends that no reservoir sites in this region be designated as unique in this Plan or in the 2017 State Water Plan, excepting that the Region D RWPG does not challenge Marvin Nichols Reservoir as a unique reservoir site for the purposes of this Plan and the 2017 State Water Plan.

The NETRWPG recognizes that there are approximately [2] 16 locations, listed above, in NETRWPG area where the topography is such that the area could be classified as uniquely suitable as a reservoir site. The NETRWPG recognizes that the waters of the State of Texas belong to the citizens of Texas for their specific use, but it is also recognized that the properties rights belong to individuals. Local government should be recognized for the effect that major alterations to the local economy, such as the development of a unique reservoir site, will have on them. To address the issue of unique reservoirs and the accompanying property owners, industry, and local government concerns the NETRWPG recommended those issues of identification of a unique reservoir site; mitigation; compensation to property owners, local government, taxing agencies, and business; and future disposition of water resources be considered as early in the process as possible.

The development of reservoirs in the NETRWPG area as a future water source for other portions of the state would require interbasin transfer authorizations from the Texas Commission on Environmental Quality (TCEQ). Among its many provisions, SB 1 includes provisions (Texas Water Code, Section 11.085) requiring the TCEQ to weigh benefits of a proposed new interbasin transfer to the receiving basin against the detriments to the basin supplying the water. SB 1 also established criteria to be used by the TCEQ in its evaluation of proposed interbasin transfers.

The NETRWPG supports the full application of the criteria for authorization of interbasin transfers contained in current state law. With regard to compensation to the basin of origin, the NETRWPG recommends that a portion of the firm yield of projects developed in the NETRWPG basins for interbasin transfer, be reserved for future use within the basin of origin. The specific terms of such compensation, along with other issues associated with development of the project (e.g., financing, operation of the reservoir, etc.), should be addressed by the appropriate representatives of the authority within the basin of origin, in coordination with the water districts and the entities in receiving regions and within the North East Texas Region that are seeking the additional supply.

2 Several potential reservoir locations exist for the proposed Marvin Nichols Reservoir I/IA site, representing varying configurations.

The NETRWPG also endorses the recommendation contained in the adopted Comprehensive Sabine Watershed Management Plan that the Sabine River Authority (SRA) develop the Prairie Creek Reservoir. As previously noted, the Prairie Creek Reservoir and Pipeline Project is being pursued by the Sabine River Authority at this time due to the conservation easement limitation on the Waters Bluff reservoir site. If the conservation easement were removed, the Water Bluff Reservoir would become the Sabine River Authority's top priority project to meet projected water needs in the upper Sabine River Basin.

The NETRWPG also has definite concerns about local property owners who would be directly impacted by reservoir construction. A particular concern is that landowners be compensated fairly for the value of any land acquired for reservoir development.

The NETRWPG recommends that the Wetlands Compensatory Mitigation Rule be closely followed to minimize any impact on the region through the consideration of reservoirs and the mitigation thereof. The group strongly supports the requirement of the mitigation sequence of "avoid, minimize and compensate" should any new reservoirs in Region D be pursued.

It is the position of the NETRWPG that there be no development of new reservoirs in the Sulphur River Basin within Region D nor transfer of water out of the basin for that part that is within Region D until the flows necessary to maintain a sound ecological environment are defined for the Sulphur River Basin through the process established in Senate Bill 3, 2007 Regular Session of the Texas Legislature, resulting in the adoption of environmental standards to be applied to future permits or amendments for surface water supplies in the region.

The North East Texas Regional Water Planning Group does not recommend protection for any of the potential reservoir sites in Region D, with the exception that the NETRWPG does not challenge Marvin Nichols Reservoir as a unique reservoir site for the purposes of this Plan.

As noted in Trungale (2015), the identified flow regime therein "reflects the historic instream flow conditions that continue to exist today." The regime has not, however, been subject to review and revision by scientists or stakeholders to determine the extent of this flow regime that is needed to maintain the ecological health of the fish and wildlife habitat and the economic and other values currently provided. Thus, this flow regime serves as only a first attempt at identifying voluntary instream flow goals for the Sulphur River Basin. The NETRWPG proposes and supports the development of a stakeholder process, similar to that of the Cypress Creek Basin, to develop such goals in the future.

Although the flows identified in Trungale (2015) are not presented herein as requirements to be implemented on regional water management strategies, the flow regime identified therein does provide additional information for consideration of potential impacts on the agricultural and natural resources of the region and the state. This initial work provides a point of reference for considering the pulse flows previously discussed in Chapter 6 as necessary for the floodplain forests below the Marvin Nichols reservoir site.

It is the position of the NETRWPG that there be no development of new reservoirs in the Sulphur River Basin within Region D nor transfer of water out of the basin for that part that is within Region D until the flow needs for a sound ecological environment are defined for the Sulphur

River Basin through the process established in Senate Bill 3, 2007 Regular Session of the Texas Legislature. Those flow needs are defined as the low, pulse, and flood flows.

The flow needs assessment for the Sulphur River has not yet begun. No development should take place until the State has identified the flow needs for the Sulphur River and established a demand for the environmental flows for the basin. The NETRWPG recognizes that other regional water planning groups may include recommendations for new reservoirs in the Sulphur River Basin or for the transfer of water out of the Sulphur River Basin to basins in other regions, as part of their recommended water management strategies or as alternate strategies. It is the position of the NETRWPG that proposed reservoirs or transfers include explicit recognition that the needs for environmental flows in the North East Texas Region must be satisfied first consistent with SB 3.

Development of new reservoirs prior to determination of the water demands required for environmental flows in the Sulphur River Basin would be premature. It is the position of the NETRWPG that proposed reservoirs or transfers need to be consistent with the protection of significant agricultural and natural resources of Region D and the State.

Legislative Recommendations

TWDB rules for the 2016 regional water planning activities provide that Regional Water Planning Groups may include in their regional water plans recommendations to the legislature. The approved scope of work for the development of the regional water plan for the North East Texas Region includes development of legislative recommendations for ecologically unique stream segments, ecologically unique reservoir sites and general recommendations to the state legislature on water planning actives as well as issues in the North East Texas Region.

Throughout the 2016 planning process, the one major policy issue that dominated the meetings of the NETRWPG and received the most comment from the public during the public comment portion of the regular meetings was the designation of the various Marvin Nichols Reservoir Sites in the Sulphur River Basin as a water management strategy for providing water outside the Region. Below are additional legislative recommendations.

Recommendation: Marvin Nichols I Reservoir Site

Based on the reasons set forth in Section 6.9 of this regional plan, it has been the position of the North East Texas Regional Water Planning Group that Marvin Nichols reservoir should not be included in the 2017 State Water Plan as a water management strategy prior to the year 2070, as specified in the mutually adopted agreement stemming from the October 5, 2015 mediation process between Region C and Region D. Region D continues to oppose Marvin Nichols Reservoir, but is willing to work with other regions to obtain water supplies from the Sulphur River Basin that do not involve new reservoir construction. In referencing Marvin Nichols Reservoir, this plan incorporates Marvin Nichols I, Marvin Nichols IA and any other dam site on the main stem of the reaches of the Sulphur River.

Concerning the potential Marvin Nichols reservoir sites (including but not limited to I, IA and II) the North East Texas Regional Water Planning Group does not recommend any of the potential reservoir sites for designation as a Unique Reservoir Site; however, Region D does not challenge the designation of Marvin Nichols Reservoir as a unique reservoir site for the purposes of this Plan and the 2017 State Water Plan. Also, the potential Marvin Nichols reservoir site as described in the Reservoir Site Protection Study, TWDB Report 370, published July 2008, is not recommended by the North East Texas Water Planning Group for designation as a unique Reservoir Site.

Recommendation: The Growth of Giant Salvinia

The North East Texas Water Planning Group recommends that available State funds be dedicated to the control of Giant Salvinia and that governmental sources provide additional resources when available, such as enactment of complementary legislation to support control efforts and prevent distribution of Giant Salvinia. The Texas Legislature is also recommended to approve legislation that will assist local and state officials in controlling the spread and elimination of existing infestations of the plant. It is further recommended by the North East Water Planning Group that the local and state governments adopt the following:

- Continue to research and develop efficient, effective and appropriate control techniques;
- Provide extension and education services to urban and industry stakeholders;
- Support enforcement of legislation and control measures;
- Ensure that Giant Salvinia is identified in local, regional, and State level pest management plans;
- Coordinate with landholder, community and industry interest groups to cooperatively manage and control Giant Salvinia infestations;
- Research and develop best management practices;
- Monitor water pollution;
- Periodically inspect all water bodies for Giant Salvinia; and
- Promote reporting of new Giant Salvinia infestations.

The North East Texas Regional Water Planning Group also recommends to the appropriate State and Federal governmental departments adopt the following actions:

- Develop awareness campaigns to discourage the transportation and/or possession of Giant Salvinia;
- Eradicate infestations where feasible, and ensure Giant Salvinia control is undertaken on all federally managed land.

Recommendation: Concerning Oil and Gas Wells

The NETRWPG recommends that the Texas Railroad Commission review the practices and regulations concerning the protection of the fresh water supply located in the aquifers that supply much of East Texas with fresh water as to the regulation of the drilling, maintaining and plugging of oil or gas wells with regards to public fresh water supply wells.

Recommendation: Concerning Mitigation

The North East Texas Regional Planning Group recommends that any planning group or entity proposing a new reservoir or any other water management strategy should address the subject of mitigation in conjunction with any and all feasibility studies. As evidenced in Section 6.9 of this plan, a study on possible mitigation effects should be undertaken and completed in conjunction with any and all feasibility studies. Information should include estimates of mitigation, predication ratios, and other information useful to landowners potentially affected by mitigation requirements. Also, any new reservoir proposed by a planning group must be accompanied by a map of the proposed reservoir and a map of the land proposed to be mitigated, including proposed acreage.

Recommendation: Future Interbasin Transfers from the North East Texas Region

The North East Texas Region currently supplies surface water to other areas of the state through interbasin transfers and is identified in the current state water plan as a likely source of additional future water supply for various entities in Region C. Specifically, the 1997 State Water Plan includes recommendations that one or more new reservoirs be developed in the Sulphur River Basin as a source of future water supply for the Dallas-Ft. Worth Metroplex. In addition to potential future water transfers from the North East Texas Region to Region C, there may also be water management strategies for meeting needs within the North East Texas Region that will involve conveyance of supplies from one river basin to another within the region.

Current state law and policy regarding interbasin transfers of surface water provide a useful starting point for inter-regional discussions on the development of a new reservoir in the Sulphur River Basin. Several of the criteria that TCEQ is to consider in its review of interbasin transfers are of particular relevance, including:

- Future needs for water supply in the Sulphur River Basin;
- Economic impacts of future reservoir development and interbasin transfer on the Sulphur River Basin;
- Environmental impacts; and
- Mitigation of impacts to Sulphur Basin and compensation for the interbasin transfer.

Recommendation: Designation of Wholesale Water Providers

The North East Texas Regional Water Planning Group supports the designation of a Wholesale Water Provider (WWP) as described in the Texas Administrative Code §357.10(30) as:

> Any person or entity, including river authorities and irrigation districts, that has contracts to sell more than 1,000 acre-feet of water wholesale in any one year during the five years immediately preceding the adoption of the last regional water plan. The regional water planning groups shall include as wholesale water providers other persons and entities that enter or that the regional water planning group expects or recommends to enter contracts to sell more than 1,000 acre-feet of water wholesale during the period covered by the plan.

The NETRWPG supports the granting of a designation of WWP for an entity within Region D depending upon a written request from that entity to the NETRWPG that demonstrates said entity has entered or the RWPG expects or recommends to enter into contracts to sell more than 1,000 acre-feet of water wholesale during the period covered by the plan, including the designation of expected demand and the expected supply. Without a request that includes sufficient identification of expected contractual demand and expected supply, the NETRWPG cannot plan for such an entity. With this noted, Region D expects that the water supply out of Lake Wright Patman will continue to be with Texarkana and Riverbend Water Resources District control as Wholesale Water Providers.

Recommendation: Future Water Needs

A widely held view within the North East Texas Region is that future water needs within the region must be assured before additional interbasin transfers are permitted. Many residents of the region express support for future reservoir development and interbasin transfers provided the region's long term water demands are met. This sentiment is supported by TWDB rules for regional water planning, which require that the evaluation of interbasin transfer options include consideration of "…the need for water in the basin of origin and in the proposed receiving basin."

The issue of how much water is needed in the North East Texas Region for local use is not as simple as just comparing estimates of existing water supply to projections of future water demand. It should be remembered that the water demand projections adopted by the NETRWPG and the TWDB for development of the regional plan are based largely on an extrapolation of past growth trends. While this is a common and accepted method for forecasting future conditions, there are nonetheless significant uncertainties in the projections.

Shifting demographics and economic and technological change could result in substantially higher demand for water in the North East Texas Region than is currently projected. For example, there is an observed trend over the past decade in many areas of the U.S. of higher population growth in small and medium sized cities and rural areas. This has been attributed in part to advancements in telecommunications and the evolving information and service based economy, which no longer requires a concentration of labor in large cities. Another factor is the aging of the population and the trend toward retirement in rural areas. Also, development of a new reservoir in the Sulphur Basin could, itself, act as a significant catalyst for economic development and growth in the area. In fact, some in the planning region have expressed interest in building reservoirs as part of an overall regional economic development strategy. Results from the recent SRBA (2014) Sulphur River Basin Feasibility Study suggest a wide variety of potential demands in the region, many significantly higher than those estimates developed for regional planning.

Such factors suggest that the NETRWPG may want to review a possible policy recommendation regarding the definition of "need" in the basin of origin. Some members have also suggested broadening the test of need for interbasin transfers to consideration of projected needs throughout the *region* of origin, not just the basin of origin.

Recommendation: Improvements to the Regional Water Planning Process

a) The NETRWPG believes that the regional water planning process should provide greater flexibility in development of water demand projections. TWDB rules and guidelines regarding population and water demand projections tend to confine rural and smaller urban areas to past rates of growth without allowing for consideration of alternative scenarios for future growth and economic development initiatives. Because the region has a relatively small population and water demands, the impact of a major new water user, such as a paper mill or a power plant, could dramatically alter the water supply and demand equation at a county or even basin level. There is no mechanism in the current process to provide for these potential increases, until the five year review period.

   TWDB rules also build into municipal water demand projections conservation assumptions which may be unrealistic. In rural areas that already have low rates of per capita use, there often is an increase in per capita use as development takes hold in the area. Assumptions about conservation in these areas that already use far less on a per capita basis than the very large and rapidly growing urban areas could have the effect of limiting future development. There are more than 30 water user groups in the North East Texas Region with per capita usage levels well below the 115 gallons per capita per day (gpcpd) level set as the "floor" by the NETRWPG. Some usage rates are in the 70-80 gpcpd range, a sharp contrast with large urban areas where 200 gpcpd or more is not uncommon. Landscape watering, a prime target for urban water conservation programs, is much less prevalent in rural areas. Further, the housing stock is not undergoing rapid growth or replacement, thus reducing the potential impact of plumbing fixture efficiency standards.

The North East Texas Regional Water Planning Group recommends that the TWDB should revise procedures for calculating water demand reduction projections contained in its conservation scenarios by recognizing a floor for the application of demand reduction for rural and small city areas where the per capita water consumption levels are already very low.

b) For the present round of planning, the TWDB established a floor for water demand at 60 gpcpd. In previous rounds, the RWPGs were allowed the capability to establish individual floors, whereby Region D used an amount of 115 gpcpd. It appears inappropriate to assume that usage less than 115 gpcpd can be sustained over the long-term planning horizon. For those communities using in excess of 250 gallons per day, it should be noted that TWDB planning rules for this current round of planning are enabling 50 year forecasts for systems using 4 times or more than another community. This rule, as applied, is inherently unfair, and eliminates small per capita usage systems from ever having a normal usage, as it basically confines that system to always serving an area that is constraining growth. The growth cannot be higher usage (water usage generally increases as disposable income per household increases) with the TWDB methodology as presently applied.

   The NETRWPG recommends that the TWDB allow the RWPGs to establish individual thresholds for a given region, as this provides a more equitable solution for the establishment of future demands in the region.

c) The NETRWPG recommends additional funding be made available to allow for greater scrutiny of rural water supply entities at the Sub-Water User Group (Sub-WUG) level. For this round of regional planning, such entities are aggregated and represented within the plan as a "County-Other" WUG. Where necessary, extra effort has been given to identify and evaluate the needs for entities within this "County-Other" category, but with limited funding in the present round as compared to previous rounds the level of overall effort to distinguish these entities has been necessarily diminished. Additional funding affords the capability to more rigorously evaluate these smaller, rural entities, which comprise a significant portion of the Region D population, as was done in previous rounds of planning.

d) Lastly, recent analyses in the Sulphur River Basin (SRBA Watershed Study; 2014) suggest that although the historic Drought of Record for the basin is 1951 to 1956, a more significant drought occurs between 2002 and 2006. As a result, the SRBA study suggests the official TCEQ "Sulphur WAM misses the critical drought" that forms the basis for calculations of firm supply, since the official TCEQ WAM for the Sulphur River Basin is based upon historic data from 1940 to 1996. Given the proximity of this river basin to the remaining river basins within the North East Texas Region, it is not unreasonable to consider similar hydroclimatologies existing in the remaining basins. If a worse drought exists than the current Drought of Record utilized in the official TCEQ WAMs, this poses additional uncertainty with regard to the modeled firm yields and reliabilities upon which water supplies in the North East Texas Region are based.

Thus, the NETRWPG recommends that the TCEQ initiate a process to appropriately update the Red River, Sabine, Cypress, and Sulphur Water Availability Models (WAMs) in a manner consistent with these WAMs' original development, to reflect more recent information on the hydroclimatology of the river basins in the North East Texas Region, and provide additional certainty to resultant calculations of firm supplies in the Region. Further, existing official WAMs utilized by TCEQ in the permitting process should be made readily available in time for use in the regional water planning process.

Recommendation: Establishment of Available Groundwater Supply in a Region

The North East Texas Region is overlain partly by two separate GMA's (8 and 11). With no Groundwater Conservation Districts (GCD) in the Region, a large portion of the Region has no voting representation on either board. The NETRWPG opposes the formation of a GCD in the North East Texas Region, as it is an unnecessary and expensive regulatory burden on rural water producers and their customers. The exercise of the authority granted to GCD's by the legislature erodes the long standing linkage between a surface owner of land and ownership of the waters beneath the land.

The NETRWPG recommends that the availability of groundwater supplies within a region with no Groundwater Conservation Districts should be established by the regional water planning group for that region. Such an approach affords the opportunity for local representation to establish existing and future groundwater supply, and remains consistent with the "bottom-up" approach established by Senate Bill 1 for regional water planning. This proposed transfer of responsibility for determination of the available supply of groundwater for regional planning purposes may not be expanded or construed to vest the regional water planning group with any of the other responsibilities or enforcement powers held by properly established Groundwater Conservation Districts per Section 16 of the Texas Water Code. The NETRWPG supports the passage of SB 1101 as introduced by Senator Kevin Eltife, and HB 3942 as introduced by Representative Chris Paddie.

Recommendation: Wright Patman Lake/Reservoir

The North East Texas Regional Water Planning Group recommends that before any new reservoirs are planned in the North East Texas Water Planning Area, the alternative of raising the level of the Wright Patman Lake /Reservoir be considered.

Chapter 9: Infrastructure Financing Recommendations

The Infrastructure Financing Report (IFR) requirement was incorporated into the regional water planning process in response to Senate Bill 2 (77th Texas Legislature). The Texas Administrative Code, 31 TAC 357.44 requires that regional water planning groups shall assess and quantitatively report on how individual local governments, regional authorities, and other political subdivisions in their RWPA propose to finance recommended water management strategies. According to TWDB guidelines, the primary objectives of the IFR are:

- To determine the number of political subdivisions with identified needs for additional water supplies that will be unable to pay for their water infrastructure needs without some form of outside financial assistance.

- To determine how much of the infrastructure costs in the regional water plans cannot be paid for solely using local utility revenue sources.

- To determine the financing options proposed by political subdivisions to meet future water infrastructure needs (including the identification of any State funding sources considered).

- To determine what role(s) the Regional Water Planning Groups (RWPG) propose for the State in financing the recommended water supply projects.

The NETRWPG used the IFR survey form developed by the TWDB to gather information from the Water User Groups (WUGs) with water management strategies involving capital costs identified in this round of planning. These were then compiled and reported.

For county aggregate WUGs (e.g., manufacturing, agriculture, etc.), with identified shortages during the planning period and where no political subdivision is responsible for providing water supplies, the RWPG previously determined probable funding mechanisms for meeting the water management strategies. These determinations are compiled into discussion paragraphs included in Chapter 9. As many of these entities are normally private interests or companies that are not eligible for State or Federal assistance, financing for this water management strategy will likely come from private funding.

Twenty-two (22) non-county aggregate WUGs were involved in the IFR survey process. The RWPG consultants attempted to contact each of these entities with water management strategies requiring capital costs via phone calls with known points of contact at each WUG. Once attempts had been made to contact all 22 WUGs, the survey results were compiled into an Excel spreadsheet provided by TWDB, which was then submitted back to TWDB.

Chapter 10: Adoption of the Plan and Public Participation

The final plan was submitted to the TWDB prior to the December 1, 2015 deadline. Chapter 10 contains a summary of the communications and public participation conducted during the RWP development for the North East Texas Region. Records of the public participation for the plan review are presented in this chapter. The regular meetings of the NETRWPG allowed time at each meeting for the public to express their concerns and to offer comments to the planning group without response. There was held a public comment meeting to receive comments both oral and written and was well attended. Also there have been many news releases, and public notices.

The subject that dominated the meeting comment segment and the Public comment meeting was the possible development of reservoir sites in the NETRWPG area, especially in the Sulphur River Basin. After the Initially Prepared Plan was submitted and released, the NETRWPG conducted a public hearing to receive public comments on the IPP. Copies of the plan were made available in the Office of the County Clerk and in a public library in each of the 19 counties in the region. Comments were received and incorporated in the comments section of the final Water Plan for the NETRWPG.

Included within Chapter 10 and the Appendix to Chapter 10 is a summary discussion and documents pertaining to the 2016 Interregional Conflict Resolution process for Region C and Region D.

This document is the certified Final 2016 North East Texas Regional Water Plan, being complete and adopted by the North East Texas Regional Water Planning Group at its November 18, 2015 public meeting.

Chapter 11: Implementation and Comparison to the Previous Regional Water Plan

Included herein is a summary of recent implementation of water management strategies identified in the 2011 North East Texas Regional Water Plan, and a brief summary that shows how the 2016 Plan differs from the 2011 Plan. Comparisons including summary tables and other graphics, convey the changes between plans.

Significant differences exist between the 2016 and 2011 Plans. Demands for small municipalities and rural areas are now significantly less, given that for this round of planning a floor of 60 gpcpd was established by the TWDB, rather than the 115 gpcpd adopted by the NETRWPG in the previous round of planning. More significantly, greater scrutiny has been enforced in the present round with regard to the source availabilities of both surface and groundwater supplies, and existing legal and infrastructure constraints limiting resultant supplies for both WUGs and WWPs.

The latest available TCEQ Water Availability Models (WAMs) have been employed to identify the firm yield, or 100% reliable, supply from existing surface water rights, under full demand conditions with the assumption of no return flows in the basins. For groundwater, TWDB established aquifer availabilities based upon results from Groundwater Availability Models (GAMs), which produced Modeled Available Groundwater amounts (MAGs) for use in the development of groundwater supplies in the 2016 Plan. These constraints result in a greater limitation to existing supplies, representing a more conservative estimation of supplies available during a repeat of the Drought of Record. The limited supplies, when compared to projected demands, result in a substantial increase to the number of identified needs in the North East Texas Region over the 2020 – 2070 planning horizon.

The identification of more needs in the current 2016 Plan necessitates more numerous, and sophisticated, water management strategies than those developed in the 2011 Plan. Where possible, efforts from the previous rounds of planning were utilized to opportunistically take advantage of previously developed strategies.

CHAPTER 1 DESCRIPTION OF THE REGIONAL WATER PLANNING AREA

1.1 INTRODUCTION

"*High and fine literature is wine, and mine is only water; but everybody likes water*."

– Mark Twain

1.1.1 Overview of Texas Legislation

The population of Texas is growing rapidly and is expected to double from 2000 to 2070. As a result, water demand is expected to increase by almost 30 percent by 2070. These ever-increasing water demands are placed on finite resources, which can be exhausted if not prudently managed.

Texans have been involved in water planning for generations. Water supply districts, river authorities, municipalities and others have developed local and regional water plans. While these plans are vital for local water planning, they may not always consider the effects on larger regions and the state as a whole. Therefore, water planning on a statewide basis is essential in order to grasp the totality of the needs of the people and environments and the resources available to meet those needs. The responsibility for water planning on a statewide basis is that of the Texas Water Development Board (TWDB), and this agency's task includes analyzing water supply and demand using a holistic approach over the entire state.

Increased awareness of Texas' vulnerability to drought, and an estimated one hundred percent increase in population over the next fifty years, caused the 75th Texas Legislature to consider several avenues in state water resource planning. In 1997, the Texas Legislature enacted Senate Bill 1, comprehensive legislation which addressed water planning. One result of this legislation was a "bottom up" approach to Texas water planning, rather than the top-down approach of the past. This new approach gives local and regional entities a greater opportunity to participate in the planning and to have a stake in the future of water availability in Texas. The TWDB divided the state into 16 planning regions, each of which is responsible for analyzing a geographic area and creating a water plan spanning 50 years, to be submitted every 5 years. Then, TWDB staff reviews the plans and molds them into a statewide water plan. The 77th Legislature amended the planning process by adopting Senate Bill 2 (SB 2), which added a requirement for water conservation and drought management strategies, added a requirement for infrastructure funding strategies, and clarified the definition of unique stream segments, among other changes. Most recently, the 80th Legislature added Senate Bill 3 (SB 3), providing guidance on adopting environmental flow standards for river basins, bays and estuaries, and designating unique stream segments and reservoir sites. In addition, it established a Study Commission on Region C (Dallas-Fort Worth) water supply.

Regional water planning groups have been established by the TWDB in each region to prepare and adopt a regional water plan for a designated area. Each Regional Water Planning Group (RWPG) represents diverse realms of public interest including:

- Agriculture
- Counties
- Environment
- Industry
- Municipalities
- River authorities
- Small business
- Water districts
- Water utilities
- Electric generating utilities
- General public

The variety of backgrounds of the board members is intended to ensure that a broad range of public interests are represented.

The North East Texas Regional Water Planning Group (NETRWPG) represents the North East Texas Region and is also referred to as Region D. This region is made up of all or part of 19 counties in northeast Texas (See Figure 1.1) including Bowie, Camp, Cass, Delta, Franklin, Gregg, Harrison, Hopkins, Hunt, Lamar, Marion, Morris, Rains, Red River, Smith, Titus, Upshur, Van Zandt and Wood. This Regional Water Planning Group includes representatives of all of the above-mentioned public interest groups; in addition, each county has at least one representative. There are 24 voting members, and several non-voting members. The administrative agent for the group is the Northeast Texas Municipal Water District, located in Hughes Springs, Texas.

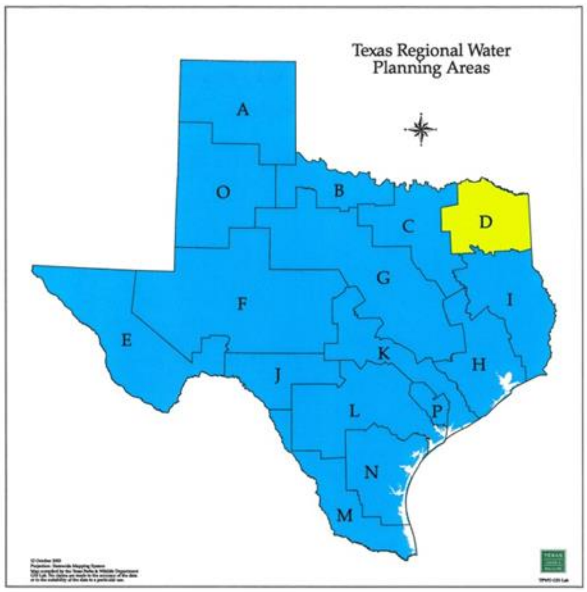


Figure 1.1 Texas Regional Water Planning Areas
(*Source: Texas Parks & Wildlife Department*)

The ultimate goal of the State Water Plan is to identify those policies and actions that may be needed to meet Texas' near- and long-term water needs based on a reasonable projection of water use, affordable water supply availability, and conservation of the State's natural resources.

The Regional Water Planning Groups are to address three major goals, which include:

- Determine ways to conserve water supplies
- Determine how to meet future water supply needs
- Determine strategies to respond to future droughts in the planning area

1.1.2 The Planning Process

The TWDB has developed the "General Guidelines for R.W.P. Development (2011-2016)" which includes a set of 11 tasks that the regional groups are to accomplish in the regional water plan, as follows:

Chapter 1 presents a description of the planning region including the region's physical characteristics, demographics and economics. Other information included in this description are the sources of surface and groundwater, major water suppliers and demand centers, current water uses, and water quality conditions. Finally, an initial assessment of the region's preparations for drought is discussed, as well as the region's agricultural and natural resources and potential threats to those resources.

Chapter 2 addresses population and water demand projections. Population and water demand projections have been completely revised from previous planning rounds, utilizing 2010 U.S. Census data. TWDB, in conjunction with Texas Commission on Environmental Quality (TCEQ), Texas Parks and Wildlife Department (TPWD), and Texas Department of Agriculture (TDA), has prepared population and water demand projections for all water demands and all Water User Groups (WUGs). Draft population and water demand projections were provided to the RWPGs for review, with requested changes to the projections made where provided by the RWPG. The population and water demand projections were formally adopted for use in development of the 2016 RWPs.

Chapter 3 is an evaluation of current water supplies in the North East Texas Region, including surface and groundwater. It also presents the available supplies for each user group.

Chapter 4 of the report presents identified water needs (i.e., shortages) and surpluses in the region and lists shortages by county and river basin. It also includes a comparison of supply and demand for each wholesale water provider.

Chapter 5 of the plan presents the identification of potentially feasible water management strategies for solving each shortage, evaluations of these potentially feasible strategies, and recommended and alternative water management strategies for the 2016 NETRWPG Plan, along with implementation evaluations, cost estimates, and environmental analyses. This chapter establishes criteria to be applied in the evaluation of water management strategies, and includes a sub-section regarding conservation recommendations.

Chapter 6 of the plan presents a discussion on the impacts of the plan, and provides a description as to how this plan is consistent with the long-term protection of the State's water resources, agricultural resources, and natural resources. Additionally, this chapter also addresses the potential impact of the Marvin Nichols I Reservoir on the long-term protection of the State's water resources, agricultural resources, and natural resources.

Chapter 7 consolidates existing information on droughts of record and drought preparations in the region and presents a variety of recommendations developed by the RWPG in this regard. Additionally, this chapter includes a region-specific model drought contingency plan.

Chapter 8 identifies policy recommendations regarding designation of unique reservoir sites and unique streams. Other policy recommendations include interbasin transfers, conversion of water supplies from groundwater to surface water, Texas Commission on Environmental Quality (TCEQ) regulations, and improvements to the regional water supply planning process.

Chapter 9 constitutes a reporting of financing mechanisms for water management strategies in the plan.

Chapter 10 consists of a summary of public involvement throughout the planning process.

Chapter 11 provides a description of the level of implementation of previously recommended WMSs for meeting needs, and a summary comparison of the present 2016 Plan to the previous 2011 Plan.

1.2 PHYSICAL DESCRIPTION OF THE REGION

1.2.1 Regional Entities

The North East Texas Region includes all or a part of the following counties (see Figure 1.2):

Bowie County	Camp County	Cass County
Delta County	Franklin County	Gregg County
Harrison County	Hopkins County	Hunt County
Lamar County	Marion County	Morris County
Rains County	Red River County	Smith County (partial)
Titus County	Upshur County	Van Zandt County
Wood County		

The Region is home to various agencies interested in water planning, including:

- Ark-Tex Council of Governments
- East Texas Council of Governments
- North Central Texas Council of Governments
- Red River Authority
- Sabine River Authority
- Sulphur River Basin Authority
- Neches River Authority
- Natural Resource Conservation Service
- Riverbend Water Resources District
- Rural Development, USDA
- United States Army Corps of Engineers (USACE), Tulsa
- USACE, Fort Worth
- USACE, Vicksburg

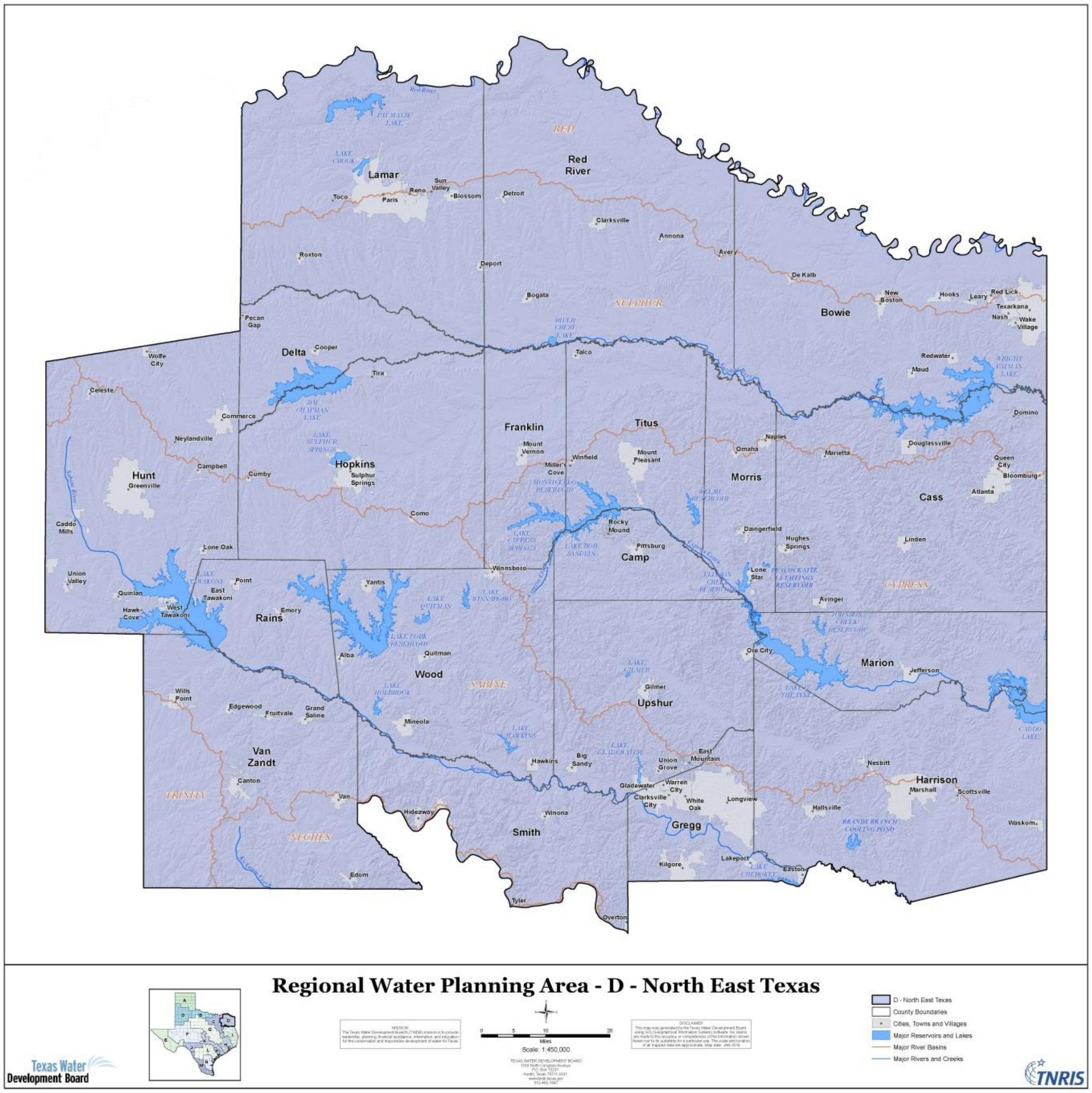


Figure 1.2 Regional Water Planning Area

The following table compares the size and population of the Region's counties and lists the largest city in each county.

Table 1.1 County Population Comparison

County	Area (Square Miles)	2010 Census	Largest City
Bowie	923	92,565	Texarkana°
Camp	203	12,401	Pittsburg
Cass	960	30,464	Atlanta
Delta	278	5,231	Cooper
Franklin	295	10,605	Mount Vernon
Gregg	276	121,730	Longview°
Harrison	915	65,631	Marshall°
Hopkins	793	35,161	Sulphur Springs
Hunt	882	86,129	Greenville°
Lamar	932	49,793	Paris°
Marion	420	10,546	Jefferson
Morris	259	12,934	Daingerfield
Rains	259	10,914	Emory
Red River	1,058	12,860	Clarksville
Smith	433*	39,186	Lindale*
Titus	426	32,334	Mount Pleasant
Upshur	593	39,309	Gilmer
Van Zandt	860	52,579	Canton
Wood	696	41,964	Mineola
Region Total	11,461	762,336	

*Portion within the North East Texas Region
°Population over 20,000

1.2.2 **Physiography**

The NETRWPG is located in the physiographic region known as the Gulf Coastal Plains, which extends from the eastern border of Texas to the Balcones fault zone and spans from the Texas/Oklahoma border to the southern tip of the state (Figure 1.3). Topography in this region is primarily hilly in the east, with pine and hardwood vegetation. Moving westward, the region becomes more arid with a post oak dominated fauna, until the vegetation becomes prairie. The Gulf Coastal Plains are located in "lowland Texas" as opposed to upland Texas west of the Balcones fault.

The Gulf Coastal Plains has been divided into several sub-areas. Within the NETRWPG, the Blackland Prairies Belt and the Interior Coastal Plains are represented. These belts are distinguished by surface topography and vegetation.

Elevations within the Region range from 150 - 200 feet above sea level at Caddo Lake on the eastern edge of the region, to 650 – 700 feet above sea level in the northwestern portions of Hunt County.

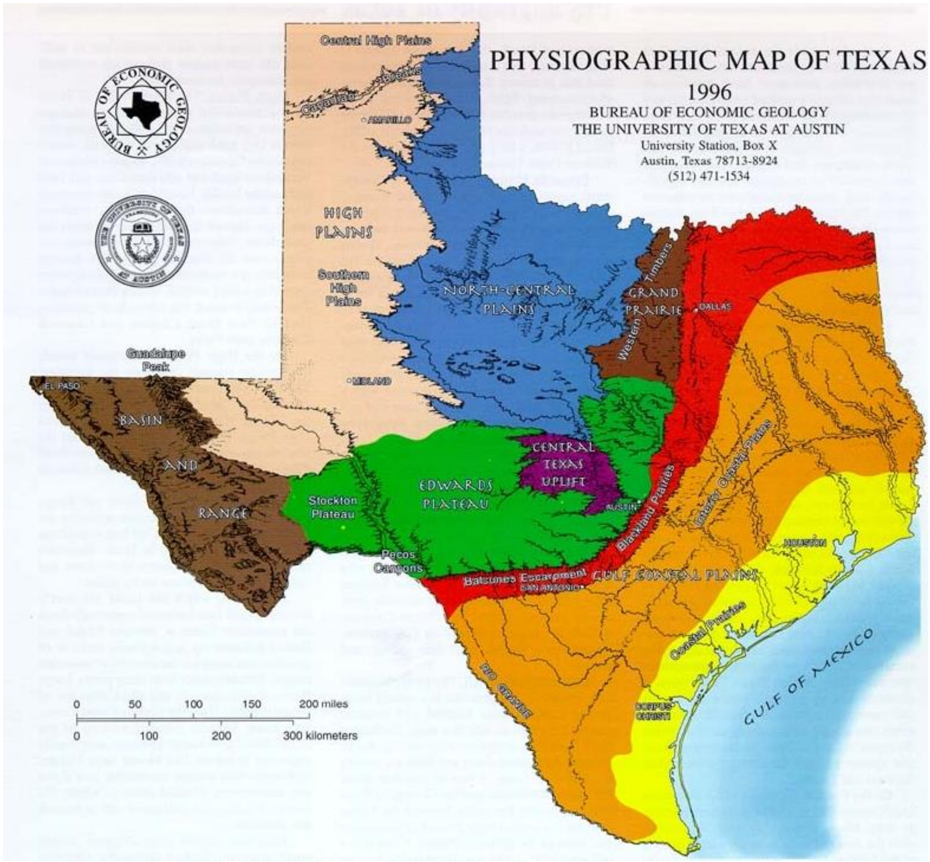


Figure 1.3 Physiographic Map of Texas
(Source: Bureau of Economic Geology, University of Texas at Austin)

The Region has 24 surface water bodies with capacity of 5,000 ac-ft or more. The terrain is crossed by a network of rivers, streams, and creeks. In addition, farm and pasture land is scattered with ponds and pools. Major waterways bordering or crossing through the Region include the Red River, Sulphur River, Sabine River, and Cypress Creek. There are six river basins in the North East Texas Region including the Red, Sulphur, Cypress, Sabine, and small portions of the Neches in Van Zandt County and the Trinity in Hunt County.

1.2.3 Climate

The North East Texas Region experiences a "subtropical humid" climate, noted for its warm summers. Climate in the area is generally mild. The average annual temperature in northeast Texas is 65°F. The mean high temperature for July in the Region is 94°F, and the mean low January temperature is 32°F. The 30-year average number of days with temperatures of 100°F and higher is 8. Relative humidity is high in the Region, which makes temperatures seem more extreme. The growing season in northeast Texas lasts approximately 239 days.

Average annual precipitation in the region is 43.7 inches (see Figure 1.4). Average annual lake surface evaporation over a five-year period, from 2009 to 2013, was 52.72 inches up from 50.84 inches from 2004 – 2008. Over the same period, the January average evaporation rate was 1.92 inches, and in August the rate was 7.31 inches. The Region experienced 13 recorded droughts from

1892 – 2013. Winter precipitation, such as snow, sleet and ice, occurs infrequently in northeast Texas and is generally short-lived. Figure 1.5 depicts average net evaporation in the region.

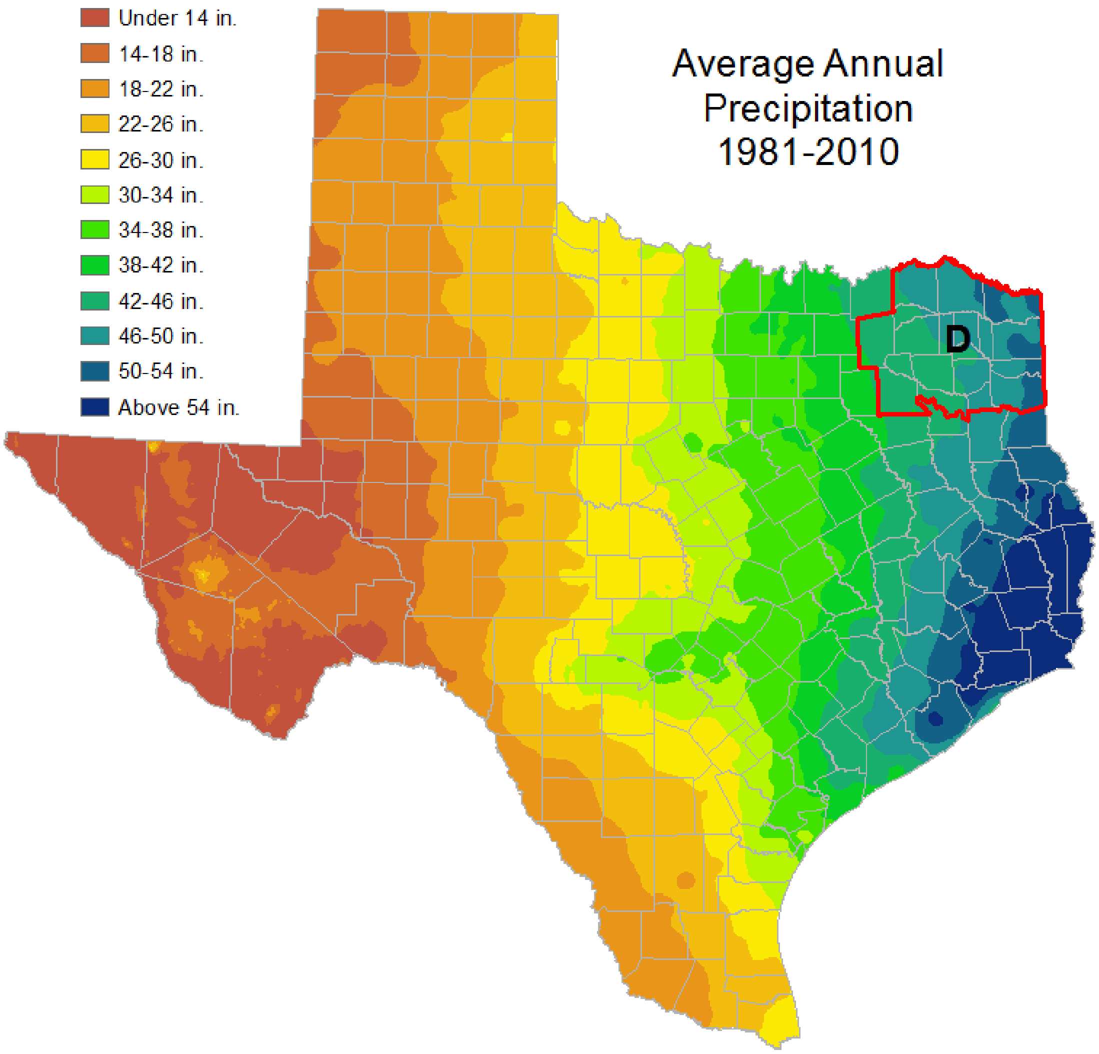


Figure 1.4 Average Annual Precipitation (1981 – 2010)
(***Source: Texas Almanac)***

Winds in northeast Texas are predominately from a southerly direction during summer months. In winter, winds from the north are typical. Velocities range from an annual average of 8.3 mph on the eastern edge of the region, to 10.7 mph on the west.

Destructive weather is a factor in the North East Texas Region. Hurricanes in the Gulf of Mexico can bring thunderstorms with high winds as was the case with hurricanes Ike and Dolly in 2008. Tornadoes are frequent and are often destructive according to the National Climatic Data Center. The Region has an average of 1-2 tornadoes per 2,500 square miles per year. According to the 2008 – 2009 Texas Almanac, the Red River Valley, in the northern part of the Region, has the highest frequency of tornadoes in the state

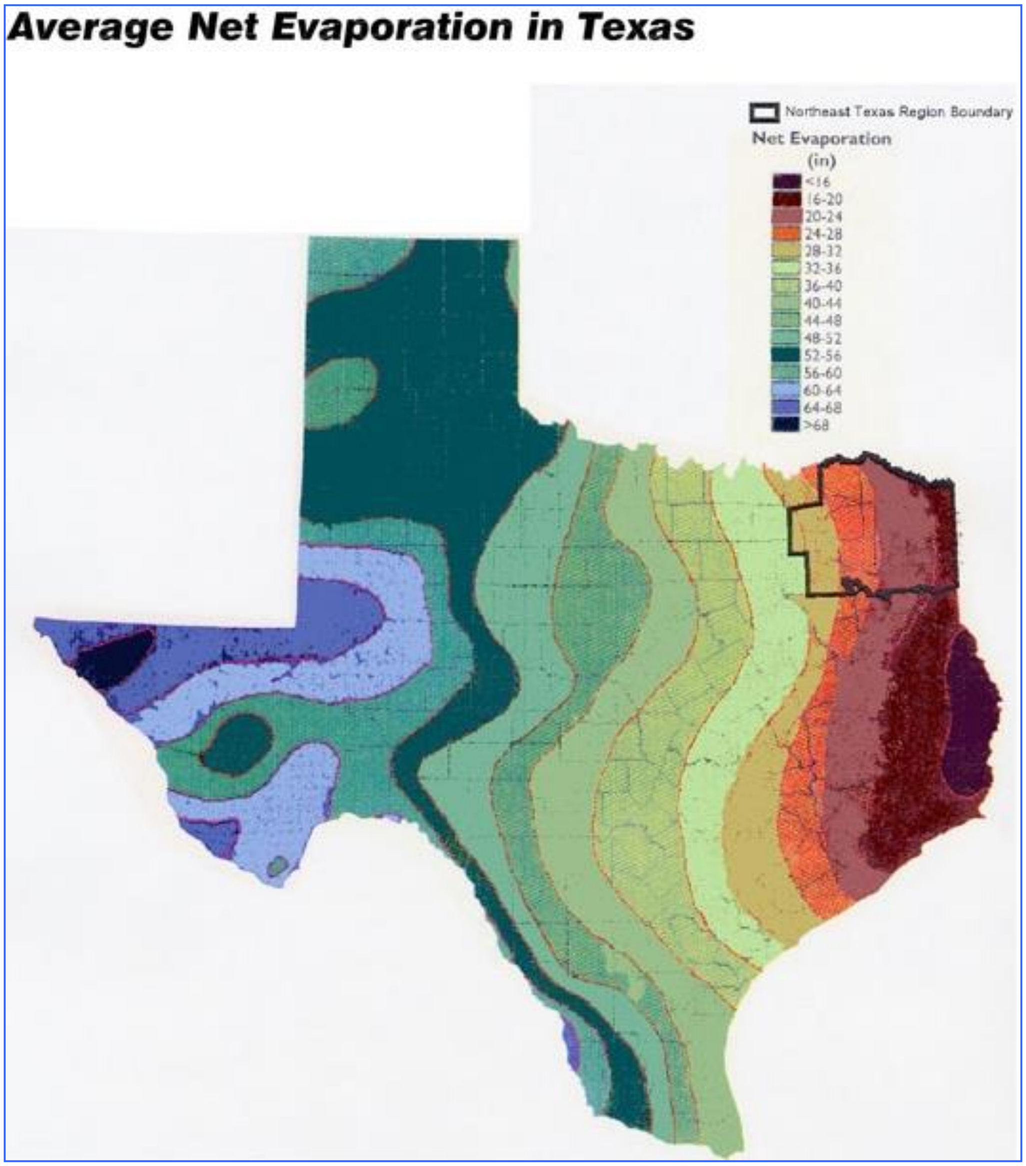


Figure 1.5 Average Net Evaporation in Texas
(*Source: TWDB)*

1.2.4 **Geology**

Surface outcroppings in the Region are from the Cretaceous, Paleocene and Eocene periods. From the northwest corner of the region moving southeast, the bands of rocks become younger. Soils in the Region range from light colored, acid sandy loams, clay loams and sands in the east to dark colored calcareous clays in the western part of the region. Northeast Texas is located just east of the Ouachita Mountains, a buried mountain range that reaches from southwest Texas through the Austin and Dallas areas and eventually runs eastward to the Appalachian Mountains. Formation of this range 300 million years ago caused downwarping on either side, and as a result, much sediment settled in northeast Texas. For the past 60 million years, the North East Texas Region has been "sinking", and rocks from earlier periods have been buried rather than exposed. The effects of sediment buildup from the mountain range run-off coupled with waters of the Gulf of Mexico flowing over the surface, led to the formation of rich organic sediments that over time turned into oil and gas deposits. Salt deposits compressed by dense organic-rich muds formed domes and spikes beneath the surface.

Mineral resources in the Region are varied and abundant. Lamar and Red River counties have chalk deposits buried beneath the surface. The southern part of the Region is dotted with salt domes. Salt was deposited about 200 million years ago when the Gulf of Mexico was beginning, before it was connected to other oceans. This is salt that pushed up through layers of thick, dense sediment, created domes which are mined today. This area also contains significant oil and gas deposits. Oil in northeast Texas is produced from the late Cretaceous Woodbine Formation. Normally found deep below the surface, some oil has been forced upward by the upheaval of the salt domes which trapped oil and natural gas. Oil is an important industry in Texas, and Gregg County has produced more total barrels of oil since discovery than any other county in Texas. Lignite, a low grade form of coal, was formed in northeast Texas when organic rich muds, flowing from the Ouachita Mountains, were pressed beneath later layers. This fuel resource is used by the electric utility industry. Industrial clays, used for producing bricks, tile, pottery, and even fine china, are located beneath parts of Bowie, Franklin, Harrison, Hopkins, Morris, Titus, Rains and Van Zandt counties.

1.2.5 Natural Resources

Soils within the Region are good for crop production and cattle grazing. Soils in the Piney Woods support fruit crops, especially peaches, blueberries and strawberries. The Piney Woods is also abundant in timber and supports a large timber industry. Livestock is another important economic resource in northeast Texas and regional soils support sufficient vegetation for grazing. Cattle in northeast Texas are raised for stocker operations, cow-calf operations, beef production and dairies. Northeast Texas is home to major poultry processing plants, and many farmers raise poultry for eggs and broilers. Finally, hogs and horses are significant in some counties, but are raised less extensively Region wide.

Vegetation in the Region is varied due to local differences in rainfall, temperature, and terrain. Figure 1.6 delineates the vegetative or eco-regions within northeast Texas. The Piney Woods is appropriately named, because the vast majority of its timber is pine. Native vegetation is defined as a pine-hardwood forest, and principal trees include shortleaf pine, loblolly pine, sweetgum and red oak. Moving westward, vegetation changes from pine to oak and from oak to prairie, with scattered trees. Vegetation in the Oak Woods and Prairies Belt is distinct between uplands and bottomlands. Uplands contain tall bunchgrasses and stands of post oak and blackjack oak. The bottomlands, wooded and brushy, contain chiefly hardwoods, with an occasional pecan. Native vegetation in the Blackland Prairies Belt is classified as true prairie with important native grasses being little bluestem, big bluestem, Indian grass, switch grass, and Texas wintergrass. Pastures seeded with Dallis grass and Bermuda grass are common. Principal trees are post oak, shumard oak, bur oak, magnificent chinquapin oak, pecan, American and cedar elms, soapberry, hackberry and eastern red cedar.

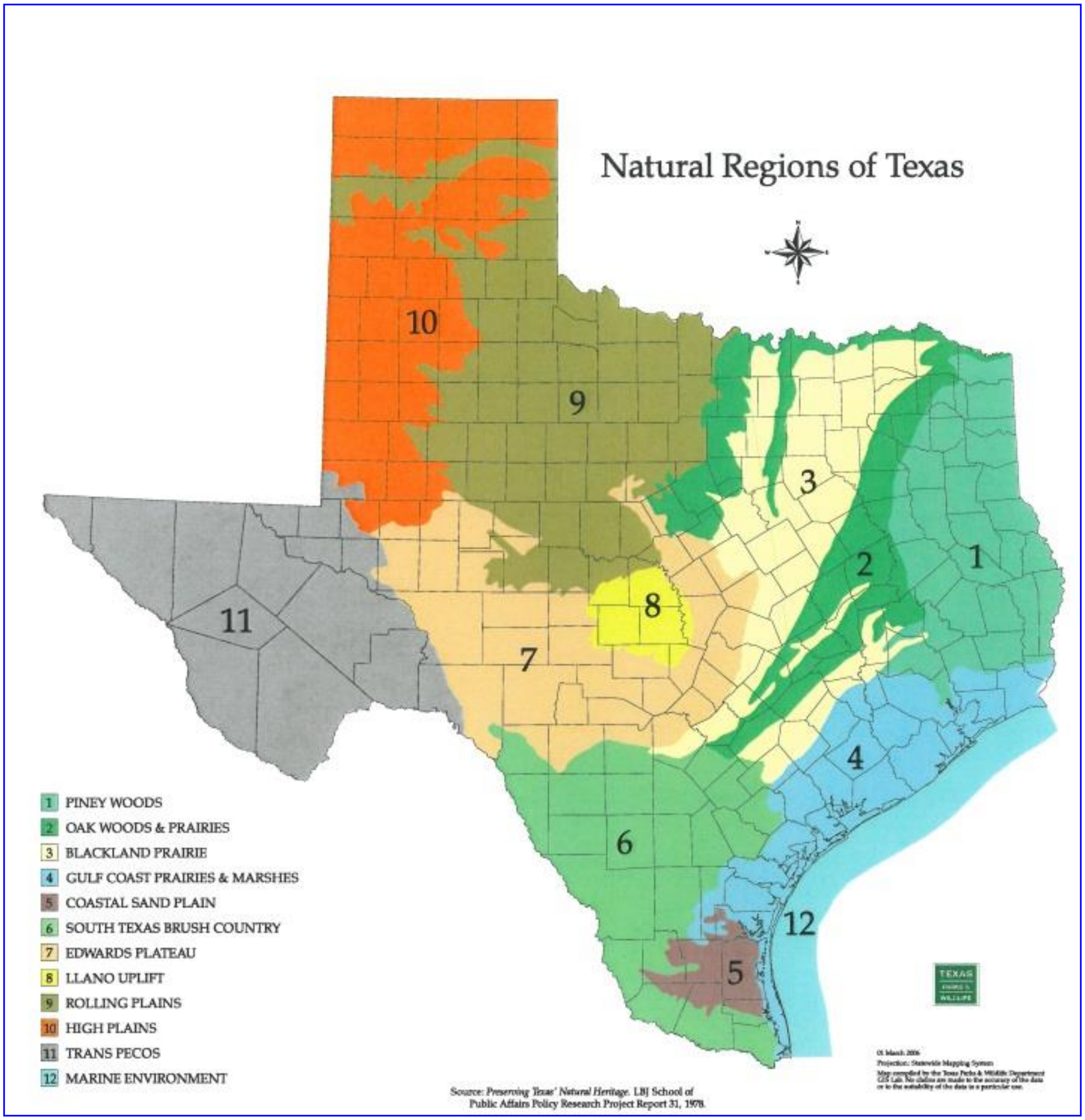


Figure 1.6 Natural Regions of Texas
(Source: Texas Parks and Wildlife Department)

The Region supports numerous species of wildlife, including, but certainly not limited to white-tailed deer, armadillo, quail, rabbit, opossum, raccoon, squirrel, dove, wild hog and wild duck. Since northeast Texas is predominantly rural, there is farm and ranch land as well as recreational, undeveloped and timbered land available for wildlife habitat. The numerous surface water impoundments, rivers and streams provide suitable habitat for many different species. Wetlands, bottomland hardwood forests, pine forests and state protected lands also provide habitat. At one time, larger deer and black bears were found in the area; however population growth and accompanying development and hunting encroached upon the habitat of bears, and also caused a reduction in deer size. According to the Texas Parks and Wildlife Department, there are six TPWD wildlife management areas in the NETRWPG Region. These include Cooper (14,480 acres), Pat Mayse (8,925 acres), Tawakoni (1,562 acres), White Oak Creek (25,700 acres), Old Sabine Bottom (5,727 acres), and Caddo Lake (7,805). These areas are used for hunting, research, fishing, wildlife viewing, hiking, camping, bicycling, and horseback riding.

Air quality in Texas is monitored by the Texas Commission on Environmental Quality (TCEQ), which has monitoring stations in various locations around the state. The monitoring locations in or near the North East Texas Region include those in the Dallas-Ft. Worth area and the Tyler-Marshall-Longview area. Currently, the TCEQ monitors six air pollutants including ozone, sulfur dioxide, nitrogen dioxide, respirable particulate matter, carbon monoxide, and lead. In the Region, Gregg, Harrison, Smith and Upshur counties are in the non-attainment zone for ozone. Other counties do not have permanent monitoring stations.

The Haynesville Shale formation is currently being developed in western Louisiana and eastern Texas. The area being developed overlaps with the Region D water planning area primarily in Harrison and Marion Counties (Figure 1.7).

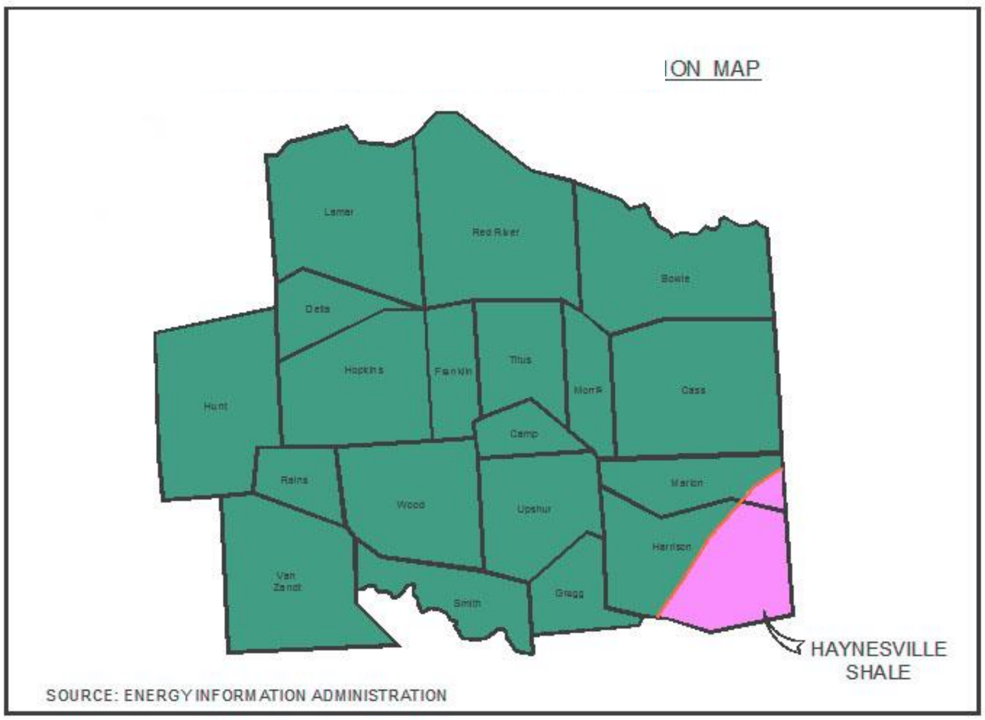


Figure 1.7 Haynesville Shale Location Map
(Source: Energy Information Administration)

The Haynesville Shale is considered a tight formation which requires that a technique called fracking be utilized to open up the shale and allow easier capture of the oil/gas. The water demand necessary to complete and frack a well is reported to be of the magnitude of seven million gallons of water per well. This equates to approximately 21 acre-feet per well. The fracking operation typically is completed in a matter of days. Historically the oil and gas industry has used groundwater for drilling operations because local water wells could be drilled on each site and provide the necessary water for drilling. The Haynesville Shale wells will require a significantly larger volume of water in a shorter time period leading to the necessity of additional supply. The development of Haynesville Shale in Louisiana is ahead of Texas and it has been reported that the majority of water being supplied for Haynesville Shale wells in Louisiana is coming from surface water sources. It is estimated that as many as 1,000 Haynesville Shale wells could potentially be drilled in Region D over the next few decades. This number of wells would equate to 20,000 acre-feet of water demand.

There have been concerns raised within the Region concerning the possibility of groundwater contamination associated with oil/gas drilling activities. The fracking process consists of injecting water and solid materials at an extremely high pressure to force open and hold open cracks in the shale to allow the desired product to flow more freely and be captured. The concern is that the frack fluid and product would flow up into the water bearing strata. While industry professionals indicate that this is not likely to occur, most agree that it is possible and additional study is necessary.

There are oil fields located throughout the Region, as noted on Figure 1.8. Counties in the Region with the largest oil production in 2013 include Wood, Harrison, and Smith. Table 1.2, taken from the Texas Railroad Commission reported production data, lists the amount of crude oil produced in the North East Texas Region in 2012 and 2013. These amounts are depicted graphically in Figure 1.9.

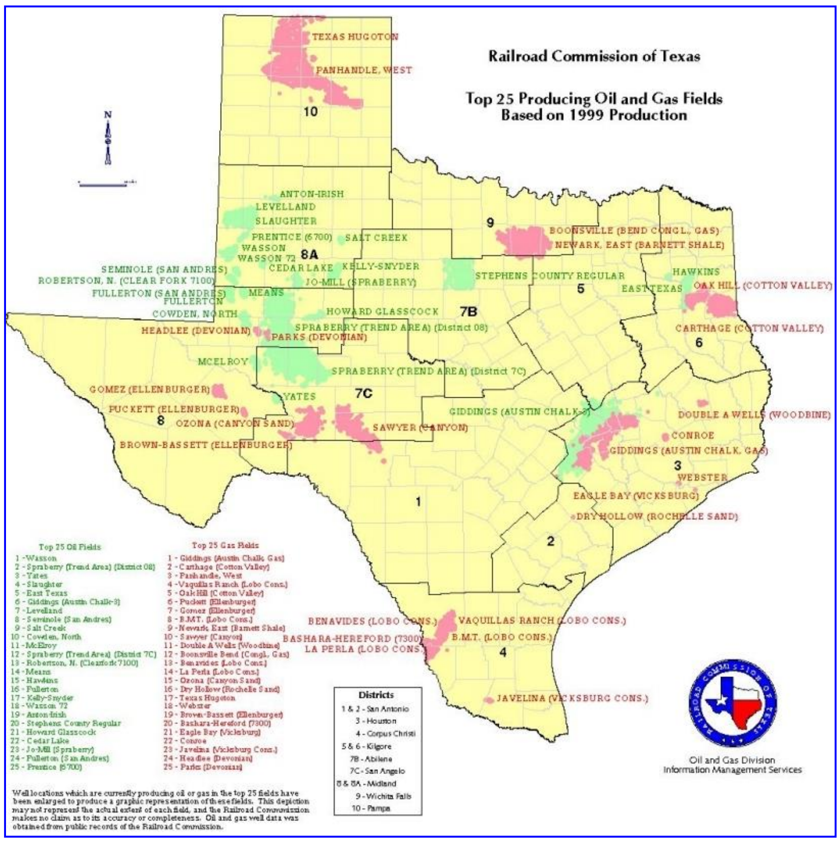


Figure 1.8 Top 25 Producing Oil and Gas Fields based on 1999 Production
(Source: Railroad Commission of Texas)

Table 1.2 Regional Oil Production
(*Source: Railroad Commission of Texas)*

County	Oil Production 2012 (barrels)	Oil Production 2013 (barrels)	Total Production since January 1, 1993
Bowie	57,063	56,432	3,369,991
Camp	177,179	193,428	7,162,248
Cass	275,284	296,967	9,580,508
Delta	0	0	0
Franklin	515,296	686,168	10,944,456
Gregg	435,326	452,023	11,070,027
Harrison	1,065,237	1,030,112	22,492,204
Hopkins	0	0	0
Hunt	0	0	0
Lamar	0	0	0
Marion	165,371	160,402	4,509,002
Morris	1,385	1,292	17,581
Rains	0	0	39
Red River	91,116	98,155	5,524,987
Smith	1,429,475	1,414,522	33,416,890
Titus	466,555	557,125	11,877,905
Upshur	315,374	280,916	11,922,542
Van Zandt	0	0	0
Wood	3,515,315	3,476,494	114,787,718

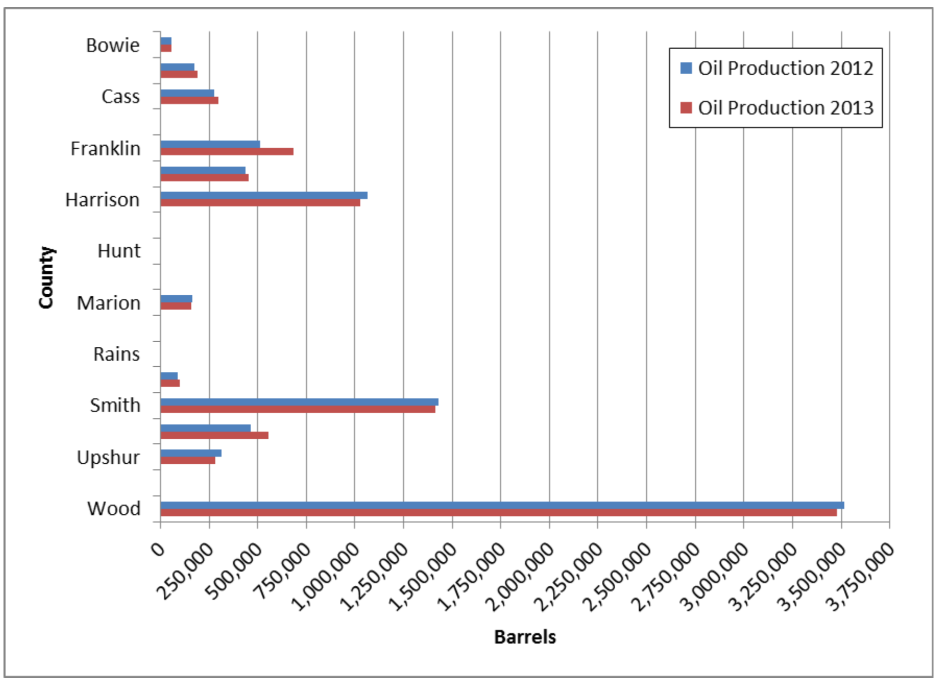


Figure 1.9 Oil Production by County (Barrels; 2012 – 2013)
(Source: Railroad Commission of Texas)

Lignite resources are also found in portions of northeast Texas (See Figure 1.10), and there are near-surface operating mines in Harrison, Titus, and Hopkins counties. Finally, both ceramic and non-ceramic iron oxide deposits are located in Cass, Harrison, Marion, Morris, Smith, and Upshur counties.

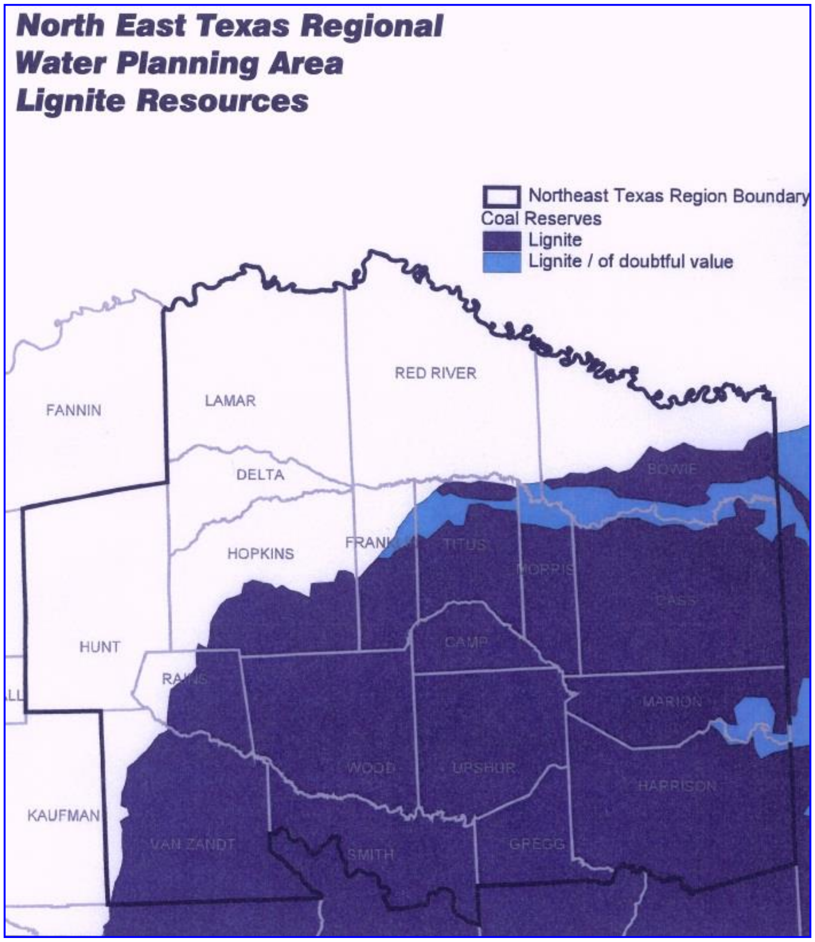


Figure 1.10 North East Texas Regional Water Planning Area Lignite Resources

Agricultural land is important to northeast Texas and much agricultural production takes place on prime farm land. Prime farm land is defined by the Natural Resource Conservation Service as "land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses." Figure 1.11 shows locations of agricultural land in the Region. Timber is the second most important agricultural crop in Texas, and the most important timber producing area is in the Piney Woods of east Texas. Counties within the Region with significant timber production include Bowie, Camp, Cass, Franklin, Gregg, Harrison, Marion, Morris, Red River, Smith, Titus, Upshur, Van Zandt, and Wood. Of these counties, only Van Zandt and Titus produce more cubic feet of hardwoods than pine. Non-industrial parties own approximately 66 percent of timber production areas in the North East Texas Region, with industrial interests owning 25%, and the remainder used for public lands. Stumpage value of the East Texas timber harvest in 2005 was $494.6 million, and the delivered value of timber was $839.6 million, both values up from 2004.

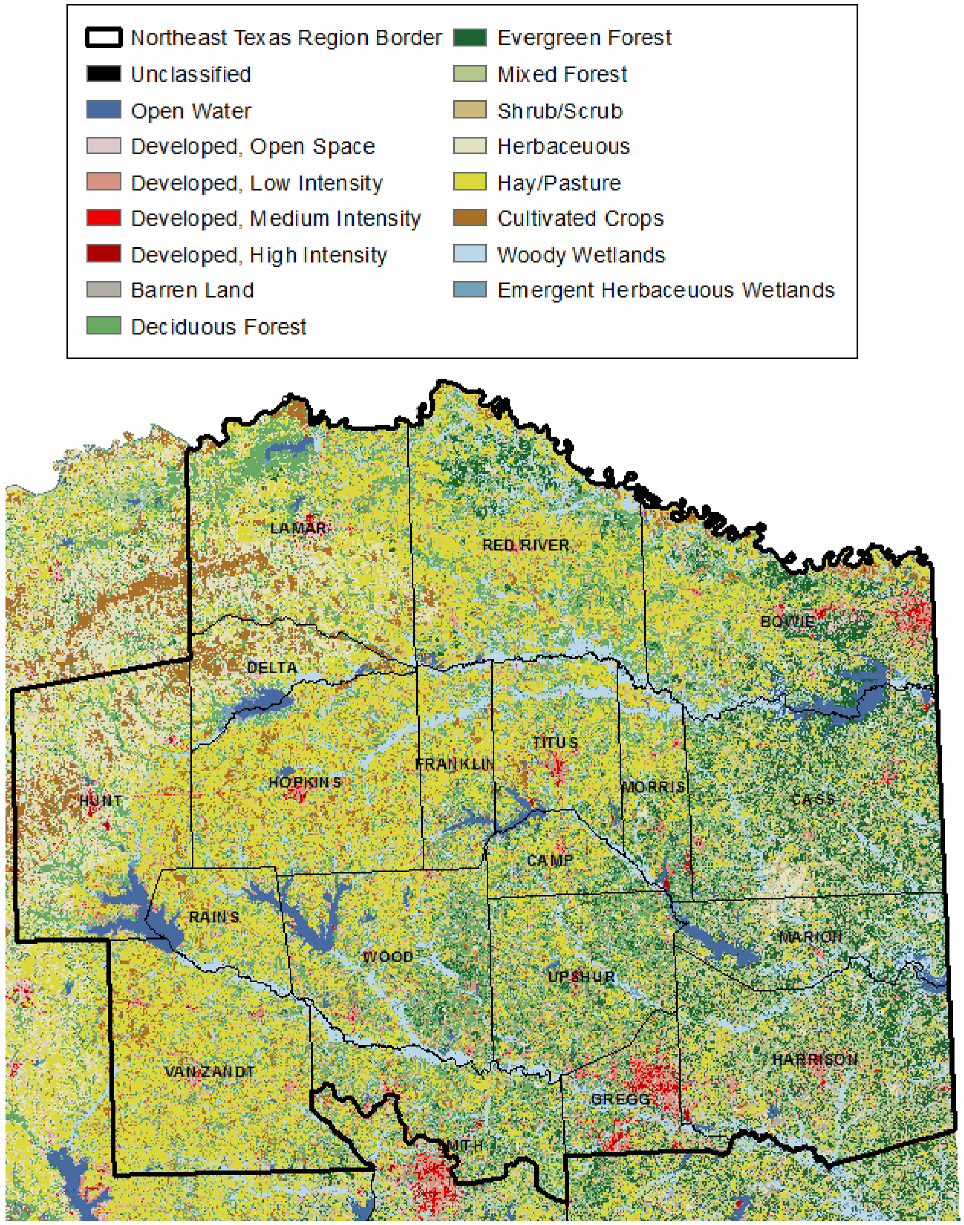
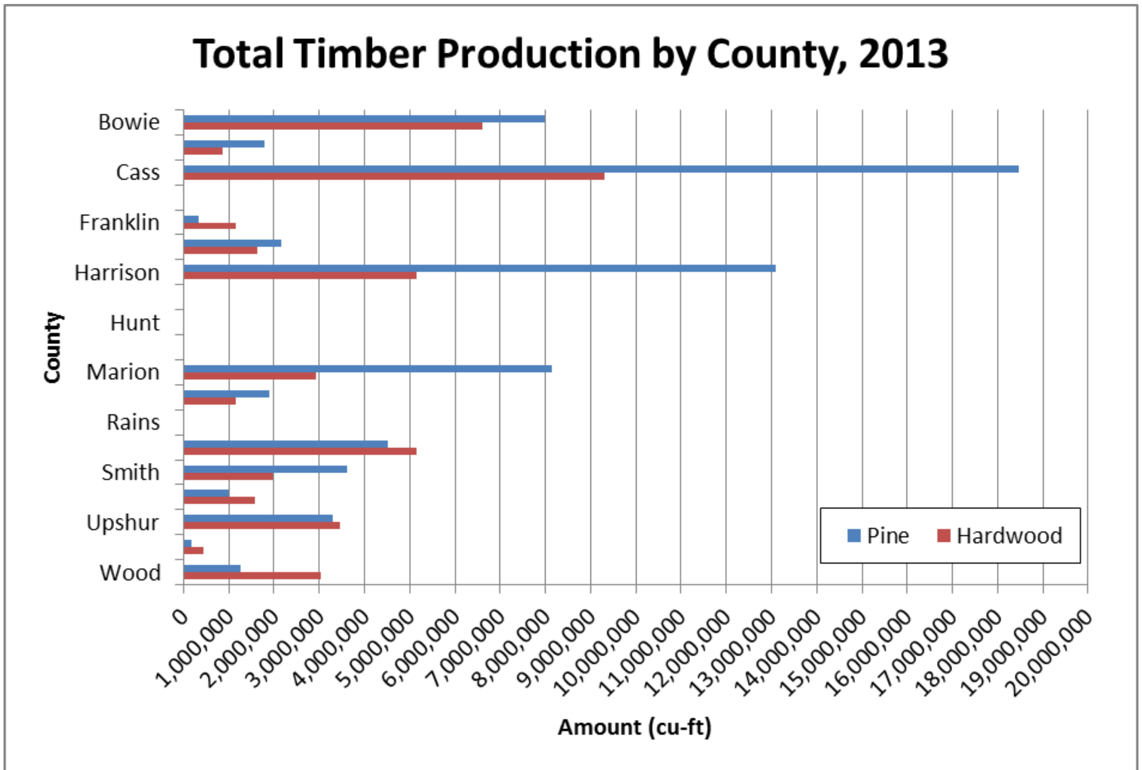


Figure 1.11 North East Texas Water Planning Area Land Use Map
(Source: U.S. Department of Agriculture, Natural Resource Conservation Service)

Data taken from Harvest Trends 2013 from the Texas A&M Forest Service (see Figure 1.12) depict the counties within the Region that are important timber producers.



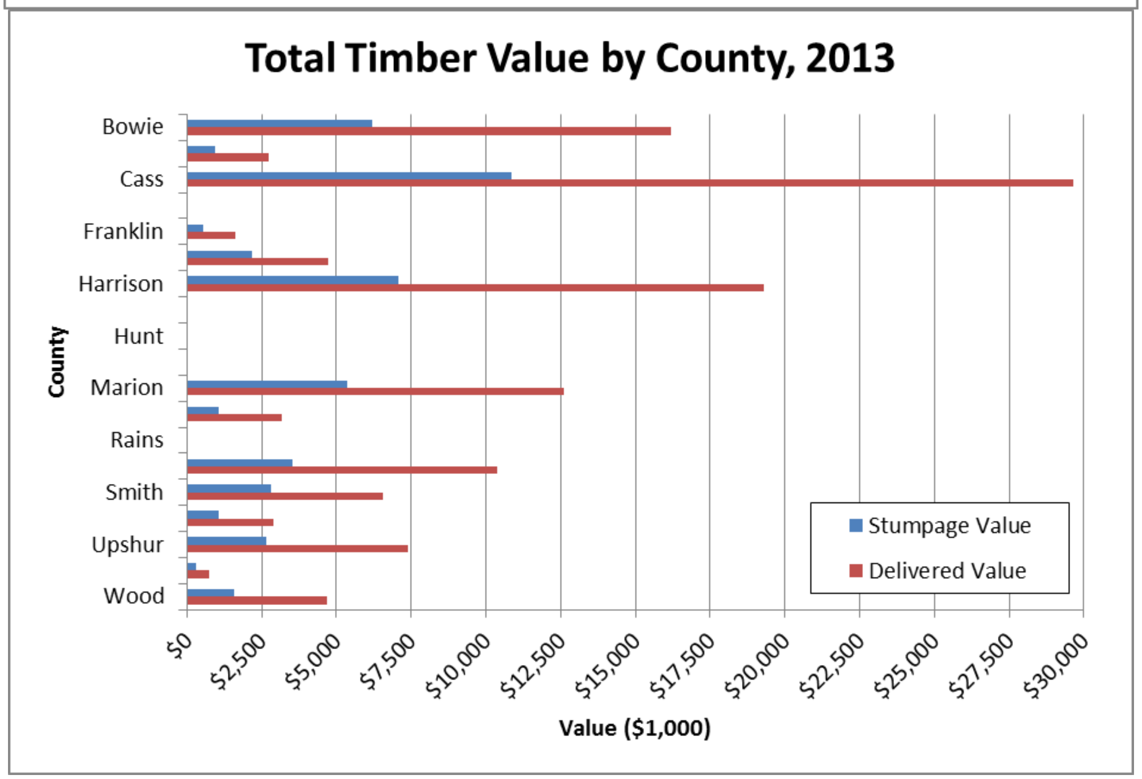


Figure 1.12 Total Timber Production and Value by County (2013)
(Source: Texas A&M Forest Service)

The timber industry in the Region is threatened by the proposed Marvin Nichols Reservoir, as determined in "The Economic Impact of the Proposed Marvin Nichols I Reservoir to the Northeast Texas Forest Industry" report (2002), created by the Texas Forest Service. The report estimates that, depending on what type of wildlife mitigation strategy is chosen, construction of the reservoir could impact the local economy with an annual loss of $51 to $164 million in industry output, $22 to $70 million in value-added, 417 to 1,334 jobs, and $13 to $41 million in labor income.

Types of business and industry in the North East Texas Region vary from county to county, depending on location and natural resources present. For example, Cass County has paper mills and sawmills because of the abundance of timber in the area. Wood, Harrison, and Gregg counties' economies are oil-based due to extensive oil resources. Hunt County is home to Texas A&M University - Commerce, and therefore has a percentage of its economic base in education. Hunt County is also located near the Dallas Metroplex, and many of its residents are employed there. While there are differences in the economic bases within the counties, there are also similarities. Government employment, tourism, manufacturing and agribusiness are present in every county within the Region.

Northeast Texas's flora and fauna, as well as its rich history and local pride, are attractions for tourists. There are many things to see and do in northeast Texas, from visiting museums and local festivals to taking nature walks in state parks. Table 1.3 lists state parks in the region by county.

Table 1.3 State Parks by County

County	State Park(s)
Cass	Atlanta State Park
Delta and Hopkins	Cooper Lake State Park
Harrison	Caddo Lake State Park Starr Family State Historic Park
Hunt and Van Zandt	Lake Tawakoni State Park
Lamar	Pat Mayse State Park Sam Bell Maxey State Park
Morris	Daingerfield State Park
Smith	Tyler State Park
Titus	Lake Bob Sandlin State Park
Van Zandt	Purtis Creek State Park
Wood	Governor Hogg Shrine State Park

The North East Texas Region has agricultural, art and cultural museums, including the Parchman House in Franklin County, the Marshall Pottery Museum, the Cotton Museum in Greenville, the North East Texas Rural Heritage Center Museum and the Texarkana Historical Museum, to name a few. Almost every town in the Region has at least one fair or festival throughout the year, from the East Texas Yamboree in Gilmer to the Four States Fair in Texarkana.

1.3 SOCIOECONOMIC CHARACTERISTICS OF THE REGION

1.3.1 Historical and Current Population

Population in the North East Texas Region has both increased and declined in the past 100 years due to economic (primarily agricultural) change. Much of the economy in northeast Texas has historically been based on agriculture, and many large on-farm families lived in the area until the 1930's. During the depression years, farmers had to look for work in the cities, and high-yield cotton-producing farms, as well as other types of farms. Beginning in the 1950's, the region saw a resurgence, and has been growing steadily since. Booms in the oil, timber and tourism industries brought people back to northeast Texas in the 1970's and 1980's, and the 1990's have seen an increase in persons coming to northeast Texas to retire around area lakes.

Table 1.4 presents the historical population of each county. These population counts are provided by the United States census. The graph shows that most of the counties have seen growth of over 25 percent. Several counties, including Franklin, Hunt, Rains, Smith, Titus, Upshur, Van Zandt and Wood, experienced growth of over 75 percent. The Region as a whole grew 70 percent from 1970 to 2010, compared to a 125 percent growth in Texas and a 47 percent growth in the United States.

Table 1.4 Historic Population by County

County										40 Yr. Growth
	1970	1980	% Growth	1990	% Growth	2000	% Growth	2010	% Growth	
Bowie	67,813	75,301	11.0%	81,665	8.5%	89,306	9.4%	92,565	3.6%	36.5%
Camp	8,005	9,275	15.9%	9,904	6.8%	11,549	16.6%	12,401	7.4%	54.9%
Cass	24,133	29,430	21.9%	29,982	1.9%	30,438	1.5%	30,464	0.1%	26.2%
Delta	4,927	4,839	-1.8%	4,857	0.4%	5,327	9.7%	5,231	-1.8%	6.2%
Franklin	5,291	6,893	30.3%	7,802	13.2%	9,458	21.2%	10,605	12.1%	100.4%
Gregg	75,929	99,487	31.0%	104,948	5.5%	111,379	6.1%	121,730	9.3%	60.3%
Harrison	44,841	52,265	16.6%	57,483	10.0%	62,110	8.0%	65,631	5.7%	46.4%
Hopkins	20,710	25,247	21.9%	28,833	14.2%	31,960	10.8%	35,161	10.0%	69.8%
Hunt	47,948	55,248	15.2%	64,343	16.5%	76,596	19.0%	86,129	12.4%	79.6%
Lamar	36,062	42,156	16.9%	43,949	4.3%	48,499	10.4%	49,793	2.7%	38.1%
Marion	8,517	10,360	21.6%	9,984	-3.6%	10,941	9.6%	10,546	-3.6%	23.8%
Morris	12,310	14,629	18.8%	13,200	-9.8%	13,048	-1.2%	12,934	-0.9%	5.1%
Rains	3,752	4,839	29.0%	6,715	38.8%	9,139	36.1%	10,914	19.4%	190.9%
Red River	14,298	16,101	12.6%	14,317	-11.1%	14,314	0.0%	12,860	-10.2%	-10.1%
Smith*	97,096	128,366	32.2%	151,309	17.9%	174,706	15.5%	209,714	20.0%	116.0%
Titus	16,702	21,442	28.4%	24,009	12.0%	28,118	17.1%	32,334	15.0%	93.6%
Upshur	20,976	28,595	36.3%	31,370	9.7%	35,291	12.5%	39,309	11.4%	87.4%
Van Zandt	22,155	31,426	41.8%	37,944	20.7%	48,140	26.9%	52,579	9.2%	137.3%
Wood	18,589	24,697	32.9%	29,380	19.0%	36,752	25.1%	41,964	14.2%	125.7%
TOTAL	**550,054**	**680,596**	**23.7%**	**751,994**	**10.5%**	**847,071**	**12.6%**	**932,864**	**12.60%**	**69.6%**

Note: Population numbers reflect the whole of Smith County, not the portion in Region D.

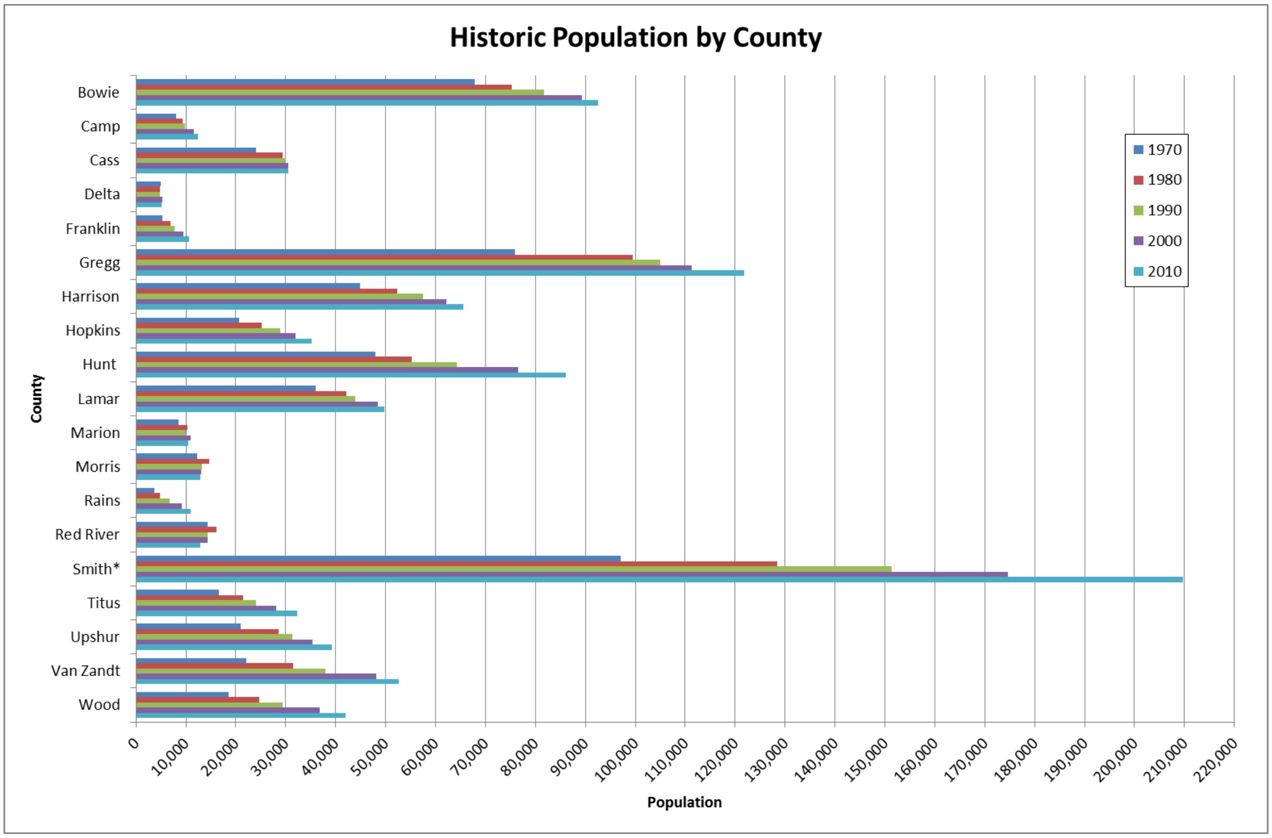


Figure 1.13 Historic Population by County, North East Texas Region (1970 – 2010)

1.3.2 Demographics

The North East Texas Region is largely rural. Most towns within the region have populations of less than 10,000, and there are many small, unincorporated areas within counties. Cities with populations over 10,000 are listed in Table 1.5.

Table 1.5 Cities with 2010 Populations over 10,000
(Source: U.S. Census Bureau)

City	2010 Census
Greenville	25,557
Kilgore	12,975
Longview	80,455
Marshall	23,523
Mount Pleasant	15,564
Paris	25,171
Sulphur Springs	15,449
Texarkana	36,411

The 2010 U.S. Census identifies totals of ethnic categories, including black, white, and other (Asian, American Indian, Hispanic, etc.). The graphs in Figure 1.14 illustrate ethnic percentages in the Region compared to the State.

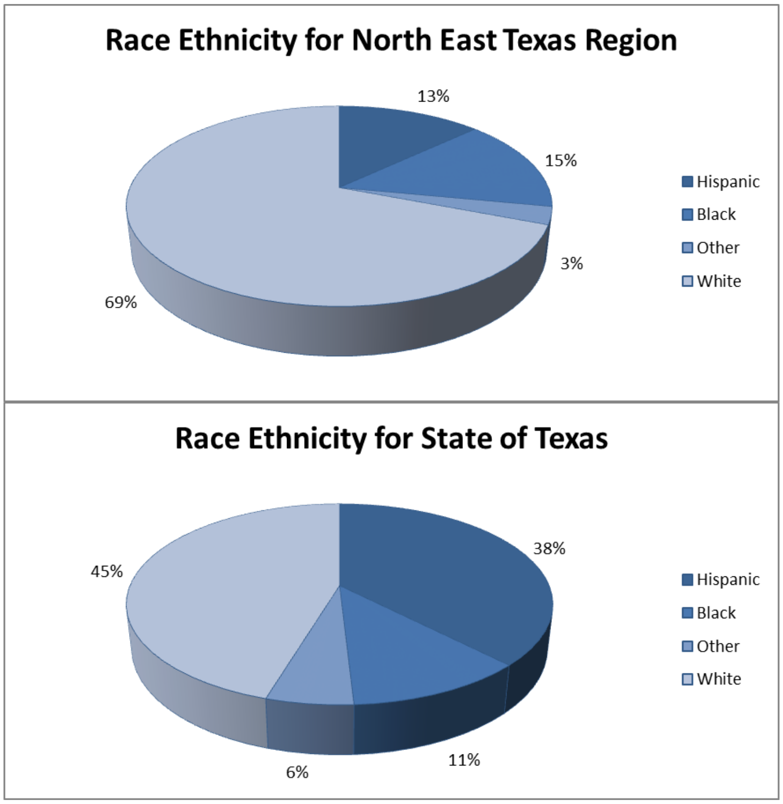


Figure 1.14 Comparison of Ethnic Percentages in the Region compared to the State.
(Source: US Census Bureau 2010 Census)

Incomes in the Region are earned through a variety of occupations, with many either directly or indirectly related to agriculture. The average median household income in the Region in 2012, as reported by the U.S. Bureau of Economic Analysis, is $40,094, which is lower than the state average of $43,815. Red River County reported the lowest median income of the Region, at $33,153, and Smith County reported the highest income at $46,305. Figure 1.15 shows the median family income by county. The average 2012 per capita income for the Region is $35,726 compared to the state average of $39,154. Titus County reported the lowest per capita income of $29,157 and Gregg County reported the highest, at $46,954.

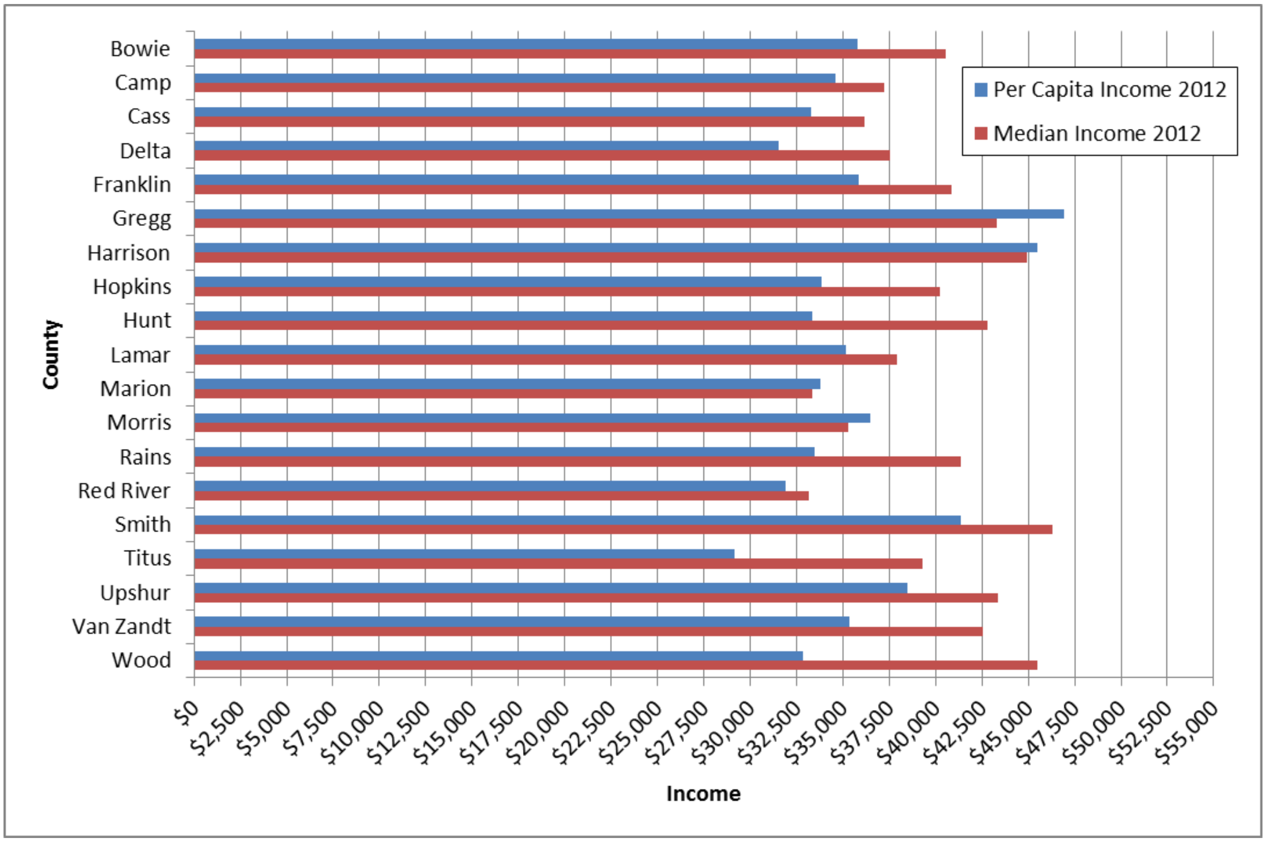


Figure 1.15 Regional Incomes
(Source: U.S. Bureau of Economic Analysis)

1.3.3 Economic Activity

The North East Texas Region's main economic base is agribusiness. Crops are varied, and include vegetables, fruits, and grains. Cattle and poultry production are important – cattle for dairies and cow-calf operations, and poultry for eggs and fryers. In the eastern half of the Region, the timber, oil and gas industries are important, as is mining. Many residents on the western border of the region are employed in the Dallas-Fort Worth Metroplex.

The North East Texas Region is traversed by several major highways, including Interstate 30 which passes from Dallas-Ft. Worth through the region to Texarkana. Interstate 20 runs from the Dallas Metroplex east/west across the southern portion of the region. Other major highways include U.S. 271, U.S. 69, U.S. 82, U.S. 59, U.S. 259, and U.S. 80.

Water travel is not significant in the Region. However, there are numerous airports including the East Texas Regional Airport in Longview as well as many county and municipal airports.

1.4 DESCRIPTIONS OF WATER SUPPLIES AND WATER PROVIDERS IN THE REGION

1.4.1 Groundwater

The TWDB has identified two major aquifers and four minor aquifers in the North East Texas Region. The difference between the major and minor classification as used by the TWDB relates to the total quantity of water produced from an aquifer, and not the total volume available.

Major aquifers are the:

- Carrizo-Wilcox
- Trinity

Minor aquifers are the:

- Blossom
- Nacatoch
- Queen City
- Woodbine

The total groundwater usage in the North East Texas Region was 86,944 ac-ft during 2012, as represented by water use surveys. Sixty-five percent of that groundwater was used for municipal purposes. About twenty-four percent of the groundwater was used for irrigation purposes and the rest of the groundwater was used for manufacturing, mining, livestock, and steam electric.

(1) Major Aquifers (see Figure 1.16)

a) Carrizo-Wilcox Aquifer

The Carrizo-Wilcox Aquifer is the most heavily utilized aquifer in the Region, producing approximately 66 percent of the total groundwater. The Carrizo-Wilcox Aquifer is formed by the hydrologically connected Wilcox Group and the overlying Carrizo Formation of the Claiborne Group. This aquifer extends from the Rio Grande in south Texas northeast into Arkansas and Louisiana, providing water to 60 counties in Texas. In the outcrop, wells generally yield less than 100 gpm – downdip yields greater than 500 gpm are not uncommon. Regionally, water from the Carrizo-Wilcox Aquifer is fresh to slightly saline. Iron and manganese are frequently encountered. In the outcrop, the water is hard, yet usually low in dissolved solids. Hydrogen sulfide and methane may occur locally. Excessively corrosive water is common in some areas of the Region.

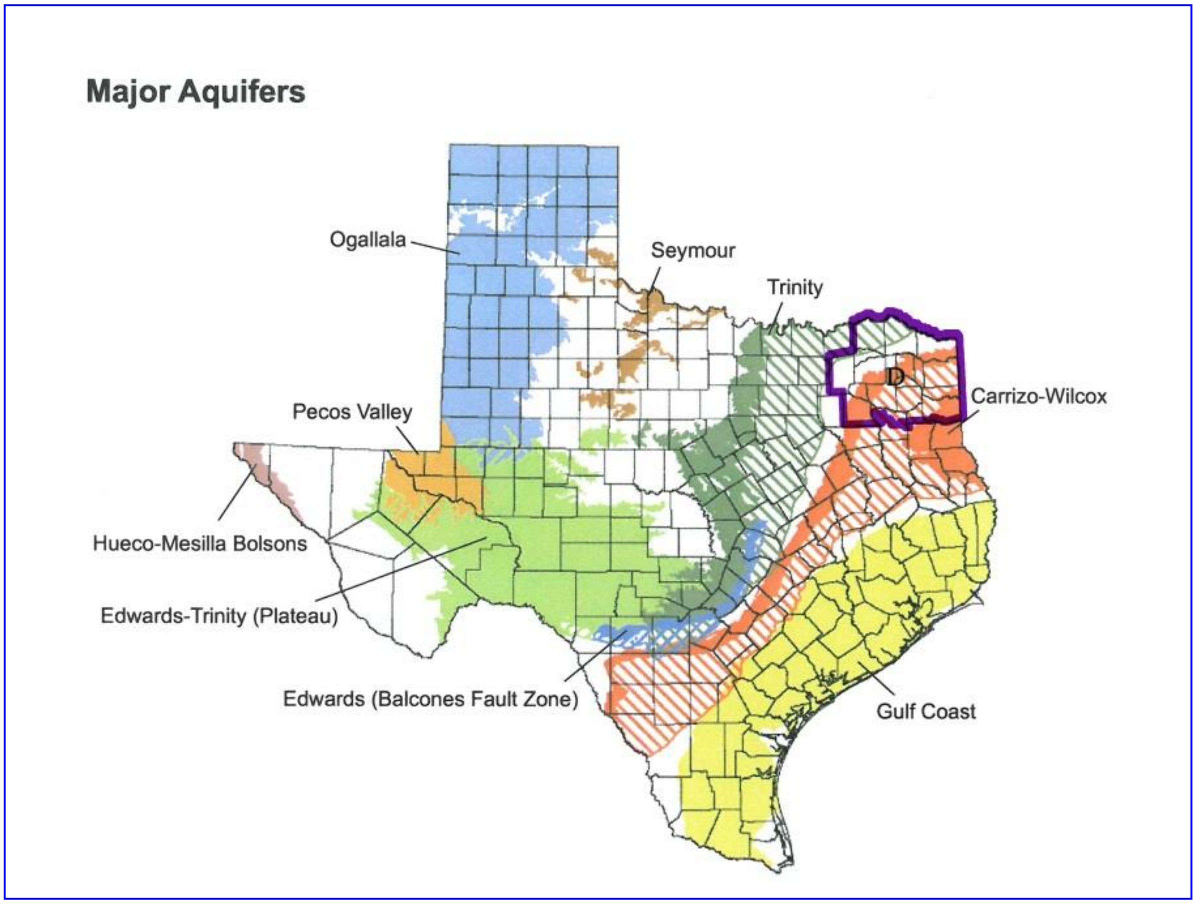


Figure 1.16 Major Aquifers
(Source: TWDB)

Total groundwater pumpage from the Carrizo-Wilcox Aquifer in the North East Texas Region was 56,850 ac-ft during 2012. Groundwater Management Area (GMA) 11 adopted Desired Future Conditions (DFCs) for the Carrizo-Wilcox Aquifer in April of 2010. The June 2012 Modeled Available Groundwater (MAG) can be used to determine available supply in this aquifer.

b) Trinity Aquifer

The Trinity Aquifer is composed of sand, clay, and limestone units which occur in a band from the Red River in north Texas, to the Hill Country of south-central Texas. It provides water in all or parts of 55 Texas counties. Sherman and Gainesville, located west of the Region, are two large public supply users of the Trinity Aquifer. The groundwater use from the Trinity Aquifer during 2012 in the Region was 1,597 ac-ft. This value is relatively small because only a small northwestern portion of the Region overlies the downdip portion of the Trinity Aquifer, and the groundwater from the Trinity Aquifer in the Region exceeds the 1,000 milligrams per liter (mg/l) TDS limits established by TCEQ for municipal supply. The December 2011 MAG can be used to determine available supply in this aquifer.

(2) Minor Aquifers (see Figure 1.17)

a) Queen City Aquifer

The Queen City Aquifer extends in a band across most of Texas from the Frio River in south Texas northeast into Louisiana. The Queen City formation is composed mainly of sand, loosely cemented sandstone, and interbedded clays. Although large amounts of usable quality groundwater are contained in the Queen City yields are typically low. A few wells exceed 400 gallons per minute (gpm). Throughout most of its extent, the chemical quality of the Queen City Aquifer water is excellent; however, quality deteriorates with depth in the downdip direction. Due to the relatively low well yields, overdrafting of the aquifer has not occurred. The groundwater usage from the Queen City aquifer during 2012 in the Region was 4,001 ac-ft. Groundwater Management Area (GMA) 11 adopted Desired Future Conditions (DFCs) for the Queen City Aquifer in April of 2010. The June 2012 MAG can be used to determine available supply in this aquifer.

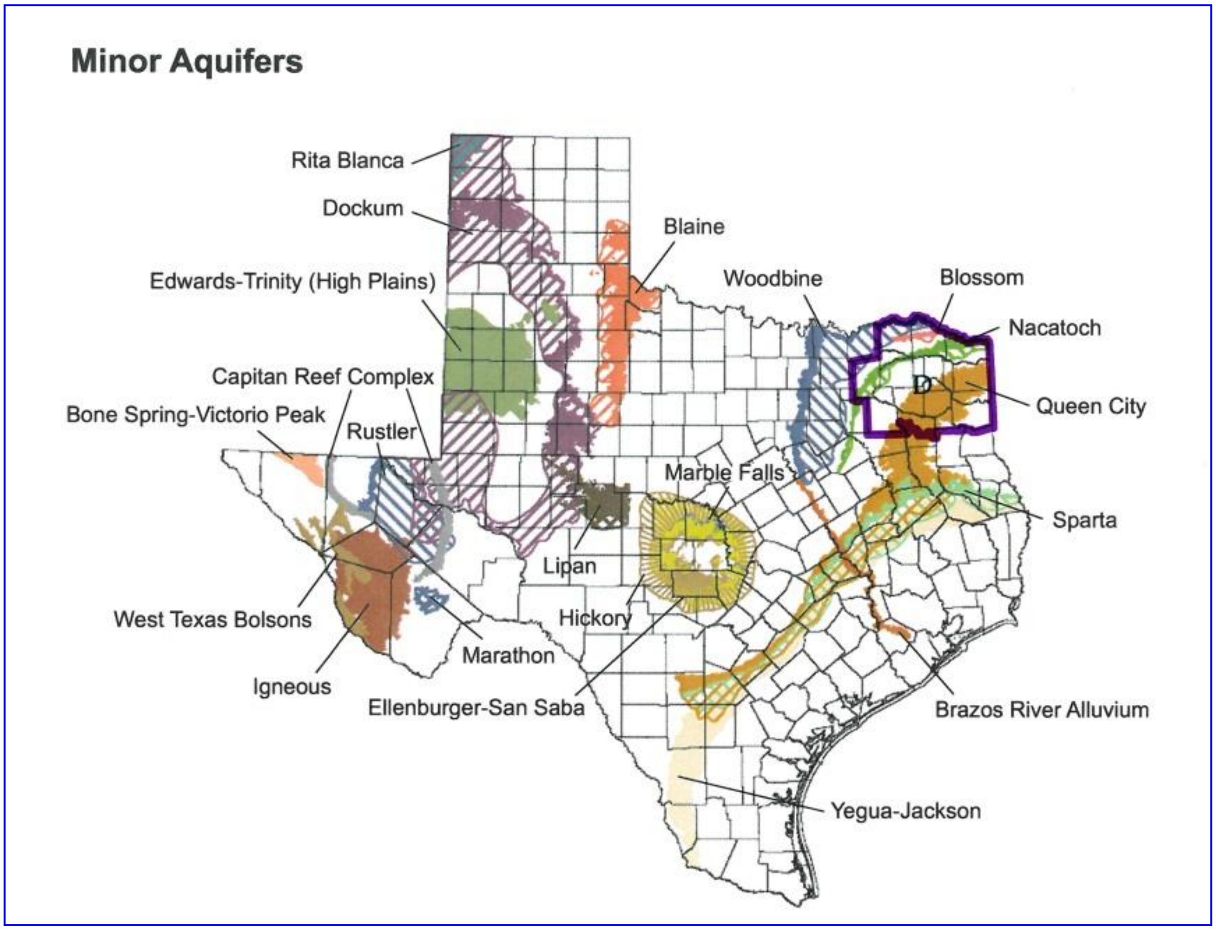


Figure 1.17 Minor Aquifers
(Source: TWDB)

b) Woodbine Aquifer

The Woodbine Aquifer extends from McLennan County in north-central Texas northward to Cooke County and eastward to Red River County, paralleling the Red River. The Woodbine Aquifer is composed of water bearing sand and sandstone beds interbedded with shale and clay. The water in storage is under water-table conditions in the outcrop and under artesian conditions in the subsurface. The aquifer dips eastward into the subsurface where it reaches a maximum depth of 2,500 feet below land surface and a maximum thickness of approximately 700 feet.

Yields of wells in the Woodbine Aquifer in the Region are generally less than 100 gpm. Water produced from the aquifer furnishes municipal, industrial, domestic, livestock, and small irrigation supplies throughout northeast Texas. Chemical quality of water deteriorates rapidly in well depths below 1,500 feet. In areas between the outcrop and this depth, quality is considered good overall as long as groundwater from the upper Woodbine Aquifer is sealed off. The upper Woodbine Aquifer contains water of extremely poor quality in downdip locales and contains excessive iron concentrations along the outcrop. Total pumpage from the Woodbine Aquifer in the Region during 2012 was 484 ac-ft. Groundwater Management Area (GMA) 8 re-adopted Desired Future Conditions (DFCs) for the Woodbine Aquifer in June of 2011. The June 2012 MAG can be used to determine available supply in this aquifer.

c) Nacatoch Aquifer

The Nacatoch Aquifer occurs in a narrow band in northeast Texas and extends eastward into Arkansas and Louisiana. The Nacatoch formation is composed of one to three sequences of sands separated by impermeable layers of mudstone or clay. The aquifer also includes a hydrologically connected mantle of alluvium up to 80 feet thick where it covers the Nacatoch formation along major drainage ways. Groundwater in this aquifer is usually under artesian conditions except in shallow wells on the outcrop where water-table conditions exist. Well yields are generally low, less than 50 gal/min, and rarely exceed 500 gal/min. The quality of groundwater in the aquifer is generally alkaline, high in sodium bicarbonate, and soft. Dissolved-solids concentrations increase in the downdip portion of the aquifer and are significantly higher downdip of faults.

During 2012, pumpage from the aquifer totaled 4,313 ac-ft. Groundwater Management Area (GMA) 8 adopted Desired Future Conditions (DFCs) for the Nacatoch Aquifer in June of 2011. The December 2011 MAG can be used to determine available supply in this aquifer.

d) Blossom Aquifer

The Blossom Aquifer occupies a narrow east-west band in parts of Bowie, Red River, and Lamar counties in the northeast corner of the State. The Blossom formation consists of alternating sequences of sand and clay. In places it attains a thickness of 400 feet, although no more than 29 percent of this thickness consists of water-bearing sand. The Blossom

Aquifer yields water in small to moderate amounts over a limited area on and south of the outcrop area. Most of the water in storage is under water-table conditions. The average well yields 75 gal/min in Red River County. Production decreases in the western half of the aquifer where yields less than 50 gal/min are more typical. Wells producing fresh to slightly saline water are located on the formation outcrop in northwestern Bowie and eastern Red River counties and in the City of Clarksville. The groundwater is generally soft, slightly alkaline and, in some areas, high in sodium bicarbonate, iron, and fluoride.

In 2012, the total pumpage in the Region was 8,783 ac-ft from the Blossom Aquifer. Groundwater Management Area (GMA) 8 adopted Desired Future Conditions (DFCs) for the Blossom Aquifer in April of 2011. The December 2011 MAG can be used to determine available supply in this aquifer.

(3) Other Aquifers

Some groundwater pumpage from “other aquifers” is registered in the TWDB historical groundwater pumpage database in Bowie, Delta, Gregg, Harrison, Hunt, Lamar, Marion, Morris, Rains, Red River, Smith, Upshur, Van Zandt, and Wood counties. ‘Other aquifer’ refers to localized pockets of groundwater that are not classified as either a major or minor aquifer of the state. Other aquifer supplies are generally small but can be locally significant. The total reported from these aquifers in 2012 was 8,268 ac-ft.

(4) Springs

There are over 150 springs of various sizes documented in the North East Texas Regional Water Planning Area (Brune, 1981). The majority of the largest springs (20 to 200 gpm) are located in the southern third of the Region. The northern third of the Region has smaller spring flows ranging from 0.2 to 20 gpm. A number of springs in Red River, Bowie, Hunt, Delta, Lamar and Titus counties have gone dry. Most springs discharge less than 10 gpm and are inconsequential for planning purposes.

In the northern third of the Region (Lamar, Red River, and Bowie counties) springs issue from the Upper Cretaceous Formations including the Woodbine, Navarro and Ozan Sands, Bonham and Blossom. Springs in the central and southern third of the Region issue from the Tertiary Eocene Sands including the Reklaw, Carrizo, Wilcox and Queen City. The water quality of springs in the Region is dominated by calcium and sodium bicarbonate type waters with locally high concentrations of iron, manganese and sulfate.

(5) Threats and Constraints on Water Supply

Potential threats to the groundwater resources of the Region include contamination from point and nonpoint sources. In general, contamination from point sources such as landfills, wastewater outfalls, hazardous waste spills, and leaking underground storage tanks have a relatively localized impact on the shallow water resources of the aquifers. Nonpoint source contamination from agricultural practices such as fertilization and application of herbicides and pesticides as well as urban runoff may have more regionalized impact on shallow groundwater. Adherence to TCEQ regulations concerning stormwater and wastewater discharges should reduce threats to groundwater from these sources.

(6) Groundwater Management Areas

A Groundwater Management Area (GMA) is defined as an area suitable for the management of groundwater resources. Groundwater Management Areas were created through Texas Water Code §35.001. The purpose of a GMA is to preserve, conserve, protect, recharge, and prevent waste of groundwater and groundwater reservoirs, and this is accomplished by joint planning. Each GMA is comprised of representatives of the Groundwater Conservation Districts (GDCs) within the GMA area. A key part of the aforementioned joint planning is determining "desired future conditions" (DFC), conditions of the aquifer that are used to calculate "Modeled Available Groundwater (MAG)" values. These conditions and numbers are used for regional water plans, groundwater management plans, and permitting.

Within the North East Texas Region, there are two GMAs – 8 and 11. GMA 8 includes the Edwards and Trinity Aquifers, as well as the Blossom, Brazos River Alluvium, Ellenburger-San Saba, Hickory, Marble Falls, Nacatoch, and Woodbine Aquifers. It is managed by the Clearwater Underground Water Conservation District and includes 10 Groundwater Conservation Districts (GDCs), none of which are located within Region D. GMA 8 has created desired future conditions (DFCs) for all of its aquifers, and Modeled Available Groundwater (MAG) reports have been created by TWDB for all of the aquifers within Region D.

GMA 11 includes the Carrizo-Wilcox and Gulf Coast Aquifers, as well as the Nacatoch, Queen City, Sparta, and Yegua-Jackson Aquifers. It does not list a managing entity, but is comprised of 5 GCDs, none of which are in Region D. A groundwater district for Harrison County was created by the 81st Legislature, but the County voters turned this down in 2010. GMA 11 adopted DFCs for its aquifers in April of 2010.

The concern in Region D with respect to GMAs, is that it has no representation in either of its management areas. Legislation states that the GMA has the authority to determine DFCs for all areas within the GMA; therefore, Region D's groundwater availability is being controlled by entities in different regions, sometimes hundreds of miles away.

1.4.2 Surface Water Supplies

The North East Texas Region contains portions of the Red, Sulphur, Cypress and the Sabine River Basins. A small corner of Van Zandt County also lies in the Neches River Basin. Likewise, a small corner of Hunt County is in the Trinity Basin.

Groundwater is limited in quality and quantity in large portions of the North East Texas Region, and, consequently a majority of the Region relies on surface water supplies. For example, of the estimated 2020 supplies in the Sulphur Basin, 95 percent of the water is surface water; 89 percent of water supplied in the Cypress Creek Basin is surface water, and in the Sabine River Basin, some

81 percent of the need is met by surface water. In the portion of the Red River Basin in the Region, 83 percent of the water supply used is surface water. These major river basins are shown in Figure 1.18.

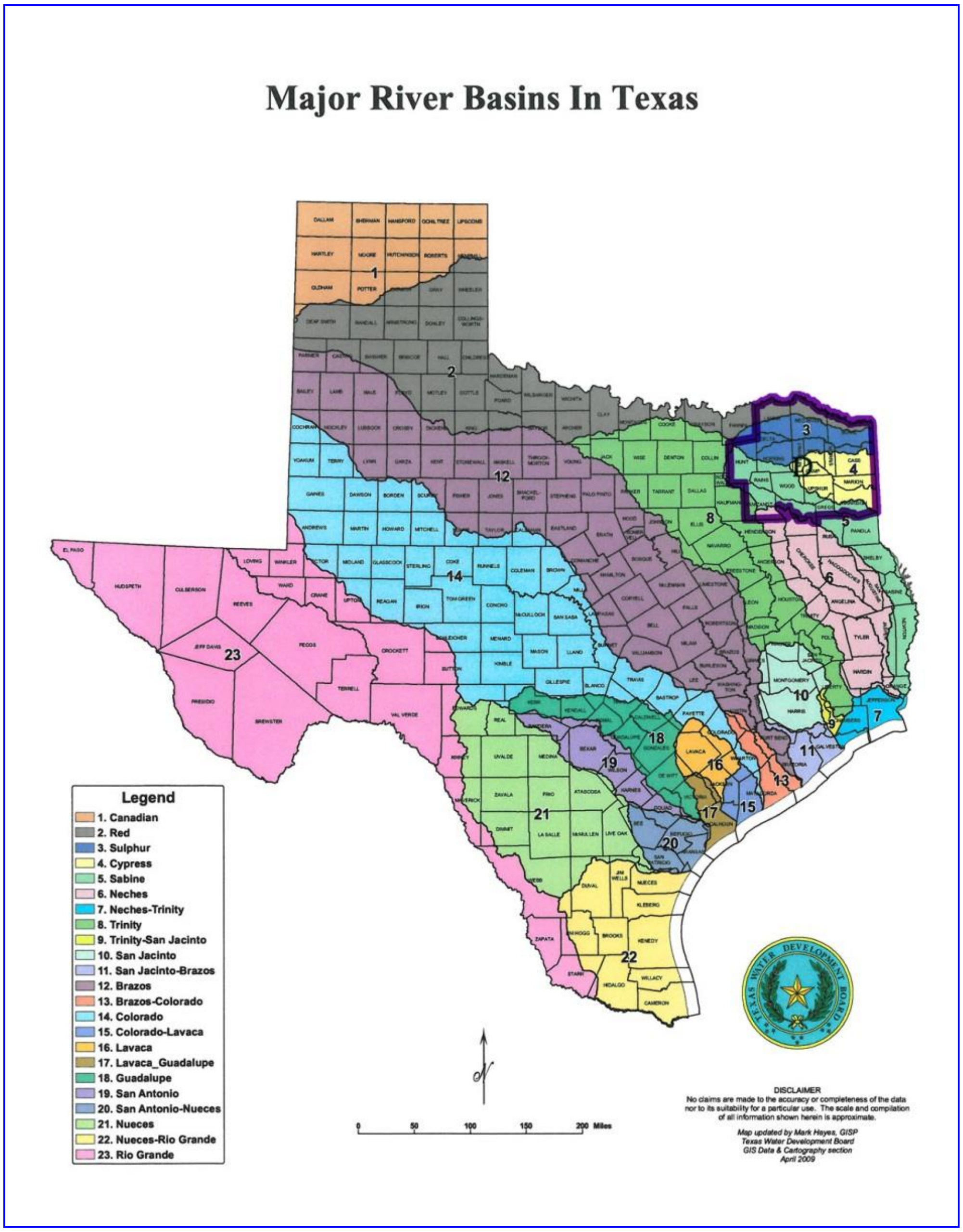


Figure 1.18 Major River Basins in Texas
(Source: TWDB)

Within the Region, a number of surface water reservoirs greater than 500 surface acres exist as shown in Table 1.6. The larger of these reservoirs are illustrated on Figure 1.19.

Table 1.6 Existing Reservoirs

			Conservation Pool			
Lake/Reservoir	**County**	**Built**	**Area (acres)**	**Capacity (ac-ft)**	**Firm Yield (ac-ft)**	**Volumetric Survey Date**
Red River Basin						
Lake Crook	Lamar	1923	1,060	9,210	7,290	2009
Pat Mayse Lake	Lamar	1967	5,638	117,844	59,670	2009
Sulphur River Basin						
Big Creek Lake	Delta	1986	520	4,890	1,518	
Cooper**	Delta	1991	17,958	298,900	114,705	2007
Rivercrest***	Red River	1953	555	7,000	8,624	
Langford Creek Lake	Red River	1966	162	947	540	2013
Lake Sulphur Springs	Hopkins	1974	1,557	14,370	11,530	
Lake Wright Patman*	Bowie/Cass	1956	18,247	97,927	294,000	2010
Elliott Creek Lake	Bowie				1,910	
Sulphur Turkey Creek Lakes	Fannin/Hunt				200	
Sabine Edgewood City Lake	Van Zandt				160	
Big Sandy Creek Lake					2,000	
Sabine Mill Creek	Van Zandt				1,150	
Cypress Creek Basin						
Lake Bob Sandlin	Wood Titus Franklin	1975	8,703	201,733	60,430	2008
Caddo Lake	Marion/Harrison	1971	26,800	129,000	10,000	
Cypress Springs	Franklin	1971	3,252	66,756	12,100	2007
Ellison Creek	Morris	1943	1,516	24,700	33,700	
Lake Gilmer	Upshur	1998	895	12,720	6,300	
Johnson Creek Reservoir	Marion	1961	650	10,100	2,000	
Lake O' the Pines	Marion/Upshur	1958	17,638	241,363	151,600	2009

			Conservation Pool			
Lake/Reservoir	**County**	**Built**	**Area (acres)**	**Capacity (ac-ft)**	**Firm Yield (ac-ft)**	**Volumetric Survey Date**
Monticello Lake	Titus	1973	2,001	34,740	5,000	1998
Tankersley Lake	Titus		na	na	1,500	
Welsh Reservoir	Titus	1975	1,269	20,242	3,000	2002
Sabine River Basin						
Brandy Branch Reservoir	Harrison	1983	1,242	29,513	19,891	
Lake Cherokee	Gregg	1948	3,467	43,737	29,120	2003
Lake Gladewater	Upshur	1952	481	4,738	4,000	2000
Greenville Lakes	Hunt	na	na	6,864	3,350	
Lake Fork**	Wood/Rains	1980	26,889	636,504	171,260	2009
Lake Hawkins	Wood	1962	776	11,890	0	
Lake Holbrook	Wood	1962	653	7,990	0	
Loma Lake					1,000	
Lake Quitman	Wood	1962	814	7,440	0	
Lake Winnsboro	Wood	1962	806	8,100	0	
Lake Tawakoni**	Rains/Van Zandt/Hunt	1960	37,325	871,693	229,710	2009

Source: 2002 – 2003 Texas Almanac, TWDB Reservoir Volumetric Surveys and Chapter 3 of this plan.
*Firm yield at ultimate curve reservoir operations with sedimentation. Permitted yield is currently 180,000 ac-ft/yr.
**Firm yield goes partly to Region C.
***Includes permitted diversion from Sulphur River

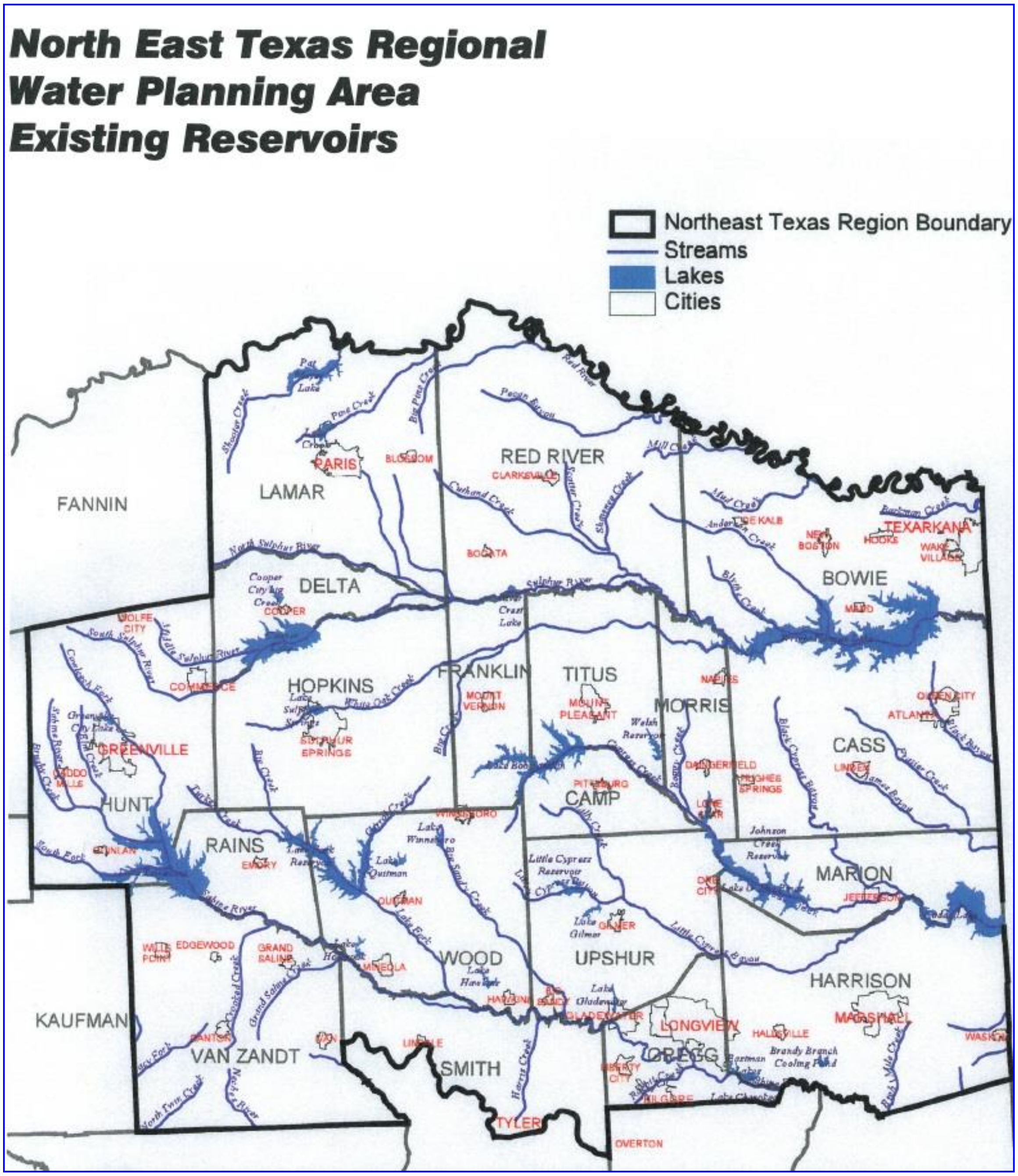


Figure 1.19 North East Texas Regional Water Planning Area Existing Reservoirs
(Source: TWDB)

Surface water reservoirs in the North East Texas Region are used for a variety of purposes, including municipal and industrial water supply, fishing, boating, water sports, cooling water for electric generation, irrigation, livestock, and flood control. State parks exist adjacent to several of the reservoirs, including: Caddo Lake State Park, Lake Bob Sandlin State Park, Tawakoni State Park, and Cooper Lake State Park. The Texas Parks and Wildlife Department maintains an 8925 acre wildlife management area on Pat Mayse Lake in Lamar County. The Corps of Engineers maintains recreational areas on several reservoirs, including: Pat Mayse, Lake O' the Pines, and Wright Patman. The Sabine River Authority and various local districts and municipalities maintain recreation facilities on their respective reservoirs. Corps of Engineers lakes in the North East Texas Region such as Pat Mayse, Wright Patman, and Lake O' the Pines have a major operational goal of flood control, as well as water supply and recreation. Other reservoirs such as Monticello, Rivercrest, Johnson Creek, Brandy Branch and Welsh Reservoir provide cooling water for power generation as well as recreation.

Three major agreements that affect surface water availability in the North East Texas Region are the Red River Compact, the Cypress Basin Operating Agreement, and the Sabine River Compact. The Red River Compact, entered into by Arkansas, Oklahoma, Louisiana, and Texas was adopted in 1979, and apportions water from the Red, Sulphur, and Cypress Creek Basins between the various states. Water in the Cypress Basin is controlled by the Cypress Basin Operating Agreement. This agreement between the various water rights holders in the basin provides an accounting of water storage, and specifies the storage capabilities of Lakes Bob Sandlin and Cypress Springs, subject to calls for release by downstream Lake O' the Pines. The Sabine River Compact, to which Texas and Louisiana are partners, recognizes that neither entity will construct reservoirs which reduce the "Stateline" flow to less than 36 cubic feet per second.

Several of the water supply reservoirs in the North East Texas Region have been the subject of recent volumetric surveys by the TWDB. In each case, as shown on the next page in Table 1.7, the survey showed a lesser volume than originally estimated. While this can at least partially be attributed to sedimentation, it is difficult to draw any further conclusions since original estimating methodologies varied and generally lacked the precision of these latest surveys.

Table 1.7 Capacity of Reservoirs with Recent Volumetric Surveys

Reservoir	Previously Reported Capacity at Conservation Pool – (ac-ft)	Date of Previous Report	Recent Capacity at Conservation Pool – (ac-ft)	Study Date	Percent Reduction
Lake Bob Sandlin	213,350	1975	201,733	2008	5.4
Lake Cherokee	49,295	1948	43,737	2003	11.3
Lake Cypress Springs	72,800	1971	66,756	2007	8.3
Lake Monticello	40,100	1973	34,740	1998	13.4
Lake O' The Pines	254,900	1958	241,363	2009	5.3
Lake Tawakoni	936,200	1960	871,693	2009	6.9
Wright Patman Lake	158,000	1956	97,927	2010	38
Lake Gladewater	6,950	1952	4,738	2000	31.8
Lake Fork	675,819	1980	636,504	2009	5.8
Welsh Reservoir	23,587	1975	20,242	2001	14.2
Lake Crook	11,487	1923	9,210	2009	19.8
Pat Mayse Lake	124,500	1967	117,844	2009	5.3

Surface water is currently imported to, and exported from, the North East Texas Region. In the Red River Basin, Texarkana Water Utilities imports from Arkansas, and exports to the City of Texarkana, Arkansas. In the Sulphur Basin, Cooper Lake serves as a supply for the City of Irving and the North Texas Municipal Water District, both in Region C. The City of Commerce has leased its water in Cooper Reservoir to Upper Trinity (Region C) for the next 50 years. In the Sabine Basin, Lake Tawakoni is a partial supply for Dallas Water Utilities, and that entity has rights to water in Lake Fork Reservoir. Several entities in Hunt County import water from Region C via the North Texas Municipal Water District. These are further identified in Table 1.8.

Table 1.8 Imported and Exported Water

Entity	Imported From	Exported To
Ables Springs WSC	—	Region C Kaufman County
Ben Wheeler WSC	—	Region I Smith County
Bethel-Ash WSC	—	Region C and Region I Henderson County
BHP WSC	Region C (NTMWD)	Region C Rockwall County
Blackland WSC	Region C (NTMWD)	Region C Rockwall County
Caddo Basin Special Utility District	Region C (NTMWD)	Region C Collin County
Cash SUD	Region C (NTMWD)	Region C Rockwall County
Commerce, City of	—	Region C Denton County
Edom WSC	—	Region I Henderson County
Elderville WSC	—	Region I Rusk County
Elysian Field WSC	—	Region I Panola County
Gill WSC	—	Region I Panola County
Hickory Creek Special Utility District	—	Region C – Fannin County and Collin County
Josephine, City of	Region C (NTMWD)	Region C Collin County
Kilgore, City of	—	Region I Rusk County
Longview	Region I (Lake Cherokee)	—
MacBee WSC	—	Region C Kaufman County
North Hunt WSC	Region C (Fannin County-Groundwater)	—
Poetry WSC	—	Region C Kaufman County
RMP WSC	—	Region I Henderson and Smith Counties
Terrell, City of	—	Region C Kaufman County
Texarkana Water Utilities	Arkansas (Millwood Reservoir)	Arkansas
Van, City of	—	Region I Smith County
West Gregg WSC	—	Region I Rusk County
City of Wolfe City	Region C (Fannin County Groundwater)	—

1.4.3 **Surface Water Quality**

The Texas Commission on Environmental Quality (TCEQ) is the state agency responsible for monitoring water quality in Texas. The Texas Water Quality Inventory and 303(d) List is a statewide report on the status of the state waters which is prepared and submitted to EPA every two years. This list describes the condition of all surface water bodies of the state that were evaluated for the given assessment period. The 2012 list focused on all 374 classified water bodies with adequate data and those unclassified water bodies where there was pending regulatory reason or need to initiate or revise planning activities, a Total Maximum Daily Limits (TMDL), or watershed protection plan. The year 2012 303(d) list is the most recent list available from TCEQ. Table 1.9 presents a summary of segment impairments within the North East Texas Region area on TCEQ's 2012 303(d) list:

Table 1.9 2012 Texas Surface Water Segments on 303(d) List

Segment		Pollutant	Category
0201A	Mud Creek	bacteria depressed dissolved oxygen	5b
0202G	Smith Creek	bacteria	5b
0302	Wright Patman Lake	pH depressed dissolved oxygen	5b 5c
0303B	White Oak Creek	depressed dissolved oxygen bacteria	5b 5b
0304A	Swampoodle Creek	impaired fish community impaired macrobenthic community	5b 5b
0304B	Cowhorn Creek	impaired fish community impaired macrobenthic community	5b 5b
0307	Cooper Lake	pH	5b
0401	Caddo Lake	mercury in edible tissue depressed dissolved oxygen pH	5c 5c 5b
0401A	Harrison Bayou	depressed dissolved oxygen	5b
0402	Big Cypress Creek below Lake O' the Pines	pH mercury in edible tissue depressed dissolved oxygen	5b 5c 5b
0402A	Black Cypress Bayou	depressed dissolved oxygen bacteria mercury in edible tissue copper in water	5b 5c 5c 5c
0404	Big Cypress Creek below	bacteria	5b

Segment		Pollutant	Category
	Lake Bob Sandlin		
0404A	Ellison Creek Reservoir	PCBs in edible tissue toxicity in sediment	5a 5c
0404B	Tankersley Creek	bacteria	5b
0404C	Hart Creek	bacteria	5b
0404N	Lake Daingerfield	mercury in edible tissue	5c
0405	Lake Cypress Springs	pH	5c
0406	Black Bayou	depressed dissolved oxygen bacteria	5b 5c
0407	James' Bayou	depressed dissolved oxygen pH bacteria	5b 5b 5c
0409	Little Cypress Bayou	bacteria depressed dissolved oxygen	5c 5b
0409B	South Lilly Creek	bacteria	5c
0505	Sabine River Above Toledo Bend Reservoir	bacteria	5a
0505B	Grace Creek	bacteria depressed dissolved oxygen	5b 5c
0505G	Wards Creek	depressed dissolved oxygen	5c
0506A	Harris Creek	depressed dissolved oxygen	5b
0507	Lake Tawakoni	pH	5c
0507G	South Fork of Sabine River	bacteria	5c
0512A	Running Creek	bacteria	5b
0512B	Elm Creek	bacteria	5b
0514	Big Sandy Creek	bacteria	5c

Segment		Pollutant	Category
0606	Neches River Above Lake Palestine	bacteria depressed dissolved oxygen pH	5b 5c 5b

1.4.4 Feral Hogs

The population of feral hogs has increased substantially in the northeast Texas region over the last decade. As feral hogs congregate around water sources to drink and wallow, this concentration of high numbers in small riparian areas poses a threat to water quality. Fecal matter deposited directly in streams by feral hogs contributes bacteria and nutrients, polluting water belonging to the State. In addition, extensive rooting activities of groups of feral hogs can cause extreme erosion and soil loss. The destructive habits of feral hogs cause an estimated $52 million worth of damage each year in Texas alone. Landowners are encouraged to seek assistance and information on feral hog biology, behavior, and management options for the proper control of feral hogs. It is recommended that landowners should take actions to reduce the population, limit the spread of these animals, and minimize their effects on water quality and the surrounding environment. State agencies together with local and regional entities are monitoring water quality which should lead to a more informed assessment of the effects that the feral hogs are having on the environment. In the event that the adverse effects of the feral hog population cannot be adequately minimized with existing laws and control mechanisms, additional measures to limit the problems being created by the feral hog population may deserve consideration.

1.4.5 Wholesale Water Providers

TWDB rules for regional water planning require each RWPG to identify and designate "wholesale water providers." TWDB guidelines define a "wholesale water provider" as:

> "…any person or entity, including river authorities and irrigation districts, that has contracts to sell more than 1000 acre-feet of water wholesale in any one year during the five years immediately preceding the adoption of the last Regional Water Plan ."

The intent of these requirements is to ensure that there is an adequate future supply of water for each entity that receives all or a significant portion of its current water supply from another entity. This requires an analysis of projected water demands and currently available water supplies for the primary supplier, each of its wholesale customers, and all of the suppliers in the aggregate as a "system." For example, a city that serves both retail customers within its corporate limits as well as other nearby public water systems would need to have a supply source(s) that is adequate for the combined total of future retail water sales and future wholesale water sales. If there is a "system" deficit currently or in the future, then recommendations are to be included in the regional water plan with regard to strategies for meeting the "system" deficit.

Based upon this explanation, the NETRWPG identified 17 wholesale water providers (WWPs), as shown in Table 1.10, along with identified customers of these entities.

Table 1.10 Wholesale Providers of Municipal and Manufacturing Water Supply

Wholesale Water Provider	Available 2020 (ac-ft) Supply	Wholesale Customers	
Cash SUD	2,952	Lone Oak, City of	Quinlan, City of
Cherokee Water Company	28,650	Longview, City of Southwestern Electric Power Company (SWEPCO)	
Commerce, City of	2,750	Gafford Chapel WSC Maloy WSC North Hunt SUD	West Delta WSC Texas A&M University
Emory, City of	1,589	East Tawakoni	City of South Rains WSC
Franklin County Water District	12,100	Cypress Springs SUD Winnsboro, City of	Mt. Vernon, City of Mt. Pleasant, City of
Greenville, City of	11,317	Caddo Mills, City of Jacobia WSC Shady Grove WSC	Manufacturing Mining
Lamar County Water Supply District	11,556	410 WSC Blossom, City of Deport, City of Detroit, City of Manufacturing	Pattonville WSC Red River County WSC Reno, City of Roxton, City of Toco, City of
Longview, City of	67,253	Elderville WSC Gum Springs WSC Hallsville, City of	Manufacturing White Oak, City of (raw water)
Marshall, City of	9,000	Cypress Valley WSC Gill WSC Leigh WSC	Manufacturing Talley WSC
Mt. Pleasant, City of	14,113	Tri Water SUD Lake Bob Sandlin State Park	Manufacturing Winfield, City of
Northeast Texas Municipal Water District	185,342	Avinger, City of Daingerfield, City of Diana SUD Harleton WSC Hughes Springs, City of Jefferson, City of Lone Star, City of	Longview, City of Marshall, City of Mims WSC Ore City, City of Pittsburg , City of SWEPCO Luminant

Wholesale Water Provider	Available 2020 (ac-ft) Supply	Wholesale Customers	
		Lone Star Steel	Tyron Road SUD
Paris, City of	58,778	Lamar County WSD Manufacturing	MJC WSC Steam Electric
Sabine River Authority*	1,293,701	Ables Springs WSC Cash SUD Combined Consumers SUD Commerce, City of Eastman Chemicals Edgewood, City of Emory, City of Greenville, City of Henderson, City of Bright Star-Salem	Kilgore, City of Longview, City of Mac Bee SUD Point, City of Quitman, City of Release from TXU South Tawakoni WSC West Tawakoni, City of Wills Point, City of
Sulphur River MWD	15,027	Cooper, City of	Sulphur Springs, City of
Sulphur Springs, City of	24,376	Brashear WSC Brinker WSC Gafford Chapel WSC Martin Springs WSC Livestock	North Hopkins WSC Pleasant Hill WSC Shady Grove WSC #2 Manufacturing
Texarkana, City of	121,044	Annona, City of Atlanta, City of Avery, City of Central Bowie WSC DeKalb, City of Domino, City of Hooks, City of Macedonia Eylau MUD Manufacturing – Cass Co. Federal Correctional Institution TexAmericas Center	Manufacturing – Bowie County Maud, City of Nash, City of New Boston, City of Oak Grove WSC Queen City, City of Red River Water Corp. Redwater, City of Wake Village, City of
Titus County FWD #1	48,500	Mt. Pleasant, City of	Luminant

*Note: Sabine River Authority included herein as this entity is a significant WWP to Region D.

1.5 DESCRIPTION OF WATER DEMAND IN THE REGION

1.5.1 Historical and Current Water Use

Historical and current uses in the North East Texas Region include municipal, manufacturing, recreation, irrigation, mining, power generation and livestock. As depicted in Figure 1.20, municipal and manufacturing uses are the predominant use categories. Mining and livestock are relatively insignificant water uses in the Region.

In addition to these uses, which are mostly consumptive uses, there are non-consumptive uses such as flows in rivers, streams, and lakes that have been relied upon to maintain healthy ecological conditions, navigation, recreation and other conditions or activities that bring benefit to the Region. These historic non-consumptive uses and future needs have not yet been the subject of detailed consideration in the State's Senate Bill 3 planning process, but are discussed in *Section 8.7 Voluntary Instream Flow Goals and Proposals*.

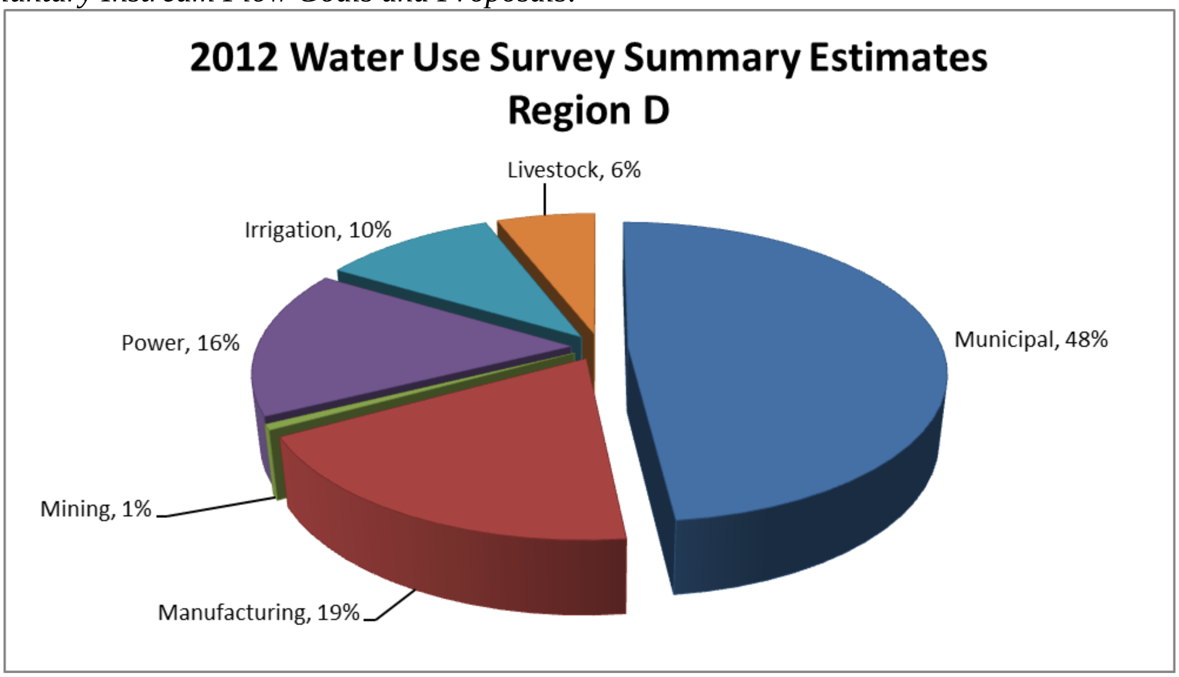


Figure 1.20 2012 Water Use Survey Summary Estimates
(Source: TWDB)

The North East Texas Region utilizes both ground and surface water supplies. Figure 1.21 shows a total percent water usage in 2010 and the projected usage in 2070.

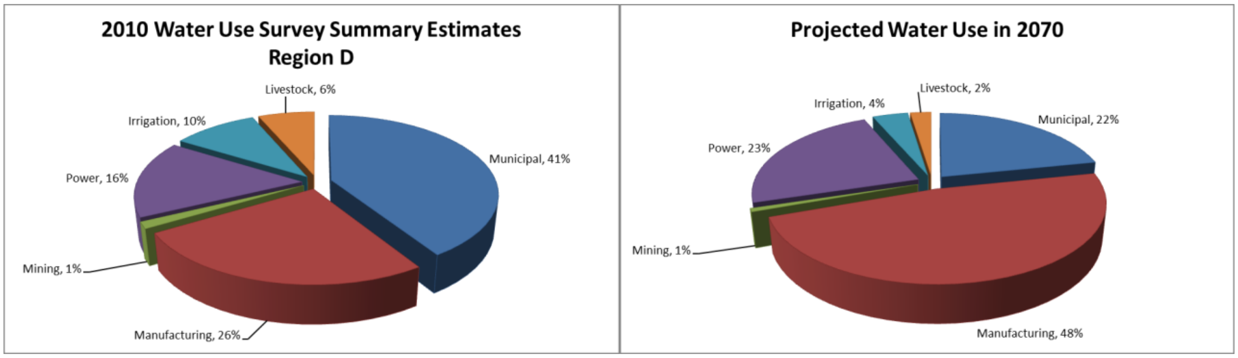


Figure 1.21 Comparison of 2010 Water Use and Projected 2070 Water Use for the North East Texas Region
(Source: TWDB)

In 2012, total estimated usage in the North East Texas Region – both ground and surface – was 351,784 ac-ft/yr, distributed as shown in Figure 1.20. By 2070, projections developed in this plan indicate usage will reach 956,972 ac-ft/yr, a 172 percent increase from 2012. Historic reported use in the North East Texas Region is presented in Table 1.11.

Table 1.11 Water Use by County and Category

County	Municipal				Manufacturing				Mining				Power			
	1990	2000	2010	2012	1990	2000	2010	2012	1990	2000	2010	2012	1990	2000	2010	2012
Bowie	10052	11872	18842	19180	1736	1897	1610	358	29	0	0	0	0	0	0	0
Camp	1429	1486	1473	775	0	37	32	35	71	0	3	0	0	0	0	0
Cass	4445	2968	2752	2730	81743	120051	33763	30846	787	0	18	0	0	0	0	0
Delta	587	848	666	652	0	0	0	0	0	0	0	0	0	0	0	0
Franklin	1652	1549	1970	1625	0	127	4	5	706	0	1	1	0	0	0	0
Gregg	17666	25501	25115	28083	14634	1917	1100	1148	124	114	228	112	465	414	825	915
Harrison	7773	10068	10021	9804	75039	16646	19357	18779	351	219	1365	790	4869	24336	12193	14980
Hopkins	4890	6285	5848	6100	591	640	944	893	123	69	995	50	0	0	0	0
Hunt	12000	12644	13831	16022	521	361	555	553	0	0	70	0	834	498	343	299
Lamar	10692	8889	6394	7184	4635	4530	5019	3770	20	0	0	0	0	1135	336	360
Marion	1341	1494	1171	1083	0	72	0	0	68	0	212	24	1953	2917	2659	4257
Morris	1500	1723	1709	2410	126770	53402	25739	405	7	0	0	0	8	16775	2830	2
Rains	1096	1661	1815	1527	0	2	12	3	0	0	0	0	0	0	0	0
Red River	1893	1963	1857	2158	5	5	3	2	0	0	1	0	1494	162	0	0
Smith	27265	41117	36261	48188	3341	2941	2780	2711	696	1	253	264	0	0	0	0
Titus	4135	6506	5307	5072	2252	2510	2878	3790	1711	9	1712	928	36406	27527	40331	35122
Upshur	4592	4699	4850	3947	192	161	69	54	0	0	63	1	0	0	0	0
Van Zandt	5356	5542	7793	7533	223	23	203	264	836	315	235	1	0	0	0	0
Wood	4250	5442	5743	5561	41	366	1739	2532	3162	0	15	2	0	0	0	0
Total	122614	152257	153418	169634	311723	205688	95807	66148	8691	727	5171	2173	46029	73764	59517	55935

County	Irrigation				Livestock				Total			
	1990	2000	2010	2012	1990	2000	2010	2012	1990	2000	2010	2012
Bowie	3959	2204	7889	12738	1571	1439	1630	1069	17347	17412	29971	33345
Camp	87	0	0	0	688	930	1958	1845	2275	2453	3466	2655
Cass	0	6	0	0	835	834	1175	840	87810	123859	37708	34416
Delta	2000	585	333	303	770	11903	524	488	3357	13336	1523	1443
Franklin	33	0	0	129	1303	1122	1292	1238	3694	2798	3267	2998
Gregg	0	0	38	32	230	239	260	188	33119	28185	27566	30478
Harrison	100	106	765	637	991	875	631	541	89123	52250	44332	45531
Hopkins	0	50	7867	4060	5990	4856	3979	3969	11594	11900	19633	15072
Hunt	271	1938	341	349	1127	1120	1176	830	14753	16561	16316	18053
Lamar	4417	5768	11579	11609	1526	830	1429	1328	21290	21152	24757	24251
Marion	0	68	0	0	162	1085	243	136	3524	5636	4285	5500
Morris	192	0	0	10	414	485	788	565	128891	72385	31066	3392
Rains	20	0	65	53	790	675	424	384	1906	2338	2316	1967
Red River	100	3751	4637	4305	1183	1610	1600	1116	4675	7491	8098	7581
Smith	180	774	818	761	1208	1254	1201	868	32690	46087	41313	52792
Titus	0	0	954	1000	1174	1007	1128	1038	45678	37559	52310	46950
Upshur	0	240	116	136	1325	1530	1099	987	6109	6630	6197	5125
Van Zandt	50	33	625	420	2213	2434	2047	1875	8678	8347	10903	10093
Wood	354	373	562	365	1816	2063	1754	1682	9623	8244	9813	10142
Total	11763	15896	36589	36907	25316	36291	24338	20987	526136	484623	374840	351784

1.5.2 Major Demand Centers

Major water demand centers include:

City	2012 Use*
Longview	8,568 MG/YR
Texarkana, Texas	6,326 MG/YR
Paris	4,685 MG/YR
Greenville	2,976 MG/YR
Marshall	2,210 MG/YR

*From TWDB 2012 Water Use Survey Summary Estimates by Cities in Texas (Total Intake).

1.5.3 Recreational Demands

Recreational demands for water revolve principally around the Region's reservoirs. Recreational activities include fishing, boating, swimming, water sports, picnicking, camping, wildlife observation, and others. Waterside parks attract over 2 million visitors each year.

Recreational use of the Region's reservoirs is coincidental with other purposes, including flood control and water supply. Conflicts arise when the designated use for flood control keeps water elevations too high for recreation or, in the opposite, when drought conditions and water supply demands leave boathouses and marinas dry.

1.5.4 Navigation

The lack of perennial streams limits the viability of navigation projects in northeast Texas. However, two potential projects are worth noting.

One project considered in the North East Texas Region is the “Red River Waterway Project – Shreveport to Daingerfield Reach.” The Shreveport to Daingerfield navigation channel, with accompanying locks, would be an extension of the Red River Waterway Project, Mississippi River to Shreveport, Louisiana, which is in operation. A channel to Daingerfield was authorized by Congress in 1968. As envisioned, it would begin at the Red River and would be routed through Twelve-mile Bayou, Caddo Lake, Cypress Bayou, and Lake O' the Pines. However, an updated review of this project was conducted by the United States Army Corps of Engineers (USACE) in the early 1990’s, which concluded that the project was not currently economically feasible and could result in significant environmental impacts for which mitigation was not considered to be practicable.

A second navigation project under study is the Southwest Arkansas Navigation Study. This joint project between the USACE and the Arkansas Red River Commission is studying the feasibility of making the Red River navigable from Shreveport, Louisiana, through southwest Arkansas to near Texarkana, Texas. The Red River is already navigable below Shreveport-Bossier City, through the construction of five locks and dams, and various channel modifications, and this project would extend that to more northern reaches. According to the USACE Vicksburg, the draft study was completed in 2005, but questions about the economic feasibility have resulted in the need for additional analyses.

While transportation cost savings are the primary factor in the feasibility of a navigation project, there can often be associated benefits, including such things as hydropower, bank stabilization, recreation, flood control, water supply, and fish and wildlife habitat. From a water planning perspective, navigation can provide supply, as well as demands. Pools associated with the various locks and dams may be beneficial for water supply. On the other hand, low flow demands may be placed upon contributory streams to maintain navigable levels. Lake O' the Pines, for example, is obligated to supply up to 3,600 ac-ft of water per year in conjunction with navigability of the Red River below Shreveport. Extension of this project northward would likely require similar releases from the Sulphur Basin.

1.5.5 **Environmental Water Needs**

Environmental water demands in the Region include the need for water and associated releases necessary to support migratory water fowl, threatened and endangered species, and populations of sport and commercial fish. Flows must remain sufficient to assimilate wastewater discharges or there will be higher costs associated with wastewater treatment and nonpoint discharge regulations. Periodic "flushing" events should be allowed for channel maintenance, and low flow conditions must consider drought periods as well as average periods. In recognition of the importance that the ecological soundness of our riverine, bay, and estuary systems and riparian lands has on the economy, health, and well-being of our state, the 80th Texas Legislature created the Environmental Flows Advisory Group.

The Environmental Flows Advisory Group has conducted public hearings and studied public policy implications for balancing the demands on the water resources of the state resulting from a growing population and the requirements of the riverine, bay, and estuary systems. In the course of this effort, this Advisory Group has established and implemented a schedule for the development of environmental flow standards for instream and bay and estuary freshwater inflows. In July 2008, the Advisory Group appointed a Science Advisory Committee, and appointed a Basin and Bay Area Stakeholders Committee (BBASC) for the Sabine-Neches Estuary and Lower Tidal Sabine River (i.e., the Sabine-Neches BBASC). Similar processes were established for the remaining river basins contributing to bay and estuary systems in Texas. The Sabine-Neches BBASC subsequently appointed a Basin and Bay Expert Science Team (BBEST), that ultimately developed recommendations for environmental flow needs in the Sabine and Neches River Basins. These recommendations, along with recommendations from the Sabine-Neches BBASC that were developed in an attempt to balance environmental needs with the needs for other human uses, were then submitted to the Texas Commission on Environmental Quality (TCEQ). The TCEQ then underwent a rulemaking process, establishing standards for environmental flows for the Sabine and Neches River Basins.

Although a SB 3 process has not been undertaken for the river basins in Region D other than the Sabine, another ongoing study is the Cypress Basin Flows Project, initiated in 2004. Over the past 10 years, a number of stakeholders have worked with the USACE and the Northeast Texas Municipal Water District (NETMWD) to develop a set of environmental flow regimes in the Cypress Basin. Over the past 4 years, the USACE and NETMWD have worked to meet those flow regimes through voluntary changes in the water release patterns from Lake O' the Pines. Because of the success of this project to date, NETRWPG considers those regimes as voluntary goals for instream flows for the purposes of this 2016 North East Texas Water Plan.

While a process similar to that used in the Cypress Basin has not yet been developed for the Sulphur Basin, a potential first step has been taken that is important to the NETRWPG. This step includes an individual analysis calculating a potential environmental flow regime for the Sulphur River Basin. Although these calculated flows are not presented herein as requirements to be implemented on water management strategies, the identified flow regime does provide additional information for consideration of potential impacts on the agricultural and natural resources of the region and the state. This initial work provides a point of reference for considering the pulse flows necessary for the flood plain forests below the Marvin Nichols reservoir site.

1.6 EXISTING WATER PLANNING IN THE REGION

1.6.1 Initial Assessment for Drought Preparedness

Texas is no stranger to drought; drought conditions in 1996 caused greater economic losses to agriculture than any previously recorded one-year drought event. The drought of 1998, though relatively short, caused agricultural impacts with total losses estimated to be just over $6 billion, or slightly higher than those recorded in 1996. In Region D, droughts in the mid- to late 1990s caused emergency actions such as lowering the intake structures around Lake Tawakoni to accommodate critically low levels of the lake.

The State responded to drought situations in recent years in several ways. HB 2660 formed the Drought Preparedness Council (DPC) in 1999. The DPC was requested to support drought management efforts, emphasizing drought monitoring, assessment, preparedness, mitigation, and assistance. The DPC created the State Drought Preparedness Plan. In addition, the State started requiring all water systems to create drought contingency plans with measurable triggering conditions. As well, any TWDB loan in excess of $500,000 requires the borrowing entity to have a drought contingency plan in place. These plans must be revised every five years. These requirements, as well as recent drought experiences, have caused the Region to look closely at drought preparedness.

TWDB provides much drought assistance on its website, including tips on drought planning, drought monitoring, weather conditions reports, climate predictions, etc. The TCEQ Map of Water Systems Under Water Use Restriction maps systems on a monthly basis that are affected by water use restrictions.

In addition to drought response, the State also encourages continual water conservation. In a report to the 81st legislature in 2008, the Water Conservation Advisory Council made several recommendations regarding the state's role in funding and support, monitoring implementation progress, defining measurement methodology, promoting conservation awareness and recognition, and developing supporting resources that include information, tools, and expertise. As required by HB 3338, TWDB sent water loss audit forms to all suppliers in the State in 2010 to be completed and returned. According to the water loss audit responses submitted by 103 Region D entities, total water loss is estimated at 4.645 billion gallons for the year 2010 at an estimated cost of

$20,553,620, or an average of one dollar for every 226 gallons lost. It is difficult to ascertain if numbers have been reported correctly, and if all utilities measured water loss similarly. It is hoped that using an official method of gathering data, the Water Audit Method, and by requiring systems to complete an audit frequently, the uncertainties in these data may be reduced. A table of TWDB's summarized water loss data for Region D for the year 2010 can be found in Appendix A.

According to the Texas Water Conservation Implementation Task Force's 2004 report to the Texas Legislature, the Task Force adopted a recommendation that the goal of a Municipal Water User Group with unmet water needs in the applicable Regional Water Plan should be to first meet or reduce that need using advanced water conservation techniques, including any appropriate BMPs or other water conservation strategies selected by the Water User Group. "Advanced water conservation techniques" means conservation techniques that go beyond implementation of the state plumbing fixture requirements and beyond adoption and implementation of water conservation education programs." Therefore, Region D supports advanced conservation efforts for those WUGs that have projected water shortages.

In response to conservation efforts, the Region determined that a reasonable upper municipal level consumption goal should be established at 140 gallons per capita per day (gpcd) for all municipal water user groups; this target was selected to coincide with the State's Water Conservation Implementation Task Force. The Region recommended that systems which experience a per capita usage greater than 140 gpcd should consider advanced water conservation as a water management strategy. In addition, systems with water "loss" greater than 15% should be encouraged to perform physical and records surveys to identify the sources of this unaccounted-for water. Finally, the planning group encourages funding and implementation of educational water conservation programs and campaigns for the water-using public; and continued training and technical assistance to enable water utilities to reduce water losses and improve accountability.

1.6.2 **Existing Local Water Plans**

A listing of local water plans pertinent to the North East Texas Region is included in Appendix B. In general, the smaller water systems allocate insufficient funds for long range planning purposes. Instead, the systems rely on periodic inspections by TCEQ, and then respond in a "reactive" mode to correct the deficiencies encountered by the regulators.

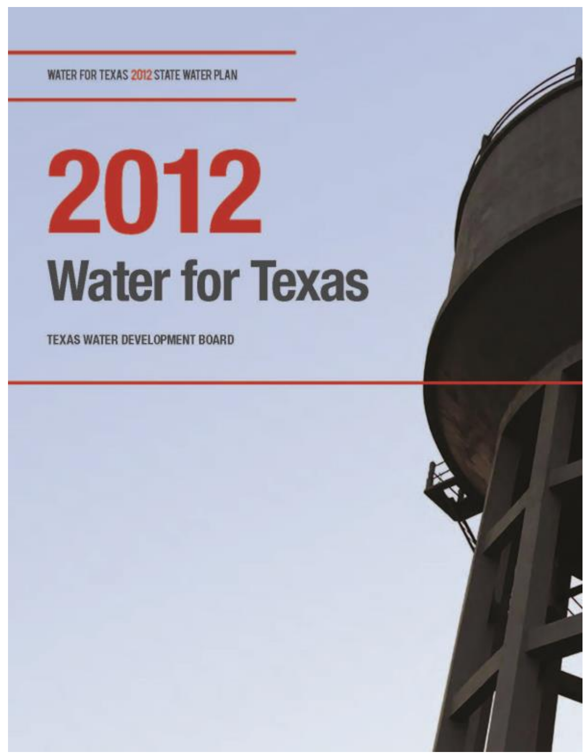
1.6.3 **Existing Regional Water Plans**

A number of major suppliers in the North East Texas Region maintain regional plans. Among these are the Sabine River Authority, which has completed two studies entitled "Comprehensive Sabine Watershed Management Plan" and "Upper Sabine Basin Water Supply Study," dealing with water resources in the Sabine River Basin. Longview prepared a water supply study in 1982, and Paris is in the midst of a water supply study at the current time, in conjunction with the City of Irving. In addition, Northeast Texas Municipal Water District has completed studies on sources of additional water supply. Lamar County Water Supply District maintains a master plan for its two county service area in the northwest corner of the Region. Riverbend Water District, has developed recent studies (CH2MHill 2009) of needs for specific member cities in Bowie County. The Sulphur River Basin Authority is in the process of developing the "Sulphur River Feasibility Study", in cooperation with the United States Corps of Engineers. A Comprehensive Water Study is available for the City of Greenville. The Texas Water Development Board completed the development of a Groundwater Availability Model of the northern part of the Carrizo-Wilcox aquifer in 2003, the Queen City aquifer in 2004, the Woodbine in 2004, the Nacatoch in 2009, and the Blossom aquifer in 2010.

Each of these regional plans pertains to the existing and fringe service areas of the entity involved. There are expanses of the planning area which are not covered by any regional plan. The region is divided among four river basins and three council of government planning areas. Thus, regional planning is hampered by the numerous entities with conflicting and competing goals and by the lack of an entity with authority throughout a substantial portion of the Region.

The planning group is not aware of any other agricultural, manufacturing, power generation, or commercial water users in the North East Texas Region with publicly available plans of a magnitude sufficient to impact the Regional Plan.

1.6.4 Summary of Recommendations from the 2012 State Water Plan



The 2012 Texas Water Plan "Water for Texas" gave a summary of North East Texas Region based on the 2011 Water Plan prepared for the NETRWPG – Region D.

The State Plan highlights the additional supply needed in 2060 as being 96,142 ac-ft/yr, with water management strategies equalling 98,466 ac-ft/yr for a total capital cost of $38.5 million. The State Plan notes there were limited unmet irrigation needs, and that surface water contract strategies were developed to meet most of the needs, including contracting for water from a new reservoir in Region C. In addition, the State Plan notes that the NETRWPG does not support the proposed Marvin Nichols Reservoir. Policy recommendations in the State Plan for Region D include designation of 3 stream segments of unique ecological value.

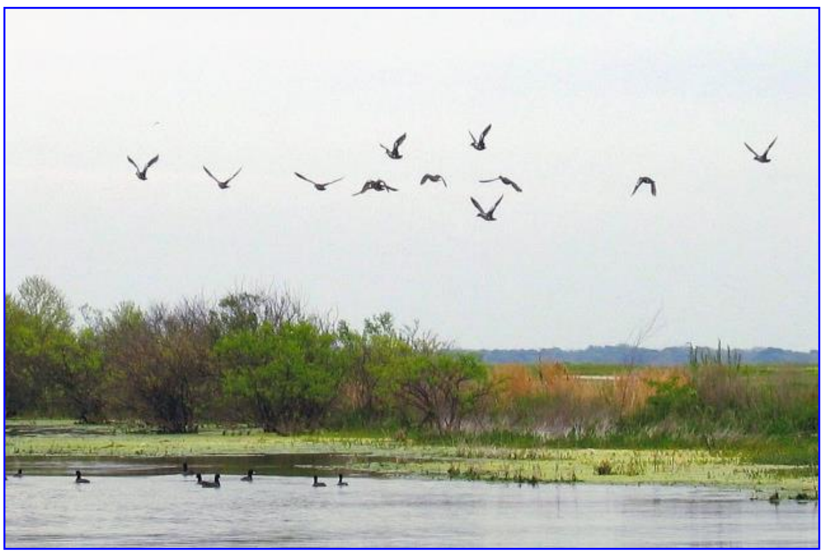
There is a 2010 water need in the Region of 10,252 ac-ft/yr, with steam electric needs making up approximately 84% of that total. By 2060, the need was projected at 96,142 ac-ft/yr. Region D proposed two kinds of water management strategies for its water shortages, including new groundwater wells and new surface water purchases. If fully implemented, recommended water management strategies would provide an additional 98,466 acre-feet at a total capital cost of $38,500,000.

1.7 THREATS TO AGRICULTURAL AND NATURAL RESOURCES

1.7.1 Prime Farmland

The federal government has instituted the Farmland Protection Policy Act to protect prime farmland from being converted to other uses in order to provide for adequate farmland for the future. Developments, such as subdivisions, schools, industrial parks, and others, can wipe out hundreds of acres of prime farmland. When rivers and streams reroute themselves over time, they may encroach upon prime farmlands. Finally, building new reservoirs on prime farmland will reduce the amount of this valuable resource. It has been estimated by the Texas Parks and Wildlife Department that the construction of the Marvin Nichols Reservoir would result in the loss of 10,000 acres of agricultural land. The New Bonham site would cost 7,000 acres, and George Parkhouse I would cost 14,000 acres in prime farmland.

1.7.2 Surface Water


Ducks on Lake Tawakoni, Lake Tawakoni.com

The North East Texas Region has many lakes and reservoirs as well as ponds and streams. Currently, most of the Region uses surface water as a primary source for drinking water. Surface water quality is threatened by point and nonpoint source pollution from wastewater treatment facilities, industry, farms and ranches, recreational vehicles, etc.

Specific steps for minimizing threats to surface water supplies from point and non-point source pollution include the following:

1. Continuation of the efforts of the Texas Pollutant Discharge Elimination System (TPDES) permitting process for point sources including enforcement procedures for permit violations.
2. Continuation of the 303d assessment program under the auspices of the TCEQ and the Texas State Soil and Water Conservation Board.
3. Encouragement of reservoir owners/operators to participate in watershed protection programs such as the TWDB Source Water Assessment Program, part of the Clean Water State Revolving Fund; and the Section 319 Program offered by the Natural Resources Conservation Service in Conjunction with the Texas State Water Conservation Board.

4. Active enforcement, by county on-site system regulatory agencies, of TCEQ on-site sewage system regulations, particularly within critical areas around drinking water supply resources.
5. Continuation of the funding of data gathering and research activities for the TCEQ Clean Rivers Program throughout the North East Texas Region.

Surface water quality has been recently threatened by giant salvinia (*Salvinia molesta*), a floating plant that was first reported in Texas lakes in 1999, and made its way to east Texas. According to Texas Parks & Wildlife Department officials, it is threatening to overtake Caddo Lake and other bodies of water. Since 2008, giant salvinia has expanded in Caddo Lake from two acres of coverage to 1,000. Giant salvinia floats on the surface of the water and multiplies rapidly, limiting boater access and choking out sunlight and oxygen to other water plants, fish and wildlife. It cannot be eradicated, but officials are using herbicides and mechanical harvesting to attempt to control infestations. Giant salvinia is a serious threat to the Region's water sources and of great concern to water suppliers. There are also several other species of concern which could be a detriment to the natural resources of the Region including water hyacinth, hydrilla, zebra mussels and other exotic species.

Surface water quantity is threatened by short and long term overuse, and by exportation. Short-term overuse can occur during drought conditions when conservation practices are not implemented. Long term overuse, the constant depletion of the resource, is a more serious problem. These threats can be controlled by proactive use of conservation practices, judicious construction of new supplies, and active enforcement of prohibitions and controls on use of potential contaminants in the watershed.

Exportation of the Region's surface water to other regions can limit supplies available for regional growth and industry development. In addition, agriculture interests could suffer if water were exported to other regions who can afford to pay more for the water. Thus a balance must be reached between meeting the needs of the Region and sharing our resources with others. This highlights the importance of conservation efforts in all regions of the State.

1.7.3 Groundwater

In areas where a sufficient quality and quantity groundwater is available in northeast Texas, it is utilized. Groundwater, like surface water, is threatened in both quantity and quality. Water levels in several aquifers have declined over the past several decades due to extensive pumping by municipalities, agriculture, and industries, and will continue to do so if conservation practices are not followed. Continued over-pumping can degrade water quality, as less desirable water is drawn into the aquifer. Abandoned wells must be adequately plugged. Groundwater quality can be degraded by waste activity such as landfills and waste spills where contaminants seep into aquifers. Groundwater is a key supply for many entities in the Region and should be protected through wellhead protection and similar programs.

In Hunt County, for example, usage of the Woodbine Aquifer is decreasing as larger regional systems absorb and/or contract with smaller groundwater entities. The larger regional systems such as Cash SUD rely on surface water from Lake Tawakoni and/or other regions. In Bowie, Hopkins, and Hunt counties, reliance on the Nacatoch Aquifer is also declining. The City of

Commerce, once a major user of Nacatoch Aquifer resources, now relies predominantly on supply from Lake Tawakoni. The city is also wholesaling surface water to area groundwater suppliers including Gafford Chapel WSC, Maloy WSC, North Hunt WSC and West Delta WSC.

Finally, usage in the Blossom Aquifer is decreasing due to conversion to surface water and the availability of larger regional supplies such as the Lamar County Water Supply District in Lamar and Red River counties, and Texarkana Water Utilities in Red River and Bowie Counties. Both of these regional systems utilize surface water supplies.

Groundwater Management Areas (GMAs) that encompass the Region are GMA 8, which includes the northern half of the Region, and GMA 11, which includes the southern half of the Region (See Figure 1.22 and Figure 1.23). These GMAs contain Groundwater Conservation Districts (GCDs), which work together to protect local groundwater resources. GMA 8 released "desired future conditions" of the Blossom, Nacatoch, Trinity, and Woodbind aquifers in 2011. GMA 11 adopted desired future conditions in the Carrizo-Wilcox and Queen City aquifers in 2010.

There is controversy over GMAs because of the rule of capture, which allows a landowner to pump as much groundwater from his property as he chooses, without liability to neighbors whose wells might be depleted. It has been cited by opponents that GCDs violate the freedom of the landowner. In addition, opponents in GMAs without a GCD for representation are concerned that those controlling the GMA might not share their interests and goals. Within Region D, there are no GCDs, but there are several GCDs further west and south of the Region on the GMA 8 board, and south of the Region on the GMA 11 board. A groundwater district was created by the 81st Legislature in Harrison County (Harrison County Groundwater Conservation District) but was rejected by county voters 2:1 in a May, 2010 confirmation election. There is concern that the Region's interests might not be represented. The State continues to study this issue.

1.7.4 **Wildlife and Vegetation**

Increased population and development in northeast Texas causes increased stress on vegetation and wildlife resources. Urbanization destroys natural habitat and pushes animals into smaller and smaller territories. Loss of vegetation affects even those species that are abundant, such as deer, opossum, rabbit, and dove. Currently, there are 152 plant and animal species on the Texas threatened and endangered species list, and 30 of those species can be found in the planning region. (See Table 1.12 for a regionally specified listing of endangered species as supplied by the Texas Parks and Wildlife Department in 2009.) Efforts to protect these natural resources are ongoing, and must be continued in order to save the species of plants and animals that are in decline in North East Texas.

According to "An Analysis of Bottomland Hardwood Areas at Three Proposed Reservoir Sites in Northeast Texas (TPWD)," there are 36,177 acres of bottomland hardwood forests on the Marvin Nichols I reservoir site. According to TPWD, these are the best remaining bottomland hardwood areas in the State. These forests, and associated fish and wildlife, are threatened by the proposed reservoir construction.

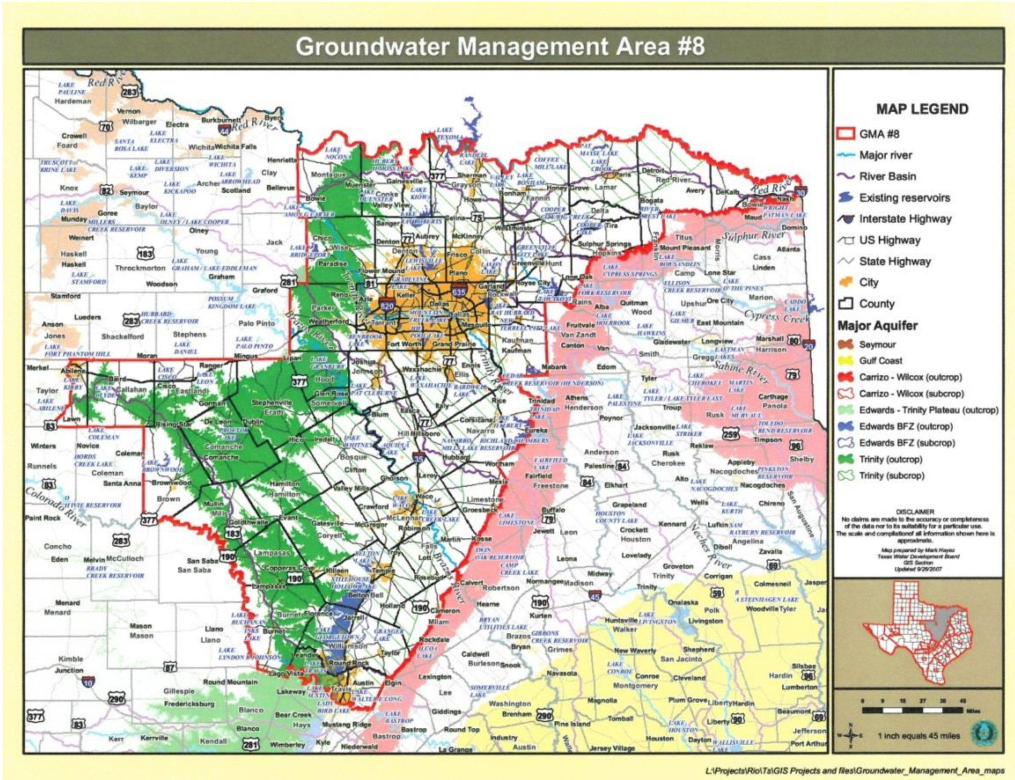


Figure 1.22 Groundwater Management Area #8

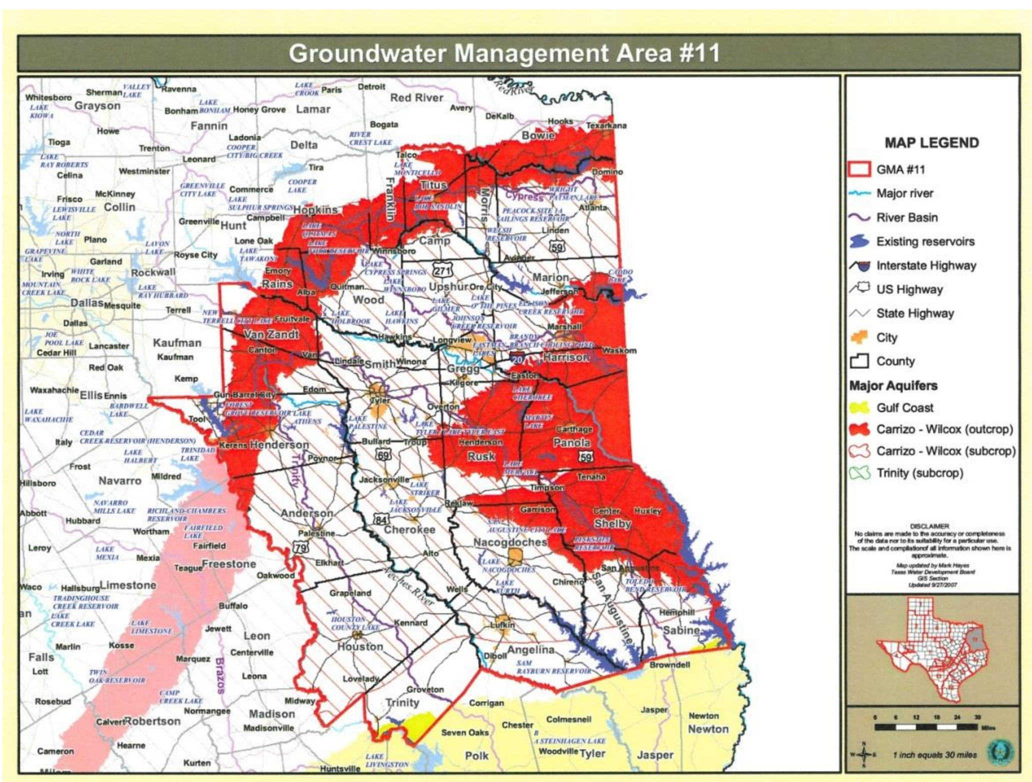


Figure 1.23 Groundwater Management Area #11

Table 1.12 Texas Parks and Wildlife Department Listed Threatened and Endangered Species in the North East Texas Region
(Source: Texas Biological and Conservation Data System. Texas Parks and Wildlife Department, Endangered Resources Branch. County Lists of Texas' Special Species, 2014)

Birds	
American Peregrine Falcon	*Falco Peregrinus Anatum*
Arctic Peregrine Falcon	*FalcoPeregrinus Tundrius*
Bachman's Sparrow	*Aimophila Aestivalis*
Bald Eagle	Haliaeetus Leucocephalus
Eskimo Curlew	*Numenius Borealis*
Interior Least Tern	SternaAntillarum Athalassos
Peregrine Falcon	*Falco Peregrinus*
Piping Plover	*Charadrius Melodus*
Sprague's Pipit	*Anthus spragueii*
White-Faced Ibis	*Plegadis Chihi*
Whooping Crane	*Grus Americana*
Wood Stork	Mycteria Americana
Fishes	
Blue Sucker	Cycleptus Elongatus
Blackside Darter	*Percina Maculata*
Bluehead Shiner	*Notropis Hubbsi*
Creek Chubsucker	*Erimyzon Oblongus*
Paddlefish	Polyodon Spathula
Shovelnose Sturgeon	Scaphirhynchus Platorynchus

Eskimo Curlew
Source: Wikipedia.org

Texas Paddlefish
Source: TPWD

Mammals

Black Bear	*Ursus Americanus*
Louisiana Black Bear	*Ursus Americanus Luteolus*
Rafinesque's Big-Eared Bat	*Corynorhinus Rafinesquii*
Red Wolf	*Canis Rufus*

Reptiles

Alligator Snapping Turtle	*Macroclemys Temminckii*
Louisiana Pine Snake	*Pituophis Melanoleucus Ruthveni*
Northern Scarlet Snake	*Cemophora Coccinea Copei*
Texas Horned Lizard	*Phrynosoma Cornutum*
Timber/Canebrake Rattlesnake	*Rotalus Horridus*

Insects

American Burying Beetle	*Nicrophorus Americanus*

Mollusks

Louisiana Pigtoe	*Pleurobema riddellii*
Ouachita Rock Pocketbook	*Arkansia wheeleri*
Sandbank Pocketbook	*Lampsilis satura*
Southern Hickorynut	*Obovaria jacksoniana*
Texas Heelsplitter	*Potamilus Amphichaenus*
Texas Pigtoe	*Fusconaia askewi*

Plants

Earth Fruit (Tinytim)	*Geocarpon Minimum*
Neches River Rose-mallow	*Hibiscus Dasycalyx*

1.7.5 Petroleum Resources

The oil industry is economically important in northeast Texas, but remaining supplies become increasingly expensive to extract. Oil is a non-renewable resource, and exhausting this resource is a possibility. Careful monitoring of petroleum resources is important to ensure that they will be available in the future. Additionally, the Haynesville Shale is currently being developed in Harrison and Marion Counties in Region D. The development of this oil/gas resource requires a significant consumption of water resources which will have a negative impact on available water resources.

1.7.6 **Air**

Clean air is vital to both humans and the environment. Air quality in the North East Texas Region complies with national ambient air quality standards in all areas, except the Tyler-Longview-Marshall area. This area is compliant with all standards except those of ozone. Air quality problems result from vehicle emissions, industrial exhaust, fire, and similar contaminants. Organizations such as Northeast Texas Air Care, through the East Texas Council of Governments (COG), are committed to improving air quality in Northeast Texas.

1.7.7 **Wetlands**

The U.S. Corps of Engineers defines wetlands as, "these areas that are inundated or saturated by surface or groundwater at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands are an important natural resource in northeast Texas for several reasons. Wetlands support numerous plant and animal species including several threatened and endangered species. When wetlands are harmed, fish, birds, and other species that make their homes there are also harmed. In addition, wetlands influence the flow and quality of water by acting as sponges. They are able to store flood water and then slowly release it, reducing water's erosive potential. Finally, wetlands improve water quality by removing nutrients, processing organic wastes, and reducing sediment load. Destruction of wetlands has a documented negative impact on the environment.

CHAPTER 2 POPULATION AND WATER DEMAND PROJECTIONS

In each planning cycle, the Regional Water Planning Groups are required to revisit past planning efforts and revise population and water demand projections to reflect changes that have occurred since the previous round of planning and to incorporate any newly available information. Per the TWDB's "Guidelines for Regional Water Plan Development (Fourth Cycle of Regional Water Planning)", the population and water demand projections have been completely revised from previous planning rounds, utilizing 2010 U.S. Census data. TWDB, in conjunction with TCEQ, TPWD, and Texas Department of Agriculture (TDA), has prepared population and water demand projections for all water demands and all Water User Groups (WUGs). Draft population and water demand projections were provided to the NETRWPG for review, with requested changes to the projections made where provided by the RWPG. The population and water demand projections have been formally adopted for use in development of the 2016 RWPs.

The new population projections used in the 2016 RWPs increase population projections in some locations while decreasing population projections in other locations, relative to the population projections in the 2011 RWPs. TWDB has directly populated the Regional Water Planning Application (DB17) with all WUG-level projections.

The following sections of this chapter describe the methodology that has been used in the current (fourth) round of planning, to develop regional population and water demand projections. This chapter presents projections for population and water demand for major cities, major providers of municipal and manufacturing water, and for categories of water use including municipal, manufacturing, irrigation, steam electric power generation, mining and livestock. Projected demands are also provided for each of the six river basins located within the North East Texas Region.

The results presented herein represent the population and water demand projections that received final approval from the Region D – Regional Water Planning Group for inclusion in the 2016 Regional Water Plan and approval from the Texas Water Development Board (TWDB) for inclusion in the 2017 State Water Plan.

Table 2.1 Population and Water Demand Projections for the North East Texas Region

Total Regional Projection	2020	2030	2040	2050	2060	2070
Population	**831,469**	**907,531**	**988,859**	**1,089,197**	**1,211,979**	**1,370,438**
Water Demand (ac-ft)						
Municipal	134,310	142,631	152,536	166,385	184,540	208,132
Manufacturing	332,070	355,072	377,273	396,249	425,638	457,217
Irrigation	40,866	40,737	40,442	39,913	39,413	39,138
Steam Electric	96,574	112,905	132,815	157,084	186,668	222,648
Mining	7,115	7,748	7,670	7,280	6,914	6,795
Livestock	23,237	23,281	23,220	23,116	23,036	23,042
Total Water Demand (ac-ft)	**634,172**	**682,374**	**733,956**	**790,027**	**866,209**	**956,972**

Both population and water demand are projected to grow by approximately 65% and 51%, respectively, from the years 2020 to 2070. The largest percentage of water is currently used for manufacturing and municipal uses. In the future demand for steam electric power generation is expected to grow substantially as greater needs for electric utilities powering this region and other regions within the state increase through 2070.

2.1 METHODOLOGY

2.1.1 Population Projections

Population projections were developed using the 2010 Census data and other available sources. Projections were first developed at the county level, and then allocated to municipal and county-other water user groups (WUG's). For this planning round TWDB staff summed the county populations in the state to regional totals. Any adjustments to a county-level population required a justifiable redistribution of projected county populations within the region so that the summed regional total remained the same.

2.1.2 Water Demand Projections

Discussion of how demand projections were developed in the fourth round of planning is presented in the following paragraphs. Water demand projections for RWPs are based upon dry-year conditions, so the base year for the projections is intended to be the driest year from 2006 onwards. Based upon quarterly drought indices from the National Drought Mitigation Center, TWDB staff determined that 2011 was to be used as the dry-year base for the water demand projections. Reported municipal water use data through the TWDB Water Use Survey for the designated dry year was used to calculate the base per capita water use for each city.

Demand projections for non-municipal water user groups were also developed. TWDB relied on a recent study with the Bureau of Economic Geology at the University of Texas at Austin to prepare draft mining water demand projections for each planning region. TWDB annual Irrigation water use estimates are produced by calculating a crop water need based on evapotranspiration and other climatic factors, this need per acre is then applied to irrigated acreage data obtained from the Farm Service Agency (FSA) in order to determine estimated irrigation water use by TWDB crop category. These estimates are then made available to Groundwater Conservation Districts for comment. Similar to the population projections, the water demand projections were released for the planning groups to review and request revisions as necessary.

2.2 POPULATION PROJECTIONS

The population of the nineteen county North East Texas Region is projected to grow over the fifty year planning period. The graphic below illustrates the historical and projected population for the North East Texas Region. The tables on the following pages break down the population projections by county and river basin. The figures illustrate the percent of population growth by county and population by river basin.

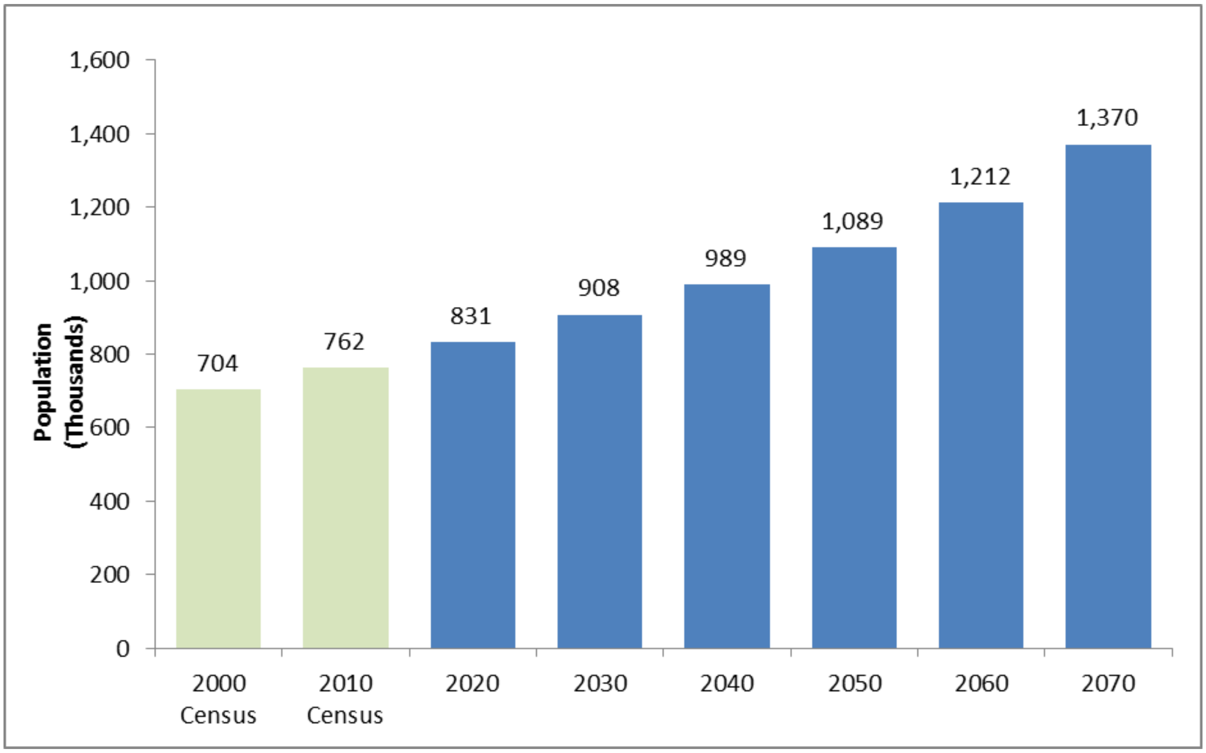


Figure 2.1 Historical and Projected Population for Region D

The Region's population is anticipated to grow by 77% overall (from 2010 to 2070) with the largest percentage growth (262%) occurring in Hunt County and 97% in Smith County. In the year 2010, the counties with the largest population were Gregg and Bowie Counties. These counties include the Cities of Longview and Texarkana respectively. By 2070 the largest county populations in the region are expected to be Hunt County and Gregg County, with Bowie County falling to the fourth largest county in the region. Although population is expected to increase at varying rates in each county throughout the region, the particularly large population growth in Hunt County can be attributed to the anticipated growth of the City of Greenville and urban sprawl from the Dallas-Fort Worth Metroplex to the east.

Table 2.2 Population Projection by County

County	2020	2030	2040	2050	2060	2070
Bowie	95,703	98,413	99,263	99,263	99,263	99,263
Camp	13,555	14,873	15,904	17,127	18,264	19,372
Cass	31,016	31,229	31,229	31,229	31,229	31,229
Delta	5,320	5,376	5,376	5,376	5,376	5,376
Franklin	11,124	11,627	11,930	12,226	12,447	12,622
Gregg	133,347	146,034	160,540	176,927	195,352	216,203
Harrison	70,337	75,538	80,921	88,474	96,706	106,413
Hopkins	37,978	40,895	43,555	46,610	49,556	52,517
Hunt	104,894	130,351	164,886	212,575	280,518	379,250
Lamar	52,170	54,189	55,683	57,037	58,092	58,943
Marion	10,601	10,601	10,601	10,601	10,601	10,601
Morris	13,364	13,612	13,886	14,293	14,618	14,942
Rains	11,888	12,605	12,809	12,947	13,007	13,035
Red River	12,976	12,976	12,976	12,976	12,976	12,976
Smith	44,540	50,821	57,944	66,275	76,093	87,762
Titus	36,643	41,381	46,283	51,665	57,330	63,315
Upshur	42,696	46,129	49,089	52,128	54,915	57,519
Van Zandt	58,455	64,146	68,496	72,817	76,407	79,478
Wood	44,862	46,735	47,488	48,651	49,229	49,622
Region Total	**831,469**	**907,531**	**988,859**	**1,089,197**	**1,211,979**	**1,370,438**

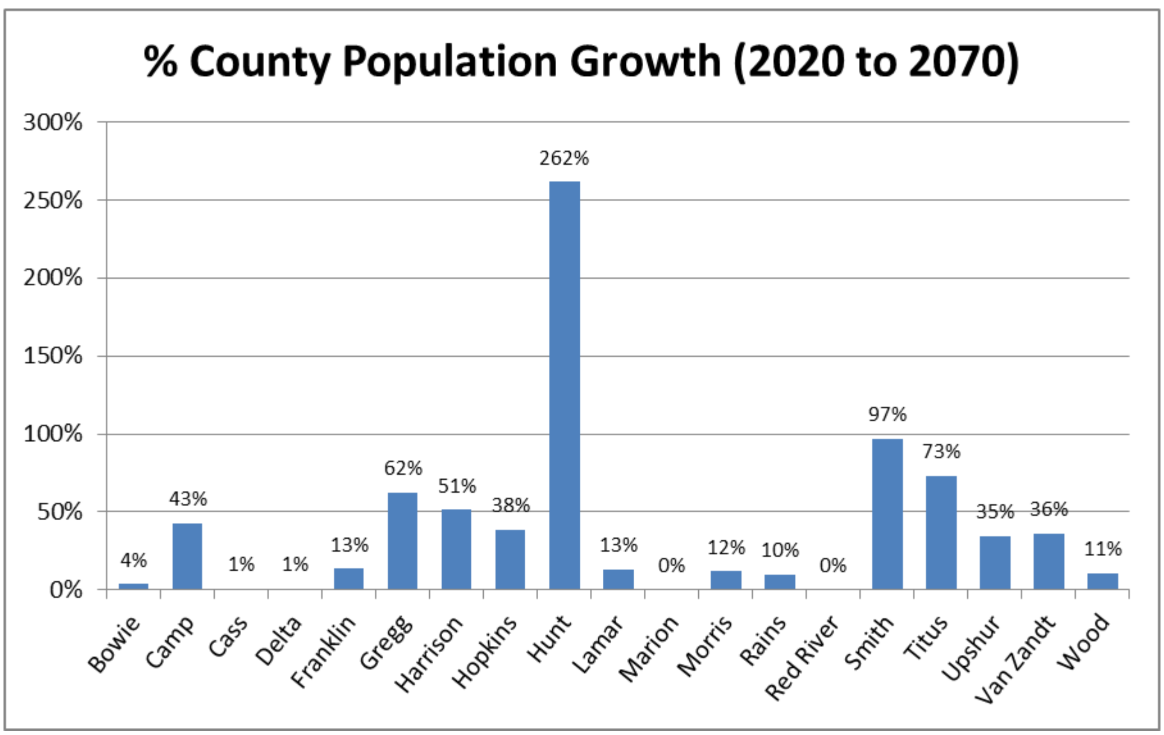


Figure 2.2 Percent Population Growth by County (2020 – 2070)

As depicted in Table 2.3 and Figure 2.3, the largest portion of the Region's population is within the Sabine River Basin. The Cities of Greenville, Longview, Kilgore and portions of Marshall are within the Sabine River basin as well as a large geographic area comprised of many smaller water user groups. The Sabine River Basin is anticipated to grow more quickly than other basins in the region because of the large population growth expected in the eastern portion of Hunt County, as mentioned previously.

A more detailed breakdown of population projections for the North East Texas Region is presented in Appendix C for this chapter, Table C2.1.

Table 2.3 Population Projection by River Basin

Basin	2020	2030	2040	2050	2060	2070
Cypress	160,795	171,462	181,446	193,093	204,893	217,408
Neches	13,721	15,057	16,078	17,092	17,935	18,656
Red	43,801	45,217	46,051	46,665	46,884	47,280
Sabine	411,680	461,842	519,730	593,292	686,356	809,458
Sulphur	187,369	198,212	208,417	220,248	235,770	255,384
Trinity	14,103	15,741	17,137	18,807	20,141	22,252
Region Total	**831,469**	**907,531**	**988,859**	**1,089,197**	**1,211,979**	**1,370,438**

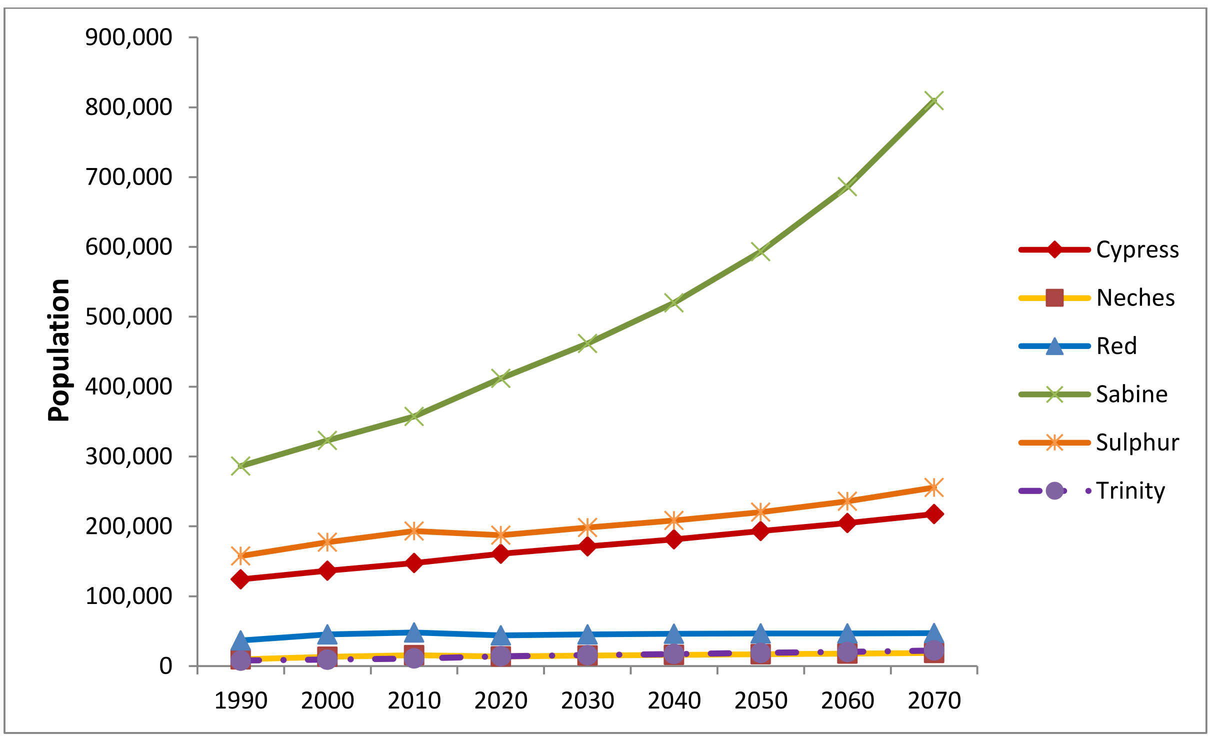


Figure 2.3 Population Projection by River Basin

2.3 WATER DEMAND PROJECTIONS

As noted earlier, the new population projections to be used in the 2016 RWPs will increase population projections in some locations while decreasing population projections in other locations, relative to the population projections in the 2011 RWPs. Total annual water demand is expected to increase approximately 51% or 322,800, from 2020 to 2070. The increase in regional water demand will be due to increases in steam electric, manufacturing and municipal water demand. Table 2.4 and Figure 2.4 summarize and illustrate the projected water demand by category.

Table 2.4 Regional Water Demand Projections by Category of Use (acre-feet)

Total Water Demand	2020	2030	2040	2050	2060	2070
Municipal	134,310	142,631	152,536	166,385	184,540	208,132
Manufacturing	332,070	355,072	377,273	396,249	425,638	457,217
Irrigation	40,866	40,737	40,442	39,913	39,413	39,138
Steam Electric	96,574	112,905	132,815	157,084	186,668	222,648
Mining	7,115	7,748	7,670	7,280	6,914	6,795
Livestock	23,237	23,281	23,220	23,116	23,036	23,042
Total Water Demand (ac-ft)	**634,172**	**682,374**	**733,956**	**790,027**	**866,209**	**956,972**

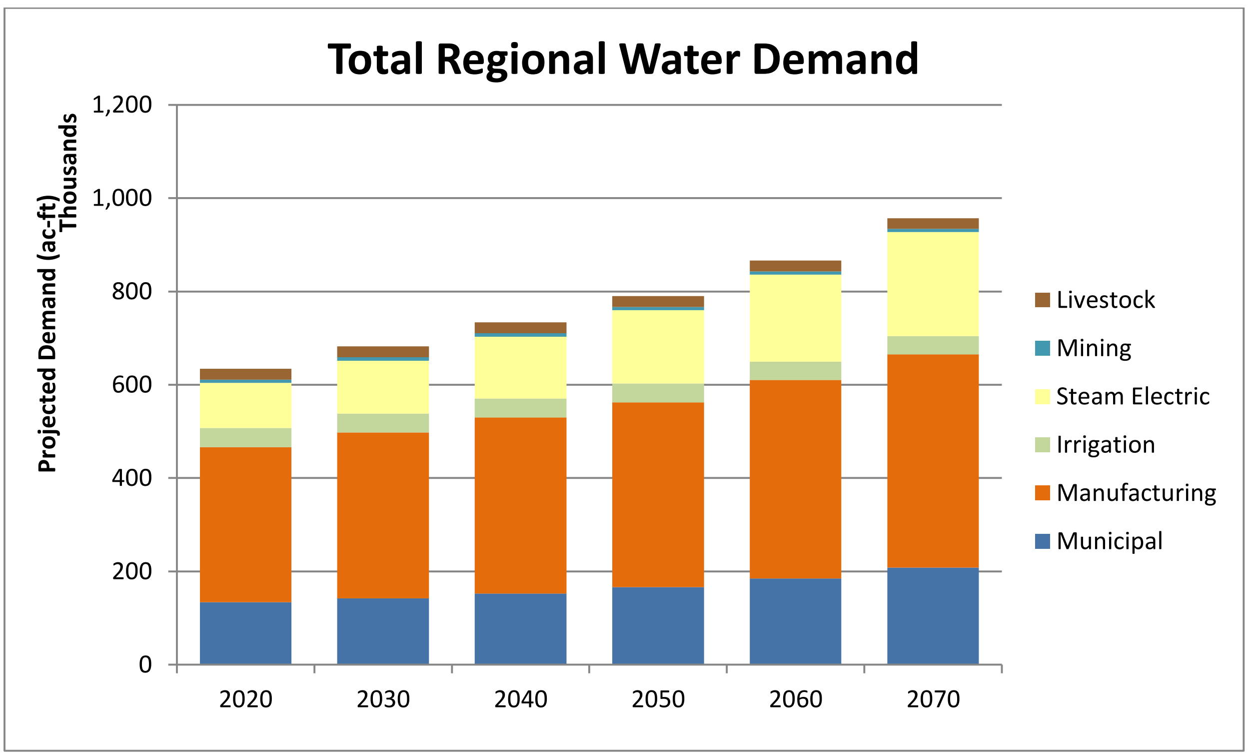


Figure 2.4 Regional Water Demand Projections by Category of Use (acre-feet)

Total water demand by county and by river basin, as presented in Tables 2.5 and 2.6, respectively, are cumulative measures of all water demand in the region for municipal, manufacturing, mining, steam electric, livestock and irrigation purposes. Cass, Harrison, Morris and Titus Counties currently have, and are projected to continue to have the highest overall water demand through 2070. Due to population growth (municipal demand), manufacturing, and to a lesser extent steam electric power generation growth, the Sabine River Basin is projected to have the highest overall water demand of the six river basins within the region. Approximately 168,000 acre-feet of water will be needed in 2070 for the portion of the Sabine River Basin that is in the North East Texas Region. This growth in water demand by river basin is depicted graphically in Figure 2.5.

Table 2.5 Total Water Demand Projections by County (acre-feet)

County	2020	2030	2040	2050	2060	2070
Bowie	28,709	29,020	28,795	28,246	27,871	27,830
Camp	2,685	2,796	2,881	3,003	3,130	3,259
Cass	119,424	125,475	131,237	136,272	145,221	154,794
Delta	3,812	3,781	3,739	3,709	3,679	3,651
Franklin	2,518	2,539	2,542	2,559	2,582	2,601
Gregg	36,539	39,606	43,034	46,968	51,670	56,916
Harrison	129,406	141,909	155,303	168,880	185,120	204,611
Hopkins	14,771	15,145	15,516	15,993	16,592	17,223
Hunt	32,234	37,602	44,744	54,377	67,552	85,718
Lamar	45,069	46,769	48,762	51,157	54,295	57,955
Marion	3,792	4,372	4,696	5,043	5,498	5,806
Morris	98,344	104,490	110,180	114,848	123,769	133,391
Rains	2,304	2,364	2,364	2,369	2,374	2,376
Red River	8,617	8,567	8,558	8,608	8,685	8,718
Smith	8,914	9,871	11,015	12,417	14,118	16,156
Titus	70,997	80,919	92,827	107,178	124,935	146,127
Upshur	7,290	7,865	8,117	8,233	8,388	8,580
Van Zandt	10,328	10,787	11,164	11,594	12,044	12,462
Wood	8,419	8,497	8,482	8,573	8,686	8,798
Region Total	**634,172**	**682,374**	**733,956**	**790,027**	**866,209**	**956,972**

Table 2.6 Total Water Demand Projections by River Basin (acre-feet)

River Basin	2020	2030	2040	2050	2060	2070
Cypress	189,256	206,432	224,608	244,357	272,006	303,797
Neches	3,074	3,166	3,245	3,336	3,427	3,509
Red	40,348	41,758	43,304	45,108	47,420	50,439
Sabine	218,799	240,764	265,448	293,293	328,018	371,179
Sulphur	180,831	188,274	195,265	201,701	212,988	225,494
Trinity	1,864	1,980	2,086	2,232	2,350	2,554
Total Water Demand (ac-ft)	**634,172**	**682,374**	**733,956**	**790,027**	**866,209**	**956,972**

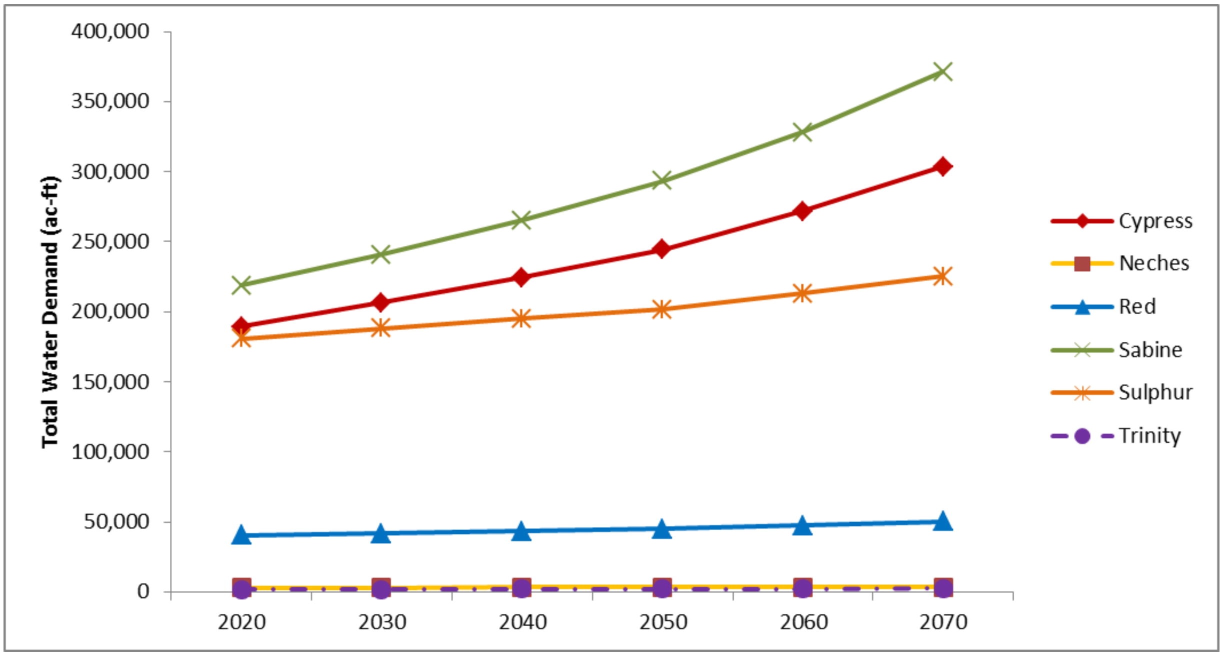


Figure 2.5 Water Demand Projections by River Basin

2.3.2 Municipal Water Demand

Municipal water use is comprised of residential (single and multifamily housing) and commercial/institutional water uses. Commercial use includes water used by business establishments, public offices, and institutions, but does not include industrial water use. The TWDB has grouped residential, commercial and institutional water use into the municipal category because of the similarity of usage. Each of the three requires water primarily for drinking, cleaning, sanitation, air cooling and outdoor use.

2.3.2.1 Methodology

Municipal water demand was calculated for each of the Water User Groups (WUGs) designated in the population projection portion of the study. The municipal water demand projections are based on population and per capita water usage.

- Reported municipal water use data through the TWDB Water Use Survey for the designated dry year (i.e., 2011) is used to calculate the base per capita water use for each city.
- For planning purposes in previous rounds, the North East Texas Regional Water Planning Group employed a minimum baseline per capita water use rate of 115 gallon per capita per day (gpcpd) for entities with current municipal water demand below that level. Historical records indicate that communities use more water as they become more affluent and as a steady supply of water is available. However, this assumption has not been used for this present round of planning, as TWDB has employed a minimum baseline per capita water use rate of 60 gpcpd.
- Municipal demands have incorporated water savings due to the installation of water efficient plumbing fixtures and appliances. These amounts have been subtracted from the base gpcpd.

The recommended reductions in gpcd from the base year are mandated in State and Federal Legislation. Recommended savings were based on a state-wide formula.

- After subtraction of plumbing code savings from the per capita water demand for each planning year, the average per capita water demand per WUG was multiplied by the WUG's population for that year to obtain a projected water demand.

2.3.2.2 Regional Municipal Water Demand Projections

Approximately 20% of the total regional water demand is for municipal purposes. Municipal water demand for the North East Texas Region is projected to increase by approximately 74,000 acre-feet, or 55% over the fifty year planning period (2020 to 2070). Table 2.7 and Table 2.8 summarize the projected municipal water demand by county and by river basin for the region. Municipal water demand is currently concentrated in Gregg, Bowie and Hunt Counties. Driven by the large population growth, Hunt County municipal water demand is projected to grow by over 210% through the year 2070.

A more refined breakdown of water demand and estimated plumbing code savings per specific WUG can be found in Table C2.2 – in the Appendix to Chapter 2.

Table 2.7 Municipal Water Demand by County (acre-feet)

County	2020	2030	2040	2050	2060	2070
Bowie	19,753	19,929	19,840	19,732	19,704	19,703
Camp	1,675	1,785	1,869	1,990	2,115	2,242
Cass	3,471	3,347	3,225	3,188	3,177	3,176
Delta	664	662	654	653	652	652
Franklin	1,451	1,472	1,476	1,493	1,517	1,537
Gregg	30,797	33,078	35,856	39,247	43,267	47,861
Harrison	10,669	11,107	11,622	12,561	13,691	15,055
Hopkins	5,494	5,686	5,874	6,172	6,515	6,866
Hunt	17,570	20,713	25,179	31,567	40,851	54,400
Lamar	6,394	6,408	6,410	6,472	6,571	6,666
Marion	968	956	947	942	940	940
Morris	1,752	1,721	1,708	1,741	1,775	1,814
Rains	1,757	1,817	1,817	1,822	1,827	1,829
Red River	1,475	1,395	1,339	1,318	1,297	1,277
Smith	7,477	8,364	9,428	10,731	12,331	14,247
Titus	6,005	6,611	7,277	8,059	8,923	9,846
Upshur	5,096	5,305	5,491	5,751	6,040	6,322
Van Zandt	6,738	7,135	7,433	7,792	8,145	8,455
Wood	5,104	5,140	5,091	5,154	5,202	5,244
Region Total	**134,310**	**142,631**	**152,536**	**166,385**	**184,540**	**208,132**

Table 2.8 Municipal Water Demand by River Basin (acre-feet)

River Basin	2020	2030	2040	2050	2060	2070
Cypress	21,065	21,889	22,767	24,122	25,683	27,395
Neches	1,470	1,557	1,625	1,706	1,788	1,859
Red	6,369	6,370	6,334	6,339	6,332	6,372
Sabine	73,144	79,746	87,997	99,225	114,000	133,480
Sulphur	30,803	31,499	32,147	33,191	34,826	36,921
Trinity	1,459	1,570	1,666	1,802	1,911	2,105
Region Total	**134,310**	**142,631**	**152,536**	**166,385**	**184,540**	**208,132**

2.3.3 Industrial Water Demand

Water used in the production of manufactured products, steam-electric power generation and mining activities, including water used by employees for drinking and sanitation, are included in the Industrial Water Use Category. Water demands have been divided into these three sub-categories for greater clarity.

2.3.3.1 Methodology

Like municipal water demand, the TWDB recommended water demand projections for manufacturing, steam-electric power generation, and mining to the Regional Water Planning Group.

The water planning group further evaluated water demand estimates from the TWDB industrial and mining water use database by surveying WUGs to update water demand information and adding known water users not previously included. This updated information was obtained largely through surveys of water providers who supplied water to manufacturing facilities. The recommended demands were revised as necessary and approved for presentation to the TWDB by the Planning Group.

2.3.3.2 Regional Manufacturing Demand Projections

Over the fifty year period from 2020 to 2070, 52% to 48% of the total water demand in the North East Texas Region is projected to be manufacturing demand. Overall manufacturing water demand for the region is projected to grow approximately 38% in the period from 2020 to 2070. Harrison, Cass and Morris counties currently have the greatest demand for water used for manufacturing purposes. These three counties are also projected to have the greatest incremental manufacturing water demand growth through 2070.

The three largest water using industries in the region, in order of size, are:

International Paper
U.S. Steel
Eastman Chemical Company

Table 2.9 Manufacturing Demand by County (acre-feet)

County	2020	2030	2040	2050	2060	2070
Bowie	1,579	1,714	1,845	1,957	2,115	2,286
Camp	46	48	50	52	55	58
Cass	115,199	121,355	127,237	132,324	141,299	150,883
Delta	0	0	0	0	0	0
Franklin	0	0	0	0	0	0
Gregg	4,251	4,713	5,165	5,554	6,028	6,542
Harrison	95,100	104,187	113,268	121,203	130,511	140,534
Hopkins	1,741	1,830	1,915	1,987	2,126	2,275
Hunt	705	837	980	1,116	1,210	1,312
Lamar	6,427	6,741	7,045	7,306	7,805	8,338
Marion	72	76	79	83	89	95
Morris	95,931	102,101	107,795	112,420	121,294	130,868
Rains	3	3	3	3	3	3
Red River	9	9	9	9	10	11
Smith	300	327	354	377	408	442
Titus	8,995	9,315	9,615	9,864	10,537	11,256
Upshur	272	291	312	330	355	382
Van Zandt	681	724	764	797	860	928
Wood	759	801	837	867	933	1004
Region Total	**332,070**	**355,072**	**377,273**	**396,249**	**425,638**	**457,217**

Table 2.10 Manufacturing Water Demand by River Basin (acre-ft)

River Basin	2020	2030	2040	2050	2060	2070
Cypress	105,526	112,056	118,091	123,002	132,602	142,951
Neches	0	0	0	0	0	0
Red	787	826	863	897	958	1,024
Sabine	101,556	111,314	121,054	129,565	139,571	150,353
Sulphur	124,194	130,869	137,257	142,777	152,498	162,880
Trinity	7	7	8	8	9	9
Region Total	**332,070**	**355,072**	**377,273**	**396,249**	**425,638**	**457,217**

2.3.3.3 Regional Steam Electric Demand Projections

Annual steam electric water demand is projected to increase 131% from the year 2020 to 2070. The majority of this increase is expected to occur in Hunt, Harrison, Titus and Lamar counties as steam electric power generation facilities are expanded and additional facilities are anticipated to come on-line to supply the power generation needs of Region D and surrounding regions. In 2020, steam electric power generation projections represent approximately 15% of water demand for this Region. By 2070 steam electric is anticipated to require 23% of the region's water demand.

Table 2.11 Steam Electric Water Demand by County (acre-ft)

County	2020	2030	2040	2050	2060	2070
Bowie	0	0	0	0	0	0
Camp	0	0	0	0	0	0
Cass	0	0	0	0	0	0
Delta	0	0	0	0	0	0
Franklin	0	0	0	0	0	0
Gregg	978	1,143	1,345	1,591	1,890	2,094
Harrison	19,838	23,193	27,283	32,268	38,345	46,625
Hopkins	0	0	0	0	0	0
Hunt	12,436	14,539	17,102	20,228	24,038	28,564
Lamar	8,503	9,941	11,694	13,831	16,435	19,529
Marion	1,852	2,165	2,547	3,012	3,580	3,967
Morris	43	50	59	69	82	91
Rains	0	0	0	0	0	0
Red River	489	572	673	796	946	1048
Smith	12	14	16	19	23	27
Titus	52,423	61,288	72,096	85,270	101,329	120,703
Upshur	0	0	0	0	0	0
Van Zandt	0	0	0	0	0	0
Wood	0	0	0	0	0	0
Region Total	**96,574**	**112,905**	**132,815**	**157,084**	**186,668**	**222,648**

Table 2.12 Steam Electric Water Demand by River Basin (acre-ft)

River Basin	2020	2030	2040	2050	2060	2070
Cypress	54,318	63,503	74,702	88,351	104,991	124,761
Neches	0	0	0	0		0
Red	8,503	9,941	11,694	13,831	16,435	19,529
Sabine	33,264	38,889	45,746	54,106	64,296	77,310
Sulphur	489	572	673	796	946	1,048

River Basin	2020	2030	2040	2050	2060	2070
Trinity	0	0	0	0	0	0
Region Total	**96,574**	**112,905**	**132,815**	**157,084**	**186,668**	**222,648**

2.3.3.4 Regional Mining Demand Projections

Mining water demand represents a very small portion of the regional water demand (about 1%). Annual water demand for mining purposes is anticipated to grow first and then decrease by about 4.5% for the fifty year period from 2020 to 2070. Mining water demand is largest in Harrison County, and is projected to be largest in Titus County by 2070. TWDB relied on a recent study with the Bureau of Economic Geology at the University of Texas at Austin to prepare mining water demand projections for each planning region.

Table 2.13 Mining Water Demand by County (acre-ft)

County	2020	2030	2040	2050	2060	2070
Bowie	0	0	0	0	0	0
Camp	12	11	10	9	8	7
Cass	39	58	60	45	30	20
Delta	0	0	0	0	0	0
Franklin	5	5	4	4	3	2
Gregg	274	433	429	337	246	180
Harrison	2,498	2,077	1,740	1,412	1,088	855
Hopkins	1,031	1,124	1,222	1,329	1,446	1,577
Hunt	128	118	88	71	58	47
Lamar	0	0	0	0	0	0
Marion	489	764	712	595	478	393
Morris	0	0	0	0	0	0
Rains	0	0	0	0	0	0
Red River	4	4	3	3	3	3
Smith	287	309	341	394	438	497
Titus	1,644	1,775	1,909	2,055	2,216	2,392
Upshur	379	726	771	609	450	333
Van Zandt	300	319	358	396	430	470
Wood	25	25	23	21	20	19
Region Total	**7,115**	**7,748**	**7,670**	**7,280**	**6,914**	**6,795**

Table 2.14 Mining Water Demand by Basin (acre-ft)

River Basin	2020	2030	2040	2050	2060	2070
Cypress	2,923	3,534	3,571	3,377	3,196	3,122
Neches	81	86	97	107	116	127
Red	0	0	0	0	0	0
Sabine	3,174	3,117	2,916	2,624	2,336	2,173
Sulphur	856	925	991	1,067	1,153	1,250
Trinity	81	86	95	105	113	123
Region Total	**7,115**	**7,748**	**7,670**	**7,280**	**6,914**	**6,795**

2.3.4 Livestock Demand

Livestock water demand is the water consumed in the production of cattle, hogs, pigs, sheep, goats, chickens and horses.

2.3.4.1 Methodology

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

2.3.4.2 Regional Livestock Water Demand Projections

Livestock water demand in 2012 represented approximately 6% of water demand in the North East Texas Region. Livestock water demand is projected to be approximately 3.7% of water demand in the year 2020. Livestock water demand is expected to remain relatively constant over the 50 year planning period, with a reduction to 2.4% of Regional water demand. Livestock water demand is spread relatively evenly throughout the region with Hopkins County showing the largest demand of approximately 4,236 acre-feet annually. Tables 2.15 and 2.16 present livestock water demand for Region D.

Table 2.15 Livestock Water Demand by County (acre-ft)

County	2020	2030	2040	2050	2060	2070
Bowie	1,156	1,156	1,050	900	771	720
Camp	952	952	952	952	952	952
Cass	715	715	715	715	715	715
Delta	373	373	373	373	373	373
Franklin	1,036	1,036	1,036	1,036	1,036	1,036
Gregg	215	215	215	215	215	215
Harrison	856	900	945	991	1,040	1,097
Hopkins	4,236	4,236	4,236	4,236	4,236	4,236
Hunt	1,141	1,141	1,141	1,141	1,141	1,141
Lamar	2,800	2,800	2,800	2,800	2,800	2,800

County	2020	2030	2040	2050	2060	2070
Marion	411	411	411	411	411	411
Morris	618	618	618	618	618	618
Rains	506	506	506	506	506	506
Red River	1,484	1,484	1,484	1,484	1,484	1,484
Smith	468	468	468	468	468	468
Titus	930	930	930	930	930	930
Upshur	1,358	1,358	1,358	1,358	1,358	1,358
Van Zandt	2,172	2,172	2,172	2,172	2,172	2,172
Wood	1,810	1,810	1,810	1,810	1,810	1,810
Region Total	**23,237**	**23,281**	**23,220**	**23,116**	**23,036**	**23,042**

Table 2.16 Livestock Water Demand by River Basin (acre-feet)

River Basin	2020	2030	2040	2050	2060	2070
Cypress	4,785	4,811	4,838	4,866	4,895	4,929
Neches	1,167	1,167	1,167	1,167	1,167	1,167
Red	2,349	2,349	2,309	2,253	2,204	2,185
Sabine	6,123	6,141	6,159	6,177	6,197	6,220
Sulphur	8,530	8,530	8,464	8,370	8,290	8,258
Trinity	283	283	283	283	283	283
Region Total	**23,237**	**23,281**	**23,220**	**23,116**	**23,036**	**23,042**

2.3.5 Irrigation Demand

TWDB annual Irrigation water use estimates are produced by calculating a crop water need based on evapotranspiration and other climatic factors, this need per acre is then applied to irrigated acreage data obtained from the USDA Farm Service Agency in order to determine estimated irrigation water use by TWDB crop category. These estimates are then made available to Groundwater Conservation Districts for comment, although in the North Texas Region no Groundwater Conservation Districts presently exist.

2.3.5.1 Methodology

The acreage planted for each crop under irrigation is estimated for each county. The crop water application for each crop is estimated by the Natural Resources Conservation Service (NRCS) and multiplied by the acreage to estimate the total irrigation for a county or region. 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 USDA Farm Service Agency, for the designated dry year were provided by TWDB, whereby the NETRWPG submitted adjustments based on available information to refine the irrigation water demand projections. Any economic, technical, and/or water supply-related evidence showing cause for adjustment in the future rate of change in irrigation water use was utilized where available.

2.3.5.2 Regional Irrigation Water Demand Projections

Irrigation water represented approximately 10% of water demand in the North East Texas Region in 2012. Projected irrigation water demand represents approximately 6.4% of water demand in the year 2020. Irrigation demand is expected to remain relatively constant over the 50 year planning period, with a reduction in percentage to around 4.1% of the Region's total water demand. Irrigation water demand is concentrated in Lamar, Red River, Bowie, Hopkins and Delta Counties. Tables 2.17 and 2.18 present irrigation water demand for Region D.

Table 2.17 Irrigation Water Demand by County (acre-ft)

County	2020	2030	2040	2050	2060	2070
Bowie	6,221	6,221	6,060	5,657	5,281	5,121
Camp	0	0	0	0	0	0
Cass	0	0	0	0	0	0
Delta	2,775	2,746	2,712	2,683	2,654	2,626
Franklin	26	26	26	26	26	26
Gregg	24	24	24	24	24	24
Harrison	445	445	445	445	445	445
Hopkins	2,269	2,269	2,269	2,269	2,269	2,269
Hunt	254	254	254	254	254	254
Lamar	20,945	20,879	20,813	20,748	20,684	20,622
Marion	0	0	0	0	0	0
Morris	0	0	0	0	0	0
Rains	38	38	38	38	38	38
Red River	5,156	5,103	5,050	4,998	4,945	4,895
Smith	370	389	408	428	450	475
Titus	1,000	1,000	1,000	1,000	1,000	1,000
Upshur	185	185	185	185	185	185
Van Zandt	437	437	437	437	437	437
Wood	721	721	721	721	721	721
Region Total	**40,866**	**40,737**	**40,442**	**39,913**	**39,413**	**39,138**

Table 2.18 Irrigation Water Demand by River Basin (acre-ft)

River Basin	2020	2030	2040	2050	2060	2070
Cypress	640	640	640	640	640	640
Neches	356	356	356	356	356	356
Red	22,340	22,272	22,104	21,788	21,491	21,329
Sabine	1,537	1,556	1,575	1,595	1,617	1,642
Sulphur	15,959	15,879	15,733	15,500	15,275	15,137
Trinity	34	34	34	34	34	34
Region Total	**40,866**	**40,737**	**40,442**	**39,913**	**39,413**	**39,138**

2.3.6 Demands Associated with Wholesale Water Providers by Category of Use

Demands may also be disaggregated based upon the provision of supply from a Wholesale Water Provider (WWP). Table 2.19 presents projected demands associated with each WWP in the North East Texas Region by category of water use. Note that for WWPs that are also a WUG (denoted as a WUG/SELLER below), the demands presented below represent contractual demands, and do not reflect demands from the WUG itself. A more comprehensive presentation that includes both the contractual and WUG demands is presented in Appendix C3_2.

Table 2.19 Projected Demands by Wholesale Water Provider

Name	WWP/WUG Seller	Use Category	County	Basin	2020	2030	2040	2050	2060	2070
BI COUNTY WSC	WUG/SELLER	MANUFACTURING	CAMP	CYPRESS	2	2	2	2	2	2
		STEAM ELECTRIC POWER	TITUS	CYPRESS	3	3	3	3	3	3
CASH SUD	WUG/WWP	MUNICIPAL	HUNT	SABINE	769	769	769	769	769	769
CHEROKEE WATER COMPANY	WWP	MUNICIPAL	GREGG	SABINE	7,497	7,497	7,497	7,497	17,071	17,071
		MUNICIPAL	HARRISON	SABINE	10,503	10,503	10,503	10,503	929	929
		STEAM ELECTRIC POWER	GREGG	SABINE	2,000	2,000	2,000	2,000	2,000	2,094
COMMERCE WD	WWP	MANUFACTURING	HUNT	SULPHUR	338	401	470	535	580	650
		MUNICIPAL	DELTA	SULPHUR	577	561	565	568	569	497
		MUNICIPAL	HUNT	SABINE	293	434	564	1,607	1,551	1,684
		MUNICIPAL	HUNT	SULPHUR	1,542	7,099	6,708	5,845	4,499	4,498
		MUNICIPAL	HUNT	TRINITY	0	3	4	13	0	8
COOPER	WUG/SELLER	MUNICIPAL	DELTA	SULPHUR	471	474	477	479	479	481
		MUNICIPAL	HUNT	SABINE	4	6	8	12	19	21
COUNTY-OTHER, HUNT	WUG/SELLER	MANUFACTURING	HUNT	SABINE	1	1	1	1	1	1
CRYSTAL SYSTEMS INC	WUG/SELLER	MUNICIPAL	SMITH	SABINE	1,004	1,140	1,296	1,480	1,697	1,839
DETROIT	WUG/SELLER	MANUFACTURING	RED RIVER	SULPHUR	1	1	1	1	1	1
ELDERVILLE WSC	WUG/SELLER	MUNICIPAL	GREGG	SABINE	305	304	305	304	304	303
		MUNICIPAL	RUSK	SABINE	5	6	5	6	6	7
EMORY	WUG/WWP	MUNICIPAL	RAINS	SABINE	1,091	1,091	1,091	1,091	1,091	1,091
FRANKLIN COUNTY WD	WWP	MUNICIPAL	FRANKLIN	CYPRESS	4,249	4,249	4,248	4,248	4,248	4,248
		MUNICIPAL	FRANKLIN	SULPHUR	3,487	3,487	3,486	3,486	3,485	3,485
		MUNICIPAL	HOPKINS	CYPRESS	576	576	576	576	576	576
		MUNICIPAL	HOPKINS	SULPHUR	95	95	95	95	95	94

Name	WWP/WUG Seller	Use Category	County	Basin	2020	2030	2040	2050	2060	2070
		MUNICIPAL	TITUS	CYPRESS	3,563	3,563	3,563	3,563	3,563	3,562
		MUNICIPAL	TITUS	SULPHUR	27	27	28	29	30	32
		MUNICIPAL	WOOD	CYPRESS	438	438	439	438	438	438
		MUNICIPAL	WOOD	SABINE	565	565	565	565	565	565
GLADEWATER	WUG/SELLER	MUNICIPAL	GREGG	SABINE	154	154	154	154	154	54
		MUNICIPAL	SMITH	SABINE	23	23	23	23	23	23
		MUNICIPAL	UPSHUR	CYPRESS	76	76	76	76	76	76
		MUNICIPAL	UPSHUR	SABINE	36	36	36	36	36	36
GOLDEN WSC	WUG/SELLER	MANUFACTURING	VAN ZANDT	SABINE	2	2	2	2	2	2
GRAND SALINE	WUG/SELLER	MANUFACTURING	VAN ZANDT	SABINE	15	15	15	15	14	14
GREENVILLE	WUG/WWP	MANUFACTURING	HUNT	SABINE	797	965	1,146	1,319	1,438	1,624
		MINING	HUNT	SABINE	13	14	16	17	19	16
		MINING	HUNT	SULPHUR	5	5	6	6	9	13
		MINING	HUNT	TRINITY	1	1	1	1	1	1
		MUNICIPAL	HUNT	SABINE	1,242	1,250	1,265	1,306	1,373	1,383
		STEAM ELECTRIC POWER	HUNT	SABINE	351	351	351	351	351	351
KILGORE	WUG/SELLER	MUNICIPAL	GREGG	CYPRESS	17	17	17	17	17	17
		MUNICIPAL	GREGG	SABINE	126	126	125	125	126	126
		MUNICIPAL	RUSK	SABINE	248	248	249	249	248	248
LAMAR COUNTY WSD	WUG/WWP	MANUFACTURING	LAMAR	RED	858	900	941	976	1,042	1,077
		MUNICIPAL	LAMAR	RED	120	134	144	155	166	177
		MUNICIPAL	LAMAR	SULPHUR	1,202	1,292	1,371	1,418	1,464	1,513
		MUNICIPAL	RED RIVER	RED	441	441	441	441	441	441
		MUNICIPAL	RED RIVER	SULPHUR	183	180	177	177	177	177
LONGVIEW	WUG/WWP	MANUFACTURING	GREGG	SABINE	6,366	6,368	6,368	6,368	6,368	6,368
		MANUFACTURING	HARRISON	SABINE	11,285	11,285	11,285	11,285	11,285	11,285

Name	WWP/WUG Seller	Use Category	County	Basin	2020	2030	2040	2050	2060	2070
		MUNICIPAL	GREGG	SABINE	3,097	3,096	3,096	3,096	3,097	3,099
		MUNICIPAL	HARRISON	CYPRESS	309	309	309	309	309	309
		MUNICIPAL	HARRISON	SABINE	1,915	1,915	1,915	1,915	1,915	1,915
		MUNICIPAL	RUSK	SABINE	250	251	251	251	250	248
		STEAM ELECTRIC POWER	HARRISON	SABINE	6,161	6,161	6,161	6,161	6,161	6,161
MABANK	WUG/SELLER	MUNICIPAL	VAN ZANDT	TRINITY	185	218	251	287	321	357
MARSHALL	WUG/WWP	MANUFACTURING	HARRISON	CYPRESS	0	0	0	0	0	0
		MANUFACTURING	HARRISON	SABINE	2,000	2,000	2,000	2,000	2,000	2,000
		MUNICIPAL	HARRISON	CYPRESS	253	253	253	253	253	253
		MUNICIPAL	HARRISON	SABINE	137	137	137	137	137	137
		MUNICIPAL	PANOLA	SABINE	33	33	33	33	33	33
MOUNT PLEASANT	WUG/WWP	MANUFACTURING	TITUS	CYPRESS	3,345	3,409	3,472	3,483	3,617	3,651
		MUNICIPAL	FRANKLIN	SULPHUR	14	16	17	17	17	17
		MUNICIPAL	MORRIS	CYPRESS	293	326	348	368	385	411
		MUNICIPAL	TITUS	CYPRESS	397	431	455	477	496	525
		MUNICIPAL	TITUS	SULPHUR	941	1,034	1,095	1,153	1,215	1,290
NORTH TEXAS MWD	WWP	MUNICIPAL	COLLIN	SABINE	186	218	279	347	415	485
		MUNICIPAL	COLLIN	TRINITY	91	107	139	172	205	235
		MUNICIPAL	HOPKINS	SABINE	7	10	12	10	10	8
		MUNICIPAL	HUNT	SABINE	2,296	2,866	3,701	4,186	4,758	5,533
		MUNICIPAL	HUNT	SULPHUR	22	27	35	36	38	36
		MUNICIPAL	HUNT	TRINITY	2	6	8	17	2	7
		MUNICIPAL	RAINS	SABINE	51	55	62	53	45	41
		MUNICIPAL	ROCKWALL	SABINE	85	117	163	170	167	167
NORTHEAST TEXAS MWD	WWP	MANUFACTURING	MORRIS	CYPRESS	45,437	45,437	45,437	45,437	45,437	45,437
		MINING	TITUS	CYPRESS	1,644	1,775	1,909	2,055	2,216	2,392
		MUNICIPAL	CAMP	CYPRESS	12,588	12,588	12,588	12,588	12,588	12,588

Name	WWP/WUG Seller	Use Category	County	Basin	2020	2030	2040	2050	2060	2070
		MUNICIPAL	CASS	CYPRESS	4,399	4,399	4,399	4,399	4,399	4,399
		MUNICIPAL	GREGG	CYPRESS	1,177	1,177	1,177	1,177	1,177	1,177
		MUNICIPAL	GREGG	SABINE	20,495	20,495	20,495	20,495	20,495	20,495
		MUNICIPAL	HARRISON	CYPRESS	2,094	2,094	2,094	2,094	2,094	2,094
		MUNICIPAL	HARRISON	SABINE	7,870	7,870	7,870	7,870	7,870	7,870
		MUNICIPAL	MARION	CYPRESS	7,889	7,889	7,889	7,889	7,889	7,889
		MUNICIPAL	MORRIS	CYPRESS	10,922	10,922	10,922	10,922	10,922	10,922
		MUNICIPAL	UPSHUR	CYPRESS	2,520	2,520	2,520	2,520	2,520	2,520
		STEAM ELECTRIC POWER	HARRISON	SABINE	18,000	18,000	18,000	18,000	18,000	18,000
		STEAM ELECTRIC POWER	MARION	CYPRESS	6,668	6,668	6,668	6,668	6,668	6,668
		STEAM ELECTRIC POWER	TITUS	CYPRESS	52,423	61,288	72,096	85,270	101,329	120,703
PARIS	WUG/WWP	MANUFACTURING	LAMAR	SULPHUR	5,091	5,340	5,580	5,787	6,183	6,386
		MUNICIPAL	LAMAR	RED	8,064	8,066	8,065	8,065	8,066	8,066
		MUNICIPAL	LAMAR	SULPHUR	5,378	5,376	5,377	5,377	5,376	5,376
		STEAM ELECTRIC POWER	LAMAR	RED	8,961	8,961	8,961	8,961	8,961	8,961
POINT	WUG/SELLER	MANUFACTURING	RAINS	SABINE	3	3	3	3	3	3
SABINE RIVER AUTHORITY	WWP	MINING	HARRISON	CYPRESS	29	29	29	29	29	29
		MINING	HARRISON	SABINE	111	111	111	111	111	111
		MUNICIPAL	GREGG	SABINE	23,002	22,990	22,990	22,992	23,000	23,012
		MUNICIPAL	HOPKINS	SABINE	23	8	7	9	10	11
		MUNICIPAL	HUNT	SABINE	18,604	19,108	19,270	19,411	19,530	19,660
		MUNICIPAL	HUNT	SULPHUR	61	22	24	32	42	56
		MUNICIPAL	KAUFMAN	SABINE	77	85	92	101	111	122
		MUNICIPAL	KAUFMAN	TRINITY	10	12	15	17	18	20
		MUNICIPAL	RAINS	SABINE	3,194	3,069	3,055	3,051	3,047	3,039

Name	WWP/WUG Seller	Use Category	County	Basin	2020	2030	2040	2050	2060	2070
		MUNICIPAL	ROCKWALL	SABINE	284	109	129	173	229	289
		MUNICIPAL	RUSK	SABINE	922	934	934	932	924	912
		MUNICIPAL	VAN ZANDT	SABINE	3,228	3,260	3,274	3,290	3,310	3,308
		MUNICIPAL	VAN ZANDT	TRINITY	2,833	2,765	2,705	2,641	2,566	2,493
		MUNICIPAL	WOOD	SABINE	1,019	1,012	1,004	997	990	983
		WWP	(blank)	(blank)	8,236	8,127	7,940	8,197	6,828	7,040
SULPHUR RIVER MWD	WWP	MUNICIPAL	DELTA	SULPHUR	838	832	827	822	816	811
		MUNICIPAL	HOPKINS	SABINE	44	43	41	44	42	43
		MUNICIPAL	HOPKINS	SULPHUR	14,145	14,055	13,966	13,872	13,783	13,691
SULPHUR SPRINGS	WUG/WWP	LIVESTOCK	HOPKINS	SULPHUR	1,474	1,551	1,720	1,730	1,914	1,996
		MANUFACTURING	HOPKINS	SULPHUR	1,741	1,830	1,915	1,987	2,126	2,275
		MANUFACTURING	HUNT	SABINE	50	50	50	50	50	50
		MINING	HOPKINS	CYPRESS	6	7	7	8	9	9
		MINING	HOPKINS	SABINE	62	68	74	81	88	96
		MINING	HOPKINS	SULPHUR	132	145	159	172	188	205
		MINING	TITUS	CYPRESS	80	80	80	80	80	80
		MUNICIPAL	HOPKINS	SABINE	401	410	415	397	380	361
		MUNICIPAL	HOPKINS	SULPHUR	1,207	1,216	1,222	1,201	1,182	1,163
TERRELL	WUG/SELLER	MUNICIPAL	HUNT	SABINE	268	360	502	698	1,047	1,527
		MUNICIPAL	HUNT	SULPHUR	1	1	0	0	0	0
		MUNICIPAL	HUNT	TRINITY	5	10	12	28	5	20
TEXARKANA	WUG/WWP	MANUFACTURING	BOWIE	RED	1,258	1,367	1,472	1,563	1,690	1,788
		MANUFACTURING	BOWIE	SULPHUR	1,257	1,366	1,472	1,562	1,689	1,787
		MANUFACTURING	CASS	SULPHUR	120,000	120,000	120,000	120,000	120,000	120,000
		MUNICIPAL	BOWIE	RED	14,832	14,835	14,835	14,830	14,828	14,826
		MUNICIPAL	BOWIE	SULPHUR	16,259	16,259	16,255	16,250	16,247	16,245
		MUNICIPAL	CASS	CYPRESS	1,181	1,160	1,137	1,129	1,127	1,127

Name	WWP/WUG Seller	Use Category	County	Basin	2020	2030	2040	2050	2060	2070
		MUNICIPAL	CASS	SULPHUR	654	657	660	662	662	664
		MUNICIPAL	RED RIVER	RED	201	201	201	201	201	201
		MUNICIPAL	RED RIVER	SULPHUR	200	200	200	200	200	200
TITUS COUNTY FWD #1	WWP	MUNICIPAL	TITUS	CYPRESS	10,000	10,000	10,000	10,000	10,000	10,000
		STEAM ELECTRIC POWER	TITUS	CYPRESS	10,000	10,000	10,000	10,000	10,000	10,000
TRI SUD	WUG/SELLER	MINING	TITUS	CYPRESS	7	7	7	7	7	7
TYLER	WUG/WWP	MUNICIPAL	SMITH	NECHES	239	239	239	239	239	239
WHITE OAK	WUG/SELLER	MUNICIPAL	GREGG	SABINE	50	50	50	50	50	50
		MUNICIPAL	UPSHUR	CYPRESS	27	27	27	27	27	27
		MUNICIPAL	UPSHUR	SABINE	13	13	13	13	13	13
				TOTAL	**564,925**	**581,721**	**594,857**	**610,627**	**626,875**	**649,421**

2.3.7 Regional Environmental Flow Demand Projections

An additional demand for water in the Region is that water needed for "environmental flows," as that term is defined in Senate Bill 3 of the 2007 Regular Session (SB 3). While no volumes or rates have been projected in this plan, the NETRWPG anticipates a significant amount of water will be needed for the Region's rivers, streams, and lakes to maintain the agricultural and natural resources of the North East Texas Region.

As discussed in *Section 3.4 Impact of Environmental Flow Policies on Water Rights, Water Availability, and Water Planning,* SB 3 establishes a process to determine the environmental flow needs for each river basin. To date, a schedule has not been established for a SB 3 process for the Red, Sulphur, or Cypress basins. However, a voluntary process is ongoing for the Cypress Basin, whereby voluntary environmental flow goals have been identified, and studies have been undertaken to evaluate and consider environmental flow needs in the Sulphur River Basin (discussed in more detail within Chapter 8 of this Plan).

CHAPTER 3 EVALUATION OF CURRENT WATER SUPPLIES IN THE REGION

A key task in the preparation of the water plan for the North East Texas Region is the determination of the amount of water that is currently available to the region. In Chapter 4, this information will be compared to the water demand projections presented in Chapter 2 to identify water user groups with projected needs beyond their available supply.

As part of the evaluation of current water supplies in the Region, the NETRWPG was charged with updating the water supply availability numbers from the 2011 plan. Water supply estimates were updated using a variety of methods:

- Groundwater availability was based on the Modeled Available Groundwater (MAG) volumes that may be produced on an average annual basis to achieve a Desired Future Conditions (DFC) as adopted by Groundwater Management Areas (GMAs) (per Texas Water Code 36.001). Groundwater availability is not limited by permits currently issued. MAG volumes for each aquifer were provided by TWDB through the DB17 interface, and split into discrete geographic-aquifer units by: Aquifer/Region/County/ Basin).
- In the Red River Basin, Lamar County reservoir yields were updated based upon a modification of the WAM for the Red River Basin, as developed for the City of Paris by HDR Engineers and approved by the TWDB.
- A survey form was distributed to all municipal WUGs to identify any changes in supply sources or amounts since the 2011 plan – for example, new wells, purchase contract renewals, new contracts, mergers, or new reuse supplies.
- In all river basins, the firm yields of various water supplies have been updated using TCEQ supplied WAM model results, the implementation of which is detailed in the April 1, 2013 Water Supplies Assumption memorandum submitted to the TWDB by the RWPG, as approved at the April 3, 2013 RWPG meeting.

The analysis of currently available water supply is to be presented in three parts, per TWDB:

- Estimates of available water by source;
- Estimates of the supplies currently available to each water user group; and
- Estimates of the supplies currently available to each designated major water provider.

The following sections of this chapter present the supply availability estimates accordingly.

Table 3.1 Overall Water Availability by Source

Water Availability (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Surface Water in Region D	1,283,365	1,246,460	1,207,676	1,168,889	1,127,733	1,079,376
Groundwater in Region D	288,083	287,261	286,526	285,896	285,111	285,111
Direct Reuse	83,965	78,682	73,509	74,909	83,926	77,843
Total	**1,655,413**	**1,612,403**	**1,567,711**	**1,529,694**	**1,496,770**	**1,442,330**

3.1 SURFACE WATER SUPPLIES

The North East Texas Regional Water Planning Region includes all or a portion of 19 counties that encompass major portions of four river basins: the Cypress Creek Basin, the Red River Basin, Sulphur River Basin and the Sabine River Basin. Relatively small portions of the Neches River Basin and the Trinity River Basin also extend into the North East Texas Region. Surface water sources within the region include rivers, streams, lakes, ponds, and tanks.

Surface water in Texas is owned by the State, and its use is regulated under the legal doctrine of prior appropriation. This means that water rights that are issued by the state for the diversion and use of surface water have priority according to the date that the right was issued. The oldest issued water right has priority over all subsequently issued water rights, regardless of the type of use. Water rights issued by the state generally are one of two types, run-of-the-river rights and stored water rights.

Run-of-the-river water rights permits allow diversions of water directly from a river or stream provided there is water in the stream and that the water is not needed to meet senior downstream water rights. Run-of-the-river rights are greatly impacted by drought conditions, particularly in the upper portions of a river basin.

Stored water rights allow the impoundment of water by a permittee in a reservoir. Water can be held for storage as long as the inflow is not needed to meet a senior downstream water right or other condition, such as release requirements for maintenance of instream flows. Water stored in the reservoir can be withdrawn by the permittee at a later date to meet water demands. Stored water rights are generally based on a reservoir's firm yield and are therefore less sensitive to drought conditions.

In addition to water rights issued by the state, individual land owners are allowed to use certain surface waters without a permit. Specifically, land owners are allowed to construct impoundments with up to 200 acre-feet of storage or use water directly from a stream for domestic and livestock purposes. These types of water supplies are referred to as "local supply sources."

A summary of the available surface water supplies for each of the river basins within the region is presented below. In accordance with TWDB requirements, the estimates of available water supply are based on the following key assumptions:

- Water supply is to be evaluated as the amount of water that a user can depend on obtaining during a drought of record conditions. For reservoirs, this corresponds to the firm yield. For run-of-the-river sources, this corresponds to the amount of water available for diversion during the driest period of record.

- Water availability is to be based on the assumption that all senior downstream water rights are being fully utilized.

- Water availability is to be based on the infrastructure that is currently in place. For example, water would not be considered available from a reservoir if a user needs to construct the water intake and pipeline required for diverting and conveying water from the reservoir to the area of need. In this case, the strategies considered in Chapter 5 could include construction of the necessary pipeline, intake, or other infrastructure necessary to fully access the source.

- A properly issued water right is no guarantee of access to water. It is possible that a water right can be held in which there is no water during some time of the year. For example, a holder of a water right that is run-of-the-river may have no access to water when there is no flow in the river. A holder of a water right that is a right to store and divert at a later date may have only limited access to water during a drought. It should be acknowledged that water rights have been issued in circumstances where the water is estimated to be available under a water right in a water supply contract. It is essential that buyers understand the limitations and qualifications of the water right that supports the water supply contract. It is not uncommon for Wholesale Water Providers to have water rights for a volume greater than what can be delivered during the worst drought of record. It is not uncommon for water rights to be issued in an amount greater than the dependable yield of a reservoir.

3.1.1 Water Availability Models

As required by TWDB rules, for the 2016 Regional Water Plan, Texas Commission on Environmental Quality (TCEQ) Water Availability Models (WAM) for reservoirs and river systems were utilized, except for Pat Mayse and Lake Crook Reservoirs. The WAM was developed to account for water availability during drought of record conditions and considers factors such as reservoir firm yield, run-of-river diversions, and assumed full exercise of senior water rights within a system.

The working definition for firm yield is the maximum amount of water the reservoir can provide each year during drought of record considering reasonable sedimentation rates and reasonable predetermined withdrawal patterns, assuming full utilization of senior water rights, both upstream and downstream, and full satisfaction of environmental flow requirements for bays and estuaries, if they apply. It also accounts for a minimum pool level for each reservoir in the system and, if applicable, maximum reservoir level at the top of the water supply storage (i.e., conservation pool) volume.

Table 3.2 below presents a list of the water rights that are the basis for the surface water availability in the plan.

Table 3.2 List of Water Rights Utilized in Development of Surface Water Availability

County	Basin	WUG	WR Number	Water Right Owner
BOWIE	Red	IRRIGATION	4317	ELLEN KREMPIN THOMAS
BOWIE	Red	IRRIGATION	4392	DAN H BYRAM
BOWIE	Red	IRRIGATION	4952	DPT FARRIS INC
BOWIE	Red	IRRIGATION	4953	GUY W FARRIS CO-TRUSTEE ET AL
BOWIE	Red	IRRIGATION	4955	MILO CROP & LAND N V
BOWIE	Red	IRRIGATION	4957	JOE CONNER HART
BOWIE	Red	IRRIGATION	4959	TEXARKANA RIVERBEND PLANTATION
BOWIE	Red	IRRIGATION	4960	W H WOMMACK JR
BOWIE	Red	IRRIGATION	4962	STEVE LEDWELL
BOWIE	Sulphur	IRRIGATION	4829	WILLIAM E JOHNSON JR ET AL
BOWIE	Sulphur	IRRIGATION	4830	WILLIAM E JOHNSON JR ET AL
BOWIE	Sulphur	IRRIGATION	4834	WILLIAM E JOHNSON JR ET AL
BOWIE	Sulphur	IRRIGATION	4837	LEON S KENNEDY JR
BOWIE	Red	MANUFACTURING	4958	CRANFILL DAIRY FARMS INC
BOWIE	Sulphur	MANUFACTURING	4833	H C PRANGE JR
BOWIE	Sulphur	NEW BOSTON	4831	CITY OF NEW BOSTON
BOWIE	Sulphur	NEW BOSTON	4832	CITY OF NEW BOSTON
BOWIE	Sulphur	TEXAMERICAS CENTER	5873	TEXAMERICAS CENTER
BOWIE	Red	TEXARKANA	4961	CITY OF TEXARKANA
CAMP	Cypress	IRRIGATION	4574	PRINCEDALE COUNTRY CLUB
CAMP	Cypress	IRRIGATION	4561	LOYD DAILY ET UX
CAMP	Cypress	MINING	5813	LUMINANT MINING CO LLC
CAMP	Cypress	TITUS CO FWSD 1	4564	TITUS CO FWSD 1
CASS	Sulphur	COUNTY-OTHER	5449	TEXAS PARKS & WILDLIFE DEPT
CASS	Cypress	IRRIGATION	4587	EAGLE LANDING HOMEOWNERS ASSOCIATION

County	Basin	WUG	WR Number	Water Right Owner
CASS	Cypress	IRRIGATION	4597	LLOYD JUSTISS FARMS INC
CASS	Cypress	IRRIGATION	4599	DELWIN YOUNG
CASS	Cypress	MANUFACTURING	4598	JIMMY H WAKEFIELD
CASS	Sulphur	TEXARKANA	4836	CITY OF TEXARKANA
DELTA	Sulphur	COOPER	4800	CITY OF COOPER
DELTA	Sulphur	IRRIGATION	3845	SULPHUR BLUFF RANCH LLC
DELTA	Sulphur	IRRIGATION	4395	STEPHEN B TUCKER JR ET AL
DELTA	Sulphur	IRRIGATION	4801	DELTA COUNTRY CLUB INC
DELTA	Sulphur	IRVING	4799	CITY OF IRVING
DELTA	Sulphur	NORTH TEXAS MWD	4798	NORTH TEXAS MWD
DELTA	Sulphur	SULPHUR RIVER MWD	4797	SULPHUR RIVER MWD
FRANKLIN	Cypress	FRANKLIN CO WATER DIST	4560	FRANKLIN CO WATER DIST
FRANKLIN	Sulphur	IRRIGATION	4803	HELMUT HERMANN ET AL
FRANKLIN	Sulphur	IRRIGATION	4817	HANS WEISS ET UX
FRANKLIN	Sulphur	IRRIGATION	4818	ROBERT W CAMPBELL ET AL
FRANKLIN	Sulphur	IRRIGATION	5392	O V GRUBERT
FRANKLIN	Sulphur	MOUNT VERNON	4816	CITY OF MOUNT VERNON
GREGG	Sabine	CHEROKEE WATER COMPANY	4642	CHEROKEE WATER COMPANY
GREGG	Cypress	IRRIGATION	5608	HUNTERS CREEK HOA INC
GREGG	Cypress	IRRIGATION	4608	GEORGE D GROGAN
GREGG	Sabine	IRRIGATION	4626	M F GLOVER ET AL
GREGG	Sabine	IRRIGATION	4628	GINO VENITUCCI ET AL
GREGG	Sabine	IRRIGATION	4629	CARLOS B GRIFFIN SR ET UX
GREGG	Sabine	IRRIGATION	4630	GEORGE D GROGAN
GREGG	Sabine	IRRIGATION	4732	EDWIN BAGGETT ET UX

County	Basin	WUG	WR Number	Water Right Owner
GREGG	Sabine	LONGVIEW	5090	CITY OF LONGVIEW
GREGG	Sabine	LONGVIEW	4624	CITY OF LONGVIEW
GREGG	Sabine	MINING	5491	ROBERT D HEJL
GREGG	Sabine	MINING	4623	G R AKIN ET AL
GREGG	Sabine	SABINE RIVER AUTHORITY	4669	SABINE RIVER AUTHORITY
HARRISON	Cypress	IRRIGATION	4610	WESTOVER LAND & LIVESTOCK CO
HARRISON	Cypress	IRRIGATION	4615	MARSHALL LAKESIDE COUNTRY CLUB
HARRISON	Sabine	IRRIGATION	4632	PINECREST COUNTRY CLUB
HARRISON	Sabine	IRRIGATION	4634	E C JOHNSTON JR
HARRISON	Sabine	IRRIGATION	4635	BRACK-CO
HARRISON	Sabine	IRRIGATION	4645	JAMES E UTZ
HARRISON	Sabine	IRRIGATION	4646	CAROLYN HOLLOWAY BICKNELL
HARRISON	Sabine	IRRIGATION	5918	LARRY & CHARLOTTE SLONE
HARRISON	Cypress	MANUFACTURING	4609	T S MURRELL
HARRISON	Cypress	MANUFACTURING	4573	EDITH A SANDERS ET AL
HARRISON	Cypress	MANUFACTURING	4611	T & P LAKE INC ET AL
HARRISON	Sabine	MANUFACTURING	5158	NORIT AMERICAS INC
HARRISON	Sabine	MANUFACTURING	5468	NORIT AMERICAS INC
HARRISON	Sabine	MANUFACTURING	4631	EASTMAN CHEMICAL COMPANY
HARRISON	Sabine	MANUFACTURING	4633	CLARENCE W YOUNG & WIFE
HARRISON	Sabine	MINING	5082	THE SABINE MINING COMPANY

County	Basin	WUG	WR Number	Water Right Owner
HARRISON	Sabine	MINING	5124	SABINE MINING COMPANY
HARRISON	Sabine	MINING	5177	THE SABINE MINING COMPANY
HARRISON	Sabine	MINING	5246	THE SABINE MINING COMPANY
HARRISON	Sabine	MINING	5382	SABINE MINING CO
HARRISON	Sabine	MINING	5439	THE SABINE MINING COMPANY
HARRISON	Sabine	MINING	5454	THE SABINE MINING COMPANY
HARRISON	Sabine	MINING	5607	SABINE MINING COMPANY
HARRISON	Sabine	MINING	5662	THE SABINE MINING COMPANY
HARRISON	Sabine	MINING	12049	SABINE MINING CO
HARRISON	Sabine	STEAM ELECTRIC POWER	4647	SOUTHWESTERN ELECTRIC POWER CO
HOPKINS	Sabine	IRRIGATION	4699	TRUMAN L RENSHAW
HOPKINS	Sabine	IRRIGATION	4702	DEWEY DICKENS ET UX
HOPKINS	Sabine	IRRIGATION	4703	ANITA L TYNES ET AL
HOPKINS	Sulphur	IRRIGATION	4813	SULPHUR SPRINGS COUNTRY CLUB
HOPKINS	Sulphur	IRRIGATION	4814	JERRY N JORDAN TRUSTEE ET AL
HOPKINS	Sulphur	IRRIGATION	5150	LARRY MILES ET AL
HOPKINS	Sulphur	IRRIGATION	12145	LOS SENDEROS CATTLE AND RANCH COMPANY
HOPKINS	Sabine	LIVESTOCK	5217	COY JOHNSON & PATSY JOHNSON
HOPKINS	Sulphur	SULPHUR SPRINGS	4811	CITY OF SULPHUR SPRINGS
HOPKINS	Sulphur	SULPHUR SPRINGS	4812	CITY OF SULPHUR SPRINGS
HUNT	Sabine	GREENVILLE	4665	CITY OF GREENVILLE
HUNT	Sabine	GREENVILLE	4668	GREENVILLE LAKE & WATER CO
HUNT	Sabine	IRRIGATION	4667	E F BUEHRING
HUNT	Sulphur	IRRIGATION	4796	WEBB HILL COUNTRY CLUB

County	Basin	WUG	WR Number	Water Right Owner
HUNT	Sulphur	WOLFE CITY	4795	CITY OF WOLFE CITY
LAMAR	Red	COUNTY-OTHER	5149	MFW DEVELOPMENT
LAMAR	Red	COUNTY-OTHER	4944	TEXAS NATIONAL GUARD ARMORY
LAMAR	Red	IRRIGATION	4228	ANGELINA & NECHES RIVER AUTHORITY
LAMAR	Red	IRRIGATION	5558	PARIS GOLF & COUNTRY CLUB INC
LAMAR	Red	IRRIGATION	4930	LEDBETTER-RHODE FARM & RANCH
LAMAR	Red	IRRIGATION	4945	CLYDE L DARNELL ET AL
LAMAR	Red	IRRIGATION	4209	DAMSON OIL CORP ET AL
LAMAR	Red	IRRIGATION	4934	A G ROBINSON
LAMAR	Red	IRRIGATION	4935	R R SHERWOOD ET AL
LAMAR	Red	IRRIGATION	4938	FELIX STEPHENS
LAMAR	Red	IRRIGATION	4939	Q B STEPHENS & LAURA STEPHENS
LAMAR	Red	IRRIGATION	4941	CHARLES C TAYLOR ET UX
LAMAR	Red	IRRIGATION	5233	LEROY H KAUTZ ET UX
LAMAR	Red	MANUFACTURING	4920	PILGRIMS PRIDE CORP
LAMAR	Red	PARIS	4942	CITY OF PARIS
LAMAR	Red	PARIS	4943	CITY OF PARIS
LAMAR	Red	PARIS	4940	CITY OF PARIS
MARION	Cypress	COUNTY-OTHER	4349	RDS LAND CO LLC
MARION	Cypress	IRRIGATION	4618	JAMES H MORRIS
MARION	Cypress	IRRIGATION	4525	SPARKS FAMILY PARTNERSHIP LTD
MARION	Cypress	IRRIGATION	4591	H ZEKE GROGAN
MARION	Cypress	IRRIGATION	4592	DAVID R & E M KEY
MARION	Cypress	IRRIGATION	4593	GEORGE D GROGAN
MARION	Cypress	IRRIGATION	4594	BILLIE J ELLIS ET UX
MARION	Cypress	IRRIGATION	4596	DAVID R KEY ESTATE

County	Basin	WUG	WR Number	Water Right Owner
MARION	Cypress	IRRIGATION	4600	JARVIS L SMOAK
MARION	Cypress	IRRIGATION	4612	DAVID R KEY
MARION	Cypress	JEFFERSON	4595	JEFFERSON WATER & SEWER DIST
MARION	Cypress	MARSHALL	4614	CITY OF MARSHALL
MARION	Cypress	MINING	4613	FAIR OIL LC
MARION	Cypress	STEAM ELECTRIC POWER	4588	SOUTHWESTERN ELECTRIC POWER CO
MORRIS	Cypress	IRRIGATION	4577	ADRON JUSTISS
MORRIS	Cypress	IRRIGATION	4578	ADRON JUSTISS
MORRIS	Cypress	IRRIGATION	4579	ADRON JUSTISS
MORRIS	Cypress	IRRIGATION	4580	SAM L DALE
MORRIS	Cypress	NORTHEAST TEXAS MWD	4582	US STEEL TUBULAR PRODUCTS INC
RAINS	Sabine	IRRIGATION	4681	PAMELA H STEELE ET VIR
RAINS	Sabine	IRRIGATION	4700	NELL COBB CLICK
RAINS	Sabine	SABINE RIVER AUTHORITY	5046	ROBERT CARROZZA
RED RIVER	Red	IRRIGATION	4947	JAMES E WAGGONER
RED RIVER	Red	IRRIGATION	4948	JAMES E WAGGONER
RED RIVER	Red	IRRIGATION	4949	GLEN E & SUE NICHOLS
RED RIVER	Red	IRRIGATION	4950	JAMES E WAGGONER
RED RIVER	Red	IRRIGATION	4946	ATLEE M KOHL ET AL
RED RIVER	Red	IRRIGATION	4951	CLARKSVILLE COUNTRY CLUB

County	Basin	WUG	WR Number	Water Right Owner
RED RIVER	Sulphur	IRRIGATION	4802	ALEXANDER FRICK ET AL
RED RIVER	Sulphur	IRRIGATION	4806	MARY MARGARET VAUGHAN
RED RIVER	Sulphur	IRRIGATION	4807	MARY MARGARET VAUGHAN
RED RIVER	Sulphur	IRRIGATION	4810	PERRY R BASS INC
RED RIVER	Sulphur	RED RIVER COUNTY WSC	4809	RED RIVER COUNTY WCID 1
RED RIVER	Sulphur	STEAM ELECTRIC POWER	4804	LUMINANT GENERATION CO LLC
SMITH	Sabine	COUNTY-OTHER	3931	DALE A HIPKE ET AL
SMITH	Sabine	COUNTY-OTHER	5287	FIRST CITY TEXAS-TYLER TRUSTEE
SMITH	Sabine	IRRIGATION	4248	ROBERT THOMAS PERRY ET UX
SMITH	Sabine	IRRIGATION	5229	CHARLES BREEDLOVE
SMITH	Sabine	IRRIGATION	4698	JAMES C MILLER ET UX
SMITH	Sabine	IRRIGATION	4724	HIDE-A-WAY LAKE CLUB
SMITH	Sabine	IRRIGATION	4727	JAMES C MILLER & WIFE
SMITH	Sabine	IRRIGATION	4728	ROBERT W ARTHUR ET AL
SMITH	Sabine	IRRIGATION	4739	R E SMITH ET UX
SMITH	Sabine	IRRIGATION	4740	WILLIAM L BRADY ET AL
SMITH	Sabine	IRRIGATION	4742	SUZETTE D SHELMIRE ET AL
SMITH	Sabine	IRRIGATION	4743	WILLIAM L BRADY ET UX
SMITH	Sabine	IRRIGATION	4745	EDWIN B ASHBY ET UX
SMITH	Sabine	IRRIGATION	4746	WILLIAM L BRADY ET AL
SMITH	Sabine	IRRIGATION	4747	WILLIAM L BRADY ET AL
SMITH	Sabine	IRRIGATION	4748	PINEHURST PARTNERS I LLC
SMITH	Sabine	MANUFACTURING	4761	DONALD THERNEAU
SMITH	Sabine	OVERTON	4625	CITY OF OVERTON
SMITH	Sabine	VAN	4693	CITY OF VAN
TITUS	Cypress	IRRIGATION	4562	G M SCOTT
TITUS	Cypress	IRRIGATION	4566	WILLIAM DEAN PRIEFERT

County	Basin	WUG	WR Number	Water Right Owner
TITUS	Cypress	IRRIGATION	4567	WILLIAM DEAN PRIEFERT
TITUS	Cypress	IRRIGATION	4568	BILLY JACK MAXTON
TITUS	Cypress	IRRIGATION	4571	R J PORTER ESTATE
TITUS	Cypress	IRRIGATION	4572	SUSAN ANDERSON BOOZER ET AL
TITUS	Sulphur	IRRIGATION	4805	E P LAND & CATTLE CO INC
TITUS	Sulphur	IRRIGATION	4820	BILLY J MAXTON
TITUS	Sulphur	IRRIGATION	4822	JOHN E & BERNICE BALDWIN
TITUS	Sulphur	IRRIGATION	4823	ARDELIA GAUNTT
TITUS	Sulphur	IRRIGATION	4824	WALTER W LEE
TITUS	Sulphur	IRRIGATION	4825	ROBERT CROOKS ET AL
TITUS	Sulphur	IRRIGATION	5285	WILLIAM J TERRELL ET AL
TITUS	Sulphur	MANUFACTURING	4821	ANNA PEARL LEWIS
TITUS	Cypress	MINING	5850	LUMINANT MINING CO LLC
TITUS	Sulphur	MINING	5562	LUMINANT MINING CO LLC
TITUS	Cypress	MOUNT PLEASANT	4565	CITY OF MOUNT PLEASANT
TITUS	Cypress	MOUNT PLEASANT	4569	CITY OF MOUNT PLEASANT
TITUS	Cypress	MOUNT PLEASANT	4570	CITY OF MOUNT PLEASANT
TITUS	Cypress	STEAM ELECTRIC POWER	4563	LUMINANT GENERATION CO LLC
TITUS	Cypress	STEAM ELECTRIC POWER	4576	SOUTHWESTERN ELECTRIC POWER CO
UPSHUR	Sabine	COUNTY-OTHER	4758	INSTITUTE IN BASIC LIFE PRINCIPLES INC
UPSHUR	Cypress	GILMER	5272	GILMER ECONOMIC DEVELOPMENT CORPORATION
UPSHUR	Sabine	GLADEWATER	4762	CITY OF GLADEWATER
UPSHUR	Cypress	IRRIGATION	4583	JFS TIMBER PARTNERS LTD

County	Basin	WUG	WR Number	Water Right Owner
UPSHUR	Cypress	IRRIGATION	4584	EDWIN LACY ESTATE ET AL
UPSHUR	Cypress	IRRIGATION	4585	GASTON W DEBERRY
UPSHUR	Cypress	IRRIGATION	4586	DOUGLAS NEWSOM
UPSHUR	Cypress	IRRIGATION	4604	M C JACKSON
UPSHUR	Sabine	IRRIGATION	3899	RALPH TRIMBLE
UPSHUR	Sabine	IRRIGATION	4763	JACK L PHILLIPS & WIFE
UPSHUR	Sabine	LONGVIEW	4759	CITY OF LONGVIEW
UPSHUR	Sabine	MINING	3969	TYLER SAND COMPANY
VAN ZANDT	Sabine	CANTON	4675	CITY OF CANTON
VAN ZANDT	Sabine	CANTON	4676	CITY OF CANTON
VAN ZANDT	Sabine	COUNTY-OTHER	4293	MICHAEL S ANDERSON
VAN ZANDT	Sabine	COUNTY-OTHER	4673	WILLOW LAKE ESTATES ASSN
VAN ZANDT	Sabine	EDGEWOOD	4678	CITY OF EDGEWOOD
VAN ZANDT	Sabine	GRAND SALINE	4679	CITY OF GRAND SALINE
VAN ZANDT	Sabine	IRRIGATION	4682	THE ESTATE OF DOROTHY C JONES
VAN ZANDT	Sabine	IRRIGATION	4684	JACK C KELLAM
VAN ZANDT	Sabine	IRRIGATION	4688	ROBERT DOZIER ET AL
VAN ZANDT	Sabine	MINING	4689	MORTON SALT INC
VAN ZANDT	Sabine	SABINE RIVER AUTHORITY	4670	SABINE RIVER AUTHORITY
VAN ZANDT	Sabine	WILLS POINT	4671	CITY OF WILLS POINT
WOOD	Sabine	COUNTY-OTHER	4736	WOOD COUNTY
WOOD	Sabine	COUNTY-OTHER	4749	WOOD COUNTY

County	Basin	WUG	WR Number	Water Right Owner
WOOD	Sabine	IRRIGATION	3942	PEACH SPRINGS NURSERY LLC
WOOD	Sabine	IRRIGATION	4202	KAY H WALKER
WOOD	Sabine	IRRIGATION	4701	LARRY KNECHT ET AL
WOOD	Sabine	IRRIGATION	4704	A C MCAFEE ET UX
WOOD	Sabine	IRRIGATION	4710	WALTER L LENGEL ET UX
WOOD	Sabine	IRRIGATION	4712	LAKE LYDIA INC
WOOD	Sabine	IRRIGATION	4718	H L HOBBS
WOOD	Sabine	IRRIGATION	4722	BARNEY HOLMES JR
WOOD	Sabine	IRRIGATION	4737	BO HOLMES ET UX
WOOD	Sabine	IRRIGATION	4738	BARNEY HOLMES JR ET UX
WOOD	Sabine	IRRIGATION	4750	VIRGIL WOODARD ET UX
WOOD	Sabine	IRRIGATION	4752	COMY E BRADSHAW ET UX
WOOD	Sabine	IRRIGATION	4754	MILL CREEK COMPANY
WOOD	Sabine	IRRIGATION	4755	REAL ESTATE HOLDINGS INC
WOOD	Sabine	IRRIGATION	4769	FRANK E ELRO
WOOD	Sabine	LONGVIEW	4759	CITY OF LONGVIEW
WOOD	Sabine	MANUFACTURING	4716	BANK OF AMERICA N A TRUSTEE

3.1.1.1 Sabine River Basin

The Sabine River originates in Collin County, just west of the North East Texas Region, and extends to Sabine Lake in the far southeastern portion of Texas. The total drainage area of the basin is nearly 9,800 square miles. Of this area, approximately 7,400 square miles are in Texas while the remaining 2,400 square miles of drainage are in Louisiana. Within the North East Texas Region, all or portions of Hunt, Hopkins, Franklin, Rains, Wood, Upshur, Gregg, Harrison, Smith and Van Zandt counties are in the Sabine Basin. The existing surface water supplies modeled in the Sabine Basin included 13 reservoirs and run-of-the-river supplies from the Sabine River. Table 3.3 presents the estimated available water supply for these sources during drought of record conditions by decade.

Table 3.3 Sabine Basin Surface Water Firm Yield (ac-ft/yr)

Source Name	2020	2030	2040	2050	2060	2070
Big Sandy Creek Lake / Reservoir	2,000	2,000	2,000	2,000	2,000	2,000
Brandy Branch Lake / Reservoir	19,891	19,891	19,891	19,891	19,891	19,891
Edgewood City Lake / Reservoir	160	160	160	160	160	160
Lake Fork / Reservoir	171,260	169,280	167,300	165,320	163,340	161,360
Gladewater Lake / Reservoir	4,900	4,380	3,850	3,000	2,000	2,000

Source Name	2020	2030	2040	2050	2060	2070
Greenville City Lake / Reservoir	3,350	3,350	3,350	3,350	3,350	3,350
Hawkins Lake / Reservoir	-	-	-	-	-	-
Holbrook Lake / Reservoir	-	-	-	-	-	-
Loma Lake / Reservoir	1,000	1,000	1,000	1,000	1,000	1,000
Mill Creek Lake / Reservoir	1,150	1,150	1,150	1,150	1,150	1,150
Quitman Lake / Reservoir	-	-	-	-	-	-
Tawakoni Lake / Reservoir	229,710	228,030	226,350	224,670	222,990	221,310
Winnsboro Lake / Reservoir	-	-	-	-	-	-
Sabine River Combined Run of River	14,669	14,671	14,671	14,671	14,671	14,671
Direct Reuse	6,161	6,161	6,161	6,161	6,161	6,161
Total	**454,251**	**450,073**	**445,883**	**441,373**	**436,713**	**433,053**

3.1.1.2 Red River Basin

The Red River Basin originates in eastern New Mexico and extends eastward across north Texas and southern Oklahoma and into Louisiana. Approximately 24,460 square miles of the 48,030 square mile drainage area of the basin are within Texas. Within the North East Texas Region, all or part of Bowie, Red River, and Lamar counties are in the Red River Basin.

The existing surface water supplies in the Red River Basin include Lake Texoma, Pat Mayse Lake and Lake Crook. Table 3.4 presents the modeled water supply that is available under drought of record conditions for sources in the Red River Basin from which entities in Region D currently have available water supply. None of the water in Lake Texoma is considered available to the North East Texas Region due to lack of infrastructure and water rights; thus it is not listed as a supply for Region D.

Pat Mayse Reservoir and Lake Crook supplies have been updated as shown in Table 3.4. HDR Engineering, at the request of the City of Paris, completed a study in which the water availability for the two lakes was analyzed. HDR developed a drainage area specific water availability model for these two reservoirs, which they based upon information from the Corps of Engineers and stream flow data from the Sulphur River gauge at Highway 24. The NETRWPG in their April 3rd, 2013 meeting approved the utilization of the results from the HDR water availability model. The Consideration of run-of-river rights in Region D provides slightly more water than shown in the 2011 Plan.

Table 3.4 Red River Basin Surface Firm Yield (ac-ft/yr)

Source Name	2020	2030	2040	2050	2060	2070
Crook Lake / Reservoir	7,290	7,290	7,290	7,290	7,290	7,290
Pat Mayse Lake / Reservoir	59,670	59,670	59,670	59,670	59,670	59,670
Red River Combined Run of River	3,158	3,158	3,158	3,158	3,158	3,158
Total	**70,118**	**70,118**	**70,118**	**70,118**	**70,118**	**70,118**

3.1.1.3 Sulphur River Basin

The Sulphur River Basin begins in Fannin and Hunt counties and extends eastward to southwest Arkansas where it joins the Red River. Within the North East Texas Region, all or part of Hunt, Delta, Lamar, Hopkins, Franklin, Titus, Red River, Morris, Bowie, and Cass counties are within the Sulphur Basin. The Texas portion of the Sulphur Basin covers approx. 3,558 square miles.

Due to high average rainfall and runoff, the Sulphur Basin has an abundant supply of surface water. There are 29 impoundments in the Sulphur Basin with a normal storage capacity greater than 200 acre-feet. However, five reservoirs account for the majority of current supply in the basin. Table 3.5 presents the supply available in the Sulphur River Basin.

Table 3.5 Sulphur River Basin Surface Firm Yield (ac-ft/yr)

Source Name	2020	2030	2040	2050	2060	2070
Big Creek Lake / Reservoir	1,518	1,518	1,518	1,518	1,518	1,518
Turkey Creek Lake	200	200	200	200	200	200
Chapman/Cooper Lake/Reservoir (Non-System)	69,913	69,465	69,017	68,569	68,121	67,673
Chapman/Cooper Lake/Reservoir (NTMWD)	44,792	44,505	44,218	43,931	43,644	43,357
Caney Creek Lake	1,010	1,010	1,010	1,010	1,010	1,010
Langford Lake / Reservoir	540	340	0	0	0	0
River Crest Lake / Sulphur Run of the River*	-	-	-	-	-	-
Sulphur Springs Lake	11,530	11,530	11,530	11,530	11,520	11,550
Elliot Creek Lake	1,910	1,910	1,910	1,910	1,910	1,910
Wright Patman Lake / Reservoir**	294,000	263,830	232,000	200,000	166,000	123,000
Sulphur River Combined Run of River	15,384	15,424	15,424	15,424	15,424	16,104
Total	**440,797**	**409,732**	**376,827**	**344,092**	**309,347**	**266,322**

* River Crest watershed is negligible. This yield is based on a permit for transfer of up to 10,000 ac-ft/yr from the Sulphur River.

** Firm yield of Wright Patman estimated at ultimate curve reservoir operations with sedimentation. However, only 180,000 ac-ft/yr is permitted.

3.1.1.4 Cypress Creek Basin

The Cypress Creek Basin originates in Hopkins County and extends eastward into northwest Louisiana, where it flows into the Red River. The Texas portion of the Cypress Basin covers approximately 2,800 square miles and includes all or portions of Hopkins, Gregg, Franklin, Wood, Titus, Camp, Upshur, Cass, Marion, Morris and Harrison counties in the North East Texas Region.

Table 3.6 Cypress Creek Basin Surface Firm Yield (ac-ft/yr)

Source Name	2020	2030	2040	2050	2060	2070
Bob Sandlin Lake/Reservoir	60,430	60,430	60,430	60,430	60,430	60,430
Caddo Lake / Reservoir	10,000	10,000	10,000	10,000	10,000	10,000
Cypress Springs Lake / Reservoir	12,100	11,700	11,300	11,000	10,600	10,200
Ellison Creek Lake / Reservoir	33,700	33,700	33,700	33,700	33,700	33,700
Gilmer Lake / Reservoir	6,180	6,180	6,180	6,180	6,180	6,180
Johnson Creek Lake / Reservoir	2,000	2,000	2,000	2,000	2,000	2,000
Monticello Lake/Reservoir	5,000	4,500	4,000	3,400	2,900	2,400
Lake O' the Pines / Reservoir	151,600	151,000	150,500	150,000	149,500	149,000
Tankersley Lake / Reservoir	1,500	1,500	1,500	1,500	1,500	1,500
Welsh Lake / Reservoir	3,000	2,800	2,600	2,400	2,100	1,800
Direct Reuse	72,246	66,820	61,504	62,760	71,634	65,408
Cypress River Combined Run-of-River	1,789	1,789	1,789	1,789	1,789	1,789
Grays Creek Run-of-River	16,084	16,084	16,084	16,084	16,084	16,084
Total	**375,629**	**368,503**	**361,587**	**361,243**	**368,417**	**360,491**

*Firm yields of reservoirs presented herein do not reflect contractual agreements between entities. Such agreements are reflected in the individual supplies for each WUG/WWP.

3.1.1.5 Neches River Basin

The Neches River Basin originates in Van Zandt County and extends southeast to the Gulf of Mexico. The total drainage area of the basin is approximately 10,000 square miles, although the portion within the North East Texas Region is very small. Only small portions of Van Zandt and Smith Counties are located within the basin.

3.1.1.6 Trinity River Basin

The Trinity River Basin originates in Archer County and extends southeast to the Gulf of Mexico. The total drainage area of the basin is nearly 18,000 square miles and contains the largest population of any basin in the state. However, within the North East Texas Region only small parts of Hunt and Van Zandt counties are located within the Trinity River Basin.

There are no major surface water supplies within the portion of the Trinity Basin in the North East Texas Region. However, some supply from Lake Lavon is available for use in the region.

3.2 GROUNDWATER SUPPLIES

Groundwater availability estimates for the North East Texas Region are presented in the sections that follow. This includes a brief discussion of the methods that were used to estimate groundwater availability, including the methodology used to develop estimates for each aquifer represented in this regional water plan.

3.2.1 Background

In June 1997, the 75th Texas Legislature enacted Senate Bill 1 (SB 1) to establish a comprehensive statewide water planning process to help ensure that the water needs of all Texans are met. SB1 mandated that representatives serve as members of RWPGs to prepare regional water plans for their respective areas. These plans map out how to conserve water supplies, meet future water supply needs and respond to future droughts in the planning areas. Additionally, SB 1 established that groundwater conservation districts (GCDs) were the preferred entities for groundwater management and contained provisions that required the GCDs to prepare management plans.

In 2001, the Texas Legislature enacted Senate Bill 2 (SB 2) to build on the planning requirements of SB 1 and to further clarify the actions necessary for GCDs to manage and conserve groundwater resources. As part of SB 2, the Legislature called for the creation of Groundwater Management Areas (GMAs) which were based largely on hydrogeologic and aquifer boundaries instead of political boundaries. The TWDB divided Texas into 16 GMAs, and most contain multiple GCDs. One of the purposes for GMAs was to manage groundwater resources on a more aquifer-wide basis. Figure 3.1 shows the regulatory boundaries of the GMAs within Region D. The North East Texas Region does not contain any GCDs.

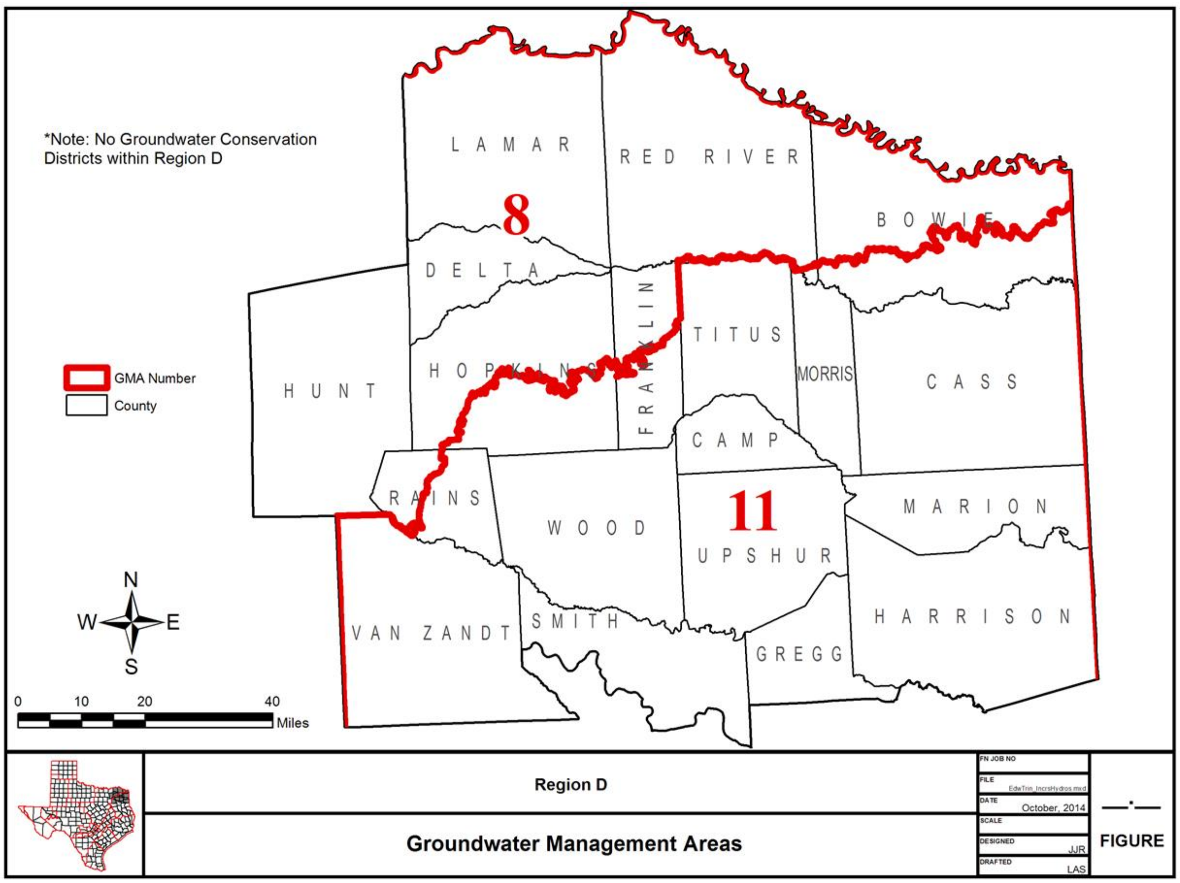


Figure 3.1 Groundwater Management Areas within Region D

The Texas Legislature enacted significant changes to the management of groundwater resources in Texas with the passage of House Bill 1763 (HB 1763) in 2005. A main goal of HB 1763 was intended to clarify the authority and conflicts between GCDs and RWPGs. The new law clarified that GCDs would be responsible for aquifer planning and developing the amount of groundwater available for use and/or development by the RWPGs. To accomplish this, the law directed that all GCDs within each GMA to meet and participate in joint groundwater planning efforts. The focus of joint groundwater planning was to determine the Desired Future Conditions (DFCs) for the groundwater resources within the GMA boundaries (before September 1, 2010, and at least once every 5 years after that).

Desired Future Conditions were defined by statute to be "the desired, quantified condition of groundwater resources (such as water levels, spring flows, or volumes) within a management area at one or more specified future times as defined by participating groundwater conservation districts within a groundwater management area as part of the joint groundwater planning process." DFCs are quantifiable management goals that reflect what the GCDs want to protect in their particular area. The most common DFCs are based on the volume of groundwater in storage over time, water levels (limiting decline within the aquifer), water quality (limiting deterioration of quality), or spring flow (defining a minimum flow to sustain).

After the DFCs are determined by the GMAs, the TWDB performs quantitative analyses to determine the amount of groundwater available for production to meet the DFC. For aquifers where a Groundwater Availability Model (GAM) exists, the GAM is used to develop the Modeled Available Groundwater (MAG). For aquifers without a GAM, another quantitative approach is used to estimate the MAG.

In 2011, Senate Bill 660 required that GMA representatives must participate within each applicable RWPG. It also required the Regional Water Plans be consistent with the DFCs in place when the regional plans are initially developed. TWDB technical guidelines for the current round of planning establishes that the MAG (within each county and basin) is the maximum amount of groundwater that can be used for existing uses and new strategies in Regional Water Plans. In other words, the MAG volumes are a cap on groundwater production for TWDB planning purposes.

Any reallocation of MAG amounts between Aquifer/Region/County/Basin splits are required to be consistent with the relevant MAG and requires written pre-approval from the TWDB Executive Administrator (EA). Requests to reallocate MAG amounts between discrete geographic-aquifer units are required to be in writing from the RWPG and include a table with the proposed changes for each geographic-aquifer unit, for each decade, along with an explanation of the basis for the reallocation request; how DFCs at that location as well as the DFCs in any surrounding areas shall be achieved under the reallocation; how the reallocation is consistent with the relevant MAG and GCD management plan(s); and, the long-term impact that pumping based on the reallocation would have on the DFC at that location.

3.2.2 Characterization of Aquifers in Region D

The following discussion describes the two major aquifers (Carrizo-Wilcox and Trinity) along with the four minor aquifers (Nacatoch, Blossom, Queen City and Woodbine) found in the North East Texas Region.

Groundwater availability estimates have been extracted from Groundwater Availability Model (GAM) runs to determine the Modeled Available Groundwater (MAG) for each aquifer. Table 3.7 details updated availability (MAG) numbers for 2016. The source(s) of data for each aquifer as well as a brief discussion of each aquifer are summarized below.

3.2.2.1 Blossom Aquifer

The Blossom Aquifer (see Figure 3.2) occupies a narrow east-west band in parts of Bowie, Red River, and Lamar counties in the northeast corner of the North East Texas Region. The TWDB has historically assumed that the annual availability for the Blossom Aquifer is equal to the effective recharge that occurs primarily through infiltration of rainfall over the outcrop.

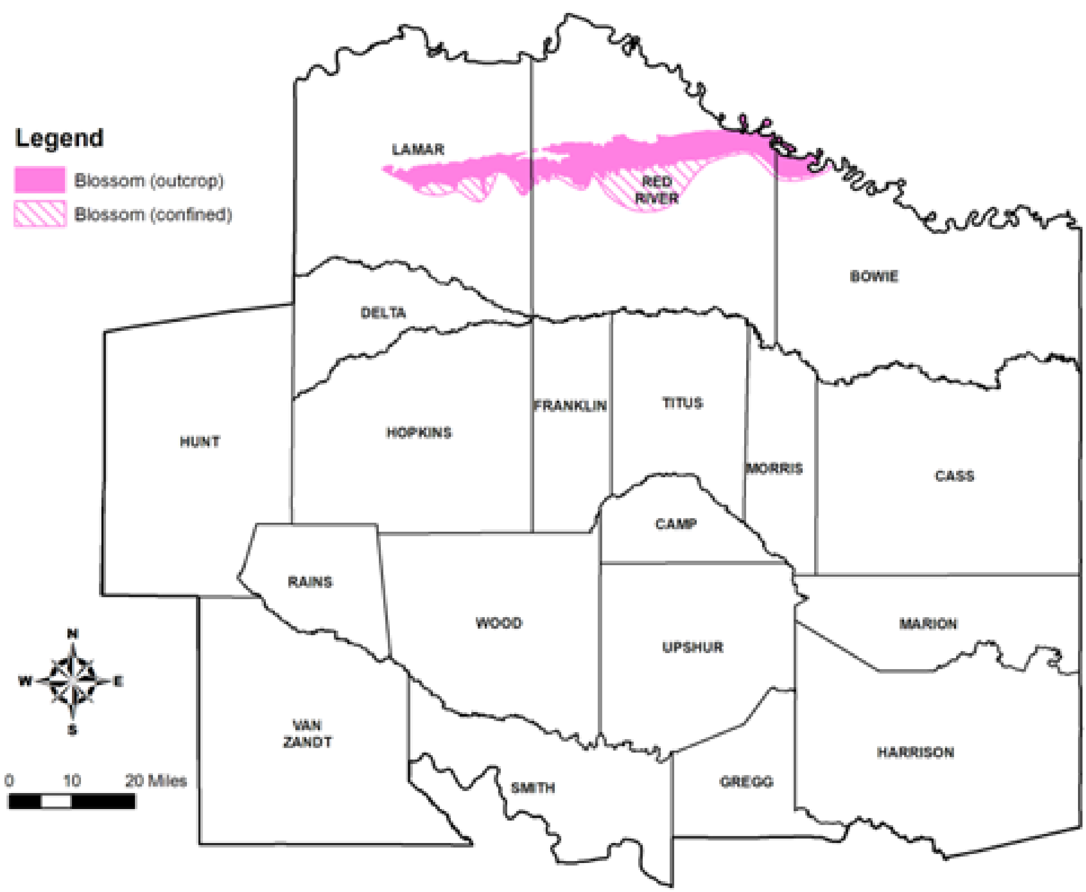


Figure 3.2 Blossom Aquifer within Region D

The Blossom Aquifer yields water in small to moderate amounts over a limited area on and south of the outcrop, with the largest well yields occurring in Red River County. Production decreases in the western half of the aquifer, where yields of 35 gpm to 85 gpm are typical. In addition, water quality from the Blossom Aquifer does not meet current drinking water standards for public water supplies but may be used for domestic and livestock purposes.

Groundwater availability estimates for the Blossom Aquifer were taken from the GTA Aquifer Assessment 10-19 MAG report. In a letter dated August 31, 2011, Mr. Eddy Daniel provided the TWDB with the desired future condition of the Blossom Aquifer that were adopted in a resolution, dated April 27, 2011, by the members of Groundwater Management Area 8. The desired future condition requested for the Blossom Aquifer was based on the desired future condition adopted by Groundwater Management Area 8. The pumping results presented for Groundwater Management Area 8 were taken directly from GTA Aquifer Assessment 10-19 MAG. This resolution referenced the previously adopted desired future conditions for the Blossom Aquifer, as described in a resolution adopted March 16, 2009 by the groundwater conservation districts in Groundwater Management Area 8 was described in the report. Because the desired future conditions were identical to the previous submission, the modeled available groundwater estimates in this report are identical to the previously released "Modeled Available Groundwater" estimates that were in GTA Aquifer Assessment 09-05mag.

3.2.2.2 Carrizo-Wilcox Aquifer

The Carrizo-Wilcox group (see Figure 3.3) is the most extensive and productive aquifer in the North East Texas Region and is considered a major aquifer by the TWDB. The production capacity of the Carrizo-Wilcox Aquifer is variable because of the heterogeneous nature of the sediments that comprise the aquifer. Nevertheless, in general, it is a very productive aquifer and is recharged from infiltration from precipitation. The majority of municipal wells in the North East Texas Region produce from the Carrizo-Wilcox Aquifer.

Regionally, water from the Carrizo-Wilcox Aquifer is fresh to slightly saline with quality problems in localized areas. Total estimated groundwater availability (MAGs) for the Carrizo-Wilcox Aquifer in the North East Texas Region is 113,050 ac-ft/yr for planning year 2020.

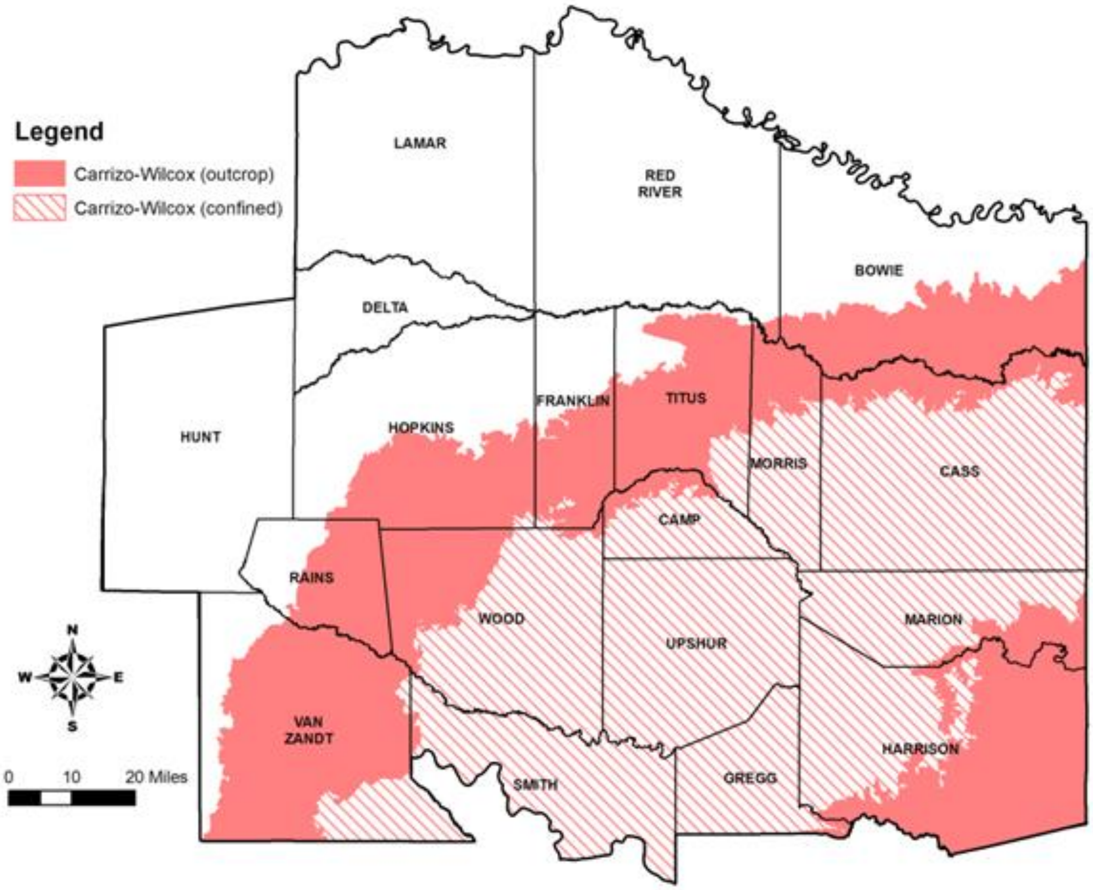


Figure 3.3 Carrizo-Wilcox Aquifer within Region D

Groundwater availability estimates for the Carrizo-Wilcox Aquifer were listed in GAM Run 10-016 MAG (Version 2) report, which applied to the Queen City/Sparta,Yegua/Jackson and Carrizo-Wilcox predictive model. The modeled available groundwater within the groundwater conservation districts reflected the desired future conditions adopted by GMA 11. In a letter dated May 4th, 2010 and received by the TWDB on May 6th, 2010, Ms. Norman and Mr. Luscomb provided the TWDB with the desired future condition (DFC) of the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers within Groundwater Management Area 11. The desired future condition for the aquifers, as described in Resolution No. 1 and adopted April 13, 2010 by the groundwater conservation districts (GCDs) within Groundwater Management Area 11, the Desired Future Condition is defined as allowing up to an average drawdown of 17 feet that applies throughout Groundwater Management Area 11. The Desired Future Condition of 17 feet average drawdown is based on 178 individual well drawdowns by aquifer and county.

3.2.2.3 Nacatoch Aquifer

The Nacatoch Aquifer (see Figure 3.4) is classified as a minor aquifer by the TWDB. This sandstone aquifer occurs along a narrow band in northeast and north-central Texas and extends into Arkansas and Louisiana. Nacatoch water quality is generally good and the aquifer provides water used for municipal, domestic, and other uses within its extent.

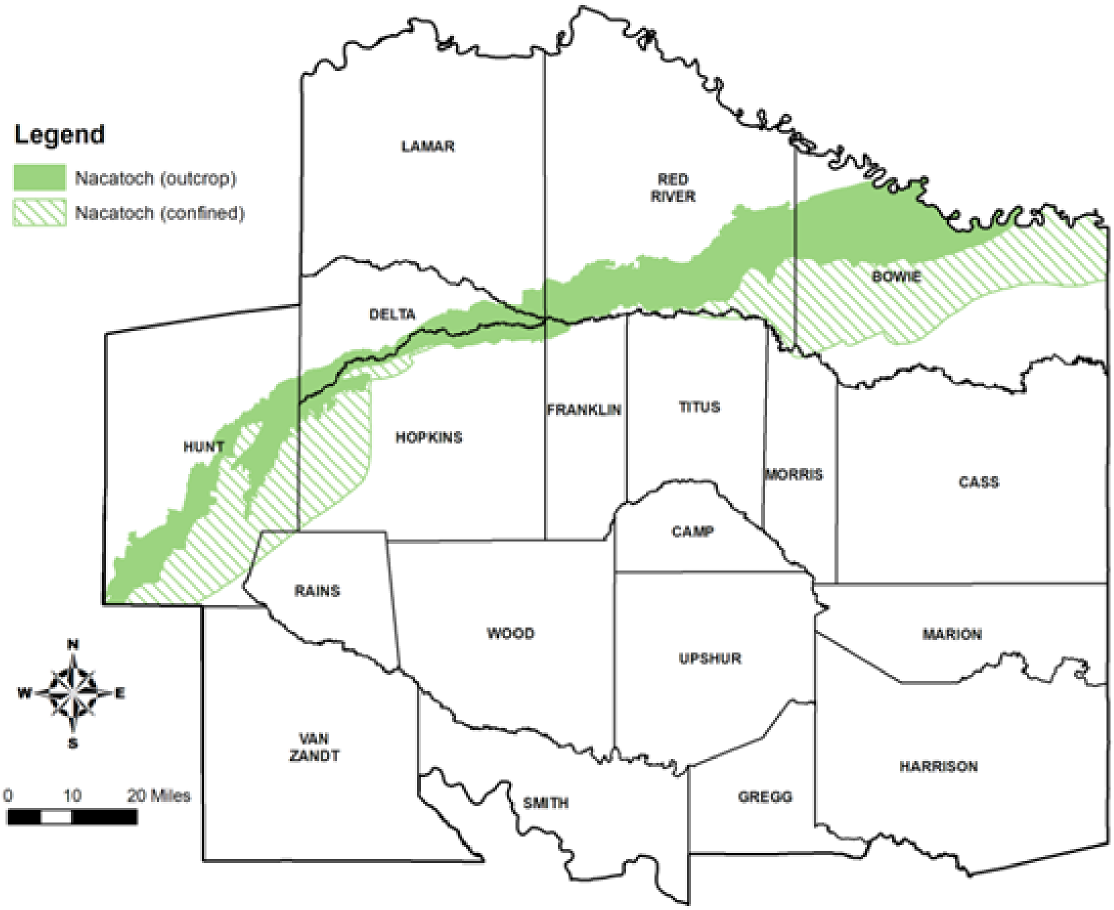


Figure 3.4 Nacatoch Aquifer within Region D

It is stated in the GMA 11 report that the TWDB previously completed a series of simulations using the groundwater availability model (GAM) for the Nacatoch Aquifer to assist the members of Groundwater Management Area 8 in developing desired future conditions. These are documented in GAM Run 11-011 (Oliver, 2011). As shown in the desired future condition resolution, the simulation on which the desired future conditions above are based is Scenario 4 of GAM Run 10-006. The estimates of modeled available groundwater for the Nacatoch Aquifer presented here, taken directly from the above scenario, have been divided by county, regional water planning area, river basin, and groundwater conservation district.

3.2.2.4 Queen City Aquifer

The Queen City Aquifer (see Figure 3.5) is classified as a minor aquifer by the TWDB. The Queen City Aquifer overlies the Carrizo-Wilcox Aquifer and is shallower and more prone to potential impacts of drought and overpumping as compared to the deeper Carrizo-Wilcox Aquifer. However, the Queen City Aquifer contains relatively large quantities of recoverable groundwater in the North East Texas Region.

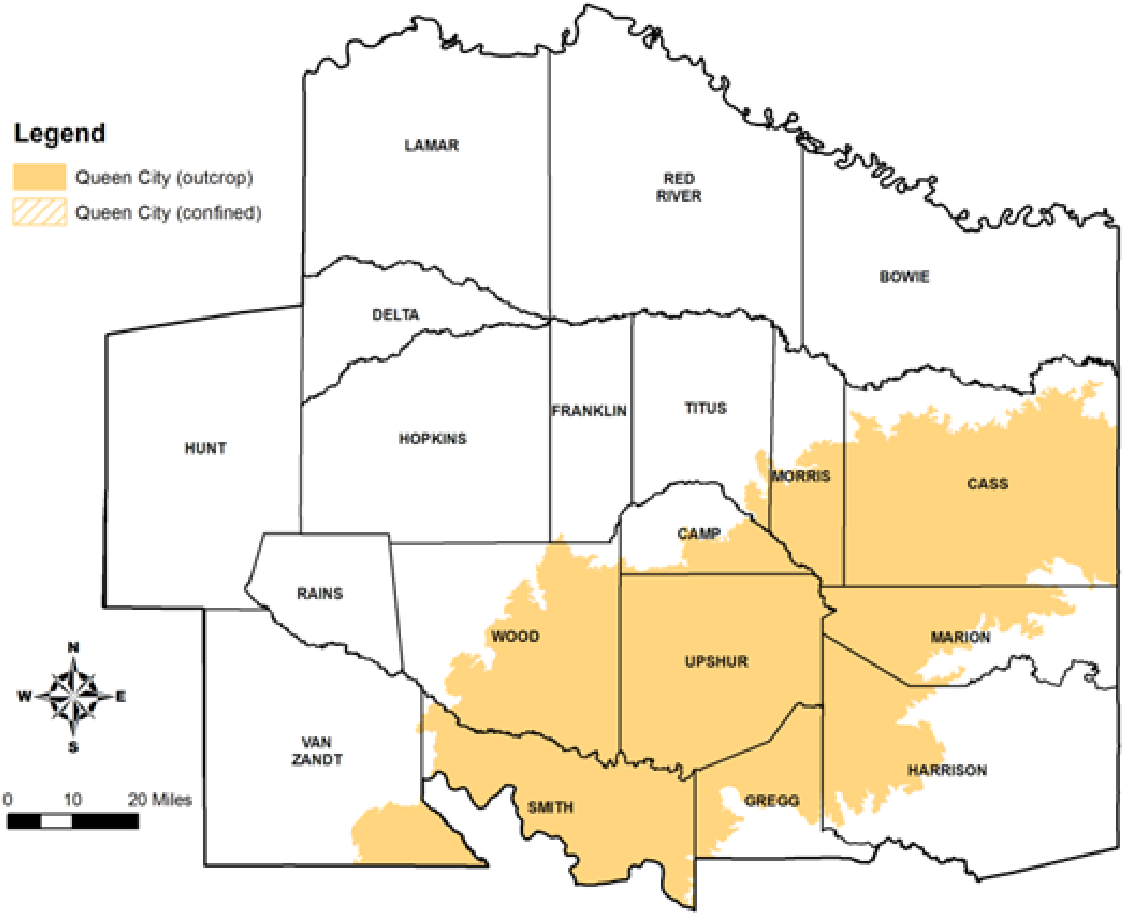


Figure 3.5 Queen City Aquifer within Region D

Groundwater availability estimates for the Queen City Aquifer were listed in GAM Run 10-016 MAG (Version 2) report, which applied to the Queen City/Sparta,Yegua/Jackson and Carrizo-Wilcox predictive model. The modeled available groundwater within the groundwater conservation districts reflected the desired future conditions adopted by GMA 11. In a letter dated May 4th, 2010 and received by the TWDB on May 6th, 2010, Ms. Norman and Mr. Luscomb provided the TWDB with the desired future condition (DFC) of the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers within Groundwater Management Area 11. The desired future condition for the aquifers, as described in Resolution No. 1 and adopted April 13, 2010 by the groundwater conservation districts (GCDs) within Groundwater Management Area 11, the Desired Future Condition is defined as allowing up to an average drawdown of 17 feet that applies throughout Groundwater Management Area 11. The Desired Future Condition of 17 feet average drawdown is based on 178 individual well drawdowns by aquifer and county.

3.2.2.5 Trinity Aquifer

Water quality in the Trinity Aquifer (see Figure 3.6) in the North East Texas Region, is typically not acceptable for public water supply because it does not meet current drinking water standards, but it may be used for domestic, irrigation, and livestock purposes. Although the Trinity Aquifer is classified as a major aquifer by the TWDB, groundwater availability and usage from the aquifer is limited in the North East Texas Region.

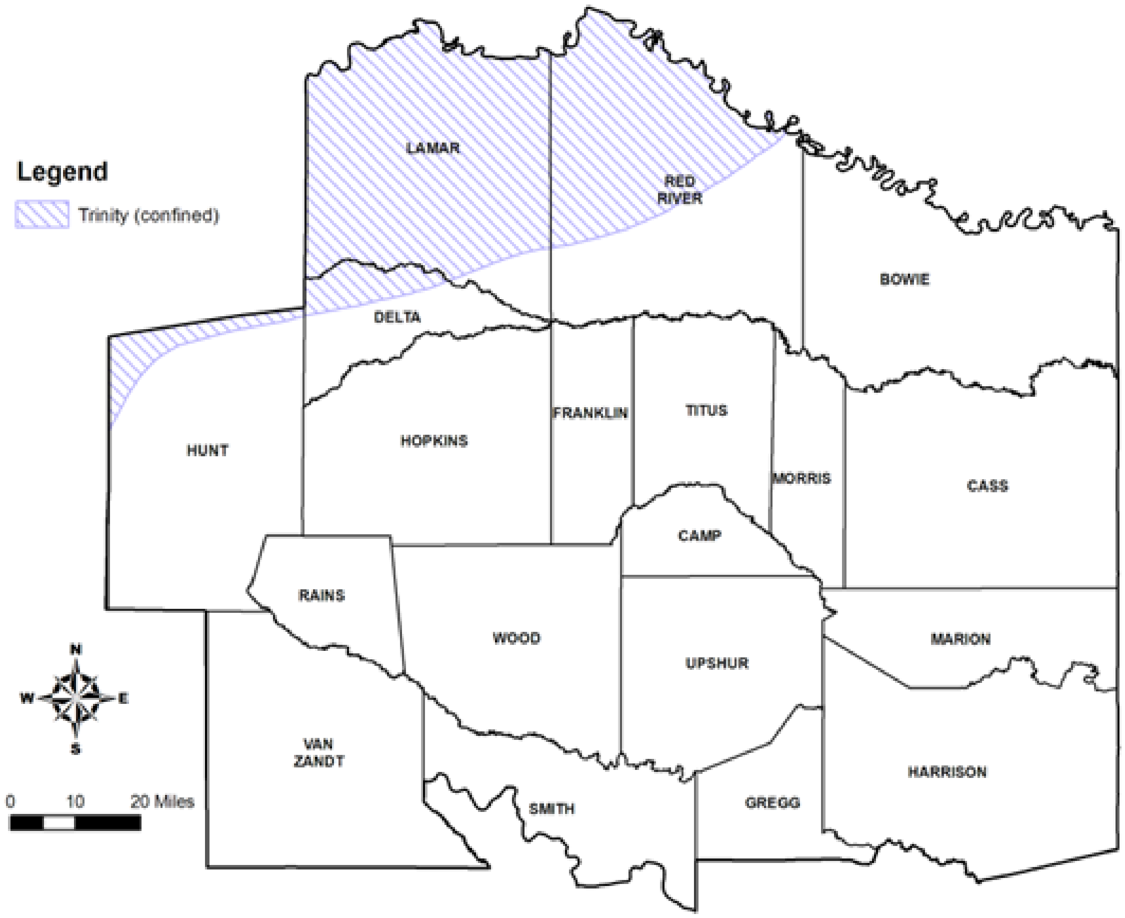


Figure 3.6 Trinity Aquifer within Region D

Groundwater availability estimates for the Trinity Aquifer were taken from GAM Run 10-063 MAG. In a letter dated August 31, 2011, Mr. Eddy Daniel provided the TWDB with the desired future conditions of the Trinity Aquifer adopted in a resolution dated April 27, 2011, by the members of Groundwater Management Area 8. This resolution referenced the desired future conditions previously adopted for the aquifer on September 17, 2008 by the groundwater conservation districts within Groundwater Management Area 8.

3.2.2.6 Woodbine Aquifer

The Woodbine Aquifer (see Figure 3.7) is classified as a minor aquifer by the TWDB. Water quality in the Woodbine Aquifer in the North East Texas Region is typically not acceptable for public water supply because it does not meet current drinking water standards, but it may be used for domestic, irrigation, and livestock purposes.

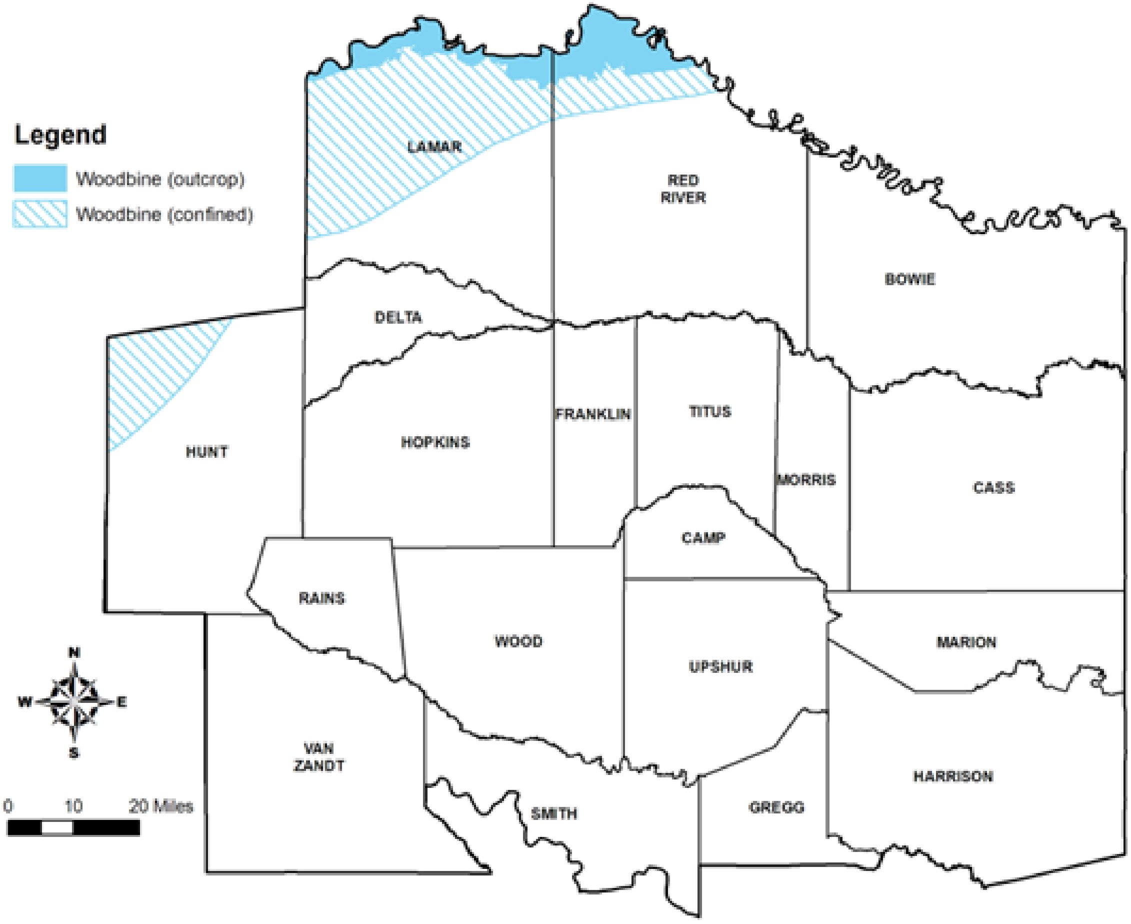


Figure 3.7 Woodbine Aquifer within Region D

Groundwater availability estimates for the Woodbine Aquifer were taken from GAM Run 10-064 MAG. In a letter dated August 31, 2011, Mr. Eddy Daniel provided the TWDB with a resolution dated June 23, 2011 to retain the previously adopted desired future conditions of the Woodbine Aquifer adopted by the districts of Groundwater Management Area 8 [on December 17, 2007], except for the Southern Trinity Groundwater Conservation District, which adopted a resolution dated June 23, 2011 to declare the Woodbine Aquifer non-relevant for joint planning purposes within their district.

3.2.3 **Existing Groundwater Supplies**

Based on historic groundwater estimates for years 2007 through 2011, regional groundwater sources supplied an average of 52,350 acre feet of water annually. Groundwater provides most of the municipal water used in the region, with minimal volumes of groundwater used by irrigation. Groundwater is primarily found in two major and four minor aquifers in Region D, as shown in Figure 3.8. Wells in the aquifers vary in production capacity and groundwater quality.

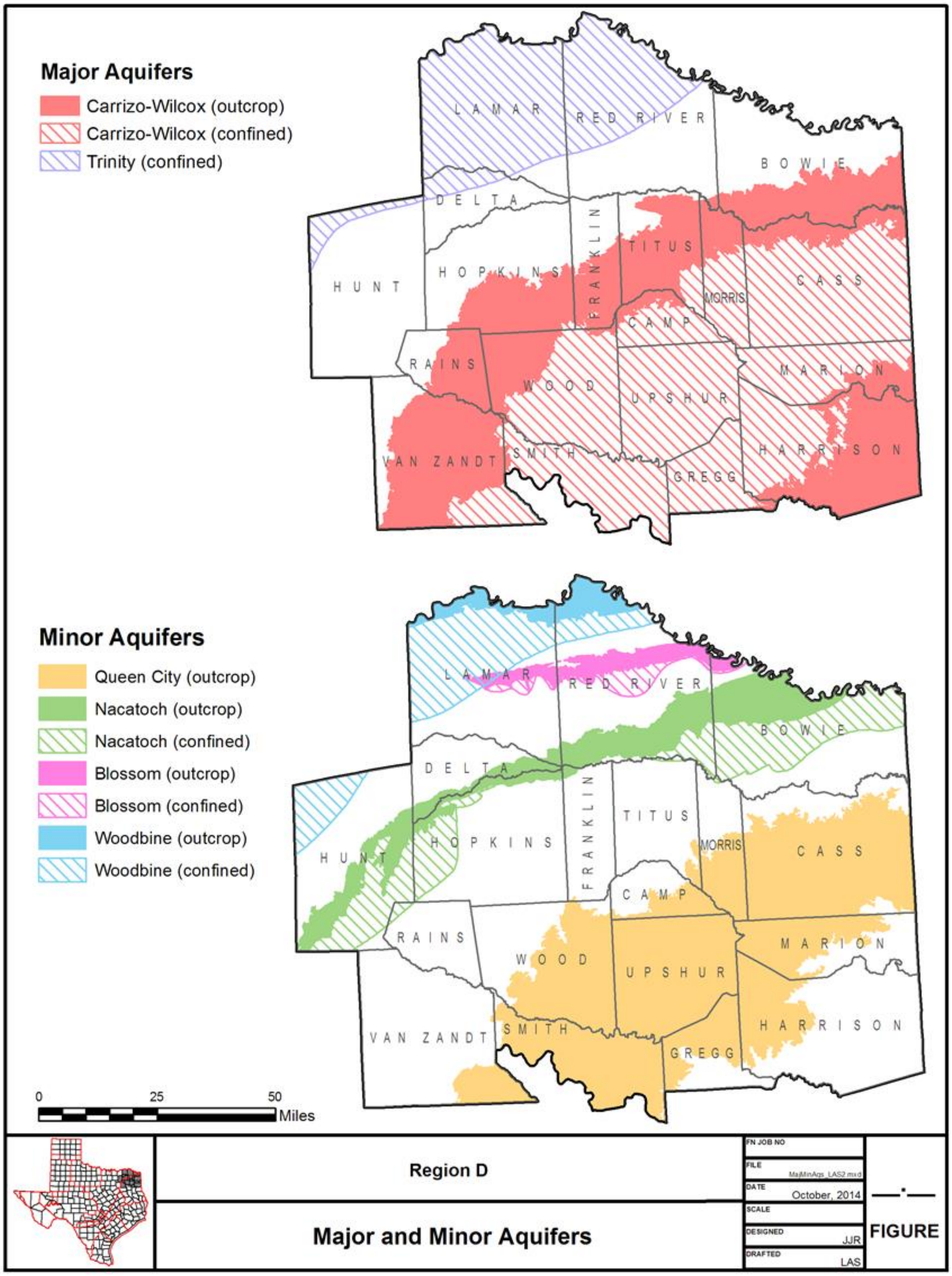


Figure 3.8 Major and Minor Aquifers in Region D

Region D historical groundwater pumping by aquifer for years 2007 through 2011 is shown in Figure 3.9. These data were calculated using the TWDB historical groundwater pumping estimates. The Carrizo-Wilcox supplied 72 percent of the region's groundwater, and the Trinity supplied 2 percent. The minor aquifers provided the remaining 26 percent.

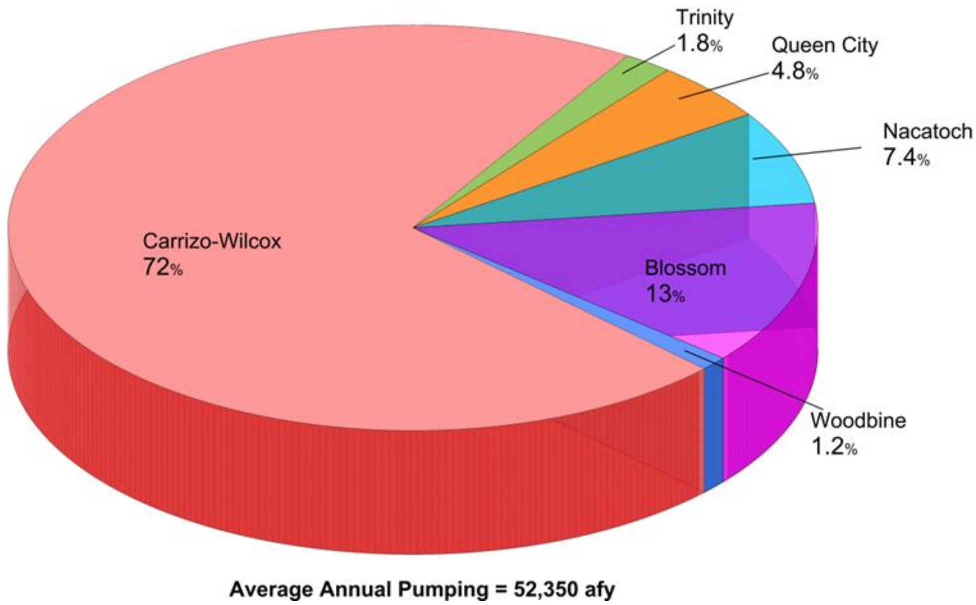


Figure 3.9 Historical Groundwater Pumping by Aquifer (2007-2011)

The same historical data set is presented in Figure 3.10 by use category. Municipal accounted for 67 percent of groundwater pumped in the region. Irrigation pumping consumed 17 percent of the groundwater and the remaining use categories collectively accounted for about 16 percent of total usage in the five-year period.

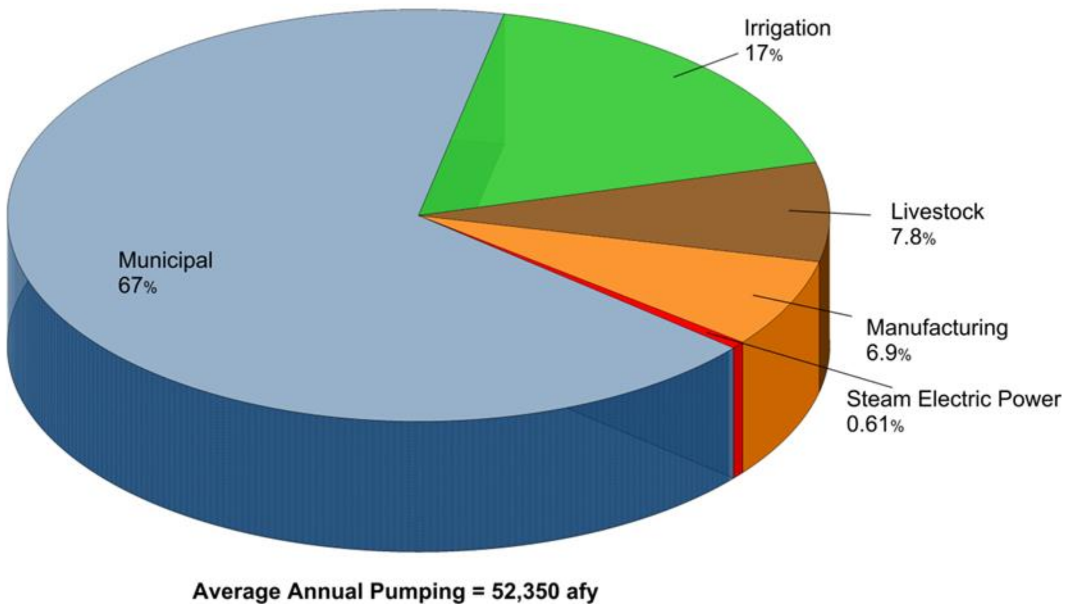


Figure 3.10 Historical Groundwater Pumping by Use (2007-2011)

Table 3.7 presents the MAG numbers by county, aquifer and river basin for planning years 2020 through 2070. MAG volumes are the largest amount of water that can be withdrawn from a given source without violating DFCs. Table 3.7 only includes county aquifer combinations where a DFC has been defined by a GCD/ GMA and the MAG subsequently has been determined by the TWDB using the GAM.

Table 3.7 Modeled Available Groundwater in Region D by County/Aquifer (ac-ft/yr)

County	Aquifer	Basin	2020	2030	2040	2050	2060	2070
Bowie	Carrizo-Wilcox	Sulphur	8,216	7,976	7,533	7,533	7,083	7,083
	Blossom	Red	21	21	21	21	21	21
		Sulphur	180	180	180	180	180	180
	Nacatoch	Red	3,071	3,071	3,071	3,071	3,071	3,071
		Sulphur	1,942	1,942	1,942	1,942	1,942	1,942
Camp	Carrizo-Wilcox	Cypress	4,041	4,041	4,041	4,041	4,041	4,041
	Queen-City	Cypress	3,542	3,542	3,542	3,542	3,542	3,542
Cass	Carrizo-Wilcox	Cypress	2,955	2,955	2,955	2,955	2,955	2,955
		Sulphur	578	578	578	578	578	578
	Queen-City	Cypress	35,970	35,970	35,970	35,970	35,970	35,970
		Sulphur	3,223	3,223	3,223	3,223	3,223	3,223
Delta	Trinity	Sulphur	362	362	362	362	362	362
	Nacatoch	Sulphur	575	575	575	575	575	575
Franklin	Carrizo-Wilcox	Cypress	7,736	7,736	7,736	7,736	7,736	7,736
		Sulphur	1,748	1,748	1,748	1,748	1,748	1,748
	Nacatoch	Sulphur	30	30	30	30	30	30
Gregg	Carrizo-Wilcox	Cypress	820	820	820	820	820	820
		Sabine	6,829	6,829	6,829	6,829	6,829	6,829
	Queen-City	Cypress	1,359	1,359	1,359	1,359	1,359	1,359
		Sabine	6,214	6,214	6,214	6,214	6,214	6,214
Harrison	Carrizo-Wilcox	Cypress	4,873	4,839	4,787	4,772	4,728	4,728
		Sabine	3,964	3,947	3,911	3,911	3,911	3,911
	Queen City	Cypress	7,890	7,890	7,890	7,890	7,890	7,890
		Sabine	2,483	2,483	2,483	2,483	2,483	2,483
Hopkins	Carrizo-Wilcox	Cypress	253	253	253	253	253	253
		Sabine	2,001	2,001	2,001	2,001	2,001	2,001
		Sulphur	1,137	1,137	1,137	1,137	1,137	1,137
	Nacatoch	Sabine	291	291	291	291	291	291
		Sulphur	916	916	916	916	916	916

County	Aquifer	Basin	2020	2030	2040	2050	2060	2070
Hunt	Trinity	Trinity	551	551	551	551	551	551
	Nacatoch	Sabine	3,303	3,303	3,303	3,303	3,303	3,303
		Sulphur	491	491	491	491	491	491
	Woodbine	Sabine	1,867	1,867	1,867	1,867	1,867	1,867
		Sulphur	849	849	849	849	849	849
		Trinity	124	124	124	124	124	124
Lamar	Trinity	Red	1,320	1,320	1,320	1,320	1,320	1,320
		Sulphur	2	2	2	2	2	2
	Blossom	Red	323	323	323	323	323	323
		Sulphur	71	71	71	71	71	71
	Nacatoch	Sulphur	110	110	110	110	110	110
	Woodbine	Red	1,910	1,910	1,910	1,910	1,910	1,910
		Sulphur	1,734	1,734	1,734	1,734	1,734	1,734
Marion	Carrizo-Wilcox	Cypress	2,077	2,077	2,077	2,077	2,077	2,077
	Queen City	Cypress	15,549	15,549	15,549	15,549	15,549	15,549
Morris	Carrizo-Wilcox	Cypress	2,196	2,174	2,174	2,174	2,174	2,174
		Sulphur	420	384	384	384	384	384
	Queen City	Cypress	9,652	9,652	9,652	9,537	9,537	9,537
Rains	Carrizo-Wilcox	Sabine	1,703	1,620	1,620	1,620	1,583	1,583
	Nacatoch	Sabine	1	1	1	1	1	1
Red River	Trinity	Red	263	263	263	263	263	263
		Sulphur	267	267	267	267	267	267
	Blossom	Red	1,053	1,053	1,053	1,053	1,053	1,053
		Sulphur	625	625	625	625	625	625
	Nacatoch	Red	58	58	58	58	58	58
		Sulphur	1,047	1,047	1,047	1,047	1,047	1,047
	Woodbine	Red	162	162	162	162	162	162
		Sulphur	4	4	4	4	4	4
Smith	Carrizo-Wilcox	Sabine	12,245	12,245	12,235	12,221	12,221	12,221
	Queen City	Sabine	25,994	25,994	25,994	25,994	25,994	25,994
Titus	Carrizo-Wilcox	Cypress	7,516	7,214	7,063	6,833	6,833	6,833
		Sulphur	2,805	2,805	2,805	2,805	2,805	2,805
	Queen City	Cypress	138	138	138	138	138	138
Upshur	Carrizo-Wilcox	Cypress	5,426	5,426	5,426	5,426	5,426	5,426
		Sabine	1,689	1,689	1,689	1,689	1,689	1,689

County	Aquifer	Basin	2020	2030	2040	2050	2060	2070
	Queen City	Cypress	18,324	18,324	18,324	18,143	18,143	18,143
		Sabine	7,246	7,246	7,246	7,246	7,246	7,246
Van Zandt	Carrizo-Wilcox	Neches	4,288	4,288	4,288	4,288	4,288	4,288
		Sabine	4,611	4,611	4,611	4,611	4,379	4,379
		Trinity	1,384	1,384	1,384	1,384	1,384	1,384
	Queen City	Neches	3,814	3,814	3,814	3,814	3,814	3,814
Wood	Carrizo-Wilcox	Cypress	2,053	2,053	2,053	2,053	2,053	2,053
		Sabine	19,486	19,398	19,355	19,280	19,258	19,258
	Queen City	Cypress	1,009	1,009	1,009	1,009	1,009	1,009
		Sabine	9,103	9,103	9,103	9,103	9,103	9,103

Non-relevant aquifers are areas determined by the TWDB as “DFC-compatible availability values.” These areas have aquifer characteristics, groundwater demands, and current groundwater uses that do not warrant adoption of a desired future condition. It is anticipated that there will be no large-scale production from non-relevant aquifers. Additionally, it is assumed that what production does occur will not affect conditions in relevant portions of the aquifer(s). In Region D, one non-relevant volume of 20 acre-feet was determined for Delta County, in the Sulphur river basin of the Woodbine aquifer. In Region D, one non-relevant volume of 20 acre-feet was determined for Delta County, in the Sulphur River basin of the Woodbine Aquifer. Groundwater availability estimates for this non-relevant aquifer were included in GAM Run 08-14 MAG report.

Historical pumping estimates for years 2007 through 2011 were also utilized for comparison against the MAGs (Table 3.8). The county-aquifer-basin combinations that are highlighted exceed the year 2020 MAG. All pumping was summed by county, basin and aquifer and divided by five to determine average annual use. This was done in an attempt to determine potential needs and conflicts based on where pumping has been occurring.

The pumping estimates are based on reported pumping (from TWDB surveys) as well as non-surveyed estimates. Non-surveyed estimates can comprise a rather significant portion of the historical estimates data. Irrigation estimates are based on USDA Farm Service Administration crop acreage data and irrigation depths are based on evapotranspiration. Livestock estimates are based upon Texas Agricultural Statistics Service livestock population statistics with use per animal derived from Texas Agricultural Experiment Station research. TWDB estimates water use for non-surveyed cities with a population greater than 500.

Table 3.8 presents a comparison between MAG volumes and the estimated historical pumping from 2007 through 2011. In Lamar County, the estimated historical reports indicate an annual average pumping of 5,688 acre-feet. The 2020 MAG volume is 323 acre-feet, creating a difference of 5,365 acre-feet. This was the largest overdraft identified.

Table 3.8 Groundwater Supplies and Historical Pumping Estimates (2007-2011) (ac-ft/yr)

County	Aquifer	Basin	MAG 2020	Non - Relevant Groundwater Supplies	Historical Pumping Average 2007-2011
Bowie	Carrizo-Wilcox	Sulphur	8,216	-	1,393
	Blossom	Red	21	-	-
		Sulphur	180	-	-
	Nacatoch	Red	3,071	-	828
		Sulphur	1,942	-	349
Camp	Carrizo-Wilcox	Cypress	4,041	-	-
	Queen-City	Cypress	3,542	-	-
Cass	Carrizo-Wilcox	Cypress	2,955	-	995
		Sulphur	578	-	414
	Queen-City	Cypress	35,970	-	4
		Sulphur	3,223	-	33
Delta	Trinity	Sulphur	362	-	632
	Nacatoch	Sulphur	575	-	78
	Woodbine	Sulphur	-	20	-
Franklin	Carrizo-Wilcox	Cypress	7,736	-	185
		Sulphur	1,748	-	243
	Nacatoch	Sulphur	30	-	-
Gregg	Carrizo-Wilcox	Cypress	820	-	261
		Sabine	6,829	-	2,171
	Queen-City	Cypress	1,359	-	104
		Sabine	6,214	-	-
Harrison	Carrizo-Wilcox	Cypress	4,873	-	2,527
		Sabine	3,964	-	3,504
	Queen City	Cypress	7,890	-	102
		Sabine	2,483	-	21
Hopkins	Carrizo-Wilcox	Cypress	253	-	368
		Sabine	2,001	-	500
		Sulphur	1,137	-	2,840
	Nacatoch	Sabine	291	-	963
		Sulphur	916	-	-
Hunt	Trinity	Trinity	551	-	-
	Nacatoch	Sabine	3,303	-	461
		Sulphur	491	-	822
	Woodbine	Sabine	1,867	-	96
		Sulphur	849	-	421

County	Aquifer	Basin	MAG 2020	Non - Relevant Groundwater Supplies	Historical Pumping Average 2007-2011
		Trinity	124	-	92
Lamar	Trinity	Red	1,320	-	-
		Sulphur	2	-	20
	Blossom	Red	323	-	5,688
		Sulphur	71	-	588
	Nacatoch	Sulphur	110	-	3
	Woodbine	Red	1,910	-	26
		Sulphur	1,734	-	12
Marion	Carrizo-Wilcox	Cypress	2,077	-	682
	Queen City	Cypress	15,549	-	19
Morris	Carrizo-Wilcox	Cypress	2,196	-	439
		Sulphur	420	-	293
	Queen City	Cypress	9,652	-	23
Rains	Carrizo-Wilcox	Sabine	1,703	-	475
	Nacatoch	Sabine	1	-	-
Red River	Trinity	Red	263	-	79
		Sulphur	267	-	59
	Blossom	Red	1,053	-	-
		Sulphur	625	-	575
	Nacatoch	Red	58	-	-
		Sulphur	1,047	-	325
	Woodbine	Red	162	-	1
		Sulphur	4	-	-
Smith	Carrizo-Wilcox	Sabine	12,245	-	5,781
	Queen City	Sabine	25,994	-	1,249
Titus	Carrizo-Wilcox	Cypress	7,516	-	267
		Sulphur	2,805	-	171
	Queen City	Cypress	138	-	-
Upshur	Carrizo-Wilcox	Cypress	5,426	-	2,401
		Sabine	1,689	-	944
	Queen City	Cypress	18,324	-	269
		Sabine	7,246	-	381
Van Zandt	Carrizo-Wilcox	Neches	4,288	-	1,516
		Sabine	4,611	-	2,174
		Trinity	1,384	-	573
	Queen City	Neches	3,814	-	75

County	Aquifer	Basin	MAG 2020	Non - Relevant Groundwater Supplies	Historical Pumping Average 2007-2011
Wood	Carrizo-Wilcox	Cypress	2,053	-	190
		Sabine	19,486	-	6,109
	Queen City	Cypress	1,009	-	45
		Sabine	9,103	-	163

According to the Guidance Manual for Brackish Groundwater in Texas, prepared for the TWDB by NRS Consulting Engineers (2008), there exists 55.8 million acre-feet of brackish groundwater in storage beneath Region D. Brackish groundwater is groundwater with a total dissolved solids content of over 1000 mg/l, and would require treatment to be acceptable for municipal supply. However, groundwater with TDS below 1500 mg/l is sometimes acceptable for irrigation, and below 3000 mg/l is acceptable for some livestock.

In a number of cases, existing groundwater supplies within the North East Texas Region were required to be reduced to meet the established MAG. Said another way, to ascribe to the TWDB guidelines requiring the MAG to be the set definition of the available groundwater supply, it was necessary to assume that certain *existing* supplies available from groundwater wells in the Region do not exist for the purposes of the 2016 RWP. As noted previously, the MAG's generated via the establishment of DFC's, which are set by GMA 8 and GMA 11 for the North East Texas Region. An analysis has been performed to identify, in terms of both magnitude and percentage, the maximum reductions necessary to meet the associated MAGs (recall that reductions may be applied over the 2020 – 2070 planning period). These reductions, identified by county/basin/aquifer/entity/GMA, are presented in terms of volume (Figure 3.11) and percentage of existing supply (Figure 3.12).

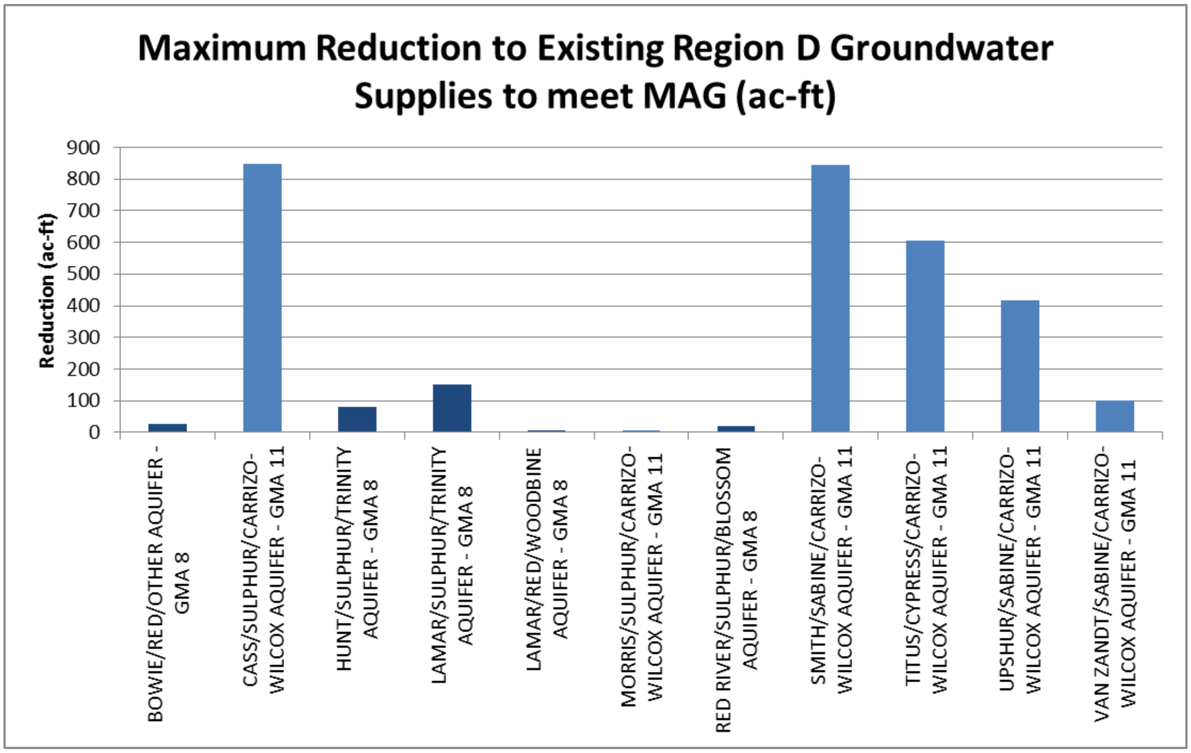


Figure 3.11 Max. Reduction to Existing Region D Groundwater Supplies to meet MAG (ac-ft)

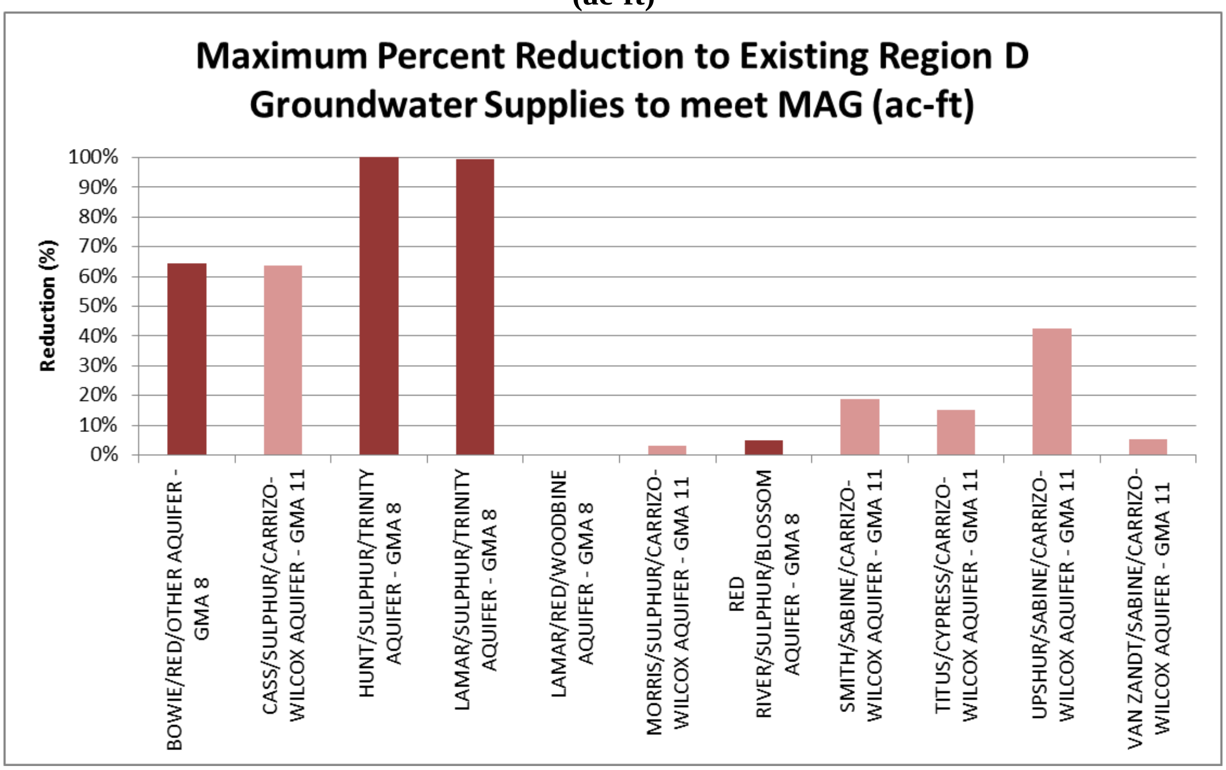


Figure 3.12 Max. Percent Reduction to Existing Region D Groundwater Supplies to meet MAG (ac-ft)

As depicted in Figure 3.11 a significant portion of the volumetric reduction is due to limitations in the MAG as established by GMA 11. A recent study performed by the TWDB (*Total Estimated Recoverable Storage for Aquifers in Groundwater Management Area 11*, 2014), identifies the total estimated recoverable storage for aquifers in GMA 11. The total estimated recoverable storage is defined therein as:

> "The estimated amount of groundwater within an aquifer that accounts for recovery scenarios that range between 25 percent and 75 percent of the porosity-adjusted aquifer volume."

In other words, it is assumed that only 25 to 75 percent of groundwater held within an aquifer can be removed by pumping. To place the aforementioned MAGs established by GMA 11 into context with this work, a comparison between the total storage of each aquifer, by county, as identified in the TWDB (2014) report for GMA 11, has been performed, as shown in Table 3.9 below. As evidenced therein, when considered in aggregate, there has been an approximate 20,000 ac-ft decrease in availability of total groundwater supplies in the Region, a decrease of approximately 5%. In terms of total available storage, the 2016 MAG amounts represent 0.054% of the estimated amount of total storage in aquifers in the region. Similarly considered, the 2011 amounts represent approximately 0.058% of the estimated total aquifer storage in the region.

Although a cumulative assessment is informative, particularly when considered in relation to the total estimated aquifer storage in the system, evaluation of differences in the individual counties

Table 3.9 GMA 11's MAG Impact on Region D Groundwater Availability

County	Total Storage (acre-feet)	25 % of Total Storage (acre-feet)	75 % of Total Storage (acre-feet)	2016 MAG*** (acre-feet)	2011 GW Avail (acre-feet)	MAG % of Total Storage	MAG % of 1/4 Total Storage	Diff. in 2011 & 2016 (acre-feet)	% Diff. In 2011 & 2016	2011 % of Total Storage	2011% of 1/4 Total Storage
Nacatoch Aquifer											
Bowie	140,000	35,000	105,000	5,013	3,941	3.581%	14.323%	1,072	27.2%	2.815%	11.260%
Morris	2,900	725	2,175	0	0	0.000%	0.000%	0	0.0%	0.000%	0.000%
Red River	11,000	2,750	8,250	1,105	708	10.045%	40.182%	397	56.1%	6.436%	25.745%
Titus	15,000	3,750	11,250	0	1,041	0.000%	0.000%	-1,041	-100.0%	6.940%	27.760%
Sub-totals/Average %	168,900	42,225	126,675	6,118	5,690	3.622%	14.489%	428	7.5%	3.369%	13.475%
Carrizo-Wilcox Aquifer											
Bowie	6,400,000	1,600,000	4,800,000	8,216	15,673	0.128%	0.514%	-7,457	-47.6%	0.245%	0.980%
Camp	15,000,000	3,750,000	11,250,000	4,041	3,921	0.027%	0.108%	120	3.1%	0.026%	0.105%
Cass	60,000,000	15,000,000	45,000,000	3,533	3,527	0.006%	0.024%	6	0.2%	0.006%	0.024%
Franklin	6,000,000	1,500,000	4,500,000	9,484	11,671	0.158%	0.632%	-2,187	-18.7%	0.195%	0.778%
Gregg	21,000,000	5,250,000	15,750,000	7,649	7,539	0.036%	0.146%	110	1.5%	0.036%	0.144%
Harrison	40,000,000	10,000,000	30,000,000	8,837	8,660	0.022%	0.088%	177	2.0%	0.022%	0.087%
Hopkins	7,000,000	1,750,000	5,250,000	3,391	4,761	0.048%	0.194%	-1,370	-28.8%	0.068%	0.272%
Marion	25,000,000	6,250,000	18,750,000	2,077	2,030	0.008%	0.033%	47	2.3%	0.008%	0.032%
Morris	16,000,000	4,000,000	12,000,000	2,616	2,660	0.016%	0.065%	-44	-1.7%	0.017%	0.067%
Rains	3,200,000	800,000	2,400,000	1,703	1,770	0.053%	0.213%	-67	-3.8%	0.055%	0.221%
Red River	33,000	8,250	24,750	0	239	0.000%	0.000%	-239	-100.0%	0.724%	2.897%
Smith*	100,000,000	25,000,000	75,000,000	12,245	13,981	0.012%	0.049%	-1,736	-12.4%	0.014%	0.056%
Titus	13,000,000	3,250,000	9,750,000	10,321	11,134	0.079%	0.318%	-813	-7.3%	0.086%	0.343%
Upshur	45,000,000	11,250,000	33,750,000	7,115	6,959	0.016%	0.063%	156	2.2%	0.015%	0.062%

County	Total Storage (acre-feet)	25 % of Total Storage (acre-feet)	75 % of Total Storage (acre-feet)	2016 MAG*** (acre-feet)	2011 GW Avail (acre-feet)	MAG % of Total Storage	MAG % of 1/4 Total Storage	Diff. in 2011 & 2016 (acre-feet)	% Diff. In 2011 & 2016	2011 % of Total Storage	2011% of 1/4 Total Storage
Van Zandt	35,000,000	8,750,000	26,250,000	10,283	11,087	0.029%	0.118%	-804	-7.3%	0.032%	0.127%
Wood	54,000,000	13,500,000	40,500,000	21,539	9,852	0.040%	0.160%	11,687	118.6%	0.018%	0.073%
Sub-totals/Average %	446,633,000	111,658,250	334,974,750	113,050	115,464	0.025%	0.101%	-2,414	-2.1%	0.026%	0.103%
Queen City Aquifer											
Camp	600,000	150,000	450,000	3,542	3,610	0.590%	2.361%	-68	-1.9%	0.602%	2.407%
Cass	8,000,000	2,000,000	6,000,000	39,193	38,189	0.490%	1.960%	1,004	2.6%	0.477%	1.909%
Gregg	1,500,000	375,000	1,125,000	7,573	7,500	0.505%	2.019%	73	1.0%	0.500%	2.000%
Harrison	1,200,000	300,000	900,000	10,373	10,020	0.864%	3.458%	353	3.5%	0.835%	3.340%
Marion	2,500,000	625,000	1,875,000	15,549	15,150	0.622%	2.488%	399	2.6%	0.606%	2.424%
Morris	1,300,000	325,000	975,000	9,652	9,540	0.742%	2.970%	112	1.2%	0.734%	2.935%
Smith*	23,000,000	5,750,000	17,250,000	25,994	35,520	0.113%	0.452%	-9,526	-26.8%	0.154%	0.618%
Titus	63,000	15,750	47,250	138	0	0.219%	0.876%	138	100.0%	0.000%	0.000%
Upshur	7,800,000	1,950,000	5,850,000	25,570	25,000	0.328%	1.311%	570	2.3%	0.321%	1.282%
Van Zandt	1,200,000	300,000	900,000	3,814	3,750	0.318%	1.271%	64	1.7%	0.313%	1.250%
Wood	8,700,000	2,175,000	6,525,000	10,112	21,231	0.116%	0.465%	-11,119	-52.4%	0.244%	0.976%
Sub-totals /Average %	55,863,000	13,965,750	41,897,250	151,510	169,510	0.271%	1.085%	-18,000	-10.6%	0.303%	1.214%
****Totals /Average %**	502,664,900	125,666,225	376,998,675	270,678	290,664	0.054%	0.215%	-19,986	-5.2%	0.058%	0.231%

* Total Storage Includes Reg D & Reg I MAG numbers, 2011 and 2020 MAG based on solely Region D amounts.
**Aquifers with no 2016 MAG are not included in totals.
*** 2016 MAG amounts represent 2020 decadal supplies.

reflects more significant changes. The significant change in availabilities in the Carrizo-Wilcox and Queen City aquifers within Wood County, i.e. the increase of approximately 11,000 ac-ft in the former and the decrease of nearly 12,000 ac-ft in the latter, mask substantial decreases in supply when considered cumulatively by aquifer. Without the effect of Wood County changes considered, 2016 MAG supplies for the remaining counties in Region D decreased from the 2011 available supplies by approximately 14,000 ac-ft (~13%) in the Carrizo-Wilcox Aquifer, and nearly 7,000 ac-ft (~5%) in the Queen City Aquifer. When disaggregated by county, these changes become more significant. Supplies in the Carrizo-Wilcox Aquifer decreased most substantially in Bowie County (-7,457 ac-ft; -47.6%), Franklin County (-2,187 ac-ft; -18.7%), Hopkins County (-1,370 ac-ft; -28.8%), and Smith County (-1,736 ac-ft; -12.4%). Supplies in the Queen City Aquifer decreased almost entirely in Smith County (-9,526 ac-ft; -26.8%).

3.2.3.1 Other Aquifers

Table 3.10 presents groundwater availability numbers for 'other' aquifers found within the North East Texas Region. These availability numbers were published by the TWDB as "DFC-compatible availability values" that align directly with 2011 regional water plan data in DB12.

Table 3.10 Groundwater Availability by Aquifer (ac-ft/yr)

Aquifer	County	Water Availability Estimates
Blossom Aquifer	Bowie	201
	Lamar	394
	Red River	1,678
	Total	2,273
Carrizo-Wilcox Aquifer	Bowie	8,216
	Camp	4,041
	Cass	3,533
	Franklin	9,484
	Gregg	7,649
	Harrison	8,837
	Hopkins	3,391
	Marion	2,077
	Morris	2,616
	Rains	1,703
	Red River	0
	Smith	12,245
	Titus	10,321
	Upshur	7,115
	Van Zandt	10,283
	Wood	21,539

Aquifer	County	Water Availability Estimates
	Total	113,050
Nacatoch Aquifer	Bowie	5,013
	Delta	575
	Franklin	30
	Hopkins	1207
	Hunt	3,794
	Lamar	110
	Rains	1
	Red River	1105
	Total	11,835
Queen City Aquifer	Camp	3,542
	Cass	39,193
	Gregg	7,573
	Harrison	10,373
	Marion	15,549
	Morris	9,652
	Smith	25,994
	Titus	138
	Upshur	25,570
	Van Zandt	3,814
	Wood	10,112
	Total	151,510
Trinity Aquifer	Delta	362
	Hunt	551
	Lamar	1,322
	Red River	530
	Total	2,765
Other Aquifer	Hunt	2,840
	Lamar	3,644
	Red River	166
	Total	6,650
Total Regional Groundwater	Total	288,083

3.3 SUPPLIES CURRENTLY AVAILABLE TO EACH WATER USER GROUP

The water supplies available to the individual water user groups in North East Texas Region are presented in the following sections. Also included is a description of the methods used to determine the supplies available to each water user group for the 2016 RWP and the assumptions, if any, made in developing this data. Note that for the purposes of the 2016 regional water planning process, the term 'supply' differs from the volume of available water from a given source, as the supply to a given entity may be limited by existing legal or infrastructure constraints. For example, a reservoir (source) with an identified firm yield may provide a lesser amount of 'supply' to an entity due to permit limitations, or due to an existing infrastructure limitation such as the pumping capacity of an intake.

The first series of data presents water supply by use category.

3.3.1 Methodology to Determine Water User Supply

As noted in Chapter 2, each water user group was surveyed to determine not only population and population growth pattern but also water use and water supply. Each water user group was asked to identify their water supply source and supply volume.

The water user group was asked to provide the contract period if the water supply was provided by a contract with some other source. The water supply is assumed to end with the contract, although it is understood that contract renewal may likely continue the supply to meet future needs. In those instances where the water supply contract does not specify the contract expiration date, the contract is assumed to continue through at least year 2070. If a maximum quantity is not specified in the contract then the supply was set equal to the demand for each year of the contract.

The 2016 North East Texas Regional Water Plan water supply volumes also reflect known infrastructure limitations. Livestock and irrigation were assumed to be from private (local) supplies, except in instances where surface water permits, wells, or contracts were identified. These private supplies may be individual water wells on private property or local surface water supplies.

3.3.2 Regional Municipal Water Supply

Table 3.11 North East Texas Regional Municipal Water Supply by County (ac-ft/yr)

County	Basin	2020	2030	2040	2050	2060	2070
Bowie	Red	1,171	1,194	1,215	1,196	1,185	1,185
	Sulphur	2,517	2,563	2,605	2,561	2,537	2,537
	Total	**3,688**	**3,757**	**3,820**	**3,757**	**3,722**	**3,722**
Camp	Cypress	3,194	3,206	3,215	3,257	3,264	3,270
	Total	**3,194**	**3,206**	**3,215**	**3,257**	**3,264**	**3,270**
Cass	Cypress	4,382	4,402	4,420	4,453	4,451	4,482
	Sulphur	1,358	1,398	1,439	1,480	1,480	1,511

County	Basin	2020	2030	2040	2050	2060	2070
	Total	**5,740**	**5,800**	**5,859**	**5,933**	**5,931**	**5,993**
Delta	Sulphur	2,955	2,887	2,872	2,852	2,820	2,690
	Total	**2,955**	**2,887**	**2,872**	**2,852**	**2,820**	**2,690**
Franklin	Cypress	3,408	3,413	3,363	3,321	3,216	3,102
	Sulphur	1,770	1,774	1,776	1,769	1,752	1,735
	Total	**5,178**	**5,187**	**5,139**	**5,090**	**4,968**	**4,837**
Gregg	Cypress	1,339	1,350	1,363	1,379	1,392	1,395
	Sabine	42,910	44,026	44,124	44,259	49,443	49,441
	Total	**44,249**	**45,376**	**45,487**	**45,638**	**50,835**	**50,836**
Harrison	Cypress	4,424	4,480	4,522	4,572	4,656	4,725
	Sabine	15,200	15,275	15,332	15,399	10,496	10,570
	Total	**19,624**	**19,755**	**19,854**	**19,971**	**15,152**	**15,295**
Hopkins	Cypress	599	599	588	581	561	541
	Sabine	1,674	1,682	1,683	1,673	1,657	1,642
	Sulphur	20,741	20,380	19,960	19,790	19,353	19,013
	Total	**23,014**	**22,661**	**22,231**	**22,044**	**21,571**	**21,196**
Hunt	Sabine	14,641	18,555	18,775	21,883	23,848	24,458
	Sulphur	2,431	2,679	3,005	3,466	4,198	5,189
	Trinity	149	155	154	169	127	148
	Total	**17,221**	**21,389**	**21,934**	**25,518**	**28,173**	**29,795**
Lamar	Red	16,688	16,514	16,363	16,241	16,032	15,895
	Sulphur	21,498	21,372	21,247	21,126	20,872	20,742
	Total	**38,186**	**37,886**	**37,610**	**37,367**	**36,904**	**36,637**
Marion	Cypress	3,474	3,474	3,474	3,474	3,474	3,474
	Total	**3,474**	**3,474**	**3,474**	**3,474**	**3,474**	**3,474**
Morris	Cypress	3,136	3,144	3,144	3,110	3,111	3,114
	Sulphur	429	421	421	421	421	421
	Total	**3,565**	**3,565**	**3,565**	**3,531**	**3,532**	**3,535**
Rains	Sabine	2,733	3,952	3,946	3,932	3,917	3,905
	Total	**2,733**	**3,952**	**3,946**	**3,932**	**3,917**	**3,905**
Red River	Red	354	355	355	355	355	355
	Sulphur	1,883	1,634	970	970	970	970
	Total	**2,237**	**1,989**	**1,325**	**1,325**	**1,325**	**1,325**
Smith	Sabine	10,288	10,792	11,340	12,099	13,064	14,008
	Total	**10,288**	**10,792**	**11,340**	**12,099**	**13,064**	**14,008**
Titus	Cypress	6,948	6,680	6,326	6,038	6,559	7,139
	Sulphur	1,591	1,689	1,749	1,811	1,879	1,928
	Total	**8,539**	**8,369**	**8,075**	**7,849**	**8,438**	**9,067**
Upshur	Cypress	6,520	6,547	6,573	6,606	6,623	6,641
	Sabine	2,401	2,409	2,404	2,396	2,387	2,412

County	Basin	2020	2030	2040	2050	2060	2070
	Total	**8,921**	**8,956**	**8,977**	**9,002**	**9,010**	**9,053**
Van Zandt	Neches	2,685	2,797	2,875	2,962	3,061	3,060
	Sabine	6,514	8,343	8,406	8,484	8,392	8,393
	Trinity	2,500	3,679	3,661	3,651	3,620	3,544
	Total	**11,699**	**14,819**	**14,942**	**15,097**	**15,073**	**14,997**
Wood	Cypress	1,326	1,330	1,338	1,329	1,335	1,327
	Sabine	10,937	11,684	11,665	11,657	11,634	11,627
	Total	**12,263**	**13,014**	**13,003**	**12,986**	**12,969**	**12,954**
REGION TOTAL		**226,768**	**236,834**	**236,668**	**240,722**	**244,142**	**246,589**

Table 3.12 North East Texas Regional Municipal Water Supply by Basin (ac-ft/yr)

Basin	2020	2030	2040	2050	2060	2070
Cypress	38,750	38,625	38,326	38,120	38,642	39,210
Neches	2,685	2,797	2,875	2,962	3,061	3,060
Red	18,213	18,063	17,933	17,792	17,572	17,435
Sabine	107,298	116,718	117,675	121,782	124,838	126,456
Sulphur	57,173	56,797	56,044	56,246	56,282	56,736
Trinity	2,649	3,834	3,815	3,820	3,747	3,692
TOTAL	**226,768**	**236,834**	**236,668**	**240,722**	**244,142**	**246,589**

3.3.3 Regional Manufacturing Supply

Table 3.13 North East Texas Regional Manufacturing Water Supply by County (ac-ft/yr)

County	Basin	2020	2030	2040	2050	2060	2070
Bowie	Red	7	7	7	7	7	7
	Sulphur	28	28	28	28	28	28
	Total	**35**	**35**	**35**	**35**	**35**	**35**
Camp	Cypress	47	49	51	53	56	58
	Total	**47**	**49**	**51**	**53**	**56**	**58**
Cass	Cypress						
	Sulphur	120,051	120,050	120,048	120,047	120,047	88,056
	Total	**120,051**	**120,050**	**120,048**	**120,047**	**120,047**	**88,056**
Delta	Sulphur						
	Total						
Franklin	Cypress						
	Sulphur						
	Total						
Gregg	Cypress						
	Sabine	6,846	6,848	6,848	6,848	6,848	6,848
	Total	**6,846**	**6,848**	**6,848**	**6,848**	**6,848**	**6,848**
Harrison	Cypress	957	957	957	957	957	957
	Sabine	39,999	39,999	39,999	39,999	39,999	39,999
	Total	**40,956**	**40,956**	**40,956**	**40,956**	**40,956**	**40,956**
Hopkins	Cypress						
	Sabine						
	Sulphur	1,741	1,830	1,915	1,987	2,126	2,275
	Total	**1,741**	**1,830**	**1,915**	**1,987**	**2,126**	**2,275**
Hunt	Sabine	1,048	1,216	1,397	1,570	1,689	1,875
	Sulphur	338	401	470	535	580	650
	Trinity						
	Total	**1,386**	**1,617**	**1,867**	**2,105**	**2,269**	**2,525**
Lamar	Red	870	912	953	988	1,054	1,089
	Sulphur	5,091	5,340	5,580	5,787	6,183	6,386
	Total	**5,961**	**6,252**	**6,533**	**6,775**	**7,237**	**7,475**
Marion	Cypress	72	76	79	83	89	95
	Total	**72**	**76**	**79**	**83**	**89**	**95**
Morris	Cypress	134,943	129,517	124,201	125,457	134,331	128,105
	Sulphur						
	Total	**134,943**	**129,517**	**124,201**	**125,457**	**134,331**	**128,105**
Rains	Sabine	5	5	5	5	5	5

County	Basin	2020	2030	2040	2050	2060	2070
	Total	**5**	**5**	**5**	**5**	**5**	**5**
Red River	Red						
	Sulphur	9	9	2	2	2	2
	Total	**9**	**9**	**2**	**2**	**2**	**2**
Smith	Sabine						
	Total						
Titus	Cypress	5,392	5,596	5,782	5,806	5,804	5,816
	Sulphur						
	Total	**5,392**	**5,596**	**5,782**	**5,806**	**5,804**	**5,816**
Upshur	Cypress	6	6	6	6	6	6
	Sabine						
	Total	**6**	**6**	**6**	**6**	**6**	**6**
Van Zandt	Neches						
	Sabine	520	546	570	590	617	638
	Trinity	3	3	3	3	3	3
	Total	**523**	**549**	**573**	**593**	**620**	**641**
Wood	Cypress						
	Sabine	1,502	1,502	1,502	1,502	1,502	1,502
	Total	**1,502**	**1,502**	**1,502**	**1,502**	**1,502**	**1,502**
REGION TOTAL		**319,475**	**314,897**	**310,403**	**312,260**	**321,933**	**284,400**

Table 3.14 North East Texas Regional Manufacturing Supply by Basin (ac-ft/yr)

Basin	2020	2030	2040	2050	2060	2070
Cypress	141,417	136,201	131,076	132,362	141,243	135,037
Necehes	0	0	0	0	0	0
Red River	877	919	960	995	1,061	1,096
Sabine	49,920	50,116	50,321	50,514	50,660	50,867
Sulphur	127,258	127,658	128,043	128,386	128,966	97,397
Trinity	3	3	3	3	3	3
TOTAL	**319,475**	**314,897**	**310,403**	**312,260**	**321,933**	**284,400**

3.3.4 Regional Irrigation Supply

Table 3.15 North East Texas Regional Irrigation Water Supply by County (ac-ft/yr)

County	Basin	2020	2030	2040	2050	2060	2070
Bowie	Red	891	891	891	891	891	891
	Sulphur	90	90	90	90	90	90
	Total	**981**	**981**	**981**	**981**	**981**	**981**
Camp	Cypress						
	Total						
Cass	Cypress						
	Sulphur						
	Total						
Delta	Sulphur	4,601	4,595	4,588	4,582	4,576	4,530
	Total	**4,601**	**4,595**	**4,588**	**4,582**	**4,576**	**4,530**
Franklin	Cypress	10	10	10	10	10	10
	Sulphur	290	290	290	290	290	290
	Total	**300**	**300**	**300**	**300**	**300**	**300**
Gregg	Cypress	44	44	44	44	44	44
	Sabine	138	138	138	138	138	138
	Total	**182**	**182**	**182**	**182**	**182**	**182**
Harrison	Cypress	35	35	35	35	35	35
	Sabine	177	177	177	177	177	177
	Total	**212**	**212**	**212**	**212**	**212**	**212**
Hopkins	Cypress	3	3	3	3	3	3
	Sabine	35	35	35	35	35	35
	Sulphur	105	105	105	105	105	105
	Total	**143**	**143**	**143**	**143**	**143**	**143**
Hunt	Sabine	106	106	106	106	106	106
	Sulphur	2	2	2	2	2	2
	Trinity						
	Total	**108**	**108**	**108**	**108**	**108**	**108**
Lamar	Red	1,066	1,083	996	996	891	873
	Sulphur	1,567	1,488	1,512	1,450	1,494	1,447
	Total	**2,633**	**2,571**	**2,508**	**2,446**	**2,385**	**2,320**
Marion	Cypress						
	Total						
Morris	Cypress						
	Sulphur						
	Total						
Rains	Sabine	55	55	55	55	55	55

County	Basin	2020	2030	2040	2050	2060	2070
	Total	**55**	**55**	**55**	**55**	**55**	**55**
Red River	Red	330	330	330	330	330	330
	Sulphur	450	460	460	460	460	440
	Total	**780**	**790**	**790**	**790**	**790**	**770**
Smith	Sabine	370	389	408	428	450	475
	Total	**370**	**389**	**408**	**428**	**450**	**475**
Titus	Cypress	82	82	82	82	82	82
	Sulphur	995	995	995	995	995	995
	Total	**1,077**	**1,077**	**1,077**	**1,077**	**1,077**	**1,077**
Upshur	Cypress	252	252	252	252	252	252
	Sabine	20	20	20	20	20	20
	Total	**272**	**272**	**272**	**272**	**272**	**272**
Van Zandt	Neches	26	26	26	26	26	26
	Sabine	52	52	52	52	52	52
	Trinity	29	29	29	29	29	29
	Total	**107**	**107**	**107**	**107**	**107**	**107**
Wood	Cypress	125	125	125	125	125	125
	Sabine	815	815	815	815	815	815
	Total	**940**	**940**	**940**	**940**	**940**	**940**
REGION TOTAL		**12,761**	**12,722**	**12,671**	**12,623**	**12,578**	**12,472**

Table 3.16 North East Texas Regional Irrigation Water Supply by Basin (ac-ft/yr)

Basin	2020	2030	2040	2050	2060	2070
Cypress	551	551	551	551	551	551
Neceches	26	26	26	26	26	26
Red River	2,287	2,304	2,217	2,217	2,112	2,094
Sabine	1,768	1,787	1,806	1,826	1,848	1,873
Sulphur	8,100	8,025	8,042	7,974	8,012	7,899
Trinity	29	29	29	29	29	29
TOTAL	**12,761**	**12,722**	**12,671**	**12,623**	**12,578**	**12,472**

3.3.5 Regional Steam Electric Supply

Table 3.17 North East Texas Regional Steam Electric Water Supply by County (ac-ft/yr)

County	Basin	2020	2030	2040	2050	2060	2070
Bowie	Red						
	Sulphur						
	Total						
Camp	Cypress						
	Total						
Cass	Cypress						
	Sulphur						
	Total						
Delta	Sulphur						
	Total						
Franklin	Cypress						
	Sulphur						
	Total						
Gregg	Cypress						
	Sabine	2,242	2,242	2,242	2,242	2,242	2,242
	Total	**2,242**	**2,242**	**2,242**	**2,242**	**2,242**	**2,242**
Harrison	Cypress						
	Sabine	24,161	24,161	24,161	24,161	24,161	24,161
	Total	**24,161**	**24,161**	**24,161**	**24,161**	**24,161**	**24,161**
Hopkins	Cypress						
	Sabine						
	Sulphur						
	Total						
Hunt	Sabine	351	351	351	351	351	351
	Sulphur						
	Trinity						
	Total	**351**	**351**	**351**	**351**	**351**	**351**
Lamar	Red	8,961	8,961	8,961	8,961	8,961	8,961
	Sulphur						
	Total	**8,961**	**8,961**	**8,961**	**8,961**	**8,961**	**8,961**
Marion	Cypress	1,852	2,165	2,547	3,012	3,580	3,967
	Total	**1,852**	**2,165**	**2,547**	**3,012**	**3,580**	**3,967**
Morris	Cypress	820	820	820	820	820	820
	Sulphur						
	Total	**820**	**820**	**820**	**820**	**820**	**820**
Rains	Sabine						

County	Basin	2020	2030	2040	2050	2060	2070
	Total						
Red River	Red						
	Sulphur	8,510	8,510	8,510	8,510	8,510	9,290
	Total	**8,510**	**8,510**	**8,510**	**8,510**	**8,510**	**9,290**
Smith	Sabine	12	14	16	19	23	27
	Total	**12**	**14**	**16**	**19**	**23**	**27**
Titus	Cypress	31,865	31,165	30,465	29,665	29,517	29,148
	Sulphur						
	Total	**31,865**	**31,165**	**30,465**	**29,665**	**29,517**	**29,148**
Upshur	Cypress						
	Sabine						
	Total						
Van Zandt	Neches						
	Sabine						
	Trinity						
	Total						
Wood	Cypress						
	Sabine						
	Total						
REGION TOTAL		**78,774**	**78,389**	**78,073**	**77,741**	**78,165**	**78,967**

Table 3.18 North East Texas Regional Steam Electric Water Supply by Basin (ac-ft/yr)

Basin	2020	2030	2040	2050	2060	2070
Cypress	34,537	34,150	33,832	33,497	33,917	33,935
Neceĥes	0	0	0	0	0	0
Red River	8,961	8,961	8,961	8,961	8,961	8,961
Sabine	26,766	26,768	26,770	26,773	26,777	26,781
Sulphur	8,510	8,510	8,510	8,510	8,510	9,290
Trinity	0	0	0	0	0	0
TOTAL	**78,774**	**78,389**	**78,073**	**77,741**	**78,165**	**78,967**

3.3.6 Regional Mining Supply

Table 3.19 North East Texas Regional Mining Water Supply by County (ac-ft/yr)

County	Basin	2020	2030	2040	2050	2060	2070
Bowie	Red						
	Sulphur						
	Total						
Camp	Cypress	23	23	23	23	23	23
	Total	**23**	**23**	**23**	**23**	**23**	**23**
Cass	Cypress	839	862	884	904	926	952
	Sulphur						
	Total	**839**	**862**	**884**	**904**	**926**	**952**
Delta	Sulphur						
	Total						
Franklin	Cypress						
	Sulphur	1,040	1,016	994	974	954	954
	Total	**1,040**	**1,016**	**994**	**974**	**954**	**954**
Gregg	Cypress						
	Sabine	70	79	88	98	107	116
	Total	**70**	**79**	**88**	**98**	**107**	**116**
Harrison	Cypress	253	262	270	279	286	296
	Sabine	612	621	631	640	648	657
	Total	**865**	**883**	**901**	**919**	**934**	**953**
Hopkins	Cypress	24	26	25	27	28	28
	Sabine	249	260	267	274	283	291
	Sulphur	531	555	570	584	602	619
	Total	**804**	**841**	**862**	**885**	**913**	**938**
Hunt	Sabine	49	48	46	45	41	36
	Sulphur	5	5	6	6	9	13
	Trinity	1	1	1	1	1	1
	Total	**55**	**54**	**53**	**52**	**51**	**50**
Lamar	Red						
	Sulphur						
	Total						
Marion	Cypress	116	119	122	124	126	128
	Total	**116**	**119**	**122**	**124**	**126**	**128**
Morris	Cypress						
	Sulphur						
	Total						
Rains	Sabine						

County	Basin	2020	2030	2040	2050	2060	2070
	Total						
Red River	Red						
	Sulphur	4	4	3	3	3	3
	Total	**4**	**4**	**3**	**3**	**3**	**3**
Smith	Sabine	320	360	378	409	430	452
	Total	**320**	**360**	**378**	**409**	**430**	**452**
Titus	Cypress	4,192	4,417	4,641	4,866	4,648	4,184
	Sulphur	361	383	406	429	453	475
	Total	**4,553**	**4,800**	**5,047**	**5,295**	**5,101**	**4,659**
Upshur	Cypress	1	1	1	1	1	1
	Sabine						
	Total	**1**	**1**	**1**	**1**	**1**	**1**
Van Zandt	Neches	126	137	147	158	168	179
	Sabine	1,942	2,103	2,262	2,425	2,524	2,683
	Trinity	78	83	93	103	112	122
	Total	**2,146**	**2,323**	**2,502**	**2,686**	**2,804**	**2,984**
Wood	Cypress	25	25	28	31	32	35
	Sabine	284	288	289	290	292	293
	Total	**309**	**313**	**317**	**321**	**324**	**328**
REGION TOTAL		**11,145**	**11,678**	**12,175**	**12,694**	**12,697**	**12,541**

Table 3.20 North East Texas Regional Mining Water Supply by Basin (ac-ft/yr)

Basin	2020	2030	2040	2050	2060	2070
Cypress	5,473	5,735	5,994	6,255	6,070	5,647
Neceshes	126	137	147	158	168	179
Red River						
Sabine	3,526	3,759	3,961	4,181	4,325	4,528
Sulphur	1,941	1,963	1,979	1,996	2,021	2,064
Trinity	79	84	94	104	113	123
TOTAL	**11,145**	**11,678**	**12,175**	**12,694**	**12,697**	**12,541**

3.3.7 Regional Livestock Supply

Table 3.21 North East Texas Regional Livestock Water Supply by County (ac-ft/yr)

County	Basin	2020	2030	2040	2050	2060	2070
Bowie	Red	435	435	395	339	290	271
	Sulphur	721	721	655	561	481	449
	Total	**1,156**	**1,156**	**1,050**	**900**	**771**	**720**
Camp	Cypress	952	952	952	952	952	952
	Total	**952**	**952**	**952**	**952**	**952**	**952**
Cass	Cypress	484	484	484	484	484	484
	Sulphur	355	355	355	357	357	357
	Total	**839**	**839**	**839**	**841**	**841**	**841**
Delta	Sulphur	373	373	373	373	373	373
	Total	**373**	**373**	**373**	**373**	**373**	**373**
Franklin	Cypress	424	424	424	424	424	424
	Sulphur	621	621	621	621	621	621
	Total	**1,045**	**1,045**	**1,045**	**1,045**	**1,045**	**1,045**
Gregg	Cypress	11	11	11	11	11	11
	Sabine	204	204	204	204	204	204
	Total	**215**	**215**	**215**	**215**	**215**	**215**
Harrison	Cypress	559	614	670	729	769	799
	Sabine	405	425	447	469	492	514
	Total	**964**	**1,039**	**1,117**	**1,198**	**1,261**	**1,313**
Hopkins	Cypress	146	146	146	146	146	146
	Sabine	1,457	1,457	1,457	1,457	1,457	1,457
	Sulphur	3,251	3,251	3,251	3,251	3,252	3,253
	Total	**4,854**	**4,854**	**4,854**	**4,854**	**4,855**	**4,856**
Hunt	Sabine	812	812	812	812	812	812
	Sulphur	300	300	300	300	300	300
	Trinity	38	38	38	38	38	38
	Total	**1,150**	**1,150**	**1,150**	**1,150**	**1,150**	**1,150**
Lamar	Red	1,634	1,634	1,634	1,634	1,634	1,629
	Sulphur	1,624	1,624	1,624	1,624	1,624	1,624
	Total	**3,258**	**3,258**	**3,258**	**3,258**	**3,258**	**3,253**
Marion	Cypress	411	411	411	411	411	411
	Total	**411**	**411**	**411**	**411**	**411**	**411**
Morris	Cypress	326	326	326	326	326	326
	Sulphur	300	300	300	300	300	300
	Total	**626**	**626**	**626**	**626**	**626**	**626**
Rains	Sabine	506	506	506	506	506	506

County	Basin	2020	2030	2040	2050	2060	2070
	Total	**506**	**506**	**506**	**506**	**506**	**506**
Red River	Red	738	738	738	738	738	738
	Sulphur	949	949	949	949	949	949
	Total	**1,687**	**1,687**	**1,687**	**1,687**	**1,687**	**1,687**
Smith	Sabine	468	468	468	468	468	468
	Total	**468**	**468**	**468**	**468**	**468**	**468**
Titus	Cypress	433	433	433	433	428	428
	Sulphur	575	575	575	575	535	514
	Total	**1,008**	**1,008**	**1,008**	**1,008**	**963**	**942**
Upshur	Cypress	1,158	1,158	1,158	1,158	1,158	1,158
	Sabine	353	353	353	353	353	353
	Total	**1,511**	**1,511**	**1,511**	**1,511**	**1,511**	**1,511**
Van Zandt	Neches	1,167	1,167	1,167	1,167	1,167	1,167
	Sabine	1,124	1,124	1,124	1,124	1,119	1,119
	Trinity	637	637	637	637	637	637
	Total	**2,928**	**2,928**	**2,928**	**2,928**	**2,923**	**2,923**
Wood	Cypress	449	449	449	449	449	449
	Sabine	1,643	1,643	1,643	1,643	1,643	1,643
	Total	**2,092**	**2,092**	**2,092**	**2,092**	**2,092**	**2,092**
REGION TOTAL		**26,043**	**26,118**	**26,090**	**26,023**	**25,908**	**25,884**

Table 3.22 North East Texas Regional Livestock Water Supply by Basin (ac-ft/yr)

Basin	2020	2030	2040	2050	2060	2070
Cypress	5,353	5,408	5,464	5,523	5,558	5,588
Necehes	1,167	1,167	1,167	1,167	1,167	1,167
Red River	2,807	2,807	2,767	2,711	2,662	2,638
Sabine	6,973	6,993	7,015	7,037	7,055	7,077
Sulphur	9,069	9,069	9,003	8,911	8,792	8,740
Trinity	675	675	675	675	675	675
TOTAL	**26,044**	**26,119**	**26,091**	**26,024**	**25,909**	**25,885**

3.3.8 Wholesale Water Providers

Wholesale Water Providers (WWP) sell water to other entities for distribution. Table 3.23 provides a listing of WWPs supplying water to entities in the North East Texas Regional Water Planning Area. Note that Cash SUD obtains some water from Lake Lavon in Region C, Cherokee Water Company imports water from Lake Cherokee in Region I, and the Sabine River Authority is included herein as that entity is a major water provider in the North East Texas Region. Note that these supplies are the entirety of volume from each source available to the WWP.

Table 3.23 Wholesale Water Provider Water Supplies

Wholesale Water Provider	Source Region	Source Basin	Supply Available ac-ft/yr					
			2020	2030	2040	2050	2060	2070
Cash SUD	D	Sabine	2,004	5,001	5,005	4,960	4,915	4,872
Cash SUD	C	Sabine	948	1171	1432	1410	1328	1231
Cherokee Water Company	I	Sabine	28,650	28,415	28,180	27,945	27,710	27,477
City of Commerce	D	Sabine	2,379	8,127	7,940	8,197	6,828	7,040
City of Commerce	D	Sulphur	371	371	371	371	371	371
City of Emory	D	Sabine	1,589	1,918	1,910	1,902	1,895	1,887
Franklin County WD	D	Cypress	12,100	11,700	11,300	11,000	10,600	10,200
City of Greenville	D	Sabine	11,317	14,443	14,642	14,857	15,048	15,245
Lamar County WSD	D	Red	11,556	11,604	11,650	11,683	11,748	11,758
City of Longview	D	Cypress	20,000	20,000	20,000	20,000	20,000	20,000
City of Longview	D	Sabine	47,253	47,255	47,255	47,255	47,255	47,255
City of Marshall	D	Cypress	9,000	9,000	9,000	9,000	9,000	9,000
City of Mount Pleasant	D	Cypress	14,113	13,873	13,633	13,393	13,143	12,905
Northeast Texas MWD	D	Cypress	185,342	184,040	182,838	181,536	180,233	178,931
City of Paris	D	Red	58,778	58,780	58,779	58,779	58,780	58,751
Sabine River Authority*	D	Sabine	396,601	392,915	389,231	385,551	381,853	378,172
Sulphur River MWD	D	Sulphur	15,027	14,930	14,834	14,738	14,641	14,545
City of Sulphur Springs	D	Sulphur	24,376	24,285	24,194	24,103	24,012	23,921
City of Texarkana	D	Sulphur	121,044	121,023	121,000	120,992	120,990	89,000
City of Texarkana	D	Red	0	0	0	0	0	0
Titus County FWD #1	D	Cypress	48,500	48,500	48,500	48,500	48,500	48,500
Total Water Availability to WWPs in Region D			**1,010,948**	**1,017,351**	**1,011,694**	**1,006,172**	**998,850**	**961,061**

*While the Sabine River Authority is primarily within Region I, this WWP is included herein as it is a major provider of surface water supply in the Region. Thus, SRA supplies within the Region D planning area (Lake Fork and Lake Tawakoni) are shown herein.

Detailed tabulations of WWP and WUG Seller supplies and customer demands (by use amount and by contractual amount) are presented in Table 3_2 in Chapter 3 of Appendix C.

3.4 IMPACT OF ENVIRONMENTAL FLOW POLICIES ON WATER RIGHTS, WATER AVAILABILITY, AND WATER PLANNING

The objective of this section of the 2016 Plan is to provide an evaluation of the effect of environmental flow policies on water rights, water availability, and water planning in the NETRWPG area and within Region I to the extent that it affects Region D. Much has occurred in the area of environmental flow recommendations since the 2011 Plan was adopted, including the adoption of new environmental flow standards for the Sabine and Neches watersheds.

The Legislature passed Senate Bill 3 (SB 3) in the 2007 80th Regular Session. SB 3 is the third in a series of three omnibus water bills related to the State of Texas' meeting the future needs for water. SB. 3 created a basin-by-basin process for developing recommendations to meet the instream flow needs of rivers as well as freshwater inflow needs of affected bays and estuaries. SB 3 requires TCEQ to consider the recommendations of both the Basin and Bay Area Stakeholder Committee (BBASC) and Basin and Bay Expert Science Team (BBEST) for basin, and go through a rulemaking process to adopted environmental flow standards for each basin. Once adopted, such standards are utilized in the decision-making process for new water right applications and in establishing an amount of unappropriated water to be set aside for the environment.

Prior to SB 3, Texas law recognized the importance of balancing the biological soundness of the state's rivers, lakes, bays, and estuaries with the public's economic health and general well-being. The Texas Water Code (TWC) requires the TCEQ, while balancing all other interests, to consider and provide for the instream flows and freshwater inflows necessary to maintain a sound ecological environment in TCEQ's regular granting of permits for the use of state water. Balancing the effect of authorizing a new use of water with the need for that water to maintain a sound ecological system was done in the past on a case-by-case basis as part of the water rights permitting process.

SB 3 called for the appointment of stakeholder committees for the various watersheds contributing to bays and estuaries for the Texas coast. For that portion within Region D and I, the primary basins of interest were the Sabine and Neches Rivers, and part of the Neches-Trinity Coastal basin. These basins contribute fresh water to Sabine Lake and the upper Texas coast. Since a portion of the Trinity River basin is in Region D and I and the Trinity River forms a portion of the western boundary of Region I, another stakeholder group of the Trinity-San Jacinto-Galveston Bay area is also of potential interest. Stakeholder committees for both areas were appointed in 2008. Each stakeholder committee then appointed a BBEST in the fall of 2008 to address the development of environmental flow recommendations in accordance with SB 3.

BBESTs met individually over the course of 12 months to develop environmental flow recommendations for their respective areas. The recommendations and the Sabine and Neches Executive Summary (ES) are accessible from the TCEQ. It is suggested that this information be reviewed by all interested persons. The ES describes, generally, the process undertaken and the recommendations made by the BBEST.

The recommendations prepared by the BBEST were considered by the stakeholder committee but were not adopted. The stakeholder committee provided recommendations for environmental flow standards to the TCEQ, which then underwent a rulemaking process resulting in the adoption of environmental flow standards for the Sabine and Neches river basins.

Environmental flow standards will impact the procurement of water rights in the future by creating a comprehensive process of evaluating environmental flow needs whenever a new water right application is processed. The process of approving water rights is likely to become more complex under the new environmental flow policies that will be implemented by the TCEQ. However, it is intended to result in more clarity as to how diversions can be made and better ensure that sufficient water is available in the streams and rivers of the State.

As a result of the implementation of new environmental flow standards, the operation of reservoirs will become more dependent on the development of an "accounting plan," which is a feature that the TCEQ is already implementing within the State. Whether such accounting plans will have a significant impact on the availability of water is not known at this time.

Standards adopted for the Sabine and Neches River basins have been incorporated into the analysis of feasible water management strategies for the purposes of the 2016 North East Texas Regional Water Plan.

The implementation of environmental flow standards will require more careful consideration of environmental flow needs during the process of water planning in Region D, as well as in other areas. In future planning cycles the NETRWPG will need to analyze potential new water rights and amendments to existing water rights in light of these standards to determine how the new environmental flow requirements are consistent with the long-term protection of the region's water, agricultural, and natural resources. Other studies, external to the SB 3 process, will also provide the opportunity for broader consideration of potential environmental flow needs in Region D and elsewhere. Such considerations are proffered herein within Chapter 8, to provide a basis for future planning efforts.

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CHAPTER 4 IDENTIFICATION OF WATER NEEDS

The objective of this chapter is to compare the water demands within the North East Texas Region, as presented in Chapter 2, with currently available water supplies, as presented in Chapter 3. This chapter compares the demands and supplies of each Water User Group (WUG) within the Region to determine which entities are projected to encounter demands greater than their projected supplies, or water supply shortages. Water shortages for all six user group categories (municipal, manufacturing, mining, steam electric, irrigation, and livestock) are presented in three ways. First, shortages are presented at the county level. WUG's that span two or more counties are listed in each of the counties in which they are located. Second, shortages are shown by river basin. WUG's are listed in the river basin where the demands occur, rather than the basin where the supplies are located. If a WUG demand spans two or more river basins, it is divided proportionately between the appropriate basins. Finally, water shortages are presented for major water providers. If an entity obtains water from more than one major water provider, it is listed under each of its water sources.

Within the North East Texas Region, four types of water shortages have been identified. The first is caused by expiration of a water supply contract or permit. Most water supply contracts and permits have expiration dates, and the TWDB guidelines require that supplies based on contractual agreements should extend past the existing term of contract if the contract is renewable. In this chapter, an "E" will designate WUGs with shortages due to contract or permit expirations. In most cases, the recommended water supply strategy for these WUGs will be renewal of their existing contract/permit on or before its expiration date, and if supply is available from the seller. The second type of shortage is also contractual. These are instances where a contract expires or is for an insufficient volume, and the simple renewal of that contract will not adequately compensate for increased demands. In this case, an increase in the contract amount, or additional water supply sources, would be required to meet demands. This type of shortage is designated by "EI". The third type of shortage is modeled shortage, designated by "M". For this round of planning, groundwater supplies have been limited to those amounts determined by the official TWDB Groundwater Availability Model (GAM), which produces the Modeled Available Groundwater (MAG) for a given county/basin/aquifer. Those instances where available groundwater supply has been limited by the amount of the MAG have been identified so consideration may be given to the fact that no regulatory authority for groundwater pumping (i.e., a groundwater conservation district) exists within the region. The final type of shortage addressed in this region is the "actual" or "physical" water shortage, designated by an "A". In this case, the entity's current water supply will not be sufficient to meet projected demands and additional water sources will be required.

The NETRWPG (Region D) has considered the variety of actions and permit applications that may come before the TCEQ and the TWDB and does not want to unduly constrain projects or applications for small amounts of water that may not be specifically included in the adopted regional water plan. "Small amounts of water" is defined as involving no more than 1,000 acre feet per year, regardless of whether the action is for a temporary or long term action. The NETRWPG provides direction to TCEQ and TWDB regarding appropriations, permit amendments, and projects involving small amounts of water that will not have a significant impact on the region's water supply, such projects are consistent with the regional water plan, even though not specifically recommended in the plan.

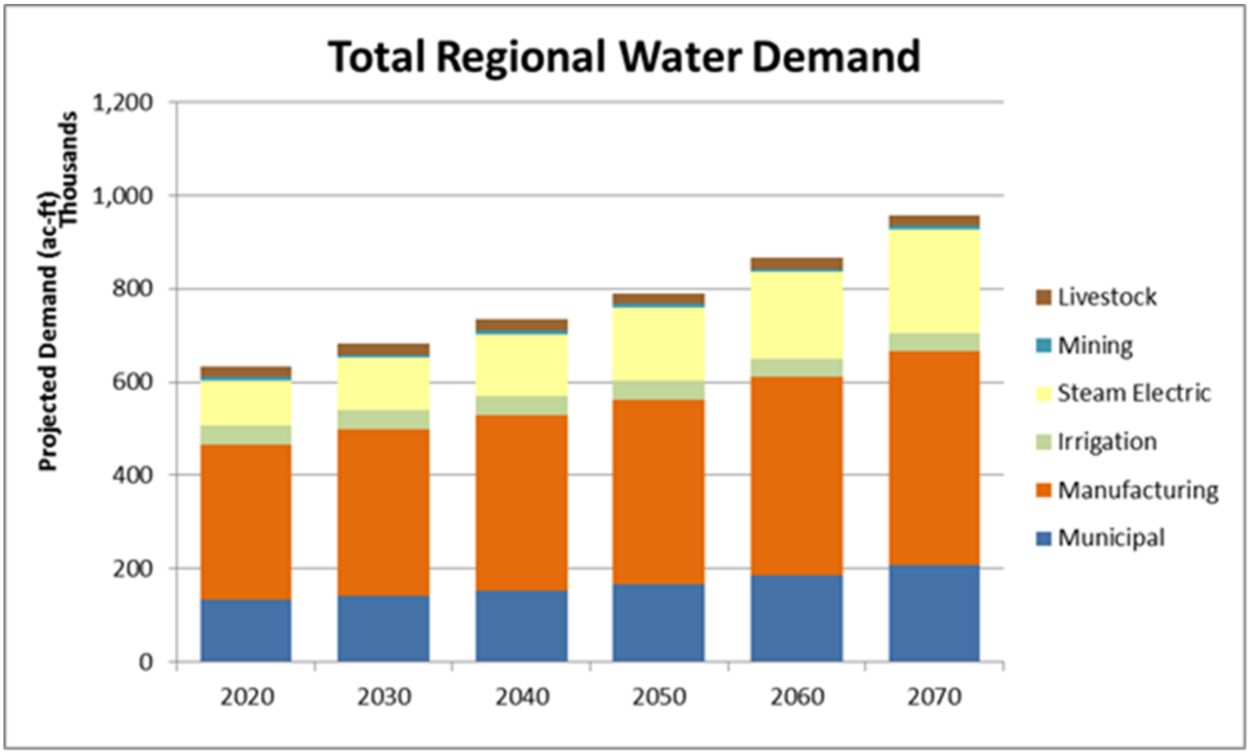


Figure 4.1 Projected Demands of the Six Water User Groups within Region D

4.1 COUNTY SUMMARIES OF WATER NEEDS

The following subsections, 4.1.1 through 4.1.49, identify water supply shortages in all six categories of water use within the North East Texas Region. The tables in this section list only the entities that have been determined to have water needs that exceed supply at some point within the planning period. Entities that are anticipated to have a surplus have been included in Table 4.58 at the end of this chapter.

4.1.1 Bowie County

The primary source of water in Bowie County is Wright Patman Lake. A majority of the industrial and municipal user groups have either the contractual authority to use water from Wright Patman, or direct contracts with the City of Texarkana (Texarkana Water Utilities) for water supply from Wright Patman. A summary of the estimated water supply shortages in Bowie County is listed below in Table 4.1. City of Texarkana and irrigation in Bowie County are projected to have shortages. City of Texarkana also imports water from Arkansas, and exports water to Texarkana, Arkansas. For this water plan, these imports and exports are assumed to offset one another, and Arkansas demand/supply has been excluded from the plan totals.

Table 4.1 Water Supply Shortages in Bowie County

Bowie County	Total Water Shortage in ac-ft/yr						Shortage
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**Type**
CENTRAL BOWIE COUNTY WSC	535	529	534	534	534	534	E
DE KALB	304	303	299	298	297	297	E
HOOKS	265	258	249	244	243	243	E
IRRIGATION	5,240	5,240	5,079	4,676	4,300	4,140	A
MACEDONIA-EYLAU MUD #1	565	574	577	577	577	577	EI
MANUFACTURING	1,544	1,679	1,810	1,922	2,080	2,251	E
MAUD	170	169	167	165	164	164	E
NASH	206	212	214	214	214	214	E
NEW BOSTON	1,098	1,104	1,094	1,091	1,089	1,089	E
REDWATER	82	82	79	77	77	77	E
TEXAMERICAS CENTER	514	527	529	528	528	528	E
TEXARKANA	12,771	12,960	12,938	12,865	12,852	12,851	A
WAKE VILLAGE	677	669	654	644	642	642	E

4.1.2 Camp County

Groundwater from the Carrizo-Wilcox Aquifer and surface water from the Northeast Texas Municipal Water District (Lake Bob Sandlin and Lake O' The Pines) supply the majority of water for Camp County. Bi-County WSC is projected to have shortages. A summary of the identified water supply shortages in Camp County is listed below in Table 4.2.

Table 4.2 Water Supply Shortages in Camp County

Camp County	Total Water Shortage in ac-ft/yr						Shortage
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**Type**
BI COUNTY WSC	0	0	0	0	113	226	A

4.1.3 Cass County

Cass County is supplied by the Carrizo-Wilcox and Queen City Aquifers and surface water from Lake O' the Pines and Wright Patman. One shortage has been identified for Manufacturing in Cass County. A summary of the identified water supply shortages in Cass County is listed below in Table 4.3.

Table 4.3 Water Supply Shortages in Cass County

Cass County	Total Water Shortage in ac-ft/yr						Shortage
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**Type**
MANUFACTURING	115	1,305	7,189	12,277	21,252	62,827	EI, A

4.1.4 Delta County

Delta County is primarily supplied by surface water from Big Creek Lake, Cooper Reservoir, Lake Tawakoni and run of river rights on the Sulphur River with supplemental supplies from groundwater in the Trinity, Nacatoch, and Woodbine aquifers. No water supply shortages have been identified in Delta County in this round of planning.

4.1.5 Franklin County

Both the Carrizo-Wilcox Aquifer and Lake Cypress Springs are important water supplies in Franklin County. The main wholesale water provider for customers in Franklin County is Franklin County Water District. The main retail suppliers are the City of Mt. Pleasant, and Cypress Springs Special Utility District (SUD). No water supply shortages have been identified in Franklin County in this round of planning.

4.1.6 Gregg County

The major surface water supply source in Gregg County is the Sabine River, which flows through the southern portion of the county and provides water for the cities of Kilgore and Longview. Longview also gets surface water from Lake Cherokee (Cherokee Water Company), Lake Fork (SRA), and Lake O' The Pines (NETMWD). Groundwater from the Carrizo-Wilcox is also a significant water source in the Region. The City of Gladewater is supplied by Lake Gladewater. The City of White Oak gets water from Big Sandy Creek. Mining in Gregg County is identified as having shortages throughout the planning period. A summary of the identified water supply shortages in Gregg County is presented as Table 4.4.

Table 4.4 Water Supply Shortages in Gregg County

Gregg County	Total Water Shortage in ac-ft/yr						Shortage
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**Type**
Mining	204	354	341	239	139	64	A

4.1.7 Harrison County

Harrison County uses groundwater from the Carrizo-Wilcox and Queen City Aquifers and surface water from Lake O' the Pines, Cherokee Lake, Lake Fork and the Sabine and Cypress Rivers. Significant water shortages in Harrison County have been identified during this planning effort. These shortages are related to well production capacity, insufficient contract amounts, and limitations in the representation of surface water availability in the current round of planning. The following table, Table 4.5, is a summary of identified water supply shortages in Harrison County.

Table 4.5 Water Supply Shortages in Harrison County

Harrison County	Total Water Shortage in ac-ft/yr						Shortage
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**Type**
IRRIGATION	233	233	233	233	233	233	A
MANUFACTURING	55,006	64,084	73,156	81,083	90,381	100,394	A
MARSHALL	0	0	0	0	41	701	EI
MINING	1,633	1,194	839	493	212	18	A
STEAM ELECTRIC POWER	0	0	3,122	8,107	14,184	22,464	A
WASKOM	6	20	37	67	104	148	A

4.1.8 Hopkins County

The Carrizo Wilcox and the Nacatoch aquifers are the main source of groundwater supply for the county while Cooper Lake, Sulphur Springs Lake, and Lake Tawakoni are the major sources of surface water. Contracts in Hopkins County are mostly with the City of Sulphur Springs. The City of Sulphur Springs has a contract with the Sulphur River MWD for water from Cooper Reservoir, and also has rights to Lake Sulphur Springs. The following table, Table 4.6, is a summary of identified water supply shortages in Hopkins County.

Table 4.6 Water Supply Shortages in Hopkins County

Hopkins County	Total Water Shortage in ac-ft/yr						Shortage
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**Type**
BRINKER WSC	0	0	0	0	29	63	EI, M
CUMBY	0	12	25	42	59	77	A
IRRIGATION	2,126	2,126	2,126	2,126	2,126	2,126	A, M
MARTIN SPRINGS WSC	0	0	0	0	43	115	A
MINING	227	283	360	444	533	639	M

4.1.9 Hunt County

Water shortages in Hunt County are both contractual and actual in nature. The Sabine River Authority (SRA) is the leading wholesale water provider for consumers in Hunt County. All SRA water from Lake Tawakoni and Lake Fork has been contracted; thus, there is no water available from these lakes to meet projected shortages. Water from Lake Lavon and the Greenville City Lakes are also used by some systems in the county. Groundwater is mainly from the Nacatoch, Woodbine and the Trinity aquifers. The following table, Table 4.7, is a summary of identified water supply shortages in Hunt County.

Table 4.7 Water Supply Shortages in Hunt County

Hunt County	Total Water Shortage in ac-ft/yr						Shortage
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**Type**
ABLES SPRINGS WSC	4	22	38	64	103	170	EI
BLACKLAND WSC	1	2	2	2	3	3	EI
CADDO BASIN SUD	54	213	343	520	799	1,242	A
CADDO MILLS	0	1	36	68	108	255	EI
CELESTE	0	0	0	28	100	204	A
COUNTY-OTHER	0	433	1,314	1,759	4,100	7,554	A
GREENVILLE	3,299	4,847	6,900	7,521	9,361	14,315	A
HICKORY CREEK SUD	0	0	95	416	882	1,568	A
IRRIGATION	146	146	146	146	146	146	A
JOSEPHINE	0	8	16	27	31	34	EI
LONE OAK	0	0	0	0	0	56	EI
MINING	73	64	35	19	7	0	A
NORTH HUNT SUD	0	0	99	235	431	713	EI
ROYSE CITY	4	12	20	26	40	61	EI
STEAM ELECTRIC POWER	12,085	14,188	16,751	19,877	23,687	28,213	EI
WOLFE CITY	0	0	0	30	128	271	A

4.1.10 Lamar County

Lamar County utilizes surface water from Crook Lake and Pat Mayse Reservoir and utilizes ground water from Trinity and Woodbine Aquifers. The City of Paris is the major supplier of surface water in the county. Irrigation in the county utilizes run-of-river supplies in the red river and groundwater. A summary of the identified water supply shortages in Lamar County is presented below in Table 4.8.

Table 4.8 Water Supply Shortages in Lamar County

Lamar County	Total Water Shortage in ac-ft/yr						Shortage
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**Type**
COUNTY-OTHER	67	81	83	96	107	116	EI
IRRIGATION	18,312	18,308	18,305	18,302	18,299	18,302	A, M
MANUFACTURING	565	592	620	642	685	951	A, M
STEAM ELECTRIC POWER	0	980	2,733	4,870	7,474	10,568	EI

4.1.11 **Marion County**

The Carrizo-Wilcox Aquifer and Lake O' The Pines supply most of the water demand in Marion County. The following table, Table 4.9, is a summary of identified water supply shortages in Marion County.

Table 4.9 Water Supply Shortages in Marion County

Marion County	Total Water Shortage in ac-ft/yr						Shortage
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**Type**
Mining	373	645	590	471	352	265	A

4.1.12 **Morris County**

Morris County is supplied surface water from Lake O' the Pines and Ellison Lakes and groundwater from the Carrizo-Wilcox and Queen City Aquifers. Direct reuse is also a supply for manufacturing in the county. The following table, Table 4.10, is a summary of identified water supply shortages in Morris County.

Table 4.10 Water Supply Shortages in Morris County

Morris County	Total Water Shortage in ac-ft/yr						Shortage
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**Type**
Manufacturing						2,763	A
Tri SUD	164	161	160	163	166	170	EI

4.1.13 **Rains County**

The Sabine River Authority, via Lakes Tawakoni and Fork, is the main wholesale water provider for Rains County. Groundwater is predominantly from the Carrizo-Wilcox. There are no identified water supply shortages in Rains County.

4.1.14 **Red River County**

Water supplies for Red River County are met by surface water from run-of-river rights, Pat Mayse Reservoir, Langford Lake, and Lake Wright Patman, while groundwater is provided from the Blossom, Nacatoch, Trinity and Woodbine aquifers. Irrigation supplies are from run-of-river water rights for which available supplies can be limited. The following table, Table 4.11, is a summary of identified water supply shortages in Marion County.

Table 4.11 Water Supply Shortages in Red River County

Red River County	Total Water Shortage in ac-ft/yr						Shortage
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**Type**
CLARKSVILLE	0	0	593	592	591	591	A
IRRIGATION	4,376	4,313	4,260	4,208	4,155	4,125	A, M
MANUFACTURING	0	0	7	7	8	9	A

4.1.15 Smith County

The portion of Smith County that is in the North East Texas Region is almost entirely supplied by the Carrizo-Wilcox Aquifer. Most projected shortages in this county are due to insufficient well capacity to withdraw water from the aquifer. The City of Tyler's supply comes from sources in Region I. A summary of the identified water supply shortages in Smith County is listed below as Table 4.12.

Table 4.12 Water Supply Shortages in Smith County

Smith County	Total Water Shortage in ac-ft/yr						Shortage
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**Type**
CRYSTAL SYSTEMS INC	29	221	432	669	944	1,194	A
HIDEAWAY	0	0	0	0	0	117	EI
LINDALE	100	278	485	731	1,025	1,375	A
MANUFACTURING	300	327	354	377	408	442	EI
MINING	0	0	0	0	8	45	M
OVERTON	17	18	21	23	27	31	A
WINONA	0	0	0	23	51	85	A

4.1.16 Titus County

Water supply in Titus County is predominately from Lakes Monticello, Bob Sandlin Welsh Reservoir, Lake O' the Pines, and Tankersley, and from the Carrizo-Wilcox Aquifer. Titus County Franklin County Water District (FWSD) supplies water to the City of Mount Pleasant. Mount Pleasant supplies county-other, and manufacturing demands in addition to its internal needs. A summary of the identified water supply shortages in Titus County is listed below in Table 4.13.

Table 4.13 Water Supply Shortages in Titus County

Titus County	Total Water Shortage in ac-ft/yr						Shortage
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**Type**
MANUFACTURING	3,603	3,719	3,833	4,058	4,733	5,440	A
STEAM ELECTRIC POWER	20,558	30,123	41,631	55,605	71,812	91,555	EI
TRI SUD	1,396	1,520	1,659	1,828	2,021	2,229	EI

4.1.17 **Upshur County**

Water supplies for Upshur County are met by surface water from Lake O' the Pines, Gilmer, and Gladewater Lakes and groundwater from the Carrizo-Wilcox aquifer. A summary of the identified water supply shortages in Upshur County is listed below in Table 4.14.

Table 4.14 Water Supply Shortages in Upshur County

Upshur County	Total Water Shortage in ac-ft/yr						Shortage
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**Type**
BI COUNTY WSC	0	0	0	0	23	45	A, M
GILMER	0	14	63	123	186	246	A, M
MANUFACTURING	266	285	306	324	349	376	A, M
MINING	378	725	770	608	449	332	A, M

4.1.18 **Van Zandt County**

Water supplies for Van Zandt County are met by surface water from Tawakoni, Fork, and Mill Creek Lakes, the Sabine River and groundwater from the Carrizo-Wilcox aquifer. The following table, Table 4.15, is a summary of identified water supply shortages in Van Zandt County.

Table 4.15 Water Supply Shortages in Van Zandt County

Van Zandt County	Total Water Shortage in ac-ft/yr						Shortage
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**Type**
ABLES SPRINGS WSC	1	0	2	2	3	2	EI
IRRIGATION	330	330	330	330	330	330	A
MANUFACTURING	158	175	191	204	240	287	A
R-P-M WSC	12	56	93	132	167	197	A

4.1.19 Wood County

Water supplies for Wood County are met by surface water from Cypress Springs Lake and Lake Fork and groundwater from the Carrizo-Wilcox aquifer. There are no identified water supply shortages in Wood County.

4.2 RIVER BASIN SUMMARIES OF WATER NEEDS

The North East Texas Regional Water Planning Area is divided among four main river basins including the Red River Basin, the Sulphur River Basin, the Cypress Creek Basin, and the Sabine River Basin. There is a small area of the Neches Basin in Van Zandt County and a smaller portion of the Trinity Basin in Hunt and Van Zandt Counties. These two basins are not discussed at length because of the small area situated within the North East Texas Region.

4.2.1 Red River Basin

The Red River Basin includes portions of Bowie, Lamar, and Red River Counties. Water shortages in the Red River Basin are both contractual and actual shortages. The largest volume of shortages is associated with Irrigation use, which utilizes groundwater and run-of-river water from the Red River. Table 4.16 and Table 4.17 detail the shortages in the basin.

Table 4.16 Water Shortages due to Expirations and Insufficient Contract Amounts – Red River Basin

Insufficient Contract	Water Shortage in ac-ft/yr					
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Central Bowie County Wsc	84	83	84	84	84	84
County-Other	46	61	61	65	69	71
De Kalb	47	47	46	46	46	46
Hooks	265	258	249	244	243	243
Manufacturing	9	10	11	13	14	16
New Boston	323	325	322	321	321	321
Steam Electric Power		980	2,733	4,870	7,474	10,568
Texamericas Center	88	90	90	90	90	90

Table 4.17 Actual Water Shortages – Red River Basin

Actual Shortages	Water Shortage in ac-ft/yr					
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Irrigation	20,053	19,968	19,887	19,571	19,379	19,235
Texarkana	1,507	1,530	1,527	1,518	1,517	1,517

4.2.2 Sulphur River Basin

The Sulphur River Basin includes portions of Bowie, Cass, Franklin, Hopkins, Hunt, Lamar, Morris, Red River, and Titus Counties. It also includes all of Delta County. Water shortages in the Sulphur Basin are primarily due to contract expirations, though there are several entities with projected actual water needs. Most of the actual needs are caused by insufficient supplies from groundwater sources. The cities of Wolfe City and Clarksville have inadequate surface water source in their city lakes. Table 4.18 and Table 4.19 detail the shortages in the basin.

Table 4.18 Water Shortages due to Expiration and Insufficient Contract Amounts – Sulphur River Basin

Insufficient Contract	Water Shortage in ac-ft/yr					
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Brinker Wsc					29	63
Central Bowie County Wsc	451	446	450	450	450	450
County-Other	21	20	22	31	38	45
De Kalb	257	256	253	252	251	251
Macedonia-Eylau Mud #1	565	574	577	577	577	577
Manufacturing	2,100	3,445	9,488	14,703	23,870	65,871
Maud	170	169	167	165	164	164
Mining	179	214	255	306	359	422
Nash	206	212	214	214	214	214
New Boston	775	779	772	770	768	768
North Hunt Sud			99	235	431	713
Redwater	82	82	79	77	77	77
Texamericas Center	426	437	439	438	438	438
Tri Sud	478	520	568	626	692	763
Wake Village	677	669	654	644	642	642

Table 4.19 Actual Water Shortages – Sulphur River Basin

Actual Shortages	Water Shortage in ac-ft/yr					
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Clarksville			593	592	591	591
Cumby		1	2	4	5	7
Hickory Creek Sud			36	153	320	560
Irrigation	10,034	10,052	9,916	9,774	9,534	9,491
Martin Springs Wsc					7	18
Texarkana	11,264	11,430	11,411	11,347	11,335	11,334
Wolfe City				30	128	271

4.2.3 Cypress Creek Basin

The Cypress Creek Basin includes portions of Cass, Franklin, Gregg, Harrison, Hopkins, Morris, Titus, Upshur, and Wood Counties, as well as all of Camp and Marion Counties. There is a projected shortage in manufacturing starting in year 2020, and steam electric will have a shortage in the Cypress Creek Basin starting year 2030. Table 4.20 and Table 4.21 detail the shortages in the basin.

Table 4.20 Water Shortages due to Expiration and Insufficient Contract Amounts – Cypress Creek Basin

Insufficient Contract	Water Shortage in ac-ft/yr					
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Marshall					7	123
Steam Electric Power	20,558	30,123	41,631	55,605	71,812	91,555
Tri Sud	1,082	1,161	1,251	1,365	1,495	1,636

Table 4.21 Actual Water Shortages – Cypress Creek Basin

Actual Shortages	Water Shortage in ac-ft/yr					
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Bi County Wsc					136	271
Gilmer		14	63	123	186	246
Irrigation	232	232	232	232	232	232
Manufacturing	3,984	4,125	4,266	4,514	5,223	8,730
Mining	964	1,422	1,325	999	734	555
Waskom	6	20	37	67	104	148

4.2.4 Neches River Basin

The Neches Basin includes portions of Van Zandt and Smith Counties. The Smith County portion is not located within the North East Texas Region and is not included. Supply shortages in the Neches River Basin are groundwater sources from the Carrizo-Wilcox Aquifer. Table 4.22 details the shortages in the basin.

Table 4.22 Actual Water Shortages – Neches River Basin

Actual Shortages	Water Shortage in ac-ft/yr					
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Crystal Systems Inc	12	105	219	356	510	642
Irrigation	330	330	330	330	330	330
Lindale	52	180	310	451	596	746
Mining	108	113	114	83	54	32
R-P-M Wsc	16	79	129	186	238	283

4.2.5 Sabine River Basin

The Sabine Basin includes portions of Gregg, Harrison, Hunt, Smith, Upshur, Van Zandt, and Wood Counties as well as all of Rains County. The Sabine Basin has both contractual and actual shortages, and many of the actual shortages are due to deficits in groundwater supply or production. Steam electric and manufacturing makes up a significant amount of the shortage in the Sabine Basin. Increasing growth in population also results in projected shortages for the City of Greenville. Table 4.23 and Table 4.24 detail the shortages in the basin.

Table 4.23 Water Shortages due to Expiration and Insufficient Contract Amounts – Sabine River Basin

Insufficient Contract	Water Shortage in ac-ft/yr					
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Ables Springs Wsc	5	22	40	66	106	172
Blackland Wsc	1	2	2	2	3	3
Caddo Mills		1	36	68	108	255
County-Other		433	1,314	1,759	4,100	7,554
Hideaway						117
Josephine		8	16	27	31	34
Lone Oak						56
Manufacturing	55,460	64,582	73,696	81,659	91,023	101,117
Marshall					34	578
Royse City	4	12	20	26	40	61
Steam Electric Power	12,085	14,188	19,873	27,984	37,871	50,677

Table 4.24 Actual Water Shortages – Sabine River Basin

Actual Shortages	Water Shortage in ac-ft/yr					
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Caddo Basin Sud	69	261	426	636	954	1,445
Celeste				28	100	204
Crystal Systems Inc	29	221	432	669	944	1,194
Cumby		11	23	38	54	70
Greenville	3,299	4,847	6,900	7,521	9,361	14,315
Hickory Creek Sud			47	204	432	769
Irrigation	109	109	109	109	109	109
Lindale	100	278	485	731	1,025	1,375
Martin Springs Wsc					36	97
Mining	1,743	1,627	1,354	968	607	386
Overton	17	18	21	23	27	31
Winona				23	51	85

4.2.6 Trinity River Basin

The Trinity Basin includes portions of Hunt and Van Zandt Counties. Both contractual and actual shortages have been identified and are presented in Table 4.25 and Table 4.26, respectively.

Table 4.25 Water Shortages due to Expiration and Insufficient Contract Amounts – Trinity River Basin

Insufficient Contract	Water Shortages in ac-ft/yr					
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Manufacturing	4	4	5	5	6	6
Mining	2	2	1	1		

Table 4.26 Actual Water Shortages – Trinity River Basin

Actual Shortages	Water Shortage in ac-ft/yr					
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Caddo Basin Sud	8	24	40	56	75	101
Hickory Creek Sud			18	74	156	272
Irrigation	5	5	5	5	5	5

4.3 SUMMARY OF NEEDS – WHOLESALE WATER PROVIDERS

The following section presents the supply/demand analysis for the 17 Wholesale Water Providers and additional WUG Sellers in the North East Texas Region that sell more than 1,000 acre-feet in any one year. Table 4.27 presents the summary of projected contractual needs by Wholesale Water Provider, which considers the potential full legal demand of WWP/WUG Sellers' customers. Subsequent tables present the total water supply for each major water provider assuming that current contracts, permits, and water rights are held constant. Demands in Tables 4.28 - 4.57 are comprised of current contracted customers at *projected demand*. While this method does not take into account that entities may use alternate water sources rather than increase contracts, and does not portray current contracted amounts as the full legal demand on supply, it gives major water providers a good approximation of what future demands will be if all current users continue with existing supplies and contracts at projected TWDB demands. A characterization of the full legal contractual demand on supply, by WWP and WUG seller, is presented in Table C3_2 in Chapter 3 of Appendix C.

Table 4.27 Projected Needs by Wholesale Water Provider

Name	WWP/WUG Seller	Use Category	County	Basin	2020	2030	2040	2050	2060	2070
BI COUNTY WSC	WUG/SELLER	MANUFACTURING	CAMP	CYPRESS	0	0	0	0	0	0
		STEAM ELECTRIC POWER	TITUS	CYPRESS	0	0	0	0	0	0
CASH SUD	WUG/WWP	MUNICIPAL	HUNT	SABINE	-280	-240	-191	-225	-260	-292
CHEROKEE WATER COMPANY	WWP	MUNICIPAL	GREGG	SABINE	0	0	0	0	0	0
		MUNICIPAL	HARRISON	SABINE	0	0	0	0	0	0
		STEAM ELECTRIC POWER	GREGG	SABINE	0	0	0	0	0	0
COMMERCE WD	WWP	MANUFACTURING	HUNT	SULPHUR	0	0	0	0	0	0
		MUNICIPAL	DELTA	SULPHUR	0	0	0	0	0	0
		MUNICIPAL	HUNT	SABINE	0	0	0	0	0	0
		MUNICIPAL	HUNT	SULPHUR	0	-5,409	-4,739	-3,425	-1,359	-377
		MUNICIPAL	HUNT	TRINITY	0	0	0	0	0	0
COOPER	WUG/SELLER	MUNICIPAL	DELTA	SULPHUR	0	0	0	0	0	0
		MUNICIPAL	HUNT	SABINE	0	0	0	0	0	0
COUNTY-OTHER, HUNT	WUG/SELLER	MANUFACTURING	HUNT	SABINE	0	0	0	0	0	0
CRYSTAL SYSTEMS INC	WUG/SELLER	MUNICIPAL	SMITH	SABINE	0	0	0	0	0	0
DETROIT	WUG/SELLER	MANUFACTURING	RED RIVER	SULPHUR	0	0	0	0	0	0
ELDERVILLE WSC	WUG/SELLER	MUNICIPAL	GREGG	SABINE	0	0	0	0	0	0
		MUNICIPAL	RUSK	SABINE	0	0	0	0	0	0
EMORY	WUG/WWP	MUNICIPAL	RAINS	SABINE	0	0	0	0	0	0
	WWP	MUNICIPAL	FRANKLIN	CYPRESS	-830	-830	-830	-830	-830	-830

Name	WWP/WUG Seller	Use Category	County	Basin	2020	2030	2040	2050	2060	2070
FRANKLIN COUNTY WD		MUNICIPAL	FRANKLIN	SULPHUR	-109	-109	-109	-109	-108	-108
		MUNICIPAL	HOPKINS	CYPRESS	-129	-129	-129	-129	-129	-129
		MUNICIPAL	HOPKINS	SULPHUR	-21	-21	-21	-21	-21	-21
		MUNICIPAL	TITUS	CYPRESS	-1,311	-1,551	-1,791	-2,031	-2,281	-2,519
		MUNICIPAL	TITUS	SULPHUR	-6	-6	-6	-6	-7	-7
		MUNICIPAL	WOOD	CYPRESS	-61	-61	-61	-61	-61	-61
		MUNICIPAL	WOOD	SABINE	-65	-65	-65	-65	-65	-65
GLADEWATER	WUG/SELLER	MUNICIPAL	GREGG	SABINE	0	0	0	0	0	0
		MUNICIPAL	SMITH	SABINE	0	0	0	0	0	0
		MUNICIPAL	UPSHUR	CYPRESS	0	0	0	0	0	0
		MUNICIPAL	UPSHUR	SABINE	0	0	0	0	0	0
GOLDEN WSC	WUG/SELLER	MANUFACTURING	VAN ZANDT	SABINE	0	0	0	0	0	0
GRAND SALINE	WUG/SELLER	MANUFACTURING	VAN ZANDT	SABINE	0	0	0	0	0	0
GREENVILLE	WUG/WWP	MANUFACTURING	HUNT	SABINE	0	0	0	0	0	0
		MINING	HUNT	SABINE	0	0	0	0	0	0
		MINING	HUNT	SULPHUR	0	0	0	0	0	0
		MINING	HUNT	TRINITY	0	0	0	0	0	0
		MUNICIPAL	HUNT	SABINE	0	0	0	0	0	0
		STEAM ELECTRIC POWER	HUNT	SABINE	0	0	0	0	0	0
KILGORE	WUG/SELLER	MUNICIPAL	GREGG	CYPRESS	0	0	0	0	0	0
		MUNICIPAL	GREGG	SABINE	0	0	0	0	0	0
		MUNICIPAL	RUSK	SABINE	0	0	0	0	0	0
LAMAR COUNTY WSD	WUG/WWP	MANUFACTURING	LAMAR	RED	0	0	0	0	0	0
		MUNICIPAL	LAMAR	RED	0	0	0	0	0	0
		MUNICIPAL	LAMAR	SULPHUR	0	0	0	0	0	0

Name	WWP/WUG Seller	Use Category	County	Basin	2020	2030	2040	2050	2060	2070
		MUNICIPAL	RED RIVER	RED	-139	-139	-139	-139	-139	-139
		MUNICIPAL	RED RIVER	SULPHUR	0	0	0	0	0	0
LONGVIEW	WUG/WWP	MANUFACTURING	GREGG	SABINE	0	0	0	0	0	0
		MANUFACTURING	HARRISON	SABINE	0	0	0	0	0	0
		MUNICIPAL	GREGG	SABINE	0	0	0	0	0	0
		MUNICIPAL	HARRISON	CYPRESS	0	0	0	0	0	0
		MUNICIPAL	HARRISON	SABINE	0	0	0	0	0	0
		MUNICIPAL	RUSK	SABINE	0	0	0	0	0	0
		STEAM ELECTRIC POWER	HARRISON	SABINE	0	0	0	0	0	0
MABANK	WUG/SELLER	MUNICIPAL	VAN ZANDT	TRINITY	0	-6	-37	-72	-108	-147
MARSHALL	WUG/WWP	MANUFACTURING	HARRISON	CYPRESS	0	0	0	0	0	0
		MANUFACTURING	HARRISON	SABINE	0	0	0	0	0	0
		MUNICIPAL	HARRISON	CYPRESS	0	0	0	0	0	0
		MUNICIPAL	HARRISON	SABINE	0	0	0	0	0	0
		MUNICIPAL	PANOLA	SABINE	0	0	0	0	0	0
MOUNT PLEASANT	WUG/WWP	MANUFACTURING	TITUS	CYPRESS	0	0	0	0	0	0
		MUNICIPAL	FRANKLIN	SULPHUR	0	0	0	0	0	0
		MUNICIPAL	MORRIS	CYPRESS	-293	-326	-348	-368	-385	-411
		MUNICIPAL	TITUS	CYPRESS	-293	-326	-348	-368	-385	-411
		MUNICIPAL	TITUS	SULPHUR	-294	-326	-349	-368	-385	-411
NORTH TEXAS MWD	WWP	MUNICIPAL	COLLIN	SABINE	-14	-49	-80	-113	-151	-199
		MUNICIPAL	COLLIN	TRINITY	-7	-25	-40	-58	-75	-99
		MUNICIPAL	HOPKINS	SABINE	0	-1	-4	-4	-5	-4
		MUNICIPAL	HUNT	SABINE	-182	-672	-1,088	-1,398	-1,790	-2,339
		MUNICIPAL	HUNT	SULPHUR	0	-6	-10	-13	-15	-16
		MUNICIPAL	HUNT	TRINITY	0	-1	-2	-6	-1	-3

Name	WWP/WUG Seller	Use Category	County	Basin	2020	2030	2040	2050	2060	2070
		MUNICIPAL	RAINS	SABINE	-4	-13	-19	-19	-17	-17
		MUNICIPAL	ROCKWALL	SABINE	-7	-27	-48	-56	-62	-71
NORTHEAST TEXAS MWD	WWP	MANUFACTURING	MORRIS	CYPRESS	0	0	0	0	0	0
		MINING	TITUS	CYPRESS	-246	-547	-724	-828	-921	-1,664
		MUNICIPAL	CAMP	CYPRESS	-11,244	-11,244	-11,244	-11,244	-11,244	-11,244
		MUNICIPAL	CASS	CYPRESS	-3,455	-3,455	-3,455	-3,455	-3,455	-3,455
		MUNICIPAL	GREGG	CYPRESS	-229	-229	-229	-229	-229	-229
		MUNICIPAL	GREGG	SABINE	-185	-185	-185	-185	-185	-185
		MUNICIPAL	HARRISON	CYPRESS	-285	-285	-285	-285	-285	-285
		MUNICIPAL	HARRISON	SABINE	0	0	0	0	0	0
		MUNICIPAL	MARION	CYPRESS	-6,178	-6,178	-6,178	-6,178	-6,178	-6,178
		MUNICIPAL	MORRIS	CYPRESS	-8,579	-8,579	-8,579	-8,579	-8,579	-8,579
		MUNICIPAL	UPSHUR	CYPRESS	-492	-492	-492	-492	-492	-492
		STEAM ELECTRIC POWER	HARRISON	SABINE	0	0	0	0	0	0
		STEAM ELECTRIC POWER	MARION	CYPRESS	0	0	0	0	0	0
		STEAM ELECTRIC POWER	TITUS	CYPRESS	-30,561	-40,126	-51,634	-65,608	-82,390	-102,103
PARIS	WUG/WWP	MANUFACTURING	LAMAR	SULPHUR	0	0	0	0	0	0
		MUNICIPAL	LAMAR	RED	-1,131	-1,103	-1,075	-1,055	-1,017	-1,011
		MUNICIPAL	LAMAR	SULPHUR	-755	-735	-717	-704	-677	-673
		STEAM ELECTRIC POWER	LAMAR	RED	0	0	0	0	0	0
POINT	WUG/SELLER	MANUFACTURING	RAINS	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	WWP	MINING	HARRISON	CYPRESS	0	0	0	0	0	0
		MINING	HARRISON	SABINE	0	0	0	0	0	0

Name	WWP/WUG Seller	Use Category	County	Basin	2020	2030	2040	2050	2060	2070
		MUNICIPAL	GREGG	SABINE	-1,055	0	0	0	0	0
		MUNICIPAL	HOPKINS	SABINE	-15	0	0	0	0	0
		MUNICIPAL	HUNT	SABINE	-6,722	0	0	0	0	0
		MUNICIPAL	HUNT	SULPHUR	-40	0	0	0	0	0
		MUNICIPAL	KAUFMAN	SABINE	-61	0	0	0	0	0
		MUNICIPAL	KAUFMAN	TRINITY	-8	0	0	0	0	0
		MUNICIPAL	RAINS	SABINE	-1,324	0	0	0	0	0
		MUNICIPAL	ROCKWALL	SABINE	-187	0	0	0	0	0
		MUNICIPAL	RUSK	SABINE	-324	0	0	0	0	0
		MUNICIPAL	VAN ZANDT	SABINE	-1,730	0	0	0	0	0
		MUNICIPAL	VAN ZANDT	TRINITY	-1,165	0	0	0	0	0
		MUNICIPAL	WOOD	SABINE	-719	0	0	0	0	0
		WWP	(blank)	(blank)	-5,857	0	0	0	0	0
SULPHUR RIVER MWD	WWP	MUNICIPAL	DELTA	SULPHUR	0	0	0	0	0	0
		MUNICIPAL	HOPKINS	SABINE	0	0	0	0	0	0
		MUNICIPAL	HOPKINS	SULPHUR	0	0	0	0	0	0
SULPHUR SPRINGS	WUG/WWP	LIVESTOCK	HOPKINS	SULPHUR	0	0	0	0	0	0
		MANUFACTURING	HOPKINS	SULPHUR	0	0	0	0	0	0
		MANUFACTURING	HUNT	SABINE	0	0	0	0	0	0
		MINING	HOPKINS	CYPRESS	0	0	0	0	0	0
		MINING	HOPKINS	SABINE	0	0	0	0	0	0
		MINING	HOPKINS	SULPHUR	0	0	0	0	0	0
		MINING	TITUS	CYPRESS	0	0	0	0	0	0
		MUNICIPAL	HOPKINS	SABINE	0	0	0	0	0	0
		MUNICIPAL	HOPKINS	SULPHUR	0	0	0	0	0	0
TERRELL	WUG/SELLER	MUNICIPAL	HUNT	SABINE	-21	-85	-149	-235	-395	-646
		MUNICIPAL	HUNT	SULPHUR	0	0	0	0	0	0

Name	WWP/WUG Seller	Use Category	County	Basin	2020	2030	2040	2050	2060	2070
		MUNICIPAL	HUNT	TRINITY	0	-2	-3	-10	-2	-8
TEXARKANA	WUG/WWP	MANUFACTURING	BOWIE	RED	-1,258	-1,367	-1,472	-1,563	-1,690	-1,788
		MANUFACTURING	BOWIE	SULPHUR	-1,257	-1,366	-1,472	-1,562	-1,689	-1,787
		MANUFACTURING	CASS	SULPHUR	0	0	0	0	0	-31,990
		MUNICIPAL	BOWIE	RED	-14,832	-14,835	-14,835	-14,830	-14,828	-14,826
		MUNICIPAL	BOWIE	SULPHUR	-16,259	-16,259	-16,255	-16,250	-16,247	-16,245
		MUNICIPAL	CASS	CYPRESS	-182	-182	-182	-182	-182	-182
		MUNICIPAL	CASS	SULPHUR	-609	-612	-615	-617	-617	-619
		MUNICIPAL	RED RIVER	RED	-201	-201	-201	-201	-201	-201
		MUNICIPAL	RED RIVER	SULPHUR	-200	-200	-200	-200	-200	-200
TITUS COUNTY FWD #1	WWP	MUNICIPAL	TITUS	CYPRESS	0	0	0	0	0	0
		STEAM ELECTRIC POWER	TITUS	CYPRESS	0	0	0	0	0	0
TRI SUD	WUG/SELLER	MINING	TITUS	CYPRESS	-7	-7	-7	-7	-7	-7
TYLER	WUG/WWP	MUNICIPAL	SMITH	NECHES	0	0	0	0	0	0
WHITE OAK	WUG/SELLER	MUNICIPAL	GREGG	SABINE	0	0	0	0	0	0
		MUNICIPAL	UPSHUR	CYPRESS	0	0	0	0	0	0
		MUNICIPAL	UPSHUR	SABINE	0	0	0	0	0	0
TOTAL					-121,418	-118,612	-130,642	-144,383	-160,349	-213,273

4.3.1 Cash SUD

Cash SUD is a public water supply located primarily in Hunt County. The water supply corporation sells water to the City of Lone Oak and the City of Quinlan. In addition to meeting the needs of its retail customers, Cash SUD supplies water to consumers in Hunt, Hopkins, Rains and Rockwall counties. Current water supply is from the Sabine River Authority (SRA) and North Texas Municipal Water District (NTMWD). Cash SUD is not projected to have any water supply deficits in the current planning period. Supplies and demands are shown in Table 4.28.

Table 4.28 Water Supplies and Demands for Cash SUD

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Cooper Reservoir	155	174	198	182	165	151
Lake Fork	891	3,949	3,929	3,911	3,894	3,876
Indirect Reuse - Lavon	178	239	309	322	294	269
Indirect Reuse - East Fork	180	267	366	391	400	385
Lake Lavon	325	365	414	380	345	313
Lake Tawakoni	958	878	878	867	856	845
Lake Texoma	265	300	343	317	289	264
TOTAL	**2,952**	**6,172**	**6,437**	**6,370**	**6,243**	**6,103**

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
Lone Oak, City of	164	164	164	164	164	164
Quinlan, City of	325	365	414	380	345	313
Non-Contractual:						
Cash SUD	2,296	2,669	3,136	3,714	4,425	5,276
TOTAL	**2,785**	**3,198**	**3,714**	**4,258**	**4,934**	**5,753**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
TOTAL	**167**	**2,974**	**2,723**	**2,112**	**1,309**	**350**

While Cash SUD does not have any projected water supply shortages, one of its customers, the City of Lone Oak, is projected to have a shortage in 2070. Table 4.29 presents the customer WUGs with projected shortages.

Table 4.29 Cash SUD Customer Entity Shortages

Needs (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Lone Oak	0	0	0	0	0	56
TOTAL	**0**	**0**	**0**	**0**	**0**	**56**

4.3.2 Cherokee Water Company

This provider supplies the City of Longview and industry with surface water supply from Lake Cherokee in Gregg and Rusk Counties, Region I. Longview obtains water from three major water providers, Cherokee Water, Sabine River Authority, and Northeast Texas Municipal Water District, as well as owning water rights from the Sabine River. Assuming contract amounts stay constant over the 2020 – 2070 planning period,at TWDB projected demands Cherokee Water Company will have adequate supply, as shown in Table 4.30.

Table 4.30 Water Supplies and Demands for Cherokee Water Company

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Lake Cherokee	28,650	28,415	28,180	27,945	27,710	27,477
TOTAL	**28,650**	**28,415**	**28,180**	**27,945**	**27,710**	**27,477**

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
City of Longview	18,000	18,000	18,000	18,000	18,000	18,000
Steam Electric	2,000	2,000	2,000	2,000	2,000	2,094
TOTAL	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,094**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
TOTAL	**8,650**	**8,415**	**8,180**	**7,945**	**7,710**	**7,383**

4.3.3 City of Commerce (Commerce Water District)

The City of Commerce is served by the Commerce Water District, located in Hunt County, which buys most of its water from the Sabine River Authority, with additional supply from five wells into the Nacatoch Aquifer. The city also has a contract with the Sulphur River Municipal Water District (SRMWD) for 16,000 ac-ft/yr, which has been leased to the Upper Trinity for 50 years. Commerce supplies North Hunt SUD, rural areas in Delta and Hunt Counties, and Manufacturing in Hunt County. In addition, Commerce Water District serves its own municipal needs. Available supplies and demands are shown in Table 4.31.

Table 4.31 Water Supplies and Demands for Commerce

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Lake Tawakoni	2,379	8,127	7,940	8,197	6,828	7,040
Nacatoch Aquifer	371	371	371	371	371	371
TOTAL	**2,750**	**8,498**	**8,311**	**8,568**	**7,199**	**7,411**

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
County-Other, Delta	545	548	551	553	553	481
County-Other, Hunt	293	437	655	1,868	2,086	2,573
Manufacturing, Hunt	338	401	470	535	580	650
North Hunt SUD	147	147	147	147	147	147
Non-Contractual:						
Commerce	1,427	6,965	6,488	5,465	3,833	3,486
TOTAL	**2,750**	**8,498**	**8,311**	**8,568**	**7,199**	**7,337**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
TOTAL	**0**	**0**	**0**	**0**	**0**	**74**

Customers of the City of Commerce are projected to have shortages beginning in 2030. Table 4.32presents the City of Commerce customer WUGs with projected shortages.

Table 4.32 City of Commerce Customer Entity Shortages

Needs (ac-ft/yr)	2020	2030	2040	2050	2060	2070
County-Other, Hunt	0	432	1,313	1,754	4,100	7,553
North Hunt SUD	0	0	99	235	431	713
TOTAL	**0**	**432**	**1,412**	**1,989**	**4,531**	**8,266**

4.3.4 **City of Emory**

The City of Emory supplies East Tawakoni and rural portions of Rains County. In addition, the city serves its own municipal needs. The City of Emory buys water from the Sabine River Authority. The current contract with the authority is for 3,229 ac-ft/yr. Emory is projected to have a water surplus of 305 ac-ft/yr in 2030 and 263 ac-ft/yr in 2070. Available supplies and demands are shown in Table 4.33.

Table 4.33 Water Supplies and Demands for City of Emory

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Lake Fork	498	827	819	811	804	796
Lake Tawakoni	1,091	1,091	1,091	1,091	1,091	1,091
TOTAL	**1,589**	**1,918**	**1,910**	**1,902**	**1,895**	**1,887**

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
County-Other, Rains	318	318	318	318	318	318
East Tawakoni	773	773	773	773	773	773
Non-Contractual:						
Emory Municipal	498	522	527	530	532	533
TOTAL	**1,589**	**1,613**	**1,618**	**1,621**	**1,623**	**1,624**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
TOTAL	**0**	**305**	**292**	**281**	**272**	**263**

4.3.5 Franklin County Water District

The Franklin County Water District (FCWD) holds water rights in Lake Cypress Springs of 15,300 ac-ft, which exceeds the firm yield calculated for the reservoir using the Cypress Basin WAM. FCWD serves wholesale customers only, and these customers include Cypress Springs SUD, the City of Mount Vernon, and the City of Winnsboro. Available supplies and demands are shown in Table 4.34.

Table 4.34 Water Supplies and Demands for Franklin County Water District

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Lake Cypress Springs	12,100	11,700	11,300	11,000	10,600	10,200
TOTAL	**12,100**	**11,700**	**11,300**	**11,000**	**10,600**	**10,200**

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
Cypress Springs SUD	3,494	3,494	3,494	3,494	3,494	3,494
City of Mt. Pleasant	2,203	1,963	1,723	1,483	1,233	995
City of Mount Vernon	3,000	3,000	3,000	3,000	3,000	3,000
City of Winnsboro	1,771	1,771	1,771	1,771	1,771	1,771
TOTAL	**10,468**	**10,228**	**9,988**	**9,748**	**9,498**	**9,260**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
TOTAL	**1,632**	**1,472**	**1,312**	**1,252**	**1,102**	**940**

4.3.6 Lamar County Water Supply District

Lamar County Water Supply District (LCWSD) buys water from the City of Paris, the source being Pat Mayse Lake. The water district supplies water to several other water supply companies and cities, manufacturing, and its own retail needs. As shown in Table 4.35, LCWSD has a water supply surplus.

Table 4.35 Water Supplies and Demands for Lamar County Water Supply District

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Pat Mayse Lake	11,556	11,604	11,650	11,683	11,748	11,758
TOTAL	**11,556**	**11,604**	**11,650**	**11,683**	**11,748**	**11,758**

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
Blossom	216	230	245	245	245	245
County-Other, Lamar	274	280	285	283	281	279
County-Other, Red River	253	250	247	247	247	247
Deport	107	113	120	120	120	120
Detroit	41	41	41	41	41	41
Manufacturing, Lamar	858	900	941	976	1,042	1,077
Red River County WSC	184	184	184	184	184	184
Reno	628	699	754	814	873	935
Roxton	104	111	118	118	118	118
Non-Contractual:						
Lamar County WSD	2,217	2,239	2,253	2,281	2,316	2,350
TOTAL	**4,882**	**5,047**	**5,188**	**5,309**	**5,467**	**5,596**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
TOTAL	**6,674**	**6,557**	**6,462**	**6,374**	**6,281**	**6,162**

While LCWSD does not have any projected water supply shortages, two customers are projected to have shortages beginning 2020. Table 4.36presents the customer WUGs with projected shortages.

Table 4.36 LCWSD Customer Entity Shortages

Needs (ac-ft/yr)	2020	2030	2040	2050	2060	2070
County-Other, Lamar	67	81	83	96	107	116
Manufacturing, Lamar	466	489	512	531	568	863
TOTAL	**533**	**570**	**595**	**627**	**675**	**979**

4.3.7 Northeast Texas Municipal Water District

Northeast Texas Municipal Water District (NETMWD) obtains water from numerous sources, listed below, and supplies the cities of Avinger, Daingerfield, Hughes Springs, Jefferson, Lone Star, Longview, Marshall, Ore City, and Pittsburg. Also supplied are Diana SUD, Harleton WSC, Tryon Road SUD, and Mims WSC. The NETMWD has existing contracts to supply an aggregate of 46,668 ac-ft to three power plants owned by AEP-SWEPCO and one power plant operated by Luminant. U.S. Steel has a contractual right to 32,400 ac-ft of water in Lake O' the Pines. The NETMWD is projected to maintain a supply surplus throughout the planning period, which is shown in Table 4.37.

Table 4.37 Water Supplies and Demands for Northeast Texas Municipal Water District

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Lake O' The Pines	151,600	151,000	150,500	150,000	149,500	149,000
Lake Bob Sandlin	11,885	11,883	11,881	11,879	11,876	11,874
Ellison Creek Lake	13,857	13,857	13,857	13,857	13,857	13,857
Lake Monticello	5,000	4,500	4,000	3,400	2,900	2,400
Welsh Lake	3,000	2,800	2,600	2,400	2,100	1,800
TOTAL	**185,342**	**184,040**	**182,838**	**181,536**	**180,233**	**178,931**

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
County-Other, Cass	302	302	302	302	302	302
County-Other, Harrison	68	68	68	68	68	68
County-Other, Marion	178	178	178	178	178	178
Daingerfield	1,582	1,582	1,582	1,582	1,582	1,582
Diana SUD	595	595	595	595	595	595
Hughes Springs	656	656	656	656	656	656
Jefferson	1,509	1,509	1,509	1,509	1,509	1,509
Lone Star	747	747	747	747	747	747
Longview	20,000	20,000	20,000	20,000	20,000	20,000
Manufacturing, Morris	45,437	45,437	45,437	45,437	45,437	45,437
Marshall	9,000	9,000	9,000	9,000	9,000	9,000
Mining, Titus	1,398	1,228	1,185	1,227	1,295	728
Ore City	1,504	1,504	1,504	1,504	1,504	1,504
Pittsburg	1,344	1,344	1,344	1,344	1,344	1,344
Steam Electric Power, Harrison	18,000	18,000	18,000	18,000	18,000	18,000
Steam Electric Power, Marion	6,668	6,668	6,668	6,668	6,668	6,668
Steam Electric Power, Titus	21,862	21,162	20,462	19,662	18,939	18,600
Tryon Road SUD	1,822	1,822	1,822	1,822	1,822	1,822
TOTAL	**132,672**	**131,802**	**131,059**	**130,301**	**129,646**	**128,740**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
TOTAL	**52,670**	**52,238**	**51,779**	**51,235**	**50,587**	**50,191**

While NETMWD does not have any projected water supply shortages, NETMWD customers are projected to have shortages beginning in 2020. Table 4.38 presents the customer WUGs with projected shortages.

Table 4.38 NETMWD Customer Entity Shortages

Needs (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Manufacturing, Morris	0	0	0	0	0	2,763
Marshall	0	0	0	0	41	701
Steam Electric Power, Harrison	0	0	3,122	8,107	14,184	22,464
Steam Electric Power, Titus	20,558	30,123	41,631	55,605	71,812	91,555
TOTAL	**20,558**	**30,123**	**44,753**	**63,712**	**86,037**	**117,483**

4.3.8 Sabine River Authority

The Sabine River Authority (SRA) holds water rights in Lake Fork (Wood and Rains Counties) and Lake Tawakoni (Hunt, Rains, and Van Zandt Counties). The SRA supplies the cities of Commerce, Edgewood, Emory, Greenville, Quitman, Kilgore, Longview, Point, West Tawakoni, Wills Point, the Ables Springs WSC, Cash SUD, Combined Consumers SUD, MacBee SUD and South Tawakoni, as well as industry. SRA also serves customers in other regions, but only Region D customers are identified in Table 4.39.

Table 4.39 Water Supplies and Demands for the Sabine River Authority

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Lake Tawakoni	229,415	227,709	226,005	224,305	222,587	220,886
Lake Fork	167,186	165,206	163,226	161,246	159,266	157,286
TOTAL	396,601	392,915	389,231	385,551	381,853	378,172

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
Bright Star-Salem SUD	0	840	840	840	840	840
Cash SUD	1,651	4,780	4,753	4,728	4,704	4,679
Combined Consumers SUD	2,506	2,537	2,561	2,591	2,624	2,651
Commerce WD	2,379	8,127	7,940	8,197	6,828	7,040
Edgewood	113	781	776	770	764	759
Emory	1,589	1,918	1,910	1,902	1,895	1,887

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Greenville	7,967	11,093	11,292	11,507	11,698	11,895
Kilgore	2,545	3,924	3,924	3,924	3,924	3,924
Longview	20,000	20,000	20,000	20,000	20,000	20,000
Macbee SUD	427	2,051	2,035	2,019	2,003	1,987
Mining, Harrison	140	140	140	140	140	140
Point	223	258	255	252	249	246
Quitman	300	1,012	1,004	997	990	983
South Tawakoni Wsc	400	1,041	1,033	1,025	1,018	1,010
West Tawakoni	186	1,064	1,056	1,047	1,039	1,031
Wills Point	2,001	2,075	2,060	2,044	2,029	2,013
TOTAL	**42,427**	**61,641**	**61,579**	**61,983**	**60,745**	**61,085**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
TOTAL	**0**	**0**	**0**	**0**	**0**	**0**

Two of the SRA's Region D customers have water shortages, presented in Table 4.40.

Table 4.40 Sabine River Authority Region D Customer Entity Shortages

Needs (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Greenville	3,299	4,847	6,900	7,521	9,361	14,315
Mining, Harrison	1,633	1,194	839	493	154	0
TOTAL	**4,932**	**6,041**	**7739**	**8,014**	**9,515**	**14,315**

4.3.9 Sulphur River Municipal Water District

The Sulphur River Municipal Water District Authority (SRMWD) holds water rights in Cooper Lake. The City of Commerce, City of Cooper and City of Sulphur Springs are the three member cities constituting the SRMWD. Water supplies and demands for the SRMWD are presented in Table 4.41.

Table 4.41 Water Supplies and Demands for the SRMWD

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Cooper Reservoir	15,027	14,930	14,834	14,738	14,641	14,545
TOTAL	**15,027**	**14,930**	**14,834**	**14,738**	**14,641**	**14,545**

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
Cooper	838	832	827	822	816	811
Sulphur Springs	14,189	14,098	14,007	13,916	13,825	13,734
TOTAL	**15,027**	**14,930**	**14,834**	**14,738**	**14,641**	**14,545**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
TOTAL	**0**	**0**	**0**	**0**	**0**	**0**

4.3.10 Titus County Fresh Water Supply District (TCFWSD) No.1

TCFWSD supplies the City of Mount Pleasant and Texas Utilities with water from Lake Bob Sandlin. TCFWSD has no uncommitted water supply in Lake Bob Sandlin. No shortages are projected for this system as shown in Table 4.42.

Table 4.42 Water Supplies and Demands for Titus County Fresh Water Supply District

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Lake Bob Sandlin	48,500	48,500	48,500	48,500	48,500	48,500
TOTAL	**48,500**	**48,500**	**48,500**	**48,500**	**48,500**	**48,500**

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
Mt. Pleasant	10,000	10,000	10,000	10,000	10,000	10,000
Steam Electric Power, Titus	10,000	10,000	10,000	10,000	10,000	10,000
TOTAL	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
TOTAL	**28,500**	**28,500**	**28,500**	**28,500**	**28,500**	**28,500**

One of the TCFWSD's customers has water shortages, as presented in Table 4.43.

Table 4.43 TCFWSD Customer Entity Shortages

Needs (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Steam Electric Power, Titus	20,558	30,123	41,631	55,605	71,812	91,555
TOTAL	**20,558**	**30,123**	**41,631**	**55,605**	**71,812**	**91,555**

4.3.11 City of Greenville

Greenville owns several small city lakes, which have a combined firm yield of 3,350 ac-ft. In addition, Greenville has a contract with the Sabine River Authority for supply from Lake Tawakoni. Greenville supplies water to its own municipal, mining, and industrial customers as well as Jacobia WSC, Shady Grove WSC, and the City of Caddo Mills. The City currently owns and operates a 13 MGD WTP. As shown in Table 4.44, Greenville has a water supply surplus until 2050, at which point a water supply deficit is projected.

Table 4.44 Water Supplies and Demands for the City of Greenville

SUPPLIES (ac-ft)	2020	2030	2040	2050	2060	2070
Lake Tawakoni	7,967	11,093	11,292	11,507	11,698	11,895
City Lakes	3,350	3,350	3,350	3,350	3,350	3,350
TOTAL	**11,317**	**14,443**	**14,642**	**14,857**	**15,048**	**15,245**

DEMAND (ac-ft)	2020	2030	2040	2050	2060	2070
Contractual:						
Caddo Mills	178	186	201	242	309	319
County-Other, Hunt	1,064	1,064	1,064	1,064	1,064	1,064
Manufacturing, Hunt	797	965	1146	1319	1438	1624
Mining, Hunt	19	20	23	24	29	30
Steam Electric Power, Hunt	351	351	351	351	351	351
Non-Contractual:						
Greenville Municipal	8,908	10,070	11,709	14,051	17,451	22,405
TOTAL	**11,317**	**12,656**	**14,494**	**17,051**	**20,642**	**25,793**

SURPLUS (ac-ft)	2020	2030	2040	2050	2060	2070
TOTAL	**0**	**1,787**	**148**	**-2,194**	**-5,594**	**-10,548**

Customers of City of Greenville are projected to have shortages beginning in 2020. Table 4.45 presents the City of Greenville customer WUGs with projected shortages.

Table 4.45 City of Greenville Customer Entity Shortages

Needs (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Caddo Mills	0	1	36	68	108	255
County-Other, Hunt	0	432	1,313	1,754	4,100	7,553
Mining, Hunt	73	64	35	19	7	0
Steam Electric Power, Hunt	12,085	14,188	16,751	19,877	23,687	28,213
TOTAL	**12,158**	**14,685**	**18,135**	**21,718**	**27,902**	**36,021**

4.3.12 City of Marshall

This water provider, located in Harrison County, supplies water to several water supply corporations including Cypress Valley WSC, Talley WSC, Gill WSC, and Leigh WSC, with water from the Big Cypress Bayou and Lake O' the Pines. It also supplies its own water needs. Marshall is projected to have a deficit of supplies beginning in 2060, which is shown in Table 4.46. The deficit is due to water rights from Big Cypress Bayou not being available in a drought of record.

Table 4.46 Water Supplies and Demands for the City of Marshall

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Big Cypress Bayou	0	0	0	0	0	0
Lake O' The Pines	9,000	9,000	9,000	9,000	9,000	9,000
TOTAL	**9,000**	**9,000**	**9,000**	**9,000**	**9,000**	**9,000**

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
County-Other, Harrison	323	323	323	323	323	323
Manufacturing	2,000	2,000	2,000	2,000	2,000	2,000
Gill WSC	100	100	100	100	100	100
Non-Contractual:						
Marshall	5,085	5,326	5,599	6,067	6,618	7,278
TOTAL	**7,508**	**7,749**	**8,022**	**8,490**	**9,041**	**9,701**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
TOTAL	**1,492**	**1,251**	**978**	**510**	**-41**	**-701**

Customers of the City of Marshall are projected to have shortages beginning in 2020. Table 4.47 presents the City of Marshall customer WUGs with projected shortages.

Table 4.47 City of Marshall Customer Entity Shortages

Needs (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Marshall	0	0	0	0	41	701
Manufacturing, Harrison	54,144	63,231	72,312	80,247	89,555	99,578
TOTAL	**54,144**	**63,231**	**72,312**	**80,247**	**89,596**	**100,279**

4.3.13 City of Longview

The City of Longview purchases water supplies from the Northeast Texas Municipal Water District (NETMWD), Cherokee Water Co., SRA, and owns water rights on Big Sandy Creek and the Sabine River. Table 4.48shows Longview is projected to have a supply surplus throughout the planning period.

Table 4.48 Water Supplies and Demands for the City of Longview

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Cherokee Water Company	18,000	18,000	18,000	18,000	18,000	18,000
NETMWD	20,000	20,000	20,000	20,000	20,000	20,000
Big Sandy Creek	2,000	2,000	2,000	2,000	2,000	2,000
Sabine River Authority	20,000	20,000	20,000	20,000	20,000	20,000
Sabine River ROR	1,092	1,094	1,094	1,094	1,094	1,094
Direct Reuse	6,161	6,161	6,161	6,161	6,161	6,161
TOTAL	**67,253**	**67,255**	**67,255**	**67,255**	**67,255**	**67,255**

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
County-Other, Gregg	18	18	18	18	18	18
County-Other, Harrison	382	382	382	382	382	382
Elderville WSC	737	737	737	737	737	737
Gum Springs WSC	1,105	1,105	1,105	1,105	1,105	1,105
Hallsville	737	737	737	737	737	737
Manufacturing, Gregg	6,366	6,368	6,368	6,368	6,368	6,368
Manufacturing, Harrison	11,285	11,285	11,285	11,285	11,285	11,285
Steam Electric, Harrison	6,161	6,161	6,161	6,161	6,161	6,161
White Oak	2,592	2,592	2,592	2,592	2,592	2,592
Non-Contractual:						
Longview	24,220	26,070	28,296	30,989	34,163	37,789
TOTAL	**53,603**	**55,455**	**57,681**	**60,374**	**63,548**	**67,174**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
TOTAL	**13,650**	**11,800**	**9,574**	**6,881**	**3,707**	**81**

Customers of City of Longview are projected to have shortages beginning in 2020. Table 4.49 presents the City of Longview customer WUGs with projected shortages.

Table 4.49 City of Longview Customer Entity Shortages

Needs (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Manufacturing, Harrison	54,144	63,231	72,312	80,247	89,555	99,578
TOTAL	**54,144**	**63,231**	**72,312**	**80,247**	**89,555**	**99,578**

4.3.14 City of Mount Pleasant

Mount Pleasant has water rights in Lake Cypress Springs and Lake Tankersley. The city has a contract with Titus County Freshwater Supply District for 10,000 ac-ft from Lake Bob Sandlin. Mount Pleasant provides water to its own municipal customers as well as some of the manufacturing users in Titus County. Mount Pleasant's wholesale customers include Tri Water Supply Corporation and the City of Winfield. Lake Bob Sandlin State Park is a separate entity from Mount Pleasant, but is treated as a retail customer. The city is projected to have a surplus of 6,085 ac-ft in 2020, reducing to a surplus of 1,763ac-ft by 2070, as shown in Table 4.50.

Table 4.50 Water Supplies and Demands for the City of Mount Pleasant

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Lake Tankersley	1,500	1,500	1,500	1,500	1,500	1,500
Lake Cypress Springs	2,203	1,963	1,723	1,483	1,233	995
Lake Bob Sandlin	10,000	10,000	10,000	10,000	10,000	10,000
Cypress Run of River	410	410	410	410	410	410
TOTAL	14,113	13,873	13,633	13,393	13,143	12,905

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
County-Other, Franklin	14	16	17	17	17	17
County-Other, Titus	687	743	776	810	848	890
Manufacturing, Titus	3,345	3,409	3,472	3,483	3,617	3,651
Tri SUD	0	0	0	0	0	0
Winfield	64	70	77	84	93	103
Non-Contractual:						
Mount Pleasant Municipal	3,918	4,334	4,780	5,299	5,871	6,481
TOTAL	**8,028**	**8,572**	**9,122**	**9,693**	**10,446**	**11,142**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
TOTAL	**6,085**	**5,301**	**4,511**	**3,700**	**2,697**	**1,763**

Customers of the City of Mount Pleasant are projected to have shortages beginning in 2020. Table 4.51 presents the City of Mount Pleasant customer WUGs with projected shortages.

Table 4.51 City of Mount Pleasant Customer Entity Shortages

Needs (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Manufacturing, Titus	3,603	3,719	3,833	4,058	4,733	5,440
Tri SUD	1,560	1,681	1,819	1,991	2,187	2,399
TOTAL	**5,163**	**5,400**	**5,652**	**6,049**	**6,920**	**7,839**

4.3.15 City of Paris

The City of Paris, located within Lamar County, has water rights in Lake Crook and in Pat Mayse Lake. Paris serves its own municipal, steam electric and manufacturing needs. In addition, the city has wholesale contracts with Lamar County Water Supply District and MJC WSC. The city is projected to have a surplus of 30,206 ac-ft in 2020, reducing to a surplus of 28,621 ac-ft by 2070, as shown in Table 4.52.

Table 4.52 Water Supplies and Demands for the City of Paris

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Pat Mayse Lake	51,488	51,490	51,489	51,489	51,490	51,461
Lake Crook	7,290	7,290	7,290	7,290	7,290	7,290
TOTAL	**58,778**	**58,780**	**58,779**	**58,779**	**58,780**	**58,751**

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
Lamar County WSD	11,556	11,604	11,650	11,683	11,748	11,758
Manufacturing, Lamar	5,091	5,340	5,580	5,787	6,183	6,386
Steam Electric Power, Lamar	8,961	8,961	8,961	8,961	8,961	8,961
Non-Contractual:						
Paris	2,964	2,947	2,923	2,938	2,982	3,025
TOTAL	**28,572**	**28,852**	**29,114**	**29,369**	**29,874**	**30,130**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
TOTAL	**30,206**	**29,928**	**29,665**	**29,410**	**28,906**	**28,621**

Customers of the City of Paris are projected to have shortages beginning in 2020. Table 4.53 presents the City of Paris customer WUGs with projected shortages.

Table 4.53 City of Paris Customer Entity Shortages

Needs (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Manufacturing, Lamar	466	489	512	531	568	863
Steam Electric Power, Lamar	0	980	2,733	4,870	7,474	10,568
TOTAL	**466**	**1,469**	**3,245**	**5,401**	**8,042**	**11,431**

4.3.16 City of Sulphur Springs

Sulphur Springs, located in Hopkins County, has three sources of water supply. Lake Sulphur Springs has a firm yield of 10,057 ac-ft/yr. The city has a contract with the Sulphur River Municipal Water District (SRMWD) for supply from Cooper Reservoir, available for the life of the reservoir. Sulphur Springs currently has a surplus totaling 63 percent of total available supply. By 2070, the surplus decreases to 55 percent. Available supplies and demands are shown in Table 4.54.

Table 4.54 Water Supplies and Demands for the City of Sulphur Springs

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Cooper Lake	14,189	14,098	14,007	13,916	13,825	13,734
Lake Sulphur Springs	10,057	10,057	10,057	10,057	10,057	10,057
Sulphur River Run of River	130	130	130	130	130	130
TOTAL	**24,376**	**24,285**	**24,194**	**24,103**	**24,012**	**23,921**

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
Brinker WSC	77	77	77	77	77	77
County-Other, Hopkins	387	405	416	377	341	303
Livestock, Hopkins	1,474	1,551	1,720	1,730	1,914	1,996
Manufacturing, Hopkins	1,741	1,830	1,915	1,987	2,126	2,275
Manufacturing, Hunt	50	50	50	50	50	50
Martin Springs WSC	223	223	223	223	223	223
Mining, Hopkins	200	220	240	261	285	310
Mining, Titus	80	80	80	80	80	80
North Hopkins WSC	921	921	921	921	921	921
Non-Contractual:						
Sulphur Springs	3,196	3,278	3,360	3,487	3,635	3,789
TOTAL	**8,349**	**8,635**	**9,002**	**9,193**	**9,652**	**10,024**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
TOTAL	**16,027**	**15,650**	**15,192**	**14,910**	**14,360**	**13,897**

Customers of the City of Sulphur Springs are projected to have shortages beginning in 2020. Table 4.55 presents the City of Sulphur Springs customer WUGs with projected shortages.

Table 4.55 City of Sulphur Springs Customer Entity Shortages

Needs (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Brinker WSC	0	0	0	0	29	63
Martin Springs WSC	0	0	0	0	43	115
Mining, Hopkins	227	283	360	444	533	639
TOTAL	**227**	**283**	**360**	**444**	**605**	**817**

4.3.17 City of Texarkana (Texarkana Water Utilities)

Texarkana Water Utilities supplies Texarkana, Texas, and Texarkana, Arkansas. There is supply and demand in both states. For planning purposes, it has been assumed that water supply from Arkansas will meet Arkansas demand. Therefore, supply and demands in Table 4.55 only consider Texarkana, Texas.

Texarkana, Texas executes water supply contract extensions, an interlocal cooperation agreement with Riverbend, and the formation of an advisory committee regarding the creation of water facilities and new cooperative agreements. The City of Texarkana sells and/or supplies surface water to: City of Atlanta, Central Bowie County WSC, City of De Kalb, City of Hooks, Macedonia-Eylau MUD#1, City of Maud, City of Nash, City of New Boston, City of Queen City, Red River County WSC, City of Redwater, TexAmericas Center, City of Wake Village, County-Other portions of Bowie, Cass and Red River Counties, and Manufactuing in Bowie and Cass Counties.

Texarkana, Texas supply comes from Lake Wright Patman through a contract with the U.S. Army Corps of Engineers. Texarkana's surface water right in Wright Patman totals 180,000 ac-fy/yr, of supply, but is limited by contractual and infrastructure constraints on reservoir operations, as well as sedimentation. Demands come from three counties and are as follows: Texarkana municipal and manufacturing, City of DeKalb, City of Hooks, City of Maud, City of Nash, City of New Boston, City of Redwater, City of Wake Village, City of Atlanta, City of Queen City, City of Domino, City of Annona, City of Avery, Central Bowie WSC, Macedonia-Eylau MUD #1, Oak Grove WSC, Red River WSC, Park Terrace MHP and manufacturing in Cass County. Texarkana is projected to have a deficit of supplies beginning in 2020, which is shown in Table 4.56. The deficit is primarily due to the treatment capacity of Texarkana's water treatment plant limiting available supply, the elevation of the City of Texarkana's intake, and sedimentation effects.

Table 4.56 Water Supplies and Demands for the City of Texarkana

SUPPLIES (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Lake Wright Patman	121,044	121,023	121,000	120,992	120,990	89,000
Red River Run of River	0	0	0	0	0	0
TOTAL	**121,044**	**121,023**	**121,000**	**120,992**	**120,990**	**89,000**

DEMAND (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Contractual:						
Atlanta	1,000	979	956	948	946	946
Central Bowie County Wsc	535	529	534	534	534	534
County-Other, Bowie	0	0	0	0	0	0
County-Other, Cass	44	44	44	44	44	44
County-Other, Red River	0	0	0	0	0	0
De Kalb	304	303	299	298	297	297
Hooks	265	258	249	244	243	243
Macedonia-Eylau MUD #1	565	574	577	577	577	577
Manufacturing, Bowie	1,544	1,679	1,810	1,922	2,080	2,251
Manufacturing, Cass	120,000	120,000	120,000	120,000	120,000	88,010
Maud	170	169	167	165	164	164
Nash	206	212	214	214	214	214
New Boston	1,098	1,104	1,094	1,091	1,089	1,089
Queen City	0	0	0	0	0	0
Red River County WSC	0	0	0	0	0	0
Redwater	82	82	79	77	77	77
Texamericas Center	514	527	529	528	528	528
Wake Village	677	669	654	644	642	642
Non-Contractual:						
Texarkana	12,771	12,960	12,938	12,865	12,852	12,851
TOTAL	**139,775**	**140,089**	**140,144**	**140,151**	**140,287**	**108,467**

SURPLUS (ac-ft/yr)	2020	2030	2040	2050	2060	2070
	-18,731	**-19,066**	**-19,144**	**-19,159**	**-19,297**	**-19,467**

Customers of City of Texarkana are projected to have shortages beginning in 2020. Table 4.57 presents the City of Texarkana customer WUGs with projected shortages.

Table 4.57 City of Texarkana Customer Entity Shortages

Needs (ac-ft/yr)	2020	2030	2040	2050	2060	2070
Central Bowie County WSC	535	529	534	534	534	534
De Kalb	304	303	299	298	297	297
Hooks	265	258	249	244	243	243
Macedonia-Eylau MUD #1	565	574	577	577	577	577
Manufacturing, Bowie	1,544	1,679	1,810	1,922	2,080	2,251
Manufacturing, Cass	0	1,305	7,189	12,277	21,252	62,827
Maud	170	169	167	165	164	164
Nash	206	212	214	214	214	214
New Boston	1,098	1,104	1,094	1,091	1,089	1,089
Redwater	82	82	79	77	77	77
Tex Americas Center	514	527	529	528	528	528
Wake Village	677	669	654	644	642	642
TOTAL	**5,960**	**7,411**	**13,395**	**18,571**	**27,697**	**69,443**

4.4 WATER SURPLUSES IN THE NORTH EAST TEXAS REGION

Table 4.58 lists the entities within the North East Texas Region, which have a supply surplus during the planning period. TWDB designated WUGs and County Other WUGs surpluses are listed in the table. Several WUGs are split and require multiple entries in the following tables. If a City serves customers outside of the City Limits they will have a county other component with the same name under "county other".

Table 4.58 Water Surpluses in the North East Texas Region by County

		Total Water Supply Surplus in ac-ft/yr					
County	**WUG**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Bowie	County-Other	1,122	1,215	1,312	1,258	1,231	1,231
Bowie	Red Lick	0	0	2	4	4	4
Total		**1,122**	**1,215**	**1,314**	**1,262**	**1,235**	**1,235**
Camp	Bi County Wsc	277	165	78	0	0	0
Camp	County-Other	296	328	353	379	405	430
Camp	Manufacturing	1	1	1	1	1	0
Camp	Mining	11	12	13	14	15	16
Camp	Pittsburg	946	928	915	888	857	824
Total		**1,531**	**1,434**	**1,360**	**1,282**	**1,278**	**1,270**

		Total Water Supply Surplus in ac-ft/yr					
County	**WUG**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Cass	County-Other	1,177	1,334	1,488	1,595	1,601	1,663
Cass	Eastern Cass Wsc	455	460	466	468	469	469
Cass	Hughes Springs	441	448	456	457	458	458
Cass	Linden	155	164	171	172	172	173
Cass	Livestock	124	124	124	126	126	126
Cass	Manufacturing	4,967	0	0	0	0	0
Cass	Mining	800	804	824	859	896	932
Cass	Queen City	41	47	53	53	54	54
Total		**8,160**	**3,381**	**3,582**	**3,730**	**3,776**	**3,875**
Delta	Cooper	1,329	1,354	1,340	1,317	1,286	1,226
Delta	County-Other	941	871	878	882	882	812
Delta	Irrigation	1,826	1,849	1,876	1,899	1,922	1,904
Delta	North Hunt Sud	21	0	0	0	0	0
Total		**4,117**	**4,074**	**4,094**	**4,098**	**4,090**	**3,942**
Franklin	County-Other	44	57	70	67	64	62
Franklin	Cypress Springs Sud	2,108	2,108	2,049	1,997	1,866	1,727
Franklin	Irrigation	274	274	274	274	274	274
Franklin	Livestock	10	10	10	10	10	10
Franklin	Mining	1,035	1,011	990	970	951	952
Franklin	Mount Vernon	742	720	715	706	696	688
Franklin	Winnsboro	833	830	829	827	825	823
Total		**5,046**	**5,010**	**4,937**	**4,851**	**4,686**	**4,536**
Gregg	Clarksville City	144	139	133	123	111	97
Gregg	County-Other	570	612	653	696	783	607
Gregg	Cross Roads Sud	53	51	48	45	43	40
Gregg	Easton	55	56	56	57	54	48
Gregg	Elderville Wsc	494	471	446	418	387	353
Gregg	Gladewater	250	208	161	99	23	0
Gregg	Irrigation	158	158	158	158	158	158
Gregg	Kilgore	482	1,351	1,141	888	592	258
Gregg	Lakeport	88	88	88	87	76	63
Gregg	Liberty City Wsc	328	303	269	222	161	90
Gregg	Longview	8,317	6,498	4,305	1,666	3,553	0
Gregg	Manufacturing	2,595	2,135	1,683	1,294	820	306
Gregg	Steam Electric Power	1,264	1,099	897	651	352	148
Gregg	Tryon Road Sud	1,352	1,312	1,261	1,194	1,102	994
Gregg	West Gregg Sud	188	174	154	127	90	35

		Total Water Supply Surplus in ac-ft/yr					
County	**WUG**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Gregg	White Oak	1,131	1,035	916	769	593	390
Total		**17,469**	**15,690**	**12,369**	**8,494**	**8,898**	**3,587**
Harrison	County-Other	1,024	1,051	1,019	874	717	448
Harrison	Diana Sud	63	62	61	58	55	51
Harrison	Gill Wsc	149	144	139	123	106	85
Harrison	Gum Springs Wsc	590	575	552	501	434	351
Harrison	Hallsville	291	269	242	196	140	73
Harrison	Livestock	108	139	172	207	221	216
Harrison	Longview	5,333	5,302	5,269	5,215	154	81
Harrison	Manufacturing	862	853	844	836	826	816
Harrison	Marshall	1,492	1,251	978	510	0	0
Harrison	Mining	0	0	0	0	58	116
Harrison	Steam Electric Power	4,323	968	0	0	0	0
Harrison	Tryon Road Sud	19	14	9	0	0	0
Total		**14,254**	**10,628**	**9,285**	**8,520**	**2,711**	**2,237**
Hopkins	Brinker Wsc	88	60	35	4	0	0
Hopkins	Cash Sud	1	0	0	0	0	0
Hopkins	Como	52	48	43	37	29	22
Hopkins	County-Other	881	892	910	859	798	741
Hopkins	Cumby	3	0	0	0	0	0
Hopkins	Cypress Springs Sud	406	410	400	394	371	347
Hopkins	Jones Wsc	11	13	14	16	18	19
Hopkins	Livestock	618	618	618	618	619	620
Hopkins	Martin Springs Wsc	210	150	95	27	0	0
Hopkins	North Hopkins Wsc	459	440	421	382	338	293
Hopkins	Sulphur Springs	15,409	14,974	14,464	14,195	13,633	13,163
Total		**18,138**	**17,605**	**17,000**	**16,532**	**15,806**	**15,205**
Hunt	Caddo Mills	25	0	0	0	0	0
Hunt	Campbell	56	46	40	43	49	7
Hunt	Cash Sud	150	2,974	2,723	2,112	1,309	350
Hunt	Celeste	77	54	21	0	0	0
Hunt	Combined Consumers Sud	1,738	1,651	1,522	1,330	1,045	628
Hunt	County-Other	235	1	1	5	0	1
Hunt	Hickory Creek Sud	279	127	0	0	0	0
Hunt	Livestock	9	9	9	9	9	9
Hunt	Lone Oak	101	88	70	43	3	0
Hunt	Macbee Sud	0	94	103	114	132	155

		Total Water Supply Surplus in ac-ft/yr					
County	**WUG**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Hunt	Manufacturing	681	780	887	989	1,059	1,213
Hunt	Mining	0	0	0	0	0	3
Hunt	North Hunt Sud	42	2	0	0	0	0
Hunt	Quinlan	198	239	287	247	200	149
Hunt	West Tawakoni	0	856	813	753	670	551
Hunt	Wolfe City	112	82	38	0	0	0
Total		**3,703**	**7,003**	**6,514**	**5,645**	**4,476**	**3,066**
Lamar	Blossom	78	94	111	111	110	108
Lamar	Deport	58	66	73	72	71	71
Lamar	Lamar County Wsd	6,674	6,557	6,462	6,374	6,281	6,162
Lamar	Livestock	458	458	458	458	458	453
Lamar	Manufacturing	99	103	108	111	117	88
Lamar	Paris	24,932	24,654	24,391	24,136	23,632	23,347
Lamar	Reno	79	142	192	244	293	347
Lamar	Roxton	38	46	54	54	53	52
Lamar	Steam Electric Power	458	0	0	0	0	0
Total		**32,874**	**32,120**	**31,849**	**31,560**	**31,015**	**30,628**
Marion	County-Other	1,221	1,221	1,221	1,221	1,221	1,221
Marion	Diana Sud	17	19	20	20	21	21
Marion	Jefferson	1,268	1,278	1,286	1,291	1,292	1,292
Total		**2,506**	**2,518**	**2,527**	**2,532**	**2,534**	**2,534**
Morris	Bi County Wsc	35	37	37	1	0	0
Morris	County-Other	95	107	111	100	92	82
Morris	Daingerfield	1,109	1,113	1,115	1,106	1,096	1,085
Morris	Hughes Springs	13	13	13	13	13	13
Morris	Livestock	8	8	8	8	8	8
Morris	Lone Star	561	565	568	566	563	559
Morris	Manufacturing	39,012	27,416	16,406	13,037	13,037	0
Morris	Naples	60	64	67	64	60	57
Morris	Omaha	104	106	106	103	99	95
Morris	Steam Electric Power	777	770	761	751	738	729
Total		**41,774**	**30,199**	**19,192**	**15,749**	**15,706**	**2,628**
Rains	Alba	1	1	1	1	1	0
Rains	Bright Star-Salem Sud	265	1,107	1,112	1,112	1,112	1,112
Rains	Cash Sud	6	0	0	0	0	0
Rains	County-Other	124	124	129	126	120	119
Rains	East Tawakoni	576	568	568	567	566	566

		Total Water Supply Surplus in ac-ft/yr					
County	**WUG**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Rains	Emory	0	305	292	281	272	263
Rains	Golden Wsc	4	4	4	4	4	4
Rains	Irrigation	17	17	17	17	17	17
Rains	Manufacturing	2	2	2	2	2	2
Rains	Point	0	26	23	19	15	12
Total		**995**	**2,154**	**2,148**	**2,129**	**2,109**	**2,095**
Red River	Bogata	147	153	157	157	158	158
Red River	Clarksville	296	58	0	0	0	0
Red River	County-Other	94	144	185	230	274	318
Red River	Deport	3	3	3	3	3	3
Red River	Detroit	50	50	50	50	50	50
Red River	Livestock	203	203	203	203	203	203
Red River	Red River County Wsc	172	186	184	159	134	110
Red River	Steam Electric Power	8,021	7,938	7,837	7,714	7,564	8,242
Total		**8,986**	**8,735**	**8,619**	**8,516**	**8,386**	**9,084**
Smith	County-Other	1,541	1,649	1,734	1,921	2,156	2,200
Smith	Liberty City Wsc	13	12	10	8	5	2
Smith	Lindale Rural Wsc	630	594	514	387	237	104
Smith	Mining	33	51	37	15	0	0
Smith	Smith County Mud #1	692	631	560	477	376	257
Smith	West Gregg Sud	48	41	32	21	6	0
Smith	Winona	33	18	0	0	0	0
Total		**2,990**	**2,996**	**2,887**	**2,829**	**2,780**	**2,563**
Titus	Bi County Wsc	105	102	87	61	41	29
Titus	County-Other	1,076	1,142	1,154	1,159	1,111	1,053
Titus	Cypress Springs Sud	44	43	40	36	32	26
Titus	Irrigation	77	77	77	77	77	77
Titus	Livestock	78	78	78	78	33	12
Titus	Mining	2,909	3,025	3,138	3,240	2,885	2,267
Titus	Mount Pleasant	2,322	1,614	805	0	0	0
Titus	Talco	383	377	371	362	352	342

		Total Water Supply Surplus in ac-ft/yr					
County	**WUG**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Total		**6,994**	**6,458**	**5,750**	**5,013**	**4,531**	**3,806**
Upshur	Bi County Wsc	22	6	0	0	0	0
Upshur	Big Sandy	62	51	42	30	17	5
Upshur	County-Other	421	401	368	311	252	195
Upshur	Diana Sud	699	687	675	656	633	610
Upshur	East Mountain	256	251	247	242	236	231
Upshur	Fouke Wsc	3	2	2	1	1	0
Upshur	Gilmer	43	0	0	0	0	0
Upshur	Gladewater	152	125	94	55	12	4
Upshur	Irrigation	87	87	87	87	87	87
Upshur	Livestock	153	153	153	153	153	153
Upshur	Ore City	1,570	1,564	1,559	1,552	1,543	1,535
Upshur	Pritchett Wsc	369	352	337	310	275	240
Upshur	Sharon Wsc	228	226	225	217	210	202
Total		**4,065**	**3,905**	**3,789**	**3,614**	**3,419**	**3,262**
Van Zandt	Bethel-Ash Wsc	96	94	88	74	61	47
Van Zandt	Canton	583	512	459	401	305	259
Van Zandt	Combined Consumers Sud	174	202	223	249	277	300
Van Zandt	County-Other	1,678	1,769	1,818	1,878	1,849	1,722
Van Zandt	Edgewood	0	655	641	623	605	590
Van Zandt	Golden Wsc	42	44	46	47	47	47
Van Zandt	Grand Saline	271	270	270	265	223	216
Van Zandt	Livestock	756	756	756	756	751	751
Van Zandt	Macbee Sud	0	1,400	1,324	1,242	1,149	1,052
Van Zandt	Mining	1,846	2,004	2,144	2,290	2,374	2,514
Van Zandt	South Tawakoni Wsc	0	609	578	541	505	471
Van Zandt	Van	627	599	577	552	528	507
Van Zandt	Wills Point	1,503	1,586	1,580	1,567	1,549	1,530

		Total Water Supply Surplus in ac-ft/yr					
County	**WUG**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Total		**7,576**	**10,500**	**10,504**	**10,485**	**10,223**	**10,006**
Wood	Alba	34	33	34	34	33	33
Wood	Bright Star-Salem Sud	217	220	225	222	222	221
Wood	County-Other	3,936	3,968	3,965	3,954	3,949	3,946
Wood	Cypress Springs Sud	39	39	38	36	33	29
Wood	Fouke Wsc	186	180	186	178	171	165
Wood	Golden Wsc	160	160	163	160	157	153
Wood	Hawkins	725	718	717	711	707	704
Wood	Holly Ranch Water Company	390	382	379	374	372	370
Wood	Irrigation	219	219	219	219	219	219
Wood	Jones Wsc	294	295	302	298	290	284
Wood	Livestock	282	282	282	282	282	282
Wood	Manufacturing	743	701	665	635	569	498
Wood	Mineola	177	169	174	166	158	152
Wood	Mining	284	288	294	300	304	309
Wood	New Hope Sud	36	33	36	33	30	27
Wood	Pritchett Wsc	0	0	1	1	1	1
Wood	Quitman	0	710	704	693	683	674
Wood	Ramey Wsc	337	341	349	346	342	340
Wood	Sharon Wsc	373	380	391	386	384	381
Wood	Winnsboro	255	246	248	240	235	230
Total		**8,687**	**9,364**	**9,372**	**9,268**	**9,141**	**9,018**

CHAPTER 5 IDENTIFICATION AND EVALUATION OF POTENTIALLY FEASIBLE, RECOMMENDED, AND ALTERNATIVE WATER MANAGEMENT STRATEGIES

The primary emphasis of the regional water supply planning process established by S.B. 1 is the identification of current and future water needs and the development of strategies for meeting those needs. This chapter presents the results of the evaluation of various water management strategies, a conceptual framework and overview of the water management strategies recommended for implementation within the North East Texas Region, and specific recommendations to meet specific water supply shortages. Also included within this chapter is the required subsection on Water Conservation, as is required by TAC §357.34(g).

5.1 TWDB GUIDELINES FOR PREPARATION OF REGIONAL WATER PLANS

By rule, the Texas Water Development Board (TWDB) has set forth specific requirements for the preparation of a regional water plan (31 Texas Administrative Code, Chapter 357). With regard to the identification and evaluation of water management strategies to meet identified water supply needs, as defined in 31 TAC §357.34 and §357.35:

- RWPGs shall identify and evaluate potentially feasible water management strategies for all WUGs and WWPs with identified water needs.
- The strategies shall meet new water supply obligations necessary to implement recommended water management strategies of WWPs and WUGs.
- RWPGs shall plan for water supply during Drought of Record conditions.
- In developing RWPs, RWPGs shall provide WMSs to be used during a drought of record.

It should be noted that TWDB rules provide that a regional water plan may also identify water needs for which no water management strategy is feasible, i.e., unmet needs, provided applicable strategies are evaluated and reasons are given as to why no strategies are determined to be feasible.

TWDB rules also specify that the regional water plans are to include the evaluation of all water management strategies the Regional Water Planning Group determined to be potentially feasible. Strategies to be considered may include:

- Water conservation and drought management measures, including demand management;
- Reuse of wastewater;
- Interbasin transfers of surface water;
- Emergency transfers of surface water;
- Expanded use or acquisition of existing supplies including systems optimization and conjunctive use of resources;
- Reallocation of reservoir storage to new uses;
- Voluntary redistribution of water resources including contracts, water marketing, regional water banks, sales, leases, options, subordination agreements, and financing agreements;
- Subordination of existing water rights through voluntary agreements;

- Enhancements of yields of existing sources;
- Improvement of water quality including control of naturally occurring chlorides;
- New supply development including construction and improvement of surface water and groundwater resources;
- Brush control, precipitation enhancement, and desalinization;
- Water supply that could be made available by cancellation of water rights based on data provided by the Texas Commission on Environmental Quality;
- Rainwater harvesting; and
- Aquifer storage and recovery.

According to TWDB rules, each of the potentially feasible water management strategies are to be evaluated by considering:

- The TCEQ's most current Water Availability Model (WAM) with assumptions of no return flows and full utilization of senior water rights is to be used;
- An equitable comparison between and consistent evaluation and application of all water management strategies the regional water planning groups determine to be potentially feasible for each water supply need;
- The net quantity, reliability, and cost of water delivered and treated for the end user's requirements during drought of record conditions;
- Environmental factors including effects on environmental water needs, wildlife habitat, cultural resources, including consideration of the TCEQ's adopted environmental flow standards under 30 TAC Chapter 298 (relating to Environmental Flow Standards for Surface Water). In the absence of such standards, information from existing site-specific studies or state environmental planning criteria adopted by the Board shall be used;
- Impacts to agricultural resources;
- Impacts on other water resources of the state including other water management strategies and groundwater / surface water interrelationships;
- Each threats to agricultural or natural resources;
- If applicable, the provisions in Texas Water Code, Section 11.085(k)(1) for interbasin transfers;
- Consideration of third party social and economic impacts resulting from voluntary redistributions of water, including impacts of moving water from rural and agricultural areas;
- Major impacts of recommended water management strategies on key parameters of water quality;
- Consideration of water pipelines and other facilities that are currently used for water conveyance; and
- Any other factors deemed relevant by the regional water planning group including recreational impacts.

TWDB rules also require the RWPGs to:

- Recommend water management strategies to be used during a drought of record based on the potentially feasible water management strategies.

- Recommend specific water management strategies based upon the identification, analysis, and comparison of water management strategies by the RWPG that the RWPG determines are potentially feasible so that the cost effective water management strategies that are environmentally sensitive are considered and adopted unless a RWPG demonstrates that adoption of such strategies is inappropriate.

The NETRWPG's approach to the evaluation of water management strategies focused on the modeled water supply yield, cost, the anticipated environmental impact of each water management strategy, and local information developed from the individual WUGs. In accordance with TWDB guidelines, yield is the quantity of water that is available from a particular strategy under drought-of-record hydrologic conditions.

The cost of implementing a strategy includes the estimated capital cost (including construction, engineering, legal, and other costs), the total annualized cost, and the unit cost expressed as dollars per acre-foot of yield. As indicated, cost estimates include the cost of water delivered and treated for end user requirements. Cost estimates were prepared utilizing the TWDB Unified Costing Model (UCM), in accordance with TWDB guidelines regarding interest rates, debt service, and other project costs (e.g., environmental studies, permitting, and mitigation). Treated and raw water rates at the time of publication were acquired, when possible, from regional water providers, and are to be used solely for comparative purposes of the various strategies considered herein. These costs represent a snapshot indicative of the order of magnitude of potential present contract costs, and are not intended to be indicative of future rates for raw or treated water; as such rates are individually negotiated and will likely vary in the future. In addition to environmental considerations included in estimates of cost for each strategy, environmental impacts were considered and assessed at a reconnaissance level.

The TWDB requires groundwater strategies to identify a specific supply source aquifer and location by county and river basin. Many WUGs within Region D are located geographically in multiple counties, multiple river basins, and even have access to multiple aquifers. A diligent effort has been made to determine which supply source aquifer, county, and river basin the proposed strategy is likely to be developed in, but the reality is that there are numerous factors involved in the decision making process of a specific project which could alter the outcome. Therefore it should be noted that for purposes of this planning effort the strategy of "developing additional groundwater supply" includes all available groundwater aquifers in all applicable river basins in all applicable counties for a given WUG.

As noted in Chapter 3, joint groundwater planning for groundwater resources within Groundwater Management Area (GMA) boundaries have been determined through the establishment of Desired Future Conditions (DFCs) for the groundwater resources. After the DFCs are determined by the GMAs, the TWDB performs quantitative analyses to determine the amount of groundwater available for production to meet the DFC. For aquifers where a Groundwater Availability Model (GAM) exists, the GAM is used to develop the Modeled Available Groundwater (MAG). For aquifers without a GAM, another quantitative approach is used to estimate the MAG. In 2011, Senate Bill 660 required that GMA representatives must participate within each applicable RWPG. It also required the Regional Water Plans be consistent with the DFCs in place when the regional plans are initially developed. TWDB technical guidelines for the current round of planning establishes that the MAG (within each county and basin) is the maximum amount of groundwater that can be used for existing uses and new strategies in Regional Water Plans. In other words, the MAG volumes are a cap on groundwater production for TWDB planning purposes.

Within the North East Texas Region, there are two GMAs: 8 and 11. GMA 8 is managed by the Clearwater Underground Water Conservation District and includes 10 Groundwater Conservation Districts (GDCs), none of which are located within Region D. GMA 8 has created desired future conditions (DFCs) for all of its aquifers, and Modeled Available Groundwater reports have been created by TWDB for each of the aquifers within Region D. GMA 11 includes the Carrizo-Wilcox and Gulf Coast Aquifers, as well as the Nacatoch, Queen City, Sparta, and Yegua-Jackson Aquifers. It does not list a managing entity, but is comprised of 5 GCDs, none of which are in Region D. A groundwater district for Harrison County was created by the 81st Legislature, but the County voters turned this down in 2010. GMA 11 adopted DFCs for its aquifers in April of 2010.

The concern in Region D with respect to GMAs is that the region has no representation in either of its' management areas. Legislation states that the GMA has the authority to determine DFCs for all areas within the GMA; therefore, Region D's groundwater availability is being controlled by entities in different regions, sometimes hundreds of miles away. There is currently no regulatory entity (in the form of a GCD) to regulate the development of groundwater supplies. Thus, entities within the North East Texas Region have the legal capability to withdraw groundwater in amounts in exceedance of the MAG volumes used as a cap for TWDB planning purposes. To address this, where appropriate, feasible water management strategies have been evaluated and developed as alternative strategies to reflect this reality. Thus, in accordance with TAC §357.32(d), no recommended water management strategy is proffered whereby the MAG volume would be exceeded.

In general, most of the projected water supply needs within the North East Texas Region are associated with manufacturing, steam electric power generation, and relatively small municipal water user groups. Overall, the recommended strategies for meeting these needs involve the development of additional groundwater supplies in areas where Modeled Available Groundwater (MAG) availability is not a constraint, the acquisition of surface water supplies from existing sources, and advanced water conservation. Significant major water supply development projects are as follows (in no priority order):

13. Texarkana/Riverbend Water Resources District - Riverbend Strategy - Replacement of Existing Water Treatment Plant (2020);
14. City of Texarkana/Riverbend Water Resources District, Texas - Dredge Wright Patman (2060);
15. Manufacturing and Steam Electric, Harrison County – Toledo Bend Intake and Raw Water Pipeline (2020);
16. Irrigation, Hopkins County – Lake Sulphur Springs Raw Water Pipeline (2020);
17. County-Other, Hunt County – Greenville Tie-In Pipeline (2070;
18. City of Greenville, Hunt County – WTP Expansion (2020)
19. City of Greenville, Hunt County – Chapman Raw Water Pipeline and New WTP (2050);
20. City of Greenville, Hunt County – Toledo Bend Tie-In Pipeline (2070);
21. North Hunt SUD, Hunt County – Delta County Pipeline (2060);
22. Irrigation, Lamar County – Pat Mayse Raw Water Pipeline (2020);
23. City of Clarksville – Wright Patman Pipeline (2040);
24. City of Canton - Direct/Indirect Reuse (2020).

With the exception of the above listed strategies, no other major water supply development projects are recommended to meet needs within the North East Texas Region. Please refer to Chapter 5 of Appendix C for detailed analyses of all proposed strategies. The regional solutions proposed for localized water supply problems will not adversely impact other water resources of the state, will not aggravate or increase threats to agricultural and natural resources (see Chapter 1), and will not result in adverse socioeconomic impacts to third parties from voluntary redistribution of water (e.g., contractual water sales). Also, to the extent that future interbasin transfers from the North East Texas Region to adjacent regions are contemplated in another region's water plan, it is primarily the responsibility of that region to fully consider the provisions of current state law relating to state authorization of interbasin transfers (Texas Water Code, Section 11.085(k)(1)).

5.2 REGIONAL SUMMARY

5.2.1 Current and Projected Water Demands

Current and projected water demands within the North East Texas Region are presented in Chapter 2 of this plan. As indicated, moderate population growth is expected to continue through the 50 year planning period, with population increasing from approximately 762,000, 2010 Census, to over 1.3 million in 2070. With population growth and continued urbanization, increases in municipal water demands are projected through the planning period. Table 5.1 below summarizes current and projected regional water demands for each of the six major water use categories.

Table 5.1 Population and Water Demand Projections Summary for the North East Texas Region

Total Regional Projection	2020	2030	2040	2050	2060	2070
Population	**831,469**	**907,531**	**988,859**	**1,089,197**	**1,211,979**	**1,370,438**
Water Demand (ac-ft)						
Municipal	134,310	142,631	152,536	166,385	184,540	208,132
Manufacturing	332,070	355,072	377,273	396,249	425,638	457,217
Irrigation	40,866	40,737	40,442	39,913	39,413	39,138
Steam Electric	96,574	112,905	132,815	157,084	186,668	222,648
Mining	7,115	7,748	7,670	7,280	6,914	6,795
Livestock	23,237	23,281	23,220	23,116	23,036	23,042
Total Water Demand (ac-ft)	**634,172**	**682,374**	**733,956**	**790,027**	**866,209**	**956,972**

It is important to note that manufacturing will remain the dominant water use in the region, accounting for roughly 52% of water demand at present and 48% of water demand in 2070.

5.2.2 Currently Available Water Supply

As discussed in Chapter 3 of this plan, surface water is the primary water source for the North East Texas Region, now and in the future. At present, the surface water supply sources available to the region during drought-of-record hydrologic conditions are approximately 1.28 million ac-ft/yr. This represents more than 77 percent of the total amount of water presently available to the region from all sources (i.e., groundwater and local sources). Current water supplies, when considering legal and infrastructure constraints, are approximately 525,000 ac-ft/yr, or approximately 41% of the total availability of surface water sources.

In addition to the supply available from surface water, nearly 288,000 ac-ft./yr. of water supply, or 17 percent of the total water supply, is estimated to be available from groundwater sources at present. When considering current infrastructure, the current available groundwater supply is about 91,000 ac-ft/yr, or approximately 32% of the total availability of groundwater sources.

5.2.3 Water Supply Needs

A user-by-user comparison of supply and demand (as detailed in Chapter 4) reveals that 71 entities within the designated water user groups (WUGs) within the North East Texas Region are projected to experience shortages during the 50 year planning period. Total shortages in all sectors are expected to reach 412,095 acre-ft/yr by the year 2070.

Manufacturing shortages have been identified in Cass, Harrison, Lamar, Morris, Red River, Smith, Titus, Upshur, and Van Zandt Counties. Significant increases in manufacturing demands are projected for Cass, Harrison, Morris, and Titus County. In Harrison, Hunt, Lamar, and Titus Counties, Steam Electric shows a shortage during the 50 year planning period. Mining shortages are projected for Gregg, Harrison, Hopkins, Hunt, Marion, Smith, and Upshur Counties. Shortages in meeting irrigation demands are projected for Bowie, Harrison, Hopkins, Hunt, Lamar, Red River, and Van Zandt Counties. No shortages are projected in meeting Livestock demands.

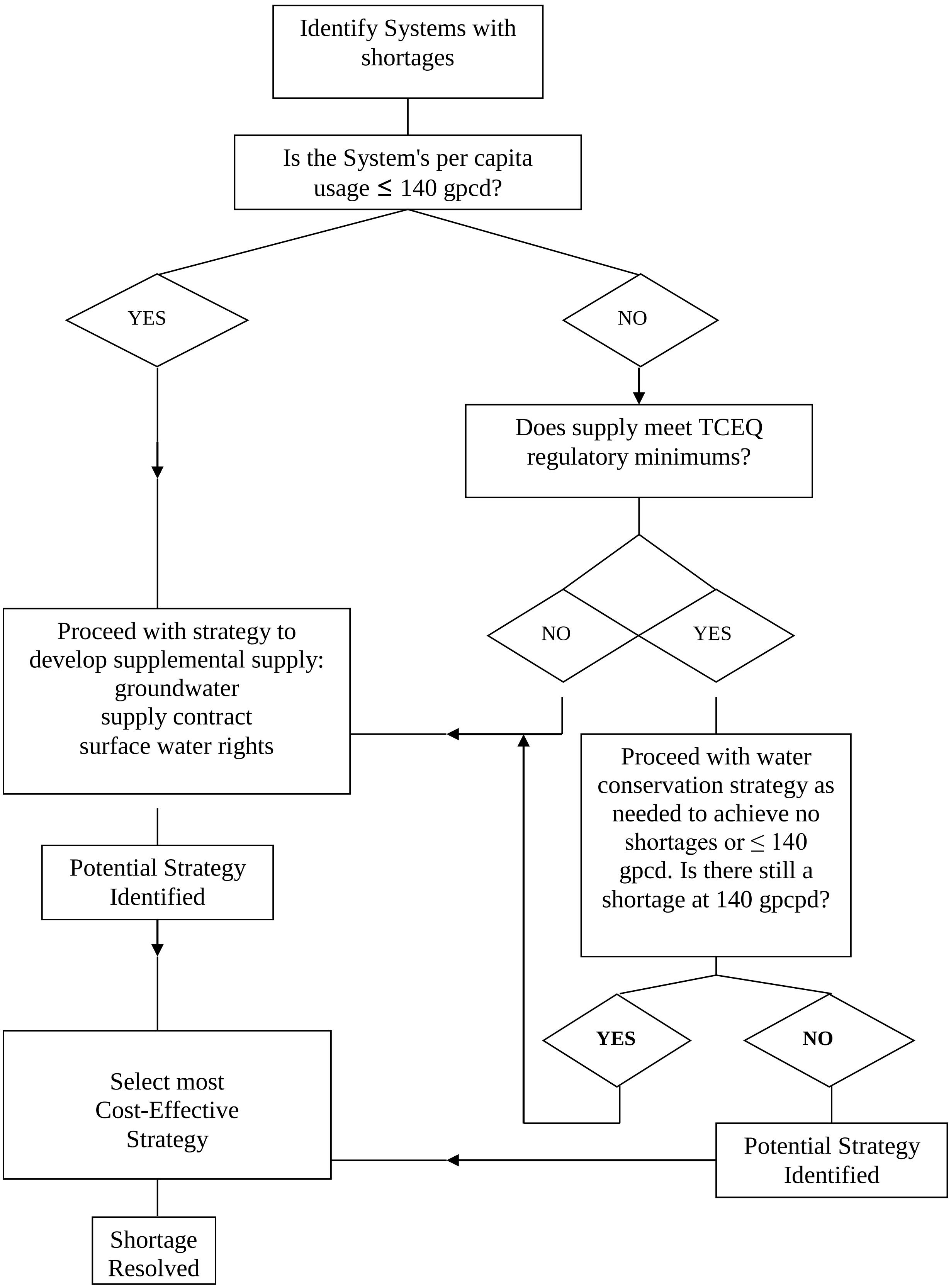
5.2.4 Potentially Feasible Water Management Strategies

The Regional Water Planning Group is required by TWDB rules to evaluate all water management strategies that are deemed to be "potentially feasible." TAC 357.5(e)(4) states:

> *"A RWPG shall hold a public meeting to determine the process for identifying potentially feasible water management strategies; the process shall be documented and shall include input received at the public meeting;…*

A process description and a list of possible management strategies were presented to the planning group in May, 2012. In general, the process allowed for an initial broad list of strategies, with 30 days allowed for comment. To be considered feasible a strategy must be cost-effective for the intended use, must meet federal and state environmental constraints, and alone, or in combination with other strategies, must meet the identified shortage. All potentially feasible strategies identified for consideration by TWDB were considered by the NETRWPG. The NETRWPG established 140 gpcd usage as a limit above which all shortages were evaluated for a water conservation strategy. A flow chart outlining this process is presented in Figure 5.1.

Figure 5.1 Region D Water Conservation Strategy Decision Tree



The consultants prepared a qualitative rating of the various strategies for each entity, including strategies proposed by the entity, based on cost, reliability, environmental and political factors. Recommended strategies were presented to the planning group for approvals and included in the Plan.

By count, most of the water supply shortages in the region are projected to occur in municipalities. There are also shortages projected to occur in the industrial and agricultural categories, as discussed in the previous section. Within the municipal water use category, there are two types of shortages: 1) those that are due to expiration of an existing water supply contract and / or an insufficient contract amount; and 2) actual physical shortages of water where the demand for water is projected to exceed currently available water supplies. With few exceptions, the recommended strategy for addressing the "contractual" water shortages is for the individual water user to renew their contract and / or increase the amount of water that can be supplied under an existing contract. Each water user with a contractual water shortage was contacted and their concurrence with the recommended strategy was requested. In several instances, strategies are contingent upon the implementation of a strategy for the water provider, characterized as "seller" water management strategies for the WWPs and WUG Sellers herein. Estimates of water loss for each entity's water management strategy have been based upon average water losses from reported water loss audit data for each entity. Where no losses have been reported for a given entity, average water losses in the region as reported by TWDB (i.e., 13.7%) have been assumed. Per 31 TAC §357.34(d)(3)(A), a table presenting these water loss estimates (as an estimated percent loss), are presented in Chapter 5 of Appendix C.

Potentially feasible strategies considered by the RWPG included the following:

- Expanded use of existing supplies;
- Voluntary transfers of water within the region using, but not limited to, regional water banks, sales, leases, options, subordination agreements, and financing agreements;
- New supply development including groundwater well development, conjunctive use, brush control, precipitation enhancement, desalination, water supply via cancellation of WR's, rainwater harvesting, and/or Aquifer Storage and Recovery;
- Conservation and Drought Management;
- Reuse;
- Interbasin Transfer;
- Emergency Connections or transfers that would not cause unreasonable damage to the property of the water rights holder;
- Dredging and other land management practices.

As indicated above, most of the municipal water users identified with water supply shortages are municipalities, special utility districts, or water supply corporations. Generally speaking, there are four primary categories of options as follows:

- Advanced Water Conservation
- Water Reuse
- Groundwater
- Surface Water

Presented below is the discussion of the potentially feasible water management strategies selected by the NETRWPG within each option category. Each of the potentially feasible water management strategies listed below correspond with one or more of those listed in the TWDB rules.

5.2.5 Advanced Water Conservation

TAC §357.34(g) requires that planning groups "shall include a subchapter consolidating the RWPG's recommendations regarding water conservation." Also required is the inclusion of model water conservation plans pursuant to Texas Water Code §11.1271. The Texas Water Code §11.002(8) (1) defines conservation as "the development of water resources; and those practices, techniques, and technologies that will reduce the consumption of water, reduce the loss or waste of water, improve 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."

The adopted water demand projections (see Chapter 2) for municipal water users in North East Texas includes a significant degree of reduction in future per capita water demand due to plumbing code requirements for more efficient fixtures (consistent with the State Water Efficient Plumbing Act of 1991), and more use of water efficient appliances (See Chapter 2 of Appendix C for a detailed breakdown of these savings). These assumed reductions tended to increase for future projections. Advanced water conservation includes strategies resulting in savings beyond the aforementioned approaches that reduce the demand for water supply, or increase efficiency to conserve supply to be made available for future use.

The following types of water users are required by TCEQ to develop, implement, and submit water conservation plans and implementation reports:

- Surface water right users with 1,000 acre-feet for municipal, industrial, and other non-irrigation uses;
- Surface water right users with 10,000 acre-feet for irrigation uses;
- Retail public water suppliers providing service to ≥3,300 connections; and
- Applicants relating to the appropriation or use of state water.

In accordance with the above conditions, water supply entities and some major water right holders are required by regulations to have a Drought Contingency and Water Conservation Plan. These plans feature approaches for water demand reductions when such demand threatens the water supply delivery system's total capacity or when overall supplies are low. If strong conservation measures are taken early in a drought and employed in the planning stages, little or no flexibility remains if the drought exceeds the conservation assumed during planning. The ability to adopt measures more stringent than planned could be limited in times of emergency.

The planning group has developed a model Water Conservation Plan, presented within this subchapter, for use by holders of 1,000 acre-feet or more of water rights. A model Drought Contingency Plan is presented as part of the Drought Management discussion within Chapter 7. The planning rules also require a model drought contingency plan for irrigation districts, but no such districts were identified in this region, and so no plan was developed.

5.2.5.1 Municipal Water Conservation Strategies

An “advanced” water conservation scenario has been evaluated for municipal water users in the North East Texas Region that have a demand greater than 140 gpcpd and an identified need. This scenario includes implementation of the plumbing code measure plus implementation of additional measures by local entities including:

- Single family clothes washer rebates
- Single family irrigation audits
- Single family rainwater harvesting
- Single family rain barrels
- Multi-family clothes washer rebates
- Multi-family irrigation audits
- Multi-family rainwater harvesting
- Commercial clothes washer rebates (coin-operated)
- Commercial irrigation audits
- Commercial rainwater harvesting

The advanced water conservation scenario would also involve additional action by the state of Texas, including mandatory implementation of water conservation programs by all municipal water users; a statewide water conservation education program with funding similar to that provided for the “Don’t Mess with Texas” highway litter educational program; and requirements for labeling of clothes washers and dishwashers with consumer oriented water use and conservation information.

The NETRWPG established a goal of 140 gallons/person/day in the approved water demand projections. Advanced water conservation practices were considered and quantitatively evaluated for all water user groups to which TWC §11.1271 and §13.146 apply. After a quantitative evaluation of reported 2011 usage for WUGs' lying primarily within the North East Texas Region using the aforementioned 140 gpcpd threshold, the advanced water conservation scenario was only identified as a feasible strategy by the NETRWPG for a single municipality, the City of Texarkana, which has projected per capita amounts in exceedance of the aforementioned goal of 140 gpcd. The established goals are based upon goals established in the City’s Water Conservation and Drought Contingency Plan, projected to the year 2070 with 140 gpcpd used as a threshold per capita usage.

Several entities serving populations primarily in other regional water planning areas, but serving small portions of WUGs with populations within the Region D planning area, have been identified by other RWPG’s, namely Region C and Region I. The City of Overton and R-P-M WSC have been identified by the East Texas Regional Water Planning Group (ETRWPG; Region I) as entities for which an Advanced Conservation/Demand Reduction would be a recommended strategy. Region C has identified Advanced Water Conservation as a strategy for Ables Springs WSC, Blackland WSC, the City of Josephine, and Royse City, with populations in the Region D planning area located in Hunt County.

The amount of savings calculated by these RWPGs for those portions of entities within the Region D Planning Area are shown, along with Texarkana’s savings, in Table 5.2.

Table 5.2 Advanced Water Conservation Savings for Selected Municipal Entities

Entity (County)		2020	2030	2040	2050	2060	2070
Ables Springs WSC (Hunt)	Goal (gpcd)	Conservation Goals Established by Region C					
	Savings (ac-ft/yr)	2	4	3	6	9	15
Blackland WSC (Hunt)	Goal (gpcd)	Conservation Goals Established by Region C					
	Savings (ac-ft/yr)	12	19	22	26	31	36
Josephine (Hunt)	Goal (gpcd)	Conservation Goals Established by Region C					
	Savings (ac-ft/yr)	2	4	5	9	11	13
R-P-M WSC	Goal (gpcd)	Conservation Goals Established by Region I					
	Savings (ac-ft/yr)	1	6	10	15	19	23
Royse City (Hunt)	Goal (gpcd)	Conservation Goals Established by Region C					
	Savings (ac-ft/yr)	4	12	20	26	40	61
Texarkana (Bowie)	Goal (gpcd)	151	145	140	140	140	140
	Savings (ac-ft/yr)	6,403	6,664	6,815	6,742	6,729	6,728
Overton (Smith)	Goal (gpcd)	200	200	200	200	200	200
	Savings (ac-ft/yr)	17	18	21	23	27	31
	TOTAL	**6,441**	**6,727**	**6,896**	**6,847**	**6,866**	**6,907**

5.2.5.2 Manufacturing Water Conservation Strategies

The criteria for evaluating water conservation measures for manufacturing uses was limited to counties showing a need in this sector during the planning period with use greater than 5,000 ac-ft per year. The counties meeting these criteria include Cass, Harrison, Lamar, Morris, and Titus County.

TWDB Report 362 lists fourteen best management practices for industrial users. Application of each of these practices to the manufacturing industries in these counties is not practical at present. However, the industrial water audit practice is a feasible alternative to consider for implementation. The TWDB Report 362 determined that an audit could result in savings of 10 to 35 percent if an audit has not been performed. Table 5.3 indicates the expected savings of implementation of this water conservation strategy is based on a savings of 10 percent.

Table 5.3 Manufacturing Water Conservation Savings (ac-ft/yr)

County	Demand or Savings					
	2020	**2030**	**2040**	**2050**	**2060**	**2070**
Cass						
Total Demand	115,199	121,355	127,237	132,324	141,299	150,883
Water Conservation Savings	11,508	12,123	12,711	13,219	14,116	15,073
Harrison						
Total Demand	95,005	104,083	113,155	121,082	130,380	140,393
Water Conservation Savings	9,501	10,408	11,316	12,108	13,038	14,039
Lamar						
Total Demand	6,427	6,741	7,045	7,306	7,805	8,338
Water Conservation Savings	565	592	620	642	685	834
Morris						
Total Demand	95,931	102,101	107,795	112,420	121,294	130,868
Water Conservation Savings	9,593	10,210	10,780	11,242	12,129	13,087
Titus						
Total Demand	8,995	9,315	9,615	9,864	10,537	11,256
Water Conservation Savings	900	932	962	986	1,054	1,126
TOTAL	**32,145**	**33,347**	**36,474**	**38,286**	**41,118**	**44,159**

5.2.5.3 Steam Electric Power Generation Conservation Strategies

TWDB's Water Conservation Best Management Practices (BMP) Guide for Industrial Users can be found at http://www.twdb.texas.gov/conservation/BMPs/Ind/index.asp. These guides provide information on measures that can be used to reduce the amount of water used in electric power generation plant's cooling towers. The measures include: once-through cooling, improved system monitoring and operation, optimal contaminant removal, use of alternative sources for make-up water, and reducing heat load to evaporative cooling. The demand for steam-electric use is projected to grow from 15% to 23% of the demand during the 50-year period. The projections for steam-electric use were provided by the TWDB.

Most of the demand will be consumed by increasing existing contracts, which include conservation in the projected water use, and voluntary reallocations of existing supply. In this round of planning, estimates were not made for the majority of steam-electric power water conservation because data on operating strategies for each power plant was not available, and many plants have currently implemented conservation measures already, particularly once-through cooling, which consumes less water than cooling towers by forced evaporation. The plants do have water conservation plans, whereby annual reports on annual conservation and projected future conservation measures are considered.

The single identified conservation strategy recommended in the 2016 Plan for steam electric power generation is for Hunt County. In 2008, the Bureau of Economic Geology

(BEG) developed multiple scenarios for projected steam electric generation demands in Hunt County, from one- to four-times the amount of Business As Usual (BAU). These projections incorporate alternative means of power generation facilities (e.g. once-through cooling, etc.), with resultant projections significantly lower than those projected by TWDB. These implementation approaches represent significantly lower usage of water, and as such, are recommended as a water conservation strategy for Hunt County (Table 5.4). To be conservative, the 4xBAU projections of water demand were utilized as the basis to establish the potential water conservation savings.

Table 5.4 Steam Electric Water Conservation Savings (ac-ft/yr)

County	Demand or Savings					
	2020	2030	2040	2050	2060	2070
Hunt						
Total Demand	12,436	14,539	17,102	20,228	24,038	28,564
Water Conservation Savings	7,448	7,398	9,141	8,988	9,038	12,061

Water conservation strategies for other users (irrigation, livestock and mining) were not developed. Irrigation demand is projected to decline from 6% to 4% of the demand over the planning period. Livestock and mining comprise a total of 3% to 5% of the demand. The cost of water in these industries comprises a small percentage of the overall business cost and it is not expected these industries will see a significant economic benefit to water conservation.

5.2.5.4 Water Conservation Environmental Issues

No substantial environmental impacts are anticipated, as water conservation is typically a non-capital intensive alternative that is not associated with direct physical impacts to the natural environment. A summary of the few environmental concerns that might arise for this strategy is presented in Table 5.5.

Table 5.5 Potential Environmental Issues associated with Water Conservation

Environmental Issue	Evaluation Result
Implementation Measures	Voluntary reduction, water pricing, drought contingency plans
Environmental Water Needs/Instream Flows	No substantial impact identified, assuming relatively low reduction in diversions and return flows: substantial reductions in municipal and industrial diversions from water conservation would result in possibly low to moderate positive impacts as more stream flow would be available for environmental water needs and instream flows.
Bays and Estuaries	Not applicable
Fish and Wildlife Habitat	No substantial impact identified, assuming relatively low reductions in diversions and return flows; possible low to moderate positive impact to aquatic and riparian habitats with substantial reductions as more stream flow would be available to these habitats.

Environmental Issue	Evaluation Result
Cultural Resources	No substantial impact identified
Threatened and Endangered Species	No substantial impact identified, assuming relatively low reduction in diversions and return flows; possible low to moderate positive impact to aquatic and riparian threatened and endangered species (where they occur) with substantial diversion reductions.
Comments	No significant change in infrastructure has been assumed

5.2.5.5 Water Conservation Cost Considerations

Since water conservation plans are required for each community, regular costs for implementing and enforcing a general conservation program were not estimated. Only the efforts needed to enforce a more stringent conservation plan over and above that assumed in the projections were considered. Costs for municipal conservation were generated using the TWDB's Unified Costing Model, with unit costs as shown in Table 5.6 below. These costs were derived from the GDS Associates (2003) "*Quantifying the Effectiveness of Various Water Conservation Techniques in Texas*" performed for the TWDB. Costs for manufacturing and steam electric conservation approaches were assumed negligible, as these approaches reflect industrial water auditing and the implementation of 4-times business-as-usual (BAU) facilities in the future.

Table 5.6 Assumed Unit Costs of Advanced Municipal Conservation

Category	Unit Cost ($/ac-ft/yr)
Urban	600
Suburban	681
Rural	770

5.2.5.6 Water Conservation Implementation Issues

Water conservation as a water supply option has been evaluated, as shown in Table 5.7, and has been determined to meet the evaluation criteria.

Table 5.7 Water Conservation Implementation Evaluation

Impact Category	Comment
A. Water Supply	
1. Quantity	Limited
2. Reliability	Variable, reliant upon acceptance
3. Cost	Reasonable
B. Environmental Factors	
1. Environmental Water Needs	None to low impact
2. Habitat	No impact
3. Cultural Resources	None
4. Bays and Estuaries	Not applicable

Impact Category	Comment
C. Impact on Other State Water Resources	No apparent impacts on state water resources or navigation
D. Threates to Agriculture and Natural Resources	None
E. Equitable Comparison of Strategies Deemed Feasible	Option considered for municipal and manufacturing needs
F. Requirements for Interbasin Transfers	Not applicable
G. Third Party Social and Economic Impacts from Voluntary Redistribution	Not applicable

5.2.5.7 Model Water Conservation Plan

The planning group has developed and provides herein a model water conservation plan for use by holders of 1000 acre feet or more of water rights. A model drought contingency plan for use by wholesale and retail public water suppliers is presented in Chapter 7 of this plan. The planning rules also require a model drought contingency plan for irrigation districts, but no such districts were identified in this region, and so no plan was developed.

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 North East 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 the North East Texas Region, 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, NETRWPG supports 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 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, industrial, and non-irrigation…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. [30 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, Resource Protection Team, Mail Code 160, 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.

Each entity required to submit a Water Conservation Plan (WCP) to TCEQ must also submit a copy to TWDB no later than May 1, 2009. In addition, retail public water suppliers providing water service to 3,300 or more connections must develop, submit and implement a WCP to TWDB. These plans should be sent to TWDB, 1700 North Congress Ave., PO Box 13231, Austin, Texas 78711-3231.

This guidance document was created using several reference materials, including Texas Administrative Code (TAC) Title 30 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. Water conservation forms are available in MSWord and PDF formats on the TCEQ website (www.tceq.state.tx.us), water conservation page.

The __________________(water system) recognizes that water conservation is a viable strategy to protecting its water supply. This Water Conservation 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.

Include a description of your service area so that users can become familiar with the service area. The 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. This form can be downloaded in MSWord or PDF from the Conservation Program page of the TCEQ website or by calling 512-239-4691.

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. [30 TAC Chapter 288]

Coordination with the North East 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 North East 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, or use groundwater, 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 your plan should not contradict your wholesaler's 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. –30 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 ____________.

Note that there should be a goal for water loss and a goal for municipal water use; water use should be calculated in gpcpd.

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. –30 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… –30 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… –30 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. –30 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.). –30 TAC Chapter 288

Discuss your existing and/or proposed measures to find and control unaccounted-for water use. This should include discussion of leak detection and repair programs. The TWDB offers free assistance for water loss determination, including on-site water audit assistance and free water loss audit workshops. In addition, TWDB will loan out leak detection and flow meter testing equipment to aid in determining water loss. You may also find the Water Loss Audit Manual for Texas Utilities helpful in determining water loss. More information can be found on TWDB's website or by calling the Water Conservation Division.

In addition to the examples above, some 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. –30 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 free and low cost 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. TWDB offers the Major Rivers Water Education curriculum for 4th and 5th graders, and the Raising Your Water IQ curriculum for 6th graders. In addition, there is a TWDB kid's page which promotes conservation with interactive games,

coloring pages, and water facts. These can be accessed on TWDB's website or by calling TWDB.

- 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. Free brochures from TWDB could be dispersed.
- 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. –30 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. –30 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:

- Conservation-oriented rate structures.
- 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

Additional Requirements for Systems Serving over 5,000 Population

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. –30 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. –30 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.

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. – 30 TAC Chapter 288

The ______________ (authorized representative) shall be responsible for updating and revising this plan five years after its adoption, or May 1, 2014, whichever is earlier.

PLAN FOR EMERGENCIES (DROUGHT CONTINGENCY)

A drought contingency plan is required for all public water suppliers, in addition to this Water conservation Plan. Please see the NETRWPG guidance documents for drought contingency plans Sections 6.6 and 6.7 herein, and use the one that is appropriate for you – either wholesale or retail.

1.2 MODEL WATER CONSERVATION PLAN – RETAIL WATER PROVIDERS

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 2008, drought strained water systems in the northeast Texas region. 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 Methyl Tertiary Butyl Ether (MTBE) spill into Lake Tawakoni in May 2000, 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 North East 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 Chapters 288 and 363 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 the amended Chapter 288, Subchapter C of the Texas Administrative Code, retail public water suppliers providing water service to 3,300 or more connections must submit revisions to existing drought contingency plans to the executive director 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 North East 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 North East 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. – 30 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. – 30 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 30 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, Resource Protection Team, Mail Code 160, 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. – 30 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 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 consideration of our water provider, _______________'s drought contingency plan. 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 (DCP). 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).

<u>Stage 2 – Moderate Water Shortage</u>

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. – 30 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. – 30 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. – 30 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. – 30 TAC Chapter 288

This plan shall be revaluated and updated every five years based on the most recent information; especially the latest adopted NETRWPG Regional Water Plan.

5.2.5.8 Water Conservation and Drought Management Recommendations

The NETRWPG offers the following water conservation and drought management recommendations:

1. The State Water Conservation Implementation Task Force recommended a statewide goal for municipal use of 140 gpcpd. Systems which experience a per capita usage greater than 140 gpcpd should perform a water audit to more clearly identify the source of the higher consumption. 140 gpcpd should not be considered an enforceable limit, but rather a reasonable target, which may not be appropriate for all entities. Among other tasks, the audit

should establish record management systems that allow the utility to readily segregate user classes. A water audit worksheet by TWDB (http://www.twdb.texas.gov/conservation/municipal/waterloss/), can be used along with the Task Force's Best Management Practices Guide in performing an audit. The BMP Guide can be downloaded from the TWDB's website on the conservation webpage at (http://www.twdb.texas.gov/conservation/BMPs/index.asp).

2. Higher per capita consumption figures are often related to "unaccounted-for" water – water which is produced or purchased, but not sold to the end user. Systems with a water "loss" greater than 15% should be encouraged to perform physical and records surveys to identify the sources of this unaccounted-for water. TWDB will provide assistance in the form of on-site review of the worksheet, water loss workshops, and the loaning of water loss detection equipment. More information can be obtained on the TWDB website, www.twdb.state.tx.us.

3. The planning group encourages funding and implementation of educational water conservation programs and campaigns for the water-using public; and continued training and technical assistance to enable water utilities to reduce water losses and improve accountability.

5.2.6 **Water Reuse**

Wastewater reuse uses treated wastewater effluent as either a replacement for a potable water supply, or involves the treatment of wastewater to parameters that allows it to be returned to the water source. This strategy includes the direct use of reclaimed water for non-potable purposes (e.g., irrigation, industrial and steam electric cooling water). This strategy was considered applicable only to entities with a central wastewater collection and treatment system, or when a request from an entity was received and supporting data provided.

5.2.7 **Groundwater**

This strategy includes development of new supply (e.g., drilling additional wells), receipt of a contract supply from another provider, and consideration of advanced treatment scenarios (e.g., demineralization, removal of iron, manganese, or fluoride).

Due to the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues within the region, this strategy was considered applicable only to entities with demands considered small with respect to the entire region. For example, a small, isolated water supply corporation with available groundwater and wells and a relatively low demand is a likely candidate for this option.

It is recommended that groundwater supplied systems in the Region combine resources and / or solicit future water supply from neighboring systems and/or major water providers in the region where possible. If feasible alternatives become available, such as system grouping or creation of a large surface water supply network, groundwater supply recommendations should be re-evaluated.

5.2.7.1 Groundwater Environmental Issues

Potential environmental issues related to the development of groundwater strategies are presented in Table 5.8.

Table 5.8 Potential Environmental Issues associated with Groundwater Strategies

Environmental Issue	Evaluation Result
Implementation Measures	Local impacts resulting from development of well fields, storage facilities, pump stations, and pipelines
Environmental Water Needs/Instream Flows	Potential increase in return flows to streams
Bays and Estuaries	Not applicable
Fish and Wildlife Habitat	No substantial impact identified
Cultural Resources	No substantial impact identified
Threatened and Endangered Species	No substantial impact identified

5.2.7.2 Groundwater Cost Considerations

Costs are predominantly related to the distance from the development of the wells to the need for the water. Facilities requiring capital investment include wells, pipelines, pump stations and storage. In some cases, water supply developed from groundwater wells may require treatment. Total capital costs have been calculated using the TWDB Unified Costing Model (UCM). Groundwater strategies addressing well development over multiple decades necessitate developing distinct projects as new wells are developed over time. Thus, a single groundwater strategy, i.e., Drill New Wells, may contain multiple projects over the 2020 - 2070 analysis period. Hence, the UCM model was individually applied to each decadal project within a single strategy. The total capital costs for each project were then summed to develop the total capital cost for the recommended strategy. For an accurate comparison to be made between groundwater strategies and other types of strategies, the TWDB UCM was then applied to the entire strategy, in order to determine a single comparable annual cost and unit cost for the groundwater strategy, reflecting debt service amounts in a manner similarly derived as to other strategy types.

5.2.7.3 Groundwater Implementation Issues

This water supply option has been evaluated as shown in Table 5.9.

Table 5.9 Groundwater Strategy Implementation Evaluation

Impact Category	Comment
A. Water Supply	
1. Quantity	Adequate to meet identified need
2. Reliability	High
3. Cost	Moderate
B. Environmental Factors	
1. Environmental Water Needs	Low impact
2. Habitat	Low impact
3. Cultural Resources	Low impact
4. Bays and Estuaries	Not applicable
C. Impact on Other State Water Resources	No apparent impacts, no effect on navigation
D. Threates to Agriculture and Natural Resources	None
E. Equitable Comparison of Strategies Deemed Feasible	Option considered for all WUGs
F. Requirements for Interbasin Transfers	None
G. Third Party Social and Economic Impacts from Voluntary Redistribution	None

5.2.8 **Surface Water**

This strategy includes receipt of contract supply from another provider (e.g., water purchase contracts), the development of new supply (e.g., new run-of-the-river diversions, new reservoirs, enhanced yields of existing sources), the voluntary redistribution of available surplus supply, and consideration of interbasin transfers.

WUGs and/or WWPs that have the capability to meet demands through the renewal of existing contracts, or the expansion of existing contracts, either by having available supplies, currently providing needs through voluntary redistribution, or having the ability to obtain new supplies have been identified. It is important to note that redistribution of water is voluntary. As such, no entity is required to participate.

5.2.8.1 Surface Water Environmental Issues

Potential environmental issues related to the development of surface water strategies are presented in Table 5.10. Potential environmental concerns can vary significantly depending upon the type of surface water strategy. The purchase and/or expansion of surface water supply via contract is generally assumed to have low environmental impacts, unless significant changes to existing infrastructure is warranted. The impacts to the environment due to pipeline construction are expected to be temporary and minimal. New surface water projects may have more significant environmental issues.

Table 5.10 Potential Environmental Issues associated with Surface Water Strategies

Environmental Issue	Evaluation Result
Implementation Measures	Local impact resulting from development of pump stations, pipelines, and/or storage facilities (including reservoirs if applicable).
Environmental Water Needs/Instream Flows	Probable significant impact, relative to specific strategy
Bays and Estuaries	Not applicable
Fish and Wildlife Habitat	Possible high to moderate impacts to species in general. Potential moderate impacts to State-listed species.
Cultural Resources	Probable moderate to significant impact.
Threatened and Endangered Species	Possible moderate to low impact pending identification of such speces in a project area.

5.2.8.2 Surface Water Cost Considerations

Costs will vary with each project. Surface water strategies may vary significantly, from the development of stock ponds for livestock use, to the purchase and/or expansion of surface water supply via contract, to the development of new surface water supplies. For livestock surface water strategies, costs are generally low. Potential costs for water contracts include the cost of raw water, treatment costs, conveyance costs, and potential additional costs required by the water supplier. New surface water projects may have significant costs associated with the development of the supply, including intake structures, pump stations, conveyance costs, and possibly storage facilities.

The cost of implementing a strategy includes the estimated capital cost (including construction, engineering, legal, and other costs), the total annualized cost, and the unit cost expressed as dollars per acre-foot of yield. As indicated, cost estimates include the cost of water delivered and treated for end user requirements. Cost estimates were prepared utilizing the TWDB Unified Costing Model (UCM), in accordance with TWDB guidelines regarding interest rates, debt service, and other project costs (e.g., environmental studies, permitting, and mitigation). Treated and raw water rates at the time of publication were acquired, when possible, from regional water providers, and are to be used solely for comparative purposes of the various strategies considered herein. These costs represent a snapshot indicative of the order of magnitude of potential present contract costs, and are not intended to be indicative of future rates for raw or treated water; as such rates are individually negotiated and will likely vary in the future. In addition to environmental considerations included in estimates of cost for each strategy, environmental impacts were considered and assessed at a reconnaissance level.

5.2.8.3 Surface Water Implementation Issues

Surface water supply strategies have been considered with regard to implementation issues, as depicted in Table 5.11.

Table 5.11 Surface Water Strategy Implementation Evaluation

Impact Category	**Comment**
A. Water Supply	
1. Quantity	Adequate to meet identified need
2. Reliability	High (low to moderate for run-of-river diversions)
3. Cost	Reasonable to High
B. Environmental Factors	
1. Environmental Water Needs	Moderate impact (except contracts)
2. Habitat	High impact (except contracts)
3. Cultural Resources	High impact (except contracts)
4. Bays and Estuaries	Not applicable
C. Impact on Other State Water Resources	Moderate impacts on state water resources (availability); moderate effect on navigation
D. Threates to Agriculture and Natural Resources	If reservoir, potential high impacts to habitat, mitigation requirements
E. Equitable Comparison of Strategies Deemed Feasible	Priority given to all other possible approaches before consideration of a new reservoir as a strategy
F. Requirements for Interbasin Transfers	Potential interbasin transfers
G. Third Party Social and Economic Impacts from Voluntary Redistribution	Varies: Potential for positive economic impacts

5.2.9 **Other Potentially Feasible Strategies**

Identified, potentially feasible water management strategies as required by rule and statute [TWC §16.053(e)(5) and 31 TAC §357.34(a),(c)(1-6)], and listed in Section 5.2 herein, have been considered in terms of feasibility for each WUG/WWP in the North East Texas Region. Unless specifically addressed in the below discussion for each WUG/WWP in the Region, such strategies were considered for each water user and found not to be feasible in the North East Texas Region and were therefore not further evaluated.

Brush control, rainwater harvesting, and precipitation enhancement are approaches to increasing water supply that do not provide the degree of reliability during drought conditions that is required for municipal, manufacturing, and steam electric uses in the Region. Similarly, seawater desalinization, conjunctive use, aquifer storage and recovery, water rights cancellations, and control of naturally occurring chlorides are not feasible to address the needs of water users in the North East Texas Region.

5.3 RECOMMENDED WATER MANAGEMENT STRATEGIES

Senate Bill 1 requires future projects to be consistent with the regional water plans to be eligible for TWDB funding and TCEQ permitting. The provision related to TCEQ is found in Texas Water Code §11.134. It provides that the Commission shall grant an application to appropriate surface water, including amendments, only if the proposed appropriation addresses a water supply need in a manner that is consistent with the state water plan and the relevant approved regional water plan for any area in which the proposed appropriation is located, unless the commission determines that conditions warrant waiver of this requirement. For TWDB funding, Texas Water Code § 16.053(j) states that after January 5, 2002, TWDB may provide financial assistance to a water supply project only after the Board determines that the needs to be addressed by the project will be addressed in a manner that is consistent with the regional water plan for the region of the state that includes the area benefiting from the proposed project, and is consistent with that regional water plan. The TWDB may waive this provision if conditions warrant.

The North East Texas Regional Water Planning Group (NETRWPG) recognizes that a wide variety of proposals could be brought before TCEQ and TWDB. For example, TCEQ considers water right applications for irrigation, hydroelectric power, and industrial purposes, in addition to water right applications for municipal purposes. It also considers other miscellaneous types of applications, such as navigation or recreational uses. Many of these applications are for small amounts of water, often less than 1,000 acre-feet per year. Some are temporary.

Small applications to the TCEQ of this nature are consistent with the 2016 North East Texas Regional Water Plan, when the surface water uses will not have a significant impact on the region's water, even though not specifically recommended in the regional water plan.

TWDB receives applications for financial assistance for many types of water supply projects. Some involve repairing plants and pipelines and constructing new water towers. Water supply projects that do not involve the development of, or connection to, a new water supply are considered consistent with the regional water plan even though not specifically recommended in the regional water plan.

The NETRWPG has identified a total of 71 Water User Groups with shortages during the 2020 – 2070 planning period which will require strategies in this plan. A total of 98 Water Management Strategies are recommended herein to meet these projected shortages. There are many instances wherein multiple strategies are recommended to meet the projected demands for a given WUG. 37 shortages will be resolved by simply renewing, extending, or increasing existing water purchase contracts, and will not require capital expenditure or new sources of supply. As noted previously, 13 shortages will be resolved with the implementation of Advanced Water Conservation measures. 32 shortages will be resolved with additional groundwater supplies. There are six (6) instances of recommended voluntary reallocations of existing supplies, recommended to WWP and WUG sellers in the region to meet projected customer needs. These comprise a portion of a total of 12 "seller" strategies have been recommended for six (6) of the WWPs and WUG sellers that provide water in to customers in the North East Texas Region. There are 12 water management strategies that have been recommended that entail more significant development of infrastructure or implementation of practices (in the case of dredging) to develop additional supplies utilizing existing surface water resources in the region. Included within Chapter 5 of Appendix C are tabulations of the various recommended Water Management Strategies organized by WUG/WWP and by source.

5.3.1 Recommended Strategies for Entities with Contractual Shortages

Within the North East Texas Region, there are 29 entities with shortages that can be addressed via contract. As discussed earlier, there are three possible strategies to resolve these shortages: increase an existing contract, renew an existing contract, and/or establish a new contract. The most common strategy (21 occurrences in the 2016 Plan) is to increase an existing contract. Ten (10) entities require a renewal of their contract. There are two entities, Macedonia-Eylau MUD #1 and Tri SUD, that require a renewal of their respective contracts along with an increase in the contracted amounts. One entity, Caddo Basin SUD, is recommended to establish a new contract. There is one entity, the Titus County Steam Electric WUG, which has multiple recommended strategies to increase three different existing contracts for supply. Nine (9) entities have strategies for contract renewals with Texarkana/Riverbend Water Resources District, which have been included herein at the request of Riverbend Water Resources District. In total, there are 37 recommended contractual strategies in the 2016 Region D Plan, as shown in Table 5.12. Also shown in Table 5.12 are those instances where the WMS is contingent upon another WMS.

5.3.2 Recommended Groundwater Strategies

There are 32 entities in the North East Texas Region for which 39 groundwater strategies are recommended. Table 5.13 details these strategies. Supplemental information on the evaluation of water management strategies for each entity with identified needs can be found in Chapter 5 of Appendix C.

5.3.3 Recommended Strategies necessitating Development of Additional Supply

There are 47 entities in the North East Texas Region with actual projected water supply shortages for which a strategy beyond a contractual approach is necessary. There are 39 recommended strategies based on the development of additional groundwater supply. There are 14 strategies based on the development or enhancement of use from surface water supplies and infrastructure for 10 entities. Advanced water conservation has been recommended for 13 entities, while there are 6 instances of recommendations for voluntary reallocations of existing supply (recommended for wholesale water providers and sellers to meet projected customer needs). A number of entities have multiple recommended strategies under various categories. Although there are more individual entities with a recommendation for groundwater, surface water is the predominant recommended strategy in terms of the amount of supply, accounting for approximately 80 percent of the total supply required in 2020, and 90% of the total supply required in 2070. Table 5.14 summarizes the strategies for entities with actual shortages, as well as those instances where the WMS is contingent upon another WMS. Supplemental information on the evaluation of water management strategies for each entity with identified needs can be found in Chapter 5 of Appendix C.

Table 5.12 Recommended Strategies for Entities with Contractual Shortages

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year						Strategy	Contingency	Seller (if applicable)	Supply Source		Basin	Total Capital Cost
		2020	2030	2040	2050	2060	2070				Ground-water	Surface Water		
BOWIE	DE KALB	-304	-303	-299	-298	-297	-297							
		304	303	299	298	297	297	RENEW EXISTING CONTRACT	TEXARKANA /RIVERBEND STRATEGIES	TEXARKAN A		WRIGHT PATMAN LAKE/RESERV OIR	SULPHUR	$ -
BOWIE	HOOKS	-265	-258	-249	-244	-243	-243							
		265	258	249	244	243	243	RENEW EXISTING CONTRACT	TEXARKANA /RIVERBEND STRATEGIES	TEXARKAN A		WRIGHT PATMAN LAKE/RESERV OIR	SULPHUR	$ -
BOWIE	MACEDONIA-EYLAU MUD #1	-565	-574	-577	-577	-577	-577							
		565	574	577	577	577	577	RENEW EXISTING CONTRACT	TEXARKANA /RIVERBEND STRATEGIES	TEXARKAN A		WRIGHT PATMAN LAKE/RESERV OIR	SULPHUR	$ -
BOWIE	MAUD	-170	-169	-167	-165	-164	-164							
		170	169	167	165	164	164	RENEW EXISTING CONTRACT	TEXARKANA /RIVERBEND STRATEGIES	TEXARKAN A		WRIGHT PATMAN LAKE/RESERV OIR	SULPHUR	$ -
BOWIE	NASH	-206	-212	-214	-214	-214	-214							
		206	212	214	214	214	214	RENEW EXISTING CONTRACT	TEXARKANA /RIVERBEND STRATEGIES	TEXARKAN A		WRIGHT PATMAN LAKE/RESERV OIR	SULPHUR	$ -
BOWIE	NEW BOSTON	-1,098	-1,104	-1,094	-1,091	-1,089	-1,089							
		1,098	1,104	1,094	1,091	1,089	1,089	RENEW EXISTING CONTRACT	TEXARKANA /RIVERBEND STRATEGIES	TEXARKAN A		WRIGHT PATMAN LAKE/RESERV OIR	SULPHUR	$ -
BOWIE	REDWATER	-82	-82	-79	-77	-77	-77							
		82	82	79	77	77	77	RENEW EXISTING CONTRACT	TEXARKANA /RIVERBEND STRATEGIES	TEXARKAN A		WRIGHT PATMAN LAKE/RESERV OIR	SULPHUR	$ -
BOWIE		-514	-527	-529	-528	-528	-528							

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year						Strategy	Contingency	Seller (if applicable)	Supply Source		Basin	Total Capital Cost
		2020	2030	2040	2050	2060	2070				Ground-water	Surface Water		
	TEXAMERICAS CENTER	514	527	530	530	530	530	RENEW EXISTING CONTRACT	TEXARKANA /RIVERBEND STRATEGIES	TEXARKANA		WRIGHT PATMAN LAKE/RESERVOIR	SULPHUR	$ -
BOWIE	WAKE VILLAGE	-677	-669	-654	-644	-642	-642							
		677	669	654	644	642	642	RENEW EXISTING CONTRACT	TEXARKANA /RIVERBEND STRATEGIES	TEXARKANA		WRIGHT PATMAN LAKE/RESERVOIR	SULPHUR	$ -
CASS	MANUFACTURING CASS	-115	-1,305	-7,189	-12,277	-21,252	-62,827							
		0	0	0	0	16,000	47,990	INCREASE EXISTING CONTRACT	TEXARKANA ADVANCED WATER CONSERVATION DREDGE WRIGHT PATMAN	TEXARKANA		WRIGHT PATMAN LAKE/RESERVOIR	SULPHUR	$ -
HARRISON	MARSHALL	0	0	0	0	-41	-701							
		0	0	0	0	41	701	INCREASE EXISTING CONTRACT		NETMWD		O' THE PINES LAKE/RESERVOIR	CYPRESS	$ 4,738,000
HOPKINS	BRINKER WSC	0	0	0	0	-29	-63							
		0	0	0	0	29	63	INCREASE EXISTING CONTRACT		SULPHUR SPRINGS		SULPHUR SPRINGS LAKE/RESERVOIR	SULPHUR	$ -
HUNT	ABLES SPRINGS WSC	-4	-22	-38	-64	-103	-170							
		86	184	278	391	544	756	INCREASE EXISTING CONTRACT	REGION C STRATEGY	NTMWD			SABINE	REGION C COSTING
HUNT	BLACKLAND WSC	-1	-2	-2	-2	-3	-3							
		48	153	204	246	296	356	DIRECT CONNECTION AND ADDITIONAL WATER	REGION C STRATEGY	NTMWD			SABINE	REGION C COSTING
HUNT		-77	-285	-466	-515	-792	-1,235							

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year						Strategy	Contingency	Seller (if applicable)	Supply Source		Basin	Total Capital Cost
		2020	2030	2040	2050	2060	2070				Ground-water	Surface Water		
	CADDO BASIN SUD	75	282	462	609	613	570	NEW CONTRACT	GREENVILLE WTP EXPANSION AND VOLUNTARY REALLOC OF HUNT MAN SURPLUS	GREENVILLE		TAWAKONI LAKE /RESERVOIR	SABINE	$ -
		0	0	0	77	409	967	NEW CONTRACT	GREENVILLE CHAPMAN RAW WATER PIPELINE	GREENVILLE		CHAPMAN /COOPER LAKE /RESERVOIR NON-SYSTEM PORTION	SULPHUR	$ -
HUNT	CADDO MILLS	0	-1	-36	-68	-108	-255							
		0	1	36	68	108	255	INCREASE EXISTING CONTRACT	GREENVILLE WTP EXPANSION AND VOLUNTARY REALLOC OF HUNT MAN SURPLUS	GREENVILLE		TAWAKONI LAKE /RESERVOIR	SABINE	$ -
HUNT	COUNTY-OTHER HUNT	0	-433	-1,314	-1,759	-4,102	-7,564							
		0	0	670	670	670	551	POETRY WSC INCREASE CONTRACT	SRA VOLUNTARY REALLOCATION WEST TAWAKONI SURPLUS TO POETRY WSC	SABINE RIVER AUTHORITY		TAWAKONI LAKE /RESERVOIR	SABINE	$ -
		0	0	0	0	1,045	628	POETRY WSC INCREASE CONTRACT	SRA VOLUNTARY REALLOCATION COMBINED CONSUMERS SUD SURPLUS TO POETRY WSC	SABINE RIVER AUTHORITY		FORK LAKE /RESERVOIR	SABINE	$ -

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year						Strategy	Contingency	Seller (if applicable)	Supply Source		Basin	Total Capital Cost
		2020	2030	2040	2050	2060	2070				Ground-water	Surface Water		
HUNT	JOSEPHINE	0	-8	-16	-27	-31	-34							
		38	121	201	286	311	339	INCREASE EXISTING CONTRACT	REGION C STRATEGY	NTMWD			SABINE	REGION C COSTING
HUNT	LONE OAK	0	0	0	0	0	-56						SABINE	
		0	0	0	0	0	56	INCREASE EXISTING CONTRACT		CASH SUD		TAWAKONI LAKE /RESERVOIR	SABINE	$ -
HUNT	NORTH HUNT SUD	0	-36	-134	-268	-460	-738							
		0	36	134	268	338	388	INCREASE EXISTING CONTRACT	COMMERCE VOLUNTARY REALLOCATION OF HUNT MANUFACTURING SUPPLY FROM CHAPMAN TO NORTH HUNT SUD	COMMERCE WD		CHAPMAN LAKE/RESERVOIR	SULPHUR	$ -
LAMAR	COUNTY-OTHER LAMAR	-67	-81	-83	-96	-107	-116							
		116	116	116	116	116	116	INCREASE EXISTING CONTRACT		LAMAR COUNTY WSD		PAT MAYSE LAKE/RESERVOIR	RED	$ -
LAMAR	STEAM ELECTRIC LAMAR	0	-980	-2,733	-4,870	-7,474	-10,568							
		0	1,415	2,733	4,870	7,474	10,568	INCREASE EXISTING CONTRACT		PARIS		PAT MAYSE LAKE/RESERVOIR	RED	$ -
MORRIS	TRI SUD	-164	-161	-160	-163	-166	-170							
		164	161	160	163	166	170	RENEW AND INCREASE EXISTING CONTRACT		MOUNT PLEASANT		BOB SANDLIN LAKE/RESERVOIR	CYPRESS	$ -
	CLARKSVILLE	0	0	-593	-592	-591	-591							

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year						Strategy	Contingency	Seller (if applicable)	Supply Source		Basin	Total Capital Cost
		2020	2030	2040	2050	2060	2070				Ground-water	Surface Water		
RED RIVER		0	0	303	303	303	303	CONTRACT WITH TEXARKANA AND TREATED WATER PIPELINE TO DEKALB	CITY OF CLARKSVILLE'S EXISTING SURFACE WATER SUPPLIES	TEXARKANA /RIVERBEND		WRIGHT PATMAN LAKE/RESERVOIR	SULPHUR	$ 15,728,000
RED RIVER	COUNTY-OTHER	0	0	0	0	0	0							
		94	144	185	230	274	318	RENEW EXISTING CONTRACT	TEXARKANA/ RIVERBEND STRATEGIES	TEXARKANA /RIVERBEND		WRIGHT PATMAN LAKE/RESERVOIR	SULPHUR	$ -
SMITH	HIDEAWAY	0	0	0	0	0	-117							
		0	0	0	0	0	117	INCREASE EXISTING CONTRACT	CRYSTAL SYSTEMS INC DRILL NEW WELLS	CRYSTAL SYSTEMS INC	QUEEN CITY AQUIFER		SABINE	$ -
SMITH	MANUFACTURING SMITH	-300	-327	-354	-377	-408	-442							
		300	327	354	377	408	442	INCREASE EXISTING CONTRACT		TYLER		TYLER SURFACE SUPPLY	SABINE	REGION I COSTING
TITUS	MANUFACTURING TITUS	-3,603	-3,719	-3,833	-4,058	-4,733	-5,440							
		2,658	2,742	2,826	3,027	3,634	4,269	INCREASE EXISTING CONTRACT		MOUNT PLEASANT		BOB SANDLIN LAKE/RESERVOIR	CYPRESS	$ -
TITUS	STEAM ELECTRIC POWER TITUS	-20,558	-30,123	-41,631	-55,605	-71,812	-91,555							
		24,942	24,826	24,712	24,487	23,812	22,592	INCREASE EXISTING CONTRACT		TITUS COUNTY FWD #1		BOB SANDLIN LAKE/RESERVOIR	CYPRESS	$ -
		0	9,849	9,890	9,846	9,698	9,802	INCREASE EXISTING CONTRACT		NETMWD		BOB SANDLIN LAKE/RESERVOIR	CYPRESS	$ -
		0	0	41,069	40,569	40,028	38,868	INCREASE EXISTING CONTRACT		NETMWD		O' THE PINES LAKE/RESERVOIR	CYPRESS	$ -

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year						Strategy	Contingency	Seller (if applicable)	Supply Source		Basin	Total Capital Cost
		2020	2030	2040	2050	2060	2070				Ground-water	Surface Water		
		0	0	0	0	0	18,000	INCREASE EXISTING CONTRACT	NETMWD VOLUNTARY REALLOCATION OF HARRISON STEAM ELECTRIC	NETMWD		O' THE PINES LAKE/RESERVOIR	CYPRESS	$ -
		0	0	0	0	0	2,293	INCREASE EXISTING CONTRACT	NETMWD VOLUNTARY REALOCATION OF MARION STEAM ELECTRIC	NETMWD		O' THE PINES LAKE/RESERVOIR	CYPRESS	$ -
TITUS	TRI SUD	-1,396	-1,520	-1,659	-1,828	-2,021	-2,229							
		918	1,000	1,091	1,202	1,329	1,466	RENEW AND INCREASE EXISTING CONTRACT		MOUNT PLEASANT		BOB SANDLIN LAKE/RESERVOIR	CYPRESS	$ -
		478	520	568	626	692	763	RENEW AND INCREASE EXISTING CONTRACT		MOUNT PLEASANT		BOB SANDLIN LAKE/RESERVOIR	SULPHUR	SEE ABOVE

Table 5.13 Recommended Groundwater Strategies

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year						Strategy	Source			Total Capital Cost
		2020	2030	2040	2050	2060	2070		Groundwater	County	Basin	
BOWIE	IRRIGATION BOWIE	-5,240	-5,240	-5,079	-4,676	-4,300	-4,140					
		3,700	3,700	3,638	3,483	3,338	3,276	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	BOWIE	SULPHUR	$ 2,021,000
		1,540	1,525	1,441	1,193	1,000	1,000	DRILL NEW WELLS	NACATOCH AQUIFER	BOWIE	RED	$ 1,466,000
CAMP	BI COUNTY WSC	0	0	0	0	-113	-226					
		0	0	0	0	161	269	DRILL NEW WELLS	QUEEN CITY AQUIFER	CAMP	CYPRESS	$ 2,232,000
CASS	MANUFACTURING CASS	-115	-1,305	-7,189	-12,277	-21,252	-62,827					
		151	151	151	151	151	151	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	CASS	CYPRESS	$ 894,000
GREGG	MINING GREGG	-204	-354	-341	-239	-139	-64					
		54	54	54	54	54	54	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	GREGG	CYPRESS	$ 377,000
		226	339	339	339	339	339	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	GREGG	SABINE	$ 1,569,000
HARRISON	IRRIGATION HARRISON	-233	-233	-233	-233	-233	-233					
		236	236	236	236	236	236	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	HARRISON	CYPRESS	$ 1,092,000
		54	54	54	54	54	54	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	HARRISON	SABINE	$ 377,000
HARRISON	MINING HARRISON	-1,633	-1,194	-839	-493	-212	-18					
		324	324	324	324	108	0	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	HARRISON	CYPRESS	$ 1,578,000
		1,398	1,398	1,398	1,398	1,398	1,398	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	HARRISON	SABINE	$ 5,994,000

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year						Strategy	Source			Total Capital Cost
		2020	2030	2040	2050	2060	2070		Groundwater	County	Basin	
HARRISON	WASKOM	-6	-20	-37	-67	-104	-148					
		46	46	46	92	138	184	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	HARRISON	CYPRESS	$ 1,780,000
HOPKINS	CUMBY	0	-12	-25	-42	-59	-77					
		0	79	78	76	75	73	DRILL NEW WELLS	NACATOCH AQUIFER	HOPKINS	SABINE	$ 772,000
		0	1	2	4	5	7	DRILL NEW WELLS	NACATOCH AQUIFER	HOPKINS	SULPHUR	SEE ABOVE
HOPKINS	IRRIGATION HOPKINS	-2,126	-2,126	-2,126	-2,126	-2,126	-2,126					
		210	210	210	210	210	210	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	HOPKINS	CYPRESS	$ 33,000
		610	610	610	610	610	610	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	HOPKINS	SABINE	$ 681,000
HOPKINS	MARTIN SPRINGS WSC	0	0	0	0	-43	-115					
		0	0	0	0	60	120	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	HOPKINS	SABINE	$ 1,844,000
HUNT	CELESTE	0	0	0	-28	-100	-204					
		0	0	0	102	102	204	DRILL NEW WELLS	WOODBINE AQUIFER	HUNT	SABINE	$ 2,550,000
HUNT	COUNTY-OTHER HUNT	0	-433	-1,314	-1,759	-4,102	-7,564					
		0	600	1,200	1,800	2,385	2,387	DRILL NEW WELLS	NACATOCH AQUIFER	HUNT	SABINE	$ 9,584,000
HUNT	HICKORY CREEK SUD	0	0	-95	-416	-882	-1,568					
		0	0	0	189	378	463	DRILL NEW WELLS	TRINITY AQUIFER	HUNT	SABINE	$ 4,821,000
		0	0	189	378	567	1,138	DRILL NEW WELLS	WOODBINE AQUIFER	HUNT	SABINE	$ 8,325,000
HUNT	IRRIGATION HUNT	-146	-146	-146	-146	-146	-146					

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year						Strategy	Source			Total Capital Cost
		2020	2030	2040	2050	2060	2070		Groundwater	County	Basin	
		150	150	150	150	146	146	DRILL NEW WELLS	NACATOCH AQUIFER	HUNT	SABINE	$ 282,000
HUNT	MINING HUNT	-73	-64	-35	-19	-7	0					
		75	75	75	75	7	0	DRILL NEW WELLS	NACATOCH AQUIFER	HUNT	SABINE	$ 254,000
HUNT	WOLFE CITY	0	0	0	-30	-128	-271					
		0	0	0	81	192	271	DRILL NEW WELLS	WOODBINE AQUIFER	HUNT	SULPHUR	$ 4,376,000
LAMAR	MANUFACTURING LAMAR	-565	-592	-620	-642	-685	-951					
		0	0	0	0	0	120	DRILL NEW WELLS	BLOSSOM AQUIFER	LAMAR	RED	$ 76,000
MARION	MINING MARION	-373	-645	-590	-471	-352	-265					
		432	648	648	648	648	648	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	MARION	CYPRESS	$ 1,569,000
RED RIVER	MANUFACTURING RED RIVER	0	0	-7	-7	-8	-9					
		0	0	20	20	20	20	DRILL NEW WELLS	TRINITY AQUIFER	RED RIVER	SULPHUR	$ 136,000
SMITH	CRYSTAL SYSTEMS INC	-29	-221	-432	-669	-944	-1,194					
		644	644	966	1,610	1,610	1,936	DRILL NEW WELLS	QUEEN CITY AQUIFER	SMITH	SABINE	$ 7,084,000
SMITH	LINDALE	-152	-458	-795	-1,182	-1,621	-2,121					
		966	1,288	1,610	1,932	2,576	2,898	DRILL NEW WELLS	QUEEN CITY AQUIFER	SMITH	SABINE	$ 10,977,000
SMITH	MINING SMITH	0	0	0	0	-8	-45					
		0	0	0	0	108	108	DRILL NEW WELLS	QUEEN CITY AQUIFER	SMITH	SABINE	$ 607,000
SMITH	WINONA	0	0	0	-23	-51	-85					

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year						Strategy	Source			Total Capital Cost
		2020	2030	2040	2050	2060	2070		Groundwater	County	Basin	
		0	0	0	108	108	108	DRILL NEW WELLS	QUEEN CITY AQUIFER	SMITH	SABINE	$ 755,000
TITUS	MANUFACTURING TITUS	-3,603	-3,719	-3,833	-4,058	-4,733	-5,440					
		45	45	45	45	45	45	DRILL NEW WELLS	QUEEN CITY AQUIFER	TITUS	CYPRESS	$ 113,000
UPSHUR	BI COUNTY WSC	0	0	0	0	-23	-45					
		0	0	0	0	54	54	DRILL NEW WELLS	QUEEN CITY AQUIFER	UPSHUR	CYPRESS	$ 510,000
UPSHUR	GILMER	0	-14	-63	-123	-186	-246					
		0	269	269	269	269	269	DRILL NEW WELLS	QUEEN CITY AQUIFER	UPSHUR	CYPRESS	$ 1,075,000
UPSHUR	MANUFACTURING UPSHUR	-266	-285	-306	-324	-349	-376					
		324	324	324	324	430	430	DRILL NEW WELLS	QUEEN CITY AQUIFER	UPSHUR	CYPRESS	$ 2,854,000
UPSHUR	MINING UPSHUR	-378	-725	-770	-608	-449	-332					
		430	860	860	860	860	860	DRILL NEW WELLS	QUEEN CITY AQUIFER	UPSHUR	CYPRESS /SABINE	$ 5,570,000
VAN ZANDT	CANTON	0	0	0	0	0	0					
		100	100	100	100	100	100	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	VAN ZANDT	SABINE	$ 863,000
VAN ZANDT	IRRIGATION VAN ZANDT	-330	-330	-330	-330	-330	-330					
		330	330	330	330	330	330	DRILL NEW WELLS	QUEEN CITY AQUIFER	VAN ZANDT	NECHES	$ 227,000
VAN ZANDT	MANUFACTURING VAN ZANDT	-158	-175	-191	-204	-240	-287					
		194	194	194	290	290	290	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	VAN ZANDT	NECHES	$ 734,000
VAN ZANDT	R-P-M WSC	-12	-56	-93	-132	-167	-197					

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year						Strategy	Source			Total Capital Cost
		2020	2030	2040	2050	2060	2070		Groundwater	County	Basin	
		75	150	150	225	285	285	DRILL NEW WELLS	CARRIZO-WILCOX AQUIFER	VAN ZANDT	NECHES	$ 3,836,000

Table 5.14 Recommended Strategies necessitating Development of Additional Supply

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year						Strategy	Contingency	Seller (if applicable)	Source			Total Capital Cost
		2020	2030	2040	2050	2060	2070				Surface Water	County	Basin	
BOWIE	TEXARKANA	-12,771	-12,960	-12,938	-12,865	-12,852	-12,851							
						2,000	18,000	DREDGE WRIGHT PATMAN			WRIGHT PATMAN LAKE /RESERVOIR	BOWIE	SULPHUR	$205,862,000
		6,368	6,664	6,815	6,742	6,729	6,728	RIVERBEND STRATEGY			WRIGHT PATMAN LAKE /RESERVOIR	BOWIE	SULPHUR	$ 117,116,000
HARRISON	MANUFACTURING HARRISON	-55,006	-64,084	-73,156	-81,083	-90,381	-100,394							
		50,000	55,000	65,000	70,000	80,000	0	TOLEDO BEND INTAKE AND RAW WATER PIPELINE		SABINE RIVER AUTHORITY	TOLEDO BEND RESERVOIR	SHELBY	SABINE	$498,773,000
HARRISON	STEAM ELECTRIC POWER HARRISON	-1,838	-5,193	-9,283	-14,268	-20,345	-28,625							
		2,000	6,000	10,000	15,000	21,000	47,000	TOLEDO BEND INTAKE AND RAW WATER PIPELINE		SABINE RIVER AUTHORITY	TOLEDO BEND RESERVOIR	SHELBY	SABINE	$498,773,000
HOPKINS	IRRIGATION HOPKINS	-2,126	-2,126	-2,126	-2,126	-2,126	-2,126							
		1,306	1,306	1,306	1,306	1,306	1,306	SULPHUR SPRINGS RAW WATER PIPELINE		SULPHUR SPRINGS	SULPHUR SPRINGS LAKE/RESERVOIR	HOPKINS	SULPHUR	$4,758,000
HUNT	COUNTY-OTHER HUNT	0	-433	-1,314	-1,759	-4,102	-7,564							
		0	0	0	0	0	3,990	GREENVILLE TIE-IN PIPELINE	SRA TOLEDO BEND TRANSFER AND GREENVILLE TOLEDO BEND TIE-IN PIPELINE	GREENVILLE	TOLEDO BEND RESERVOIR	SHELBY	SABINE	$25,670,000
HUNT	GREENVILLE	-3,299	-4,847	-6,900	-7,521	-9,361	-14,315							
		3,224	6,351	6,550	4,650	3,046	2,942	WTP EXPANSION			GREENVILLE SYSTEM	HUNT	SABINE	$ 36,074,000

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year 2020	2030	2040	2050	2060	2070	Strategy	Contingency	Seller (if applicable)	Source: Surface Water	Source: County	Source: Basin	Total Capital Cost
		0	0	0	10,223	9,891	9,333	CHAPMAN RAW WATER PIPELINE AND NEW WTP		SULPHUR SPRINGS	CHAPMAN /COOPER LAKE /RESERVOIR NON-SYSTEM PORTION	HUNT	SULPHUR	$ 193,438,000
		0	0	0	0	0	5,100	TOLEDO BEND TIE-IN PIPELINE	SRA TOLEDO BEND TRANSFER	SABINE RIVER AUTHORITY	TOLEDO BEND RESERVOIR	SHELBY	SABINE	$42,470,000
HUNT	NORTH HUNT SUD	0	-36	-134	-268	-460	-738							
		0	0	0	0	122	350	DELTA COUNTY PIPELINE		DELTA COUNTY-OTHER (DELTA CO. MUD)	BIG CREEK LAKE /RESERVOIR	HUNT	SULPHUR	$1,774,000
LAMAR	IRRIGATION LAMAR	-18,312	-18,308	-18,305	-18,302	-18,299	-18,302							
		18,312	18,308	18,305	18,302	18,299	18,302	PAT MAYSE RAW WATER PIPELINE		PARIS	PAT MAYSE LAKE/RESERVOIR	LAMR	RED	$7,875,000
RED RIVER	CLARKSVILLE	0	0	-593	-592	-591	-591							
		0	0	303	303	303	303	CONTRACT WITH TEXARKANA AND TREATED WATER PIPELINE TO DEKALB	CITY OF CLARKSVILLE'S EXISTING SURFACE WATER SUPPLIES	TEXARKANA /RIVERBEND	WRIGHT PATMAN LAKE /RESERVOIR	BOWIE	SULPHUR	$ 15,728,000
VAN ZANDT	CANTON	0	0	0	0	0	0							
		323	323	323	323	323	323	INDIRECT REUSE				VAN ZANDT	SABINE	$ 15,728,000

5.3.4 Bowie County

5.3.4.1 Riverbend Water Resources District

Description/Discussion of Needs

Riverbend Water Resources District (RWRD, or Riverbend) is a relatively new water entity in Bowie and Red River Counties. Riverbend is a conservation and reclamation district created by Texas Senate Bill 1223 in 2009, which encompasses the geographic territory of its member entities. Initial members include:

1. The City of Annona;
2. The City of Avery;
3. The City of DeKalb;
4. The City of Hooks;
5. The City of Maud;
6. The City of New Boston;
7. The City of Texarkana, Texas;
8. The City of Wake Village; and
9. The Red River Redevelopment Authority.

The District can be expanded in the future if additional entities so request.

The District lies in the Red and Sulphur River Basins. The member entities are supplied with surface water from Lake Wright Patman through contracts with Texarkana, TX. RWRD has completed three phases of preliminary engineering studies toward construction of an intake, pipeline, and water treatment plant using Wright Patman as the water supply, with a new proposed facility to be potentially located at TexAmericas Center. Texarkana, TX is currently working with RWRD to become the agent for Wright Patman and issues related to sales and distribution of raw and potable water.

5.3.4.2 The City of DeKalb

Description/Discussion of Needs

The City of De Kalb provides water service in Bowie County. The City population is projected to be 1,757 in 2020 and 1,822 in the year 2070. The City has a contract for water supply with the City of Texarkana from Lake Wright Patman. The City is projected to have a shortage in 2020 due to aging of Texarkana's Water Treatment Plant.

Evaluated Strategies

There were four alternative strategies considered to meet the City's water supply shortages as summarized in the Table below. Advanced conservation was not considered because De Kalb's supply is not projected to meet TCEQ regulatory minimums. 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. A request was submitted by Riverbend Water Resources District to consider a new Water Treatment Plant, pipeline, and intake to Wright Patman Reservoir. Thus, a renewal contract with Texarkana/Riverbend has been considered herein.

Recommendations

It is recommended that the City of DeKalb continue its surface water purchase from Texarkana contingent upon Texarkana/Riverbend strategies.

5.3.4.3 The City of Hooks

Description/Discussion of Needs

The City of Hooks provides water service in Bowie County. The City population is projected to be 2,863 in 2020 and 2,970 in the year 2070. The City has a contract for water supply with the City of Texarkana from Lake Wright Patman. The City is projected to have a shortage in 2020 due to aging of Texarkana's Water Treatment Plant.

Evaluated Strategies

There were four alternative strategies considered to meet the City's water supply shortages as summarized in the Table below. Advanced conservation was not considered 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. A request was submitted by Riverbend Water Resources District to consider a new Water Treatment Plant, pipeline, and intake to Wright Patman Reservoir. Thus, a renewal contract with Texarkana/Riverbend has been considered herein.

Recommendations

It is recommended that the City of Hooks continue its surface water purchase from Texarkana contingent upon Texarkana/Riverbend strategies.

5.3.4.4 Bowie County Irrigation

Description/Discussion of Needs

The Irrigation WUG in Bowie County has a demand that is projected to decrease from 6,221 ac-ft/yr in 2020 to 5,121 ac-ft/yr in 2070. The Irrigation WUG in Bowie County is projected to be supplied by surface water supplies from run-of-river diversions from the Red and Sulphur Rivers. The current round of planning has identified a deficit of 5,240 ac-ft/yr , projected to occur in 2020 and decrease to 4,140 ac-ft/yr by 2070.

Evaluated Strategies

Six alternative strategies were considered to meet the Bowie County Irrigation WUG's projected water supply shortages. Advanced water conservation for irrigation practices were not considered in this planning effort, as present irrigation practices likely already incorporate many BMPs to extend water supplies, thus no additional conservation would be feasible. The use of reuse water from nearby municipalities is not considered feasible as it would not be effective to deliver reuse water to rural farm irrigation systems. Groundwater from the Carrizo-Wilcox and Nacatoch aquifers has been identified as a potential source of water for irrigation in Bowie County. Surface water was not considered as a viable alternative to meet projected demands due to limited run-of-river availability, and the purchase of water would be considered cost prohibitive.

Recommendations

The recommended strategy for the Bowie County Irrigation WUG to meet projected demands during the planning period is to drill new ground water wells in the Carrizo-Wilcox and Nacatoch Aquifers in Bowie County.

5.3.4.5 Macedonia-Eylau MUD #1

Description/Discussion of Needs

Macedonia-Eylau MUD #1 provides water service in Bowie County. The MUD's population is projected to be 8,397 in 2020 and 8,572 in the year 2070. The MUD has a contract for water supply with the City of Texarkana for 552 ac-ft/yr that expires in 2019. The MUD is projected to have a deficit of 565 ac-ft in 2020 and increasing to a deficit of 577 ac-ft by 2070.

Evaluated Strategies

There were four alternative strategies considered to meet the MUD's water supply shortages as summarized in the table below. Advanced conservation was not considered because the per capita use per day was less than the 140 gpcd threshold established 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.

Recommendations

Surface water purchase from City of Texarkana is the recommended strategy to meet Macedonia-Eylau MUD's needs contingent upon Texarkana's strategies.

5.3.4.6 The City of Maud

Description/Discussion of Needs

The City of Maud provides water service in Bowie County. The City population is projected to be 1,092 in 2020 and 1,133 in the year 2070. The City has a contract for water supply with the City of Texarkana from Lake Wright Patman. The City is projected to have a shortage in 2020 due to aging of Texarkana's Water Treatment Plant.

Evaluated Strategies

There were four alternative strategies considered to meet the City's water supply shortages as summarized in the Table below. Advanced conservation was not considered because Maud's supply is not projected to meet TCEQ regulatory minimums. 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. A request was submitted by Riverbend Water Resources District to consider a new Water Treatment Plant, pipeline, and intake to Wright Patman Reservoir. Thus, a renewal contract with Texarkana/Riverbend has been considered herein.

Recommendations

It is recommended that the City of Maud continue its surface water purchase from Texarkana contingent upon Texarkana/Riverbend strategies.

5.3.4.7 The City of Nash

Description/Discussion of Needs

The City of Nash provides water service in Bowie County. The City population is projected to be 3,061 in 2020 and 3,175 in the year 2070. The City has a contract for water supply with the City of Texarkana from Lake Wright Patman. The City is projected to have a shortage in 2020 due to aging of Texarkana's Water Treatment Plant.

Evaluated Strategies

There were four alternative strategies considered to meet the City's water supply shortages as summarized in the Table below. Advanced conservation was not considered because Nash's supply is not projected to meet TCEQ regulatory minimums. 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. A request was submitted by Riverbend Water Resources District to consider a new Water Treatment Plant, pipeline, and intake to Wright Patman Reservoir. Thus, a renewal contract with Texarkana/Riverbend has been considered herein.

Recommendations

It is recommended that the City of Nash continue its surface water purchase from Texarkana contingent upon Texarkana/Riverbend strategies.

5.3.4.8 The City of New Boston

Description/Discussion of Needs

The City of New Boston provides water service in Bowie County. The WUG population is projected to be 4,705 in 2020 and 4,880 in the year 2070. The city has a contract for water supply with the City of Texarkana for 1,090 ac-ft/yr that expires in 2016, with a one year auto renewal. New Boston also has a water right permit for run-of-river diversions from the Sulphur River. The City is projected to have a shortage in 2020 due to aging of Texarkana's Water Treatment Plant.

Evaluated Strategies

There were four alternative strategies considered to meet New Boston's water supply shortages as summarized in the Table below. Advanced conservation was not considered because New Boston's supply is not projected to meet TCEQ regulatory minimums. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because the city has historically utilized surface water supplies and, at present, is planning on continuing to purchase surface water from the City of Texarkana. A request was submitted by Riverbend Water Resources District to consider a new Water Treatment Plant, pipeline, and intake to Wright Patman Reservoir. Thus, a renewal contract with Texarkana/Riverbend has been considered herein.

Recommendations

It is recommended that the City of New Boston continue its surface water purchase from Texarkana contingent upon Texarkana/Riverbend strategies.

5.3.4.9 The City of Redwater

Description/Discussion of Needs

The City of Redwater provides water service in Bowie County. The City population is projected to be 1,093 in 2020 and 1,134 in the year 2070. The City has a contract for water supply with the City of Texarkana from Lake Wright Patman. The City is projected to have a shortage in 2020 due to aging of the Texarkana's Water Treatment Plant.

Evaluated Strategies

There were four alternative strategies considered to meet the City's water supply shortages as summarized in the Table below. Advanced conservation was not considered because Redwater's supply is not projected to meet TCEQ regulatory minimums. 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. A request was submitted by Riverbend Water Resources District to consider a new Water Treatment Plant, pipeline, and intake to Wright Patman Reservoir. Thus, a renewal contract with Texarkana/Riverbend has been considered herein.

Recommendations

It is recommended that the City of Redwater continue its surface water purchase from Texarkana contingent upon Texarkana/Riverbend strategies. Development of infrastructure necessary to provide water to the City's customers is to be considered consistent with this recommended strategy.

5.3.4.10 TexAmericas Center

Description/Discussion of Needs

TexAmericas Center provides water service in Bowie County. The WUG population is projected to be 533 by 2020 and increasing to 553 by 2070. TexAmericas has a contract for water supply with the City of Texarkana for surface water from Wright Patman. TexAmericas is not projected to have a shortage in the current planning period; however, as a member of Riverbend Water Resources District, a request was received from Riverbend to include a strategy within the 2016 Plan.

Evaluated Strategies

There were four alternative strategies considered to meet the TexAmericas' water supply shortages as summarized in the Table below. Advanced conservation is not considered as the entity has no existing shortages. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because TexAmericas has historically utilized surface water supplies and, at present, is planning on continuing to purchase surface water from the City of Texarkana. A request was submitted by Riverbend Water Resources District to consider a new pipeline and intake to Wright Patman Reservoir as an explicit strategy for consideration in the 2016 Plan. Surface water infrastructure was thus considered to increase available supplies for potential future industrial development. Alternatively, a strategy whereby a renewal contract with Texarkana/Riverbend is implemented, contingent upon the development of Riverbend's recommended strategy for the development of a new Water Treatment Plant, pipeline, and intake, connecting Wright Patman reservoir to a new facility at TexAmericas Center, for subsequent connection to the member cities' system.

Recommendations

Renewal of the existing surface water purchase from the City of Texarkana/Riverbend is the recommended strategy to meet TexAmericas' needs, contingent upon Texarkana/Riverbend strategies.

5.3.4.11 The City of Texarkana, Texas

Description/Discussion of Needs

The City of Texarkana, Texas, is a municipality located in Bowie County, Texas. Although the City of Texarkana, Texas, is a separate and distinct entity from the City of Texarkana, Arkansas, both entities are served by the same system (operated by Texarkana Water Utility). For the purposes of the 2016 Region D Water Plan, it has been assumed that water supplied from Arkansas (i.e., Millwood Reservoir) serves the population of Texarkana, Arkansas, while water supplied from Texas serves Texarkana, Texas.

For the City of Texarkana, Texas, the system is projected to serve 37,646 people in 2020, increasing to 39,046 by 2070. The current sources of supply based in Texas are surface water from Lake Wright Patman and a run of river diversion permit from the Red River (although no infrastructure is currently in place for the latter). The City provides water to area municipal and industrial customers and is projected to have a water supply deficit of up to 19,904 ac-ft/yr in 2070, due to the age and functionality of the existing New Boston Water Treatment Plant.

In 1969 Texarkana, Texas, entered into separate water supply contracts with surrounding communities. The contracts provided that Texarkana, Texas, and member cities would participate in paying debt service on bonds to be issued by Lake Texarkana Water Supply Corporation (LTWSC, today known as Riverbend Water Resources District, referred to hereafter as Riverbend). These member cities would all make payments for water supplied through facilities. In exchange Texarkana, Texas, and member cities were guaranteed ownership interest in LTWSC facilities and specified amounts of water in Wright Patman. Each city was guaranteed a maximum amount of water sufficient to meet the needs of the member cities, but also agreed to pay a minimum amount to ensure adequate funding for LTWSC facilities. Member cities historically relied on Texarkana, Texas, to manage and administer the water, the LTWSC facilities and water rates fairly for the benefits of all parties. When debt was paid off member cities would own an undivided interest in LTWSC facilities equal to that percentage that was paid by each member city to discharge debt.

In 2010, Texarkana, Texas executes water supply contract extensions, an interlocal cooperation agreement with Riverbend, and the formation of an advisory committee regarding the creation of water facilities and new cooperative agreements. The City of Texarkana sells and/or supplies surface water to: City of Atlanta, Central Bowie County WSC, City of De Kalb, City of Hooks, Macedonia-Eylau MUD#1, City of Maud, City of Nash, City of New Boston, City of Queen City, Red River County WSC, City of Redwater, TexAmericas Center, City of Wake Village, County-Other portions of Bowie, Cass and Red River Counties, and Manufacturing in Bowie and Cass Counties. Texarkana, along with the Cities of DeKalb, Hooks, Maud, Nash, New Boston, Redwater, Wake Village, TexAmericas Center, and sub-WUG entities comprising Bowie County-Other and Red River County-Other, comprise Riverbend Water Resources District (Riverbend). The system does have a water conservation and drought management plan in place.

This 2016 Plan recognizes that Riverbend may become the contracting entity between its members and Texarkana, Tx. The strategies shown herein for entities with shortages in Bowie and Red River Counties rely on continued use of water from Lake Wright Patman. Presently, the strategies related to Riverbend are presented with the City of Texarkana's water management strategies. However, the strategies should be considered consistent with the plan for this planning cycle if Riverbend is the contracting party rather than Texarkana, as long as the water source remains Lake Wright Patman.

Summary of Evaluated Strategies

Seven alternative strategies have been considered to meet Texarkana's water supply shortages, as listed in the table below.

Advanced conservation is a probable strategy for the City of Texarkana, as identified in the City's Water Conservation Plan. There are no significant current water needs in Texarkana that could be met by water reuse.

Groundwater was not considered as an alternative for this entity as conservation can meet future needs and the City relies upon its surface water supplies.

Texarkana is supplied by water in Lake Wright Patman. Riverbend has requested consideration of the strategy to decommission the existing New Boston Rd WTP and construct a new WTP by 2020 (referred to hereafter as the Riverbend Strategy), although the timing of this action is still under consideration by Texarkana, Riverbend, and the remaining member cities. As the City of Texarkana has indicated a desire to remain flexible, the City has not ruled out any alternatives at present.

Significant growth is projected for customer demands in Cass County, specifically Manufacturing. These demands represent the dominant need in the latter part of the 2020 – 2070 period. Thus, sedimentation issues play a significant role in the availability of supply from Wright Patman. Implementation of best management practices (BMPs) in the contributing watersheds upstream of Lake Wright Patman have the potential to reduce the total sediment inflow to the lake, thus slowing the loss of conservation storage to sedimentation and slowing the resultant loss of firm yield. Another alternative is to dredge sediment from Wright Patman in an attempt to restore conservation storage that has been lost due to sedimentation.

Detailed Description of Evaluated Projects

Advanced Water Conservation – The City has identified conservation targets for near term reductions in demand. These targets have been projected to the year 2070, with a minimum threshold of 140 gpcpd, resulting in a maximum savings of 6,815 ac-ft/yr. The rate of conservation was developed from conservation targets identified by the City of Texarkana in its Water Conservation and Drought Contingency Plan. The Unified Costing Model (UCM) was then employed to develop cost estimates for the implementation of this strategy.

TexAmericas Raw Water Pipeline – Although no immediate need has been identified in the RWP process, Riverbend Water Resources District has requested the consideration of a strategy to construct a new intake at Wright Patman Reservoir and construct a raw water pipeline to TexAmericas Center, a member of Riverbend This strategy differs from the below described strategies related to the timing of construction of a new water treatment plant. Surface water infrastructure has been considered to increase available supplies for potential future industrial development, based upon analyses provided by Riverbend. This strategy is contemplated within the strategy evaluation for TexAmericas Center. However, the 2016 Plan recognizes that Riverbend or Texarkana, Tx, may become the sponsoring entity for this strategy. The strategy presented within the TexAmericas Center section of this plan as an Alternate Strategy should be considered consistent with the plan for this planning cycle if Texarkana, Tx, or Riverbend are the sponsor rather than TexAmericas, as long as the water source remains Lake Wright Patman.

Riverbend Strategy (2020) –Riverbend Water Resources District has requested for inclusion a water management strategy entailing the construction of a new WTP, pipeline, and intake to meet member cities' needs by 2020. This strategy, hereafter referred to as the Riverbend Strategy, has been identified specifically to provide the infrastructure necessary to meet the remaining member cities' needs in the year 2020. The CH2M-Hill

(2009) study performed for Riverbend in 2009 was utilized to evaluate and identify the specifics of the project, including costs. The total, annual, and unit costs of water from the project have been based upon costs originally estimated by CH2M Hill (2009). Those costs have been adjusted to September 2013 costs using the ENR Construction Cost Index (CCI) and entered into the UCM. UCM default assumptions were utilized to estimate annual operation and maintenance costs. This strategy entails the construction of a new intake location with a deeper invert elevation allowing access to additional storage in Wright Patman, a raw water pipeline, a new 20 MGD WTP, and the decommission of the existing New Boston WTP to meet member cities' and wholesale customer needs. The supply necessary to meet the needs identified in the 2016 planning process for the member cities of Riverbend is a maximum firm supply of 22,403 ac-ft/yr. The total project cost is $117.1 million, with an annual cost of $16.4 million and a unit cost of $731 per ac-ft. during debt service ($2.24/1,000 gal.) and $294 per ac-ft after debt service. Supply adequate to meet the identified needs, when considered in conjunction with the City of Texarkana's and its customers' needs, do not over allocate the existing firm supply available from Wright Patman Reservoir, if other recommended Water Management Strategies are also employed.

Sediment Reduction BMPs – The firm yield of Wright Patman decreases over time due to sedimentation in the reservoir, reducing the total volume of conservation capacity. As part of the Sulphur River Basin Feasibility Study, a report to the USACE from Freese and Nichols Inc. entitled *Watershed Overview Sulphur River Basin from January 2014* identified and discussed the benefit of establishing sediment reduction best management practices (BMPs) in the Sulphur River Basin. This report presents model results demonstrating a reduction to the sediment load of Wright Patman from application of a SWAT model to the Sulphur River Basin. A potential water management strategy is to implement and construct the BMPs described in the feasible BMP scenario within the SRBA Report, wherein an annual average reduction of sediment load to Wright Patman was estimated to be 28%. This project implements and constructs, where feasible, BMP's including vegetative filter strips, conversion of crop land to pasture, construction of channel grade control structures to reduce the hydraulic grade line of the channel, and construction of riparian buffer strips along the stream channel. Although the SRBA study identified a potentially feasible approach, no potential costs were developed as a part of that study. Thus, potential unit costs of the BMPs were developed for consideration herein from the following sources:

- San Antonio River Basin Low Impact Design Report,
- Estimated Cost of Pasture and Hay Production from Iowa State University,
- Urban Stream Repair Practices from the Center for Watershed Protection,
- And from the project budget for a Riparian Restoration Project in New Braunfels.

The overall project cost of this strategy was calculated using identified units of each BMP (as specified in SRBA, 2014) and unit costs developed from the above sources. Annual costs have also been calculated for conversion of crop land to pasture. Note, however, that this BMP is based upon an assumed 100% adoption rate developed in the SRBA 2014 study. Project costs have been input into the UCM to determine debt service costs. Water supply yield from the project has been modeled using the modified WAM utilizing sedimentation rates reduced by the proposed BMPs and identifying the additional firm yield of Wright Patman from the base sedimentation WAM. The project is estimated to yield 15,000 ac-ft of additional firm supply in the year 2060 by reducing the sediment load to Wright Patman, for a total project cost of $123.5 million, an annual cost of $31.5 million and a unit cost for the additional supply of $2,101 per ac-ft. during debt service and $1,412 per ac-ft after debt service.

Concerns with this strategy include the efficacy of the application of the BMP's, and the assumed implementation of conversion of crop land to pasture. There exists substantial uncertainty in this approach, and as such, should be further evaluated in future regional and local planning efforts. Particular attention in future efforts should be given to the conversion of crop land to pasture, as the extent of implementation and cost of this particular BMP may exhibit a significant impact to the overall, annual, and unit costs of this strategy.

Dredge Wright Patman – As described above, the firm yield of Wright Patman decreases over time due to sedimentation in the reservoir reducing the total volume of conservation capacity. This strategy would dredge sediment from Wright Patman to restore storage capacity within the reservoir which has been lost due to sedimentation. This project utilizes a 24" dredge to remove an estimated 3,000 ac-ft per year of sediment from the reservoir for an operational period of 20 years. The unit cost of reservoir dredging in units of dollars per ac-ft of sediment removed has been calculated based upon a formula from the World Bank, identified in the TWDB Report *Dredging vs. New Reservoirs (December 2005).* The cost determined by this methodology was subsequently entered into the UCM to determine debt service cost. The project is estimated to yield a maximum of 18,000 ac-ft of additional firm supply by dredging a total of 60,000 ac-ft of sediment from Wright Patman over a 20 year period for a total project cost of $205.9 million, with an annual cost of $17.2 million, and a unit cost for the additional supply of $957 per ac-ft. during debt service ($2.94/1,000 gal.) and $0 per ac-ft after debt service.

Concerns with this strategy include the location and impacts from disposition of dredged material, the efficiency of removal of the dredged material, and the potential need to repeat the effort in the future since dredging does not remove the source of sedimentation issues in the contributing watershed. As noted in TWDB (2005), issues with regard to dredging fall into four general categories: removal of the sediment, transportation, disposal, and re-use.

For the removal of sediment, dredging reservoirs, particularly at the shallow headwaters and reservoir margins can destroy habitats and affect wetland birds, etc. If the water sustains flora or fauna of particular value, or if fish issues are important, then issues exist regarding lowering the water level. Dredging may also result in a temporary loss of reservoir water quality, through removal of organic material, although there may be long-term improvements in the reservoir water quality through removal of such organic material. Downstream water quality may also be temporarily impacted due to dredging. There may also be a loss of land for containment areas to drain/treat the sediment.

Regarding transportation, reservoirs are often in remote areas. The impact of additional transportation during dredging can place pressure on local communities (e.g., noise/air pollution and physical damage to roads), although these impacts may be reduced if the sediment can be effectively dewatered at or near the reservoir site using, for example, a hydrocyclone and/or a filter bed press. The viability of disposal to land depends on the level of contaminants, whereby there may be risks to groundwater supplies from contamination by leaching.

Opportunities for the re-use of dredged material include sand/gravel/bricks for the construction industry, fertilizer, usage for filling abandoned quarry areas or mines, and usage for capping landfill sites.

Recommendations

To meet the City of Texarkana's and Riverbend's projected needs and the requested approach for the 2016 RWP, it is recommended that advanced water conservation practices as specified in the City's Water Conservation Plan be adopted to reduce demands. It is further recommended that a new intake, pipeline, and water treatment facility be constructed by 2020 to meet these WUGs' needs. Dredging of Wright Patman beginning in 2050 (with observable effects by 2060) has been identified as the more likely, and cost effective, strategy necessary to continue to meet customers' future needs in 2070, specifically projected Cass County Manufacturing demands.

At present, considerable discussions are underway between all of the member cities of Riverbend Water Resources District. As noted previously and reiterated here, this 2016 Plan recognizes that Riverbend may become the contracting entity between its members and Texarkana, Tx. The strategies shown herein for entities with shortages in Bowie and Red River Counties rely on continued use of water from Lake Wright Patman. Presently, the strategies related to Riverbend are presented with the City of Texarkana's water management strategies. However, the strategies should be considered consistent with the plan for this planning cycle if Riverbend is the contracting party rather than Texarkana, as long as the water source remains Lake Wright Patman.

5.3.4.12 The City of Wake Village

Description/Discussion of Needs

The City of Wake Village provides water service in Bowie County. The City's population is projected to be 5,949 in 2020 and 6,160 in the year 2070. The City has a contract for water supply with the City of Texarkana from Lake Wright Patman. The City is projected to have a shortage in 2020 due to aging of Texarkana's Water Treatment Plant.

Evaluated Strategies

There were four alternative strategies considered to meet the City's water supply shortages as summarized in the Table below. Advanced conservation was not considered 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. A request was submitted by Riverbend Water Resources District to consider a new Water Treatment Plant, pipeline, and intake to Wright Patman Reservoir. Thus, a renewal contract with Texarkana/Riverbend has been considered herein.

Recommendations

It is recommended that the City of Wake Village continue its surface water purchase from Texarkana contingent upon Texarkana/Riverbend strategies.

5.3.5 Camp County

5.3.5.1 Bi-County WSC

Description/Discussion of Needs

The Bi County WSC system is located in Upshur, Camp, Morris, and Titus Counties and serves the un-incorporated areas of each of the Counties. The population is projected to increase from 12,352 persons in 2020 to 20,208 persons in 2070. The WSC is included as a W.U.G. in Upshur, Camp, Morris, and Titus Counties. The system's current water supply consists of 29 water wells with 26 operational from the Carrizo-Wilcox Aquifer. The total rated capacity of the 26 operational wells is approximately 3,200 GPM, or 1,723 ac-ft/yr. The System does have a water conservation plan. The System is projected to have a water supply surplus of 277 ac-ft/yr in 2020 decreasing to a deficit of 226 ac-ft/yr in 2070.

Evaluated Strategies

Four alternative strategies were considered to meet the System's 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 system 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 system and surface water treatment is not economically feasible for a system of this size.

Recommendations

The recommended strategy for the System to meet their projected deficit of 113 ac-ft/yr in 2020 and 226 ac-ft/yr in 2070 would be to construct six additional water wells similar to other wells within their system. Three wells in Camp County and one well in Upshur County are recommended in 2060 and two additional wells are recommended in Camp County in 2070. The recommended supply source will be the Queen City Aquifer in Camp and Upshur Counties. One well with rated capacity of 100 gpm each would provide approximately 54 acre-feet each. The Queen City Aquifer in Upshur and Camp Counties are projected to have a more than ample supply availability to meet the needs of Bi County WSC for the planning period. Note that one Queen City Upshur County and five Queen City Camp County wells would be drilled.

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.

5.3.6 Cass County

5.3.6.1 Cass County Manufacturing

Description/Discussion of Needs

The Manufacturing WUG in Cass County has a demand that is projected to increase from 115,199 ac-ft/yr in 2020 to 150,883 ac-ft/yr in 2070. Manufacturing in Cass County is currently supplied by groundwater from the Carrizo-Wilcox Aquifer and surface water from Wright Patman Reservoir purchased from the City of Texarkana. A deficit of 1,184 ac-ft/yr is projected to occur in 2030 and increase to 57,571 ac-ft/yr by 2070.

Evaluated Strategies

Three alternative strategies were considered to meet the Cass County Manufacturing WUG's water supply shortages. Advanced water conservation for manufacturing was considered in this planning effort to reduce overall demands; however, it does not resolve all identified needs. The use of reuse water from nearby municipalities was not considered in this planning period beyond those amounts currently reported by manufacturing entities in the county. Groundwater has been identified as a potential source of water for manufacturing in Cass County. Surface water was considered as a potential alternative to meet projected demands.

Recommendations

The recommended strategies for the Cass County Manufacturing WUG to meet projected demands during the planning period is to implement advanced conservation measures (such as industrial water auditing), develop groundwater supplies in the Carrizo-Wilcox Aquifer, and purchase additional raw water from Wright Patman Reservoir from the City of Texarkana (necessitating an amendment to the City's current water right permit reflecting additional industrial use), contingent upon the recommended strategy for the City of Texarkana to dredge Wright Patman Reservoir. Dredging of the reservoir allows for diversion up to and beyond the presently contracted supply of 120,000 ac-ft/yr, such that adequate supply would be available to allow for a contractual increase of up to 16,000 ac-ft/yr.

5.3.7 Delta County

There are no entities with identified shortages in Delta County.

5.3.8 Franklin County

There are no entities with identified shortages in Franklin County.

5.3.9 Gregg County

5.3.9.1 Gregg County Mining

Description/Discussion of Needs

The Mining WUG in Gregg County is a split entity (by basin). In the Cypress basin, demand is projected to be decreasing from 14 ac-ft/yr in 2020 to 9 ac-ft/yr in 2070. Mining in Gregg County – Cypress does not have a current water supply, i.e., the total rated available supply is 0 ac-ft/yr. Mining in Gregg County - Cypress is projected to have a water supply deficit of 14 ac-ft/yr in 2020 increasing to 22 ac-ft/yr in 2030 then decreasing to a deficit of 9 ac-ft/yr in 2070.

In the Sabine basin, demand is projected to be decreasing from 260 ac-ft/yr in 2020 to 171 ac-ft/yr in 2070. Mining in Gregg County - Sabine has a current water supply consisting of water wells from the Carrizo-Wilcox Aquifer. The total rated available supply from these sources is 70 ac-ft/yr. Mining in Gregg County - Sabine is projected to have a water supply deficit of 190 ac-ft/yr in 2020 increasing to 332 ac-ft/yr in 2030 then decreasing to a deficit of 55 ac-ft/yr in 2070.

Evaluated Strategies

For Mining in Gregg County – Cypress, three alternative strategies were considered to meet the projected water supply shortages. Advanced conservation and water reuse was not considered because there are no existing mines. Surface water alternatives were omitted since there is not a supply source within close proximity to the county with available supply.

For Mining in Gregg County – Sabine, three alternative strategies were considered to meet the Gregg County Mining water supply shortages. Advanced conservation and water reuse was not considered because operational procedures for the existing mines are not available. Surface water alternatives were omitted since there is not a supply source within close proximity to the county with available supply.

Recommendations

The recommended strategy for the Mining in Gregg County – Cypress to meet their projected deficit of 14 ac-ft/yr in 2020 and 22 ac-ft/yr in 2030 would be to construct one water well by 2020. The recommended supply source will be the Carrizo-Wilcox Aquifer in Gregg County. One well with rated capacity of 100 gpm each would provide approximately 54 ac-ft/yr. The Carrizo-Wilcox Aquifer in Gregg County is projected to have a more than ample supply availability to meet the projected needs for the planning period.

The recommended strategy for the Mining in Gregg County – Sabine to meet their projected deficit of 190 ac-ft/yr in 2020 and 332 ac-ft/yr in 2030 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 Gregg County. Three wells with rated capacity of 210 gpm each would provide approximately 113 acre-feet each or 339 ac-ft/yr. The Carrizo-Wilcox Aquifer in Gregg County is projected to have a more than ample supply availability to meet the projected needs for the planning period.

5.3.10 Harrison County

5.3.10.1 Harrison County Irrigation

Description/Discussion of Needs

The Irrigation WUG in Harrison County is a split entity between the Cypress and Sabine River basins. Irrigation in Harrison County - Cypress has a demand that is projected to be a constant 267 ac-ft/yr from 2020 to 2070. Irrigation in Harrison County – Cypress has a current water supply consisting of water wells from the Carrizo-Wilcox Aquifer surface water from Cypress Run-of-River permit, and Sabine Run-of-River permit. The total rated available supply from these sources is 88 ac-ft/yr. Irrigation in Harrison County - Cypress is projected to have a water supply deficit of 193 ac-ft/yr in 2020 and staying even to a deficit of 193 ac-ft/yr in 2070.

The Irrigation WUG in Harrison County - Sabine has a demand that is projected to be decreasing from 178 ac-ft/yr in 2020 to 178 ac-ft/yr in 2070. Irrigation in Harrison County – Sabine has a current water supply consisting of water wells from the Carrizo-Wilcox Aquifer and surface water from Sabine Run-of-River permit, and Cypress Run-of-River permit. The total rated available supply from these sources is 88 ac-ft/yr. Irrigation in Harrison County - Sabine is projected to have a water supply deficit of 164 ac-ft/yr in 2020 and staying even to a deficit of 164 ac-ft/yr in 2070.

Evaluated Strategies

Three alternative strategies were considered to meet the Harrison County Irrigation – Cypress water supply shortages. Advanced conservation and water reuse was not considered because operational procedures for the existing irrigation is not available. Surface water alternatives were omitted since there is not a supply source within close proximity to the county with available supply.

Three alternative strategies were considered to meet the Harrison County Irrigation – Sabine water supply shortages. Advanced conservation and water reuse was not considered because operational procedures for the existing irrigation is not available. Surface water alternatives were omitted since there is not a supply source within close proximity to the county with available supply.

Recommendations

The recommended strategy for the Harrison County Irrigation – Cypress to meet their projected deficit of 232 ac-ft/yr in 2020 through 2070 would be to construct two water wells prior to 2020 as the deficits occur. The recommended supply source will be the Carrizo-Wilcox Aquifer in Harrison County. Two wells with rated capacity of 220 gpm each would provide approximately 118 acre-feet each or 236 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 Irrigation in Harrison County for the planning period.

The recommended strategy for the Harrison County Irrigation – Sabine to meet their projected deficit of 1 ac-ft/yr in 2020 from 2070 would be to construct one water well prior to 2020. The recommended supply source will be the Carrizo-Wilcox Aquifer in Harrison County. One well with rated capacity of 100 gpm each would provide approximately 54 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 Irrigation in Harrison County for the planning period.

5.3.10.2 Harrison County Manufacturing

Description/Discussion of Needs

The Manufacturing WUG in Harrison County is a split entity between the Cypress and Sabine River basins that has a demand that is projected to be increasing from 95,100 ac-ft/yr in 2020 to 140,534 ac-ft/yr in 2070. Manufacturing in Harrison County has a current water supply consisting of water wells from the Carrizo-Wilcox Aquifer, surface water from Cypress Run-of-River permit, Gray's Creek Run-of-River permit, Sabine Run-of-River permit and contracts with Sabine River Authority for surface water from Lake Fork, Northeast Texas MWD for surface water from Lake O' the Pines, and Cherokee Water Company for surface water from Lake Cherokee. The total rated available supply from these sources is 40,956 ac-ft/yr. Manufacturing in Harrison County - Sabine is projected to have a water supply deficit of 55,006 ac-ft/yr in 2020 increasing to a deficit of 100,394 ac-ft/yr in 2070.

Evaluated Strategies

Three alternative strategies were considered to meet the Harrison County Manufacturing – Sabine water supply shortages. Advanced conservation was considered through implementation of industrial water audits. Water reuse was not considered because operational procedures for the existing facilities are not available. Groundwater alternatives were omitted since there is not a source within the county with the available supply. A surface water worksheet is included as Attachment B. This strategy is combined with the strategy for Harrison Steam Electric Power with a need of 46,625 ac-ft/yr. The combined project will supply 150,000 ac-ft/yr to Harrison County entities.

Recommendations

The recommended strategy for the Harrison County Manufacturing to meet their projected deficit of 55,006 ac-ft/yr in 2020 and 90,381 ac-ft/yr in 2060 would be to first implement advanced water conservation measures (such as industrial water auditing), and to construct an intake and raw water pipeline from Toledo Bend Reservoir and contract with the Sabine River Authority to purchase raw water. The recommended contract for water for manufacturing uses with the Sabine River Authority would expire by 2070, and would not be renewed as such a renewal would result in a projected overallocation of supply from Toledo Bend Reservoir when considered in conjunction with all regions' strategies related to this supply. (Note that contracted supply for steam electric use in Harrison County is recommended to continue through 2070, as this would not result in a projected overallocation of Toledo Bend supply.) With advanced water conservation in place, in 2070 with no water contracted from the Sabine River Authority for supply from Toledo Bend Reservoir, the remaining projected need for Harrison County Manufacturing is 86,355 ac-ft/yr. This remaining amount is left as an unmet need for the purposes of this 2016 Plan.

The recommended supply source will be the Toledo Bend Reservoir in Shelby County. The Toledo Bend Reservoir in Shelby County is projected to have sufficient supply availability to meet the needs of Manufacturing in Harrison County through 2060.

5.3.10.3 The City of Marshall

Description/Discussion of Needs

The City of Marshall is located in central Harrison County and serves the incorporated city limits and an area immediately north of the City of Marshall. The population is projected to increase from 25,210 persons in 2020 to 38,140 persons in 2070. The City is included as a W.U.G. in Harrison County. The system's current water supply consists of a Run-of-the-River water rights permit for 16,000 AF/yr from Big Cypress Bayou and a water purchase contract for 9,000 AF/yr from Northeast Texas Municipal Water District from Lake O' the Pines.. The Big Cypress ROR is not available during drought conditions according to water availability models. Therefore, the total rated supply capacity is 9,000 ac-ft/yr. The system is bounded on the east and North by Leigh WSC, on the south by Gill WSC, and on the west by Talley WSC. The City has a water conservation plan. The City of Marshall is projected to have a water supply deficit of 41 ac-ft/yr in 2060 increasing to a deficit of 701 ac-ft/yr in 2070.

Evaluated Strategies

Four alternative strategies were considered to meet the City of Marshall water supply shortages. 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 are limited to an increase in contract amount from NETMWD from Lake O the Pines. Groundwater is limited in capacity in this area and therefore was not considered feasible.

Recommendations

The recommended strategy for the City of Marshall to meet their projected deficit of 41 ac-ft/yr in 2060 and 701 ac-ft/yr in 2070 would be to increase their contract amount with NETMWD. The recommended supply source will be the Lake O the Pines in Marion County. Lake O the Pines is projected to have a more than ample supply availability to meet the needs of the City of Marshall for the planning period.

5.3.10.4 Harrison County Mining

Description/Discussion of Needs

The Mining WUG in Harrison County is a split entity between the Cypress and Sabine River basins. Mining in Harrison County - Cypress has a demand that is projected to be decreasing from 525 ac-ft/yr in 2020 to 180 ac-ft/yr in 2070. Mining in Harrison County – Cypress has a current water supply consisting of water wells from the Carrizo-Wilcox Aquifer and Queen City Aquifer, and contract with Sabine River Authority for surface water from Lake Fork. The total rated available supply from these sources is 253 ac-ft/yr in 2020. Mining in Harrison County - Cypress is projected to have a water supply deficit of 272 ac-ft/yr in 2020 and increasing to a surplus of 116 ac-ft/yr in 2070.

Mining in Harrison County - Sabine has a demand that is projected to be decreasing from 525 ac-ft/yr in 2020 to 180 ac-ft/yr in 2070. Mining in Harrison County – Sabine has a current water supply consisting of water wells from the Carrizo-Wilcox Aquifer, surface water from Sabine Run-of-River permit, and contract with Sabine River Authority for surface water from Lake Fork. The total rated available supply from these sources is 612 ac-ft/yr in 2020. Mining in Harrison County - Sabine is projected to have a water supply deficit of 1,361 ac-ft/yr in 2020 decreasing to a deficit of 18 ac-ft/yr in 2070.

Evaluated Strategies

Three alternative strategies were considered to meet the Harrison County Mining – Cypress water supply shortages. Advanced conservation and water reuse was not considered because operational procedures for the existing mines is not available. Surface water alternatives were omitted since there is not a supply source within close proximity to the county with available supply.

Three alternative strategies were considered to meet the Harrison County Mining – Sabine water supply shortages as summarized in the following table. Advanced conservation and water reuse was not considered because operational procedures for the existing mines is not available. Surface water alternatives were omitted since there is not a supply source within close proximity to the county with available supply.

Recommendations

The recommended strategy for the Harrison County Mining - Cypress to meet their projected deficit of 272 ac-ft/yr in 2020 and 18 ac-ft/yr in 2050 would be to construct three additional water wells similar to their existing wells just prior to each decade as the deficits occur to 2040. The recommended supply source will be the Carrizo-Wilcox Aquifer in Harrison County. Three wells with rated capacity of 200 gpm each would provide approximately 108 acre-feet each or 323 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 Mining in Harrison County for the planning period.

The recommended strategy for the Harrison County Mining - Sabine to meet their projected deficit of 1,361 ac-ft/yr in 2020 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. Thirteen wells with rated capacity of 200 gpm each would provide approximately 108 acre-feet each or 1,398 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 Mining in Harrison County for the planning period.

5.3.10.5 Harrison County Steam Electric

Description/Discussion of Needs

The Steam Electric Power WUG in Harrison County has a demand that is projected to be increasing from 19,838 ac-ft/yr in 2020 to 46,625 ac-ft/yr in 2070. Steam Electric Power in Harrison County has a current water supply consisting of contracts with Northeast Texas MWD for surface water from Lake O' the Pines. The total rated available supply from this source is 18,000 ac-ft/yr. Steam Electric Power in Harrison County is projected to have a water supply deficit of 1,838 ac-ft/yr in 2020 increasing to a deficit of 28,625 ac-ft/yr in 2070.

Evaluated Strategies

Three alternative strategies were considered to meet the Harrison County Steam Electric Power water supply shortages. Advanced conservation and water reuse were not considered because operational procedures for the existing facilities are not available. Groundwater alternatives were omitted since there is not a source within the county with the available supply. A surface water worksheet is included as Attachment B. This strategy is combined with the strategy for Harrison Manufacturing with a need of 100,394 ac-ft/yr. The combined project will supply 150,000 ac-ft/yr to Harrison County entities. The current supply of 18,000 af-ft/yr is recommended as a strategy for Titus County Steam Electric to be voluntarily reallocated in 2070 to meet those identified needs from Lake O' the Pines.

Recommendations

The recommended strategy for the Harrison County Steam Electric Power to meet their projected deficit of 1,838 ac-ft/yr in 2020 and 28,625 ac-ft/yr in 2070 would be to construct an intake and raw water pipeline from Toledo Bend Reservoir and contract with the Sabine River Authority to purchase raw water. The recommended supply source will be the Toledo Bend Reservoir in Shelby County. The Toledo Bend Reservoir in Shelby County is projected to have a more than ample supply availability to meet the needs of Steam Electric Power in Harrison County for the planning period. The existing supply from Lake O' the Pines will be voluntarily reallocated in 2070 to other Steam Electric Power needs in the region.

5.3.10.6 The City of Waskom

Description/Discussion of Needs

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 2,315 persons in 2020 to 3,503 persons in 2070. The City is included as a WUG in Harrison County. The system's current water supply consists of nine water wells from the Carrizo-Wilcox Aquifer. The total rated capacity of these wells is 631 GPM, or 339 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. The City of Waskom is projected to have a water supply deficit of 6 ac-ft/yr in 2020 increasing to a deficit of 148 ac-ft/yr in 2070.

Evaluated Strategies

Four alternative strategies were considered to meet the City of Waskom water supply shortages. 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.

Recommendations

The recommended strategy for the City of Waskom to meet their projected deficit of 6 ac-ft/yr in 2020 and 148 ac-ft/yr in 2070 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, Cypress Creek Basin. Four wells with rated capacity of 86 gpm each would provide approximately 46 acre-feet each or 184 ac-ft/yr. The Carrizo-Wilcox Aquifer in Harrison County, Cypress Creek Basin, is projected to have a more than ample supply availability to meet the needs of the City of Waskom for the planning period.

5.3.11 **Hopkins County**

5.3.11.1 Brinker WSC

Description/Discussion of Needs

Brinker WSC provides water service in Hopkins County. It is projected that the users in the WUG will have a shortage in 2060. The WUG population is projected to be 2,252 by 2020 and increases to 3,990 by 2070. The WSC utilizes groundwater from the Carrizo-Wilcox aquifer and has a contract for water supply with City of Sulphur Springs for 77 ac-ft/yr. Brinker WSC is projected to have a deficit of 29 ac-ft in 2060 and increasing to a deficit of 63 ac-ft by 2070.

Evaluated Strategies

Four alternative strategies considered to meet the WSC's water supply shortages. 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. Additional use of groundwater has been identified as a likely source of water for Brinker WSC in Hopkins

County; however, projected needs exceed the availability of groundwater in the basin based on the modeled available groundwater (MAG) estimates. Brinker WSC has indicated that the likely future strategy would be the additional use of groundwater. However, due to current TWDB guidelines for the Regional Water Planning process, this strategy is considered an alternate strategy for the 2016 Plan. Purchase of additional surface water from Sulphur Springs Lake under contract from the City of Sulphur Springs was also considered.

Recommendations

To meet the identified needs for Brinker WSC, the recommended strategy is to increase the existing surface water contract from the City of Sulphur Springs prior to 2060.

5.3.11.2 The City of Cumby

Description/Discussion of Needs

The City of Cumby provides water service in Hopkins County. It is projected that the users in the WUG will have a shortage in 2030. The WUG population is projected to be 919 by 2020 and increases to 1,652 by 2070. The City of Cumby utilizes groundwater from the Nacatoch aquifer through 4 wells with a combined production capacity of 223 gpm. The City of Cumby is projected to have a deficit of 12 ac-ft in 2030 and increasing to a deficit of 77 ac-ft by 2070.

Evaluated Strategies

There were four alternative strategies considered to meet the WSC's water supply shortages. 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. The system is not large enough to treat surface water in a cost-effective manner. Additional groundwater from the Nacatoch aquifer has been considered as a potential water management strategy.

Recommendations

The recommended strategy for the City of Cumby to meet their projected deficit of 12 ac-ft/yr in 2030 and 77 ac-ft/yr in 2070 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 Nacatoch Aquifer in Hopkins County, Sabine River Basin. Two wells with rated capacity of 75 gpm each would provide sufficient supply to meet the projected demands. The Nacatoch Aquifer in Hopkins County, Sabine River Basin, is projected to have sufficient supply availability to meet the needs of the City of Cumby for the planning period.

5.3.11.3 Hopkins County Irrigation

Description/Discussion of Needs

The Irrigation WUG in Hopkins County has a demand that is projected to remain constant at 2,269 ac-ft/yr for the planning period. The Irrigation WUG in Hopkins County is supplied by groundwater from the Carrizo-Wilcox Aquifer and run-of-river diversions from the Sabine and Sulphur Rivers. A deficit of 2,126 ac-ft/yr is projected to occur in throughout the planning period.

Evaluated Strategies

Three alternative strategies were considered to meet the projected shortages for Hopkins County Irrigation. Advanced water conservation for irrigation practices was not considered, as present irrigation practices likely already incorporate many BMPs to extend water supplies, thus no additional conservation would be feasible. The use of reuse water from nearby municipalities was not considered feasible as it would not be effective to deliver reuse water to farm irrigation systems. Groundwater from the Carrizo-Wilcox and Nacatoch aquifers has been identified as a potential source of water for irrigation in Hopkins County; however, the total irrigation needs exceed the availability of groundwater in these aquifers based on the Modeled Available Groundwater (MAG) estimates. The construction of a pipeline to convey raw surface water from Sulphur Springs Lake purchased via the City of Sulphur Springs was also considered as a potential alternative to meet projected demands.

Recommendations

The recommended strategies for the Hopkins County Irrigation to meet their projected deficit of 2,126 ac-ft/yr would be to construct three additional water wells with a rated capacity of 50 gpm in the Carrizo-Wilcox/Cypress/Hopkins aquifer, and five additional water wells with a rated capacity of 80 gpm in the Carrizo-Wilcox/Sabine/Hopkins aquifer. The recommended supply source will be the Carrizo-Wilcox Aquifer in Hopkins County, Cypress and Sabine River basins. The Carrizo-Wilcox Aquifer in Hopkins County, both in the Cypress and Sabine River basins, is projected to have sufficient supply availability to only meet a portion needs of Hopkins County Irrigation over the planning period (approximately 820 ac-ft/yr).

To meet the remaining needs, it is recommended that a 10" diameter pipeline to Lake Sulphur Springs be developed for the purchase of raw water from the City of Sulphur Springs. For planning purposes, the raw water pipeline was estimated to be 120,000 feet long, following existing right-of-way for roads.

5.3.11.4 Martin Springs WSC

Description/Discussion of Needs

Martin Springs WSC provides water service in Hopkins County. It is projected that the users in the WUG will have a shortage in 2060. The WUG population is projected to be 3,779 by 2020 and increases to 6,979 by 2070. Martin Springs WSC utilizes groundwater from the Carrizo-Wilcox aquifer. Martin Springs WSC is projected to have a deficit of 43 ac-ft in 2060 and increasing to a deficit of 115 ac-ft by 2070.

Evaluated Strategies

Four alternative strategies were considered to meet the WSC's water supply shortages. 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. Additional use of groundwater has been identified as a potential source of water for Martin Springs WSC in Hopkins County. Purchase of surface water from Chapman Lake under contract from the Sulphur River Municipal Water District was also considered. However, Martin Springs WSC does not currently use water from Sulphur River Municipal Water District.

Recommendations

The recommended strategy for Martin Springs WSC to meet their projected deficit of 43 ac-ft/yr in 2060 and 115 ac-ft/yr in 2070 would be to construct two additional water wells with a rated capacity of 80 gpm each in the Carrizo-Wilcox/Sabine/Hopkins aquifer. The recommended supply source will be the Carrizo-Wilcox Aquifer in Hopkins County, Sabine River Basin. Construction of these wells in the year preceding the decade of need would allow for sufficient provision of supply to meet the projected demands. The Carrizo-Wilcox Aquifer in Hopkins County, in the Sabine River Basin, is projected to have sufficient supply available to meet the projected needs of Hopkins County Mining over the planning period.

5.3.11.5 Hopkins County Mining

Description/Discussion of Needs

Mining in Hopkins County has a demand that is projected to increase from 1,031 ac-ft/yr in 2020 to 1,577 ac-ft/yr in 2070. This WUG is projected to be supplied by groundwater from Nacatoch Aquifer and a nominal amount of surface water purchased from Sulphur Springs for potable use. A deficit of 227 ac-ft/yr is projected to occur in 2020 and increase to 639 ac-ft/yr by 2070.

Evaluated Strategies

Advanced water conservation for mining practices was not considered, as present operations of the facilities are not available. The use of reuse water from nearby municipalities was not considered feasible as it would not be effective to deliver reuse water to the mining locations. Since the projected demands for mining in Hopkins County are primarily due to overburden dewatering, it was assumed that projected needs would likely be met by additional groundwater pumping.

Recommendations

Since the projected demands for mining in Hopkins County are primarily due to overburden dewatering, it was assumed that projected needs would likely be met by additional groundwater pumping, and no additional supply would be sought by this WUG. Thus, this demand has been left as an unmet need.

5.3.12 **Hunt County**

5.3.12.1 Ables Springs WSC

Ables Springs WSC is located in northeastern Kaufman County within the Region C Water Planning Area, and serves a relatively smaller portion of population in southern Hunt County within the North East Texas Region (Region D). Thus, the Region C Water Planning Group has the primary responsibility for the evaluation and recommendation of water management strategies for this WUG. For completeness, the consultants have coordinated to include information on that Region's preliminary recommendations for the 2016 Region C Plan herein, as they relate to the demand and identified needs within the North East Texas Region (Region D). From the 2016 Region C Plan:

> The water supply for this WSC is treated water from North Texas Municipal Water District (NTMWD). Water management strategies for Ables Springs WSC are conservation and purchasing additional water from NTMWD.

5.3.12.2 Blackland WSC

Blackland WSC is located in eastern Rockwall County within the Region C Water Planning Area, but serves a relatively smaller portion of population within the North East Texas Region (Region D). Thus, the Region C Water Planning Group has the primary responsibility for the evaluation and recommendation of water management strategies for this WUG. For completeness, the consultants have coordinated to include information on that Region's recommendations for the 2016 Region C Plan herein, as they relate to the demand and identified needs within the North East Texas Region (Region D). From the 2016 Region C Plan:

> Blackland WSC is located in eastern Rockwall County, with a small area in Hunt County, and serves about 3,300 people. The WSC gets its water supply from the North Texas Municipal Water District (NTMWD) through Rockwall.
>
> Water management strategies for Blackland WSC include conservation, establishing a direct connection with NTMWD, and additional water from NTMWD.

5.3.12.3 Caddo Basin SUD

Description/Discussion of Needs

Caddo Basin SUD provides water service in western Hunt County and eastern Collin County. The WUG population is projected to be 8,837 in 2020 and 35,581 by the year 2070. The SUD purchases treated water from North Texas MWD and is projected to have a shortage beginning in 2030 based on the availability of current supplies from North Texas

MWD. The SUD is projected to have a deficit of 184 ac-ft in 2030 increasing to a deficit of 1,379 ac-ft by 2070.

Evaluated Strategies

Four alternative strategies were considered to meet the SUD's water supply shortages. 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 SUD does not have a demand for non-potable water. Groundwater was not considered because the SUD currently purchases treated water from North Texas MWD and is planning to meet its future needs from water purchase.

Recommendations

Based on discussions with Region C, North Texas MWD does not have additional surface water supplies available to sell over the 2020 – 2070 planning period for purposes of the 2016 Regional Plan. Therefore, the recommended strategy for Caddo Basin SUD to meet their projected deficit of 72 ac-ft/yr in 2020 and 1,537 ac-ft/yr in 2070 is to purchase treated surface water from the City of Greenville, contingent upon Greenville strategies.

5.3.12.4 Caddo Mills

Description/Discussion of Needs

The City of Caddo Mills provides water service in Hunt County. This City's population was 1,338 in 2010 and is projected to increase to 1,710 by 2020 and 7,147 by 2070. The City purchases treated water from the City of Greenville and is projected to have a shortage beginning in 2030 based on the availability of current supplies to Greenville. Caddo Mills is projected to have a deficit of 1 ac-ft in 2030 increasing to a deficit of 255 ac-ft by 2070.

Evaluated Strategies

Four alternative strategies were considered to meet the City of Caddo Mills water supply shortages. 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. Groundwater was not considered because the City currently purchases treated water from Greenville and is planning to meet its future needs from water purchase from the City of Greenville.

Recommendations

The recommended strategy for the City of Caddo Mills to meet their projected deficit of 1 ac-ft/yr in 2020 and 255 ac-ft/yr in 2070 is to increase the volume of treated surface water purchased from the City of Greenville, contingent upon Greenville strategies.

5.3.12.5 Cash SUD

Description/Discussion of Needs

Cash SUD provides water in the south-central portion of Hunt County and small areas of western Rains County from purchased surface water supplies from the North Texas Municipal Water District (NTMWD) and the Sabine River Authority for supplies out of Lake Fork and Lake Tawakoni. Over 90% of the SUD's demand is located in Region D (Hunt County), with less than 10% in Region C (Rockwall County). In both regions, the system is projected to serve a total of 19,973 people in 2020 and 48,933 people by the year 2070. Cash SUD is not projected to have a need over the 2020 – 2070 planning period. However, Cash SUD submitted a request to the Region C Water Planning Group for consideration of a near-term strategy to increase its delivery infrastructure from NTMWD.

Evaluated Strategies

Within its contract with the Sabine River Authority, Cash SUD has identified a potential water management strategy with SRA for the use of available supply from Toledo Bend Reservoir, contingent upon the development of the Toledo Bend Transfer water management strategy for SRA under consideration by Region C.

As mentioned above, Cash SUD also submitted to Region C a proposed project for a new 16" transmission line from Fate to Union Valley, for an approximate cost of $6 million. The purpose of this project would be to deliver the full contractual capacity from NTMWD. Due to the size and distance of the existing line, Cash SUD cannot receive the full capacity of its existing contract with NTMWD.

Recommendations

The North East Texas Regional Water Planning group supports the Region C recommendation for construction of a new 16" transmission line from Fate to Union Valley, for an approximate cost of $6 million.

5.3.12.6 The City of Celeste

Description/Discussion of Needs

The City of Celeste is a small public water supply located in northwest Hunt County. The system is projected to serve 991 people in 2020 and 3,584 people by the year 2070. The current sources of supply are two wells into the Woodbine Aquifer with production capacities of 150 gpm and 200 gpm. The City provides water to its own customers in the Sabine River Basin and is projected to have a water supply deficit of 28 ac-ft/yr in 2050 increasing to 204 ac-ft/yr by 2070.

Evaluated Strategies

The four alternative strategies considered to meet Celeste's water supply shortages. 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. Groundwater from the Woodbine Aquifer was also considered as an alternative for this entity.

Recommendations

The recommended strategy for the City of Celeste to meet their projected deficit of 28 ac-ft/yr in 2050 and 204 ac-ft/yr in 2070 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 Woodbine Aquifer in Hunt County. Two wells with rated capacity of 190 gpm each would provide approximately 102 acre-feet each. The Woodbine Aquifer in Hunt County is projected to have a more than ample supply availability to meet the needs of the City of Celeste for the planning period.

5.3.12.7 Commerce WD

Commerce WD is a wholesale water provider in Hunt County selling groundwater and purchased surface water supplies from the Sabine River Authority for supplies out of Lake Tawakoni. Commerce WD is projected to maintain a supply surplus throughout the planning period, but is listed herein for the purpose of recommending seller water management strategies to utilize the District's available surplus supplies to meet projected demands for the District's customer WUGs.

Evaluated Strategies

Commerce WD is projected to have a supply surplus over the 2020 – 2070 planning period.

Recommendations

It is recommended that Commerce WD voluntarily reallocate the available surplus water supplies presently contracted with Hunt County Manufacturing. Demand projections for Hunt County Manufacturing indicate sufficient supply to meet the manufacturing projected demands over the 2020-2070 planning period, even with the voluntary removal of this supply. to increase supplies for other customer contracts. A voluntary reallocation in 2030 of 388 ac-ft/yr from Hunt County Manufacturing's surplus contracted supply from Tawakoni Reservoir is projected to be adequate to allow for the purchase of said supply by North Hunt SUD, to meet that WUG's demands starting in 2030.

As noted previously, these recommendations are for the voluntary reallocation of supply. No entity should be required to participate.

5.3.12.8 Hunt County-Other

Description/Discussion of Needs

The County-Other WUG in Hunt County comprises all or portions of Jacobia WSC, Little Creek Acres WSC, Maloy WSC, Poetry WSC, Shady Grove WSC, and West Leonard WSC within Hunt County. The WUG population is projected to be 18,328 in 2020 and

109,728 by the year 2070. The WUG is supplied by groundwater from the Nacatoch, Trinity, and Woodbine Aquifers and purchases surface water from Commerce WD, City of Cooper, City of Greenville, City of Terrell, and North Texas MWD. In Hunt County, the County-Other WUG is projected to have a deficit of 398 ac-ft in 2030 increasing to 7,928 ac-ft by 2070. Only the entities within the Sabine Basin are projected to incur a deficit in supply.

Evaluated Strategies

Four alternative strategies were considered to meet the WUG's water supply shortages. 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 is not a feasible option because water supply is mainly used for public consumption. Groundwater was identified as a potential source of water for Hunt County-Other, but the Nacatoch aquifer does not have sufficient availability to cover all shortages. Various sources of treated surface water are available to the entities in the County-Other WUG based on proximity and availability. Potential sources for contracted surface water include the City of Greenville, City of Commerce, Combined Consumers SUD, and City of West Tawakoni, some of which have available surplus above their projected demands. Because of limited availability of additional supplies in Region C, additional surface water above current contract amounts is not expected to be available for Region D entities for purposes of the 2016 Plan that are currently purchasing from North Texas MWD or the City of Terrell.

Recommendations

A combination of developing additional groundwater, reallocations of existing supplies, and development of a pipeline to purchase treated surface water can provide sufficient supply to meet the demands of the County-Other WUG through 2070. A recommended strategy for Hunt County-Other would be to initially construct up to 40 additional water wells in sufficient quantity to meet demands just prior to each decade as the deficits occur. The recommended supply source will be the Nacatoch Aquifer in Hunt County, Sabine River Basin. Forty wells with rated capacity of 75 gpm each would provide approximately 60 acre-feet each. The Nacatoch Aquifer in Hunt County is projected to have sufficient supply availability to meet a portion of the needs of Hunt County-Other for the planning period.

To meet additional projected needs for Hunt County-Other, voluntary reallocations of surplus surface supplies purchased from the Sabine River Authority are recommended for Hunt County-Other. Reallocation of Combined Consumers SUD's surplus from their purchase of Lake Fork supply from the Sabine River Authority to Hunt County-Other has been recommended for the Sabine River Authority to allow more utilization of existing supplies that would be adequate, when in combination with more groundwater wells, to meet projected demands for Hunt County-Other starting in 2040. Reallocation of the City of West Tawakoni's surplus from their purchase of Lake Tawakoni supply from the Sabine River Authority to Hunt County-Other has been recommended for the Sabine River Authority as a seller strategy to meet projected demands starting in 2060. Note that as demands increase for these original purchasers of the supply for which voluntary reallocations are recommended, the surplus available to Hunt County-Other diminishes over time.

By 2070, the recommended strategy is to construct a 23-mile, 24" pipeline for the purchase of 3,990 ac-ft/yr of surface water from the City of Greenville. This strategy is contingent upon the City of Greenville's recommended strategy for a pipeline tying into the proposed Toledo Bend Transfer, a preliminarily identified strategy under consideration for the 2016 Region C Plan. Thus, this strategy is contingent upon the Toledo Bend Transfer strategy as well.

5.3.12.9 The City of Greenville

Description/Discussion of Needs

The City of Greenville provides water service in Hunt County. The WUG population is projected to be 28,700 in 2020 increasing to 74,659 by the year 2070. The City of Greenville uses surface water from Greenville's city lake and purchases surface water out of Lake Tawakoni from the Sabine River Authority. The City of Greenville sells water to the City of Caddo Mills, entities within Hunt County-Other, Manufacturing, Mining and Steam Electric WUGs in Hunt County. The City of Greenville is projected to have a deficit of 2,194 ac-ft in 2050 increasing to 10,548 ac-ft by 2070.

Evaluated Strategies

Several alternative strategies were considered to meet the City of Greenville's water supply shortages as summarized in the below 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 strategies considered included the purchase of water out of Chapman Lake from the City of Sulphur Springs and purchase of raw water from the Sabine River Authority's proposed Toledo Bend Transfer. The Chapman Lake surface water strategy would require the City to construct an intake structure, pump station, pipeline, and new Water Treatment Plant (WTP) to bring water from Chapman Lake to the City. According to preliminary discussions with Region C, the Toledo Bend Transfer is currently not being considered until 2070, so was not considered a feasible alternative for Greenville until 2070.

Because the City of Greenville currently provides wholesale water to a number of entities in the surrounding area, potentially unmet needs for Caddo Mills, Caddo Basin SUD, and County-Other were included in the analysis of needed supply for Greenville under the assumption that Greenville would sell treated and untreated water, as needed, to these other entities. The City of Sulphur Springs has up to 11,260 acre-feet available from Chapman Lake. To meet projected demands for the city along with the other entities, the City of Greenville would need to implement a contract and develop infrastructure in place by 2050 to convey 10,750 acre-feet per year from Chapman Lake. It has been assumed for the purposes of the 2016 Plan that the conveyance of this supply would not require an amendment for interbasin transfer, as the retail service area for the City of Sulphur Springs is contiguous the City of Greenville's retail service area, and would thus be exempt per TAC §297.18(k)(5). Even with this supply in place, the City of Greenville would still require an additional 5,100 acre-feet of supply by 2070 to meet projected demands. This demand could be met by purchasing water from the Sabine River Authority through the Toledo Bend Transfer.

The City's existing water treatment plant was expanded in 1993-1994 to a capacity of 13 MGD. Based on TWDB projections, the City will need to expand the WTP by 2020 to accommodate projected demand. Expanding the WTP to include an additional 16 MGD of capacity will ensure adequate capacity through 2050, when additional raw water is made available from the Chapman Lake pipeline. In 2050, the City will need to construct a new WTP with a capacity of at least 30 MGD to ensure adequate capacity for projected demands through 2070.

Projected demands for Steam Electric power generation are associated with a proposed 1,750 MW combined cycle generation facility at Greenville. This facility was announced in 2002, but has not yet been constructed. The facility has been estimated to require approximately 4,000 acre-feet per year of supply, while the projections for Steam Electric water demand in Hunt County range from 12,400 ac-ft in 2020 to 28,500 ac-ft in 2070. Because of the uncertainty in demand and when this facility will be constructed, for the purposes of the 2016 Plan, Steam Electric demands have not been included in the strategy for the City of Greenville. Depending on the actual demand, the City may need to construct a pipeline to Chapman Lake earlier than 2050 and the Toledo Bend Transfer pipeline may be necessary earlier than 2070.

Recommendations

The recommended strategies to meet the projected demands of the City of Greenville and its wholesale customers (both existing and future) first includes the voluntary reallocation in 2020 of surplus supply for Hunt County Manufacturing of 484 ac-ft in 2020, up to 825 ac-ft in 2070. Also in 2020, the existing 13 MGD water treatment plant should be expanded by 16 MGD. This will allow the provision of up to 7,048 ac-ft/yr through 2040. By 2050, it is recommended the City contract with the City of Sulphur Springs for all available supply from Chapman Lake, and to construct an intake, pump station, and pipeline along with a new 30 MGD water treatment plant. By 2070, the recommended strategy is for the City to construct a tie-in pipeline to additional supply available through the Toledo Bend Transfer from the Sabine River Authority, which has been preliminarily discussed to be a Region C strategy in the 2016 Plan. This strategy would be in combination with a recommended strategy for construction of a tie-in pipeline to the City of Greenville for the purchase and use of a portion of this Toledo Bend supply water for the Hunt County-Other WUG.

5.3.12.10 Hickory Creek SUD

Description/Discussion of Needs

Hickory Creek SUD provides water in northwestern Hunt County and small areas of eastern Collin and southern Fannin counties from four wells in the Woodbine Aquifer in Hunt County, having a total rated capacity of 1402 gpm, or 754 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 4,517 people in 2020 and 25,413 people by the year 2070. The population and demand projections for the system are shown in the table below. In Hunt County, Hickory Creek SUD is projected to have a water supply deficit of 183 ac-ft/yr by 2040 increasing to 1,774 ac-ft/yr by 2070. The system does not have either a water conservation plan or a drought management plan.

Evaluated Strategies

The four alternative strategies considered to meet Hickory Creek SUD's water supply shortages. 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. 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 because the SUD is currently using this aquifer as the source of supply for the system. However, due to the limited availability of this groundwater source, this aquifer is not projected to have sufficient supply to meet all of Hickory Creek SUD's shortage. Additional supplies are available from the Trinity Aquifer in Hunt County to satisfy the remainder of Hickory Creek SUD's needs .

Recommendations

The recommended strategy for Hickory Creek SUD to meet their projected deficit of 101 ac-ft/yr in 2040 and 1,601 ac-ft/yr in 2070 would be to construct nine additional water wells similar to their existing wells just prior to each decade as the deficits occur. The recommended supply source will be the Woodbine and Trinity aquifers in Hunt County. Wells with rated capacity of 350 gpm each would provide approximately 189 acre-feet each. The Woodbine and Trinity aquifers in Hunt County are projected to have a more than ample supply availability to meet the needs of Hickory Creek SUD for the planning period.

5.3.12.11 Hunt County Irrigation

Description/Discussion of Needs

Irrigation in Hunt County has a demand that is projected to remain constant at 254 ac-ft/yr for the planning period. The Irrigation WUG in Hunt County is supplied by groundwater from the Nacatoch Aquifer and run-of-river diversions from the Sabine and Sulphur Rivers. A deficit of 146 ac-ft/yr is projected to occur throughout the planning period.

Evaluated Strategies

Three alternative strategies were considered to meet the Hunt County Irrigation WUG's water supply shortages. Advanced water conservation for irrigation practices were not considered in this planning effort, as present irrigation practices likely already incorporate many BMPs to extend water supplies, thus no additional conservation would be feasible. The use of reuse water from nearby municipalities is not considered feasible as it would not be effective to deliver reuse water to farm irrigation systems. Groundwater has been identified as a potential source of water for irrigation in Hunt County.

Recommendations

The recommended strategy for the Hunt County Irrigation to meet their projected deficit of 146 ac-ft/yr from 2020 to 2070 would be to construct two water wells prior to 2020. The recommended supply source will be the Nacatoch Aquifer in Hunt County. One well with rated capacity of 140 gpm would provide approximately 75 ac-ft/yr, each. The Nacatoch Aquifer in Hunt County, in the Sabine River Basin, is projected to have a more than ample supply availability to meet the needs of the Irrigation in Hunt County for the planning period.

5.3.12.12 The City of Josephine

The City of Joesphine is located in southeastern Collin County within the Region C Water Planning Area, and serves a relatively smaller portion of population in southern Hunt County within the North East Texas Region (Region D). Thus, the Region C Water Planning Group has the primary responsibility for the evaluation and recommendation of water management strategies for this WUG. For completeness, the consultants have coordinated to include information on that Region's recommendations for the 2016 Region C Plan herein, as they relate to the demand and identified needs within the North East Texas Region (Region D). From the 2016 Region C Plan:

> Josephine has a population of about 1,000 and receives its water supply from NTMWD. Water management strategies for Josephine are conservation and additional water from NTMWD.

5.3.12.13 The City of Lone Oak

Description/Discussion of Needs

City of Lone Oak is a public water supply located in Hunt County. The system is projected to serve 749 people in 2020 and 2,962 people by the year 2070. The current sources of supply is surface water from Tawakoni Reservoir purchased from Cash SUD. The City provides water to its own customers in the Sabine River Basin and is projected to have a water supply deficit of 56 ac-ft/yr in 2070. The system does have a water conservation and drought management plan in place.

Evaluated Strategies

The four alternative strategies considered to meet Lone Oak'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 Lone Oak that could be met by water reuse. The purchase of additional surface water from Cash SUD was evaluated. Cash SUD is projected to have supply available in 2070. Groundwater was not considered because of limited local availability by 2070.

Recommendations

The recommended strategy to meet projected demands for Lone Oak is to purchase additional water from Cash SUD by 2070.

5.3.12.14 Hunt County Mining

Description/Discussion of Needs

Mining in Hunt County has a demand that is projected to decrease from 128 ac-ft/yr in 2020 to 47 ac-ft/yr in 2070. Mining in Hunt County is currently supplied by groundwater from the Nacatoch Aquifer, Sabine River Basin, and water purchased from the City of Greenville from Lake Tawakoni.

Evaluated Strategies

Three alternative strategies were considered to meet the Hunt County Mining water supply shortages. Advanced conservation and water reuse were not considered because operational procedures for the existing mines are not available. Groundwater has been identified as a potential source of water for mining in Hunt County. Surface water was also considered as a viable alternative to meet projected demands.

Recommendations

The recommended strategy for the Hunt County Mining WUG to meet their projected deficit of 73 ac-ft/yr in 2020 is to construct an additional water well similar to their existing wells, with a rated capacity of . The recommended supply source is the Nacatoch Aquifer in Hunt County, Sabine River Basin. The Nacatoch Aquifer in Hunt County, Sabine River Basin is projected to have a more than ample supply availability to meet the needs of the Mining in Hunt County for the planning period.

5.3.12.15 North Hunt SUD

Description/Discussion of Needs

North Hunt SUD provides water service in Hunt, Fannin, and Delta counties. It is projected North Hunt SUD will have a shortage in 2030. The WUG population is projected to be 4,246 in 2020 and 16,003 by the year 2070. The SUD has a contract for water supply with the City of Commerce for 147 ac-ft/yr, a well in Hunt county with a rating of 170 gpm , and a well in Fannin County that is rated at 318 gpm. The SUD is projected to have a deficit of 99 ac-ft in 2040, increasing to 713 ac-ft in 2070. In Hunt County, the SUD is projected to have a deficit of 36 ac-ft in 2030 increasing to 738 ac-ft by 2070.

Evaluated Strategies

Four alternative strategies considered to meet North Hunt SUD’s water supply shortages. 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 from the Woodbine Aquifer was considered because North Hunt SUD is currently using this aquifer as a source of supply for the system. However, due to the limited availability of this groundwater source, this aquifer will not be able to meet all of North Hunt SUD’s shortage. Additional supplies are available from the Paluxy Aquifer, another existing source used by the SUD. Additional purchase of water from the City of Commerce is another alternative; however, Commerce has only a limited volume potentially available only if existing supplies to the Manufacturing WUG can be reallocated. A separate feasible strategy was considered to utilize surplus supply from Delta County-Other, specifically Delta County MUD (an entity within Delta County-Other). The North Hunt SUD service area is contiguous with the service area for Delta County MUD, which purchases supply from the City of Cooper. Delta County MUD is projected to have sufficient surplus supplies to have the capability to meet North Hunt SUD needs starting in 2060. This strategy would require a pipeline connecting the two systems, of sufficient size to provide up to 325 ac-ft/yr.

Recommendations

The recommended strategy to meet North Hunt SUD's needs is to purchase surface water from City of Commerce available via a voluntary reallocation from the existing surplus for the Hunt Manufacturing – Sulphur WUG beginning in 2030. In 2060, it is recommended that North Hunt SUD construct a pipeline to connect with Delta County MUD (a Sub-WUG entity within Delta County Other) for the purchase of surplus supplies by 2060.

5.3.12.16 The City of Royse City

Description/Discussion of Needs

Royse City is a city of about 10,000 people located in northeast Rockwall County and southeast Collin County. The North Texas Municipal Water District (NTMWD) supplies most of the water used in Rockwall County and will continue to do so in the future. Water user groups that currently get water from NTMWD will purchase additional water from NTMWD to meet future demands.

Evaluated Strategies

The four alternative strategies considered to meet the City of Royse City's water supply shortages are listed in the table below. Advanced conservation was identified a feasible strategy. 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 meeting its future needs from water purchase from NTMWD.

Recommendations

The North East Texas Regional Water Planning Group supports the recommendation from Region C for advanced water conservation and an increased contract with NTMWD to meet projected future needs of the City of Royse City.

5.3.12.17 Sabine River Authority

Description/Discussion of Needs

The Sabine River Authority (SRA) holds water rights in Lake Fork (Wood and Rains Counties) and Lake Tawakoni (Hunt, Rains, and Van Zandt Counties). The SRA supplies the cities of Commerce, Edgewood, Emory, Greenville, Quitman, Kilgore, Longview, Point, West Tawakoni, Wills Point, the Ables Springs WSC, Cash SUD, Combined Consumers SUD, MacBee SUD and South Tawakoni, as well as industry. SRA is projected to maintain a supply surplus throughout the planning period, but is listed herein for the purpose of recommending seller water management strategies to utilize the District's available surplus supplies to meet projected demands for the Authorities' customer WUGs.

Evaluated Strategies

SRA is projected to have a supply surplus over the 2020 – 2070 planning period.

Recommendations

It is recommended that the Sabine River Authority voluntarily reallocate the available surplus water supplies presently contracted with the City of West Tawakoni out of Lake Tawakoni. Demand projections for the City of West Tawakoni indicate sufficient supply to meet West Tawakoni's projected demands over the 2020 – 2070 planning period, even with the voluntary removal of this supply. A voluntary reallocation in 2040 of 670 ac-ft/yr from West Tawakoni's surplus contracted supply from Tawakoni Reservoir is projected to be adequate to allow for the purchase of said supply by Poetry WSC (within the County-Other WUG for Hunt County), to meet that WUG's demands starting in 2040.

Additional supply is projected to be necessary for this WUG by 2060. Thus, starting in 2060, it is recommended that the Sabine River Authority voluntarily reallocate the available surplus water supplies presently contracted with Combined Consumers SUD out of Lake Fork. Demand projections for Combined Consumers SUD indicate sufficient supply to meet the SUD's projected demands over the 2020 – 2070 planning period, even with the voluntary removal of this supply. A voluntary reallocation in 2060 of 1,045 ac-ft/yr from Combined Consumers SUD's surplus contracted supply from Lake Fork is projected to be adequate to allow for the purchase of said supply by Poetry WSC, to meet that WUG's demands starting in 2040.

These voluntary reallocations would provide sufficient supply to meet the projected demands for the Hunt County Other WUG, in combination with a recommendation for that WUG to increase its existing contract to purchase these supplies with the Sabine River Authority. Note, however, that the amount necessary and available for reallocation diminishes as the demand for the original entity, Combined Consumers SUD, increases.

As noted earlier in this Chapter, these recommendations are for the voluntary reallocation of supply. No entity should be required to participate.

5.3.12.18 Hunt County Steam Electric

Description/Discussion of Needs

The Steam Electric WUG in Hunt County has a demand that is projected to grow from 12,436 ac-ft/yr in 2020 to 28,564 ac-ft/yr in 2070. This projected demand is associated with the proposed Cobisa generation facility near Greenville, a proposed 1,750 MW combined cycle plant announced in 2002, but not yet constructed. The facility has been estimated to require about 4,000 acre-feet per year of supply, while the projections for

Steam Electric water demand in Hunt County range from 12,436 ac-ft in 2020 to 28,564 ac-ft in 2070. Actual current demand is about 351 ac-ft for the existing Powerline facility at Greenville.

Evaluated Strategies

Projected demands for steam electric power generation in 2020 are substantially greater (by a factor of approximately 3) than existing demand plus anticipated demand for the Cobisa facility, if constructed. The differences are attributable to differing estimation methods and assumptions for future steam electric demands. TWDB projections for steam electric demand are conservatively based at the higher end of unit water use for electricity generation. Because the proposed Cobisa facility would be a combined cycle plant, actual water use would potentially be significantly lower than the adopted projections. Other factors, such as water requirements for carbon capture if required in the future, also elevate the projected demands. Uncertainty increases as projections are made further into the future; but projections for 2020 demands are likely overestimated.

Because the proposed Cobisa facility would be a combined cycle generation facility, the implementation of a combined cycle generation facility was considered advanced conservation for the purposes of the 2016 Plan. Projections of estimated savings are based upon projections developed by the University of Texas Bureau of Economic Geology (2008), utilizing a projection of four times Business As Usual (4BUA) as a conservative estimate. This conservation would meet a substantial portion (7,450 ac-ft/yr in 2020 to 12,060 ac-ft/yr in 2070) of the projected demand. No cost was assumed because the facility would be constructed with this level of conservation built in. With advanced conservation, remaining demands range from 4,990 ac-ft/yr in 2020 to 16,500 ac-ft/yr in 2070.

Because the proposed facility would be located at Greenville, it is assumed the demands would be met under contract with the City of Greenville. Groundwater is not feasible due to the limited modeled available capacity of aquifers. Greenville currently contracts with the Sabine River Authority for its supply and utilizes the city lake for storage. However, all SRA water from Lake Tawakoni and Lake Fork has been contracted, thus no additional water is available from these lakes to meet the projected steam electric demands. The recommended strategy for Greenville is to supplement existing supplies with water from Chapman Lake by 2050. To meet the projected steam electric demands (after conservation), this water would need to be available as soon as any additional, unspecified facility is constructed, such that the contract and infrastructure for Greenville would be needed as much as 30 years earlier. The available supply from Chapman Lake would not be sufficient to meet projected steam electric demands without conservation.

Conservation and supply from Chapman Lake would be sufficient to meet projected steam electric demands through 2040, but additional supplies would be necessary by 2050. The Sabine River Authority is proposing to transfer water from the Toledo Bend Reservoir to the North Texas region by 2070 to meet anticipated future needs of its customers. Analysis of available supplies in the area suggest no other wholesale water provider in the area can meet projected steam electric demands in Hunt County; thus, SRA water from the Toledo Bend Reservoir would be needed to meet demands by 2050.

Recommendations

Advanced Water Conservation, reflecting the construction of a combined cycle generation facility, is recommended to address a portion of the identified Steam Electric needs in Hunt County. Depending on the actual demand, as well as the timing of construction of new power generation facilities in Hunt County, the City of Greenville may need to construct a pipeline to Chapman Reservoir by 2020, and the Toledo Bend Transfer pipeline may be necessary by as soon as 2050. However, given the uncertainty in projected demands and the uncertain timing of construction of the proposed Cobisa facility (originally announced in 2002), Steam Electric demands above the existing 351 ac-ft/yr that are not met by the recommended Advanced Water Conservation are considered an unmet need for the purposes of the 2016 Plan.

5.3.12.19 The City of Wolfe City

Description/Discussion of Needs

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 1,719 people by 2020, and the population is expected to increase to 6,217 by the year 2070. 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, Sulphur River Basin, which has been brought back for use. Yield from the local lakes is calculated as 200 ac-ft/yr through 2070. Based on these yields, the quantity of water from the lakes will not be sufficient to meet projected demands. Wolfe City is projected to have a deficit of 30 ac-ft/yr in 2050, up to 271 ac-ft/yr in 2070.

Evaluated Strategies

Four strategies 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 would be projected to be less than 140 gpcpd. While surface water options are available, these options were not investigated due to higher costs for the acquisition of surface supplies relative to the development costs for available groundwater supplies. 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 from the Woodbine Aquifer, Sulphur River Basin, was evaluated as a potentially cost effect approach for this entity.

Recommendations

The recommended strategy for the City of Wolfe City to meet their projected deficit of 30 ac-ft/yr in 2050 and 271 ac-ft/yr in 2070 would be to construct up to four additional water wells similar to their existing wells just prior to each decade as the deficits occur. The recommended supply source will be the Woodbine Aquifer in Hunt County, Sulphur River Basin. Four wells with rated capacity of 150 gpm each would provide approximately 81 acre-feet each. The Woodbine Aquifer in Hunt County is projected to have a more than ample supply availability to meet the needs of the City of Wolfe City for the planning period.

This recommendation is made based on limited knowledge of firm yield of the Wolfe 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. The firm yields were calculated using the approved WAM, Run 3, for the Sulphur River Basin, reflecting full demand from existing water rights and no return flows.

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, the NETRWPG supports efforts for this WUG evaluating the consideration of purchasing treated surface water from regional water providers in the future. Further study of this system is warranted, and supported by the NETRWPG for the purposes of the 2016 Plan.

5.3.13 **Lamar County**

5.3.13.1 Lamar County-Other

Description/Discussion of Needs

Lamar County-Other is comprised of M-J-C, Pattonville and Petty WSCs. The WUG population is projected to be 2,707 in 2020 and 3,061 by the year 2070. The entities comprising this WUG are supplied by groundwater from the Trinity and Woodbine Aquifers, and purchased surface water from Lamar County WSD. In Lamar County, the County-Other WUG is projected to have a deficit of 67 ac-ft in 2020 and increasing to a deficit of 116 ac-ft by 2070.

Evaluated Strategies

Five alternative strategies were considered to meet the WUG’s water supply shortages. Advanced conservation was not selected because the WUG’s overall supply is not projected to meet TCEQ regulatory minimums. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater from the Trinity Aquifer has been identified as a potential source of water for Lamar County Other. The purchase of surface water from Pat Mayse from Lamar County WSD has also been identified as a potential water supply source.

Recommendations

The recommended strategy to meet Lamar County-Other needs is to increase the existing contract amounts with Lamar County WSD is the recommended strategy to meet Lamar County-Other needs.

5.3.13.2 Lamar County Irrigation

Description/Discussion of Needs

Irrigation WUG in Lamar County is projected to be supplied by surface water from run-of-river diversions from the Red River and groundwater from wells the Trinity and Woodbine Aquifers. Irrigation in Lamar County has a demand that is projected to decrease from 20,945 ac-ft/yr in 2020 to 20,622 ac-ft/yr in 2070. A deficit of 18,312 ac-ft/yr is projected to occur in 2020 and decrease to 18,302 ac-ft/yr by 2070.

Evaluated Strategies

Twelve alternative strategies were considered to meet the Lamar County Irrigation WUG's water supply shortages. Advanced water conservation for irrigation practices were not considered in this planning effort, as present irrigation practices likely already incorporate many BMPs to extend water supplies, thus no additional conservation would be feasible. The use of reuse water from nearby municipalities is not considered feasible as it would not be effective to deliver reuse water to farm irrigation systems. Groundwater was identified as a potential source of water for irrigation in Lamar County. Due to limitations of availability, the Woodbine and Trinity aquifers will not cover all shortages. Surface water purchased from the City of Paris was considered as a viable supplement to groundwater in order to meet projected demands. Another potential alternative is to purchase all needed water from the City of Paris, or Lamar Co WSD via the City of Paris. Current plans are under consideration for the development of a potential new surface water permit for a diversion and two impoundments entirely located on private property. These plans are for the generation of firm supply for agricultural uses in Lamar County.

Recommendations

The recommended strategy for the Lamar County Irrigation WUG to meet projected demands during the planning period is to purchase raw water from Pat Mayse and Crook Reservoirs through the City of Paris. Construction of a project for Daisy Farms in southern Lamar County is a currently ongoing development of water supply consistent with this recommended strategy.

5.3.13.3 Lamar County Manufacturing

Description/Discussion of Needs

Manufacturing in Lamar County has a demand that is projected to increase from 6,427 ac-ft/yr in 2020 to 8,338 ac-ft/yr in 2070. Manufacturing WUG in Lamar County is projected to be supplied by direct reuse and surface water purchased from the City of Paris and Lamar County WSD. A deficit of 565 ac-ft/yr is projected to occur in 2020, increasing to 951 ac-ft/yr by 2070 in the Sulphur River Basin. No shortages are projected within the Red River Basin.

Evaluated Strategies

Seven alternative strategies were considered to meet the Lamar County Manufacturing WUG's water supply shortages. Advanced water conservation for manufacturing was considered in this planning effort, to reduce overall demands; however, application of this strategy would not resolve all identified needs. The use of reuse water from nearby municipalities was not considered, and direct reuse of existing manufacturing supplies is already occurring. Groundwater has been identified as a potential source of water for manufacturing in Lamar County. Surface water purchases from the City of Paris and Lamar County WSD were considered as potential strategies as well.

Recommendations

The recommended strategy for the Lamar County Manufacturing WUG to meet projected demands during the planning period is to implement advanced water conservation through industrial water auditing, where possible, and develop additional groundwater wells in the Blossom Aquifer in the Red River Basin, as this would be the cost-effective solution, and allow surface water supplies to be available for other demands in the region.

5.3.13.4 Lamar County Steam Electric

Description/Discussion of Needs

The Steam Electric WUG in Lamar County has a demand that is projected to grow from a demand of 8,503 ac-ft/yr in 2020 to 19,529 ac-ft/yr in 2070. Steam electric is projected to have a deficit of 980 ac-ft/yr in 2030 and increasing to a deficit of 10,568 ac-ft/yr in 2070.

Evaluated Strategies

Seven alternative strategies were considered to meet the Hunt County Steam Electric WUG's water supply shortages. In this round of planning, advanced water conservation was not considered as a water management strategy as the majority of steam electric plants and future plants intend to operate with all possible water conservation processes practicable. Groundwater was identified as a potential source of water for steam electric power in Lamar County. However, due to the limited availability of these groundwater sources, these aquifers will not be able to provide sufficient supply to meet the identified shortages. For this reason, groundwater development was not considered a viable strategy. Surface water from Pat Mayse Reservoir purchased from the City of Paris was considered as a viable supplement to the groundwater sources to meet projected demands. Alternatively, surface water from Pat Mayse Reservoir purchased from the City of Paris was considered as a potential strategy to meet all steam electric needs.

Recommendations

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.

5.3.14 Marion County

5.3.14.1 Marion County Mining

Description/Discussion of Needs

The Mining WUG in Marion County is a split entity and has a demand that is projected to be decreasing from 489 ac-ft/yr in 2020 to 393 ac-ft/yr in 2070. Mining in Marion County has a current water supply consisting of water wells from the Carrizo-Wilcox Aquifer. The total rated available supply from these sources is 116 ac-ft/yr. Mining in Marion County is projected to have a water supply deficit of 373 ac-ft/yr in 2020 increasing to 645 in 2030 then decreasing to a deficit of 265 ac-ft/yr in 2070 for the Cypress Creek Basin portion of Marion County.

Evaluated Strategies

Three alternative strategies were considered to meet the Marion County Mining water supply shortages as summarized in the following table. Advanced conservation and water reuse was not considered because operational procedures for the existing mines is not available. Surface water alternatives were omitted since there is not a supply source within close proximity to the county with available supply.

Recommendations

The recommended strategy for the Marion County Mining to meet their projected deficit of 373 ac-ft/yr in 2020 and 645 ac-ft/yr in 2050 in the Cypress Basin would be to construct additional water wells similar to their existing wells just prior to each decade as the deficits occur till 2030. The recommended supply source will be the Carrizo-Wilcox Aquifer in Marion County. Six wells with rated capacity of 200 gpm each would provide approximately 108 acre-feet each or 648 ac-ft/yr. The Carrizo-Wilcox Aquifer in Marion County is projected to have a more than ample supply availability to meet the needs of the Mining in Marion County for the planning period.

5.3.15 Morris County

5.3.15.1 Morris County Manufacturing

Description/Discussion of Needs

The Manufacturing WUG in Morris County has a demand that is projected to be increasing from 95,931 ac-ft/yr in 2020 to 130,868 ac-ft/yr in 2070. Manufacturing in Morris County has a current water supply consisting of water wells from the Queen City Aquifer, surface water from Ellison Creek Reservoir, Reuse, and contracts with Northeast Texas MWD for surface water from Ellison Creek Reservoir and Lake O' the Pines. The total rated available supply from these sources is 122,334 ac-ft/yr. Manufacturing in Morris County is projected to have a water supply surplus of 39,012 ac-ft/yr in 2020 decreasing to a deficit of 2,763 ac-ft/yr in 2070.

Evaluated Strategies

Three alternative strategies were considered to meet the Harrison County Manufacturing water supply shortages as summarized in the following table. Advanced conservation was assumed to yield 10 percent of Demand and generates sufficient savings to satisfy the projected shortage. Water reuse was not considered because it is already being employed. Groundwater alternatives were omitted since surface water is already being utilized.

Recommendations

The recommended strategy for the Morris County Manufacturing to meet their projected deficit of 2,763 ac-ft/yr in 2070 would be to employ conservation for the planning period which is projected to save 13,087 ac-ft/yr in 2070.

5.3.16 Rains County

WUGs in Rains County include the City of Alba, Bright Star-Salem SUD, Cash SUD, the City of East Tawakoni, the City of Emory, Golden WSC, the City of Point, and the County-Other WUG. Entities comprising Rains County-Other include:

- Miller Grove Water Supply;
- South Rains SUD; and
- Shirley WSC.

The South Rains SUD purchases approximately 3.5 million gallons per month of treated supply from the City of Emory to service approximately 968 rural customers in Rains County. The South Rains SUD also purchases an average 745,000 gallons per month of treated water supply from Bright Star-Salem SUD.

There are no entities with identified shortages in Rains County.

5.3.17 Red River County

5.3.17.1 The City of Clarksville

Description/Discussion of Needs

The City of Clarksville is located in Red River County. The system is projected to serve 3,315 people through the planning period. The current sources of supply are wells into the Blossom Aquifer, mixed with surface water from Langford Lake. Water quality issues with the groundwater (TDS) and surface water (turbidity) necessitate mixing of the supplies to meet Texas drinking water standards. The groundwater has over 1,000 ppm of dissolved solids including high levels of sodium, sulfate, and chloride. The City provides water to its own customers in the Sulphur basin and is projected to have a water supply deficit of 593 ac-ft/yr in 2040, due to sedimentation issues in Langford Lake. As the surface water supply for the City diminishes, the capability to mix the surface supply with the groundwater supply commensurately diminishes as well. Thus as surface supply diminishes, so too does the capability to utilize the City's existing groundwater supply. As noted in a 4 October, 2013 memorandum from the City's consultant, Murray, Thomas & Griffin, Inc. (MTG):

> "Clarksville has no available surface water when a water level of 417.0 (2006 low water level) and a sediment level at 415.0 (2013 lake bottom) are considered. Each of these conditions has occurred during the past ten years. The surface water is necessary to address total volume needs as well as for blending with the ground water."

The system does have a water conservation and drought management plan in place.

Evaluated Strategies

The various feasible strategies considered to meet Clarksville's water supply shortages are listed in the table below. Advanced conservation was not selected because Clarksville's supply would not be projected to meet TCEQ regulatory minimums. Furthermore, reduction in demand would not alleviate the aforementioned water quality issues with the City's projected supplies. There are no significant current water needs in Clarksville that could be met by water reuse. Additional pumping (five additional wells) from the Nacatoch Aquifer in the Sulphur River Basin and Reverse Osmosis treatment of all of the City's existing groundwater supplies has also been considered. The City's existing surface water supply is rapidly decreasing due to sedimentation issues in Langford Lake, the City's sole existing surface water supply. The City has requested the consideration of multiple potential surface water strategies to meet Clarksville's water supply needs. Potentially feasible strategies evaluated include:

- Treated Water Pipeline to DeKalb - purchasing water from the City of Texarkana's available supply from Wright Patman Reservoir;
- Dredging of sediment from Langford Lake;
- Construction of a new surface water reservoir, Dimple Reservoir;
- Construction of a raw water pipeline tying into to Region C's proposed Marvin Nichols Reservoir.
- Treated Water Pipeline to Detroit - purchasing water from the City of Paris (via Lamar County WSD) from Paris available supply.

The projected amount of firm supply necessary to meet the above projected demands differ due to the City's current methodology of mixing their surface and groundwater supplies at a ratio of 51%.

More detailed discussion on this evaluation can be found in Chapter 5 of Appendix C.

Recommendations

To meet the City's projected deficit in 2040 it is recommended that Clarksville contract with the City of Texarkana for supply from Lake Wright Patman, which includes the development of a Treated Water Pipeline tying into Texarkana's system in DeKalb to provide 303 ac-ft/yr for the projected needs of the City of Clarksville, although Clarksville has indicated their intent, if this strategy were to be implemented to contract additional supply as necessary to meet their full projected demands. This strategy provides a reliable supply without construction of a new reservoir, thus minimizing potential impacts to the agricultural and natural resources within the Region. Further, this amount allows for the resumption of the City's utilization of existing groundwater supplies via mixing. Thus, this recommended strategy is contingent upon the City's use of its existing groundwater supplies, as well as contingent upon recommended strategies for the City of Texarkana and Riverbend Water Resources District.

At present, considerable uncertainty exists in each of the identified feasible water management strategies for the City of Clarksville. The NETRWPG supports any efforts by the City of Clarksville to further study all potential strategies to identify the best approach for the City to meeting all of its future water supply needs, and such a study should be considered consistent with the 2016 North East Texas Regional Water Plan.

5.3.17.2 Red River County-Other

Description/Discussion of Needs

Red River County-Other is comprised of the Cities of Annona, Avery, Bogata, and Talco as well as 410 WSC, Red River County WCID, and a portion of Oak Grove WSC. The WUG population is projected to be 1,873 in 2020 and 49 by the year 2070. Entities comprising the WUG are supplied by groundwater from the Carrizo-Wilcox, Nacatoch and Trinity Aquifers, and purchases of surface water from Lamar County WSD and the City of Texarkana. Red River County-Other is not projected to have a shortage during the planning period; however, the cities of Avery and Annona are member cities in the Riverbend Water Resources District, and a request was received from Riverbend to include a strategy within the 2016 Plan for these entities.

Evaluated Strategies

There were four alternative strategies considered to meet the SUD's water supply shortages. Advanced conservation was not selected because the WUG's overall supply is not projected to meet TCEQ regulatory minimums. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not considered as no shortages are reported and cities within the WUG purchase water from other entities such as Lamar County WSD and City of Texarkana. A request was submitted by Riverbend Water Resources District to consider a new Water Treatment Plant, pipeline, and intake to Wright Patman Reservoir. Thus, a renewal contract with Texarkana/Riverbend has been considered herein.

Recommendations

It is recommended that entities within Red River County-Other continue their existing contract for 185 ac-ft per year from Texarkana, contingent upon Texarkana/Riverbend strategies.

5.3.17.3 Red River County Irrigation

Description/Discussion of Needs

The Irrigation WUG in Red River County has a demand that is projected to decrease from 5,156 ac-ft/yr in 2020 to 4,895 ac-ft/yr in 2070. Irrigation in Red River County is projected to be supplied by existing surface water from run-of-river diversions from the Red and Sulphur Rivers. A deficit of 4,376 ac-ft/yr is projected to occur in 2020 and decrease to 4,125 ac-ft/yr by 2070.

Evaluated Strategies

Seventeen alternative strategies were considered to meet the Red River County Irrigation WUG's water supply shortages. Advanced water conservation for irrigation practices were not considered in this planning effort, as amounts potentially saved would not provide sufficient savings to meet the projected needs over the planning period. The use of reuse water from nearby municipalities is not considered feasible as it would not be effective to deliver reuse water to farm irrigation systems. Groundwater was identified as a potential source of water for irrigation in Red River County. However, due to limited availability, the Blossom, Nacatoch and Trinity aquifers will not cover all shortages. For this reason, groundwater development may not be a feasible strategy alone. However, total potentially available groundwater supply (exceeding the MAGs) was evaluated for consideration as an alternative strategy.

Treated surface water purchased from Lamar County WSD was considered as a viable supplement to the additional groundwater in order to meet projected demands. Purchasing sufficient treated surface water from Lamar County WSD to meet the entirety of the need was also considered as possible strategy. Purchasing raw water from the City of Paris has also been considered as a possible strategy, with a higher capital cost but an anticipated lower annual cost. The City's surface water permit for Pat Mayse Reservoir, as amended, allows for the interbasin transfer and use of water in both the Red and Sulphur River basins. However, the use of water via this permit would require a minor amendment to add irrigation as a permitted use.

Recommendations

The alternative supply scenarios considered herein that remain within the RWP guidelines with regard to the definition of available supply (i.e., the availability determination of groundwater supply employing solely the MAG) suggest that the most likely, cost effective strategy, the construction of additional wells, would be insufficient to meet the projected needs. The alternative solutions considered herein do not appear to be cost effective approaches, particularly given the fact that in reality, no regulatory entity exists within Region D to enforce the MAG limitations.

Thus, for the purposes of the 2016 Region D Plan, the Red River County Irrigation demands are considered an unmet need.

However, the drilling of new wells for the provision of supplies in exceedance of the MAG requirements is presented as an identified Alternative Water Management Strategy for the purposes of the 2016 Region D Plan. This alternative approach better reflects the reality of available groundwater supply in the area, while ascribing to the guidelines established by the TWDB for the regional planning process. A more detailed description of the aforementioned Alternative Water Management Strategy can be found within the Alternative Water Management Strategy section later in Chapter 5.

5.3.17.4 Red River County Manufacturing

Description/Discussion of Needs

The Manufacturing WUG in Red River County has a demand that is projected to increase from 9 ac-ft/yr in 2020 to 11 ac-ft/yr in 2070. Manufacturing in Red River County is projected to be supplied by groundwater from the Blossom Aquifer and surface water from Langford Lake. Additional groundwater from the Trinity Aquifer is purchased from the City of Detroit. A deficit of 7 ac-ft/yr is projected to occur in 2040 and increase to 9 ac-ft/yr by 2070.

Evaluated Strategies

Four alternative strategies were considered to meet the Red River County Manufacturing WUG's water supply shortages. Advanced water conservation for manufacturing in Red River County is not feasible. The use of reuse water from nearby municipalities was not considered to be available. Groundwater has been identified as a potential source of water for manufacturing in Red River County. The purchase of surface water from Langford Lake was not considered due to sedimentation issues in the lake.

Recommendations

The recommended strategy for Red River County Manufacturing to meet projected demands of 7 ac-ft/yr in 2040 and 9 ac-ft/yr in 2070 is to develop one additional groundwater well prior to 2040 in the Trinity Aquifer within the Sulphur River Basin. One well with a rated capacity of 75 gpm would provide approximately 20 ac-ft/yr. The Trinity Aquifer in the Sulphur River Basin is projected to have sufficient supply availability to meet the identified needs for this WUG over the planning period.

5.3.18 **Smith County**

5.3.18.1 Crystal Systems, Inc.

Description/Discussion of Needs

The Crystal Systems Texas, Inc. system is located in northwestern Smith County and serves the un-incorporated area surrounding Hideaway Lake. The population is projected to increase from 2,802 persons in 2020 to 5,969 persons in 2070. The System is included as a W.U.G. in Smith County. The system's current water supply consists of four water wells from the Carrizo-Wilcox Aquifer. The total rated capacity of these wells is 3,420 GPM, or 1,840 ac-ft/yr. The system is bounded on the north and southeast by the Lindale Rural WSC and on the east by the City of Lindale. The System does have a water conservation plan. The System is projected to have a water supply deficit of 31 ac-ft/yr in 2020 increasing to a deficit of 1,836 ac-ft/yr in 2070.

Evaluated Strategies

Four alternative strategies were considered to meet the Crystal System's 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 system 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 system and surface water treatment is not economically feasible for a system of this size.

Recommendations

The recommended strategy for Crystal Systems to meet their projected deficit of 41 ac-ft/yr in 2020 and 1,836 ac-ft/yr in 2070 would be to construct six additional water wells similar to their existing wells just prior to each decade as the deficits occur. The recommended supply source will be the Queen City Aquifer in Smith County. Six wells with rated capacity of 600 gpm each would provide approximately 322 acre-feet each. The Queen City Aquifer in Smith County is projected to have a more than ample supply availability to meet the needs of Crystal Systems for the planning period. During the planning period four wells will be drilled in the Queen City formation of the Sabine River Basin while two wells will be drilled into the Queen City formation of the Neches River Basin.

5.3.18.2 Hideaway

Description/Discussion of Needs

The Hideaway community is located in northwestern Smith County and serves the un-incorporated area surrounding Hideaway Lake. The population is projected to increase from 3,504 persons in 2020 to 6,904 persons in 2070. The community is included as a W.U.G. in Smith County. The system's current water supply comes directly from Crystal Systems Texas, Inc. The system is surrounded in its entirety by Crystal Systems Texas, Inc. The system does not have a water conservation plan. The system is projected to have a neutral surplus/deficit in 2020 increasing to a deficit of 117 ac-ft/yr in 2070.

Evaluated Strategies

Four alternative strategies were considered to meet the Hideaway Lake's 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 system 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 system and surface water treatment is not economically feasible for a system of this size.

Recommendations

The recommended strategy for the Hideaway community to meet their projected 117 ac-ft/yr in 2070 would be to increase their purchase for additional water from their water supplier, Crystal Systems Texas, Inc. Crystal Systems Texas, Inc. has sufficient supply in 2070 to meet Hideaway's deficit. Note that Crystal Systems Texas, Inc. is proposing improvements to provide sufficient supply for both Hideway and other customers, and this strategy would be contingent upon that recommended strategy.

5.3.18.3 The City of Lindale

Description/Discussion of Needs

The City of Lindale is located in northern Smith County and serves the incorporated city limits and an area immediately northwest of the City of Lindale. The population is projected to increase from 6,122 persons in 2020 to 15,246 persons in 2070. The City is included as a WUG in Smith County. The system's current water supply consists of four water wells from the Carrizo-Wilcox Aquifer. The total rated capacity of these wells is 1,837 GPM, or 988 ac-ft/yr. The system is bounded on the west, north, and east by the Lindale Rural WSC and on the south by the City of Tyler. The City does have a water conservation plan. The City of Lindale is projected to have a water supply deficit of 691 ac-ft/yr in 2020 increasing to a deficit of 2,893 ac-ft/yr in 2070.

Evaluated Strategies

Four alternative strategies were considered to meet the City of Lindale's 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.

Recommendations

The recommended strategy for the City of Lindale to meet their projected deficit of 691 ac-ft/yr in 2020 and 2,893 ac-ft/yr in 2070 would be to construct nine additional water wells similar to their existing wells just prior to each decade as the deficits occur. The recommended supply source will be the Queen City Aquifer in Smith County. Nine wells with rated capacity of 600 gpm each would provide approximately 322 acre-feet each. The Queen City Aquifer in Smith County is projected to have a more than ample supply availability to meet the needs of the City of Lindale for the planning period.

5.3.18.4 Smith County Manufacturing

Manufacturing in Smith County occurs predominantly within the East Texas Regional Water Planning Area, with a small portion within the North East Texas Region (Region D). Thus, Region I is the RWPG with the primary responsibility for the evaluation and recommendation of water management strategies for this WUG. For completeness, the consultants have coordinated to include information on that Region's recommendations for the 2016 Region I Plan herein, as they relate to the demand and identified needs within the North East Texas Region (Region D). From the material developed in preparation of the 2016 East Texas Regional Water Plan, the recommended strategy for Smith County Manufacturing is the purchase of 300 ac-ft/yr by the year 2020, up to 442 ac-ft/yr by 2070, from the City of Tyler's surface water supplies.

5.3.18.5 Smith County Mining

Description/Discussion of Needs

The Mining WUG in Smith County is a split entity and has a demand that is projected to be increasing from 287 ac-ft/yr in 2020 to 497 ac-ft/yr in 2070. Mining in Smith County has a current water supply consisting of water wells from the Queen City Aquifer. The total rated available supply from these sources is 320 ac-ft/yr. Mining in Smith County is projected to have a water supply deficit of 8 ac-ft/yr in 2060 increasing to 45 ac-ft/yr in 2070 for the Smith Sabine split.

Evaluated Strategies

Three alternative strategies were considered to meet the Smith County Mining water supply shortages as summarized in the following table. Advanced conservation and water reuse was not considered because operational procedures for the existing mines are not available. Surface water alternatives were omitted since the existing source is groundwater and there is adequate available supply.

Recommendations

The recommended strategy for the Smith County Mining to meet their projected deficit of 8 ac-ft/yr in 2060 and 45 ac-ft/yr in 2070 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 Queen City Aquifer in Smith County. One well with rated capacity of 200 gpm would provide approximately 108 ac-ft/yr. The Queen City Aquifer in Smith County is projected to have a more than ample supply availability to meet the needs of the Mining in Smith County for the planning period.

5.3.18.6 The City of Overton

The City of Overton is located primarily in Rusk County within the East Texas Regional Water Planning Area, but serves a relatively smaller portion of population within the North East Texas Region (Region D). Thus, Region I is the RWPG with the primary responsibility for the evaluation and recommendation of water management strategies for this WUG. For completeness, the consultants have coordinated to include information on that Region's recommendations for the 2016 Region I Plan herein, as they relate to the demand and identified needs within the North East Texas Region (Region D). From the 2016 Region I Plan:

> The current supply for this WUG is the Carrizo-Wilcox aquifer. The City's supply is limited by well capacities and water shortages are projected beginning in 2050.

The City had an average per capita consumption of 200 gpcd in 2011. This value is well over the statewide goal of 140 gpcd. After performing a conservation cost analysis, the ETRWPG believes a water conservation strategy for the City is economically achievable and is therefore recommended. This strategy includes cost estimates related to enhanced public and school education, water conservation pricing implementation, and an enhanced water loss control program. The proposed municipal conservation strategy would reduce Overton's demand by more than their projected need; therefore, municipal conservation is the only recommended WMS for the City.

5.3.18.7 The City of Winona

Description/Discussion of Needs

The City of Winona system is located in northeastern Smith County and serves the incorporated area of the City. The population is projected to increase from 654 persons in 2020 to 1,290 persons in 2070. The City is included as a W.U.G. in Smith County. The system's current water supply consists of four water wells from the Carrizo-Wilcox Aquifer. The total rated capacity of these wells is approximately 320 GPM, or 169 ac-ft/yr. The system is bounded on the north, west, and south by the Sand Flat WSC and on the east by the Star Mountain WSC. The System does have a water conservation plan. The System is projected to have a water supply surplus of 33 ac-ft/yr in 2020 decreasing to a deficit of 85 ac-ft/yr in 2070.

Evaluated Strategies

Four alternative strategies were considered to meet the City's 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 system 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 system and surface water treatment is not economically feasible for a system of this size.

Recommendations

The recommended strategy for the City to meet their projected surplus of 33 ac-ft/yr in 2020 and deficit of 85 ac-ft/yr in 2070 would be to construct one additional water well similar to what other water systems are achieving in the area just prior to each decade as the deficits occur. The recommended supply source will be the Queen City Aquifer in Smith County. One well with rated capacity of 200 gpm each would provide approximately 108 acre-feet each. The Queen City Aquifer in Smith County is projected to have a more than ample supply availability to meet the needs of Winona 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.

5.3.19 Titus County

5.3.19.1 Northeast Texas Municipal Water District

Description/Discussion of Needs

The Northeast Texas Municipal Water District (NETMWD) obtains water from numerous sources, listed below. This provider supplies the cities of Avinger, Daingerfield, Hughes Springs, Jefferson, Lone Star, Longview, Marshall, Ore City, and Pittsburg. Also supplied are Diana SUD, Harleton WSC, Tryon Road SUD, and Mims WSC. The NETMWD has existing contracts to supply an aggregate 46,668 ac-ft to three power plants owned by AEP-SWEPCO and one power plant operated by Luminant. U.S. Steel has contractual right to 32,400 ac-ft of water in Lake O' the Pines. The NETMWD is projected to maintain a supply surplus throughout the planning period, but is listed herein for the purpose of recommending seller water management strategies to utilize the District's available supplies to meet projected demands for the District's customer WUGs.

Evaluated Strategies

NETMWD is projected to have a supply surplus over the 2020 – 2070 planning period.

Recommendations

It is recommended that NETMWD voluntarily reallocate the available surplus water supplies presently contracted with the Steam Electric WUGs in Harrison and Marion Counties out of Lake O' The Pines Reservoir. Demand projections for the Marion County Steam Electric WUG indicate sufficient supply to meet the Marion County Steam Electric WUG's projected demands over the 2020 – 2070 planning period, even with the voluntary removal of this supply. Voluntary reallocation of Harrison County Steam Electric supply in 2070 is recommended in conjunction with a recommended strategy for Harrison County Steam Electric to construct an intake and raw water pipeline for the purchase of supply from the Sabine River Authority from Toledo Bend Reservoir. In conjunction with this recommended water management strategy, sufficient supply is available to meet the projected Steam Electric WUG needs for Harrison, Marion, and Titus Counties. These voluntary reallocations would provide sufficient supply to meet the projected demands for the Titus County Steam Electric WUG, in combination with a recommendation for that WUG to increase its existing contract to purchase these supplies from the NETMWD.

As noted previously herein, these recommendations are for the voluntary reallocation of supply. No entity should be required to participate.

5.3.19.2 Titus County Manufacturing

Description/Discussion of Needs

Manufacturing in Titus County has a demand that is projected to increase from 8,995 ac-ft/yr in 2020 to 11,256 ac-ft/yr in 2070. Manufacturing in Titus County is currently supplied by groundwater from the Carrizo-Wilcox Aquifer, direct reuse, and surface water from Tankersley and Bob Sandlin purchased from the City of Mount Pleasant. A deficit of 3,603 ac-ft/yr is projected to occur in 2020 and increase to 5,440 ac-ft/yr by 2070.

Evaluated Strategies

Six alternative strategies were considered to meet the Titus County Manufacturing WUG's water supply shortages. Advanced water conservation for manufacturing was considered in this planning effort to reduce overall demands; however, it does not resolve all identified needs. The use of reuse water from nearby municipalities was not considered in this planning period beyond those amounts currently reported by manufacturing entities in the county. Groundwater has been identified as a potential source of water for manufacturing in Titus County; however, manufacturing needs exceed the availability of groundwater in the basin based on the modeled available groundwater estimates. Surface water was considered as a potential alternative to meet projected demands, both individually, and in conjunction with drilling new wells.

Recommendations

The recommended strategies for the Titus County Manufacturing WUG to meet projected demands starting in 2020 is to implement advanced conservation measures (via industrial water audits). It is projected that advanced conservation could produced up to 1,126 ac-ft of savings by the year 2070. The next recommended strategy would be to construct one additional water well by 2020. The recommended supply source will be the Queen City Aquifer in Titus County, in the Cypress Basin. One well with rated capacity of 75 gpm would provide approximately 45 ac-ft/yr. The Queen City Aquifer in Titus County is projected to have adequate supply availability to provide this amount of supply over the planning period. The final recommended strategy, and most significant in terms of supply, is for the increase of the existing contract(s) with the City of Mount Pleasant for raw water supply from Bob Sandlin Reservoir.

5.3.19.3 Titus County Steam Electric

Description/Discussion of Needs

The Steam Electric Power Generation WUG in Titus County has a demand that is projected to grow from 52,423 ac-ft/yr in 2020 to 120,703 ac-ft/yr in 2070. Supplies include purchased water supplies from Welsh Reservoir, Lake Monticello, and Lake O' The Pines from the Northeast Texas Municipal Water District (NETMWD), purchased water from Titus County FWD #1 from Lake Bob Sandlin, and groundwater wells in the Carrizo-Wilcox Aquifer. Both Luminant and Southwestern Electric Power Company (SWEPCO) have plants in Titus County. Steam Electric Power Generation in Titus County is projected to have a deficit of 20,558 ac-ft/yr in 2020, increasing to a deficit of 91,555ac-ft/yr in 2070.

Evaluated Strategies

Several approaches were considered to meet the Titus County Steam Electric WUG's water supply shortages. Advanced water conservation was not considered as a water management strategy as almost all steam electric plants and future plants in the area operate with all possible water conservation processes practicable, and have plans in place to continue to do so in the future. Groundwater has not been identified as a potential source of water for steam electric power in Titus County because limited aquifer availability indicates these sources will be able to meet only a fraction of the entire shortage. Surface water was considered as a viable alternative to meet projected demands. Projected demands can be satisfied by available supplies in Lake Bob Sandlin through 2030, although additional supplies from Lake O' the Pines will be needed by 2040. Voluntary reallocations of Steam Electric supplies in the region were also identified for consideration.

Recommendations

Several strategies are recommended for the Titus County Steam Electric WUG to meet projected demands during the planning period. To meet projected needs in 2020, the recommended strategy is to increase the existing contract for the purchase of raw water from Titus County Freshwater District (Lake Bob Sandlin). To meet the projected needs in 2030, the recommended strategy is to increase the existing contract for the purchase of raw water from NETMWD (Bob Sandlin Reservoir). In 2040, the recommended strategy is to increase the existing contract for the purchase of raw water from NETMWD (Lake O' The Pines). These districts have sufficient supply from these sources to meet the projected Steam Electric demands in Titus County through 2060.

To meet the projected needs in 2070, surplus supply from Lake O' the Pines that is currently contracted for steam electric demands in Marion County are recommended to be voluntarily reallocated for the purchase of Steam Electric supply in Titus County. Additionally in 2070, contracted supplies from Lake O' the Pines for steam electric demands in Harrison County are recommended to be voluntarily reallocated for the purchase of this supply for Steam Electric Power Generation in Titus County. The resultant steam electric demands in Harrison County will be met by a recommended strategy for that WUG for construction of a new intake and pipeline for supplies from Toledo Bend Reservoir purchased from the Sabine River Authority, as described in greater detail within this Chapter 5 Appendix.

A capital cost has not been developed for these strategies, since the location of the future generator facilities is unknown; however, existing generation facilities in Titus County are presently served by Lake Bob Sandlin and Lake O' the Pines, so major infrastructure is already in place. Unit costs have been calculated for the purchase of these supplies based on presently available information, and are utilized herein to present an order of magnitude estimation of present potential cost.

5.3.19.4 Tri SUD

Description/Discussion of Needs

TRI SUD provides water service in Titus County (in the Cypress and Sulphur Basins) and Morris County (in the Cypress Basin). TRI SUD purchases treated water originating from Lake Bob Sandlin from the City of Mount Pleasant. The existing contract will expire in 2018; as a result, TRI SUD is projected to have shortages beginning in 2020. The WUG population is projected to be 15,713 in 2020 and 26,143 by the year 2070. TRI SUD is projected to have a deficit of 1,560 ac-ft in 2020, increasing to a deficit of 2,399 ac-ft by 2070.

Evaluated Strategies

Four alternative strategies were considered to meet the SUD'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 considered, but TRI SUD has indicated that it is planning on meeting future needs from water purchased from the City of Mount Pleasant. TRI SUD's contract for surface water from the City of Mount Pleasant expires in 2018, thus renewal and increase of the contracted amount was considered as a potential strategy.

Recommendations

The recommended strategy for TRI SUD to meet the identified needs in 2020 is to renew and increase their existing contract with the City of Mount Pleasant for treated supply from Lake Bob Sandlin.

5.3.20 **Upshur County**

5.3.20.1 The City of Gilmer

Description/Discussion of Needs

The City of Gilmer system is located in central Upshur County and serves the incorporated area of the City. The population is projected to increase from 5,328 persons in 2020 to 7,178 persons in 2070. The City is included as a W.U.G. in Upshur County. The system's current water supply consists of six water wells from the Carrizo-Wilcox Aquifer. The total rated capacity of these wells is approximately 2050 GPM, or 1,103 ac-ft/yr. The system is bounded on the west and south by the Pritchett WSC, the east by Bi-County WSC, and the north by Sharon WSC. The System does have a water conservation plan. The System is projected to have a water supply surplus of 43 ac-ft/yr in 2020 decreasing to a deficit of 246 ac-ft/yr in 2070.

Evaluated Strategies

Four alternative strategies were considered to meet the City's water supply shortages. 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 system 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 system and surface water treatment is not economically feasible for a system of this size.

Recommendations

The recommended strategy for the City to meet their projected surplus of 43 ac-ft/yr in 2020 and deficit of 246 ac-ft/yr in 2070 would be to construct one additional water well similar to other wells within their system just prior to each decade as the deficits occur. The recommended supply source will be the Queen City Aquifer in Upshur County. One well with rated capacity of 500 gpm each would provide approximately 269 acre-feet each. The Queen City Aquifer in Upshur County is projected to have a more than ample supply availability to meet the needs of Gilmer for the planning period.

5.3.20.2 Upshur County Manufacturing

Description/Discussion of Needs

The Manufacturing WUG in Upshur County has a demand that is projected to be increasing from 272 ac-ft/yr in 2020 to 382 ac-ft/yr in 2070. Manufacturing in Upshur County has a current water supply consisting of water wells from the Carrizo-Wilcox Aquifer. The total rated available supply from these sources is 6 ac-ft/yr. Manufacturing in Upshur County is projected to have a water supply deficit of 266 ac-ft/yr in 2020 increasing to a deficit of 376 ac-ft/yr in 2070.

Evaluated Strategies

Three alternative strategies were considered to meet the Upshur County Manufacturing water supply shortages. Advanced conservation and water reuse was not considered because operational procedures for the existing mines are not available. Surface water alternatives were omitted since there is not a supply source within close proximity to the county with available supply.

Recommendations

The recommended strategy for the Upshur County Manufacturing to meet their projected deficit of 266 ac-ft/yr in 2020 and 376 ac-ft/yr in 2070 would be to construct four additional water wells similar to other wells in the area just prior to each decade as the deficits occur. The recommended supply source will be the Queen City Aquifer in Upshur County. Four wells with rated capacity of 200 gpm each would provide approximately 108 acre-feet each or 430 ac-ft/yr. The Queen City Aquifer in Upshur County is projected to have a more than ample supply availability to meet the needs of the Manufacturing in Upshur County for the planning period.

5.3.20.3 Upshur County Mining

Description/Discussion of Needs

The Mining WUG in Upshur County is a split entity and has a demand that is projected to be 379 ac-ft/yr in 2020 to 333 ac-ft/yr in 2070. The total rated available supply is 1 ac-ft/yr. Mining in Upshur County in the Cypress Basin is projected to have a water supply deficit of 298 ac-ft/yr in 2020, increasing to a maximum deficit of 608 ac-ft/yr in 2040, then decreasing to a deficit of 262 ac-ft/yr in 2070. Mining in Upshur County in the Sabine Basin is projected to have a water supply deficit of 80 ac-ft/yr in 2020, increasing to a maximum deficit of 162 ac-ft/yr in 2040, then decreasing to a deficit of 70 ac-ft/yr in 2070.

Evaluated Strategies

Three alternative strategies were considered to meet the Upshur County Mining water supply shortages as summarized in the following table. Advanced conservation and water reuse was not considered because operational procedures for the existing mines are not available. Surface water alternatives were omitted since there is not a supply source within close proximity to the county with available supply.

Recommendations

The recommended strategy for the Upshur County Mining to meet their projected maximum deficit of 770 ac-ft/yr in 2040 would be to construct eight additional water wells similar to existing wells in the area just prior to each decade as the deficits occur to 2040. The recommended supply source will be the Queen City Aquifer in Upshur County. Eight wells with rated capacity of 200 gpm each would provide approximately 108 acre-feet each or 860 ac-ft/yr. The Queen City Aquifer in Upshur County is projected to have a more than ample supply availability to meet the needs of the Mining in Upshur County for the planning period. Note that six wells are proposed in the Upshur County Cypress Basin and two are located within the Upshur County Sabine Basin.

5.3.21 **Van Zandt County**

5.3.21.1 The City of Canton

The City of Canton provides water service in Van Zandt County. The city's population is projected to be 3,963 by 2020 and increasing to 5,329 by 2070. The City of Canton utilizes groundwater from the Carrizo-Wilcox aquifer, and surface water from Mill Creek Reservoir and a run of river water right for water supplies. The City of Canton is not projected to have a shortage during the planning period.

Description/Discussion of Needs

In 2008, the Canton City council authorized the appropriation of $70,000 to prepare a long-term water plan. The project evaluated four (4) reservoir sites in Van Zandt County. Two of the four proved to be feasible from a technical standpoint. The City spent an additional $30,000 in 2009 and 2010 to address questions and provide additional information requested by the committee members. In addition to these two long-term strategies, two additional water wells were included to satisfy short-term needs. These two additional wells have been completed. Additional groundwater supply is a potentially feasible strategy. Water reuse is a potentially feasible water supply strategy, as the City currently has a water rights application pending at the Texas Commission on Environmental Quality for the authorization of indirect reuse. At the request of the City of Canton, the construction of an additional water well by 2020 was identified as a feasible strategy because the City of Canton is planning on developing additional groundwater supply to supplement existing supplies. Also at the request of the City, a potential new reservoir on Grand Saline Creek was also considered as a feasible strategy for the City.

Evaluated Strategies

At the request of the City of Canton, the construction of an additional water well by 2020 was identified as a feasible strategy because the City of Canton is planning on developing additional groundwater supply to supplement existing supplies. Costing analyses for this strategy are based on the amount of requested supply, although no need was identified for the present round of planning.

New Reservoir on Grand Saline Creek – The City has identified a feasible strategy to meet future water supply needs as being the construction of a new 1,845 acre (24,980 ac-ft) reservoir on Grand Saline Creek, a tributary of Sabine River. This reservoir project was originally described in a 2008 report from Gary Burton Engineering, Inc. to the City of Canton, entitled Long-Term Water Study Surface Water Supply. The 2008 report identified the project site, reservoir surface area, drainage area, and estimated construction costs for the reservoir, intake structure, transmission pipeline and water treatment plant expansion.

The construction costs associated with the new reservoir, raw water transmission line, and water treatment plant expansion are based on calculations from the UCM. For the 2016 planning process, the reservoir has been modeled in the Sabine River WAM (Run 3), subject to SB 3 environmental flow criteria at a junior priority date, and modeled considering the full demand of existing water rights in the Sabine River Basin. The results of this WAM analysis indicate the project has a firm yield of 1,810 ac-ft per year. The project is estimated to yield 1.810 ac-ft/yr of supply by constructing a new 24,980 ac-ft reservoir and 14” pipeline to Canton’s WTP and expanding the WTP, for a total project cost of $45.4 million with an annual cost of $5.6 million and a unit cost for the additional supply of $3,087 per ac-ft. with debt service and $1,264 per ac-ft without debt service.

Recommendations

The recommended strategy for the City of Canton is to construct by 2020 an additional water well similar to existing wells in the area. The recommended supply source will be the Carrizo-Wilcox Aquifer in the Sabine Basin in Van Zandt County. One well with rated capacity of 180 gpm would provide approximately 100 ac-ft/yr. The Carrizo-Wilcox Aquifer in Van Zandt County is projected to have sufficient supply availability to provide this supply for the planning period.

A second recommended water conservation strategy option is the utilization of both direct and indirect water reuse. The City of Canton has submitted an application to the TCEQ to secure a water right for indirect reuse and may also seek to secure an authorization for direct reuse. These recommendations are based upon current NETRWPG population projections for the City of Canton.

Because of substantial disagreement over future population and water demands, the City has requested the following alternate strategy:

> The strategy to meet future needs "is with surface water from a proposed reservoir on Grand Saline Creek. The City of Canton has provided to NETRWPG resolutions from three other cities in Van Zandt County supporting the reservoir project. This show of support indicates that a regional surface water reservoir could possibly replace the groundwater strategies for other Van Zandt County public water supplies with projected deficits. However, due to the time typically required to obtain the necessary permits to impound surface water, the City plans to construct one or two additional wells, or implement a reuse option in the interim to meet increasing demands due to population growth and the First Monday influence." This alternative wording should be considered consistent with this plan in the event that population growth in the potential service area significantly exceeds current NETRWPG projections.

5.3.21.2 Van Zandt County Irrigation

Description/Discussion of Needs

The Irrigation WUG in Van Zandt County has a demand that is projected to remain constant at 437 ac-ft/yr for the planning period. The Irrigation WUG in Van Zandt County is currently supplied by groundwater from the Carrizo-Wilcox Aquifer and run-of-river diversions on the Sabine River. A deficit of 330 ac-ft/yr is projected to occur in throughout the planning period.

Evaluated Strategies

Three alternative strategies were considered to meet the Van Zandt County Irrigation WUG's water supply shortages. Advanced water conservation for irrigation practices were not considered in this planning effort for irrigation. The use of reuse water from nearby municipalities is not considered feasible as it would not be effective to deliver reuse water to farm irrigation systems. Groundwater from the Carrizo-Wilcox and Queen City aquifers has been identified as a potential source of water for irrigation in Van Zandt. Surface water was not considered as a potential alternative to meet projected demands due to cost efficiency.

Recommendations

The recommended strategy for Irrigation in Van Zandt County is to construct by 2020 an additional five water wells similar to existing wells in the area. The recommended supply source will be the Queen City Aquifer in the Neches River Basin in Van Zandt County. Five wells with rated capacity of 50 gpm would provide approximately 330 ac-ft/yr. The

Queen City Aquifer in Van Zandt County is projected to have sufficient supply availability to provide this supply for the planning period.

5.3.21.3 Van Zandt County Manufacturing

Description/Discussion of Needs

The Manufacturing WUG in Van Zandt County has a demand that is projected to increase from 681 ac-ft/yr in 2020 to 928 ac-ft/yr in 2070. Manufacturing in Van Zandt County is supplied by groundwater from the Carrizo-Wilcox Aquifer, purchased groundwater from Golden WSC and Grand Saline, and surface water from run-of-river permits on the Sabine River, a permit for diversion from Lake Tawakoni. A deficit of 158 ac-ft/yr is projected to occur in 2020, increasing to 287 ac-ft/yr by 2070.

Evaluated Strategies

Three alternative strategies were considered to meet the Van Zandt County Manufacturing WUG's water supply shortages. Projected manufacturing demands for Van Zandt County did not meet the threshold for consideration of advanced water conservation, so conservation was not included in the strategies. The use of reuse water from nearby municipalities was not considered to be available at present. Surface water was not considered as a viable alternative to meet projected demands because no supplies are readily available in the proximity of the identified needs. Groundwater has been identified as a potential source of water for manufacturing in Van Zandt County; however, manufacturing needs exceed the availability of groundwater in the Sabine Basin based on the modeled available groundwater estimates. In addition, groundwater supplies can be contracted from City of Grand Saline and Golden WSC.

Recommendations

The recommended strategy for Manufacturing in Van Zandt County is to construct by 2020 an additional two water wells, with the addition of a third water well by 2050. The recommended supply source will be the Carrizo-Wilcox Aquifer in the Neches River Basin in Van Zandt County. Two wells with rated capacities of 75 gpm each would provide approximately 194 ac-ft/yr. Addition of the third well in 2050 with a rated capacity of 75 gpm would, when combined with the previous two wells, provide 290 ac-ft/yr. The Carrizo-Wilcox Aquifer in Van Zandt County is projected to have sufficient supply availability to provide this supply for the planning period.

5.3.21.4 R-P-M WSC

Description/Discussion of Needs

R-P-M WSC provides water service in Van Zandt, Henderson and Smith Counties. The WUG population is projected to be 3,298 by 2020 and increases to 6,168 by 2070. R-P-M WSC supplies its customers with groundwater from the Carrizo-Wilcox and Queen City aquifers with five water wells in Van Zandt County. R-P-M WSC is projected to have a total deficit of 16 ac-ft/yr in 2020 and increasing to a deficit of 283 ac-ft/yr by 2070; the shortage projected to occur in Van Zandt County is 12 ac-ft/yr in 2020 increasing to 197 ac-ft/yr by 2070. The shortage in Henderson County is 3 ac-ft/yr in 2020, increasing to 63 ac-ft/yr in 2070. Shortages in Smith County range from 1 ac-ft/yr in 2020 up to 23 ac-ft/yr in 2070.

Evaluated Strategies

Three alternative strategies were considered to meet the WSC's water supply shortages as summarized in the following table. 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. However, the Region I RWPG did identify demand reduction as a feasible strategy. Water reuse was not considered because the WSC does not have a demand for non-potable water. Surface water was not considered because the WSC does not currently have surface water treatment. Groundwater has been identified as a potential source of additional water for R-P-M WSC.

Recommendations

The recommended strategy for R-P-M WSC to meet their projected deficit of 16 ac-ft/yr in 2020 and 283 ac-ft/yr in 2070 would be to construct four 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 the Neches Basin in Van Zandt County. Four wells with rated capacity of 75 gpm each, pumping at an approximately depth of 560 ft., would provide approximately 75 acre-feet each. The Carrizo-Wilcox Aquifer is projected to have sufficient supply availability to meet the needs of RPM WSC for the planning period.

The ETRWPG (Region I) has recommended demand reduction through enhanced public and school education for R-P-M WSC as well.

5.3.22 **Wood County**

There are no entities with identified shortages in Wood County.

5.4 WHOLESALE WATER PROVIDER AND WUG SELLER STRATEGIES

Presented herein are recommended strategies for Wholesale Water Providers (WWPs) and WUG Sellers, as shown in Table 5.15. The recommended strategies herein represent strategies that WWPs and WUG sellers are recommended to employ to meet projected needs for customers. As noted previously, strategies entailing the voluntary reallocation of supply have been identified to more efficiently utilize existing supplies that have been determined, for the purposes of the Regional Water Planning process, to be contracted to a present WUG in excess of the projected demands for that WUG. The recommended reallocations are projected to provide sufficient supply to meet identified needs for customers of the WWP/WUG seller. These recommendations are for the voluntary reallocation of supply. No entity should be required to participate. Also presented herein, for ease of reference, is an aggregation of all recommended strategies related to a given WWP or WUG Seller, as shown in Table 5.16. If a recommendation is made for a WUG to engage with either a WWP or WUG Seller, these recommended strategies are presented within this table by WWP/WUG Seller.

Table 5.15 Wholesale Water Provider and WUG Seller Strategies

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year						Strategy	Contingency	Seller (if applicable)	Supply Source			
		2020	2030	2040	2050	2060	2070				Groundwater	Surface Water	County	Basin
BOWIE	TEXARKANA	-12,771	-12,960	-12,938	-12,865	-12,852	-12,851							
						2,000	18,000	DREDGE WRIGHT PATMAN				WRIGHT PATMAN LAKE/RESERVOIR	BOWIE	SULPHUR
		6,368	6,664	6,815	6,742	6,729	6,728	RIVERBEND STRATEGY				WRIGHT PATMAN LAKE/RESERVOIR	BOWIE	SULPHUR
HUNT	COMMERCE WD	0	0	0	0	0	0							
		0	36	134	268	338	388	VOLUNTARY REALLOCATION OF HUNT MANUFACTURING SUPPLY FROM TAWAKONI TO NORTH HUNT SUD				TAWAKONI LAKE /RESERVOIR	HUNT	SABINE
HUNT	GREENVILLE	-3,299	-4,847	-6,900	-7,521	-9,361	-14,315							
		484	546	613	677	721	825	VOLUNTARY REALLOCATION OF HUNT MANUFACTURING SURPLUS	GREENVILLE WTP EXPANSION			TAWAKONI LAKE /RESERVOIR	HUNT	SABINE
		3,224	6,351	6,550	4,650	3,046	2,942	WTP EXPANSION				GREENVILLE SYSTEM	HUNT	SABINE
		0	0	0	10,223	9,891	9,333	CHAPMAN RAW WATER PIPELINE AND NEW WTP		SULPHUR SPRINGS		CHAPMAN /COOPER LAKE /RESERVOIR NON-SYSTEM PORTION	HUNT	SULPHUR
		0	0	0	0	0	5,100	TOLEDO BEND TIE-IN PIPELINE	SRA TOLEDO BEND TRANSFER	SABINE RIVER AUTHORITY		TOLEDO BEND RESERVOIR	SHELBY	SABINE
HUNT	SABINE RIVER AUTHORITY	0	0	0	0	0	0							
		0	0	670	670	670	551	SRA VOLUNTARY REALLOCATION WEST TAWAKONI SURPLUS TO POETRY WSC				TAWAKONI LAKE/RESERVOIR	HUNT	SABINE

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year						Strategy	Contingency	Seller (if applicable)	Supply Source		County	Basin
		2020	2030	2040	2050	2060	2070				Groundwater	Surface Water		
		0	0	0	0	1,045	628	VOLUNTARY REALLOCATION COMBINED CONSUMERS SUD SURPLUS PURCHASE FROM SRA TO POETRY WSC				FORK LAKE/RESERVOIR	HUNT	SABINE
SMITH	CRYSTAL SYSTEMS INC	-29	-221	-432	-669	-944	-1,194							
		644	644	966	1,610	1,610	1,936	DRILL NEW WELLS			QUEEN CITY AQUIFER		SMITH	SABINE
TITUS	NETMWD	0	0	0	0	0	0							
		0	0	0	0	0	18,000	VOLUNTARY REALLOCATION OF HARRISON STEAM ELECTRIC				O' THE PINES LAKE/RESERVOIR	MARION	CYPRESS
		0	0	0	0	0	1,592	VOLUNTARY REALLOCATION OF MARION STEAM ELECTRIC				O' THE PINES LAKE/RESERVOIR	MARION	CYPRESS

Table 5.16 Recommended Customer Strategies by WWP/WUG Seller

Entity	2020	2030	2040	2050	2060	2070
Cash SUD Total	**0**	**0**	**0**	**0**	**0**	**56**
LONE OAK						
INCREASE EXISTING CONTRACT	0	0	0	0	0	56
COMMERCE WD TOTAL	**0**	**36**	**134**	**268**	**338**	**388**
NORTH HUNT SUD						
INCREASE EXISTING CONTRACT	0	36	134	268	338	388
CRYSTAL SYSTEMS INC	**0**	**0**	**0**	**0**	**0**	**117**
HIDEAWAY						
INCREASE EXISTING CONTRACT	0	0	0	0	0	117
DELTA COUNTY-OTHER (DELTA CO. MUD)	**0**	**0**	**0**	**0**	**122**	**350**
NORTH HUNT SUD						
DELTA COUNTY PIPELINE	0	0	0	0	122	350
GREENVILLE	**75**	**283**	**498**	**754**	**1,130**	**5,782**
CADDO BASIN SUD						
NEW CONTRACT	75	282	462	686	1,022	1,537
CADDO MILLS						
INCREASE EXISTING CONTRACT	0	1	36	68	108	255
COUNTY-OTHER HUNT						
GREENVILLE TIE-IN PIPELINE	0	0	0	0	0	3,990
LAMAR COUNTY WSD	**116**	**116**	**116**	**116**	**116**	**116**
COUNTY-OTHER LAMAR						
INCREASE EXISTING CONTRACT	116	116	116	116	116	116
MOUNT PLEASANT	**4,218**	**4,423**	**4,645**	**5,018**	**5,821**	**6,668**
MANUFACTURING TITUS						
INCREASE EXISTING CONTRACT	2,658	2,742	2,826	3,027	3,634	4,269
TRI SUD						
RENEW AND INCREASE EXISTING CONTRACT	1,560	1,681	1,819	1,991	2,187	2,399
NETMWD	**0**	**9,849**	**50,959**	**50,415**	**49,767**	**69,664**
MARSHALL						
INCREASE EXISTING CONTRACT	0	0	0	0	41	701
STEAM ELECTRIC POWER TITUS						

Entity	2020	2030	2040	2050	2060	2070
INCREASE EXISTING CONTRACT	0	9,849	50,959	50,415	49,726	68,963
NTMWD	**172**	**458**	**683**	**923**	**1,151**	**1,451**
ABLES SPRINGS WSC						
INCREASE EXISTING CONTRACT	86	184	278	391	544	756
BLACKLAND WSC						
DIRECT CONNECTION AND ADDITIONAL WATER	48	153	204	246	296	356
JOSEPHINE						
INCREASE EXISTING CONTRACT	38	121	201	286	311	339
PARIS	**18,312**	**19,723**	**21,038**	**23,172**	**25,773**	**28,870**
IRRIGATION LAMAR						
PAT MAYSE RAW WATER PIPELINE	18,312	18,308	18,305	18,302	18,299	18,302
STEAM ELECTRIC LAMAR						
INCREASE EXISTING CONTRACT	0	1,415	2,733	4,870	7,474	10,568
SABINE RIVER AUTHORITY	**52,000**	**61,000**	**75,670**	**85,670**	**102,715**	**53,279**
MANUFACTURING HARRISON						
TOLEDO BEND INTAKE AND RAW WATER PIPELINE	50,000	55,000	65,000	70,000	80,000	0
STEAM ELECTRIC POWER HARRISON						
TOLEDO BEND INTAKE AND RAW WATER PIPELINE	2,000	6,000	10,000	15,000	21,000	47,000
COUNTY-OTHER HUNT						
POETRY WSC INCREASE CONTRACT	0	0	670	670	1,715	1,179
GREENVILLE						
TOLEDO BEND TIE-IN PIPELINE	0	0	0	0	0	5,100
SULPHUR SPRINGS	**1,306**	**1,306**	**1,306**	**12,056**	**12,085**	**12,119**
GREENVILLE						
CHAPMAN RAW WATER PIPELINE AND NEW WTP	0	0	0	10,223	9,891	9,333
BRINKER WSC						
INCREASE EXISTING CONTRACT	0	0	0	0	29	63
IRRIGATION HOPKINS						
SULPHUR SPRINGS RAW WATER PIPELINE	1,306	1,306	1,306	1,306	1,306	1,306

Entity	2020	2030	2040	2050	2060	2070
TEXARKANA/RIVERBEND	**3,975**	**4,042**	**4,351**	**4,373**	**20,410**	**52,444**
DE KALB						
RENEW EXISTING CONTRACT	304	303	299	298	297	297
HOOKS						
RENEW EXISTING CONTRACT	265	258	249	244	243	243
MACEDONIA-EYLAU MUD #1						
RENEW EXISTING CONTRACT	565	574	577	577	577	577
MANUFACTURING CASS						
INCREASE EXISTING CONTRACT	0	0	0	0	16,000	47,990
MAUD						
RENEW EXISTING CONTRACT	170	169	167	165	164	164
NASH						
RENEW EXISTING CONTRACT	206	212	214	214	214	214
NEW BOSTON						
RENEW EXISTING CONTRACT	1,098	1,104	1,094	1,091	1,089	1,089
REDWATER						
RENEW EXISTING CONTRACT	82	82	79	77	77	77
TEXAMERICAS CENTER						
RENEW EXISTING CONTRACT	514	527	530	530	530	530
WAKE VILLAGE						
RENEW EXISTING CONTRACT	677	669	654	644	642	642
CLARKSVILLE						
WRIGHT PATMAN PIPELINE	0	0	303	303	303	303
COUNTY-OTHER						
RENEW EXISTING CONTRACT	94	144	185	230	274	318
TITUS COUNTY FWD #1	**24,942**	**24,826**	**24,712**	**24,487**	**23,812**	**22,592**
STEAM ELECTRIC POWER TITUS						
INCREASE EXISTING CONTRACT	24,942	24,826	24,712	24,487	23,812	22,592
TYLER	**300**	**327**	**354**	**377**	**408**	**442**
MANUFACTURING SMITH						
INCREASE EXISTING CONTRACT	300	327	354	377	408	442

5.5 UNMET NEEDS

Four needs have been identified as remaining unmet in the North East Texas Region for the purposes of the 2016 Plan, and are presented in Table 5.17 below. Detailed analyses of the strategy evaluations for these entities can be found in the Appendix to this chapter.

Table 5.17 Unmet Needs in the 2016 North East Texas Regional Water Plan

WUG	2020	2030	2040	2050	2060	2070
Harrison County Manufacturing	0	0	0	0	0	86,355
Hopkins County Mining	227	283	360	444	533	639
Hunt County Steam Electric	4,637	6,790	7,610	10,889	14,649	16,152
Red River County Irrigation	4,376	4,313	4,260	4,208	4,155	4,125
TOTAL	**9,240**	**11,386**	**12,230**	**15,541**	**19,337**	**107,271**

5.5.1 Harrison County Manufacturing

Needs remaining in 2070 after implementation of advanced water conservation as a water management strategy are projected to be 86,355 ac-ft/yr. Coordination with Regions C, H, and I indicates the potential for a projected overallocation of Toledo Bend Reservoir by 2070 if all recommended water management strategies were to be implemented. In order to avoid this projected overallocation, this need in 2070 was left as unmet for the purposes of the 2016 Region D Plan, and further analyses of the projected demands and need for this WUG in the future are supported.

5.5.2 Hopkins County Mining

Mining in Hopkins County has a demand that is projected to increase from 1,031 ac-ft/yr in 2020 to 1,577 ac-ft/yr in 2070. This WUG is projected to be supplied by groundwater from Nacatoch Aquifer and a nominal amount of surface water purchased from Sulphur Springs for potable use. A deficit of 227 ac-ft/yr is projected to occur in 2020 and increase to 639 ac-ft/yr by 2070.

Advanced water conservation for mining practices was not considered, as present operations of the facilities are not available. The use of reuse water from nearby municipalities was not considered feasible as it would not be effective to deliver reuse water to the mining locations. Since the projected demands for mining in Hopkins County are primarily due to overburden dewatering, it was assumed that projected needs would likely be met by additional groundwater pumping.

Since the projected demands for mining in Hopkins County are primarily due to overburden dewatering, it was assumed that projected needs would likely be met by additional groundwater pumping, and no additional supply would be sought by this WUG. Thus, this demand has been left as an unmet need for the purposes of the 2016 Region D Plan.

5.5.3 Hunt County Steam Electric

Projected demands for steam electric power generation in 2020 are substantially greater (by a factor of approximately 3) than existing demand plus anticipated demand for the Cobisa facility, if constructed. The differences are attributable to differing estimation methods and assumptions for future steam electric demands. TWDB projections for steam electric demand are conservatively based at the higher end of unit water use for electricity generation. Because the proposed Cobisa facility would be a combined cycle plant, actual water use would potentially be significantly lower than the adopted projections. Other factors, such as water requirements for carbon capture if required in the future, also elevate the projected demands. Uncertainty increases as projections are made further into the future.

Because the proposed Cobisa facility would be a combined cycle generation facility, the implementation of a combined cycle generation facility was considered advanced conservation for the purposes of the 2016 Plan. Projections of estimated savings are based upon projections developed by the University of Texas Bureau of Economic Geology (2008), utilizing a projection of four times Business As Usual (4BUA) as a conservative estimate. This conservation would meet a substantial portion (7,450 ac-ft/yr in 2020 to 12,060 ac-ft/yr in 2070) of the projected demand. No cost was assumed because the facility would be constructed with this level of conservation built in. With advanced conservation, remaining demands range from 4,990 ac-ft/yr in 2020 to 16,500 ac-ft/yr in 2070.

Because the proposed facility would be located at Greenville, it is assumed the demands would be met under contract with the City of Greenville. Groundwater is not feasible due to the limited modeled available capacity of aquifers. Greenville currently contracts with the Sabine River Authority for its supply and utilizes the city lake for storage. However, all SRA water from Lake Tawakoni and Lake Fork has been contracted, thus no additional water is available from these lakes to meet the projected steam electric demands. The recommended strategy for Greenville is to supplement existing supplies with water from Chapman Lake by 2050. To meet the projected steam electric demands (after conservation), this water would need to be available as soon as any additional, unspecified facility is constructed, such that the contract and infrastructure for Greenville would be needed as much as 30 years earlier. The available supply from Chapman Lake would not be sufficient to meet projected steam electric demands without conservation.

Conservation and supply from Chapman Lake would be sufficient to meet projected steam electric demands through 2040, but additional supplies would be necessary by 2050. The Sabine River Authority is proposing to transfer water from the Toledo Bend Reservoir to the North Texas region by 2070 to meet anticipated future needs of its customers. Analysis of available supplies in the area suggest no other wholesale water provider in the area can meet projected steam electric demands in Hunt County; thus, SRA water from the Toledo Bend Reservoir would be needed to meet demands by 2050.

Advanced Water Conservation, reflecting the construction of a combined cycle generation facility, is recommended to address a portion of the identified Steam Electric needs in Hunt County. Depending on the actual demand, as well as the timing of construction of new power generation facilities in Hunt County, the City of Greenville may need to construct a pipeline to Chapman Reservoir by 2020, and the Toledo Bend Transfer pipeline may be necessary by as soon as 2050. However, given the uncertainty in projected demands and the uncertain timing of construction of the proposed Cobisa facility (originally announced in 2002), Hunt County Steam Electric demands above the existing 351 ac-ft/yr that are not met by the recommended Advanced Water Conservation are considered an unmet need for the purposes of the 2016 Plan.

A more detailed description of the analyses of potentially feasible strategies for these WUGs is presented in the WMS evaluation section for each WUG, within Chapter 5 of Appendix C.

5.5.4 Red River County Irrigation

The Irrigation WUG in Red River County has a demand that is projected to decrease from 5,156 ac-ft/yr in 2020 to 4,895 ac-ft/yr in 2070. Irrigation in Red River County is projected to be supplied by existing surface water from run-of-river diversions from the Red and Sulphur Rivers. A deficit of 4,376 ac-ft/yr is projected to occur in 2020 and decrease to 4,125 ac-ft/yr by 2070.

The alternative supply scenarios considered herein that remain within the RWP guidelines with regard to the definition of available supply (i.e., the availability determination of groundwater supply employing solely the MAG) suggest that the most likely, cost effective strategy, the construction of additional wells, would be insufficient to meet the projected needs. The alternative solutions considered herein do not appear to be cost effective approaches, particularly given the fact that in reality, no regulatory entity exists within Region D to enforce the MAG limitations.

Thus, for the purposes of the 2016 Region D Plan, the Red River County Irrigation demands are considered an unmet need.

However, the drilling of new wells for the provision of supplies in exceedance of the MAG requirements is presented as an identified Alternative Water Management Strategy for the purposes of the 2016 Region D Plan. This alternative approach better reflects the reality of available groundwater supply in the area, while ascribing to the guidelines established by the TWDB for the regional planning process.

That said, analysis of the available information base suggests that even if exceeding the MAG, there does not appear to be sufficient groundwater available in the area to meet the full amount of projected needs. Thus, if this identified Alternative Water Management strategy were to be implemented, a smaller portion of needs would remain unmet.

A more detailed description of the these analyses may be found within the Water Management Strategy section within the Appendix to this Chapter.

5.6 ALTERNATIVE WATER MANAGEMENT STRATEGIES

TAC §357.35(b) states in part,

> "The RWP may include alternative water management strategies evaluated by the processes described in §357.34 of this title."

Further guidance with regard to Alternative Water Management Strategies is provided in TAC §357.35(g)(3), wherein it states:

> "Fully evaluated Alternative Water Management Strategies included in the adopted RWP shall be presented together in one place in the RWP."

The North East Texas Regional Water Planning Group (NETRWPG) recognizes that a wide variety of proposals could be brought before TCEQ and TWDB. It is also recognized that given the inherent uncertainty within the regional water planning process, RWPs that anticipate the potential for change as future water supply projects develop offer an improved capability to support water providers.

Included herein are Alternative Water Management Strategies that have been fully evaluated per the aforementioned guidelines. These Alternative Water Management Strategies have been adopted by the NETRWPG so that, in the future, as plans develop and change, they may form the basis for further considerations for potential modifications to the 2016 Region D Plan. Such modifications, per requirement, would need to go through a formal major, or minor, amendment process by the NETRWPG. The Alternative Water Management Strategies are not to be construed as being Recommended Water Management Strategies for the purposes of the 2016 Region D Plan.

A total of 19 Alternative Water Management Strategies have been developed for twelve (12) WUGs. Four of these strategies have been identified herein as a means of better reflecting the realities of likely groundwater strategies within the region. As mentioned previously, restrictions due to the strict utilization of the MAG for the establishment of available supply in a region where no actual regulatory entity exists to enforce such a limit are unrealistic. With no such regulatory entity, (i.e., a GCD), WUGs within Region D have the legal right to develop groundwater supplies through the construction of water wells to meet their needs. However, the present rules for the RWP process do not allow the recommendation for WMSs that exceed the MAG limit on groundwater. Thus, to address this situation, more realistic approaches have been evaluated and included as Alternative Water Management Strategies for the purposes of the 2016 Region D Plan. The three entities to which this situation applies are:

1. Brinker WSC;
2. Hopkins County Irrigation;
3. North Hunt SUD.

A tabulation of all 19 Alternative Water Management Strategies is presented in Table 5.18 below. A detailed summarization of the identified Alternative Water Management Strategies is presented in Table 5.5 of Appendix C to this chapter.

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Table 5.18 Alternative Water Management Strategies

		Projected Deficit (-) / Recommendation (ac-ft/yr) by Year									Supply Source			
County	Entity	2020	2030	2040	2050	2060	2070	Strategy	Contingency	Seller (if applicable)	Groundwater	Surface Water	Basin	Total Capital Cost
BOWIE	TEXAMERICAS CENTER	-514	-527	-529	-528	-528	-528							
		514	527	530	530	530	530	NEW RAW WATER INTAKE RAW WATER PIPELINE	TEXARKANA/RIVERBEND STRATEGIES	TEXARKANA		WRIGHT PATMAN LAKE/RESERVOIR	SULPHUR	$ 42,178,000
HOPKINS	BRINKER WSC	0	0	0	0	-29	-63							
		0	0	0	0	65	65	DRILL NEW WELLS			CARRIZO-WILCOX AQUIFER		SULPHUR	$ 344,000
HOPKINS	IRRIGATION HOPKINS	-2,126	-2,126	-2,126	-2,126	-2,126	-2,126							
		354	354	354	354	354	354	DRILL NEW WELLS			CARRIZO-WILCOX AQUIFER		SULPHUR	$ 372,000
		709	709	709	709	709	709	DRILL NEW WELLS			CARRIZO-WILCOX AQUIFER		SABINE	$ 817,000
		1,063	1,063	1,063	1,063	1,063	1,063	DRILL NEW WELLS			NACATOCH AQUIFER		SULPHUR	$ 2,064,000
HUNT	GREENVILLE	-3,299	-4,847	-6,900	-7,521	-9,361	-14,315							
		10,750	10,750	10,750	10,750	10,750	10,750	CHAPMAN RAW WATER PIPELINE AND NEW WTP				CHAPMAN /COOPER LAKE /RESERVOIR NON-SYSTEM PORTION	SULPHUR	$ 193,438,000
		0	0	0	2,410	10,043	21,230	TOLEDO BEND TIE-IN PIPELINE	SRA TOLEDO BEND TRANSFER	SABINE RIVER AUTHORITY		TOLEDO BEND RESERVOIR	SABINE	$ 78,477,000
HUNT	NORTH HUNT SUD	0	-36	-134	-268	-460	-738							
		0	0	0	0	131	394	DRILL NEW WELLS			WOODBINE AQUIFER		SULPHUR	$ 4,958,000
HUNT	STEAM ELECTRIC POWER HUNT	-12,085	-14,188	-16,751	-19,877	-23,687	-28,213							
		4,637	6,790	7,610	10,889	14,649	16,152	INCREASE EXISTING CONTRACT	GREENVILLE CHAPMAN PIPELINE, GREENVILLE TOLDEO BEND TIE-IN PIPELINE, AND SRA TOLEDO BEND TRANSFER	GREENVILLE/SABINE RIVER AUTHORITY		CHAPMAN /COOPER LAKE /RESERVOIR NON-SYSTEM PORTION, TOLEDO BEND RESERVOIR	SABINE	$ -
RED RIVER	CLARKSVILLE	0	0	-593	-592	-591	-591							
		0	0	303	303	303	303	DIMPLE RESERVOIR				DIMPLE	RED	$ 33,906,000
		0	0	388	388	388	388	DRILL NEW WELLS AND RO TREATEMENT			NACATOCH AQUIFER		SULPHUR	$ 7,878,000
		0	0	303	303	303	303	PAT MAYSE TREATED WATER PIPELINE TO DEROIT AND CONTRACT		LAMAR CO WSD		PAT MAYSE	RED	$ 10,506,000
		-4,376	-4,313	-4,260	-4,208	-4,155	-4,125							

County	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) by Year						Strategy	Contingency	Supply Source			Basin	Total Capital Cost
		2020	2030	2040	2050	2060	2070			Seller (if applicable)	Groundwater	Surface Water		
RED RIVER	IRRIGATION RED RIVER	1,106	1,106	1,106	1,106	1,106	1,106	DRILL NEW WELLS	NO MAG		WOODBINE AQUIFER		RED	$ 1,227,000
		2,057	2,057	2,057	2,057	2,057	2,057	DRILL NEW WELLS	NO MAG		NACATOCH AQUIFER		SULPHUR	$ 2,293,000
		1,213	1,150	1,097	1,045	992	962	UNMET NEED						
TITUS	MANUFACTURING TITUS	-3,603	-3,719	-3,833	-4,058	-4,733	-5,440							
		500	500	500	500	500	500	DRILL NEW WELLS			CARRIZO-WILCOX AQUIFER		CYPRESS	$ 571,000
		2,658	2,742	2,826	3,027	3,634	4,269	INCREASE EXISTING CONTRACT		MOUNT PLEASANT		BOB SANDLIN LAKE/RESERVOIR	CYPRESS	$ -
VAN ZANDT	CANTON	0	0	0	0	0	0							
		1,810	1,810	1,810	1,810	1,810	1,810	GRAND SALINE RESERVOIR				GRAND SALINE RESERVOIR	SABINE	$ 45,373,000
VAN ZANDT	IRRIGATION VAN ZANDT	-330	-330	-330	-330	-330	-330							
		330	330	330	330	330	330	DRILL NEW WELLS			CARRIZO-WILCOX AQUIFER		NECHES	$ 376,000
VAN ZANDT	R-P-M WSC	-12	-56	-93	-132	-167	-197							
		75	150	150	225	285	285	DRILL NEW WELLS			QUEEN CITY AQUIFER		NECHES	$ 1,545,000

The following are condensed summaries of the identified Alternative Water Management Strategies. More detailed descriptions of the analysis of these strategies, including costs and figures, are presented in Chapter 5.4 of Appendix C.

5.6.1 Bowie County

5.6.1.1 TexAmericas Center

Description/Discussion of Needs

TexAmericas Center provides water service in Bowie County. The WUG population is projected to be 533 by 2020 and increasing to 553 by 2070. TexAmericas has a contract for water supply with the City of Texarkana for surface water from Wright Patman. TexAmericas is not projected to have a shortage in the current planning period; however, as a member city in the Riverbend Water Resources District, a request was received from Riverbend to include the consideration of multiple strategies within the 2016 Plan.

Evaluated Strategies

There were four alternative strategies considered to meet the TexAmericas' water supply shortages as summarized in the Table below. Advanced conservation is not considered as the entity has no existing shortages. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because TexAmericas has historically utilized surface water supplies and, at present, is planning on continuing to purchase surface water from the City of Texarkana. A request was submitted by Riverbend Water Resources District for the consideration of a new pipeline and intake to Wright Patman Reservoir as an explicit strategy for consideration in the 2016 Plan for TexAmericas Center, based upon the results of a study performed by CH2M-Hill in 2009. Surface water infrastructure was thus considered to increase available supplies for potential future industrial development, based upon the analyses provided by Riverbend. Another strategy was considered, and recommended, whereby a renewal contract with Texarkana/Riverbend is implemented, contingent upon the development of Riverbend's recommended strategy for the development of a new Water Treatment Plant, pipeline, and intake, connecting Wright Patman reservoir to a new facility at TexAmericas Center, for subsequent connection to the member cities' system.

Identification of Alternative Strategy

Although no immediate need has been identified in the present RWP process, Riverbend Water Resources District has requested the consideration of a strategy to construct a new intake at Wright Patman Reservoir and construct a raw water pipeline (42" diameter) to TexAmericas Center, a member of Riverbend. This strategy differs from the recommended full strategy for a similar approach, as the proposed approach herein is strictly for the new intake and raw water pipeline from Lake Wright Patman to TexAmericas Center (no treatment plant). Surface water infrastructure has been considered to increase available supplies for potential future industrial development, based upon analyses provided by Riverbend. Details of this alternative strategy are presented within the CH2M-Hill (2009) study performed for Riverbend. A proposed approach that is consistent with the project envisioned and described in the CH2M-Hill (2009) report, sans treatment facility, is to be considered consistent with this Alternative Water Management Strategy for the purposes of the 2016 Region D Plan. However, the NETRWPG recognizes that Riverbend or Texarkana, Tx, may become the sponsoring entity for this strategy. The strategy presented within the TexAmericas Center section of this plan as an Alternate Strategy, should be considered consistent with the plan for this planning cycle if Texarkana, Tx, or Riverbend are the sponsor rather than TexAmericas, as long as the water source remains Lake Wright Patman.

5.6.2 **Camp County**

No Alternative Water Management Strategies have been identified for entities within Camp County.

5.6.3 **Cass County**

No Alternative Water Management Strategies have been identified for entities within Cass County.

5.6.4 **Delta County**

No Alternative Water Management Strategies have been identified for entities within Delta County.

5.6.5 **Franklin County**

No Alternative Water Management Strategies have been identified for entities within Franklin County.

5.6.6 **Gregg County**

No Alternative Water Management Strategies have been identified for entities within Gregg County.

5.6.7 **Harrison County**

No Alternative Water Management Strategies have been identified for entities within Harrison County.

5.6.8 **Hopkins County**

5.6.8.1 Brinker WSC

Description/Discussion of Needs

Brinker WSC provides water service in Hopkins County. It is projected that the users in the WUG will have a shortage in 2060. The WUG population is projected to be 2,252 by

2020 and increases to 3,990 by 2070. The WSC utilizes groundwater from the Carrizo-Wilcox aquifer and has a contract for water supply with City of Sulphur Springs for 77 ac-ft/yr. Brinker WSC is projected to have a deficit of 29 ac-ft in 2060 and increasing to a deficit of 63 ac-ft by 2070.

Evaluated Strategies

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. Additional use of groundwater from the Carrizo-Wilcox has been identified as a likely source of water for Brinker WSC in Hopkins County; however, projected needs exceed the availability of groundwater in the basin based on the modeled available groundwater (MAG) estimates. Brinker WSC has indicated that the likely future strategy would be the additional use of groundwater. However, due to current TWDB guidelines for the Regional Water Planning process, this strategy could not be recommended as a water management strategy. Thus, the recommended strategy was for Brinker WSC to purchase additional surface water from Sulphur Springs Lake by Increasing its existing contract with the City of Sulphur Springs.

Identification of Alternative Strategy

The identified Alternative Water Management Strategy for Brinker WSC to meet their projected deficit of 29 ac-ft/yr in 2060 and 63 ac-ft/yr in 2070 would be to construct one additional water well similar to their existing wells just prior to 2060. The recommended supply source will be the Carrizo-Wilcox Aquifer in the Sulphur Basin in Hopkins County. One well with rated capacity of 150 gpm would provide approximately 75 acre-feet each. The Carrizo-Wilcox Aquifer is projected to have sufficient supply availability to meet the needs of RPM WSC for the planning period.

5.6.8.2 Hopkins County Irrigation

Description/Discussion of Needs

The Irrigation WUG in Hopkins County has a demand that is projected to remain constant at 2,269 ac-ft/yr for the planning period. The Irrigation WUG in Hopkins County is supplied by groundwater from the Carrizo-Wilcox Aquifer and run-of-river diversions from the Sabine and Sulphur Rivers. A deficit of 2,126 ac-ft/yr is projected to occur in throughout the planning period.

Evaluated Strategies

Three alternative strategies were considered to meet the projected shortages for Hopkins County Irrigation. Advanced water conservation for irrigation practices was not considered, as present irrigation practices likely already incorporate many BMPs to extend water supplies, thus no additional conservation would be feasible. The use of reuse water from nearby municipalities is not considered feasible as it would not be effective to deliver reuse water to farm irrigation systems. Groundwater from the Carrizo-Wilcox and

Nacatoch aquifers has been identified as a potential source of water for irrigation in Hopkins County; however, the total irrigation needs exceed the availability of groundwater in these aquifers based on the modeled available groundwater (MAG) estimates. The construction of a pipeline to convey raw surface water from Sulphur Springs Lake purchased via the City of Sulphur Springs was also considered as a potential alternative to meet projected demands.

The recommended strategies for the Hopkins County Irrigation to meet their projected deficit of 2,126 ac-ft/yr are to construct three additional water wells in the Carrizo-Wilcox/Cypress/Hopkins aquifer, and five additional water wells in the Carrizo-Wilcox/Sabine/Hopkins aquifer. To meet the remaining needs, it was recommended that a 10" diameter pipeline to Lake Sulphur Springs be developed for the purchase of raw water from the City of Sulphur Springs.

Identification of Alternative Strategy

The identified alternative water strategies for Hopkins County Irrigation to meet their projected deficit of 2,126 ac-ft/yr would be to construct five additional water wells in the Carrizo-Wilcox/Sulphur/Hopkins aquifer, six additional water wells in the Carrizo-Wilcox/Sabine/Hopkins aquifer, and 14 additional water wells in the Nacatoch/Sulphur/Hopkins aquifer. The recommended supply source will be the Carrizo-Wilcox Aquifer in the Sulphur and Sabine Basins, and the Nacatoch Aquifer in the Sulphur Basin, all in Hopkins County. In the Carrizo-Wilcox Aquifer in the Sabine basin, six wells with rated capacities of 80 gpm are projected to provide approximately 709 ac-ft/yr. In the Carrizo-Wilcox Aquifer in the Sulphur Basin, five wells with rated capacities of 50 gpm are projected to provide approximately 354 ac-ft/yr. In the Nacatoch Aquifer in the Sulphur River Basin, 14 wells with rated capacities of 50 gpm are projected to provide approximately 1,063 ac-ft/yr. The Carrizo-Wilcox and Nacatoch aquifers are projected to have sufficient supply availability to meet the needs of Hopkins County Irrigation for the planning period.

5.6.9 **Hunt County**

5.6.9.1 Greenville

Description/Discussion of Needs

The City of Greenville provides water service in Hunt County. The WUG population is projected to be 28,700 in 2020 increasing to 74,659 by the year 2070. The City of Greenville uses surface water from Greenville's city lake and purchases surface water out of Lake Tawakoni from the Sabine River Authority. The City of Greenville sells water to the City of Caddo Mills, entities within Hunt County-Other, Manufacturing, Mining and Steam Electric WUGs in Hunt County. The City of Greenville is projected to have a deficit of 2,194 ac-ft in 2050 increasing to 10,548 ac-ft by 2070.

Evaluated Strategies

Projected demands for Steam Electric power generation are associated with a proposed 1,750 MW combined cycle generation facility at Greenville. This facility was announced in 2002, but has not yet been constructed. The facility has been estimated to require approximately 4,000 acre-feet per year of supply, while the projections for Steam Electric water demand in Hunt County range from 12,400 ac-ft in 2020 to 28,500 ac-ft in 2070. Because of the uncertainty in demand and when this facility will be constructed, for the purposes of the 2016 Plan, Steam Electric demands were not included in the strategy for the City of Greenville, and were left as unmet needs given their present uncertainty. However, consideration has been given to these Hunt Steam Electric demands for the purposes of evaluating strategies to meet the projected needs. To meet the projected needs when considering Hunt Steam Electric demands, the City would need to construct a pipeline to Chapman Lake by 2020 (30 years earlier than the same strategy being recommended in 2050) and the recommended Toledo Bend Tie-In Pipeline would need to be constructed by 2050, which is 20 years earlier than the preliminarily identified Toledo Bend Transfer strategy considered by Region C.

Identification of Alternative Strategy

The alternative strategies identified herein are contingent upon the recommended strategies for the City of Greenville related to the voluntary reallocation of surplus Hunt Manufacturing supplies purchased from the City of Greenville (which purchases this supply from the purchase of water from the Sabine River Authority from Lake Tawakoni); as well as the recommended WTP expansion and replacement WTP in 2050.

The identified Alternative Water Management Strategies to meet the projected demands of the City of Greenville and its wholesale customers (both existing and future), including Hunt County Steam Electric needs, is for the City, by 2020, to contract with the City of Sulphur Springs for 10,750 ac-ft/yr of available supply from Chapman Lake, and to construct an intake, pump station, and 43-mile, 36” diameter pipeline for the development of this supply. By 2050, the recommended strategy is for the City to construct a tie-in pipeline (23-miles, 48” diameter) to additional supply available from the Toledo Bend Transfer from the Sabine River Authority, contingent upon implementation of the Toledo Bend Transfer by 2050. This strategy is considered to be in combination with the recommended strategy for the Hunt County-Other Tie-In Pipeline and the Alternative Water Management Strategy identified for Hunt Steam Electric increasing its existing contract with the City of Greenville.

5.6.9.2 Hunt County Steam Electric

Description/Discussion of Needs

The Steam Electric WUG in Hunt County has a demand that is projected to grow from 12,436 ac-ft/yr in 2020 to 28,564 ac-ft/yr in 2070. This projected demand is associated with the proposed Cobisa generation facility near Greenville, a proposed 1,750 MW combined cycle plant announced in 2002, but not yet constructed. The facility has been estimated to require about 4,000 acre-feet per year of supply, while the projections for Steam Electric water demand in Hunt County range from 12,436 ac-ft in 2020 to 28,564 ac-ft in 2070. Actual current demand is about 351 ac-ft for the existing powerline facility at Greenville.

Evaluated Strategies

Projected demands for steam electric power generation in 2020 are substantially greater (by a factor of approximately 3) than existing demand plus anticipated demand for the Cobisa facility, if constructed. The differences are attributable to differing estimation methods and assumptions for future steam electric demands. TWDB projections for steam electric demand are conservatively based at the higher end of unit water use for electricity generation. Because the proposed Cobisa facility would be a combined cycle plant, actual water use would potentially be significantly lower than the adopted projections. Other factors, such as water requirements for carbon capture if required in the future, also elevate the projected demands. Uncertainty increases as projections are made further into the future.

Because the proposed Cobisa facility would be a combined cycle generation facility, the implementation of a combined cycle generation facility was considered advanced conservation for the purposes of the 2016 Plan. Projections of estimated savings are based upon projections developed by the University of Texas Bureau of Economic Geology (2008), utilizing a projection of four times Business As Usual (4BUA) as a conservative estimate. This conservation would meet a substantial portion (7,450 ac-ft/yr in 2020 to 12,060 ac-ft/yr in 2070) of the projected demand. No cost was assumed because the facility would be constructed with this level of conservation built in. With advanced conservation, remaining demands range from 4,990 ac-ft/yr in 2020 to 16,500 ac-ft/yr in 2070.

Because the proposed facility would be located at Greenville, it is assumed the demands would be met under contract with the City of Greenville. Groundwater is not feasible due to the limited modeled available capacity of aquifers. Greenville currently contracts with the Sabine River Authority for its supply and utilizes the city lake for storage. However, all SRA water from Lake Tawakoni and Lake Fork has been contracted, thus no additional water is available from these lakes to meet the projected steam electric demands. The recommended strategy for Greenville is to supplement existing supplies with water from Chapman Lake by 2050. To meet the projected steam electric demands (after conservation), this water would need to be available as soon as any additional, unspecified facility is constructed, such that the contract and infrastructure for Greenville would be needed by 2020. The available supply from Chapman Lake would not be sufficient to meet projected steam electric demands without conservation.

Conservation and supply from Chapman Lake would be sufficient to meet projected steam electric demands through 2040, but additional supplies would be necessary by 2050. Region C has preliminarily indicated that the Toledo Bend Transfer strategy to the North Texas region is being considered by 2070 to meet anticipated future needs. Analysis of available supplies in the area suggest no other wholesale water provider in the area can meet projected steam electric demands in Hunt County; thus, the purchase of SRA water by the City of Greenville from the Toledo Bend Reservoir has been identified as an Alternative Water Management Strategy to meet demands by 2050 for the City of Greenville.

Identification of Alternative Strategy

The identified Alternative Water Management Strategy for Hunt County Steam Electric is the purchase of up to an additional 16,152 ac-ft/yr of water from the City of Greenville by increasing existing contract(s) prior to the decade of increased need. This alternative is contingent upon:

- The City of Greenville's recommended strategy for the voluntary reallocation of Hunt Manufacturing surplus supply;
- The Toledo Bend Transfer, under consideration for the purposes of the 2016 Region C Plan, being implemented by the year 2050 (present information suggests the Toledo Bend Transfer project is currently envisioned by the Region C Planning Group for the year 2070);
- The recommended strategy of Advanced Water Conservation for Hunt County Steam Electric;
- The City of Greenville's Alternative Water Management Strategy for the construction (by 2020) of the Chapman Raw Water Pipeline for the purchase of water from Lake Chapman from the City of Sulphur Springs; and
- The City of Greenville's Alternative Water Management Strategy for the construction (by 2050) of the Toledo Bend Tie-In Pipeline for the purchase of Sabine River Authority supply from the Toledo Bend Transfer.

5.6.9.3 North Hunt SUD

Description/Discussion of Needs

North Hunt SUD provides water service in Hunt, Fannin, and Delta counties. It is projected North Hunt SUD will have a shortage in 2030. The WUG population is projected to be 4,246 in 2020 and 16,003 by the year 2070. The SUD has a contract for water supply with the City of Commerce for 147 ac-ft/yr, a well in Hunt county with a rating of 170 gpm , and a well in Fannin County that is rated at 318 gpm. The SUD is projected to have a deficit of 99 ac-ft in 2040, increasing to 713 ac-ft in 2070. In Hunt County, the SUD is projected to have a deficit of 36 ac-ft in 2030 increasing to 738 ac-ft by 2070.

Evaluated Strategies

Multiple alternative strategies considered to meet North Hunt SUD's water supply shortages. 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 from the Woodbine Aquifer was considered because North Hunt SUD is currently using this aquifer as a source of supply for the system. However, due to the limited availability of this groundwater source, this aquifer will not be able to meet all of North Hunt SUD's shortage. Additional supplies are available from the Paluxy Aquifer, another existing source used by the SUD; however, there is not an identified MAG for this aquifer in this region. Additional purchase of water from the City of Commerce is another alternative; however, Commerce has only a limited volume potentially available only if existing supplies to the Manufacturing WUG can be reallocated. A separate feasible strategy was considered to utilize surplus supply from Delta County-Other, specifically Delta County MUD (an entity within Delta County-Other). The North Hunt SUD service area is contiguous with the service area for Delta County MUD, which purchases supply from the City of Cooper. Delta County MUD is projected to have sufficient surplus supplies to have the capability to meet North Hunt SUD needs starting in 2060. This strategy would require a pipeline connecting the two systems, of sufficient size to provide up to 325 ac-ft/yr.

The recommended strategy to meet North Hunt SUD's needs is to purchase surface water from City of Commerce available via a voluntary reallocation from the existing surplus for the Hunt Manufacturing – Sulphur WUG beginning in 2040. In 2060, it has been recommended that North Hunt SUD construct a pipeline to connect with Delta County MUD (a Sub-WUG entity within Delta County Other) for the purchase of surplus supplies by 2060.

Identification of Alternative Strategy

The identified alternative strategy is to construct three additional water wells similar to their existing wells, to be constructed just prior to each decade as deficits occur. The recommended supply source will be the Woodbine Aquifer in Hunt County, in the Sulphur River Basin. Individual wells with rated capacity of 244-400 gpm each are predicted to provide at least 131 acre-feet each .

5.6.10 Lamar County

No Alternative Water Management Strategies have been identified for entities within Lamar County.

5.6.11 Marion County

No Alternative Water Management Strategies have been identified for entities within Marion County.

5.6.12 Morris County

No Alternative Water Management Strategies have been identified for entities within Morris County.

5.6.13 Rains County

No Alternative Water Management Strategies have been identified for entities within Rains County.

5.6.14 **Red River County**

5.6.14.1 City of Clarksville

Description/Discussion of Needs

The City of Clarksville is located in Red River County. The system is projected to serve 3,315 people through the planning period. The current sources of supply are wells into the Blossom Aquifer, mixed with surface water from Langford Lake. Water quality issues with the groundwater (TDS) and surface water (turbidity) necessitate mixing of the supplies to meet Texas drinking water standards. The groundwater has over 1,000 ppm of dissolved solids including high levels of sodium, sulfate, and chloride. The City provides water to its own customers in the Sulphur basin and is projected to have a water supply deficit of 593 ac-ft/yr in 2040, due to sedimentation issues in Langford Lake. As the surface water supply for the City diminishes, the capability to mix the surface supply with the groundwater supply commensurately diminishes as well. Thus as surface supply diminishes, so too does the capability to utilize the City's existing groundwater supply. As noted in a 4 October, 2013 memorandum from the City's consultant, Murray, Thomas & Griffin, Inc. (MTG):

> "Clarksville has no available surface water when a water level of 417.0 (2006 low water level) and a sediment level at 415.0 (2013 lake bottom) are considered. Each of these conditions has occurred during the past ten years. The surface water is necessary to address total volume needs as well as for blending with the ground water."

The system does have a water conservation and drought management plan in place.

Evaluated Strategies

The various feasible strategies considered to meet Clarksville's water supply shortages are listed in the table below. Advanced conservation was not selected because Clarksville's supply would not be projected to meet TCEQ regulatory minimums. Furthermore, reduction in demand would not alleviate the aforementioned water quality issues with the City's projected supplies. There are no significant current water needs in Clarksville that could be met by water reuse. Additional pumping (five additional wells) from the Nacatoch Aquifer in the Sulphur River Basin and Reverse Osmosis treatment of all of the City's existing groundwater supplies has also been considered. The City's existing surface water supply is rapidly decreasing due to sedimentation issues in Langford Lake, the City's sole existing surface water supply. The City has requested the consideration of multiple potential surface water strategies to meet Clarksville's water supply needs. Potentially feasible strategies evaluated include:

- Treated Water Pipeline to DeKalb - purchasing water from the City of Texarkana's available supply from Wright Patman Reservoir;
- Dredging of sediment from Langford Lake;
- Construction of a new surface water reservoir, Dimple Reservoir;

- Construction of a raw water pipeline tying into to Region C's proposed Marvin Nichols Reservoir.
- Treated Water Piepline to Detroit - purchasing water from the City of Paris (via Lamar County WSD) from Paris available supply.

Identification of Alternative Strategy

At present, considerable uncertainty exists in each of the identified feasible water management strategies for the City of Clarksville. The NETRWPG supports any efforts by the City of Clarksville to further study all potential strategies to identify the best approach for the City to meeting all of its future water supply needs, and such a study should be considered consistent with the 2016 North East Texas Regional Water Plan.

Should development of a Treated Water Pipeline to the City of Texarkana/Riverbend's system in DeKalb and contract to provide up to 593 ac-ft (ac-ft/yr) be determined to not be cost feasible, the City will need alternative strategies. To meet the City's projected deficit in 2040, identified alternative strategies for water supply include the study and development one of the following options*:

- Construct and develop Dimple Reservoir to provide a maximum 10,200 ac-ft/yr. To meet the City's projected deficit in 2040 an identified alternative strategy is for the City of Clarksville to pursue the development of Dimple Reservoir to meet the City's projected deficit in 2040. This project has the capability to meet the City's identified needs, as well as developing a supply to be potentially utilized by other demands in the area.
- Retire Langford Lake and development of a new well field and associated RO treatment facilities.
- Contract with the Lamar County WSD for supply from the City of Paris, which includes the development of a Treated Water Pipeline tying into Lamar County WSD's system in Detroit, Texas, to provide 303 ac-ft/yr for the projected needs of the City of Clarksville, although the City of Clarksville has indicated their intent, if this strategy is implemented, to contract additional supply as necessary to meet their full projected demands. This strategy allows for the resumption of the City's utilization of existing groundwater supplies via mixing. This strategy is contingent upon the Lamar County WSD contracting for the necessary additional supply from the City of Paris.

*Assuming that water from the Sulphur River is not available from an upper region reservoir.

Given Clarksville's geographic location, it will be necessary that Clarksville establish working relationships with the City of Texarkana, Riverbend Water Resources District, the Sulphur River Basin Authority and/or the Red River Basin Authority to develop any new reservoir and/or water supply strategy.

5.6.14.2 Red River County Irrigation

Description/Discussion of Needs

The Irrigation WUG in Red River County has a demand that is projected to decrease from 5,156 ac-ft/yr in 2020 to 4,895 ac-ft/yr in 2070. Irrigation in Red River County is projected to be supplied by existing surface water from run-of-river diversions from the Red and Sulphur Rivers. A deficit of 4,376 ac-ft/yr is projected to occur in 2020 and decrease to 4,125 ac-ft/yr by 2070.

Evaluated Strategies

Seventeen alternative strategies were considered to meet the Red River County Irrigation WUG's water supply shortages. Advanced water conservation for irrigation practices were not considered in this planning effort, as present irrigation practices likely already incorporate many BMPs to extend water supplies, thus no additional conservation would be feasible. The use of reuse water from nearby municipalities is not considered feasible as it would not be effective to deliver reuse water to farm irrigation systems. Groundwater was identified as a potential source of water for irrigation in Red River County. However, due to limited availability, the Blossom, Nacatoch and Trinity aquifers will not cover all shortages. For this reason, groundwater development may not be a feasible strategy alone. Treated surface water purchased from Lamar County WSD was considered as a viable supplement to the additional groundwater in order to meet projected demands. Purchasing sufficient treated surface water from Lamar County WSD to meet the entirety of the need was also considered as possible strategy. Purchasing raw water from the City of Paris has also been considered as a possible strategy, with a higher capital cost but an anticipated lower annual cost. The City's surface water permit for Pat Mayse Reservoir, as amended, allows for the interbasin transfer and use of water in both the Red and Sulphur River basins. However, the use of water via this permit would require a minor amendment to add irrigation as a permitted use.

Identification of Alternative Strategy

The identified alternative water management strategy for the Red River County Irrigation WUG to meet projected demands during the planning period to drill new wells in the Woodbine Aquifer, Red Basin and the Nacatoch Aquifer, Sulphur Basin. The Woodbine Aquifer in the Red Basin is estimated to produce 161 ac-ft/yr (100 gpm), thus 7 wells approximately 600 feet deep are needed to meet the projected need of 1,106 ac-ft/year for a total capital cost of $1.2 million, annual cost of $0.7 million and annual unit cost of $604 per ac-ft.. The Nacatoch Aquifer in the Sulphur Basin is estimated to produce 121 ac-ft/yr (75 gpm), it is assumed that only 17 wells approximately 500 feet deep would be possible for a supply of approximately 2,057 ac-ft/yr for a total capital cost of $2.3 million, annual cost of $1.2 million and annual unit cost of $603 per ac-ft.

Even when exceeding the MAG, the best available information suggests inadequate groundwater supplies to meet the entirety of the projected demands for Red River County Irrigation over the planning period. The remaining needs are unmet due to brackish groundwater supplies, and construction of projects to access available surface water supplies do not appear to be cost effective solutions.

5.6.15 **Smith County**

No Alternative Water Management Strategies have been identified for entities within Smith County.

5.6.16 **Titus County**

5.6.16.1 Titus County Manufacturing

Description/Discussion of Needs

Manufacturing in Titus County has a demand that is projected to increase from 8,995 ac-ft/yr in 2020 to 11,256 ac-ft/yr in 2070. Manufacturing in Titus County is currently supplied by groundwater from the Carrizo-Wilcox Aquifer, direct reuse, and surface water from Tankersley and Bob Sandlin purchased from the City of Mount Pleasant. A deficit of 3,603 ac-ft/yr is projected to occur in 2020 and increase to 5,440 ac-ft/yr by 2070.

Evaluated Strategies

Six alternative strategies were considered to meet the Titus County Manufacturing WUG's water supply shortages. Advanced water conservation for manufacturing was considered in this planning effort to reduce overall demands; however, it does not resolve all identified needs. The use of reuse water from nearby municipalities was not considered in this planning period beyond those amounts currently reported by manufacturing entities in the county. Groundwater has been identified as a potential source of water for manufacturing in Titus County; however, manufacturing needs exceed the availability of groundwater in the basin based on the modeled available groundwater estimates. Surface water was considered as a potential alternative to meet projected demands, both individually, and in conjunction with drilling new wells.

Three strategies were recommended to meet the projected demands: Advanced water conservation, construction of one additional well in the Queen City Aquifer, and increasing the existing contract with the City of Mount Pleasant for supply from Lake Bob Sandlin.

Identification of Alternative Strategies

Two Alternative Water Management Strategies have been identified. The first is the development of an amount greater than the MAG from groundwater supplies in the Carrizo-Wilcox Aquifer to supplement existing supplies. This alternative strategy would include construction of five additional water wells by 2020. The alternate supply source will be the Carrizo-Wilcox Aquifer in Titus County, in the Cypress Basin. Five wells with rated capacity of 75 gpm would provide approximately 500 ac-ft/yr. The projected supply exceeds the established MAG for the Carrizo-Wilcox Aquifer in Titus County in the Cypress Basin, and alone does not meet the entirety of projected needs for the Titus County Manufacturing WUG.

Thus, the second Alternative Water Management Strategy to be performed in conjunction with the aforementioned development of wells would be to increase the amount of raw water purchased from the City of Mount Pleasant from available supply in Bob Sandlin Reservoir by up to 4,269 ac-ft/yr in 2070.

These two alternative strategies would together provide sufficient supply to meet the projected needs for Titus County Manufacturing, contingent upon implementation of the recommended strategy of Advanced Water Conservation for the WUG.

5.6.17 **Upshur County**

No Alternative Water Management Strategies have been identified for entities within Upshur County.

5.6.18 **Van Zandt County**

5.6.18.1 City of Canton

Description/Discussion of Needs

The City of Canton provides water service in Van Zandt County. The city's population is projected to be 3,963 by 2020 and increasing to 5,329 by 2070. The City of Canton utilizes groundwater from the Carrizo-Wilcox aquifer, and surface water from Mill Creek Reservoir and a run of river water right for water supplies. The City of Canton is not projected to have a shortage during the planning period.

Evaluated Strategies

In 2008, the Canton City council authorized the appropriation of $70,000 to prepare a long-term water plan. The project evaluated four (4) reservoir sites in Van Zandt County. Two of the four proved to be feasible from a technical standpoint. The City spent an additional $30,000 in 2009 and 2010 to address questions and provide additional information requested by the committee members. In addition to these two long-term strategies, two additional water wells were included to satisfy short-term needs. These two additional wells have been completed. Additional groundwater supply is a potentially feasible strategy. Water reuse is a potentially feasible water supply strategy, as the City currently has a water rights application pending at the Texas Commission on Environmental Quality for the authorization of indirect reuse. At the request of the City of Canton, the construction of an additional water well by 2020 was identified as a feasible strategy because the City of Canton is planning on developing additional groundwater supply to supplement existing supplies. Also at the request of the City, a potential new reservoir on Grand Saline Creek was also considered as a feasible strategy for the City.

Identification of Alternative Strategy

Because of substantial disagreement over future population and water demands, the City has requested the following alternate strategy:

> The strategy to meet future needs "is with surface water from a proposed reservoir on Grand Saline Creek. The City of Canton has provided to NETRWPG resolutions from three other cities in Van Zandt County supporting the reservoir project. This show of support indicates that a regional surface water reservoir could possibly replace the groundwater strategies for other Van Zandt County public water supplies with projected deficits. However, due to the time typically required to obtain the necessary permits to impound surface water, the City plans to construct one or two additional wells, or implement a reuse option in the interim to meet increasing demands due to population growth and the First Monday influence." This alternative wording should be considered consistent with this plan in the event that population growth in the potential service area significantly exceeds current NETRWPG projections.

This alternative strategy for the City of Canton is to construct by 2020 a new 1,845 acre (24,980 ac-ft) reservoir on Grand Saline Creek, a tributary of Sabine River, construct a 14" pipeline from the new reservoir's intake to Canton's WTP and expanding the WTP. The project is estimated to yield 1,810 ac-ft/yr of supply.

5.6.18.2 R-P-M WSC

Description/Discussion of Needs

R-P-M WSC provides water service in Van Zandt, Henderson and Smith Counties. The WUG population is projected to be 3,298 by 2020 and increases to 6,168 by 2070. R-P-M WSC supplies its customers with groundwater from the Carrizo-Wilcox and Queen City aquifers with five water wells in Van Zandt County. R-P-M WSC is projected to have a total deficit of 16 ac-ft/yr in 2020 and increasing to a deficit of 283 ac-ft/yr by 2070; the shortage projected to occur in Van Zandt County is 12 ac-ft/yr in 2020 increasing to 197 ac-ft/yr by 2070. The shortage in Henderson County is 3 ac-ft/yr in 2020, increasing to 63 ac-ft/yr in 2070. Shortages in Smith County range from 1 ac-ft/yr in 2020 up to 23 ac-ft/yr in 2070.

Evaluated Strategies

Three alternative strategies were considered to meet the WSC's water supply shortages as summarized in the following table. 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. Water reuse was not considered because the WSC does not have a demand for non-potable water. Surface water was not considered because the WSC does not currently have surface water treatment. Groundwater has been identified as a potential source of additional water for R-P-M WSC.

The recommended strategy was for the development of additional groundwater supplies through the construction of wells in the Carrizo-Wilcox Aquifer in Van Zandt County in the Neches River Basin.

Identification of Alternative Strategy

The identified Alternative Water Management Strategy for RPM WSC to meet their projected deficit of 16 ac-ft/yr in 2020 and 283 ac-ft/yr in 2070 would be to construct five additional water wells similar to their existing wells just prior to each decade as the deficits occur. The alternative supply source will be the Queen City Aquifer in the Neches Basin in Van Zandt County. Five wells with rated capacity of 75gpm, pumping at an approximate depth of 60 ft., would provide approximately 75 acre-feet each. The Carrizo-Wilcox Aquifer is projected to have sufficient supply availability to meet the needs of RPM WSC for the planning period.

5.6.18.3 Van Zandt Irrigation (Drill New Wells; Carrizo/Neches)

Description/Discussion of Needs

The Irrigation WUG in Van Zandt County has a demand that is projected to remain constant at 437 ac-ft/yr for the planning period. The Irrigation WUG in Van Zandt County is currently supplied by groundwater from the Carrizo-Wilcox Aquifer and run-of-river diversions on the Sabine River. A deficit of 330 ac-ft/yr is projected to occur in throughout the planning period.

Evaluated Strategies

Three alternative strategies were considered to meet the Van Zandt County Irrigation WUG's water supply shortages. Advanced water conservation for irrigation practices were not considered in this planning effort for irrigation. The use of reuse water from nearby municipalities is not considered feasible as it would not be effective to deliver reuse water to farm irrigation systems. Groundwater from the Carrizo-Wilcox and Queen City aquifers has been identified as a potential source of water for irrigation in Van Zandt. Surface water was not considered as a potential alternative to meet projected demands due to cost efficiency.

The recommended strategy was the construction of new wells in the Queen City Aquifer in the Neches Basin in Van Zandt County.

Identification of Alternative Strategy

The alternate strategy for Irrigation in Van Zandt County is to construct by 2020 an additional three water wells similar to existing wells in the area. The recommended supply source will be the Carrizo-Wilcox Aquifer in the Neches River Basin in Van Zandt County. Three wells with rated capacity of 75 gpm would provide approximately 330 ac-ft/yr. The Carrizo-Wilcox Aquifer in Van Zandt County is projected to have sufficient supply availability to provide this supply for the planning period.

5.6.19 **Wood County**

No Alternative Water Management Strategies have been identified for entities within Wood County.

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CHAPTER 6 IMPACTS OF THE REGIONAL WATER PLAN, AND DESCRIPTION OF HOW THE REGIONAL WATER PLAN IS CONSISTENT WITH THE LONG-TERM PROTECTION OF THE STATE'S WATER, NATURAL, AND AGRICULTURAL RESOURCES, AND THE IMPACTS OF MARVIN NICHOLS I RESERVOIR PROPOSED BY REGION C IN PROTECTING THESE RESOURCES

31 TAC Chapter 357.40 requires that regional water plans describe various anticipated impacts of the Regional Water Plan, including potential impacts on water quality, navigation, and impacts of moving water from agricultural to rural areas. Also required is a description of how the Regional Water Plan is consistent with the long-term protection of Texas' water, agricultural, and natural resources, including the requirement that planning analyses and recommendations honor all existing water rights and contracts.

The primary purpose of Chapter 6 is to describe the impacts of the 2016 North East Texas Regional Water Plan, and provide a description as to how this plan is consistent with the long-term protection of the State's water resources, agricultural resources, and natural resources. This description will include a discussion of the goals of and proposals for restoration and protection of instream flows that are viewed as important to the region and how those goals and proposals are consistent with the long-term protection of Texas' water, agricultural, and natural resources.

Additionally, this chapter also addresses the potential impact of the Marvin Nichols I Reservoir on the long-term protection of the State's water resources, agricultural resources, and natural resources, and those of this Region. The Marvin Nichols I Reservoir is a proposed water management strategy of Region C in the 2011 State Water Plan. The Marvin Nichols I Reservoir, if constructed, would be located in the North East Texas Region, as would the mitigation land that would be required. It will also change the pattern of flow of the Sulphur River. Because of the resulting impacts of removing and degrading productive agricultural lands, it has been the position of the North East Texas Regional Water Planning Group (NETRWPG) that inclusion of the Marvin Nichols I Reservoir, or any similarly located reservoir, is not consistent with the long-term protection of the State's water resources, agricultural resources, and natural resources, and those of Region D.

The NETRWPG takes the position for the 2016 regional water planning process that, from the information made available by Region C to Region D in early 2015, the Marvin Nichols Reservoir strategy does not satisfy the requirements of the current TWDB rules to evaluate the impacts on state and regional agricultural, natural, and water resources. Moreover, the NETRWPG continues to oppose the Marvin Nichols reservoir on the basis of the impacts described within this chapter and in Chapter 8 of this Plan.

6.1 IMPACTS OF WATER MANAGEMENT STRATEGIES ON KEY WATER QUALITY PARAMETERS IN THE STATE

The North East Texas Regional Water Planning Group (NETRWPG) has identified 71 Water User Groups with shortages, which will require strategies in this plan. There have been 33 water management strategies developed that simply extend or increase existing water purchase contracts, and will not require capital expenditure or new sources of supply. Of these strategies, 30 involve increasing the maximum quantity of taking under existing surface water purchase contracts.

Shortages for 32 entities will be resolved with additional groundwater supplies. Shortages for 13 entities will be resolved with Advanced Water Conservation strategies. There are six (6) instances of recommended voluntary reallocations of existing supplies, recommended to WWP and WUG sellers in the Region to meet projected customer needs (see Chapter 5).

Per 31 TAC §358.3(19), the development of this plan was guided by the principal that the designated water quality and related water uses as shown in the state water quality management plan shall be improved or maintained.

Chapter 357.40(b)(5) of the regional water planning guidelines provide that the plan shall include, "a description of the impacts of the Regional Water Plan regarding major impacts of recommended water management strategies on key parameters of water quality." The strategies recommended herein are primarily to address shortages in municipal water suppliers. Municipal water suppliers are governed by regulations of TCEQ, primarily Chapter 290 of Title 30 of the Texas Administrative Code. Key parameters of water quality are therefore those regulated by the TCEQ, and are summarized in Tables 6.1 through 6.4.

Table 6.1 Parameters of Water Quality – Inorganic Compounds

Contaminant	**Max Contaminant Level (MCL) (mg/L)**
Antimony	0.006
Arsenic	0.010
Asbestos	7 million fibers/L (> than 10µm)
Barium	2.0
Beryllium	0.004
Cadmium	0.005
Chromium	0.1
Cyanide	0.2 (as free Cyanide)
Fluoride	4.0
Mercury	0.002
Nitrate	10 (as Nitrogen)
Nitrite	1 (as Nitrogen)
Nitrate & Nitrite (Total)	10 (as (Nitrogen)
Selenium	0.05
Thallium	0.002

Table 6.2 Parameters of Water Quality – Organic Compounds

Contaminant	**MCL (mg/L)**
Alachlor	0.002
Atrazine	0.003
Benzopyrene	0.0002
Carbofuran	0.04
Chlordane	0.002
Dalapon	0.2
Dibromochloropropane	0.0002
Di(2-ethylhexyl)adipate	0.4
Di(2-theylhexyl)phthalate	0.006
Dinoseb	0.007
Diquat	0.02
Endothall	0.1
Endrin	0.002
Ethylene dibromide	0.00005
Glyphosate	0.7

Contaminant	MCL (mg/L)
Heptachlor	0.0004
Heptachlor epoxide	0.0002
Hexachlorobenzene	0.001
Hexachlorocyclopentadiene	0.05
Lindane	0.0002
Methoxychlor	0.04
Oxamyl (Vydate)	0.2
Pentachlorophenol	0.001
Picloram	0.5
Polychlorinated biphenyls (PCB)	0.0005
Simazine	0.004
Toxaphene	0.003
2,3,7,8-TCDD (Dioxin)	$3 X 10^{-8}$
2,4,5-TP	0.05
2,4-D	0.07

Table 6.3 Parameters of Water Quality – Volatile Organic Compounds

Contaminant	MCL (mg/L)
1,1-Dichloroethylene	0.007
1,1,1-Trichloroethane	0.2
1,1,2-Trichloroethane	0.005
1,2-Dichloroethane	0.005
1,2-Dichloropropane	0.005
1,2,4-Trichlorobenzene	0.07
Benzene	0.005
Carbon tetrachloride	0.005
Cis-1,2-Dichloroethylene	0.07
Dichloromethane	0.005
Ethylbenzene	0.7
Monochlorobenzene	0.1
o-Dichlorobenzene	0.6
para-Dichlorobenzene	0.075
Styrene	0.1
Tetrachloroethylene	0.005
Toluene	1.0
trans-1,2-Dichloroethylene	0.1
Trichloroethylene	0.005
Vinyl chloride	0.002
Xylenes (total)	10.0

Table 6.4 Parameters of Water Quality – Secondary Contaminant Levels

Contaminant	Level (mg/l except where otherwise stated)
Aluminum	0.05 to 0.2
Chloride	300
Color	15 color units
Copper	1.0
Corrosivity	Non-corrosive
Fluoride	2.0
Foaming agents	0.5
Hydrogen sulfide	0.05
Iron	0.3
Manganese	0.05
Odor	3 Threshold Odor Number

Contaminant	Level (mg/l except where otherwise stated)
pH	>7.0
Silver	0.1
Sulfate	300
Total Dissolved Solids	1,000
Zinc	5.0

6.1.1 WMS Characterization and Water Quality Considerations

The 39 strategies utilizing groundwater involve the drilling of additional wells by smaller systems, generally in the 50 to 200 gpm production range. Spacing between wells is typically recommended to be around ½ mile, to avoid interference between wells. This recommended distance can vary, dependent upon the hydrologic properties of the aquifer. Drilling of a well of this size, properly spaced and properly completed to public well standards should typically have no impact on surrounding water quality, provided the additional pumping does not overdraft the aquifer. Each of the region's aquifers has been assessed in Chapter 3, using the capacities of the aquifer determined to be adequate by the TWDB (via identified Modeled Available Groundwater, i.e. MAG, amounts) to accommodate the additional pumping. Should overdrafting occur, or should wells not be properly completed, degradation of water quality in the aquifer could occur. Possible sources would include brine intrusion from lower levels of the aquifer, or breakthrough from upper, poorly separated strata.

The 37 surface water strategies for entities with actual shortages, involving increasing contractual supplies from existing, adequate surface impoundments should result in no measurable change in water quality in the existing impoundments. The additional supplies needed are summarized in Table 6.5:

Table 6.5 WUGs Needing Additional Contractual Supply

WUG	Reservoir	Reservoir Capacity	2070 Strategy Volume	% of Permitted Capacity
BRINKER WSC	Lake Sulphur Springs	11,550	63	0.5%
CADDO BASIN SUD	Lake Tawakoni	221,310	570	0.3%
CADDO BASIN SUD	Chapman Lake/Reservoir	67,673	967	1.4%
CADDO MILLS	Lake Tawakoni	221,310	255	0.1%
CLARKSVILLE	Lake Wright Patman	123,000	303	0.2%
COUNTY-OTHER HUNT	Lake Tawakoni	221,310	551	0.2%
COUNTY-OTHER HUNT	Lake Fork	161,360	628	0.4%
COUNTY-OTHER LAMAR	Pat Mayse Lake	59,670	116	0.2%
COUNTY-OTHER RED RIVER	Lake Wright Patman	123,000	318	0.3%
DE KALB	Lake Wright Patman	123,000	297	0.2%

WUG	Reservoir	Reservoir Capacity	2070 Strategy Volume	% of Permitted Capacity
HOOKS	Lake Wright Patman	123,000	243	0.2%
LONE OAK	Lake Tawakoni	221,310	56	0.0%
MACEDONIA-EYLAU MUD #1	Lake Wright Patman	123,000	577	0.5%
MANUFACTURING CASS	Lake Wright Patman	123,000	47990	39.0%
MANUFACTURING TITUS	Lake Bob Sandlin	60,430	4269	7.1%
MARSHALL	Lake O' The Pines	149,000	701	0.5%
MAUD	Lake Wright Patman	123,000	164	0.1%
NASH	Lake Wright Patman	123,000	214	0.2%
NEW BOSTON	Lake Wright Patman	123,000	1089	0.9%
NORTH HUNT SUD	Chapman Lake/Reservoir	67,673	388	0.6%
REDWATER	Lake Wright Patman	123,000	77	0.1%
STEAM ELECTRIC LAMAR	Pat Mayse Lake	59,670	10568	17.7%
STEAM ELECTRIC TITUS	Lake Bob Sandlin	60,430	32394	53.6%
STEAM ELECTRIC TITUS	Lake O' The Pines	149,000	59161	39.7%
TEXAMERICAS CENTER	Lake Wright Patman	123,000	530	0.4%
TRI SUD	Lake Bob Sandlin	60,430	2399	4.0%
WAKE VILLAGE	Lake Wright Patman	123,000	642	0.5%

There are four strategies related to the expansion and/or replacement of a WUG's Water Treatment Plants and raw water intakes and/or reuse. These strategies include recommendations for the City of Texarkana's WTP, referred to herein as the Riverbend strategy, expansion of the City of Greenville's WTP, an eventual new WTP for Greenville, and indirect reuse for the City of Canton. These strategies are not anticipated to result in measurable changes in the water quality of existing impoundments. One recommended strategy for the City of Texarkana calls for the dredging of Lake Wright Patman. Although the dredging process can have short-term effects on reservoir water quality, no long term detrimental impacts to the water quality of Wright Patman should occur.

There are thus eight (8) surface water strategies (for 9 WUGs) involving the movement of water within the North East Texas Region, three (3) of which are contingent upon the importation of water by pipeline from Toledo Bend Reservoir in the lower Sabine River Basin (Region I) to either Harrison County, or to Lake Tawakoni or Lake Fork in the upper Sabine (Region D). The remaining strategies represent recommendations for the movement of supplies within the North East Texas Region. These eight strategies (for nine WUGs) are summarized in Table 6.6.

By the end of the 50 year planning period, the NETRWPG area needs due to these strategies will total 239,101 ac-ft per year. The percentage of supplies recommended for annual withdrawal represent a range of 0.2% – 30.1% of the available capacity of the reservoirs being utilized. The largest percentage is for Lamar County Irrigation, a substantial component of which is presently under development at the time of publication of this 2016 Plan. While it is anticipated that the detailed environmental and water quality studies will be performed by the project sponsors during the development of each project, for planning purposes the annual withdrawal of the reservoir contents in terms of overall capacity can be considered minimal to moderate.

Table 6.6 Recommended Strategies for WUGs Moving Surface Water Supplies

WUG	Strategy	Source	2070 WMS Amount (ac-ft/yr)	Total WMS Demand on Source (ac-ft/yr)	Source Capacity (ac-ft/yr)	% WMS Demand on Source (ac-ft/yr)
Harrison County, Manufacturing*	Toledo Bend Intake and Raw Water Pipeline	Toledo Bend Reservoir	0	56,090	4,412,300	1.3%
Harrison County, Steam Electric	Toledo Bend Intake and Raw Water Pipeline		47,000			
Greenville	Toledo Bend Tie-In Pipeline		5,100			
Hunt, County-Other	Greenville Tie-In Pipeline		3,990			
Greenville	Chapman Raw Water Pipeline and New WTP	Lake Chapman	9,333	9,333	67,673	13.8%
Lamar County, Irrigation	Pat Mayse Raw Water Pipeline	Pat Mayse Lake	18,302	18,302	59,670	30.7%
Clarksville	Wright Patman Pipeline	Lake Wright Patman	303	303	123,000	0.2%
North Hunt SUD*	Delta County Pipeline	Big Creek Lake	350	350	1,518	23.1%
Hopkins County Irrigation*	Lake Sulphur Springs Raw Water Pipeline	Lake Sulphur Springs	1,306	1,306	11,550	11.3%

*Note: While these Water Management Strategies are recommended for the purposes of the 2016 Region D Plan, it should be noted that these noted strategies have been recommended following TWDB requirements regarding MAG limitations on groundwater supply. In reality, these entities have the present right to legally utilize groundwater supplies beyond the MAG limitation established by TWDB for regional planning purposes. Alternate strategies reflecting this reality are presented in Chapter 5 of this report.

6.1.1.1 Toledo Bend Intake and Raw Water Pipeline

This strategy is a combined strategy to meet projected demands for the Harrison County Steam Electric WUGs for the year 2070. The project entails construction of a new intake and pipeline to convey water purchased from the Sabine River Authority to Harrison County for manufacturing and steam electric power generation uses. Supplies for Harrison County Steam Electric include a suite of sources with varying ranges in water quality parameters, from groundwater from the Carrizo-Wilcox Aquifer, to surface water supplies from permitted and/or contracted diversions in the Cypress (Lake O' The Pines) and Sabine (Cherokee Lake and Lake Fork) River Basins, along with run-of-river diversions in these basins. Harrison County Steam Electric WUG supplies include purchased supplies from the Sabine (Big Sandy Creek Reservoir and reuse from the City of Longview) and the Cypress (Lake O' The Pines) River Basins. While it is anticipated that the detailed environmental and water quality studies will be performed by the project sponsors during the development of this project, for planning purposes the annual withdrawal of the reservoir contents recommended herein can be considered to be minimal. Given the ranges of water quality currently utilized by these WUGs, no additional water quality issues are anticipated to be associated with the implementation of the recommended construction of an intake and pipeline utilizing supply from Toledo Bend Reservoir.

6.1.1.2 Toledo Bend Transfer Tie-In Strategies

There are two strategies recommended herein for development by the year 2070 that are based upon the potential utilization of supplies made available via the Sabine River Authority's Toledo Bend Transfer, a strategy previously recommended in the 2011 Region C Plan, and under current preliminary consideration again as a strategy by Region C for the present round of planning. The recommended water management strategy for the City of Greenville is to construct a tie-in pipeline to the Toledo Bend Transfer pipeline, and for the purchase of said water from the Sabine River Authority. The Hunt County-Other WUG is comprised of all or portions of Jacobia WSC, Little Creek Acres WSC, Maloy WSC, Poetry WSC, Shady Grove WSC, and West Leonard WSC within Hunt County. By 2070, the recommended strategy for this WUG is to construct a pipeline to purchase 3,990 ac-ft/yr of surface water supply from the City of Greenville, tying into the Greenville system where appropriate. This strategy is contingent upon the recommended strategies for Greenville to purchase the aforementioned additional supply from Greenville, as well as expansion of the City's existing WTP and construction of a new WTP.

The Toledo Bend Transfer pipeline project is presently envisioned to transfer water from Toledo Bend Reservoir, in the lower Sabine River Basin, to the upper portions of the basin, for potential storage in Lake Fork and/or Lake Tawakoni. Detailed studies will be required to determine the water quality impacts. Water chemistry will likely be different in the various reservoirs. For example, Lake Fork and Toledo Bend are located in the Piney Woods physiographic region, while Tawakoni is in the Blackland Prairie. Thus the runoff quality may differ. All three reservoirs are currently used for water supply, however, demonstrating that the various waters are treatable with conventional techniques. Table 6.7 compares key water quality parameters for the upper and lower basins, and shows no significant difference in water quality. The "Sabine River Basin Highlights 2012" Report indicates that all three reservoirs have uses including aquatic life, contact recreation, public water supply, fish consumption and general uses. According to that report Lake Fork is fully supporting for all listed uses, although tributaries of Lake Fork (Elm Creek and Running Creek), remain on the 303(d) list for bacteria. Lake Tawakoni water quality is listed in the 303(d) list for elevated pH. A special study for pH was completed here, and data supports the removal of this 303(d) listing. The Sabine River above Toledo Bend Reservoir is listed on the 303(d) list for bacteria. A Recreational Use Attainability Analysis has been completed for this site. Toledo Bend is fully supportive of contact recreation, public water supply and general uses. Aquatic life uses are of concern in that fish consumption is impacted by mercury levels in largemouth bass and freshwater drum species.

Table 6.7 Toledo Bend Water Quality Comparison
7-year average (June 2006-May 2013)

Parameter	Units	Upper Sabine Basin		Lower Sabine Basin
		Lake Fork	Lake Tawakoni	Toledo Bend
Temperature,	C°	19.67	19.5	21.27
pH		7.75	8.31	7.67
DO	mg/l	8.54	8.99	8.47
Turbidity	NTU	4.42	11.4	7.84
Nitrite	mg/l	0.04	0.05	0.04
Nitrate	mg/l	0.09	0.13	0.07
TOC	mg/l	6.86	6.5	7.5
Chlorides	mg/l	16.51	6.77	17.31
Sulfates	mg/l	20.4	10.8	18.78

Source: Sabine River Authority of Texas (SRA-TX) Monthly Water Quality Monitoring Program (WQMP) data used in Texas Clean Rivers Program (TCRP) water quality analysis. Data from TCEQ SWQM database (http://www.tceq.state.tx.us/waterquality/clean-rivers/data/samplequery.html) Seven year averages of monthly data, June 2006- May 2013.

The Toledo Bend Transfer project is still in a conceptual phase, so the exact withdrawal and discharge locations and details are unknown. It is possible that there could be no impact at all on Lake Fork or Tawakoni if Toledo Bend water is piped directly to a given treatment facility. If the Toledo Bend water is discharged into one or both of the reservoirs, the effect on dissolved oxygen levels could be positive or negative, depending on factors such as initial D.O., intake and discharge locations, discharge details, and others, most of which are not presently known.

6.1.2 **Chapman Pipeline**

By 2050, it is recommended that the City of Greenville contract with the City of Sulphur Springs for available supply from Chapman Lake, and to construct an intake, pump station, and pipeline along with a new WTP. The City currently treats supplies from the Greenville City Lake, and water purchased from the Sabine River Authority from Lake Tawakoni. Chapman Lake and Lake Tawakoni are listed on on the TCEQ 303(d) list for elevated pH. A planning level water quality comparison (see Table 6.8) has been performed to evaluate and characterize the similarities and differences in select water quality parameters between the City's existing and proposed sources. Data from the TCEQ Surface Water Quality Monitoring (SWQM) Database were utilized to assess a spectrum of water quality parameters at (or approximate to) the sources of supply currently and recommended to be utilized by the City. The results indicate that for planning purposes, the characteristics of the parameters analyzed for Chapman Lake appear to be within the range of average water quality conditions in Lake Tawakoni and surface water quality characteristics at Cowleech Creek, as shown in Table 6.8. It is possible that there could be no impact on the City's existing supplies if water is piped directly to a given treatment facility.

Table 6.8 Chapman Water Quality Comparison to Greenville Current Supplies

		Surface water Lake Tawakoni near Commerce Intake (SWQM Station 10437)				Surface water Cowleech Creek (SWQM Station 14971)				Surface water Chapman Lake (SWQM Station 15211)				Comparison
Water Quality Group	**Water Quality Parameter**	**Avg**	**Min**	**Max**	**Count**	**Avg**	**Min**	**Max**	**Count**	**Avg**	**Min**	**Max**	**Count**	**In Range?**
Alkalinity-related	ALKALINITY, TOTAL (MG/L AS CACO3)	74.7	12.0	100.0	122	122.0	30.0	183.0	7	77.2	56.0	102.0	44	Yes
	HARDNESS, TOTAL (MG/L AS CACO3)	77.9	52.0	170.0	97	178.6	130.0	260.0	7	78.9	67.6	91.4	4	Yes
	PH (STANDARD UNITS)	8.1	6.5	9.3	912	7.3	6.8	7.8	7	7.7	6.3	8.9	226	Yes
	CARBONATE (MG/L)	No Data				No Data				No Data				No Data
	BICARBONATE (MG/L)	No Data				No Data				No Data				No Data
Ions-related	CALCIUM, TOTAL (MG/L AS CA)	27.9	25.0	32.0	10	63.1	39.0	89.0	7	21.8	0.0	30.9	6	Yes
	MAGNESIUM, TOTAL (MG/L AS MG)	3.7	2.3	11.0	9	5.7	1.0	9.9	6	2.3	0.0	3.6	6	Yes
	SODIUM, TOTAL (MG/L AS NA)	10.6	6.6	32.0	35	31.9	19.0	47.0	7	8.5	6.5	11.2	5	Yes
	POTASSIUM, TOTAL (MG/L AS K)	No Data				No Data				3.4	3.2	3.8	5	No Data
	STRONTIUM MG/L	No Data				No Data				No Data				No Data
	SULFATE (MG/L AS SO4)	11.5	6.0	38.0	134	43.3	27.0	74.0	7	10.3	6.0	17.0	44	Yes
	CHLORIDE (MG/L AS CL)	6.2	1.0	16.0	157	21.4	11.0	34.0	7	4.0	0.5	9.0	44	Yes
	SPECIFIC CONDUCTANCE,FIELD (US/CM @ 25C)	196.3	110.0	270.0	910	430.4	278.0	639.0	7	186.0	130.0	259.0	226	Yes
Oxygen-Related	OXYGEN, DISSOLVED (MG/L)	8.3	0.1	13.4	929	7.2	4.7	10.4	7	7.9	0.1	12.6	226	Yes
	CARBON, TOTAL ORGANIC, NPOC (TOC), MG/L	6.2	1.5	15.0	122	12.7	7.0	18.0	7	6.1	4.0	10.0	41	Yes
	CHEMICAL OXYGEN DEMAND, .025N K2CR2O7 (MG/L)	No Data				No Data				No Data				No Data
Nutrients-Related	NITRATE NITROGEN, TOTAL (MG/L AS N)	0.13	0.00	0.52	84	No Data				0.16	0.03	0.4	11	Yes
	NITROGEN, AMMONIA, TOTAL (MG/L AS N)	0.05	0.01	0.36	82	0.2	0.02	0.57	7	0.04	0.02	0.1	42	Yes
	ORTHOPHOSPHATE PHOSPHORUS,DISS,MG/L,FLDFILT<15MIN	0.02	0.01	0.11	135	0.15	0.07	0.23	7	0.02	0.02	0.0	18	Yes
	PHOSPHORUS, TOTAL, WET METHOD (MG/L AS P)	0.06	0.02	0.21	140	0.28	0.17	0.39	7	0.08	0.03	0.2	42	Yes
	CHLOROPHYLL-A (UG/L)	24.7	0.5	95.0	123	11.36	0.5	51	7	17.9	5.2	31.0	15	Yes
Solids-related	TOTAL SUSPENDED SOLIDS (MG/L)	13.3	1.5	37.2	80	59.0	11.0	175.0	7	18.5	4.0	60.0	43	Yes
	TOTAL DISSOLVED SOLIDS (MG/L)	129.5	86.0	222.0	62	336.6	180.0	436.0	7	139.8	101.0	384.0	39	Yes

		Surface water Lake Tawakoni near Commerce Intake (SWQM Station 10437)				Surface water Cowleech Creek (SWQM Station 14971)				Surface water Chapman Lake (SWQM Station 15211)				Comparison
Water Quality Group	Water Quality Parameter	Avg	Min	Max	Count	Avg	Min	Max	Count	Avg	Min	Max	Count	In Range?
Bacteria-related	E. COLI (MPN/100ML)*	1.4	0.5	31.0	11	65.0	4	689	51	3.9	0.5	640.0	32	Yes
	FECAL COLIFORM,MEMBR FILTER,M-FC BROTH, #/100ML*	1.7	0.5	200.0	61	485.2	10	7100	7	1.0	0.5	1	2	Yes

*The geometric mean is calculated for E.Coli and Fecal Coli instead of the arithmetic mean, as per typical practice for bacteria samples.

6.1.3 Pat Mayse Raw Water Pipeline

Projected demands for Lamar County irrigation indicate a near-term need for additional supply to meet the identified needs for this WUG. The recommended strategy for the Lamar County Irrigation WUG to meet projected demands over the planning period is to purchase raw water from Pat Mayse and Crook Reservoirs through the City of Paris. The recommended raw water pipeline is a 30 inch pipeline connecting to the City's existing system for supply from Pat Mayse Reservoir.

The recommended strategy lies within the Sulphur River Basin. Nearby waterbodies include Auds Creek, Bakers Branch, and several tributaries to the Sulphur River. Lake Chapman, the North Sulphur River, Auds Creek, and Bakers Branch are not listed in the 2012 303(d) list. A planning level water quality evaluation has been performed to evaluate and summarize the characteristics of select water quality parameters, for potential use for agricultural purposes. Data from the TCEQ SWQM database were utilized to assess a spectrum of water quality parameters at (or approximate to) the sources of supply currently and recommended to be utilized by the the Lamar County Irrigation WUG.

The results of this comparative analysis suggest that for planning purposes, the water quality characteristics of the parameters analyzed for Pat Mayse Lake appear to be within the range of water quality conditions suitable for irrigation purposes, as shown in Table 6.9.

Table 6.9 Summary Water Quality Evaluation of Pat Mayse Lake for Irrigation

Water Quality Parameter	Pat Mayse at Intake (SWQM Station 16343)				Comparison Value for Irrigation	Suitability for Irrigation
	Avg	Min	Max	Count		
SPECIFIC CONDUCTANCE, FIELD (US/CM @ 25C)	145	106	208	677	<250	Excellent
TOTAL DISSOLVED SOLIDS (MG/L)	99	75	132	51	<175	Excellent
CHLORIDE (MG/L AS CL)	6.3	1.0	22.0	64	<350	No yield loss
SODIUM ABSORPTION RATIO	2.2	1.8	2.6	6	<10	Low sodium hazard

6.1.4 Wright Patman Pipeline

The City of Clarksville is located in Red River County. The current sources of supply are wells into the Blossom Aquifer, mixed with surface water from Langford Lake. Water quality issues with the groundwater (TDS) and surface water (turbidity) necessitate mixing of the supplies to meet Texas drinking water standards. The groundwater has over 1,000 ppm of dissolved solids including high levels of sodium, sulfate, and chloride. The City provides water to its own customers in the Sulphur basin and is projected to have a water supply deficit of 593 ac-ft/yr in 2040, due to sedimentation issues in Langford Lake. As the surface water supply for the City diminishes, the capability to mix the surface supply with the groundwater supply commensurately diminishes as well. Thus as surface supply diminishes, so too does the capability to utilize the City's existing groundwater supply.

Lake Wright Patman is on the 2012 TCEQ 303(d) list (Category 5b and 5c) for elevated pH and depressed dissolved oxygen. A planning level water quality comparison (see Table 6.10) has been performed to evaluate and characterize the similarities and differences in select water quality parameters between the City's existing and proposed sources. Data from the TCEQ SWQM database were utilized to assess a spectrum of water quality parameters at (or approximate to) the groundwater sources presently utilized by the City and at Lake Wright Patman. No SWQM data were available from Langord Lake, thus the comparison relies primarily upon the City's groundwater supply.

The results of this comparative analysis suggest that for planning purposes, the water quality characteristics of the parameters analyzed for Wright Patman Reservoir appear to, on the average, offer improved water quality characteristics in comparison to the City's groundwater supply. Although Wright Patman has elevated average Chlorophyl-a, the distinctly lower average chlorides concentration suggests the City would have the capability to similarly utilize this surface water supply in a manner similar to their current balancing between groundwater supplies and surface water supplied from Langford Lake. That said, concerns exist regarding differences in treatment methodology. The City of Texarkana uses chloramines in the treatment of the Wright Patman supply, and the City of Clarksville currently uses chlorine, making it difficult to mix waters.

The recommended pipeline is not expected to have a detrimental effect on the water quality of the Wright Patman supply, given the recommended approach is for the pipeline to tie into Texarkana/Riverbend's existing system in DeKalb. Modifications to the City's existing treatment facilities may be warranted, and the recommended approach is contingent upon recommended strategies for the City of Texarkana/Riverbend. No detrimental water quality effects are expected on the City of Clarkesville's existing supplies. Rather, it is important to note that a successful implementation of this recommended strategy is contingent upon the City's existing practices of balancing its groundwater supplies with this new surface supply.

Table 6.10 Summary Wright Patman Comparative Evaluation of Water Quality

		Groundwater under Clarksville, TX (TWDB wells 1732201, 1732202, 1732203)				Wright Patman Lake (All SWQM Stations in TCEQ Segment 0302)			
Water Quality Group	**Water Quality Parameter**	**Avg**	**Min**	**Max**	**Count**	**Avg**	**Min**	**Max**	**Count**
Alkalinity-related	ALKALINITY, TOTAL (MG/L AS CACO3)	383.7	346.0	440.0	19	68.9	5.0	268.0	323
	HARDNESS, TOTAL (MG/L AS CACO3)	20.5	10.0	68.0	19	85.1	47.0	170.0	72
	PH (STANDARD UNITS)	8.5	3.6	9.3	19	7.8	6.0	9.6	3368
	CARBONATE (MG/L)	24.0	0.0	90.0	19	1.8	0.5	10.0	66
	BICARBONATE (MG/L)	417.6	335.6	475.9	19	89.9	46.0	117.0	66
Ions-related	CALCIUM, DISSOLVED (MG/L AS CA)	5.2	2.0	21.0	19	26.2	0.0	56.7	163
	MAGNESIUM, DISSOLVED (MG/L AS MG)	1.9	0.5	6.0	19	3.2	0.0	7.4	163
	SODIUM, DISSOLVED (MG/L AS NA)	377.1	317.0	411.0	19	14.5	6.0	32.1	131
	POTASSIUM MG/L	2.5	1.5	4.8	5	4.1	2.4	6.9	131
	STRONTIUM MG/L	0.4	0.3	0.4	4	No Data			
	SULFATE (MG/L AS SO4)	166.8	128.0	212.0	19	19.2	2.5	89.1	596
	CHLORIDE (MG/L AS CL)	203.4	127.0	263.0	19	11.7	0.5	36.3	598
	SPECIFIC CONDUCTANCE,FIELD (US/CM @ 25C)	1788.9	1433.0	1944.0	15	206.0	88.0	1600.0	3225
Oxygen-Related	OXYGEN, DISSOLVED (MG/L)	No Data				7.3	0.5	14.6	265
	CARBON, TOTAL ORGANIC, NPOC (TOC), MG/L	No Data				9.3	0.5	20.0	319
	CHEMICAL OXYGEN DEMAND, .025N K2CR2O7 (MG/L)	No Data				No Data			
Nutrients-Related	NITRATE NITROGEN, TOTAL (MG/L AS N)	0.4	0.0	2.0	19	0.1	0.0	1.6	159
	NITROGEN, AMMONIA, TOTAL (MG/L AS N)	No Data				0.1	0.0	0.4	455
	ORTHOPHOSPHATE PHOSPHORUS,DISS,MG/L,FLDFILT<15MIN	No Data				0.0	0.0	0.5	285
	PHOSPHORUS, TOTAL, WET METHOD (MG/L AS P)	No Data				0.1	0.0	1.7	462
	CHLOROPHYLL-A (UG/L)	No Data				30.6	0.5	150.0	479
Solids-related	TOTAL SUSPENDED SOLIDS (MG/L)	No Data				17.8	2.0	120.0	460
	TOTAL DISSOLVED SOLIDS (MG/L)	999.6	828.0	1093.0	19	141.1	56.0	308.0	383

		Groundwater under Clarksville, TX (TWDB wells 1732201, 1732202, 1732203)				Wright Patman Lake (All SWQM Stations in TCEQ Segment 0302)			
Water Quality Group	Water Quality Parameter	Avg	Min	Max	Count	Avg	Min	Max	Count
Bacteria-related	E. COLI (MPN/100ML)*	No Data				2.3	0.5	2800.0	315
	FECAL COLIFORM,MEMBR FILTER,M-FC BROTH, #/100ML*	No Data				3.2	0.5	560.0	45

6.1.1 Delta County Pipeline

North Hunt SUD provides water service in Hunt, Fannin, and Delta counties. It is projected North Hunt SUD will have a shortage in 2030. The SUD has a contract for water supply with the City of Commerce for 147 ac-ft/yr for supply from Lake Tawakoni, and groundwater supplies from the Woodbine Aquifer in Hunt and Fannin Counties. The recommended strategy for this WUG is to utilize surplus supply from Delta County-Other, specifically Delta County MUD (an entity within Delta County-Other). The North Hunt SUD service area is contiguous with the service area for Delta County MUD, which purchases Big Creek Lake supply from the City of Cooper. Delta County MUD is projected to have sufficient surplus supplies to have the capability to meet North Hunt SUD needs starting in 2060.

Lake Tawakoni is listed on the TCEQ 303(d) list for elevated pH. Big Creek Lake, however, is not presently listed.

A planning level water quality comparison (Table 6.11) has been performed to evaluate and characterize the similarities and differences in select water quality parameters between North Hunt SUD's existing Tawakoni and groundwater rsupplies, and the recommended Big Creek Lake supply. Data from the TCEQ SWQM database and from nearby TWDB monitoring wells were utilized to assess and compare a spectrum of water quality parameters at Lake Tawakoni (near the Commerce WD intake) and North Hunt SUD's groundwater supply, in contrast to similar statistics regarding Big Creek Lake (SWQM Station 16856).

The results of this comparative analysis suggest that for planning purposes, the water quality characteristics of the parameters analyzed for surface water near Big Creek Lake (SWQM Station 16856) almost entirely appear to be within the range of average water quality conditions in Lake Tawakoni (near the Commerce WD intake; SWQM Station 10437) and the groundwater supply available to North Hunt SUD. However, it should be noted that Big Creek Lake appears to exhibit significantly higher average concentrations of E.Coli. according to the results of this comparison.

The recommended pipeline is not expected to have a detrimental effect on the water quality conditions in Big Creek Lake. With a connection directly to North Hunt SUD's existing treatment facility, no detrimental effects are expected on the existing supplies.

Table 6.11 Summary Big Creek Lake Comparative Evaluation of Water Quality

		Surface water Lake Tawakoni near Commerce Intake (SWQM Station 10437)				Groundwater supply to North Hunt SUD (TWDB wells 1840102 1733701)					Surface water Big Creek Lake (SWQM Station 16856)				Comparison
						Woodbine	Paluxy								
Water Quality Group	**Water Quality Parameter**	**Avg**	**Min**	**Max**	**Count**	**Value**	**Avg**	**Min**	**Max**	**Count**	**Avg**	**Min**	**Max**	**Count**	**In Range?**
Alkalinity-related	ALKALINITY, TOTAL (MG/L AS CACO3)	74.7	12.0	100.0	122	389	573.5	535.0	593.0	4	100.9	67.0	134.0	40	Yes
	HARDNESS, TOTAL (MG/L AS CACO3)	77.9	52.0	170.0	97	4	7.0	5.0	12.0	4	70.4	70.4	70.4	1	Yes
	PH (STANDARD UNITS)	8.1	6.5	9.3	912	8.43	8.2	8.0	8.3	5	7.8	6.8	8.9	119	Yes
	CARBONATE (MG/L)	No Data				9.6	18.6	8.9	26.4	5	No Data				No Data
	BICARBONATE (MG/L)	No Data				455.19	663.7	634.8	683.4	5	No Data				No Data
Ions-related	CALCIUM, TOTAL (MG/L AS CA)	27.9	25.0	32.0	10	1.06	1.9	1.7	2.4	5	30.3	24.2	37.4	3	Yes
	MAGNESIUM, TOTAL (MG/L AS MG)	3.7	2.3	11.0	9	<0.5	0.6	0.3	1.5	4	2.5	2.2	3.0	3	Yes
	SODIUM, TOTAL (MG/L AS NA)	10.6	6.6	32.0	35	288	350.0	336.0	361.0	5	15.1	2.0	21.5	4	Yes
	POTASSIUM, TOTAL (MG/L AS K)	No Data				1.18	1.7	1.4	2.4	4	2.9	2.6	3.2	3	No Data
	STRONTIUM MG/L	No Data				0.09	0.2	0.2	0.2	4	No Data				No Data
	SULFATE (MG/L AS SO4)	11.5	6.0	38.0	134	202	138.8	133.0	144.0	5	12.5	4.0	25.0	40	Yes
	CHLORIDE (MG/L AS CL)	6.2	1.0	16.0	157	51.6	37.3	32.6	42.0	5	6.3	2.5	10.0	40	Yes
	SPECIFIC CONDUCTANCE,FIELD (US/CM @ 25C)	196.3	110.0	270.0	910	1385	1451.0	1250.0	1548.0	4	244.2	146.0	314.0	123	Yes
Oxygen-Related	OXYGEN, DISSOLVED (MG/L)	8.3	0.1	13.4	929	No Data	No Data				7.9	0.5	12.4	119	Yes
	CARBON, TOTAL ORGANIC, NPOC (TOC), MG/L	6.2	1.5	15.0	122	No Data	No Data				6.2	1.5	15.0	122	Yes
	CHEMICAL OXYGEN DEMAND, .025N K2CR2O7 (MG/L)	No Data				No Data	No Data				No Data				No Data
Nutrients-Related	NITRATE NITROGEN, TOTAL (MG/L AS N)	0.13	0.00	0.52	84	<0.22	<0.09	<0.02	<0.09	4	0.11	0.03	0.5	8	Yes
	NITROGEN, AMMONIA, TOTAL (MG/L AS N)	0.05	0.01	0.36	82	No Data	No Data				0.05	0.03	0.3	40	Yes
	ORTHOPHOSPHATE PHOSPHORUS,DISS,MG/L,FLDFILT<15MIN	0.02	0.01	0.11	135	No Data	No Data				0.03	0.02	0.1	4	Yes
	PHOSPHORUS, TOTAL, WET METHOD (MG/L AS P)	0.06	0.02	0.21	140	No Data	No Data				0.08	0.01	0.2	38	Yes
	CHLOROPHYLL-A (UG/L)	24.7	0.5	95.0	123	No Data	No Data				9.0	2.9	15.8	23	Yes
Solids-related	TOTAL SUSPENDED SOLIDS (MG/L)	13.3	1.5	37.2	80	No Data	No Data				17.1	5.0	35.0	38	Yes
	TOTAL DISSOLVED SOLIDS (MG/L)	129.5	86.0	222.0	62	796	897.0	864.0	932.0	5	157.7	126.0	247.0	22	Yes

		Surface water Lake Tawakoni near Commerce Intake (SWQM Station 10437)				Groundwater supply to North Hunt SUD (TWDB wells 1840102 1733701)					Surface water Big Creek Lake (SWQM Station 16856)				Comparison
						Woodbine	Paluxy								
Water Quality Group	Water Quality Parameter	Avg	Min	Max	Count	Value	Avg	Min	Max	Count	Avg	Min	Max	Count	In Range?
Bacteria-related	E. COLI (MPN/100ML)*	1.4	0.5	31.0	11	No Data	No Data				6.2	0.5	160.0	32	No
	FECAL COLIFORM,MEMBR FILTER,M-FC BROTH, #/100ML*	1.7	0.5	200.0	61	No Data	No Data				No Data				No Data

* The geometric mean is calculated for E.Coli and Fecal Coli instead of the arithmetic mean, as per typical practice for bacteria samples.

6.1.2 Lake Sulphur Springs Raw Water Pipeline

The Irrigation WUG in Hopkins County is supplied by groundwater from the Carrizo-Wilcox Aquifer and run-of-river diversions from the Sabine and Sulphur Rivers. A deficit of 2,126 ac-ft/yr is projected to occur in throughout the planning period. In addition to a recommendation to construct additional wells to utilize groundwater supplies available under the MAG limit established by the TWDB, the second remaining water management strategy recommended for Hopkins County Irrigation is the construction of a pipeline to Lake Sulphur Springs for the purchase of raw water from the City of Sulphur Springs.

Lake Sulphur Springs is not listed in the 2012 TCEQ 303(d) list. A planning level water quality comparison (Table 6.11) has been performed to evaluate and characterize the similarities and differences in select water quality parameters between North Hunt SUD's existing Tawakoni and groundwater rsupplies, and the recommended Big Creek Lake supply. Data from the TCEQ SWQM database and from nearby TWDB monitoring wells were utilized to assess and compare a spectrum of water quality parameters at Lake Tawakoni (near the Commerce WD intake) and North Hunt SUD's groundwater supply, in contrast to similar statistics regarding Big Creek Lake (SWQM Station 16856).

The results of this comparative analysis suggest that for planning purposes, the water quality characteristics of the parameters analyzed for surface water near Big Creek Lake (SWQM Station 16856) almost entirely appear to be within the range of average water quality conditions in Lake Tawakoni (near the Commerce WD intake; SWQM Station 10437) and the groundwater supply available to North Hunt SUD. However, it should be noted that Big Creek Lake appears to exhibit significantly higher average concentrations of E.Coli. according to the results of this comparison.

The recommended pipeline is not expected to have a detrimental effect on the water quality conditions in Big Creek Lake. With a connection directly to North Hunt SUD's existing treatment facility, no detrimental effects are expected on the existing supplies.

Table 6.12 Summary Lake Sulphur Springs Comparative Evaluation of Water Quality

Water Quality Parameter	Surface water White Oak Creek downstream of Lake Sulphur Springs (SWQM Station 20099)				Comparison Value for Irrigation	Suitability for Irrigation
	Avg	Min	Max	Count		
SPECIFIC CONDUCTANCE,FIELD (US/CM @ 25C)	193	78	383	14	<250	Excellent
TOTAL DISSOLVED SOLIDS (MG/L)	153	95	264	12	<175	Excellent
CHLORIDE (MG/L AS CL)	9.0	2.5	24.2	12	<350	No yield loss
SODIUM ABSORPTION RATIO*	2.1	0.3	5.8	12	<10	Low sodium hazard

The proposals for voluntary strategies for meeting instream flow goals identified below and in Chapter 8 should not create water quality issues, as they will either maintain or increase current flows in the rivers and streams.

In summary, the comparative evaluations of water quality parameters for sources identified for utilization in the recommended water management strategies suggest minimal impacts to the water quality of the source supplies. The sources under consideration herein presently exist, and when considered in the context of WUGs' existing supplies, are comparable in terms of water quality.

6.2 IMPACTS OF MOVING WATER FROM RURAL AND AGRICULTURAL AREAS

Chapter 357.34 rules require that the plan include an analysis of the impacts of strategies which move water from rural and agricultural areas. As previously noted, a total of 98 strategies were identified for 69 entities in the NETRWPG area. There are 31 strategies involving the drilling of wells for use in the immediate vicinity of the well. There are 33 strategies involving contractual movements of surface water which taken from a reservoir (or run-of-river supply source) within the same proximity as the Water User Group. There are 13 Advanced Water Conservation Strategies, 6 strategies entailing the voluntary reallocation of existing supplies, and 3 strategies involving the expansion of an existing water treatment plant, development of new water treatment plant, and/or the development of new raw water intakes to utilize existing surface water supplies. One strategy entails dredging of a reservoir to address a significant accumulation of sediment that is projected to result in significant future losses of available supply.

There are nine (9) strategies recommending the movement of surface water supplies within the North East Texas Region, as denoted in Table 6.13 below.

Table 6.13 Recommended Strategies for WUGs Moving Surface Water Supplies

WUG	County of Use	Reservoir	County of Origin
Harrison County Manufacturing	Harrison	Toledo Bend Reservoir	Shelby
Harrison County Steam Electric	Harrison	Toledo Bend Reservoir	Shelby
Hopkins County Irrigation	Hopkins	Lake Sulphur Springs	Hopkins
Hunt County-Other	Hunt	Toledo Bend Reservoir	Hunt
Greenville	Hunt	Lake Chapman	Delta/Hopkins
Greenville	Hunt	Toledo Bend Reservoir	Shelby
North Hunt SUD	Hunt	Big Creek Lake	Delta
Lamar County Irrigation	Lamar	Pat Mayse Reservoir	Lamar
Clarksville	Red River	Lake Wright Patman	Bowie

With the exception of strategies related to the utilization of water from the Toledo Bend Transfer, these recommended strategies move water either between rural areas, or from urban to rural areas.

It is noteworthy that given the extensive population growth between 2020 and 2070, the implementation of several of these strategies may, by 2070, be considered movement between urban to urban areas.

The three remaining strategies (recall the recommendation for Harrison County Manufacturing and Steam Electric WUGs is a combined strategy) move water from the Toledo Bend Reservoir, which would be considered a rural and agricultural area, to the North East Texas Region. The recommended intake and pipeline for the Harrison County Manufacturing and Steam Electric WUGs would move water to a similar rural and agricultural area in Harrison County. The recommended projects contingent upon the Toledo Bend Transfer would be moving water from Toledo Bend Reservoir to Lake Tawakoni and/or Lake Fork, for use in Hunt County, which is also a rural and agricultural area. The water remains in the same river basin, and under control of the same river authority. The amount being moved for use in Region D is less than 5% of the capacity of Toledo Bend, and are presently understood to be in excess of the needs of Region I in which Toledo Bend is located. The impacts of moving the proposed quantity of water would be minimal on agricultural interests in the Toledo Bend area.

6.3 SOCIOECONOMIC IMPACTS OF UNMET NEEDS

The Texas Administrative Code (31 TAC §357.40(a)) requires that regional water plans 'include a quantitative description of the socioeconomic impacts of not meeting the identified water needs' in the planning area for water users. In previous rounds of planning, TWDB has developed a methodology to conduct this analysis and performed the analysis for the RWPGs, if requested. At its March 18, 2015 meeting, the North East Texas Regional Water Planning Group formally requested that TWDB perform this analysis. This assessment is included in its entirety in the Appendix of this Plan. Quoting from the TWDB analysis:

> " It is estimated that not meeting the identified water needs in Region D would result in an annually combined lost income impact of approximately $6.4 billion in 2020, increasing to $8.1 billion in 2070 . In 2020, the region would lose approximately 49,000 jobs, and by 2070 job losses would increase to approximately 56,000."

Results of the TWDB socioeconomic impact analysis are summarized in Table 6.14 below.

6.4 IMPACTS OF MARVIN NICHOLS I RESERVOIR PROPOSED BY REGION C IN PROTECTING REGION D RESOURCES

While not a strategy of the NETRWPG, it should be noted that Region C may propose construction of Marvin Nichols Reservoir in the NETRWPG area. Transfer of water from Marvin Nichols to the Dallas-Ft. Worth Metroplex would constitute the moving of water from rural and agricultural areas. The impact of this project, particularly on the timber industry, has been the focus of previous studies, which reached widely divergent conclusions. Potential impacts of the Marvin Nichols project are further discussed later in this chapter.

Table 6.14 Summary of Socioeconomic Impact Analysis of Region D

Regional Economic Impacts	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$ 6,429	$ 7,108	$ 7,178	$ 6,574	$ 6,712	$ 8,089
Job losses	48,970	52,112	52,778	46,740	45,645	55,938
Financial Transfer Impacts	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Tax losses on production and imports ($ millions)*	$ 664	$ 704	$ 639	$ 466	$ 360	$ 378
Water trucking costs ($ millions)*	$ 17	$ 17	$ 18	$ 18	$ 19	$ 20
Utility revenue losses ($ millions)*	$ 51	$ 58	$ 70	$ 76	$ 90	$ 125
Utility tax revenue losses ($ millions)*	$ 1	$ 1	$ 1	$ 1	$ 1	$ 2
Social Impacts	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Consumer surplus losses ($ millions)*	$ 101	$ 105	$ 113	$ 116	$ 117	$ 156
Population losses	8,991	9,568	9,690	8,581	8,380	10,270
School enrollment losses	1,663	1,770	1,793	1,587	1,550	1,900

6.5 CONSISTENCY WITH THE PROTECTION OF WATER RESOURCES

The North East Texas Regional Water Plan protects water contracts, option agreements, and special water resources. The 2016 North East Texas Regional Water Plan was developed to meet the Region's near and long-term needs during the drought of record (DOR). Water Availability Models (WAM) and Groundwater Availability Models (GAM) were employed, where available, to determine supplies available to the Region during the DOR. The WAM and this plan recognize and honor all existing water rights and water contracts. Surface water availability is based on the assumption that all senior downstream water rights are being fully utilized.

The water resources in the North East Texas Region include six river basins providing surface water and six aquifers providing groundwater. The four major river basins within the NETRWPG area boundaries include the Cypress Creek Basin, the Red River Basin, the Sabine River Basin, and the Sulphur River Basin (minor portions of the region are within the Trinity and Neches watersheds as well). The respective boundaries of these basins are depicted in Figure 1.2, in Chapter 1. The region's groundwater resources include, primarily, the Carrizo-Wilcox Aquifer, the Trinity Aquifer, the Queen City Aquifer, the Nacatoch Aquifer, the Blossom Aquifer, and the Woodbine Aquifer. Lesser amounts of water are also available from localized shallow aquifers and springs.

Surface water accounts for the majority of the total water use in the region. Of the estimated 2020 supplies in the Sulphur River Basin, 95 percent of the water used is surface water; in the Cypress Creek Basin, 89 percent of the water used is surface water; and in the Sabine River Basin, 81 percent of the need is met by surface water. In the portion of the Red River Basin in the region, 83 percent of the water supply used is surface water. Surface water sources (Table 1.6 Existing Reservoirs, Chapter 1) include 10 reservoirs in the Cypress Creek Basin, 2 in the Red River Basin, 11 in the Sabine River Basin, and 11 in the Sulphur River Basin. There are no planned additional reservoirs by the NETRWPG other than Prairie Creek Reservoir. Currently, the majority of the available surface water supply in North East Texas Planning Area comes from the Sabine River Basin.

The Carrizo-Wilcox Aquifer is the most important groundwater resource in the North East Texas Regional Water Planning Group area, accounting for a total of 72% of the available groundwater. Recent groundwater level observations indicate there are significant water level declines in the Carrizo-Wilcox Aquifer in Smith and Cass Counties. The City of Tyler has made significant investments to reduce their dependency on groundwater in Smith County.

Recommended strategies must minimize threats to the region's sources of water over the planning period to be consistent with the long-term protection of water resources. The water management strategies identified herein were evaluated for threats to water resources. The recommended strategies represent a comprehensive plan for meeting the needs of the region while effectively minimizing threats to water resources. Descriptions of the major strategies and the ways in which they minimize threats include the following:

- **Water Conservation**. Strategies for water conservation were evaluated for all WUG's with a per capita water use of at least 140 gpcpd. The Planning Area is a mostly rural region with numerous rural water supply systems, which typically have lower per capita uses. This plan includes significant savings in water demands due to the implementation of plumbing codes. These demand savings will result in conservation of the existing surface and groundwater supply resources. New plumbing codes promote water conservation, which benefits the State's water resources by reducing the volume of water necessary to support human activity.
- **Direct/Indirect Reuse**. The City of Longview, Gregg County, has contracted with a power generating facility to reuse a portion of the wastewater discharge generated by the City. Treated wastewater is pumped directly from the wastewater plant and is utilized for cooling water in a power generation plant in Harrison County. Secondly, the City of Canton is currently seeking an indirect reuse permit to more fully utilize its available resources. Reuse reduces the dependence on ground or surface water sources by more fully utilizing the resource once it has been withdrawn before returning it to the surface water system.
- **Expanded Use of Surface Water Resources**. One purpose of the Water Availability Model (WAM) development, a part of the regional planning process, is

to assess how the increased use of surface water resources will impact the Region's water resources. The WAMs developed for the Planning Area indicate adequate availability of surface water in the region. This strategy includes the voluntary reallocation of surface water supplies, in order to optimally utilize existing, reliable supplies.

- **Expanded Use of Groundwater**. This strategy has generally been recommended for entities with sufficient groundwater supply available to meet needs, but currently without adequate infrastructure (i.e., well capacity). Groundwater availability reported in the plan is based on the long-term sustainability of the aquifer as defined by the development of Modeled Available Groundwater (MAG) amounts. No strategies are recommended to use water above the acceptable sustainable level defined by these amounts.[3]

A summary of the evaluation of water management strategies is presented in Table 6.15 below.

6.6 CONSISTENCY WITH PROTECTION OF AGRICULTURAL RESOURCES

Agriculture is a significant contributor to local economies in the Planning Area. Irrigation is a critical component of successful agriculture operations in the region. Irrigation plays a significant role in numerous nurseries in the Sabine Basin and numerous row crop operations in the Red River Basin. Many dairy and beef cattle operations utilize groundwater from the Carrizo-Wilcox and Queen City Aquifers.

The WAMs indicate adequate availability of surface water to meet the projected irrigation demands for the planning period in all but a single case. Where insufficient reliabilities have been identified, water management strategies have been developed in accordance with TWDB guidelines to provide adequate supplies to meet identified agricultural needs where possible.

Each WMS has been incorporated into GIS and plotted along with the most recent available data from the National Land Cover Database (NLCD 2011), providing spatial reference and descriptive, quantitative data for characteristics of the land surface in the region. These data were overlayed for each project to develop a quantified estimation of acreages of various land coverage types (e.g. developed, deciduous forest, cultivated crops, …). For wetlands, data from the National Wetlands Inventory database have been similarly employed to identify potential acreages of impacted wetlands from various strategies. Table 6.16 presents an index associating the acreages impacted for a given WMS to a ranked score of 1-5, with 5 representing greatest impact. Acreages for each WMS and the respective index ranking for each WMS have been incorporated into Table 6.15 in the Final Plan, as shown below.

3 Although no strategies are recommended to exceed the available groundwater supplies defined by the TWDB MAG amounts, it is noted that no regulatory authority (such as a groundwater conservation district) exists within the North East Texas Regional Water Planning Area. Thus, water users within this area retain the legal right to develop groundwater supplies potentially in excess of those amounts identified by the TWDB MAGs. To reflect this reality, where applicable Alternative Water Management Strategies were evaluated and included within the Plan.

Table 6.15 Summary of Evaluation of Water Management Strategies

County	Entity	Strategy	Quantity (Ac-Ft/Yr)	Start Decade	Reliability	Cost ($/Ac-Ft)	Impacts of Strategy on: Environ. Factors	Environ. Factors	Agricultural Resources/ Rural Areas	Agricultural Resources/ Rural Areas	Other Natural Resources	Key Water Quality Parameters	Political Feasibility
			#		*(1-5)	$	(Acres)	**(1-5)	(Acres)	**(1-5)	**(1-5)	**(1-5)	**(1-5)
BOWIE	DE KALB	Renew Existing Contract (Texarkana)	304	2020	1	$243	N/A	1	N/A	1	1	1	1
BOWIE	HOOKS	Renew Existing Contract (Texarkana)	265	2020	1	$242	N/A	1	N/A	1	1	1	1
BOWIE	IRRIGATION	Drill New Wells (Nacatoch, Red)	1,540	2020	1	$599	1	1	1	1	1	1	3
BOWIE	IRRIGATION	Drill New Wells (Carrizo-Wilcox, Sulphur/Red)	3,700	2020	1	$559	1	1	1	1	1	1	3
BOWIE	MACEDONIA-EYLAU MUD #1	Renew and Increase Existing Contract (Texarkana)	577	2020	1	$482	N/A	1	N/A	1	1	1	1
BOWIE	MAUD	Renew Existing Contract (Texarkana)	170	2020	1	$241	N/A	1	N/A	1	1	1	1
BOWIE	NASH	Renew Existing Contract (Texarkana)	214	2020	1	$243	N/A	1	N/A	1	1	1	1
BOWIE	NEW BOSTON	Renew Existing Contract (Texarkana)	1,104	2020	1	$243	N/A	1	N/A	1	1	1	1
BOWIE	REDWATER	Renew Existing Contract (Texarkana)	148	2020	1	$243	N/A	1	N/A	1	1	1	1
BOWIE	RED LICK	Renew Existing Contract (Texarkana)	117	2020	1	$244	N/A	1	N/A	1	1	1	1
BOWIE	TEXAMERICAS	Renew Existing Contract (Texarkana)	503	2020	1	$483	N/A	1	N/A	1	1	1	1
BOWIE	TEXARKANA	Advanced Water Conservation	6,815	2020	1	$600	N/A	1	N/A	1	1	1	1
BOWIE	TEXARKANA	Dredge Wright Patman	18,000	2050	3	$957	50,000	5	41,366	5	3	2	2
BOWIE	TEXARKANA	Riverbend Strategy	3,324	2020	1	$4,930	87	4	68	4	2	1	4
BOWIE	WAKE VILLAGE	Renew Existing Contract (Texarkana)	677	2020	1	$242	N/A	1	N/A	1	1	1	1
CAMP	BI COUNTY WSC	Drill New Wells (Queen City, Camp/Upshur Co)	860	2030	1	$520	1	1	1	1	1	1	3
CASS	MANUFACTURING	Advanced Water Conservation	15,100	2030	1	$0	N/A	1	N/A	1	1	1	1
CASS	MANUFACTURING	Drill New Wells (Carrizo-Wilcox, Cypress)	151	2020	1	$1,086	1	1	1	1	1	1	1
CASS	MANUFACTURING	Increase Existing Contract (Texarkana)	16,000	2050	1	$179	N/A	1	N/A	1	1	1	1
GREGG	MINING	Drill New Wells (Carrizo-Wilcox, Cypress/Sabine)	393	2020	1	$685	1	1	1	1	1	1	3
HARRISON	IRRIGATION	Drill New Wells (Carrizo-Wilcox, Cypress/Sabine)	290	2020	1	$685	1	1	1	1	1	1	3
HARRISON	MANUFACTURING	Advanced Water Conservation	14,039	2020	1	$0	N/A	1	N/A	1	1	1	1
HARRISON	MANUFACTURING	Toledo Bend Intake and Raw Water Pipeline (SRA)	90,000	2020	1	$354	588	5	457	5	4	1	1
HARRISON	MARSHALL	Increase Existing Contract (NETMWD)	701	2060	1	$1,552	N/A	1	N/A	1	1	1	1

County	Entity	Strategy	Quantity (Ac-Ft/Yr)	Start Decade	Reliability	Cost ($/Ac-Ft)	Impacts of Strategy on: Environ. Factors	Environ. Factors	Agricultural Resources/ Rural Areas	Agricultural Resources/ Rural Areas	Other Natural Resources	Key Water Quality Parameters	Political Feasibility
			#		*(1-5)	$	(Acres)	**(1-5)	(Acres)	**(1-5)	**(1-5)	**(1-5)	**(1-5)
HARRISON	MINING	Drill New Wells (Carrizo-Wilcox, Cypress/Sabine)	1,721	2020	1	$415	1	1	1	1	1	1	3
HARRISON	STEAM ELECTRIC POWER	Toledo Bend Intake and Raw Water Pipeline (SRA)	49,000	2020	1	$354	588	5	457	5	4	1	1
HARRISON	WASKOM	Drill New Well (Carrizo-Wilcox, Cypress)	184	2020	1	$870	1	1	1	1	1	1	3
HOPKINS	BRINKER WSC	Increase Existing Contract (Sulphur Springs)	63	2060	1	$1,176	N/A	1	N/A	1	1	1	1
HOPKINS	CUMBY	Drill New Wells (Nacatoch, Sabine)	80	2030	1	$1,600	1	1	1	1	1	1	3
HOPKINS	IRRIGATION	Lake Sulphur Springs Raw Water Pipeline	891	2020	1	$1,176	82	4	62	4	3	1	4
HOPKINS	IRRIGATION	Drill New Wells (Carrizo-Wilcox/Nacatoch, Cypress/Sabine/Sulphur)	1,235	2020	1	$667	1	1	1	1	1	1	3
HOPKINS	MARTIN SPRINGS WSC	Drill New Wells (Carrizo-Wilcox, Sabine)	120	2060	1	$1,533	1	1	1	1	1	1	3
HUNT	ABLES SPRINGS WSC	Advanced Water Conservation	17	2020	1	Not Avail	N/A	1	N/A	1	1	1	1
HUNT	ABLES SPRINGS WSC	Increase Existing Contract (NTMWD)	756	2020	1	Not Avail	N/A	1	N/A	1	1	1	1
HUNT	BLACKLAND WSC	Advanced Water Conservation	36	2020	1	Not Avail	N/A	1	N/A	1	1	1	1
HUNT	BLACKLAND WSC	Direct Connection and Additional Water from NTMWD	807	2020	1	$406	12	1	0	1	1	1	1
HUNT	CADDO BASIN SUD	New Contract (Greenville)	1,537	2020	1	$1,085	N/A	1	N/A	1	1	1	1
HUNT	CADDO MILLS	Increase Existing Contract (Greenville)	255	2030	1	$1,085	N/A	1	N/A	1	1	1	1
HUNT	CELESTE	Drill New Wells (Woodbine, Sabine)	204	2050	1	$1,603	1	1	1	1	1	1	1
HUNT	COMMERCE WD	Voluntary Reallocation of Hunt County Manufacturing Surplus for Lone Oak	388	2030	1	$0	N/A	1	N/A	1	1	1	1
HUNT	COUNTY-OTHER	Drill New Wells (Nacatoch, Sabine)	2,400	2030	1	$918	1	1	1	1	1	1	1
HUNT	COUNTY-OTHER	Poetry WSC Increase Existing Contract (SRA)	1,045	2060	1	$1,717	N/A	1	N/A	1	1	1	3
HUNT	COUNTY-OTHER	Poetry WSC Increase Existing Contract (SRA)	813	2040	1	$1,717	N/A	1	N/A	1	1	1	3
HUNT	COUNTY-OTHER	Greenville Tie-In Pipeline	3,990	2070	1	$1,504	86	4	21	3	3	1	3
HUNT	GREENVILLE	Voluntary Reallocation (Hunt Manuf)	825	2020	1	$0	N/A	1	N/A	1	1	1	3
HUNT	GREENVILLE	WTP Expansion	7,048	2020	1	$795	5	1	2	1	2	1	3
HUNT	GREENVILLE	Chapman Raw Water Pipeline and New WTP (Contract w/Sulphur Springs)	10,750	2050	1	$2,619	157	5	97	4	1	1	3
HUNT	GREENVILLE	Toledo Bend Tie-In Pipeline	5,100	2070	1	$1,014	86	4	21	3	2	1	3

County	Entity	Strategy	Quantity (Ac-Ft/Yr)	Start Decade	Reliability	Cost ($/Ac-Ft)	Impacts of Strategy on: Environ. Factors	Environ. Factors	Agricultural Resources/ Rural Areas	Agricultural Resources/ Rural Areas	Other Natural Resources	Key Water Quality Parameters	Political Feasibility
			#		*(1-5)	$	(Acres)	**(1-5)	(Acres)	**(1-5)	**(1-5)	**(1-5)	**(1-5)
HUNT	HICKORY CREEK SUD	Drill New Wells (Woodbine Aquifer, Sabine Basin)	1,138	2040	1	$818	1	1	1	1	1	1	3
HUNT	HICKORY CREEK SUD	Drill New Wells (Trinity Aquifer, Trinity Basin)	463	2050	1	$1,015	1	1	1	1	1	1	3
HUNT	IRRIGATION	Drill New Wells (Nacatoch Aquifer, Sabine)	150	2020	1	$720	1	1	1	1	1	1	1
HUNT	JOSEPHINE	Advanced Water Conservation	13	2020	1	Not Avail	N/A	1	N/A	1	1	1	1
HUNT	JOSEPHINE	Increase Existing Contract (NTMWD)	339	2020	1	Not Avail	N/A	1	N/A	1	1	1	1
HUNT	LONE OAK	increase Existing Contract (Cash SUD)	56	2070	1	$1,717	N/A	1	N/A	1	1	1	3
HUNT	MINING	Drill New Wells (Nacatoch Aquifer, Sabine)	75	2020	1	$907	1	1	1	1	1	1	1
HUNT	NORTH HUNT SUD	Increase Existing Contract (Commerce WD)	388	2030	1	$1,085	N/A	1	N/A	1	1	1	3
HUNT	NORTH HUNT SUD	Delta County Pipeline (Delta County Other/Delta County MUD)	350	2060	1	$1,414	30	3	16	2	1	1	3
HUNT	ROYSE CITY	Advanced Water Conservation	61	2020	1	$0	N/A	1	N/A	1	1	1	1
HUNT	SABINE RIVER AUTHORITY	Voluntary Reallocation (Combined Consumers SUD Fork Supply to Poetry)	1,045	2060	1	$0	N/A	1	N/A	1	1	1	1
HUNT	SABINE RIVER AUTHORITY	Voluntary Reallocation (West Tawakoni Tawakoni Supply to Poetry)	813	2040	1	$0	N/A	1	N/A	1	1	1	1
HUNT	STEAM ELECTRIC POWER	Advanced Water Conservation	12,061	2020	1	$0	N/A	1	N/A	1	1	1	1
HUNT	WOLFE CITY	Drill New Wells (Woodbine, Sulphur and Trinity, Trinity)	323	2050	1	$2,279	1	1	1	1	1	1	3
LAMAR	COUNTY-OTHER	Increase Existing Contract (Lamar County WSD)	116	2020	1	$1,629	N/A	1	N/A	1	1	1	1
LAMAR	IRRIGATION	Pat Mayse Raw Water Pipeline (Paris)	18,312	2020	1	$257	10	1	8	1	2	1	1
LAMAR	MANUFACTURING	Advanced Water Conservation	834	2020	1	$0	N/A	1	N/A	1	1	1	1
LAMAR	MANUFACTURING	Drill New Wells (Blossom, Red)	120	2070	1	$567	1	1	1	1	1	1	3
LAMAR	STEAM ELECTRIC POWER	Increase Existing Contract (Paris)	10,568	2030	1	$52	N/A	1	N/A	1	1	1	1
MARION	MINING	Drill New Wells (Queen City, Cypress)	648	2020	1	$456	1	1	1	1	1	1	3
MORRIS	MANUFACTURING	Advanced Water Conservation	13,087	2070	1	$0	N/A	1	N/A	1	1	1	1
RED RIVER	CLARKSVILLE	Wright Patman Pipeline (Texarkana)	303	2040	1	$1,115	106	5	56	4	2	2	3
RED RIVER	COUNTY-OTHER	Renew Existing Contract (Texarkana)	185	2020	1	$481	N/A	1	N/A	1	1	1	1
RED RIVER	MANUFACTURING	Drill New Wells (Trinity, Sulphur)	20	2040	1	$1,100	1	1	1	1	1	3	3

County	Entity	Strategy	Quantity (Ac-Ft/Yr)	Start Decade	Reliability	Cost ($/Ac-Ft)	Impacts of Strategy on: Environ. Factors	Environ. Factors	Agricultural Resources/ Rural Areas	Agricultural Resources/ Rural Areas	Other Natural Resources	Key Water Quality Parameters	Political Feasibility
			#		*(1-5)	$	(Acres)	**(1-5)	(Acres)	**(1-5)	**(1-5)	**(1-5)	**(1-5)
SMITH	CRYSTAL SYSTEMS INC	Drill New Wells (Queen City, Sabine)	1,936	2020	1	$420	1	1	1	1	1	1	3
SMITH	HIDEAWAY	Increase Existing Contract (Crystal Systems Inc.)	117	2070	1	$1,303	N/A	1	N/A	1	1	1	1
SMITH	LINDALE	Drill New Wells (Queen City, Sabine)	2,904	2020	1	$450	1	1	1	1	1	1	1
SMITH	MANUFACTURING	Increase Existing Contract (Tyler)	2,721	2020	1	$597	N/A	1	N/A	1	1	1	2
SMITH	MINING	Drill New Wells (Queen City, Sabine)	108	2060	1	$528	1	1	1	1	1	1	3
SMITH	OVERTON	Advanced Water Conservation	31	2050	1	$914	N/A	1	N/A	1	1	1	1
SMITH	WINONA	Drill New Wells (Queen City, Sabine)	108	2050	1	$815	1	1	1	1	1	1	3
TITUS	MANUFACTURING	Advanced Water Conservation	1,126	2020	1	$0	N/A	1	N/A	1	1	1	1
TITUS	MANUFACTURING	Drill New Wells (Queen City, Cypress)	45	2020	1	$822	1	1	1	1	1	1	3
TITUS	MANUFACTURING	Increase Existing Contract (Mount Pleasant)	4,269	2020	1	$782	N/A	1	N/A	1	1	1	1
TITUS	NETMWD	Voluntary Reallocation (Harrison Steam Electric, Lake O' The Pines)	18,000	2070	1	$0	N/A	1	N/A	1	1	1	1
TITUS	NETMWD	Voluntary Reallocation (Marion Steam Electric, Lake O' The Pines)	1,592	2070	1	$0	N/A	1	N/A	1	1	1	1
TITUS	STEAM ELECTRIC POWER	Increase Existing Contract (Titus Co. FWD #1)	24,942	2020	1	$100	N/A	1	N/A	1	1	1	1
TITUS	STEAM ELECTRIC POWER	Increase Existing Contract (NETMWD, Lake O' The Pines)	41,069	2040	1	$100	N/A	1	N/A	1	1	1	1
TITUS	STEAM ELECTRIC POWER	Increase Existing Contract (NETMWD; Bob Sandlin)	9,890	2030	1	$100	N/A	1	N/A	1	1	1	1
TITUS	STEAM ELECTRIC POWER	Increase Existing Contract (Cont. NETMWD Voluntary Reallocation (Harrison SE)	18,000	2070	1	$100	N/A	1	N/A	1	1	1	1
TITUS	STEAM ELECTRIC POWER	Increase Existing Contract (Cont. NETMWD Voluntary Reallocation (Marion SE)	1,592	2070	1	$100	N/A	1	N/A	1	1	1	1
TITUS	TRI SUD	Renew and Increase Existing Contract (Mount Pleasant, Titus and Morris Co)	161	2020	1	$782	N/A	1	N/A	1	1	1	1
UPSHUR	GILMER	Drill New Wells (Queen City, Cypress)	269	2030	1	$487	1	1	1	1	1	1	3
UPSHUR	MANUFACTURING	Drill New Wells (Queen City, Cypress)	430	2020	1	$600	1	1	1	1	1	1	3
UPSHUR	MINING	Drill New Wells (Queen City, Cypress/Sabine)	1,076	2020	1	$600	1	1	1	1	1	1	3
VAN ZANDT	Canton	Drill New Wells (Carrizo-Wilcox, Sabine)	100	2020	1	$1,540	1	1	1	1	1	1	2

County	Entity	Strategy	Quantity (Ac-Ft/Yr)	Start Decade	Reliability	Cost ($/Ac-Ft)	Impacts of Strategy on:					Key Water Quality Parameters	Political Feasibility
							Environ. Factors	Environ. Factors	Agricultural Resources/ Rural Areas	Agricultural Resources/ Rural Areas	Other Natural Resources		
			#		*(1-5)	$	(Acres)	**(1-5)	(Acres)	**(1-5)	**(1-5)	**(1-5)	**(1-5)
VAN ZANDT	Canton	Indirect Reuse	323	2020	1	$2,065	81	4	46	3	1	1	2
VAN ZANDT	IRRIGATION	Drill New Wells (Queen City, Neches)	330	2020	1	$570	1	1	1	1	1	1	3
VAN ZANDT	MANUFACTURING	Drill New Wells (Carrizo-Wilcox, Neches)	290	2020	1	$759	1	1	1	1	1	1	3
VAN ZANDT	R-P-M WSC	Advanced Water Conservation/Dem. Red.	23	2020	1	$0	1	1	1	1	1	1	1
VAN ZANDT	R-P-M WSC	Drill New Wells (Carrizo-Wilcox, Neches)	285	2020	1	$842	1	1	1	1	1	1	2

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Table 6.16 Ranked Index of Impacted Acreages

Acreage	Rank
0 - 10	1
11 - 20	2
21 - 50	3
50 -100	4
> 100	5

New well sites have a minimal environmental impact due the size and location of the sites. Texas Commission on Environmental Quality Rule 290.41(c)(1) prevents well sites from being located in an area subject to flooding therefore they are located away from environmentally sensitive flood and wetland areas. A completed well head occupies an 8'x8' space or 0.0015 acres. Most well sites are fenced at 25'x25' or 0.014 acres. Given the small size of well sites and the location, the agricultural and environmental impacts from these strategies have been assumed negligible.

The single instance of an agricultural unmet need is for the Irrigation WUG within Red River County. The construction of raw water pipelines to available surface supplies was not considered cost effective, and groundwater availability in Red River County is restricted by the use of Modeled Available Groundwater (MAG) limits employed for the purpose of the 2016 planning process. Given there is no regulatory entity to enforce such limitations within Region D, the reality is that agricultural entities in the county would likely continue to develop groundwater supplies. Thus, no recommended strategy has been identified for the Red River County Irrigation WUG. To reflect the reality of no Groundwater Conservation Districts in Region D, an alternative water management strategy has been identified reflecting estimates of potentially available supply beyond the MAG limitation. However, even when exceeding the MAG limitation, the best available information suggests inadequate groundwater supplies to meet the entirety of the projected irrigation demands for Red River County over the 2020 – 2070 planning period (although roughly 75-percent of the demands are projected to be met).

While the NETRWPG has not had time or resources to consider the full range of options it might propose to protect and enhance the agricultural resources of the region, and, thus, the state, by protecting or enhancing instream flow considerations, the NETRWPG has identified studies that provide a basis for including voluntary goals and proposals for such efforts in the Sulphur and Cypress basins. These studies are discussed below and in Chapter 8.

6.6.1 Timber Resources

Much of the eastern portion of the NETRWPG area is heavily forested and timber is an important economic resource for the region. There are no strategies recommended by the North East Texas Regional Water Planning Group that would have a significant impact on timber resources.

6.7 CONSISTENCY WITH PROTECTION OF NATURAL RESOURCES

The North East Texas planning area contains many natural resources that must be considered in water planning. Some of the natural resources include a wide diversity of fish and wildlife species, including some rare, threatened or endangered species. The natural resources of the region also include: local, state, and federal parks and public lands; significant habitat for wildlife; and important energy/mineral reserves. The 2016 North East Texas Regional Water Plan is consistent with the long-term protection of these resources. A summary of the environmental assessment of the recommended water management strategies is presented in Table 6.17.

Each WMS has been incorporated into GIS and plotted along with the most recent available data from the National Land Cover Database (NLCD 2011), providing spatial reference and descriptive, quantitative data for characteristics of the land surface in the region. These data were overlayed for each project to develop a quantified estimation of acreages of various land coverage types (e.g. developed, deciduous forest, cultivated crops, …). For wetlands, data from the USFWS National Wetlands Inventory database have been similarly employed in GIS to identify potential acreages of impacted wetlands from various strategies. Although it is expected that wetlands would be avoided if possible in the implementation of a strategy, the estimates herein are conservative in the sense that no avoidance has been included into the calculation of potential acreage impacted. The index presented in Table 6.16 has been applied to acreages for each WMS and the respective index ranking for each WMS impact on environmental factors have been incorporated into Table 6.17 in the Final Plan, as shown below.

Following is a brief discussion of consistency of the plan with protection of natural resources.

6.7.1 Threatened/Endangered Species

A list of species of special concern, including threatened or endangered species, located within the NETRWPG area is contained in Table 6.18 (Table 6.18 lists the counties within the North East Texas Region which could potentially have an impact on endangered species related to the development of the source. Contractual shortages were considered to have insignificant or no impact.). Included are 11 species of birds, 4 mammals, 5 reptiles, 6 fish, 2 plants, and 5 mollusks. A significant number of strategies identified in the North East Texas Region include development of additional groundwater supplies (wells). There should be no significant impact on threatened and endangered species as a result of these strategies. Although none of the water management strategies evaluated for the North East Texas Regional Water Plan is expected to adversely impact any of the listed species, additional assessment should be performed in the planning stages of specific projects to ensure protection of endangered and threatened species.

As discussed above, the NETRWPG is developing steps as part of its water planning process to protect and enhance the water, agricultural and natural resources of the region, and, thus, those of the state. As was discussed in the 2011 Region D water plan, work in the Cypress basin on instream flows has shown the opportunity to protect and enhance

Table 6.17 Summary of Environmental Assessment

County	Entity	Strategy		Environmental Factors									
			Total Acres Impacted	Total Acres Impacted	Wetland Acres	Wetland Acres	Env Water Needs	Habitat	Threat and Endangered Species	Cultural Resources	Bays & Estuaries	Env Water Quality	Overall Env Impacts
			(Acres)	(1-5)	(Acres)	(1-5)	(1-5)	(1-5)	#	(1-5)	(1-5)	(1-5)	(1-5)
BOWIE	DE KALB	Renew Existing Contract (Texarkana)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
BOWIE	HOOKS	Renew Existing Contract (Texarkana)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
BOWIE	IRRIGATION	Drill New Wells (Nacatoch, Red)	1	1	0	1	1	1	33	1	N/A	1	1
BOWIE	IRRIGATION	Drill New Wells (Carrizo-Wilcox, Sulphur/Red)	1	1	0	1	1	1	33	1	N/A	1	1
BOWIE	MACEDONIA-EYLAU MUD #1	Renew and Increase Existing Contract (Texarkana)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
BOWIE	MAUD	Renew Existing Contract (Texarkana)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
BOWIE	NASH	Renew Existing Contract (Texarkana)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
BOWIE	NEW BOSTON	Renew Existing Contract (Texarkana)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
BOWIE	REDWATER	Renew Existing Contract (Texarkana)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
BOWIE	RED LICK	Renew Existing Contract (Texarkana)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
BOWIE	TexAmericas	Renew Existing Contract (Texarkana)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
BOWIE	TEXARKANA	Advanced Water Conservation	N/A	1	N/A	1	1	1	33	1	N/A	1	1
BOWIE	TEXARKANA	Dredge Wright Patman	50,000	5	13,000	5	2	3	33	1	N/A	1	4
BOWIE	TEXARKANA	Riverbend Strategy	87	4	2	1	1	2	33	2	N/A	1	2
BOWIE	WAKE VILLAGE	Renew Existing Contract (Texarkana)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
CAMP	BI COUNTY WSC	Drill New Wells (Queen City, Camp/Upshur Co)	1	1	0	1	1	1	33	1	N/A	1	1
CASS	MANUFACTURING	Advanced Water Conservation	N/A	1	N/A	1	1	1	37	1	N/A	1	1
CASS	MANUFACTURING	Drill New Wells (Carrizo-Wilcox, Cypress)	1	1	0	1	1	1	37	1	N/A	1	1
CASS	MANUFACTURING	Increase Existing Contract (Texarkana)	N/A	1	N/A	1	1	1	37	1	N/A	1	1

County	Entity	Strategy	Total Acres Impacted	Environmental Factors										
				Total Acres Impacted	Wetland Acres	Wetland Acres	Env Water Needs	Habitat	Threat and Endangered Species	Cultural Resources	Bays & Estuaries	Env Water Quality	Overall Env Impacts
			(Acres)	(1-5)	(Acres)	(1-5)	(1-5)	(1-5)	#	(1-5)	(1-5)	(1-5)	(1-5)
GREGG	MINING	Drill New Wells (Carrizo-Wilcox, Cypress/Sabine)	1	1	0	1	1	1	39	1	N/A	1	1
HARRISON	IRRIGATION	Drill New Wells (Carrizo-Wilcox, Cypress/Sabine)	1	1	0	1	1	1	43	1	N/A	1	1
HARRISON	MANUFACTURING	Advanced Water Conservation	N/A	1	N/A	1	1	1	43	1	N/A	1	1
HARRISON	MANUFACTURING	Toledo Bend Intake and Raw Water Pipeline (SRA)	588	5	47	3	1	2	43	2	N/A	1	3
HARRISON	MARSHALL	Increase Existing Contract (NETMWD)	N/A	1	N/A	1	1	1	43	1	N/A	1	1
HARRISON	MINING	Drill New Wells (Carrizo-Wilcox, Cypress/Sabine)	1	1	0	1	1	1	43	1	N/A	1	1
HARRISON	STEAM ELECTRIC POWER	Toledo Bend Intake and Raw Water Pipeline (SRA)	588	5	47	3	1	2	43	2	N/A	1	3
HARRISON	WASKOM	Drill New Well (Carrizo-Wilcox, Cypress)	1	1	0	1	1	1	43	1	N/A	1	1
HOPKINS	BRINKER WSC	Increase Existing Contract (Sulphur Springs)	N/A	1	N/A	1	1	1	31	1	N/A	1	1
HOPKINS	CUMBY	Drill New Wells (Nacatoch, Sabine)	1	1	0	1	1	1	31	1	N/A	1	1
HOPKINS	IRRIGATION	Lake Sulphur Springs Raw Water Pipeline	82	4	5	1	1	2	31	2	N/A	1	3
HOPKINS	IRRIGATION	Drill New Wells (Carrizo-Wilcox/Nacatoch, Cypress/Sabine/Sulphur)	1	1	0	1	1	1	31	1	N/A	1	1
HOPKINS	MARTIN SPRINGS WSC	Drill New Wells (Carrizo-Wilcox, Sabine)	1	1	0	1	1	1	31	1	N/A	1	1
HUNT	ABLES SPRINGS WSC	Advanced Water Conservation	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	ABLES SPRINGS WSC	Increase Existing Contract (NTMWD)	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	BLACKLAND WSC	Advanced Water Conservation	N/A	1	N/A	1	1	1	30	1	N/A	1	1

County	Entity	Strategy	Total Acres Impacted	Environmental Factors									
				Total Acres Impacted	Wetland Acres	Wetland Acres	Env Water Needs	Habitat	Threat and Endangered Species	Cultural Resources	Bays & Estuaries	Env Water Quality	Overall Env Impacts
			(Acres)	(1-5)	(Acres)	(1-5)	(1-5)	(1-5)	#	(1-5)	(1-5)	(1-5)	(1-5)
HUNT	BLACKLAND WSC	Direct Connection and Additional Water from NTMWD	12	1	0	1	1	2	30	2	N/A	1	2
HUNT	CADDO BASIN SUD	New Contract (Greenville)	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	CADDO MILLS	Increase Existing Contract (Greenville)	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	CELESTE	Drill New Wells (Woodbine, Sabine)	1	1	0	1	1	1	30	1	N/A	1	1
HUNT	COMMERCE WD	Voluntary Reallocation of Hunt County Manufacturing Surplus for Lone Oak	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	COUNTY-OTHER	Drill New Wells (Nacatoch, Sabine)	1	1	0	1	1	1	30	1	N/A	1	1
HUNT	COUNTY-OTHER	Voluntary Reallocation (Combined Consumers SUD Fork Supply to Poetry)	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	COUNTY-OTHER	Voluntary Reallocation (West Tawakoni Tawakoni Supply to Poetry)	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	COUNTY-OTHER	Greenville Tie-In Pipeline	86	4	3	1	1	2	30	2	N/A	1	3
HUNT	GREENVILLE	Voluntary Reallocation (Hunt Manuf)	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	GREENVILLE	WTP Expansion	5	1	0	1	1	2	30	2	N/A	1	2
HUNT	GREENVILLE	Chapman Raw Water Pipeline and New WTP (Contract w/Sulphur Springs)	157	5	3	1	1	2	30	2	N/A	1	3
HUNT	GREENVILLE	Toledo Bend Tie-In Pipeline	86	4	3	1	1	2	30	2	N/A	1	3
HUNT	HICKORY CREEK SUD	Drill New Wells (Woodbine Aquifer, Sabine Basin)	1	1	0	1	1	1	30	1	N/A	1	1
HUNT	HICKORY CREEK SUD	Drill New Wells (Trinity Aquifer, Trinity Basin)	1	1	0	1	1	1	30	1	N/A	1	1

County	Entity	Strategy	Total Acres Impacted	Environmental Factors									
				Total Acres Impacted	Wetland Acres	Wetland Acres	Env Water Needs	Habitat	Threat and Endangered Species	Cultural Resources	Bays & Estuaries	Env Water Quality	Overall Env Impacts
			(Acres)	(1-5)	(Acres)	(1-5)	(1-5)	(1-5)	#	(1-5)	(1-5)	(1-5)	(1-5)
HUNT	IRRIGATION	Drill New Wells (Nacatoch Aquifer, Sabine)	1	1	0	1	1	1	30	1	N/A	1	1
HUNT	JOSEPHINE	Advanced Water Conservation	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	JOSEPHINE	Increase Existing Contract (NTMWD)	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	LONE OAK	increase Existing Contract (Cash SUD)	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	MINING	Drill New Wells (Nacatoch Aquifer, Sabine)	1	1	0	1	1	1	30	1	N/A	1	1
HUNT	NORTH HUNT SUD	Increase Existing Contract (Commerce WD)	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	NORTH HUNT SUD	Delta County Pipeline (Delta County Other/Delta County MUD)	30	3	0	1	1	2	30	2	N/A	1	3
HUNT	ROYSE CITY	Advanced Water Conservation	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	SABINE RIVER AUTHORITY	Voluntary Reallocation (Combined Consumers SUD Fork Supply to Poetry)	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	SABINE RIVER AUTHORITY	Voluntary Reallocation (West Tawakoni Tawakoni Supply to Poetry)	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	STEAM ELECTRIC POWER	Advanced Water Conservation	N/A	1	N/A	1	1	1	30	1	N/A	1	1
HUNT	WOLFE CITY	Drill New Wells (Woodbine, Sulphur and Trinity, Trinity)	1	1	0	1	1	1	30	1	N/A	1	1
LAMAR	COUNTY-OTHER	Increase Existing Contract (Lamar County WSD)	N/A	1	N/A	1	1	1	36	1	N/A	1	1
LAMAR	IRRIGATION	Pat Mayse Raw Water Pipeline (Paris)	10	1	0	1	1	2	36	2	N/A	1	3

County	Entity	Strategy	Total Acres Impacted	Environmental Factors									
				Total Acres Impacted	Wetland Acres	Wetland Acres	Env Water Needs	Habitat	Threat and Endangered Species	Cultural Resources	Bays & Estuaries	Env Water Quality	Overall Env Impacts
			(Acres)	(1-5)	(Acres)	(1-5)	(1-5)	(1-5)	#	(1-5)	(1-5)	(1-5)	(1-5)
LAMAR	MANUFACTURING	Advanced Water Conservation	N/A	1	N/A	1	1	1	36	1	N/A	1	1
LAMAR	MANUFACTURING	Drill New Wells (Blossom, Red)	1	1	0	1	1	1	36	1	N/A	1	1
LAMAR	STEAM ELECTRIC POWER	Increase Existing Contract (Paris)	N/A	1	N/A	1	1	1	36	1	N/A	1	1
MARION	MINING	Drill New Wells (Queen City, Cypress)	1	1	0	1	1	1	36	1	N/A	1	1
MORRIS	MANUFACTURING	Advanced Water Conservation	N/A	1	N/A	1	1	1	35	1	N/A	1	1
RED RIVER	CLARKSVILLE	Wright Patman Pipeline (Texarkana)	106	5	1	1	1	2	33	2	N/A	1	3
RED RIVER	COUNTY-OTHER	Renew Existing Contract (Texarkana)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
RED RIVER	MANUFACTURING	Drill New Wells (Trinity, Sulphur)	1	1	0	1	1	1	33	1	N/A	1	1
SMITH	CRYSTAL SYSTEMS INC	Drill New Wells (Queen City, Neches)	1	1	0	1	1	1	40	1	N/A	1	1
SMITH	HIDEAWAY	Increase Existing Contract (Crystal Systems Inc.)	N/A	1	N/A	1	1	1	40	1	N/A	1	1
SMITH	LINDALE	Drill New Wells (Queen City, Sabine)	1	1	0	1	1	1	40	1	N/A	1	1
SMITH	MANUFACTURING	Increase Existing Contract (Tyler)	N/A	1	N/A	1	1	1	40	1	N/A	1	1
SMITH	MINING	Drill New Wells (Queen City, Sabine)	1	1	0	1	1	1	40	1	N/A	1	1
SMITH	OVERTON	Advanced Water Conservation	N/A	1	N/A	1	1	1	40	1	N/A	1	1
SMITH	WINONA	Drill New Wells (Queen City, Sabine)	1	1	0	1	1	1	40	1	N/A	1	1
TITUS	MANUFACTURING	Advanced Water Conservation	N/A	1	N/A	1	1	1	33	1	N/A	1	1
TITUS	MANUFACTURING	Drill New Wells (Queen City, Cypress)	1	1	0	1	1	1	33	1	N/A	1	1

County	Entity	Strategy	Total Acres Impacted	Environmental Factors									
				Total Acres Impacted	Wetland Acres	Wetland Acres	Env Water Needs	Habitat	Threat and Endangered Species	Cultural Resources	Bays & Estuaries	Env Water Quality	Overall Env Impacts
			(Acres)	(1-5)	(Acres)	(1-5)	(1-5)	(1-5)	#	(1-5)	(1-5)	(1-5)	(1-5)
TITUS	MANUFACTURING	Increase Existing Contract (Mount Pleasant)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
TITUS	NETMWD	Voluntary Reallocation (Harrison Steam Electric, Lake O' The Pines)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
TITUS	NETMWD	Voluntary Reallocation (Marion Steam Electric, Lake O' The Pines)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
TITUS	STEAM ELECTRIC POWER	Increase Existing Contract (Titus Co. FWD #1)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
TITUS	STEAM ELECTRIC POWER	Increase Existing Contract (NETMWD, Lake O' The Pines)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
TITUS	STEAM ELECTRIC POWER	Increase Existing Contract (NETMWD; Bob Sandlin)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
TITUS	STEAM ELECTRIC POWER	Voluntary Reallocation (Harrison SE)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
TITUS	STEAM ELECTRIC POWER	Voluntary Reallocation (Marion SE)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
TITUS	TRI SUD	Renew and Increase Existing Contract (Mount Pleasant, Titus and Morris Co)	N/A	1	N/A	1	1	1	33	1	N/A	1	1
UPSHUR	GILMER	Drill New Wells (Queen City, Cypress)	1	1	0	1	1	1	42	1	N/A	1	1
UPSHUR	MANUFACTURING	Drill New Wells (Queen City, Cypress)	1	1	0	1	1	1	42	1	N/A	1	1
UPSHUR	MINING	Drill New Wells (Queen City, Cypress/Sabine)	1	1	0	1	1	1	42	1	N/A	1	1
VAN ZANDT	Canton	Drill New Wells (Carrizo-Wilcox, Sabine)	1	1	0	1	1	1	40	1	N/A	1	1
VAN ZANDT	Canton	Indirect Reuse	81	4	2	1	1	1	40	1	N/A	1	1
VAN ZANDT	IRRIGATION	Drill New Wells (Queen City, Neches)	1	1	0	1	1	1	40	1	N/A	1	1

County	Entity	Strategy	Total Acres Impacted	Environmental Factors										
				Total Acres Impacted	Wetland Acres	Wetland Acres	Env Water Needs	Habitat	Threat and Endangered Species	Cultural Resources	Bays & Estuaries	Env Water Quality	Overall Env Impacts
			(Acres)	(1-5)	(Acres)	(1-5)	(1-5)	(1-5)	#	(1-5)	(1-5)	(1-5)	(1-5)
VAN ZANDT	MANUFACTURING	Drill New Wells (Carrizo-Wilcox, Neches)	1	1	0	1	1	1	40	1	N/A	1	1
VAN ZANDT	R-P-M WSC	Advanced Water Conservation/Dem. Red.	N/A	1	N/A	1	1	1	1	1	1	1	1
VAN ZANDT	R-P-M WSC	Drill New Wells (Carrizo-Wilcox, Neches)	1	1	0	1	1	1	40	1	N/A	1	1

Table 6.18 Summary of Endangered and Threatened Species with the North East Texas Region

	Bowie	Camp	Cass	Delta	Franklin	Gregg	Harrison	Hopkins	Hunt	Lamar	Marion	Morris	Rains	Red River	Smith	Titus	Upshur	Van Zandt	Wood
Birds																			
American Peregrine Falcon	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bachman's Sparrow	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1
Bald Eagle	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Eskimo Curlew										1									
Interior Least Tern	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Peregrine Falcon	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Piping Plover	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
White-faced Ibis									1										
Whooping Crane				1				1	1	1			1					1	
Wood Stork	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Fishes																			
Blackside darter	1	1	1	1	1	1	1	1		1	1	1		1	1	1	1		
Blue sucker						1				1									
Bluehead shiner			1				1				1	1					1		
Creek chubsucker	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1
Paddlefish	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1
Shovelnose sturgeon	1									1				1					
Insects																			
American burying beetle	1									1				1					
Mammals																			
Black bear	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1
Louisiana black bear			1			1	1				1						1		
Rafinesque's big-eared bat	1		1			1	1				1	1					1		
Red wolf	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mollusks																			
Louisiana pigtoe		1	1		1	1	1	1	1		1	1	1		1	1	1	1	1
Sandbank pocketbook						1	1		1				1		1		1	1	1
Southern hickorynut		1			1	1	1					1	1		1	1	1	1	1
Texas heelsplitter						1	1		1				1		1		1	1	1
Texas pigtoe						1	1		1			1	1		1	1	1	1	1

	Bowie	Camp	Cass	Delta	Franklin	Gregg	Harrison	Hopkins	Hunt	Lamar	Marion	Morris	Rains	Red River	Smith	Titus	Upshur	Van Zandt	Wood
Plants																			
Earth fruit (Tinytim)							1												
Neches River rose-mallow							1												
Reptiles																			
Alligator snapping turtle	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Louisiana pine snake																			1
Northern scarlet snake	1	1	1		1	1	1				1	1	1		1	1	1	1	1
Texas horned lizard		1		1	1			1	1	1			1	1	1	1	1	1	1
Timber rattlesnake	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Grand Total	**33**	**33**	**37**	**26**	**32**	**39**	**43**	**31**	**30**	**36**	**36**	**35**	**34**	**33**	**40**	**33**	**42**	**40**	**39**

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instream flows in several major stream segments in that river basin. Experimentation and monitoring done since the 2011 Region D plan indicates that the flow regimes recommended for the Cypress basin can provide the ecological benefits that formed the bases of the voluntary regimes. For example, changes in release patterns from Lake O' the Pines, and experimental reintroduction of paddlefish to the Caddo Lake watershed appears to be a success, not only allowing recovery of a state listed threatened species, but also improving habitat for other fish in the basin.

6.7.2 Parks and Public Lands

The NETRWPG area contains numerous state parks, forests, and wildlife management areas. In addition, there are a number of city parks, recreational facilities, and public lands located throughout the region. None of the water management strategies evaluated for the North East Texas Regional Water Plan is expected to adversely impact parks or public land. The development of additional groundwater resources could ultimately reduce the reliance on water from surface water resources. Where possible, reducing the need for diversions from surface water sources may enhance recreational opportunities.

6.7.3 Energy Reserves

Numerous oil and gas wells are located within the NETRWPG area, including the Hawkins Oil Field and the majority of the East Texas Oil Field. In addition, significant lignite coal resources can be found in the NETRWPG area under portions of 15 counties. These resources represent an important economic base for the region. None of the water management strategies recommended by the NETRWPG is expected to significantly impact oil, natural gas, or coal production in the Region D area.

6.8 CONSISTENCY WITH STATE WATER PLANNING GUIDELINES

To be considered consistent with long-term protection of the State's water, agricultural, and natural resources, the North East Texas Regional Water Plan must be determined to be in compliance with Texas Administrative Code (TAC) 31, Chapters 357.40, 357.41, 358.3(4) and (8).

The information, data evaluations, and recommendations included in Chapters 1 through 12 of the North East Texas Regional Water Plan collectively comply with these regulations.

6.9 MARVIN NICHOLS I RESERVOIR AND IMPACTS ON WATER RESOURCES, AGRICULTURAL RESOURCES AND NATURAL RESOURCES

Although not a recommended water planning strategy for the North East Texas Regional Water Planning Group for this round of planning, Marvin Nichols I Reservoir was a recommended water management strategy for Region C in 2011 and was included in the 2012 State Water Plan. A similar Marvin Nichols reservoir has also been included in Region C's drafts as a proposed alternative water management strategy for this round of planning. Since all proposals for Marvin Nichols reservoirs would be located exclusively in the North East Texas Region, and the impacts to agricultural and natural resources would be greatest in this Region, the NETRWPG feels it is important and necessary to review the impacts that any such Marvin Nichols reservoir would have to this area. This is particularly true since the spirit of Texas' regional water planning process includes a ground up, localized approach to the planning process. The discussion below will apply to the Marvin Nichols I/IA Reservoir, since it was included in the 2012 State Water Plan, but the approach applies to any proposed reservoir in the Sulphur River Basin.

Based on the reasons set forth below, it has been the position of the NETRWPG that Marvin Nichols I Reservoir should not be included in any regional plans as a water management strategy and not be included in the 2017 State Water Plan as a water management strategy. The NETRWPG continues to oppose any Marvin Nichols type reservoir. The NETRWPG also has not yet seen an adequate evaluation by Region C of the impacts of such a reservoir on water, agricultural and natural resources of the state and on Region D. The NETRWPG supports its positions with both the facts set out in its 2011 Region D regional plan, and those facts provided below that have come from more recent evaluations of the needs for instream flows to protect flood plain forests that exist downstream of the proposed reservoir. It is the position of the NETRWPG that all proposals for Marvin Nichols reservoirs developed by Region C are based on the impoundment and use of water that NETRWPG needs to protect these downstream agricultural and natural resources.

Per the terms of agreement set forth from the October 5, 2015 mediation between Regions C and D and ratified by the NETRWPG at its October 21, 2015 meeting, the NETRWPG does not challenge Marvin Nichols Reservoir as a unique reservoir site for the purposes of this Plan.

6.9.1 Impacts on Agricultural Resources

Agriculture as a whole and timber in particular are vital and important industries throughout the North East Texas Regional Water Planning Group area, as illustrated in Chapter 1, Figure 1.11, wherein timber is listed in 12 of the 19 counties as a principal crop.

Recent estimates developed for the USACE and Sulphur River Basin Authority (SRBA 2013) reflect that Marvin Nichols I Reservoir would flood 66,103 acres, mainly in Red River County and including portions of Titus, Franklin, Delta, and Lamar Counties. Within that study, a high-level desktop analysis using available land coverage data from the TPWD Ecological Systems Classification, and EPA concluded that included in the flooded acreage would be 31,600 acres of forest lands, including an approximation of 10,156 acres of Priority 1 bottomland hardwoods potentially classified as waters of the U.S. (SRBA Environmental Evaluation Interim Report, Sulphur River Basin Comparative Assessment, 2014). Specifically to differentiate bottomland hardwood forest by that area potentially characterized as "waters of the U.S.," dubbed "Forested Wetland," an extra GIS filter was employed using the U.S. Fish and Wildlife Service National Wetlands Inventory data coverage.

While the SRBA study suggests that the amount of bottomland hardwood forest characterized as waters of the U.S., i.e., "Forested Wetland" potentially impacted by the proposed Marvin Nichols reservoir is 10,156 acres, the amount reported in the TWDB 2008 Reservoir Site Protection Study is reported as 26,309 acres (Table 5-37, pg. 100, utilizing a methodology performed by the Texas Parks and Wildlife Department, TPWD, described in Appendix C of that report). A possible reason for this significant difference may be the extra filtering noted above to differentiate between bottomland hardwood forest, and "Forested Wetland," which is used for their calculation of "waters of the U.S." While the difference in the overall acreage between the 2008 TWDB study and the present SRBA study is less than 2%, the reported difference in impacts on potentially mitigable bottomland hardwoods has decreased by approximately 16,153 acres, or more than 60%. Ultimately, these studies provide a useful example of the uncertainty underlying the planning-level characterization of the significance of impacts from the Marvin Nichols I Reservoir on the timber industry in the North East Texas Region, and the importance of field verification and further detailed analysis.

In addition to the timber and agricultural land lost as a result of the reservoir, mitigation requirements are anticipated to significantly impact agricultural resources. The recent SRBA study of the Sulphur River Basin (specifically the Cost Rollup Report) concluded that approximately 47,060 acres would be necessary for mitigation. This methodology is based upon the application of a 2:1 ratio applied to the aforementioned calculated acreage of 23,530 acres of "water of the U.S." within the footprint of the proposed reservoir.

The results of the SRBA Study were used as the basis for the 2014 analysis for Region C entitled, "Analysis and Quantification of the Impacts of the Marvin Nichols Reservoir Management Strategy on the Agricultural and Natural Resources of Region D and the State." This analysis compiled information developed during the SRBA study for use in the TWDB's conflict resolution process between Region C and Region D.

Region D prepared a three-part response to Region C's analysis. In the first part of this response, Trungale (2014) concludes that the impacts on priority bottomland hardwoods due to the reservoir and its impacts on flows would be significant:

> "Development of the Marvin Nichols Reservoir project as proposed in the Region C water plan would permanently flood a large proportion of the last remaining intact bottomland hardwoods (BLH) in East Texas. It would also result in a massive reduction in flows remaining in the river downstream of the proposed reservoir project which would result in significant, likely catastrophic, harm to an even larger bottomland hardwood forest area. As the plan acknowledges "Marvin Nichols Reservoir will have significant environmental impacts." (Region C 2011, p 4D.11)"

These bottomland hardwoods habitats are important natural resources that are dependent on maintenance of instream flows.

> "Floodplains with BLH and other ecologically important habitats are one of most altered and imperiled ecosystems on Earth (Opperman et al. 2010). The unique importance of this BLH ecosystem is largely based on its extensive swamp communities sustained by an active regime of high and overbank flows. More than any other factor, the sustainability of ecosystem processes within floodplains depends upon the longitudinal and lateral hydrologic connections that would be severed by the proposed reservoir."

Trungale (2014) further concludes based on analysis of modeling provided by Region C that operation of Marvin Nichols as proposed by the Region C Plan would not protect these important natural resources.

> "As currently modeled, the proposed Marvin Nichols I reservoir will not provide sufficient frequency and duration of high and overbank flows to sustain downstream BLH forest….Analysis of results generated by the water availability modeling (WAM), developed to evaluate this reservoir project, indicate that the flows needed to maintain these forests would be severely diminished, if not entirely eliminated. The environmental flow requirements used to evaluate the Marvin Nichols Reservoir Water Supply Project are based on an approach developed in the 1990's called the "Consensus Criteria". Unlike the more recent environmental flow criteria developed as part of SB3, there are no requirements, under the consensus criteria, to pass any high flow pulse flows. The maximum pass through for the proposed Marvin Nichols Reservoir Project, as required by consensus criteria, would be 514 cfs in May and then only if the reservoir is greater than 80% full.
>
> The clearest problem with the Region C report is that it contains no analysis or quantification of downstream impacts. Data and methodologies to perform this type of analysis, even at a planning level, are readily available. In 2004, the TWDB and the U.S. Army Corps of Engineers (USACE) conducted a study on the Sulphur River (TWDB 2004). Direct observations and technical evaluations reported in this study indicate that flows in the range of 862 cfs (approximately 50,000 ACFT per month) are transitional between in-channel and overbank flow.
>
> An analysis of the outputs from the water availability model, developed by Region C to evaluate the Marvin Nichols project, show that under existing conditions, there is only one year, out of the 57-year record, in which flows did not exceed this threshold volume in at least one month. When the proposed reservoir is included in the simulation, this number jumps to 29 years (more than half of the time) when no overbank events occur. The longest duration of time in which no over bank event occur under the without project scenario is 16 months; the flow regime resulting from the proposed reservoir indicates that at two separate times in the record, the river would go 80 months (almost 7 years) without overbank flow events. These flow rates, based on the 7Q2 water quality target, are intended to sustain the river during brief, infrequent and severe droughts, but with the Marvin Nichols project as proposed and modeled by Region C, these extremely low flows would occur much more frequently.

The impact of flow alteration due to the Marvin Nichols Reservoir on downstream forests does not appear to have been considered in the recent Region C analyses. These losses as well as the losses within the reservoir footprint represent a significant impact on natural resources in Region D. From Trungale (2014):

> "The lack of seasonal flooding identified in the water availability results indicates BLH forests cannot be maintained downstream of the proposed Marvin Nichols reservoir. When the effect on flows and the loss of episodic inundation are added to the impacts resulting within the reservoir footprint, the impacts from the Proposed Marvin Nichols Reservoir Project are huge. In the Sulphur basin 44% of the Forested Wetland area and 17% of the Bottomland Hardwood Forests would be at significant risk. By completely ignoring the largest and most significant impacts to natural resources resulting from the Marvin Nichols Reservoir Water Supply project, the Region C report does not meet the requirements of the TWDB order."

In a separate section of Region D's 2014 response to the 2014 Region C analysis, Sharon Mattox, Ph.D., J.D., concludes that the Region C report "fails to provide reasonable quantification of impacts." This report cites a relatively recent major change in the means of determining mitigation, identifying that the U.S. Army Corps of Engineers and the U.S. EPA published their final rule, "Compensatory Mitigation for Losses of Aquatic Resources," better known as the "2008 Mitigation Rule." As noted in Mattox (2014):

> "The policies and procedures laid out in the 2008 Mitigation Rule render it improper and utterly illogical to conduct an analysis of a future project based solely on historical information (even if Region C had gathered accurate and relevant historical data). Under well-developed tools and practices stemming from the 2008 Mitigation Rule, losses of functions and values are the emphasis and simple ratios are not the touchstone. If a ratio is used, that ratio should be in the range of 3:1 to 10:1."

Mattox (2014) further notes:

> "Initially, the Report estimates impacts only for the inundation area of the Reservoir itself – that is, the footprint of reservoir. The Report fails to estimate jurisdictional areas for the 2,751 acres of "ancillary facilities" recognized in the [2011] Region C Plan. The ancillary facilities must be part of the USACE permit, which must assess the complete project. In addition, the Report fails to include any estimates for lands used during the construction process. The estimate also fails to include any estimate of critical secondary impacts to waters of the U.S., which will also require mitigation if losses of waters of the U.S. result. One example of a secondary impact that would likely have a material impact is wetlands adjacent to the Sulphur River downstream of the proposed dam that will no longer be inundated by frequent flood events."

Mattox (2014) summarizes the characterization of potential mitigation thusly:

> The 23,530 acre estimate of jurisdictional areas is not consistent even with the data on land coverage types… Based on my review of the EEIR-SRBCA, I would include the estimated acreages for bottomland hardwoods, forested wetlands, herbaceous wetlands, open water, and shrub wetland. In addition other habitat types identified … as subtypes under Grassland/Old Field, Shrubland, and Upland

> Forests that are not broken out but likely qualify as waters of the U.S., include Pineywoods: Bottomland Wet Prairie, Pineywoods: Small Stream and Riparian Wet Prairie, Pineywoods: Small Stream and Riparian Evergreen Successional Shrubland, and Pineywoods: Small Stream and Riparian Temporarily Flooded Mixed Forest.
>
> The total of only the habitat types listed Table 2 of the Report is 35,411 acres, which I believe to be a more realistic estimate of the number of acres that require mitigation, if one is limited to the numerical data provided in the Report. This number, however, still excludes the additional habitat types given above, which will also contain jurisdictional areas. It further excludes the small, but identifiable wetlands, streams, and other waters that are certainly present in other habitat categories. Although no data on these omitted waters is included, it would certainly increase the realistic minimum number of jurisdictional waters of the U.S. For planning purposes, an estimate of at least 40,000 jurisdictional acres is reasonable."

Noting that historically, all required mitigation has occurred in the watershed of the reservoir, Mattox (2014) indicates that, "given that the watershed approach is a central focus of the 2008 rule, all mitigation required for the [Marvin Nichols I] strategy must certainly occur within Region D," ultimately opining:

> "…[T]he mitigation required for the [Marvin Nichols I] strategy will require at least 3 times as much land as the acres of jurisdictional waters, and potentially much more. Any of the reasonable estimates suggest the mitigation land required for the [Marvin Nichols I] strategy will exceed 100,000 acres…"

Another previous study by the Texas Parks and Wildlife Department (TPWD)/United States Fish and Wildlife Service (USFWS) concluded a minimum of 163,620 acres would be required for mitigation and that number could be as high as 648,578 acres. "The Economic Impact of the Proposed Marvin Nichols I Reservoir to the Northeast Texas Forest Industry" prepared by the Texas Forest Service dated August 2002 estimated that the total acres affected by Marvin Nichols I Reservoir could be as low as 258,000 acres or as high as 820,000 acres. "The Economic, Fiscal and Developmental Impacts of the Proposed Marvin Nichols Reservoir Project" dated March 2003 by Weinstein and Clower prepared for the SRBA stated a lower acreage loss, estimating agricultural land loss of 165,000 to 200,000 acres.

It is understood that the exact amount and location of the mitigation acreage is unknown. However, in analyzing impacts to agricultural and natural resources in the NETRWPG area, it is clear that vast amounts of agricultural acreage will be removed from production due to flooding and mitigation requirements associated with Marvin Nichols I Reservoir. These impacts are corroborated in "Table P.1: Summary of Evaluation of Water Management Strategies" as follows: "Agricultural Resources/Rural Areas" are rated high" and "Possible Third Party" are rated "high". Third Party impacts are considered to be social and economic impacts resulting from redistribution of water.

6.9.2 Impacts on Timber Industry

The Texas Forest Service Study dated August 2002 estimated that the forest industry and local economies would incur significant losses due to a substantial reduction in timber supply from the reservoir project and required mitigation. The study further detailed that manufacturing facilities such as paper mills located near the proposed site which are dependent on hardwood resources would be impacted the most. The NETRWPG has previously received oral and written commentary from International Paper Company, which operates a paper mill in Cass County, Texas, and from numerous other timber companies, logging contractors and related industries stating that Marvin Nichols I Reservoir and the mitigation associated with the project would place their industries in peril due to the loss of hardwood timber supplies.

The Texas Forest Service Study estimated forest industry losses based on three (3) separate mitigation options. The low end impacts were estimated to be an annual reduction of $51.18 million output, $21.89 million value-added, 417 jobs and $12.93 million labor income. The high end impacts were estimated to be annual loss of $163.91 million industry output, $70.10 million value-added, 1,334 jobs and $41.4 million labor income.

The Weinstein and Clower Study dated March 2003 estimated as much as 200,000 acres of agricultural land, including 150,000 acres of timberland, could be removed from production. However, the Study opined that based on assessment U.S. Forest Service inventories, those inventories along with growth could offset the loss of timberland due to reservoir impoundment and mitigation. The Study also indicated that the loss to the timber industry should be limited to additional transportation costs associated with assessing new regional sources of timber.

The Weinstein and Clower Study has been criticized on the following grounds:

1. The Weinstein and Clower Study used total U.S. Forest Service timber inventories throughout the region in arriving at its conclusion that the inventories together with the growth of those inventories would offset any losses due to reservoir impoundment and mitigation. It did not take into account that large amounts of this acreage is unharvestable because it is located in wildlife management areas, streamside management zones, parks, housing areas and other areas which cannot be harvested. In addition, it is well documented that hardwood acreage throughout Northeast Texas as well as the State as a whole is decreasing due to development, conversions of hardwood areas to production of pine plantation acreage, and inundation for water development projects. See "An Analysis of Bottomland Hardwood Areas" report to Texas Water Development Board dated February, 1997.

2. The Weinstein and Clower Study fails to distinguish between timber inventories as a whole (which includes more pine than hardwood) and hardwood timber inventories. Many of the timber industries in Northeast Texas, such as paper mills and hardwood sawmills, are dependent upon a reliable and affordable supply of hardwood timber. Hardwood timber grows predominantly in bottomlands and thus would be more

severely impacted by the reservoir project and required mitigation than other timber species.

3. The Weinstein and Clower Study acknowledges that transportation costs would be greater with Marvin Nichols I in place as timber companies would be required to purchase timber from farther distances. These additional costs would have a huge impact on the timber industry in Northeast Texas. Timber is a heavy product and the transportation cost of timber is a substantial factor, particularly taken in conjunction with the current high cost of fuel. The industries involved compete in a global market. Additional transportation costs and additional costs in obtaining raw materials will jeopardize their ability to compete in this global market. This is particularly important considering the number of manufacturing jobs already lost due to rising costs of manufacturing products in the United States.

4. The Weinstein and Clower Study used a mitigation factor of 1.54 to 1, citing that ratio as the mitigation required by the most recently developed reservoir in Texas. It is widely believed that the estimates by the TPW/USFWS Study and the TFS Study are more accurate estimates based on the detailed analysis of the actual acreage to be mitigated rather than a recent mitigation requirement from a totally different type of habitat. In addition, Cooper Lake in Northeast Texas had 5,900 acres of bottomland hardwood and required total mitigation of 31,980 acres throughout Northeast Texas.

5. Finally, additional skepticism of the Weinstein and Clower Study is based on the knowledge that funding for the Study came from Dallas-Fort Worth entities which would benefit from and utilize the water supplies from Marvin Nichols I Reservoir.

6.9.3 **Impacts on Farming, Ranching and other Related Industries**

The studies cited above deal only with the timber industry in Northeast Texas. Marvin Nichols I Reservoir and required mitigation would also impact areas which produce wheat, cotton, rice, milo, hay, soybean, and alfalfa. In addition, acreage currently being utilized for beef cattle, dairy cattle, poultry and hog production would be affected. The NETRWPG has received numerous oral and written comments from individuals involved in the production of these agricultural commodities, along with others in agribusiness industries, reflecting negative impacts from the potential development of Marvin Nichols I Reservoir.

6.9.4 **Impacts on Natural Resources**

Additional commentary has been previously received from the NETRWPG concerning negative impacts on natural resources such as lignite and oil and gas reserves located in and near the reservoir site. See Chapter 1 Figures 1.7 and 1.9 for maps of oil and gas as well as lignite resources. "Table P.1: Summary of Evaluation of Water Management Strategies" used in Region C's 2011 water planning process corroborates the negative impacts of Marvin Nichols I upon "Other Natural Resources" in its rating of "medium high." Additional concerns have been expressed from landowners regarding economic losses from hunting leases, grazing leases and timber sales. These impacts are again corroborated in the aforementioned table from the 2011 Region C Water Plan, rating the impacts of Marvin Nichols I upon "Agricultural Resources/Rural Areas" as "high" and "Possible Third Party" are rated high.

In addition if Marvin Nichols I Reservoir is built, the footprint will sit squarely on top of the outcrop of the Nacatoch Aquifer. Local residents report there are dozens of springs and thousands of thousands of sand boils. Man-made alterations include water wells, undocumented seismograph holes and unplugged oil wells. Residents' concern is that heavy metals settling to the bottom of the reservoir will contaminate the aquifer below.

6.9.5 **Impacts on Environmental Factors**

Region C's planning process provides the following summation of significant negative environmental impacts, in "Table P.1: Summary of Evaluation of Environmental Factors" Marvin Nichols I would cause "high" overall environmental impacts. "High" is the highest category for negative impacts given to any strategy. This includes 14,422 acres of wetlands and 33,000 acres of forested lands, as well as 19 threatened/endangered species (second highest of any strategy listed). According to the Table, specific environmental factors that would experience "high" negative impacts include habitat and cultural resources.

Although the NETRWPG opposes any Marvin Nichols type reservoir, the NETRWPG notes that other potentially feasible alternatives, such as reallocation of flood pool storage in Wright Patman Reservoir, do exist in the Sulphur River Basin. Evaluations considering the feasibility of this strategy have been performed as part of the aforementioned SRBA Sulphur River Basin Feasibility Study, an ongoing effort on the part of the USACE and SRBA to evaluate potential water supply alternatives in the Sulphur River Basin.

A modified Water Availability Model (WAM) for the Sulphur River Basin, and conditions representing full demands of existing water rights with no discharges (i.e., Run 3), was used in this study to evaluate three reallocation scenarios with conservation elevations of 232.5 ft., 242.5 ft., and 252.5 ft. The results from these analyses conclude that the available firm supply from reallocation of Wright Patman reservoir ranges from 415,000 ac-ft/yr, to 730,400 ac-ft/yr, and up to 1,004,100 ac-ft/yr, depending upon the amount reallocated from flood storage[4].

Analyses of potential unit costs of alternative water supplies from the Sulphur River Basin are presented within the *Cost Rollup Report – Final* for the SRBA study. Through a series of planning level analyses, the study identified 12 alternatives having unit costs under $650 per acre-foot during debt service (after debt service, these 12 most cost effective alternatives remain the least expensive). These seven alternatives are comprised of some combination of the following components:

- Marvin Nichols 328'
- Marvin Nichols 313.5'
- Wright Patman 232.5'

4 Taken from *Technical Memorandum on Hydrologic Yields – Sulphur River Basin Feasibility Study, 08/26/2014.*

- Wright Patman 242.5’
- Talco 350’ – Configuration 1
- Talco 370’ Configuration 1
- Parkhouse I
- Parkhouse II

It is then concluded that “[i]n general, the larger Marvin Nichols scales, the smaller Wright Patman scales, and the Talco alternatives appear to merit further consideration, at least on the basis of unit costs.”

As noted in the SRBA’s Socioeconomic Study of the Sulphur River Basin, “the analysis of socioeconomic resources identifies those aspects of the social and economic environment that are sensitive to change and that may be affected by actions associated with the development of water resources in the Sulphur Basin.” Regional economic development effects were estimated using the MIG, Inc. IMPLAN modeling software for the construction and operation of alternative reservoir scenarios, with all costs and impacts expressed in 2014 dollars. Study areas for each of 12 reservoir scenarios were defined via the adjacent counties to each reservoir alternative. The resultant comparisons between modeled estimates of employment and labor income generated during construction and during project operations demonstrate that the considered Wright Patman Reservoir scenario offers the greatest induced, indirect, and direct effects of all the scenarios analyzed.

The *Environmental Evaluation Interim Report, Sulphur River Basin, Comparative Assessment* produced as part of the SRBA Sulphur River Feasibility Study provides consideration of potential environmental concerns associated with the development of additional water supply within the Sulphur River Basin. Preliminary environmental analyses were performed to, “…help with the identification of potential impacts and constraints…” to the considered potential reservoir sites under evaluation. Readily available information regarding land cover/resources, wetlands, bottomland hardwoods, water quality, archeological resources, instream uses, groundwater, and state and federally listed threatened or endangered species was gathered and reviewed. This information was analyzed within the footprint of each alternative reservoir site to develop a structured assessment. Rankings were then developed based on the identified impacts/constraints. With regard to the Marvin Nichols and Wright Patman reservoir scenarios, the report states:

> “The Marvin Nichols project is representative of a more downstream location for new storage within the Sulphur River Basin. At least five locations for this dam have been considered in previous studies. In general, these alternative sites represent an attempt to locate the impoundment so as to avoid conflicts with Priority 1 bottomland hardwood habitats and oilfield activity while maintaining yield. A potential reservoir at the Marvin Nichols 1A site …was identified as a recommended strategy for [the North Texas Municipal Water District, Upper Trinity River Water District, and the Tarrant Regional Water District] in the 2006 and 2011 [Region C] plan. The Marvin Nichols 1A site is also recommended for protection in the Reservoir Site Protection Study.”

and

"Wright Patman Lake is an existing reservoir located on the Sulphur River in Bowie and Cass Counties, Texas. The top of Wright Patman Dam is at elevation 286 ft. msl. In terms of normal operations, elevation 259.5 ft. msl is considered the top of the flood control pool. At this elevation, Wright Patman Lake would have a cumulative storage capacity of 2,659,000 acre-feet. Theoretically, reallocation of almost any portion of that flood storage is possible. In a practical sense, reallocations are typically limited by either the need to maintain a large amount of flood control storage in order to protect downstream lives and properties, or the constraint on the increase in dependable yield that can be obtained as a result of limited water rights availability, or both. For the purposes of this analysis, the assessment of potential impacts to resources was estimated for two scenarios: 1) the portion of the flood pool from the existing top-of-conservation-pool elevation of 227.5 ft msl* up to 237.5 ft. msl. (i.e., an increase of 10 ft. msl. in the conservation pool) and 2) the entire flood pool from the existing top-of-conservation-pool elevation of 227.5 ft. msl. up to 259.5 ft. msl.

** The existing top-of conservation-pool elevation of 227.5 ft. msl. was determined by calculating an average for seven years of daily water surface elevations recorded by the USGS Gage (Wright Patman Lk nr Texarkana, TX) located at Wright Patman Lake from February 2006 to February 2013."*

Based on the SRBA study's review of cultural resource records and environmental data, it is reported that the Lake Jim Chapman reallocation and Lake Wright Patman minimum reallocation (237.5 ft. msl.) have the "Lowest Impacts", while the Parkhouse I, Parkhouse II, and Wright Patman maximum reallocation (259.5 ft. msl.) have "Moderate Impacts." Significantly, the Talco and Marvin Nichols 1A scenarios were determined to have the "Highest Impacts."

The comparative environmental assessment performed for the Sulphur River Basin Feasibility Study provides a structured comparative assessment of the potential impacts associated with the alternative reservoirs considered. Significant questions remain regarding the specifics of the methods employed in deriving the impacts on archeological resources, bottomland hardwoods, wetlands, the overall rankings, and the individual weight of each ranking in contributing to the overall rankings. However, although such questions remain, the results of the analysis are informative. A comparison is summarized and presented in the SRBA study via a matrix of rankings, presented in Table 6.19.

Although the full reallocation of Wright Patman Reservoir is presented as having the greatest overall ranking (7 = most impact), it is noteworthy that the lower reallocation of Wright Patman (237.5 ft. msl.) is considered to have a lesser impact than that of Marvin Nichols 1A.

Table 6.19 Summary/Comparison Matrix of the Potential Impacts of the Alternative Reservoir Sites
(from *Environmental Evaluation Interim Report, Sulphur River Basin, Comparative Assessment*, SRBA, June 2013)

Reservoir Site	T&E Impacts	Archeological Resources Impacts	Bottomland Hardwood Impacts	Wetlands	Water Quality	Overall Ranking
Wright Patman (259.5)	7	3	7	7	7	7
Marvin Nichols 1A	6	4	6	6	4	6
Wright Patman (237.5)	4	2	5	5	6	5
Talco	5	4	4	4	5	4
Parkhouse I	3	3	3	3	3	3
Parkhouse II	2	3	2	2	2	2
Jim Chapman (446.2)	1	1	1	1	1	1

6.10 CONCLUSION

It has been the position of the NETRWPG that due to the significant negative impacts upon environmental factors, agricultural resources/rural areas, other natural resources, and third parties, Marvin Nichols I Reservoir should not be included as a water management strategy in any regional water plan or the State Water Plan. In referencing Marvin Nichols I, the North East Texas Regional Water Plan incorporates Marvin Nichols I, Marvin Nichols IA, and any major dam sites on the main stem of the Sulphur River.

Per the terms of agreement set forth from the October 5, 2015 mediation between Regions C and D and ratified by the NETRWPG at its October 21, 2015 meeting, the NETRWPG does not challenge Marvin Nichols Reservoir as a unique reservoir site for the purposes of this Plan.

Considering the aforementioned information, it is further the position of the NETRWPG that the reallocation of Wright Patman Reservoir provides a viable potential water management strategy to assist in meeting the needs for Region C. Although the approach may be potentially more expensive to Region C (in terms of the unit costs of water) to meet that region's growing needs, the reallocation of Wright Patman may produce less of a potential impact to the agricultural and natural resources of Region D, while providing greater socioeconomic benefits to North East Texas.

CHAPTER 7 DROUGHT RESPONSE INFORMATION, ACTIVITIES, AND RECOMMENDATIONS

Drought is a frequent and inevitable factor in the climate of Texas. Therefore, it is vital to plan for the effect that droughts will have on the use, allocation and conservation of water in the State. Drought management measures have been incorporated as an increasingly important part of water planning at the local, regional and statewide levels. In 2009, the Texas Water Development Board published "Drought Management in the Texas Regional and State Water Planning Process" (http://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0804830819_DroughtMgmt.pdf) which examines the potential benefits and drawbacks of including drought management as a regional water management strategy.

Prolonged drought conditions can have serious impacts on water supplies. Due to the potentially devastating effects of drought on both individuals and the State's economy, it is important that water suppliers and users consider the potential impacts of drought and develop robust plans to address supply or demand management under drought conditions.

Through the regional water planning process, requirements for drought management planning are found in Title 31 of the Texas Administrative Code (TAC), Part 10, Chapter 357, Subchapter D. Texas Statute reference §357.42 includes requirements regarding drought response information, activities, and recommendations. This chapter examines these specific requirements and identifies significant drought impacts within the Region.

7.1 DROUGHT OVERVIEW

The severity of the current drought has significantly impacted the lives of water users, providers and water managers who have been hard-pressed to find solutions to critical supply and demand issues. The severity of the impacts varies, but the overriding sense of urgency to create workable strategies and solutions has been acknowledged and acted upon Statewide. Therefore, it is critical in this planning cycle to address the impact that drought is currently having and will have on the future use, allocation and conservation of water in the State.

There are different types of drought that have been defined in various ways; however, these definitions fall into four primary categories: meteorological, agricultural, hydrological and socioeconomic drought. In the most general sense, drought is a deficiency of precipitation over an extended period of time, resulting in a water shortage for some activity, group or environmental purpose. The State Drought Preparedness Plan provides more specific and detailed definitions and is located at the following link:

http://www.txdps.state.tx.us/dem/CouncilsCommittees/droughtCouncil/droughtPrepPlan.pdf.

Meteorological drought is quantified by how dry it is (for example, a rain deficit) compared to normal conditions as well as the duration of the dry period. This is typically a region-specific metric, since factors affecting meteorological drought can vary so much in different regions.

Agricultural drought considers the effects of meteorological drought in terms of agricultural impacts. For example, evapotranspiration, soil moisture and plant stress are measures of agricultural drought, which account for vulnerability of crops through the various growth stages.

Hydrological drought is measured in terms of effects on surface and subsurface waters, such as reservoir stage and capacity, stream flow or groundwater levels in wells. Hydrological drought is usually defined on a river-basin or watershed scale. Hydrological droughts typically lag behind meteorological and agricultural droughts because it takes more time for the evidence of basin-wide impacts to manifest.

Socioeconomic drought occurs when the demand for an economic product (such as hydroelectric power) exceeds supply due to a weather-related deficit. Typically, demand for a good increases with population growth and per capita consumptions. Supply increases due to efficiency technology and the construction of new water projects. If both are increasing, the rate of change between supply and demand is the key. However, when demand exceeds supply, vulnerability is magnified by water shortages during drought.

Several climatological drought indicators have been formulated in order to quantify drought. The Palmer Drought Severity Index (PDSI) was developed in 1965 and is currently used by many federal and state agencies. The PDSI is a soil moisture index that works best in relatively large regions with uniform topography that don't experience extreme climate shifts. PDSI values can lag oncoming drought by several months. The TWDB uses the PDSI to monitor State drought conditions, which has values ranging between -6.0 (driest) to 6.0 (wettest). "Extreme drought" conditions have a PDSI between -6.0 and -4.0, and "severe drought" conditions have a PDSI between -3.99 and -3.0.

An accumulated area graph of the weekly PDSI categories for Texas is included as Table 7.1. The week of October 4, 2011 has the highest area of the State experiencing extreme drought (88 percent) for the period of record shown (January 2000 through March 2015) Texas did not experience drought conditions from October 2004 through February 2005.

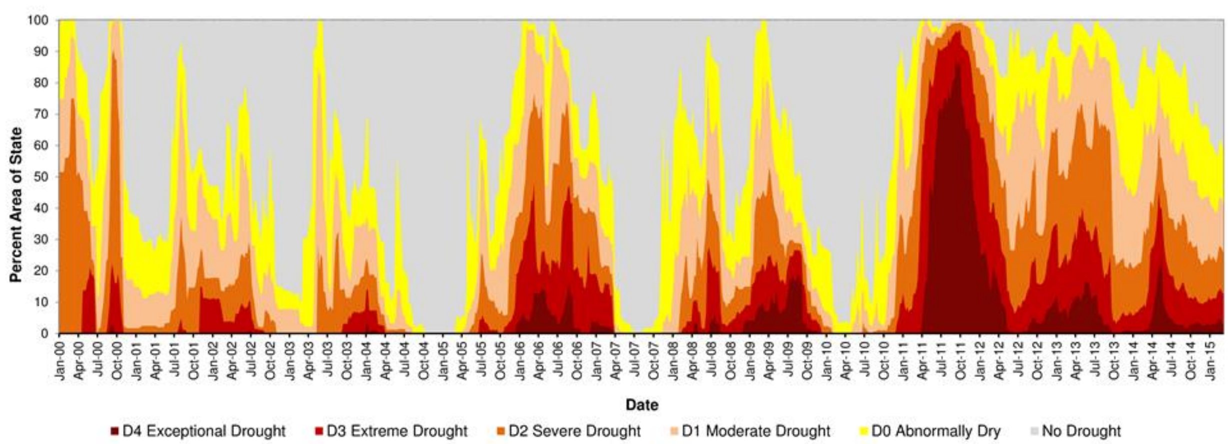

Figure 7.1 Drought in Texas, 2000 – 2014
(Source: U.S. Drought Monitor)

The U.S. Drought Monitor indicates that in October of 2011, all of the counties in the North East Texas region experienced at least some periods of severe or extreme drought (see Table 7.2). Drought conditions have improved since 2011, but there are still areas within the Region that are experiencing abnormally dry conditions.

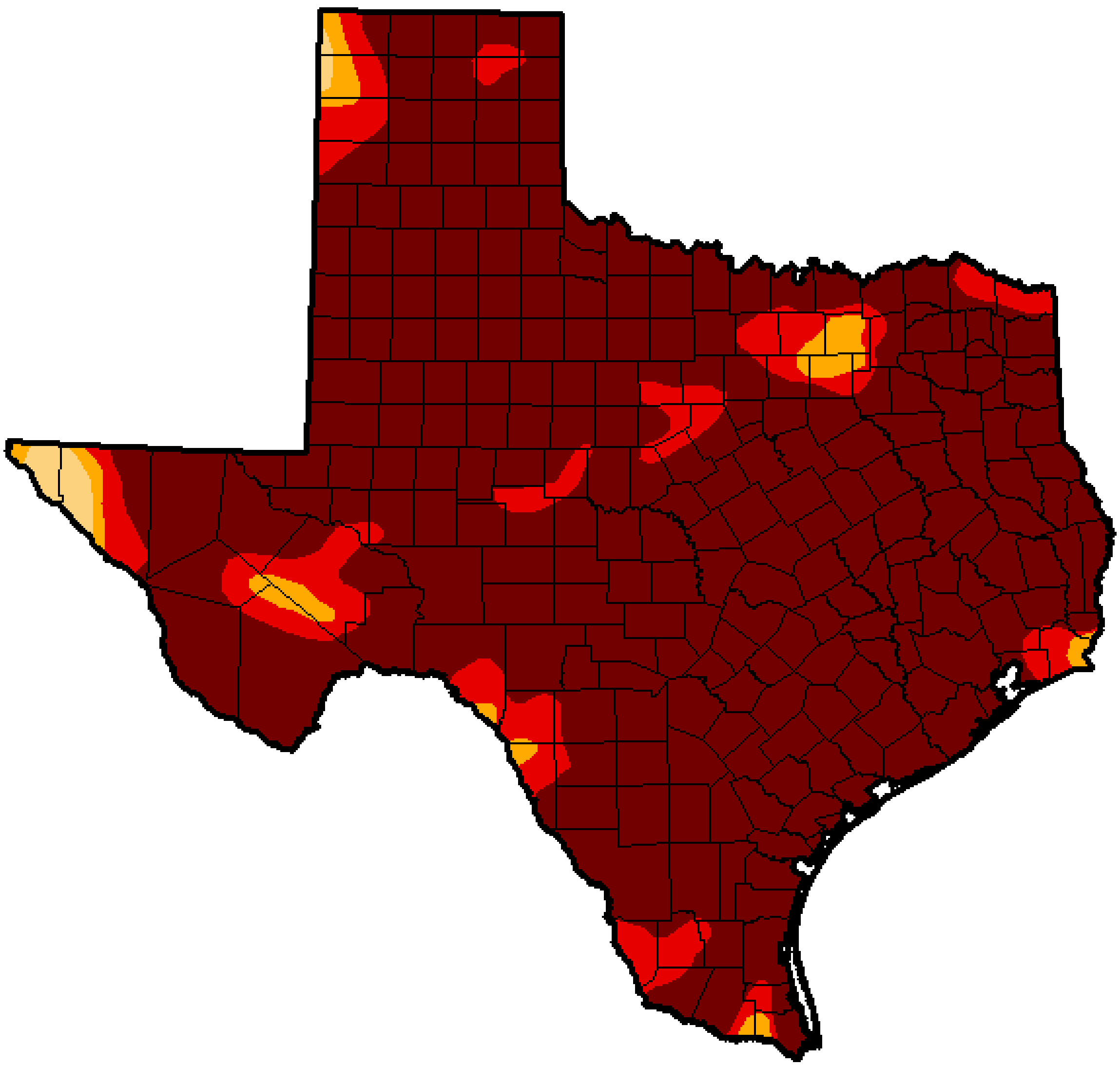

Figure 7.2 Drought in Texas, October 2011
Source: U.S. Drought Monitor

7.2 DROUGHTS IN THE NORTH EAST TEXAS REGION

North East Texas is within the humid subtropical climate zone and receives the most rainfall of any region of Texas. Comparing the existing DOR and the current drought can be done using historic precipitation and the Palmer Drought Severity Index (PDSI).

Precipitation data for quadrangles 412, 413, 512 and 513 from 1940 through 2014 are shown in Figure 7.3. The average annual rainfall for these quadrangles is 46.3 inches. These data indicate that the DOR in the 1950s was associated with five (out of eight) years of below average rainfall between 1950 and 1958. Note that a recurrence, or continuation, of the drought of the 1950s is also evident between 1962 and 1968.

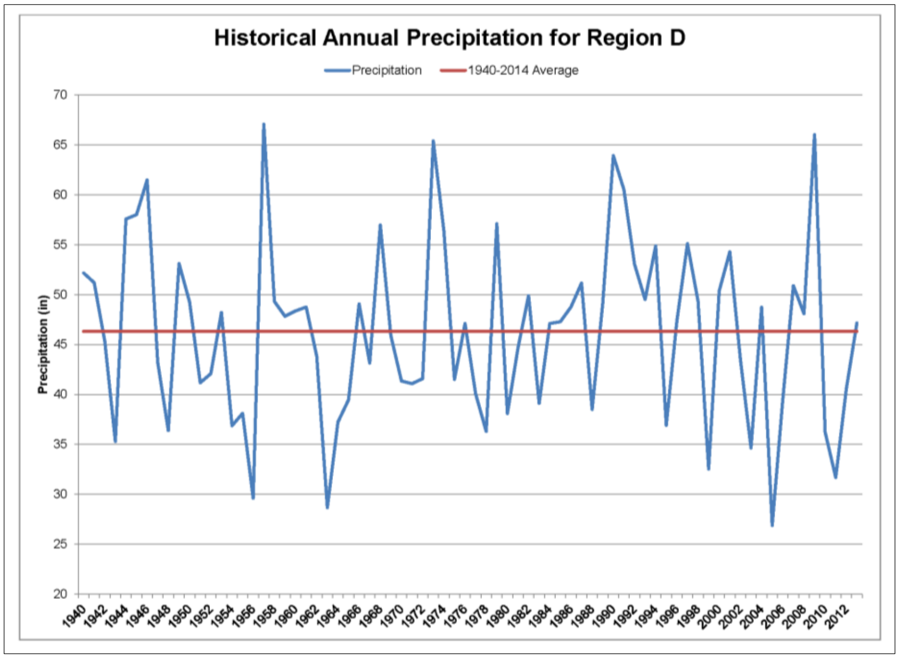

Figure 7.3 Annual Precipitation, 1940 – 2014, TWDB

The current drought indicates a possible trend toward below average annual rainfall beginning around 1995, but also shows a relatively high-amplitude fluctuation from one year to the next. The lows are also more extreme than the previous DOR. Years with below average rainfall have a deficit of about 10 to 20 inches for the year. PDSI values indicate the same patterns as the average annual precipitation data as shown in Figure 7.4.

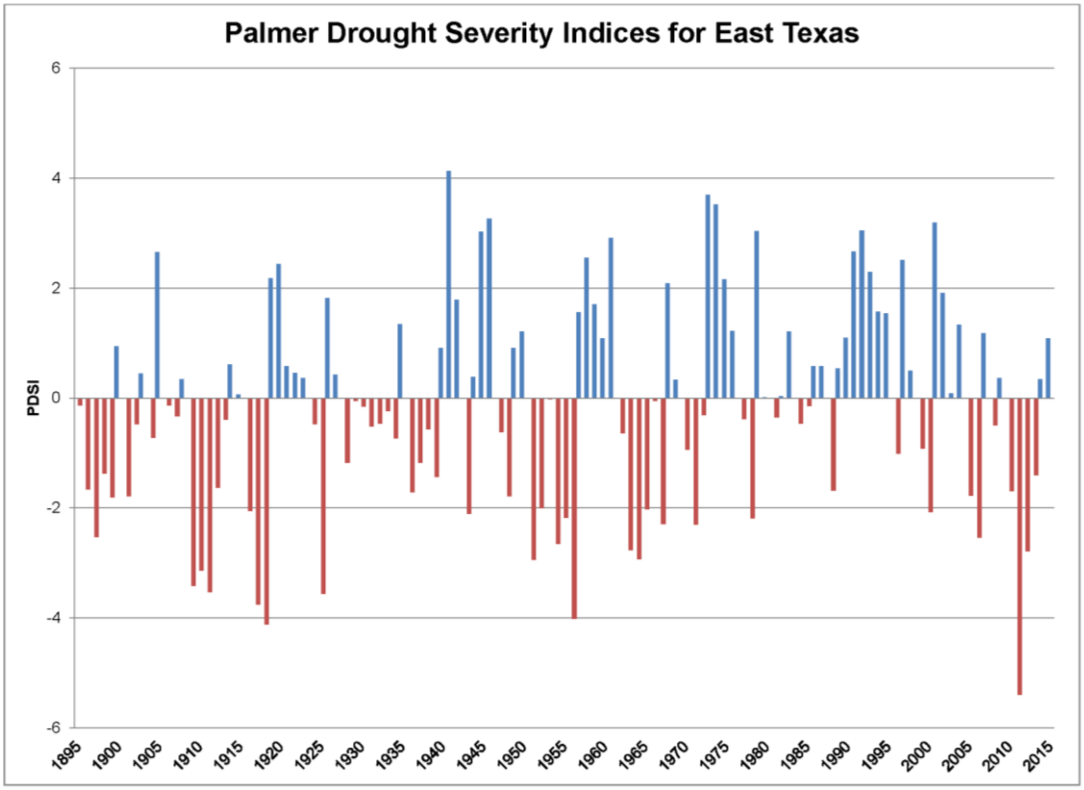

Figure 7.4 PDSI, 1895 – 2015
Source: (http://www.ncdc.noaa.gov/cdo-web)

7.3 NORTH EAST TEXAS REGION DROUGHT OF RECORD

For the purpose of this planning cycle, the drought of the 1950s is declared the Drought of Record (DOR). This drought is the key drought period represented and utilized in the official TCEQ Water Availability Models (WAMs) for the river basins within the North East Texas Region planning area. At present, it is difficult to objectively determine whether the current drought will ultimately become a new DOR because we do not know how many years the current, ongoing drought will last. The DOR in the 1950s lasted for many years so it may be a while before that distinction can be made. While subsequent major droughts have occurred in the Region, none have yet displayed the combination of intensity and duration of the 1950's drought.

The catalyst for the current drought can be attributed primarily to rainfall deficit (meteorological drought). The hydrological drought that has occurred as a result of rainfall deficit is evident in the decrease in stream flow and spring discharge data that has been presented.

The hydrological drought (impact on surface waters and groundwater) is a result of both meteorological and socioeconomic drought. To reiterate, socioeconomic drought occurs when demand exceeds supply due to a weather-related deficit. Typically, demand for a product increases with population growth and per capita consumptions. Supply increases due to efficiency technology and the construction of new water projects. If both are increasing, the rate of change between supply and demand is the key. However, when demand exceeds supply, vulnerability is magnified by water shortages during drought.

In future planning cycles, it would be useful to attempt to quantify the extent that anthropological factors exacerbate drought severity. Suggested areas of investigation include: base flow studies, sub-watershed scale water balance calculations, and rainfall deficit quantification.

7.4 CURRENT DROUGHT PREPARATIONS AND RESPONSE

As mandated by 31 TAC 357.42(a)&(b), this section of the RWP summarizes and assesses all preparations and drought contingency plans that have been adopted by municipalities and GCDs within the North East Texas Region. The summary includes what specific triggers are used to determine the onset of each defined drought stage and the associated response actions that have been developed by local entities to decrease water demand during the particular drought stage.
Because of the range of conditions that affected the more than 4,000 water utilities throughout the State in 1997, the Texas Legislature directed the TCEQ to adopt rules establishing common drought plan requirements for water suppliers. As a result, TCEQ requires all wholesale public water providers, retail public water suppliers serving 3,300 connections or more, and irrigation districts to submit drought contingency plans (DCPs). Wholesale water providers and retail public water suppliers serving less than 3,300 connections are now required to prepare and administer DCPs no later than May 1, 2014. Plans are required to be made available for inspection upon request.

DCPs are intended to establish criteria to identify when water supplies may be threatened and the actions that should be taken to ensure these potential threats are minimized. A common feature of drought contingency plans is a structure that allows increasingly stringent drought response measures to be implemented in successive stages as water supply decreases and water demand increases. This measured, or gradual, approach allows for timely and appropriate action as a water shortage develops. The onset and termination of each implementation stage should be defined by specific “triggering” criteria. Triggering criteria are intended to ensure that: 1) timely action is taken in response to a developing situation, and 2) the response is appropriate to the level of severity of the situation. Each water-supply entity is responsible for establishing its own DCP that includes appropriate triggering criteria and responses.

DCPs typically emphasize measures of demand management designed to decrease water demand through curtailment of uses. Demand management in this context differs from water conservation, although the terms are frequently interchanged. The objective of water conservation is to achieve long-term reductions in water use through improved water use efficiency, reduced waste, and through reuse. Demand management focuses on temporary reductions in use in response to temporary shortages in water supply or other emergencies (e.g. equipment failures caused by peak water demands being excessive).

7.4.1 **Drought Response Triggers**

Drought response triggers should be specific to each water supplier and should be based on an assessment of the water user's vulnerability. In some cases it may be more appropriate to establish triggers based on a supply source volumetric indicator such as a lake surface elevation or an aquifer static water level. Similarly, triggers might be based on supply levels remaining in an elevated or ground storage tank within the water distribution system; this is not a recommended approach, as the warning of supply depletion would be only three to four days. Triggers based on demand levels can also be effective, if the demands are very closely and frequently monitored. Whichever method is employed, trigger criteria should be defined on well-established relationships between the benchmark and historical experience. If historical observations have not been made then common sense must prevail until such time that more specific data can be presented.

7.4.2 **Surface Water Triggers**

Surface water triggers are widely-used in the NETRWPG, typically in conjunction with other triggers based on system demands. Surface water triggers based on reservoir capacity and/ or stage (water pool elevation) are relatively easy to monitor remotely as several reservoirs in the NETRWPG are equipped with gages and satellite telemetry with real-time data posted online.

7.4.3 **Groundwater Triggers**

Groundwater triggers that indicate the onset of drought are not as easily identified as factors related to surface-water systems. This is attributable to (1) the rapid response of stream discharge and reservoir storage to short-term changes in climatic conditions within a region and within adjoining areas where surface drainage originates, and (2) the typically slower response of groundwater systems to recharge processes. Although climatic conditions over a period of one or two years might have a significant impact on the availability of surface water, aquifers of the same area might not show comparable levels of response for much longer periods of time, depending on the location and size of recharge areas in a basin, the distribution of precipitation over recharge areas, the amount of recharge, and the extent to which aquifers are developed and exploited by major users of groundwater.

No entities utilize groundwater triggers in the Northeast Texas Regional Planning Area.

7.4.4 **System Capacity Triggers**

Because of the above described problems with using water levels as drought-condition indicators, several municipal water-supply entities in the North East Texas Region that rely on groundwater generally establish drought-condition triggers based on levels of demand that exceed a percentage of the systems production capacity. All of the entities listed in Table 7-1 use both supply triggers as well as demand triggers with one exception. The Red River Authority bases it drought triggers on average daily use.

7.4.5 Municipal and Wholesale Water Provider Drought Contingency Plans

The TCEQ requires all retail public water suppliers serving 3,300 connections or more and wholesale public water providers to submit a drought contingency plan as a way to prepare and respond to water shortages. The amended Title 30, TAC, Chapter 288 became effective on December 6, 2012 addressing TCEQ's guidelines and plan requirements. The forms for wholesale public water providers, retail public water suppliers and irrigation districts are available at:

http:// www.tceq.state.tx.us/permitting/water_supply/water_rights/contingency.html.

Drought contingency plans for municipal uses by public water suppliers must document coordination with the regional water planning groups to ensure consistency with the regional water plans. The following entities have prepared drought contingency plans. Several of the entities have plans accessible at the specified websites:

- City of Commerce http://commercetx.org
- City of Cooper
- City of Emory
- City of Greenville http://www.ci.greenville.tx.us
- City of Hughes Springs
- City of Mount Pleasant
- City of Paris http://www.paristexas.gov
- City of Sulfur Springs
- Combined Consumers Water Utility http://www.ccsud.com
- Lamar County Water Supply District
- North East Texas Municipal Water District
- North Texas Municipal Water District https://ntmwd.com
- Red River Authority http://www.rra.texas.gov
- Texarkana Water Utilities

A list of entities, their supply source, specific triggers and actions, for each drought stage is provided in Table 7.1. DCPs were not provided to the NETRWPG by Southwestern Electric Power Company.

Table 7.1 Municipal Mandated Drought Triggers and Actions

Water-Supply Entity	Water Supply Source	Drought Trigger	Drought Stage and Response				
			Mild	Moderate	Severe	Critical	Emergency
City of Commerce		Based on multi-stage drop in water levels in lakes used as water supply.	Water level in Lake Tawakoni drops below432.5 feet, the PDSI reaches -2 to -3, or when requested by the Sabine River Authority.	Water production reaches 3.1 million GPD for 5 consecutive days, or storage has not refilled for 3 consecutive days.	City's emergency pump has been put into service because other pumps have failed, or other conditions within the system present water shortages deemed severe by City Manager.	Water production reaches 3.5 million GPD for 7 consecutive days, or when storage has not completely refilled for 5 consecutive days.	Water system is contaminated; water system fails due to act of God or man; major water line breaks, pump fails, or system fails causing unprecedented loss of capability to provide water service.
			Reduce demand by 5% by voluntary measures.	Reduce demand by 10% or 2.79 million GPD.	Reduce demand to 2.79 million GPD.	Reduce demand by 10%, or to 3.15 million GPD.	Response determined based on conditions.
City of Cooper		Based on multi-stage drop in water levels in lakes used as water supply.	City reservoir levels drops to 455 feet; PDSI at "Moderate"; reservoir recharged 2 times in the past 12 months; and water demand is 75% of capacity for 3 consecutive days.	City reservoir levels drops to 454 feet; PDSI at "Severe"; reservoir recharged 1 time in the past 12 months; and water demand is 85% of capacity for 3 consecutive days.	City reservoir levels drops to 453 feet; PDSI at "Extreme"; reservoir recharged 0 times in the past 12 months; and water demand is 95% of capacity for 3 consecutive days.	N/A	N/A
			Voluntary usage reduction. Reduce demand by 70%	Prohibit unnecessary water use except for landscape use. Reduce demand by 75%.	Prohibit all unnecessary water use. Reduce demand by 85%.	N/A	N/A
City of Emory		Based on multi-stage drop in water levels in lakes used as water supply.	Water level in Lake Tawakoni drops below728,300 acre-feet; demand exceeds 1.45 million gallons for 30 day, or demand exceeds 1.7 million GPD; or demand exceeds 60% of safe capacity for 30 days, or 75% of safe capacity on a single day.	Water level in Lake Tawakoni drops below705,400 acre-feet; demand exceeds 1.7 million gallons for 30 days, or demand exceeds 1.93 million GPD; or demand exceeds 70% of safe capacity for 30 days, or 80% of safe capacity on a single day.	Water level in Lake Tawakoni drops below663,200 acre-feet; demand exceeds 1.93 million gallons for 30 days, or demand exceeds 2.17 million GPD; or demand exceeds 80% of safe capacity for 30 days, or 85% of safe capacity on a single day; or when the city determines water supplies will not last another 180 days.	Water level in Lake Tawakoni drops below632,400 acre-feet; demand exceeds 2.17 million gallons for 30 days, or demand exceeds 2.419 million GPD; or demand exceeds 90% of safe capacity for 30 days, or 100% of safe capacity on a single day; or when the city determines water supplies will not last another 120 days.	Major water line breaks, pump or system fails causing unprecedented loss of capability to provide water service. Natural or man-made contamination of water supply. When the city determines water supplies will not last another 90 days.
			Drought Stage and Response				

Water-Supply Entity	Water Supply Source	Drought Trigger	Mild	Moderate	Severe	Critical	Emergency
City of Emory (Continued)		Based on multi-stage drop in water levels in lakes used as water supply.	Voluntary usage reduction of 10%.	Prohibit unnecessary water use except for landscape use. Reduce demand by 20%.	Prohibit unnecessary water use. Limited landscape use at prescribed times. Reduce demand by 40%.	Prohibit unnecessary water use. Limited landscape use at prescribed times. Reduce demand by 50%. City will implement the placement of alternative pumping devices into Lake Tawakoni.	Prohibit any and all unnecessary water use. Reduce demand by 70%.
			The City of Emory employs a water allocation stage when the city determines that the water supply in Lake Tawakoni will not last another 60 days. Water will be rationed on a number of residence per house hold basis at a surcharged rate.				
City of Greenville		Based on city reservoir levels, Lake Tawakoni level, Palmer Drought Severity Index, recharge frequency of city reservoirs, and water demand.	City reservoir levels reach 532.5 feet; Lake Tawakoni reaches 434 feet; PDSI at "Moderate"; reservoir recharged 2 times in the past 12 months; and water demand is 60% of capacity.	City reservoir levels reach 531.5 feet; Lake Tawakoni reaches 432 feet; PDSI at "Severe"; reservoir recharged 1 time in the past 12 months; and water demand is 70% of capacity.	City reservoir levels reach 531.5 feet; Lake Tawakoni reaches 431 feet; PDSI at "Extreme"; reservoir recharged 0 times in the past 12 months; and water demand is 80% of capacity.	Four of the triggering criteria in "Severe" Stage are met or when the City Manager declares a critical water shortage.	All five of the triggering criteria in "Severe" Stage are met. Major water line breaks, pump or system fails causing unprecedented loss of capability to provide water service. Natural or man-made contamination of water supply.
			Voluntary usage reduction and conservation.	Reduce demand by 10%. Restricted water use.	Reduce demand by 20%. Restricted water use. Non-essential water use prohibited.	Reduce demand by 30%. Restricted water use. Non-essential water use prohibited.	Reduce demand by 40%. Watering of any kind prohibited. Water rationing implemented.
City of Hughes Springs		Based on a percentage of capacity usage rate.	Water shortage conditions reach 85% of capacity per day or when the volume of supply is less than 50% of capacity.	Water shortage conditions reach 90% of capacity per day or when the volume of supply is less than 40% of capacity.	Water shortage conditions reach 95% of capacity per day or when the volume of supply is less than 25% of capacity.	N/A	Major water line breaks, pump or system fails causing unprecedented loss of capability to provide water service. Natural or man-made contamination of water supply.
			Voluntary usage reduction of 10%	Prohibit non-essential water use except for landscape use. Reduce demand by 15%.	Prohibit non-essential water use except for landscape use. Reduce demand by 20%.	N/A	Assess the severity of the problem and identify the actions needed and time required to solve the problem.
			Drought Stage and Response				

Water-Supply Entity	Water Supply Source	Drought Trigger	Mild	Moderate	Severe	Critical	Emergency
City of Mount Pleasant		Based on a percentage of capacity usage rate.	Daily water demand exceeds 85% for 3 consecutive days. Water levels in Lake Bob Sandlin are declining at a rate disruptive to water supply.	Daily water demand exceeds 90% for 3 consecutive days. Water levels in Lake Bob Sandlin are declining at a rate causing imminent disruption to water supply.	Daily water demand exceeds 90% for 3 consecutive days. Failure of pumping unit. Ground and storage levels no longer achieve full recovery in low demand periods.	Daily water demand exceeds 100% for 1 day. Demand exceeds safe limits. Storage levels cannot be maintained to insure adequate fire protection. Lake Bob Sandlin levels decline to a rate that could cause failure of pumping equipment.	Major water line breaks, pump or system fails causing unprecedented loss of capability to provide water service. Natural or man-made contamination of water supply. System storage levels and pressures prevent fire protection.
			Voluntary usage reduction of 10%. Non-essential water use prohibited.	Prohibit non-essential water use. Landscape use limited to prescribed times. Reduce demand by 15%.	Prohibit non-essential water use. Landscape use limited to prescribed times. Reduce demand by 25%.	Prohibit non-essential water use. Landscape use limited to prescribed times. Reduce demand by 30%.	All water use prohibited except what is required to protect public health and safety. Reduce demand by 75%. Implementation of any and all alternative supply sources available.
City of Paris		Based on a percentage of capacity usage rate.	Water supply less than 70% in Pat Mayse Lake and Lake Crook combined; period of high demand exists; limitation on production or distribution exist.	Water supply less than 60% in Pat Mayse Lake and Lake Crook combined; daily demand exceeds 32 million gallons for 7 days; daily demand exceeds 36 million gallons for 3 days; limitation on production or distribution exist.	Water supply less than 50% in Pat Mayse Lake and Lake Crook combined; daily demand exceeds 34 million gallons for 14 days; daily demand exceeds 36 million gallons for 6 days; limitation on production or distribution exist.	N/A	Water supply less than 40% in Pat Mayse Lake and Lake Crook combined; daily demand exceeds 35 million gallons for 21 days; daily demand exceeds 36 million gallons for 9 days; limitation on production or distribution exist. Major water line breaks, pump or system fails causing unprecedented loss of capability to provide water service. Natural or man-made contamination of water supply.
			Voluntary usage reduction of 10%. Limited Non-essential water use.	Prohibit non-essential water use. Landscape use limited to prescribed times. Reduce demand by 20%.	Prohibit non-essential water use. Landscape use limited to prescribed times. Reduce demand by 30%.	N/A	Prohibit non-essential water use. Landscape use prohibited. Reduce demand by 40%. Pro-rata curtailment of water deliveries to wholesale customers.

Water-Supply Entity	Water Supply Source	Drought Trigger	Drought Stage and Response				
			Mild	Moderate	Severe	Critical	Emergency
City of Sulfur Springs		Based on a percentage of capacity usage rate, lake capacity, and potential disruption on water supply.	Daily water demand exceeds 90%. Lake water levels are declining at a rate disruptive to water supply. Water supplies are low enough to cause concern.	Daily water demand exceeds 100%. Lake water levels are declining at a rate causing a serious disruption to water supply. Storage capacity is not being maintained.	Daily water demand exceeds 110%. Lake water levels are to low for production equipment to function. Storage capacity is to low all for adeguate fire protection. Pumping capacity is not able to refill. Failure could cause an immediate health and safety hazard. Contamination of supply has occured.	N/A	N/A
			Usage reduction of 10%. Limited Non-essential water use.	Prohibit non-essential water use. Landscape use limited to prescribed times. Reduce demand by 15%.	Prohibit non-essential water use. Landscape use limited to prescribed times. Reduce demand by 20%.	N/A	N/A
Combined Consumers Water Utility		Based on a percentage of capacity usage rate, lake capacity, and replenishment percentage.	Lake Tawakoni reaches 432 feet. Demand reaches 80% of daily supply for 3 days. System storage is not replenished to 80% capacity in 3 days.	Lake Tawakoni reaches 430 feet. Demand reaches 90% of daily supply for 2 days. System storage is not replenished to 90% capacity in 2 days.	Lake Tawakoni reaches 428 feet. Demand reaches 100% of daily supply for 1 day. Natural or man-made contamination. Declaration of state of disaster. Health or safety concerns. Major system failure causing pressure below 20 psi for 24 hours or longer.	Lake Tawakoni reaches 426 feet. An emergency booster pump must be installed on lake shore.	All previous triggering criteria. Major water line breaks, pump or system fails causing unprecedented loss of capability to provide water service. Natural or man-made contamination of water supply. District is required to seek deeper water due to lake level.
			Voluntary usage reduction of 5%. Voluntary landscape use reduction. Water conservation is requested.	Prohibit non-essential water use. Landscape use limited to prescribed times. Reduce demand by 15%.	Prohibit non-essential water use. Landscape use limited to prescribed times. Reduce demand by 20%.	Prohibit non-essential water use. Landscape use limited to prescribed times. Reduce demand by 30%.	Prohibit non-essential water use. Landscape use prohibited. Reduce demand by 40%.
			Combined Consumers Water Utility employs a water allocation stage when the utility determines falling treated water levels do not refill above 50% overnight for any of the stages listed above. Water use is allocated on a surgare per household basis.				
			Drought Stage and Response				

			Mild	Moderate	Severe	Critical	Emergency
Lamar County Water Supply District		Based on a percentage of capacity usage rate, and replenishment percentage.	Demand reached 85% of peak daily use for 7 days. The system reaches 100% of peak daily use for 3 days. Reservoir levels do not fill above 90%.	Demand reached 90% of peak daily use for 14 days. The system reaches 100% of peak daily use for 6 days. Reservoir levels do not fill above 80%.	Demand reached 95% of peak daily use for 21 days. The system reaches 100% of peak daily use for 9 days. Reservoir levels do not fill above 70%.	Demand reached 97% of peak daily use for 21 days. The system reaches 100% of peak daily use for 9 days. Reservoir levels do not fill above 50%.	Major water line breaks, pump or system fails causing unprecedented loss of capability to provide water service. Natural or man-made contamination of water supply.
			Voluntary usage reduction of 10%. Voluntary landscape use reduction. Non-essential water use is prohibited.	Reduce demand by 10%. Non-essential water use is prohibited. Landscape use limited to prescribed times.	Reduce demand by 15%. Non-essential water use is prohibited. Landscape use prohibited.	Reduce demand by 20%. Non-essential water use is prohibited. Landscape use prohibited.	Reduce demand by 25%. Non-essential water use is prohibited. Landscape use prohibited.
			Lamar County Water Supply District employs a water allocation stage when emergency conditions are in place.				
North East Texas Municipal Water District		Based on a percentage of capacity usage rate, and replenishment percentage.	48 hours of 85% pumping capacity is utilized in a 24-hour period, or volume of surface supply is less than 50% of capacity.	48 hours of 90% pumping capacity is utilized in a 24-hour period, or volume of surface supply is less than 40% of capacity.	48 hours of 95% pumping capacity is utilized in a 24-hour period, or volume of surface supply is less than 25% of capacity.	N/A	Major water line breaks, pump or system fails causing unprecedented loss of capability to provide water service. Natural or man-made contamination of water supply.
			Voluntary usage reduction of 10%. Voluntary landscape use reduction.	Reduce demand by 15%. Non-essential water use is prohibited.	Reduce demand by 20%. Non-essential water use is prohibited. Pro-rate curtailment of water diversions and/or deliveries for each wholesale customer.	N/A	Assess the severity of the problem and identify the actions needed and time required to solve the problem.
			Pro-rata water allocation triggered when severe water shortage conditions have been met.				

Water-Supply Entity	Water Supply Source	Drought Trigger	Drought Stage and Response				
			Mild	Moderate	Severe	Critical	Emergency
North Texas Municipal Water District		Based on multi-stage drop in water levels in lakes used as water supply.	Demand is projected to the limit of permitted supply. Lavon Lake or Jim Chapman Lake is less than 65% full. Sabine River Authority indicates Upper Basin water supplies are in Mild Drought. Water demand exceeds 90% of amount delivered for 3 consecutive days. Water demand delivery system approaches delivery capacity. Supply becomes contaminated. Water supply system is damaged.		Demand is projected to the limit of permitted supply. Lavon Lake or Jim Chapman Lake is less than 55% full. Sabine River Authority indicates Upper Basin water supplies are in Mild Drought. Water demand exceeds 95% of amount delivered for 3 consecutive days. Water demand delivery system approaches delivery capacity. Supply becomes contaminated. Water supply system is damaged.	Demand is projected to the limit of permitted supply. Lavon Lake or Jim Chapman Lake is less than 45% full. Sabine River Authority indicates Upper Basin water supplies are in moderate drought. Water demand exceeds 98% of amount delivered for 3 consecutive days. Water demand delivery system exceeds delivery capacity. Supply becomes contaminated. Water supply system is damaged.	Demand is projected to the limit of permitted supply. Lavon Lake or Jim Chapman Lake is less than 35% full. Sabine River Authority indicates Upper Basin water supplies are in severe drought. Water demand exceeds the amount that can be delivered. Water demand delivery system seriously exceeds delivery capacity. Supply becomes contaminated. Water supply system is damaged.
			Voluntary usage reduction. Increase public education efforts on ways to reduce water use.		Reduce production by 5%. Further accelerate public eduction. Halt non-essential water use. Notify TCEQ	Reduce production by 10%. Initiate water use restrictions. Limit landscape water to once a week. Notify TCEQ	Reduce production. Impose mandatory water restrictions on member cities and customers. Notify TCEQ.
Red River Authority		Based on multiple of daily average water use and percentage of demand.	System exceeds 2.5 times established daily average for 14 days. Wholesale demand voluntarily reduced by 20%. Ability to meet demand reduced by 20%.	System exceeds 3.5 times established daily average for 7 days. Wholesale demand voluntarily reduced by 20% to 50%. Ability to meet demand reduced between 20% and 50%.	System exceeds 5.5 times established daily average for 3 days. Wholesale demand voluntarily reduced by over 50%. Ability to meet demand reduced by over 50%.	N/A	N/A
			Reduce demand by 20%.	Reduce demand by 20%. Prohibit landscape and non-essential water use.	Reduce demand to level necessary to maintain public health and safety. Prohibit landscape and non-essential water use.	N/A	N/A

Water-Supply Entity	Water Supply Source	Drought Trigger	Drought Stage and Response				
			Mild	Moderate	Severe	Critical	Emergency
Southwestern Electric Power Company - Knox Lee Power Plant	NO INFORMATION AVAILABLE						
Southwestern Electric Power Company - Pirkey Power Plant							
Southwestern Electric Power Company - Welsh Power Plant							
Southwestern Electric Power Company - Wilkes Power Plant							
Sabine River Authority - Iron Bridge and Lake Fork Divisions		Based on a percentage of capacity usage rate.	When the combined storage in Lake Tawakoni and Lake Fork falls to and remains at or below 65% of full for two consecutive months.	When the combined storage in Lake Tawakoni and Lake Fork falls to and remains at or below 55% of full for two consecutive months.	When the combined storage in Lake Tawakoni and Lake Fork falls to and remains at or below 45% of full for two consecutive months.	When the combined storage in Lake Tawakoni and Lake Fork falls to and remains at or below 30% of full for two consecutive months.	When the combined storage in Lake Tawakoni and Lake Fork falls to and remains at or below 30% of full for six consecutive months.

Water-Supply Entity	Water Supply Source	Drought Trigger	Drought Stage and Response				
			Mild	Moderate	Severe	Critical	Emergency
Sabine River Authority - Iron Bridge and Lake Fork Divisions		Based on a percentage of capacity usage rate.	Reduce contract diversion amounts from temporary and short-term contracts. Notification of customers.	Reduce contract diversion amounts from temporary and short-term contracts. Reduced diversion amount to long-term contracts possible. Notification of customers.	Reduce contract diversion amounts from temporary and short-term contracts. Reduced diversion amount to long-term contracts possible. Notification of customers, media, and possible emergency meetings.	Reduce contract diversion amounts from temporary and short-term contracts. Reduced diversion amount to long-term contracts possible. Municipal customers requested to prohibit all outdoor water use and limit indoor use. Notification of customers, media, and possible emergency meetings.	Contract diversion amounts reduced to a rationed amounted determined monthly. All non-essential outdoor water use prohibited. Indoor water use minimized. Notification of customers, media, and possible emergency meetings.
			In the event of a major contamination of Lake Tawakoni and Lake Fork; or a failure or breakdown of a major component of the pumps or delivery system, SRA will notify its customers and the media, and prohibit all non-essential water use.				
Sabine River Authority - Toledo Bend and Gulf Coast Divisions		Based on percentage of capacity usage rate.	When the water surface elevation in Toledo Bend falls to and remains at or below 165.1 feet for 14 consecutive days or the flow on the Sabine River gage falls to and remains at or below the listed "mild" condition trigger.	When the water surface elevation in Toledo Bend falls to and remains at or below 162.2 feet for 14 consecutive days or the flow on the Sabine River gage falls to and remains at or below the listed "moderate" condition trigger.	When the water surface elevation in Toledo Bend falls to and remains at or below 156 feet for 14 consecutive days or the flow on the Sabine River gage falls to and remains at or below the listed "severe" condition trigger.	N/A	N/A
			Customers will be informed of the drought condition and asked to activate an appropiate system for answering citizen inquiries.	Customers will be informed of the drought condition. Curtailing of water delivery may occur. Customers may be asked to prohibit non-essential outdoor water use.	Customers and the media will be informed of the drought condition. An emergency meeting may be called to discuss operational changes. Curtailing of water delivery may occur. Customers may be asked to prohibit all outdoor water use and to activate applicable drought measures to reduce indoor uses.	N/A	N/A
			In the event of a major contamination or a major drawdown of Toledo Bend for emergency repairs; or a failure or breakdown of a major component of the pumps or delivery system, SRA will notify its customers and the media, and prohibit all non-essential water use.				
			Drought Stage and Response				

			Mild	Moderate	Severe	Critical	Emergency
Texarkana Water Utilities		Based on reservoir conditions, and ability to meet demand.	When one of the following conditions exist: Wright Patman Reservoir is 220.60 feet, water supply pump is out of service, or demand exceeds 18 million gallons per day.	When two of the following conditions exist: Wright Patman Reservoir is 220.60 feet. When water supply pumps is out of service. Demand exceeds 18 million gallons per day.	When three of the following conditions exist: Wright Patman Reservoir is 220.60 feet. When water supply pumps is out of service. Demand exceeds 18 million gallons per day.	N/A	When the utility is unable to produce or provide treated water from both plants at the same time.
			Encourage conservation	Reduce demand by 30%. Limit non-essential and landscape water use.	Reduce non-essential demand by 40% and total water demand by 30%. Prohibited outdoor water use. Curtail wholesale use.	N/A	Reduce demand to 8.65 MGD. Water use restricted to sanitary use only. Curtailing wholesale use.

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7.5 EXISTING AND POTENTIAL EMERGENCY INTERCONNECTS

According to Texas Statute §357.42(d),(e) regional water planning groups are to collect information on existing major water infrastructure facilities that may be used in the event of an emergency shortage of water. Pertinent information includes identifying the potential user(s) of the interconnect, the potential supplier(s), the estimated potential volume of supply that could be provided, and a general description of the facility. Texas Water Code §16.053(c) requires information regarding facility locations to remain confidential. This section provides general information regarding existing and potential emergency interconnects among water user groups within the North East Texas Region.

7.5.1 Existing Emergency Interconnects

Water infrastructure facilities within the North East Texas Region were identified through a survey process in order to better evaluate existing and potentially feasible emergency interconnects. The survey included major water infrastructure facilities like the City of Longview and the City of Marshall, along with smaller systems such as Karnack WSC. Of those surveyed, eight water supply systems have the ability to receive an emergency supply of water through an existing emergency interconnect. The City of Warren City described in the survey that the City has a contract with the City of Gladewater from whom they have purchased water from for many years. This contract could act as an emergency interconnect if necessary. In addition, the survey results for the City of White Oak indicated that the City's water system has three water line connections from the City of Longview which is connected directly into the water mains. These connections have the potential to operate as the City's emergency interconnects in an event of an emergency shortage of water. Table 7.2 presents the survey results for the existing emergency interconnects among water users and neighboring systems.

Table 7.2 Existing Emergency Interconnects to Major Water Facilities in the North East Texas Region

Entity *Providing* Supply	**Entity *Receiving* Supply**
City of Gladewater	City of Warren City
City of Winnsboro	Sharon Water Supply Corp.
Karnack WSC	Caddo Lake WSC
City of Longview	City of White Oak
	Gum Springs WSC #2
City of Lindale	Lindale Rural WSC
Gum Springs WSC #1	West Harrison WSC
City of Marshall	Talley WSC

7.5.2 Potential Emergency Interconnects

Responses to survey questions helped identify other potential emergency interconnects for various WUGs within the North East Texas Region. Table 7.3 presents a list of cities for those receiving and those supplying the potential emergency interconnects.

Table 7.3 Potential Emergency Interconnects to Major Water Facilities in the North East Texas Region

Entity *Providing* Supply	Entity *Receiving* Supply
City of Mt. Vernon	Cypress Springs SUD
Shady Grove WSC	Campbell WSC
Cypress Springs SUD	City of Winnsboro
City of Gladewater	City of Clarksville City
City of White Oak	
Fouke WSC	City of Big Sandy
Myrtle Springs WSC	Crooked Creek WSC
Jones WSC	City of Quitman
Fouke WSC	
City of Emory	City of Point
City of Kilgore	Liberty City WSC
Northeast Texas MWD	Diana SUD
City of Wills Point	South Tawakoni WSC

7.6 EMERGENCY RESPONSES TO LOCAL DROUGHT CONDITIONS OR LOSS OF MUNICIPAL SUPPLY

Texas Statute §357.42(g) requires regional water planning groups to evaluate potential temporary emergency water supplies for all County-Other WUGs and municipalities with 2010 populations less than 7,500 that rely on a sole source of water. The purpose of this evaluation is to identify potential alternative water sources that may be considered for temporary emergency use in the event that the existing water supply sources become temporarily unavailable due to extreme hydrologic conditions such as emergency water right curtailment, unanticipated loss of reservoir conservation storage, or other localized drought impacts. This section provides potential solutions that should act as a guide for municipal water users that are most vulnerable in the event of a loss of supply. This review was limited and did not require technical analyses or evaluations following in accordance with 31 TAC §357.34.

7.6.1 Emergency Responses to Local Drought Conditions

A survey was conducted to identify and evaluate the municipal water users that are most vulnerable in the event of an emergency water shortage. The analysis included all 'county-other' WUGs and rural cities with a population less than 7,500 and on a sole source of water. Table 7.4 presents temporary responses that may or may not require permanent infrastructure. It was assumed in the analysis that the entities listed would have approximately 180 days or less of remaining water supply.

Table 7.4 Emergency Responses to Local Drought Conditions in the North East Texas Region

Entity				Implementation Requirements									
County	Water User Group Name	TCEQ Service Connection (Count)	2020 Demand (AF/year)	Release from upstream reservoir	Curtailment of upstream/downstream water rights	Local groundwater wells	Brackish groundwater limited treatment	Brackish groundwater desalination	Potential Emergency interconnect	Trucked - in water	Type of infrastructure required	Entity providing supply	Emergency agreements already in place
Camp	City of Pittsburg	2,082	831	▪	▪	▪	▪			▪			
Cass	City of Hughes Springs	1,279	201	▪	▪	▪				▪			
Franklin	City of Mount Vernon	1,222	548			▪				▪			
Franklin	Cypress Springs SUD	4,505	383		▪	▪			▪	▪	piping & meters	City of Mt. Vernon	
Gregg	City of Clarksville City	331	101			▪	▪		▪	▪	-	City of Gladewater	
Gregg	City of Gladewater	3,065	732		▪	▪	▪			▪	well & equip.	City of Warren City	▪
Gregg	City of White Oak	2,991	1,371		▪	▪	▪			▪		City of Longview	▪
Gregg	Liberty City WSC	1,646	504			▪			▪	▪		City of Kilgore	
Gregg	Tryon Road SUD	2,335	648	▪	▪	▪	▪			▪			
Harrison	City of Hallsville	1,400	523		▪	▪				▪			
Harrison	Gum Springs WSC #1	872	183		▪	▪				▪			

Entity				Implementation Requirements									
Harrison	Gum Springs WSC #2	2,182	496		▪	▪				▪		City of Longview	▪
Hopkins	North Hopkins WSC	2,385	462		▪	▪	▪			▪	well & equip.		
Hunt	Campbell WSC	494	49			▪	▪		▪	▪	1 mile of pipeline	Shady Grove WSC	
Rains	City of Point	967	220		▪	▪			▪	▪	well & equip.	City of Emory	
Smith	City of Lindale	2,486	913			▪				▪			
Smith	Crystal Systems	1,986	616			▪				▪			
Smith	Lindale Rural WSC	4,105	429			▪				▪		City of Lindale	▪
Upshur	City of Big Sandy	720	223			▪	▪		▪	▪	piping & meters	Fouke WSC	
Upshur	Diana SUD	1,950	423	▪	▪	▪			▪	▪	piping	Northeast Texas MUD	
Wood	Bright Star-Salem SUD	1,957	126			▪				▪			
Wood	City of Quitman	1,214	300		▪	▪			▪	▪	well & equip.	Jones WSC and/or Fouke WSC	
Wood	City of Winnsboro	1,766	211		▪	▪	▪		▪	▪	well & equip.	Shady Grove WSC	
Wood	Sharon WSC	2,671	98			▪	▪		▪	▪	piping & valves	City of Winnsboro	▪
Van Zandt	South Tawakoni WSC	1,439	400		▪				▪	▪		City of Wills Point	
COUNTY-OTHER													
Gregg	City of Warren City	126	-		▪	▪	▪			▪	existing infrastructure	City of Gladewater	▪
Harrison	Caddo Lake WSC	400	-	▪		▪				▪		Karnack WSC	▪
Harrison	Talley WSC	555	-	▪	▪	▪				▪	piping & valves	City of Marshall	▪
Harrison	North Harrison WSC	497	-	▪	▪	▪			▪	▪	piping, meters & valves	Leign WSC	
Harrison	West Harrison WSC	694	-	▪	▪	▪				▪		Gum Springs WSC #1	▪
Smith	East Texas MUD	-	-		▪	▪	▪			▪	well & equip.		
Smith	Star Mountain WSC	558	-		▪	▪	▪			▪	well & equip.		
Van Zandt	Crooked Creek WSC	296	-		▪	▪			▪	▪	piping, meters & valves	Myrtle Springs WSC	
Wood	South Rains WSC	949	-	▪	▪	▪			▪	▪		Bright Star-Salem WSC	
Wood	Yantis Water	-	-		▪	▪			▪	▪		Fork Lake/Reservoir	

7.6.2 Releases from Upstream Reservoirs and Curtailment of Rights

In times of drought and limited supply, the most 'junior' right holder must be the first to discontinue use, under Texas' "prior appropriations system". This temporary source of supply was evaluated as a feasible option during an emergency shortage of water. Of the 35 entities listed on Table 7.4, 24 municipalities might have the option of implementing curtailment of water rights. In addition, release from upstream reservoirs was also evaluated. Table 7.4 presents nine entities where this approach might be feasible.

7.6.3 Brackish Groundwater

Brackish groundwater was evaluated as a temporary source during an emergency water shortage. Some brackish groundwater is found in certain places in the Carrizo-Wilcox Aquifer, but other brackish groundwater supplies can be obtained from the Nacatoch and Queen City aquifers in the North East Texas Region.

Required infrastructure would include additional groundwater wells, potential treatment facilities and conveyance facilities. Brackish groundwater at lower TDS concentrations may require only limited treatment. Of the entities listed in Table 7.4 thirteen will be able to potentially use brackish groundwater as a feasible solution to an emergency local drought condition.

7.6.4 Drill Additional Local Groundwater Wells and Trucking in Water

In the event that the existing water supply sources become temporarily unavailable, drilling additional groundwater wells and trucking in water are optimal solutions. Table 7.4 presents this option as viable for all entities listed.

7.6.5 TCEQ Emergency Funds for Groundwater Supply Wells

In order to qualify for emergency funds that are earmarked for emergency groundwater supply wells, entities must have a drought plan in place and be currently listed as an entity that is limiting water use to avoid shortages. This list is updated weekly by the TCEQ's Drinking Water Technical Review and Oversight Team and can be found at: https://www.tceq.texas.gov/drinkingwater/trot/droughtw.html.

Forty-one entities within the North East Texas Region planning area were identified by the TCEQ as Drought Affected Public Water Systems (PWS) list as of March 2015. The list is presented as Table C7_1 in Chapter 7 of Appendix C.

There is some assistance available through the Texas Department of Agriculture and the Texas Water Development Board. There are requirements, deadlines, and a specific application process. Contact the TWDB by e-mail, <Financial_Assistance@twdb.texas.gov>, or call 512-463-7853. Contact the Texas Department of Agriculture, Community Development Block Grants, or call 512-936-7891. Funding is limited.

7.6.6 Other TCEQ Guidance Resources

- Emergency and Temporary Use of Wells for Public Water Supplies (RG-485) https://www.tceq.texas.gov/publications/rg/rg-485.html

- Questions from the TCEQ's Workshops on Drought Emergency Planning: Answers to Help Drinking-Water Systems Prepare for Emergencies https://www.tceq.texas.gov/assets/public/response/drought/workshop-questions071312.pdf

- Video: Workshop on Drought Emergency Planning for PWSs in Texas http://www.youtube.com/watch?v=BdlF9CEcGPI&feature=plcp&context=C34378a7UDOEgsToPDskJNYWXf5I3pKq8tW9pkVqQU

7.7 REGION-SPECIFIC MODEL DROUGHT CONTINGENCY PLAN

As mandated by TAC 357.42(c)&(i), the RWPGs shall develop drought response recommendations regarding the management of existing groundwater and surface water sources in the RWPA designated in accordance with §357.32. The RWPGs shall make drought preparation and response recommendations regarding the development of, content contained within, and implementation of local drought contingency plans. The RWPGs shall develop region-specific model drought contingency plans that shall be presented in the RWP which shall be consistent with 30 TAC Chapter 288 requirements.

A new component of the RWP introduced for this planning cycle is Regional Drought Planning, which essentially expands the conceptualization and application of drought planning by specific entities to encompass the entire North East Texas Region. The approach utilized in developing a region-specific drought plan will consider the following:

1) all regional groundwater and surface water sources;
2) current drought plans that are being utilized by user entities within the region; and
3) current monitoring stations within the region that have evolved since the previous planning cycle.

The goals of this approach are:

1) to gain a comprehensive view of what particular resources are being monitored by entities within the region;
2) determine which resources are not being monitored;
3) determine which users do not fall under the umbrella of existing DCPs,
4) identify potential monitoring stations with publicly accessible real-time data that currently exist;
5) determine how these data can be utilized for the water user groups that are not subject to existing DCPs; and
6) development of a regional model drought contingency plan.

As discussed in Section 7.4, several WUGs and various public supply systems have written drought management plans or drought contingency plans and have provided them for inclusion in the Regional Plan.

Drought triggers based on groundwater elevations are not utilized in Region D. Additionally, there is only one- real-time monitoring well on TWDB's Water Data for Texas website. As a result, it is recommended that the NETRWPG use the USDM to trigger drought stages. A summary of drought severity classification used by the USDM is shown in Table 7.5. Drought triggers for surface water are usually related to reservoir levels. A summary of reservoir triggers and actions are included in Table 7.1 and Table 7.6.

Table 7.5 USDM Drought Severity Classification

Category	Description	Possible Impacts	Palmer Drought Index	USGS Weekly Streamflow (Percentiles)
D0	Abnormally Dry	Going into drought: short-term dryness slow ing planting, grow th of crops or pastures. Coming out of drought: some lingering w ater deficits; pastures or crops not fully recovered	-1.0 to -1.9	21-30
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or w ells low, some w ater shortages developing or imminent; voluntary w ater-use restrictions requested	-2.0 to -2.9	11-20
D2	Severe Drought	Crop or pasture losses likely; w ater shortages common; w ater restrictions imposed	-3.0 to -3.9	6-10
D3	Extreme Drought	Major crop/pasture losses; w idespread w ater shortages or restrictions	-4.0 to -4.9	3-5
D4	Exceptional Drought	Exceptional and w idespread crop/pasture losses; shortages of w ater in reservoirs, streams, and w ells creating w ater emergencies	-5.0 or less	0-2

Source: http://droughtmonitor.unl.edu/AboutUs/ClassificationScheme.aspx

7.8 REGIONAL MODEL DROUGHT CONTINGENCY PLAN

The Regional Model DCP summary table (Table 7.6) provides an overview of all existing regional water sources, WUGs, monitoring wells, gaging stations as well as recommended drought triggers and actions. The intent of including the monitoring wells and stations is to provide a comprehensive region-wide assessment of what current tools are available to WUGs and districts to monitor resources within the North East Texas region.

A Regional Model DCP is included in Chapter 7 of Appendix C. The Regional Model DCP will undoubtedly change over time in order to address particular needs and issues of the Region's users. Therefore, this initial version of the model plan will primarily focus on identifying sources, users and monitoring tools in order to find the particular components within the Region that are not currently incorporated into any existing drought plan but could potentially utilize existing data resources.

Another focus of this first model plan will consider consistency of existing plans within the Region. Entities that have adopted drought plans will only be assessed to this end; therefore, fine tuning existing triggers of existing municipal drought plans is not a goal of the model plan, beyond an effort toward achieving consistent responses/actions to drought across the Region.

Table 7.6 Recommended Regional Drought Plan Triggers and Actions

Source Name	Type (SW/GW)	Factor considered	TRIGGERS						ACTIONS					
			Source Manager			Users			Source Manager			Users		
			Mild	Severe	Critical/ Emergency	Mild	Severe	Critical/ Emergency	Mild	Severe	Critical/ Emergency	Mild	Severe	Critical/ Emergency
Fork	SW	Supply capacity	65% combined storage	45% combined storage	duration <30% combined storage	varies by user; see Table 7.1	varies by user; see Table 7.1	varies by user; see Table 7.1	Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Tawakoni	SW								Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Cypress Springs	SW	Supply capacity, demand	demand % of capacity; lake water level declines at disruptive rate			unknown			Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Bob Sandlin	SW													
Jim Chapman	SW	Supply capacity, demand	lake less than 50% capacity; >48 hours x% pumping capacity		loss of capacity, line breaks	voluntary	halt non-essential use	mandatory restrictions	Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Monticello	SW	unknown	unknown			unknown			Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Lake O' the Pines	SW	unknown	unknown			unknown			Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Caddo	SW	unknown	unknown			unknown			Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Crook	SW	Supply capacity	70% combined storage	50% combined storage	40% combined storage	70% combined storage	50% combined storage	40% combined storage	Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Pat Mayse	SW													
Sulphur Springs	SW	unknown	unknown			unknown			Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Wright Patman	SW	unknown	unknown			unknown			Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Cypress River	SW	Drought Monitor	D1 (Moderate)	D2 (Severe)	D4 (Critical)	D1 (Moderate)	D2 (Severe)	D4 (Critical)	Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Sabine River	SSW	Drought Monitor	D1 (Moderate)	D2 (Severe)	D4 (Critical)	D1 (Moderate)	D2 (Severe)	D4 (Critical)	Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Sulphur River	SW	Drought Monitor	D1 (Moderate)	D2 (Severe)	D4 (Critical)	D1 (Moderate)	D2 (Severe)	D4 (Critical)	Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Blosson Aquifer	GW	Drought Monitor	D1 (Moderate)	D2 (Severe)	D4 (Critical)	D1 (Moderate)	D2 (Severe)	D4 (Critical)	Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Carrizo-Wilcox Aquifer	GW	Drought Monitor	D1 (Moderate)	D2 (Severe)	D4 (Critical)	D1 (Moderate)	D2 (Severe)	D4 (Critical)	Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Nacatoch Aquifer	GW	Drought Monitor	D1 (Moderate)	D2 (Severe)	D4 (Critical)	D1 (Moderate)	D2 (Severe)	D4 (Critical)	Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Queen City Aquifer	GW	Drought Monitor	D1 (Moderate)	D2 (Severe)	D4 (Critical)	D1 (Moderate)	D2 (Severe)	D4 (Critical)	Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Trinity Aquifer	GW	Drought Monitor	D1 (Moderate)	D2 (Severe)	D4 (Critical)	D1 (Moderate)	D2 (Severe)	D4 (Critical)	Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Woodbine Aquifer	GW	Drought Monitor	D1 (Moderate)	D2 (Severe)	D4 (Critical)	D1 (Moderate)	D2 (Severe)	D4 (Critical)	Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	
Other Aquifer	GW	Drought Monitor	D1 (Moderate)	D2 (Severe)	D4 (Critical)	D1 (Moderate)	D2 (Severe)	D4 (Critical)	Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies		Invoke needed actions from DCP	Invoke needed actions from DCP, evaluate other/emergency supplies	

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7.9 WUG SPECIFIC MODEL DROUGHT CONTINGENCY PLANS

7.9.1 Public Water Supplier

Drought contingency plans have previously been adopted by the majority of public suppliers and municipalities in the North East Texas Region, although some suppliers did not provide any adopted plans. Current triggers and response actions for participating entities are summarized in Table 7-1. Recommended changes to existing response actions are detailed in Table 7.6.

7.9.2 Irrigation

Irrigation wells located within a municipality are subject to the triggers and response actions designated by the city's drought plan. Non-exempt irrigation wells located outside of a municipality but within a GCD would be subject to the triggers and response actions of a GCD. Exempt irrigation wells located within a GCD are requested to comply voluntarily with response actions that have been mandated for non-exempt well owners.

7.9.3 Wholesale Water Provider

Wholesale water providers in the North East Texas Region are listed in Table 7.7. Their Drought Contingency Plan, if submitted, is summarized in Table 7.1. Generally, triggers are based upon both reservoir capacities falling below a designated elevation or capacity, and when user demand exceeds a designated percent capacity of the supply system.

Table 7.7 Wholesale Water Providers within the North East Texas Region

Name	Entity Type	Wholesale Customers
CASH SUD	WUG/WWP	Aqua Texas, Inc. City of Quinlan, City of Lone Oak
CHEROKEE WATER COMPANY	WWP	City of Longview, Southwestern Electric Power Company (SWEPCO)
COMMERCE WD	WWP	Gafford Chapel WSC, Maloy WSC, Manufacturing - Hunt County - Sulphur Basin North Hunt WSC, West Delta WSC, Texas A&M University
EMORY	WUG/WWP	City of East Tawakoni, City of South Rains WSC
FRANKLIN COUNTY WD	WWP	Cypress Springs SUD, City of Winnsboro, City of Mt. Vernon, City of Mt. Pleasant
GREENVILLE	WUG/WWP	City of Caddo Mills, Jacobia WSC, Shady Grove WSC, Manufacturing, Mining
LAMAR COUNTY WSD	WUG/WWP	410 WSC, City of Blossom, City of Deport, City of Detroit, Manufacturing, Pattonville WSC, Red River County WSC, City of Reno, City of Roxton, City of Toco
LONGVIEW	WUG/WWP	Elderville WSC, Gum Springs WSC, City of Hallsville, City of White Oak, City of (raw water)
MARSHALL	WUG/WWP	Cypress Valley WSC, Gill WSC, Leigh WSC, Talley WSC

Name	Entity Type	Wholesale Customers
MOUNT PLEASANT	WUG/WWP	Tri Water SUD, Lake Bob Sandlin State Park, Manufacturing, City of Winfield
NORTHEAST TEXAS MWD	WWP	Avinger, City of Daingerfield, City of Diana SUD Harleton WSC Hughes Springs, City of Jefferson, City of Lone Star, City of Lone Star Steel Longview, City of Luminant Marshall, City of Mims WSC Ore City, City of Pittsburg , City of SWEPCO Tyron Road SUD
PARIS	WUG/WWP	Lamar County WSD, Manufacturing, MJC WSC, Steam Electric
SULPHUR RIVER MWD	WWP	City of Commerce, City of Sulphur Springs, City of Cooper
SULPHUR SPRINGS	WUG/WWP	Brashear WSC, Brinker WSC, Gafford Chapel WSC, Marting Springs WSC, Livestock, North Hopkins WSC, Pleasant Hill WSC, Shady Grove WSC #2, Manufacturing
TEXARKANA	WUG/WWP	City of Annona, City of Atlanta, City of Avery, City of Central Bowie WSC, City of DeKalb, City of Domino, City of Hooks, Macedonia Eylau MUD, Manufacturing - Cass County, Federal Correctional Institution, Manufacturing - Bowie County, City of Maud, City of Nash, City of New Boston, City of Oak Grove WSC, City of Queen City, Red River Water Corp., CIty of Redwater, City of Wake Village
TITUS COUNTY FWD #1	WWP	City of Mt. Pleasant, Luminant
SABINE RIVER AUTHORITY	WWP	Ables Springs WSC, Cash SUD, Combined Consumers SUD, City of Commerce, Eastman Chemicals, City of Edgewood, City of Emory, City of Greenville, City of Henderson, City of Bright Star-Salem, CIty of Kilgore, City of Longivew, Mac Bee SUD, City of Point, City of Quitman, Release from TXU, South Tawakoni WSC, West Tawakoni, City of Wills Point

7.10 DROUGHT MANAGEMENT WATER MANAGEMENT STRATEGIES

31 TAC 357.42(f) states that RWPGs may designate recommended and alternative drought management water management strategies and other recommended drought measures in the RWP. The list of recommended drought strategies and alternative drought strategies must include the associated WUG/ WWP and the triggers that would initiate the strategy. Potentially feasible drought strategies that were considered but not recommended must also be listed, as well as any other recommended measures included the RWP, including any applicable triggers.

The TWDB has required the consideration of a general methodology for estimating economic impacts associated with implementation of drought management as a water management strategy. Water user groups may have some flexibility to focus on discretionary outdoor water use first to reduce water use. Commercial and manufacturing use sectors may find some degrees of drought management to be economically viable and cost-competitive with other water management strategies.

The NETRWPG does not support the provision of drought management measures as a WMS in the 2016 RWP. Drought management measures vary within the Region, and are temporary strategies intended to conserve supply and reduce impacts during drought and emergency times, and are not implemented in the Region to address long-term demands. Little to no firm supply (i.e., yield) is gained from the implementation of these measures, given their application during such specific times, particularly when considered alongside more typical WMS in the planning process. Also, the use of such measures, and their efficacy, varies greatly between entities within the North East Texas Region, creating additional uncertainty.

Although not included as a specific WMS herein, drought management is nevertheless an important component of water supply management. The NETRWPG supports implementation of DCPs under appropriate conditions by water providers in order to enhance the availability of limited supplies during emergency and drought conditions, and reduce impacts to water users and local economies. Recognizing that implementation of appropriate water management strategies is a matter of local choice, the NETRWPG supports consideration of economically viable drought management approaches as an interim strategy to meet near-term needs through demand reduction until such time as economically viable long-term water supplies can be developed. Hence, new demand reductions associated with selected 5-, 10-, and 20- percent drought management scenarios are shown at year 2020 for each municipal water user group with projected needs for additional water supply at year 2020 and where historic usage data are available. At the 5% demand reduction level, a total demand reduction of 154 acft/yr in 2020 was calculated for seven (7) WUGs at an average unit cost of $5,859/acft/yr. The results of this quantitative analysis, based upon the TWDB Unified Costing Model and historic gpcpd amounts, are presented in Table 7.8 below.

Table 7.8 Drought Management Strategy Evaluation Summary

WUG	COUNTY	BASIN	Drought Management Supply 5%	Drought Management Supply 10%	Drought Management Supply 20%	Risk Factors 5%	Risk Factors 10%	Risk Factors 20%
CROSS ROADS SUD	GREGG	SABINE	2	3	6	2.1783	2.2183	2.2983
CRYSTAL SYSTEMS INC	SMITH	SABINE	31	62	123	0.0013	0.0051	0.0202
LINDALE	SMITH	SABINE	46	91	183	0.0125	0.0214	0.0453
NEW BOSTON	BOWIE	SULPHUR	39	78	155	0.0772	0.1134	0.2007
NEW BOSTON	BOWIE	RED	16	32	65	0.0772	0.1134	0.2007
OVERTON	SMITH	SABINE	1	2	3	0.1297	0.1697	0.2497
ROYSE CITY	HUNT	SABINE	2	4	9	0.0012	0.0047	0.0216
WASKOM	HARRISON	CYPRESS	17	35	69	0.0718	0.1053	0.195

WUG	COUNTY	BASIN	Total Cost ($) 5%	Total Cost ($) 10%	Total Cost ($) 20%	Average Unit Cost ($/acft/yr) 5%	Average Unit Cost ($/acft/yr) 10%	Average Unit Cost ($/acft/yr) 20%
CROSS ROADS SUD	GREGG	SABINE	$ 62,124	$ 70,829	$ 91,907	$ 40,080	$ 22,848	$ 14,824
CRYSTAL SYSTEMS INC	SMITH	SABINE	$ 717	$ 3,209	$ 16,075	$ 23	$ 52	$ 130
LINDALE	SMITH	SABINE	$ 9,255	$ 18,180	$ 55,520	$ 203	$ 199	$ 304
NEW BOSTON	BOWIE	SULPHUR	$ 55,030	$ 90,509	$ 200,647	$ 1,420	$ 1,168	$ 1,294
NEW BOSTON	BOWIE	RED	$ 22,935	$ 37,722	$ 83,625	$ 1,420	$ 1,168	$ 1,294
OVERTON	SMITH	SABINE	$ 2,028	$ 2,971	$ 5,476	$ 2,386	$ 1,748	$ 1,610
ROYSE CITY	HUNT	SABINE	$ 46	$ 206	$ 1,196	$ 21	$ 48	$ 139
WASKOM	HARRISON	CYPRESS	$ 22,803	$ 37,406	$ 86,786	$ 1,322	$ 1,084	$ 1,258

7.11 OTHER DROUGHT RECOMMENDATIONS

31 TAC 357.42(h)&(i) state that RWPGs shall consider any relevant recommendations from the Drought Preparedness Council. Additionally, RWPGs shall make drought preparation and response recommendations regarding: development of, content contained within, and implementation of local drought contingency plans required by the Commission; current drought management preparations in the RWPA including (drought response triggers, responses to drought conditions); The Drought Preparedness Council and the State Drought Preparedness Plan; and any other general recommendations regarding drought management in the Region or State.

7.11.1 Texas Drought Preparedness Council

The Drought Preparedness Council was authorized and established by the 76th legislature (HB- 2660) in 1999, subsequent to the establishment of the Drought Monitoring and Response Committee (75th legislature, SB-1). The Council is described in Chapter 16, Section 2, Subchapter C of the Texas Water Code, and was created to carry out the provisions of Sections 16.055 and 16.0551 of the Code. The drought preparedness council is responsible for:

1. the assessment and public reporting of drought monitoring and water supply conditions;
2. advising the governor on significant drought conditions;
3. recommending specific provisions for a defined state response to drought related disasters for inclusion in the state emergency management plan and the state water plan;
4. advising the regional water planning groups on drought-related issues in the regional water plans;
5. ensuring effective coordination among state, local, and federal agencies in drought-response planning; and
6. reporting to the legislature, not later than January 15 of each odd-numbered year, regarding significant drought conditions in the state.

The Drought Preparedness Council has a significant role in Texas with regard to drought monitoring, advising the governor and other groups, and coordinating amongst state and federal agencies. The Council has produced the State Drought Preparedness Plan, establishing a framework for approaching drought in Texas that attempts to minimize the impacts of drought on people and resources.

Per the recommendations of the Texas Drought Preparedness Council provided to the NETRWPG in a November 10, 2014 letter, the NETRWPG, portions of this chapter have been formulated consistent with the outline template for Chapter 7 provided by the TWDB. Considerations with regard to drought management have been proffered herein as a means of addressing unanticipated population growth and/or industrial growth within the region over the planning horizon, as recommended by the Texas Drought Preparedness Council. Additionally, water supplies developed for the 2016 Region D Plan have been based upon firm yield/100% reliability of existing supply, thus accounting for significant drought conditions experienced historically by North East Texas. Availability determinations have been based upon full utilization of existing, permitted water rights, while demand projections have been based upon per capita usage amounts from the year 2011, a period of significant drought in the region. Each of these factors allow a margin of safety when considering risks associated with droughts more significant in the drought of record.

The NETRWPG supports the Texas Drought Preparedness Council, and recommends that water providers and others regularly review the Council's Situation Reports as part of their drought monitoring efforts. These reports can be found at:

https://www.txdps.state.tx.us/dem/CouncilsCommittees/droughtCouncil/stateDroughtPrepCouncil.htm

7.11.2 Development and Implementation of DCPs

The NETRWPG recognizes that DCPs developed by water providers within the North East Texas Region planning area are the best available approach for drought management, and makes the following recommendations:

- In addition to monitoring procedures within the DCP, consider regular monitoring of information from TCEQ, TWDB, the Texas Drought Preparedness Council, and the U.S. Drought Monitor.
- Coordination with water providers regarding the identification of drought conditions and implementation of the DCP, particularly during times of drought.
- Communication with water customers during times of drought to ensure adequate implementation of drought management measures.
- Regular consideration of updating the DCP to reflect recent changes in the status of demand, water sources, infrastructure, or service area.

CHAPTER 8 UNIQUE STREAM SEGMENTS, RESERVOIR SITES, AND LEGISLATIVE RECOMMENDATIONS

The Texas Administrative Code allows for the Regional Water Planning Groups (RWPG) to include legislative recommendations in the regional water plan with regard to legislative designation of ecologically unique river and streams segments, unique sites for reservoir construction, and legislative recommendations (31 TAC, Section 357.43). Regional water planning groups may include in the adopted regional water plans recommendations for all or parts of river and stream segments of unique ecological value located within the regional water planning area. The 77th Texas Legislature clarified that the designation of unique stream segments solely means that a state agency or political subdivision of the state may not finance the actual construction of a reservoir in a designated stream segment of unique ecological value. It does not affect the analysis to be made by the Planning Groups. The regional planning groups are also authorized to make recommendations of unique sites for reservoir construction and prepare specific legislative recommendations in these two areas. The North East Texas Regional Water Planning Group (NETRWPG) has elected to make comments in these two areas and in specific cases has elected to forward several recommendations to the legislature, which are presented in this chapter.

8.1 LEGISLATIVE DESIGNATION OF ECOLOGICALLY UNIQUE STREAM SEGMENTS

In the regional water planning process, the planning group is given the opportunity to make recommendations for designation of ecologically "unique stream segments." This process involves multiple steps with the NETRWPG, the Texas Parks and Wildlife Department (TPWD), the Texas Water Development Board (TWDB) and, ultimately, the Texas Legislature each having a role. TWDB rules (30 Texas Administrative Code 367.8) state:

> *"Regional water planning groups may include in adopted regional water plans recommendations for all or parts of river and stream segments of unique ecological value located within the RWPA by preparing a recommendation package consisting of a physical description giving the location of the stream segment, maps, and photographs of the stream segment and a site characterization of the stream segment documented by supporting literature and data."*

As stated above, the 77th Texas Legislature clarified that the designation of unique stream segments solely means that a state agency or political subdivision of the state may not finance the actual construction of a reservoir in a stream segment designated of unique ecological value.

TWDB rules provide that the planning group forward any recommendations regarding legislative designation of ecologically unique streams to the TPWD and include TPWD's written evaluation of such recommendations in the adopted regional water plan. The planning group's recommendation is then to be considered by the TWDB for inclusion in the state water plan. Finally, the Texas Legislature will consider any recommendations presented in the state water plan regarding designation of stream segments as ecologically unique.

8.2 CRITERIA FOR DESIGNATION OF ECOLOGICALLY UNIQUE STREAM SEGMENTS

TWDB rules (TAC 358.2) also specify the criteria that are to be applied in the evaluation of potentially ecologically unique river or stream segments. These are:

- **Biological Function:** Stream segments which display significant overall habitat value including both quantity and quality considering the degree of biodiversity, age, and uniqueness observed and including terrestrial, wetland, aquatic, or estuarine habitats;

- **Hydrologic Function:** Stream segments which are fringed by habitats that perform valuable hydrologic functions relating to water quality, flood attenuation, flow stabilization, or groundwater recharge and discharge;

- **Riparian Conservation Areas:** Stream segments which are fringed by significant areas in public ownership including state and federal refuges, wildlife management areas, preserves, parks, mitigation areas, or other areas held by governmental organizations for conservation purposes, or stream segments which are fringed by other areas managed for conservation purposes under a governmentally approved conservation plan;

- **High Water Quality/Exceptional Aquatic Life/High Aesthetic Value:** Stream segments and spring resources that are significant due to unique or critical habitats and exceptional aquatic life uses dependent on or associated with high water quality; or

- **Threatened or Endangered Species/Unique Communities:** Sites along stream where water development projects would have significant detrimental effects on state or federally listed threatened and endangered species; and sites along streams significant due to the presence of unique, exemplary, or unusually extensive natural communities.

8.3 CANDIDATE STREAM SEGMENTS

The TPWD prepared and published in May of 2000 a report entitled *Ecologically Significant River and Stream Segments of Region D, Regional Water Planning Area* which identified 14 stream segments within the region that meet one or more of the criteria for designation as ecologically unique. Those 14 segments are listed in Table 8.1 (The report actually listed 15 segments but the Quail Creek segment is in Region I). Figure 8.1 shows the location, in red line, of all 14 segments in Region D. Particulars of these river and stream segments may be found in either the TPWD report or the 2006 Region D Plan.

During the development of the 2011 Region D Plan, the NETRWPG received presentation of two additional stream segments for consideration as Unique Stream Segments. These are White Oak Creek in the Sulphur River Basin in Titus and Morris Counties and Pecan Bayou in the Red River Basin in Red River County. These two stream segments are shown in blue line in Figure 8.1 and in Figures 8.3, 8.4 and 8.5. They are also described in Table 8.2.

Table 8.1 TPWD Identified Ecologically Unique Stream Segments – Region D (North East Texas)

Big Cypress Bayou/Creek - From a point 7.6 miles downstream of SH 43 in Marion/Harrison County upstream to Ferrell's Bridge Dam in Marion County (TCEQ classified stream Segment 0402).

Big Cypress Creek - From a point 0.6 mile downstream of US 259 in Morris/Upshur County upstream to Fort Sherman Dam in Camp/Titus County (TCEQ classified stream segment 0404).

Black Cypress Creek - From the confluence with Black Cypress Bayou east of Avinger in south Cass County upstream to its headwaters located four miles northeast of Daingerfield in the eastern part of Morris County.

- Biological function - priority bottomland hardwood habitat displays significant overall habitat value (USFWS, 1985);
- High water quality/exceptional aquatic life/high aesthetic value - ecoregion stream; diverse benthic macroinvertebrate and fish communities (Bayer et al., 1992; Linam et al., 1999);
- Threatened or endangered species/unique communities - paddlefish (SOC/St.T) (Pitman, 1991).

Black Cypress Bayou - From the confluence with Big Cypress Bayou in south central Marion County upstream to the confluence of Black Cypress Creek east of Avinger in south Cass County.

- Biological function - priority bottomland hardwood habitat displays significant overall habitat value (USFWS, 1985);
- Threatened or endangered species/unique communities - paddlefish (SOC/St.T) (Pitman, 1991).

Frazier Creek - From the confluence with Jim Bayou in Marion County upstream to its headwaters located three miles north of Almira in west Cass County.

Glade Creek - From the confluence with the Sabine River in the northwestern corner of Gregg County near Gladewater upstream to its headwaters located about five miles southwest of Gilmer in Upshur County.

Little Cypress Bayou - From the confluence with Big Cypress Bayou in Harrison County to a point 0.6 mile upstream of FM 2088 in Wood County (TCEQ classified stream segment 0409).

Little Sandy Creek - From Lake Hawkins upstream to its headwaters in Wood County.

Pine Creek - From the confluence with the Red River in Red River County upstream to Crook Lake Dam in Lamar County.

Purtis Creek - From the Van Zandt/Henderson County line upstream to its headwaters in Van Zandt County.

Sabine River - From US 59 in south Harrison County upstream to Easton on the Rusk/Harrison County line (within TCEQ classified stream segment 0505).

Sabine River - From FM 14 in Wood/Smith County upstream to FM 1804 in Wood/Smith County (within TCEQ classified stream segment 0506).

Sanders Creek - From the confluence with the Red River in Lamar County upstream to the confluence of Spring Branch in Lamar County, excluding Pat Mayse Reservoir.

Sulphur River - From a point 0.9 miles downstream of Bassett Creek in Bowie/Cass County upstream to the IH 30 bridge in Bowie/Morris County.

Table 8.2 NETRWPG Ecologically Unique Stream Segments – Region D (North East Texas)

White Oak Creek – From just east of US 271 in western Titus County downstream to IH 30 in Western Morris County approximately 18 miles. The site, including bottomland forest, encompasses approximately 27,000 acres (Fig. 8.2). The entirety of the segment is within the White Oak Creek Wildlife Management Area.

- Biological Function - Extensive mature bottomland hardwood forest, Water oak-Willow oak association (*Quercus nigra-Q. phellos* G4S3) (U.S. Fish and Wildlife Service, 1985) Emergent wetland (PEM1), Shrub-Scrub wetland (PSS1), and Forested wetland (PFO1) (U.S. Fish and Wildlife Service, 2009) Intact natural hydrologic regime. No modification to stream. (U.S. Fish and Wildlife Service, 1985);

- Riparian conservation area - White Oak Creek Wildlife Management Area; and

- Threatened or endangered species/unique communities - Wintering area for bald eagle (U.S. Fish and Wildlife Service, 1985). High value habitat for migratory birds. (U.S. Fish and Wildlife Service, 1985).

Pecan Bayou – This Red River Basin Stream extends from two miles south of Woodland in northwestern Red River County east to the Red River approximately one mile west of the eastern Bowie County line (Texas Historical Association, 2009). The site, including bottomland forest, encompasses approximately 958 sq. mi. (Fig. 8.3 & Fig. 8.4). It represents one of the largest undammed watersheds in northeast Texas; and supports multiple large examples of mature bottomland hardwood forest, and rare and endangered species (Zwartjes, et al, 2000).

- Biological function - Extensive bottomland hardwood forest supporting multiple occurrences of rare plant life, including:
    - Arkansas meadowrue (*Thalictrum arkansanum* G2QS1) (Sanders, 1994);
    - Southern lady's slipper orchid (*Cypripedium kentuckiense* G3S1) (Sanders, 1994);
    - Old growth Shortleaf Pine-Oak forest (*Pinus echinata-Quercus sp*. G4S4) (Sanders, 1994); and

    - Water oak-Willow oak association (*Quercus nigra-Q. phellos* G4S3) (Sanders, 1994).

- Hydrologic function - Represents one of the largest undammed watersheds in northeast Texas, natural hydrologic regime is assumed intact. Flood attenuation, flow stabilization and impacts on groundwater recharge have not been quantified.

- Riparian conservation areas - No public conservation areas however significant private conservation area (Fig. 8.4) The Nature conservancy, Texas Chapter owns 1334 acres within a 6,960 acre site protecting examples of the preceding conservation elements although they are extensive within the watershed. The preserve, Lennox Woods, is located approximately 1.5 miles south of the community of Negley. The land protects approximately 2.6 miles of Pecan Bayou.

- High water quality/exceptional aquatic life - Insufficient data

- Threatened and endangered species/unique communities -
    - American Burying Beetle (*Nicrophorus americanus* G2 Federally listed Endangered) (Godwin, 2005);
    - Black Bear (Ursus americanus G5 State Threatened, ssp. luteolus Federally listed Threatened) (Garner, personal communication, 2007); and
    - Timber Rattlesnake (*Crotalus horridus* G4 State Threatened).

8.4 CONFLICTS WITH WATER MANAGEMENT STRATEGIES

As a part of the planning effort, the TPWD candidate streams from the TPWD report and the current suggestions were compared to reservoir sites which have been suggested previously in the region. Further, the candidate streams which border on other regions were compared against the recommendations of that region.

The following TPWD suggested segments conflict with the proposed location of Black Cypress Reservoir or the Caddo Lake enlargement. Neither of these projects was supported by the RWPG in previous rounds of planning:

Black Cypress Creek (Cass County)
Black Cypress Bayou (Marion County)
Big Cypress Bayou/Creek (Marion County)

The following TPWD suggested segments are contiguous with Region C or I:

Purtis Creek (Region C) (Van Zandt County)

The following TPWD suggested segments do not appear to conflict with Region D recommended water management strategies provided the stated conditions are met:

Sanders Creek (Lamar County) provided there is no interference with the operation or maintenance of Pat Mayse Reservoir.

Pine Creek (Lamar County) provided that there is no interference with the operation and maintenance of Lake Crook, or the City of Paris wastewater treatment plant.

Big Cypress Bayou/Creek (Marion County) provided that there is no interference with the operation and maintenance of Lake O' the Pines.

Glade Creek (Upshur County) provided there is no interference with the operation or maintenance of Lake Gladewater.

Big Cypress Creek (Titus, Morris, and Camp Counties) provided there is no interference with the operation and maintenance of Lake Bob Sandlin or Lake O' the Pines.

Pecan Bayou (Red River County) provided there are no interference with operation and maintenance of any local entities.

The following suggested segments have one or more conflicts with potential Region D reservoirs or other regional plans:

Sabine River from US 59 upstream to Easton (Harrison County). This segment includes the potential Carthage Reservoir site. Additionally, it abuts Region I, which has not designated it as a unique segment. A possible impact may exist on the operation or maintenance of Lake Cherokee.

Sabine River from FM 14 to FM 1804 (Wood/Smith Counties). This segment includes the potential Waters Bluff Reservoir site.

Little Cypress Creek/Bayou (Harrison, Upshur, Wood Counties). This segment includes the potential site of the Little Cypress Reservoir.

Sulphur River from a point 0.9 miles downstream of Bassett Creek upstream to the IH 30 bridge (Bowie, Morris, Cass Counties). This segment lies downstream of the proposed Marvin Nichols reservoir and upstream of existing Wright-Patman Reservoir. Designation of this segment could impact strategies which involve raising the level or changing the operations strategy in Wright Patman, and could impact the potential Marvin Nichols Reservoir.

White Oak Creek from US 271 east to IH 30 (Titus and Morris Counties). This segment lies upstream of the existing Wright-Patman Reservoir. Designation of this segment could impact strategies which involve raising the level or changing the operations strategy in Wright Patman, or other potential water management strategies located on White Oak Creek under consideration.

Pecan Bayou (Red River County). This segment extends from two miles south of Woodland in northwestern Red River County, east to the Red River approximately one mile west of the eastern Bowie County line. Designation of this segment could impact strategies including the potential Dimple Reservoir site, or other potential water management strategies located upstream of Pecan Bayou.

8.5 RECOMMENDATIONS FOR DESIGNATION OF ECOLOGICALLY UNIQUE STREAM SEGMENTS

The North East Texas Regional Planning Group does not recommend that any stream segment be unconditionally designated as Ecologically Unique in this region.

8.6 CONSIDERATIONS FOR ECOLOGICALLY UNIQUE STREAM SEGMENT RECOMMENDATIONS

After considering available information the NETRWPG elected not to recommend unconditionally that any stream segments from the TWDB report entitled *Ecologically Significant River and Stream Segments of Region D, Regional Water Planning Area*, nor did they recommend the White Oak Creek segment presented this planning session for ecologically unique status. Reasons for this decision include the following:

1. The Regional Water Planning Group believes that there exists a lack of clarity as to the effects of designation with respect to private property takings issues.

2. The Regional Water Planning Group does not wish to infringe upon the options of individual property owners to utilize stream segments adjacent to their property as they deem appropriate. For example, if reservoirs cannot be built in unique segments, will these become prime candidates for mitigation sites acquired by eminent domain?

3. Despite previous legislative clarification, there remains uncertainty as to the myriad ways in which the designation may ultimately be construed.

4. Where overlap occurs between unique stream candidates and water management strategies, sufficient information to express preference for one use to the exclusion of another is not available at this time.

5. The White Oak Creek segment could possibly be in the proposed inundated area should the level of Wright-Patman Reservoir be raised. At this time sufficient information is not available for a proper evaluation of the White Oak Creek segment.

The NETRWPG further elected to conditionally recommend to the Legislature that the Pecan Bayou stream segment in the Red River Basin and the Black Cypress Bayou and Black Cypress Creek in the Cypress Creek Basin be identified as an Ecologically Unique Stream Segments. It is believed that these three segments exhibit sufficient ecological features and meets the TWDB criteria for such designation. Because the consequences of such designation by the Legislature are not well understood, this recommendation is conditioned upon legislation providing for such designation to contain the following clarifying provisions:

1. A provision affirming that the only constraint that may result from the ecologically unique stream segment designation is that constraint described in the Texas Water Code,

Subsection 16.051(f), which prohibits a state agency or political subdivision of the state from financing the construction of a reservoir in a designated stream segment.

2. A provision stating that the constraint described in Subsection 16.051(f) Water Code does not apply to a weir, diversion, flood control, drainage, water supply, or recreation facility currently owned by a political subdivision.

3. A provision stating that this designation will not constrain the permitting, financing, construction, operation, maintenance, or replacement of any water management strategy recommended, or designated as an alternative, to meet projected needs for additional water supply in the 2016 Regional Water Plan for the North East Texas Water Planning Region.

4. A provision affirming that this designation is not related to the "wild and scenic" federal program or to any similar initiative that could result in "buffer zones," inadvertent takings, or overreaching regulation.

5. A provision stating that all affected landowners shall retain all existing private property rights.

6. A provision recognizing that the unique ecological value of the designated segment is due, in part, to the conscientious, voluntary stewardship of many landowners on the adjoining properties.

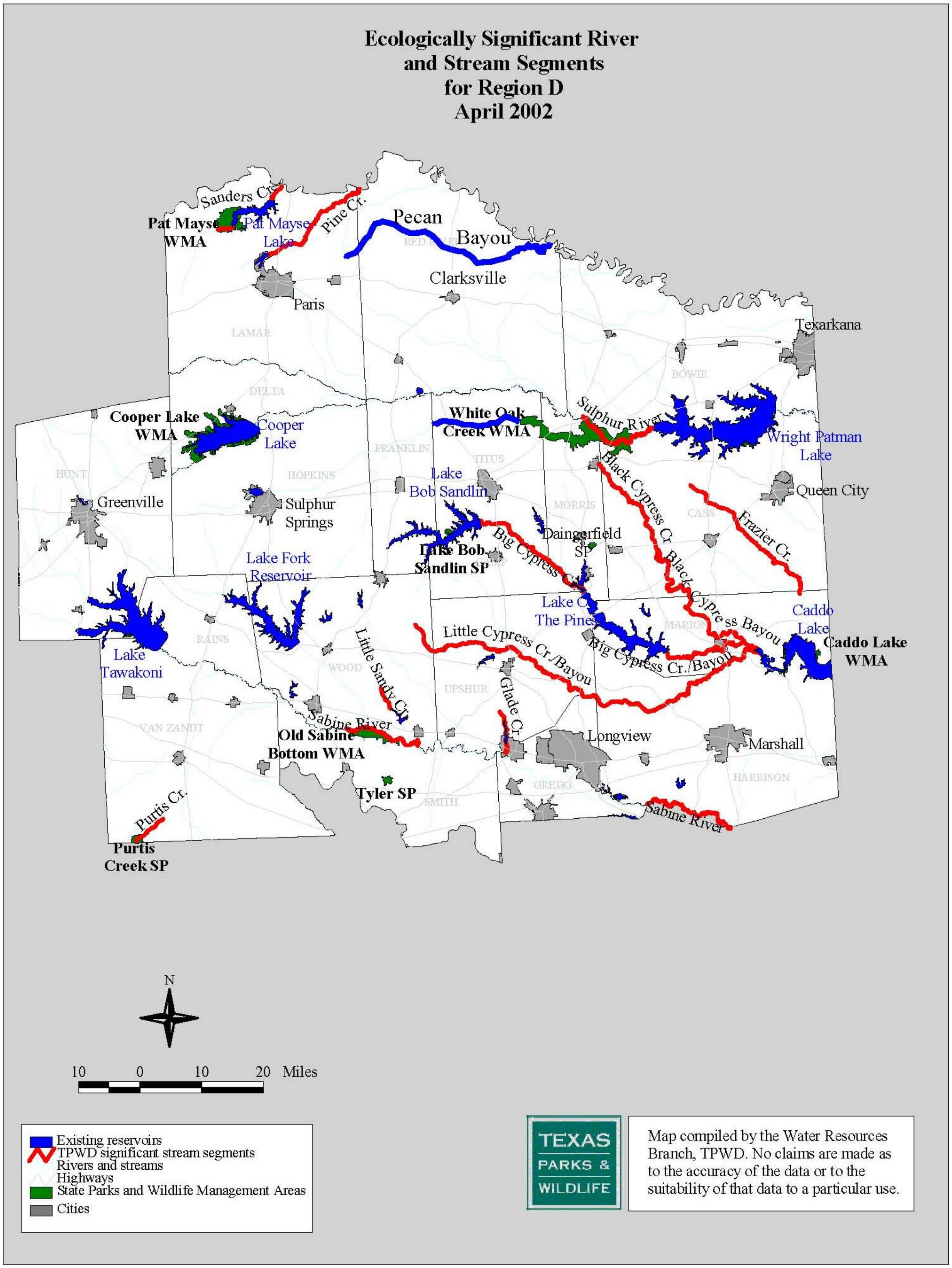

Figure 8.1 Ecologically Significant River and Stream Segments

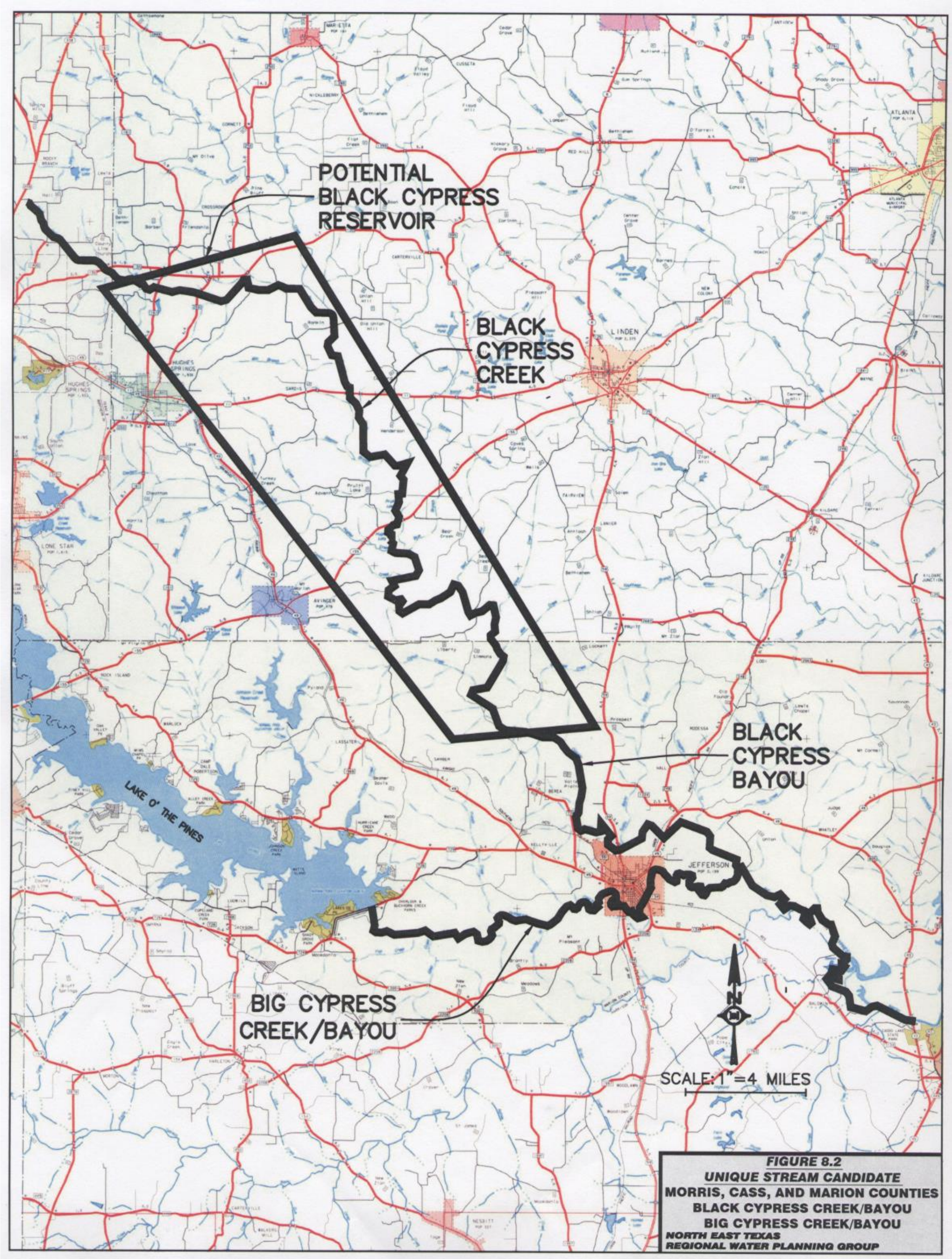

Figure 8.2 Black Cypress Creek/Black Cypress Bayou

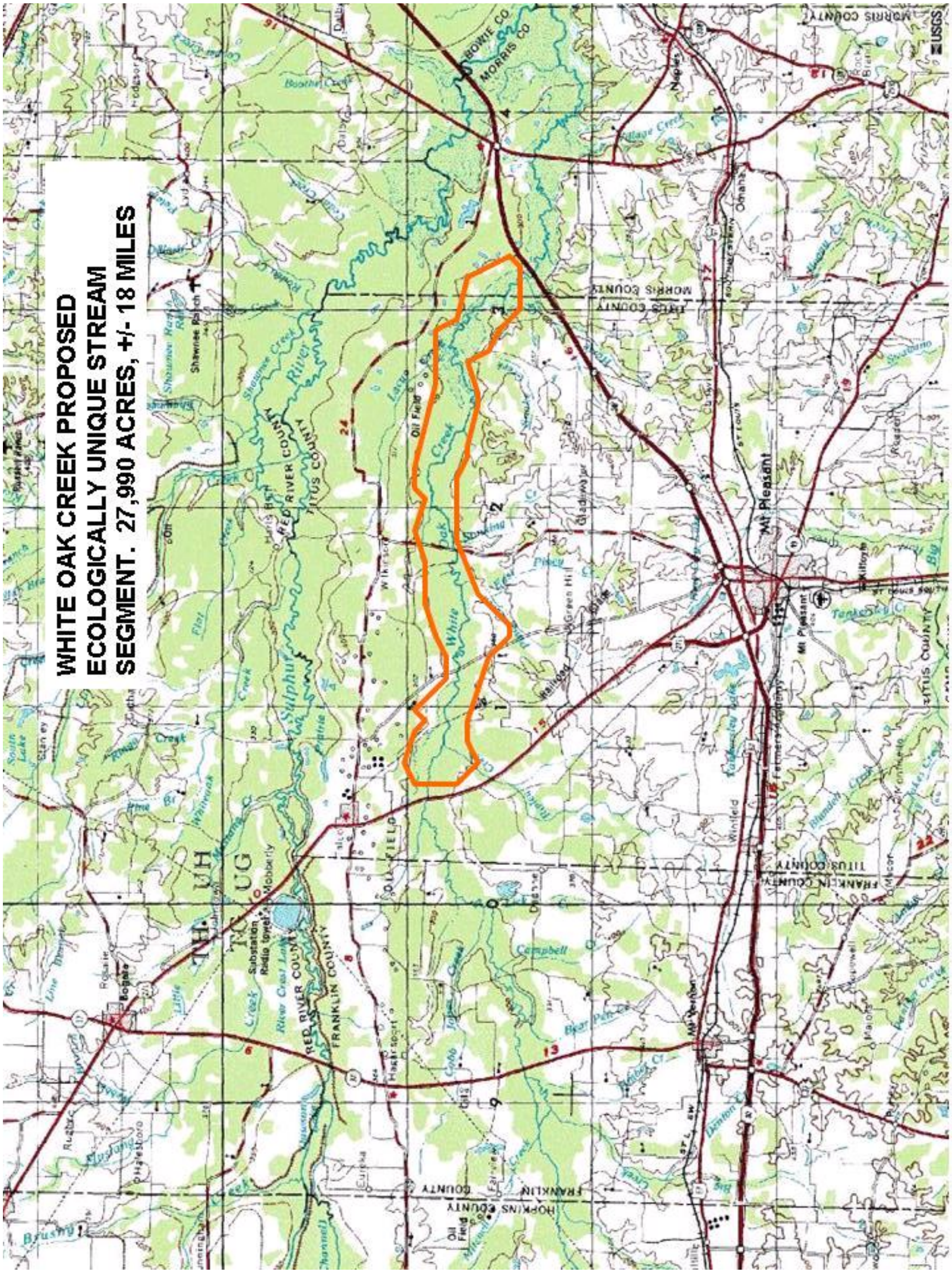

Figure 8.3 White Oak Creek Proposed

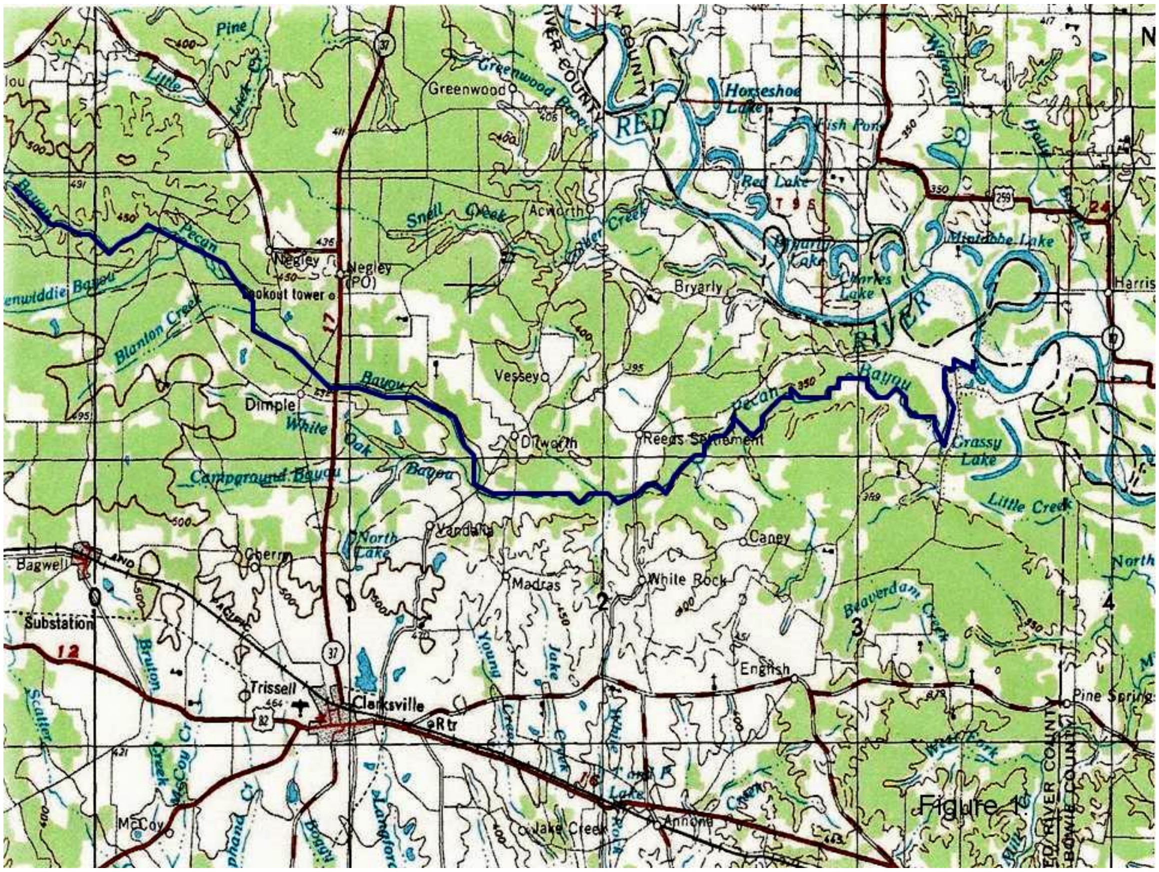

Figure 8.4 Reach of the Pecan Bayou in Red River County

Figure 8.5 Primary Boundary of Lennox Woods Site

8.7 VOLUNTARY INSTREAM FLOW GOALS AND PROPOSALS

Since 1997, the Senate Bill 1 water planning process has required protection of agricultural and natural resources as the state determines how to meet future water needs. For example, the basic directive of the legislature in Senate Bill 1 is:

> "The state water plan shall provide for the orderly development, management and conservation of water resources and preparation for and response to drought conditions, in order that sufficient water will be available at a reasonable cost to ensure public health, safety and welfare, further economic development and protection of agricultural and natural resources of the entire state." (Texas Water Code, Section. 16.051.

One of the "Guiding Principles" as adopted by the Texas Water Development Board (TWBD) for the 2017 State Water Plan is:

> (23) Consideration of **environmental water needs, including instream flows** and bay and estuary inflows, including adjustments by the [Regional Water Planning Groups] to water management strategies to provide for environmental water needs including instream flows and bay and estuary needs.…(TWDB rule at 31 Texas Admin. Code Section 358.3, emphasis added.)

Moreover, the legislature has enacted two other laws that focus on protecting environmental water needs: Senate Bill 2 in 2001 and Senate Bill 3 in 2007. These laws recognized the important role that water left in rivers plays in conserving fish and wildlife habitat, protecting healthy timber and agricultural lands, providing recreational opportunities and sustaining economic and cultural values. Even the value of private property along a river and associated riparian rights can vary significantly with the flow conditions in the river.

Texas law and TWDB's Guiding Principle 23 (TAC §358.3) provide authority for regional water planning groups to focus some of their work on "environmental water needs." TWDB defines "environmental flows" as the flow of water (both quantity and timing of flow) needed to maintain ecologically healthy streams and rivers," as described at the following location: (http://www.twdb.state.tx.us/surfacewater/flows/).

Within Senate Bill 3, the term "environmental flow regime" is defined as:

> (16) "Environmental flow regime" means a schedule of flow quantities that reflects seasonal and yearly fluctuations that typically would vary geographically, by specific location in a watershed, and that are shown to be adequate to support a sound ecological environment and to maintain the productivity, extent, and persistence of key aquatic habitats in and along the affected water bodies. Section 11.002, Tex. Water Code.

TWDB has provided guidance on the value and role of environmental flows on its website: http://www.twdb.state.tx.us/surfacewater/flows/faqs/index.asp.

Meeting environmental flow goals can be compatible while meeting other water needs. Most of the needs presently addressed in the regional plans and state water plan are for "consumptive uses," that is, water diverted from a river, stream or lake and used for drinking water, agricultural and industrial uses. A percentage of that water is returned to the river.

In contrast, most environmental water needs are non-consumptive, such as flows in the river to provide for fish and wildlife. Moving water downstream in a way that mimics natural flows, can meet environmental flow goals while providing water for consumptive use downstream.

In the 2011 Region D Regional Water Plan, the NETRWPG stated that it was taking steps to protect environmental flow goals, such as instream flows. In section 1.5 (a) Historical and Current Water Use, the 2011 Region D plan states:

> "Historical and current uses in the North East Texas Region include municipal, manufacturing, recreation, irrigation, mining, power generation and livestock. . . .
>
> In addition to these uses, which are mostly consumptive uses, there are non-consumptive uses such as flows in rivers, streams, and lakes that have been relied upon to maintain healthy ecological conditions, navigation, recreation and other conditions or activities that bring benefit to the Region. These historic non-consumptive uses and future needs have not yet been the subject of detailed consideration in the State's Senate Bill 3 planning process, but are discussed in *Section 2.3.7 Regional Environmental Flow Demand Projections* and will be addressed in more detail in Round 4 of the planning process. . . .

That plan then discusses environmental flow goals for both the Cypress and Sulphur River Basin, stating:

> "**CYPRESS CREEK BASIN**
>
> It is the position of the North East Texas Water Planning Group that there will be unavoidable negative impacts to the integrity of the ecological environment of the water bodies of the Cypress River Basin and especially Caddo Lake, should there be development of new reservoirs in the Cypress River Basin or transfer of water out of the basin, unless such new reservoirs or transfers do not conflict with the environmental flow needs for the water in the North East Texas Region. Those flow needs are defined as the low, pulse and flood flows needed for a sound ecological environment in Senate Bill 3, 2007 Regular Session of the Texas Legislature (SB-3).
>
> Those flow needs have been identified initially by the process of obtaining recommendations from scientists and stakeholders for the flow regimes for the Cypress Basin through a process initiated in 2004 and summarized in the draft Report on Environmental Flows for the Cypress Basin, updated May 2010 and provided as Appendix to the May 31, 2010 Comments of the Caddo Groups to the Region D IPP and referred to as the *Cypress Basin Flow Project Report*. . . .
>
> Proposals for new reservoirs or interbasin transfers can be made consistent with the environmental flow needs in the Cypress Basin only after final decisions have been made to determine those needs and sources to fill them. Until then, however, no water should be proposed for a new reservoir or for uses in other regions unless the proposals in other regional plans explicitly recognize the environmental flow needs for Region D and that the

amount, timing, diversion rate and other characteristics must be consistent with the needs..."

And

"SULPHUR RIVER BASIN

. . . It is the position of the North East Texas Regional Water Planning Group that there be no development of new reservoirs in the Sulphur River Basin within Region D nor transfer of water out of the basin for that part that is within Region D until the flow needs for a sound ecological environment are defined for the Sulphur River Basin through the process established in Senate Bill 3, 2007 Regular Session of the Texas Legislature. Those flow needs are defined as the low, pulse, and flood flows.

The flow needs assessment for the Sulphur River has not yet begun. No development should take place until the State has identified the flow needs for the Sulphur River and established a demand for the environmental flows for the basin..."

The NETRWPG recommended that no new reservoirs be constructed on Black Cypress based in part on data from the *Cypress Basin Flow Project Report*, but did not make any other specific recommendations.

Senate Bill 3 provided for development of environmental flow "standards" for a number of river basins, but did not include an established schedule for the Cypress or Sulphur River basins. Senate Bill 3 does, however, provide that in those basins not listed, voluntary development of environmental flow goals and proposals can proceed.[5] That voluntary approach is taking place in the Cypress Creek Basin.

8.7.1 Cypress Creek Basin

Over the past 10 years, a number of stakeholders have worked with the U.S. Army Corps of Engineers (USACE) and the Northeast Texas Municipal Water District (NETMWD) to develop a set of environmental flow regimes in the Cypress Creek Basin. Over the past 4 years, USACE and NETMWD have worked to meet those flow regimes through voluntary changes in the water release patterns from Lake O' the Pines. Because of the success of this project to date, the NETRWPG considers those regimes as voluntary goals for instream flows for the purposes of this 2016 Region D Plan. The NETRWPG recognizes that, as with other aspects of the planning process, new information in the future may change the position of the NETRWPG on these instream flow goals. The strategies to meet future water needs of regional water plans and the State Water Plan are not to be limited by these voluntary goals for instream flows. Rather, such goals are presented herein as a point of reference for the consideration of whether water strategies are consistent with the

5 See Section 11.02362(e), Tex. Water Code , the Senate Bill 3 provision for the "voluntary consensus-building process" for basins not scheduled for the formal environmental flow process

protection of the agricultural and natural resources of the Cypress Creek Basin and the state that rely upon such flows.

Details on the voluntary environmental flow goals (i.e., the recommended "flow regimes" in that study) and proposals to meet those goals are set out in detail in "Summary of Development of Environmental Flow Regimes for the Cypress Creek Basin and Caddo Lake Watershed as of 2012, with 2015 Update," available at http://www.caddolake.us/flows.html.

In addition to identifying environmental flow regimes for the rivers and streams, the Cypress Summary Report (2012, with 2015 update) discusses proposals to reach such goals over time where they are not being met. One example involves enhancement of the instream flows below Lake O' the Pines to Caddo Lake by increasing the period of the recreational pool to provide additional water for release downstream. The state's Science Advisory Commission, first created by statute in 2003, has also published a report giving a number of other options for protecting and restoring environmental flows goals.[6]

The flow regimes for the Cypress Basin report are incorporated in this regional water plan as the voluntary goals for instream flows in that basin.

8.7.2 **Sulphur River Basin**

While a process similar to that used in the Cypress Basin has not yet been developed for the Sulphur Basin, a potential first step has been taken that is important to the NETRWPG. This step is described in more detail in Trungale (2015) located at:

http://www.caddolakeinstitute.us/docs/flows/RegionD_Sulphur_eflows_20150409%20(1).pdf

As noted in Trungale (2015), the identified flow regime therein "reflects the historic instream flow conditions that continue to exist today." The regime has not, however, been subject to review and revision by scientists or stakeholders to determine the extent of this flow regime that is needed to maintain the ecological health of the fish and wildlife habitat and the economic and other values currently provided. Thus, this flow regime serves as only a first attempt at identifying voluntary instream flow goals for the Sulphur River Basin. The NETRWPG proposes and supports the development of a stakeholder process, similar to that of the Cypress Creek Basin, to develop such goals in the future.

Although the flows identified in Trungale (2015) are not presented herein as requirements to be implemented on regional water management strategies, the flow regime identified therein does provide additional information for consideration of potential impacts on the agricultural and natural resources of the region and the state. This initial work provides a point of reference for considering the pulse flows previously discussed in Chapter 6 as necessary for the floodplain forests below the Marvin Nichols reservoir site.

6 Final Report, Science Advisory Committee Report on Water for Environmental Flows, Chapter 7, October 26, 2004, Prepared for the Study Commission on Water for Environmental Flows.

It is the position of the NETRWPG that there be no development of new reservoirs in the Sulphur River Basin within Region D nor transfer of water out of the basin for that part that is within Region D until the flow needs for a sound ecological environment are defined for the Sulphur River Basin through the process established in Senate Bill 3, 2007 Regular Session of the Texas Legislature. Those flow needs are defined as the low, pulse, and flood flows.

The flow needs assessment for the Sulphur River has not yet begun. No development should take place until the State has identified the flow needs for the Sulphur River and established a demand for the environmental flows for the basin. The NETRWPG recognizes that other regional water planning groups may include recommendations for new reservoirs in the Sulphur River Basin or for the transfer of water out of the Sulphur River Basin to basins in other regions, as part of their recommended water management strategies or as alternate strategies. It is the position of the NETRWPG that such proposed reservoirs or transfers include explicit recognition that the needs for environmental flows in the North East Texas Region must be satisfied first consistent with Senate Bill 3.

8.8 RESERVOIR SITES

Regional Water Planning Guidelines (31 TAC, Section 357.43), for the preparation of regional water plans provide that a regional water planning group "…*may recommend sites of unique value for construction of reservoirs by including descriptions of the sites, reasons for the unique designation and expected beneficiaries of the water supply to be developed at the site."* The criteria used to determine if a site is unique for reservoir construction are specified in Section §358.2(7), and are as follows:

(1) Site-specific reservoir development is recommended as a specific water management strategy or as a unique reservoir site in an adopted regional water plan; or
(2) The location, hydrologic, geologic, topographic, water availability, water quality, environmental, cultural, and current development characteristics, or other pertinent factors make the site uniquely suited for reservoir development to provide water supply for:
- *a) The current planning period; or*
- b) *Where it might reasonably be needed to meet needs beyond the 50-year planning period*."

In the preparation of the 2011 Region D Plan, the NETRWPG conducted a "reconnaissance-level" assessment of previously identified reservoir sites in the region. This assessment was based on a review and limited update of information contained in previous studies for 17 reservoir sites. It should be noted that the "proposed" and "potential" designations used here and in the *Reservoir Site Assessment Study* (Appendix B), *2001 North East Texas Regional Water Plan,* were made only to assist in the planning process and are not intended to convey a relative priority among the various reservoir sites.

The 1997 State Water Plan recommended development of two new reservoirs within the North East Texas Region – the George Parkhouse II reservoir project (Lamar County) and the Marvin Nichols I reservoir project (Red River, Franklin, Morris and Titus counties), both of which are located within the Sulphur River Basin. It is noted in the 1997 State Water Plan that development of the Nichols I reservoir could eliminate or significantly delay the need for the Parkhouse II reservoir. Also, the *Comprehensive Sabine Watershed Management Plan* includes a recommendation that the Sabine River Authority develop the Prairie Creek Reservoir and Pipeline Project (Gregg and Smith counties) to supply projected needs within portions of the North East Texas Region. It should be noted that the Prairie Creek Reservoir and Pipeline Project is being pursued at this time because of the federal fish and wildlife conservation easement limitation on the Waters Bluff reservoir site. If the conservation easement were removed, the Waters Bluff reservoir would be the Sabine River Authority's top priority project to meet projected water needs in the upper Sabine River Basin.

In addition to the Marvin Nichols I, George Parkhouse II, and Prairie Creek reservoir sites, available information on 14 other reservoir sites within the North East Texas Region were also reviewed. These are:

Cypress Creek Basin
Little Cypress (Harrison)

Red River Basin
Barkman (Bowie)
Big Pine (Lamar and Red River)
Liberty Hills (Bowie)
Pecan Bayou (Red River)
Dimple (Red River)

Sabine River Basin
Big Sandy (Wood and Upshur)
Carl Estes (Van Zandt)
Carthage (Harrison)
Kilgore II (Gregg and Smith)
Waters Bluff (Wood)
Grand Saline Creek (Van Zandt)

Sulphur River Basin
George Parkhouse I (Delta and Lamar)
George Parkhouse II (Lamar)
Marvin Nichols I/IA
Marvin Nichols II (Titus)

Figure 8.6 shows the approximate location of the previously proposed and potential reservoir sites in the region, as delineated in the *Reservoir Site Assessment Study* (Appendix B), *2001 North East Texas Regional Water Plan*.

The *Reservoir Site Assessment Study* (Appendix B), *2001 North East Texas Regional Water Plan*, provided information on various characteristics of each reservoir site, including:

- Location;
- Impoundment size and volume;
- Site geology and topography;
- Dam type and size;
- Hydrology and hydraulics;
- Water quality;
- Project firm yield for water supply;
- Other potential benefits (e.g., flood control, hydro power generation, recreation);
- Land acquisition and easement requirements, and potential land use conflicts;
- Environmental conditions and impacts from reservoir development;
- Local, state, and federal permitting requirements; and,

- Project costs updated to third quarter 2013 price levels using the *Engineering News Record* Construction Cost Index (ENR) from the original ENR values of the second quarter of 1999.

8.9 CYPRESS CREEK BASIN

It is the position of the NETRWPG that there will be unavoidable negative impacts to the integrity of the ecological environment of the water bodies of the Black Cypress portion of the Cypress Creek Basin and especially Caddo Lake, should there be development of new reservoirs or transfer of water out of the basin, unless such new reservoirs or transfers do not conflict with the environmental flow needs for the water in the North East Texas Region. Those flow needs are defined as the environmental flows necessary to maintain a sound ecological environment in Senate Bill 3, 2007 Regular Session of the Texas Legislature (SB-3).

It is the position of the NETRWPG that such proposed reservoirs or transfers include explicit recognition that the needs for environmental flows in the North East Texas Region must be satisfied first consistent with the legislative intent of Senate Bill 3 with regard to maintaining an environmental flow regime necessary for a sound ecological environment.

The Cypress Basin lies entirely in the North East Texas Region (Region D). The amount of needs in the Cypress Basin for environmental flows is not fully or finally determined. Once the State has set aside water for such needs, the State will have made its determination on such needs. Proposals for new reservoirs or interbasin transfers can be made consistent with the environmental flow needs in the Cypress Basin only after final decisions have been made to determine those needs and sources to fill them.

As indicated above, three potential reservoir sites in the Cypress Creek Basin were included in the *Reservoir Site Assessment Study* (Appendix B), *2001 North East Texas Regional Water Plan* for the North East Texas Region – Black Cypress, the enlargement of Caddo Lake, and Little Cypress. However the 2001 plan did not recommend the Black Cypress and the Caddo Lake enlargement, therefore, the Little Cypress is the only one included here and is briefly described below.

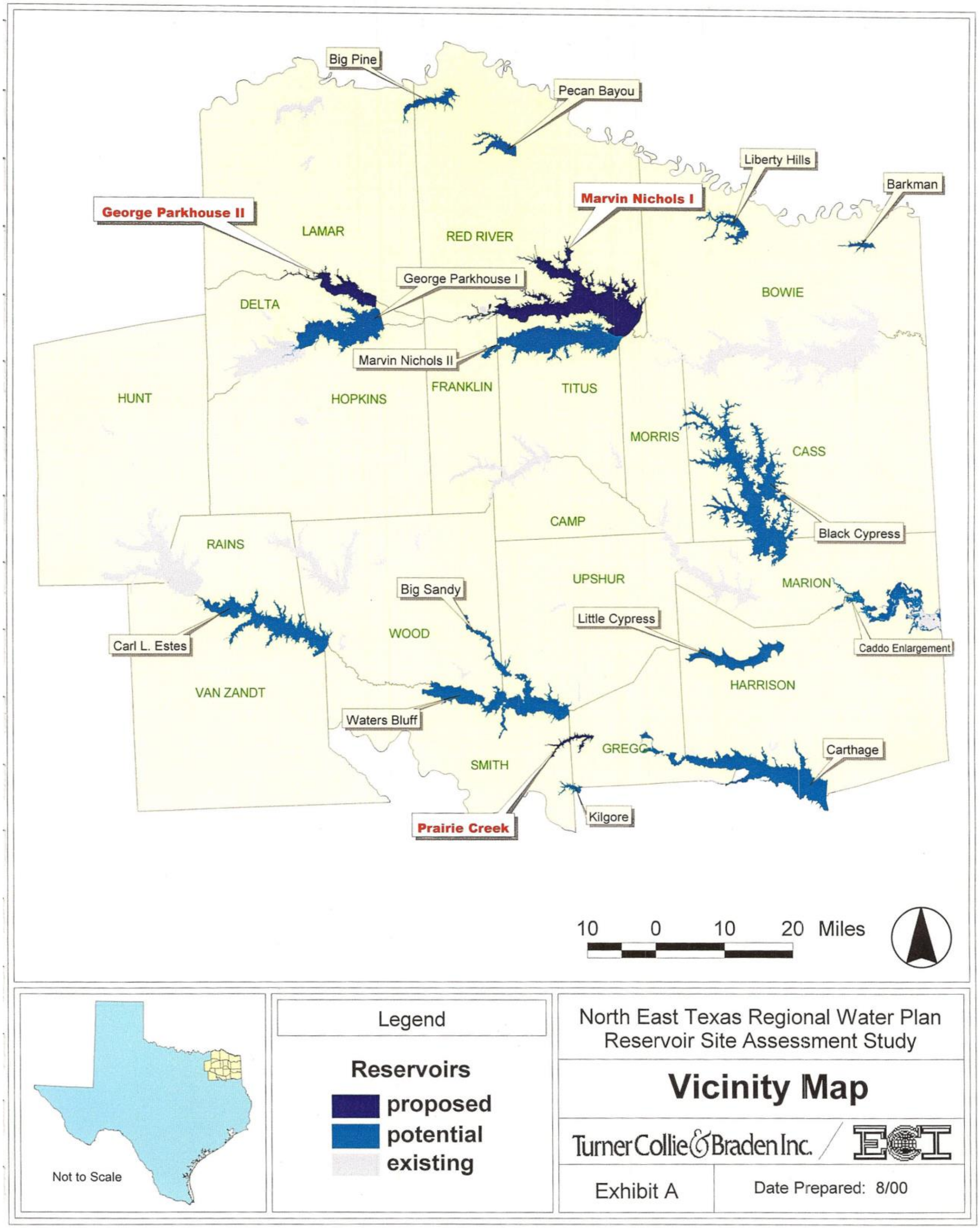

Figure 8.6 Potential Reservoir Vicinity Map, Site Assessment Study (2000)

8.9.1 Little Cypress

The Little Cypress reservoir site is located approximately nine miles northwest of the City of Marshall, within Harrison County. The dam site is at River Mile 21.3 on the Little Cypress Bayou. Previous studies have evaluated a reservoir with a conservation pool elevation of 233.1 feet msl, with a storage capacity of 217,234 ac-ft. The maximum design water surface elevation would be 252.0 feet msl. An earth fill dam 58 feet high and with a crest length of 7,000 feet would be constructed to form the reservoir. The dam would have an ogee weir type spillway with a crest elevation of 233.1 and a 400 foot crest length. The outlet works would consist of a single conduit with a 10 foot diameter and two 4.5 foot by 10 foot gates.

Previous studies of the Little Cypress reservoir site have evaluated a project with a firm yield of 144,900 ac-ft/yr. In current dollars (2009), the total cost to develop the reservoir would be approximately $431.6 million with an annualized cost of nearly $27 million. The unit cost of water from the project on an annualized basis would be $214 per ac-ft ($0.67/1,000 gallons) of firm yield. Potential beneficiaries of the project include municipal and industrial users within the Cypress Creek Basin and/or water users outside of the basin. In addition to water supply, other potential benefits of the project could include recreation and some amount of flood control.

Based on readily available information, there are no potential ecologically unique stream segments of high importance, wetland mitigation banks, or conservation easements within or adjacent to the reservoir site. The potential Little Cypress reservoir is within and adjacent to the Little Cypress Bayou site and listed as priority two: good quality bottomlands with moderate waterfowl benefits. Analyses indicate that there are no municipal solid waste landfill sites, Superfund sites, permitted industrial or hazardous waste locations, or air quality monitoring stations in or near the reservoir site. State and federal agency listings for threatened, endangered, or rare plant or animal species indicate that several species potentially occur or have habitat in or near the project location. Available data indicates that there are five hydric soil associations within the reservoir site. The number of hydric soil associations does not indicate the number of potential wetlands, but rather that a wetland area could occur where these hydric soil associations exist.

A summary of key characteristics of the reservoir site that was examined in the Cypress Creek Basin is provided in Table 8.3.

Table 8.3 Potential Reservoir Sites in the Cypress Creek Basin

Reservoir Site	Conservation Storage (ac-ft)	Surface Area (acres)	Firm Yield (ac-ft/yr)	Total Project Development Cost ($1,000)	Annualized Cost Per ac-ft
Little Cypress	217,324	15,763	144,900	$431,600	$214

The North East Texas Regional Water Planning Group does not recommend the designation of the potential Little Cypress reservoir site as a unique reservoir site.

8.10 RED RIVER BASIN

The scope of work for the *Reservoir Site Assessment Study* (Appendix B), *2001 North East Texas Regional Water Plan* identified Barkman, Liberty Hills, Big Pine and Pecan Bayou as potential reservoir sites within the portion of the Red River Basin that lies within the North East Texas Region. These sites are also listed in the 1997, 2001 and the 2006 State Water Plan as potential sites. However, a thorough search for previous studies and reports on these sites found little documentation on the Barkman and Liberty Hills sites. The Liberty Hill site is also located in Bowie County. Also within the portion of the Red River Basin within the North East Texas Region is a potential site for Dimple Reservoir, studied by HDR (1986) for the Red River Authority and participating entities at that time.

Potential beneficiaries of new reservoirs in the Red River Basin portion of the North East Texas Region include municipal, industrial, and irrigation users within the basin and/or users outside of the basin. Other potential benefits include recreation, hydroelectric power generation, and flood control.

8.10.1 Barkman

The Barkman site is located near the City of Texarkana in Bowie County. This site has apparently not been studied in detail as no information was found with regard to type and size of the dam, project firm yield, or costs.

The U.S. Fish and Wildlife Service (USFWS) and TPWD combined lists for threatened, endangered, or rare species identify seven birds, four fish, three mammals, three reptiles, and one insect to potentially occur or have habitat within the potential Barkman reservoir project location. Current Natural Resource Conservation Service (NRCS) data shows six hydric soil associations are within the potential Barkman reservoir footprint. The number of hydric soil associations does not indicate the number of potential wetlands, but rather that a wetland area could occur where these hydric soil associations exist. There are no known existing or proposed wetland mitigation bank projects, no designated bottomland hardwood areas, no high importance ecologically unique stream segments, and no conservation easements that are located near or adversely affected by the potential Barkman reservoir. The analyses indicate that there are no recorded Superfund sites, municipal solid waste landfill sites, permitted industrial and hazardous waste locations, or air quality monitoring stations located within reservoir study area.

The North East Texas Regional Water Planning Group does not recommend the designation of the potential Barkman reservoir site as a unique reservoir site.

8.10.2 Liberty Hill

The Liberty Hill site is also located in Bowie County on Mud Creek. The preferred alternative site is located about three miles upstream of the authorized site, near the Davenport Road crossing at river mile 7.8. This site has apparently not been studied in detail as no information was found with regard to type and size of the dam, project firm yield or costs.

The U.S. Fish and Wildlife Service (USFWS) and TPWD combined lists for threatened, endangered, or rare species identify seven birds, four fish, three mammals, three reptiles, and one insect to potentially occur or have habitat within the potential Liberty Hills project location. There are no known existing or proposed wetland mitigation bank projects, no designated bottomland hardwood areas, no high importance ecologically unique stream segments, and no conservation easements that are located near or adversely affected by the potential Barkman reservoir. The analyses indicate that there are no recorded Superfund sites, municipal solid waste landfill sites, permitted industrial and hazardous waste locations, or air quality monitoring stations located within reservoir study area. Current NRCS (Natural Resource Conservation Service) data shows one hydric soil association is within the potential Liberty Hills reservoir footprint. The number of hydric soil associations does not indicate the number of potential wetlands, but rather that a wetland area could occur where these hydric soil associations exist.

The North East Texas Regional Water Planning Group does not recommend the designation of the Liberty Hill possible reservoir site as a unique reservoir site.

8.10.3 **Big Pine**

The Big Pine site is located on Pine Creek primarily in Red River County with a small portion of the reservoir area located in Lamar County. The land area required for the reservoir is 9,200 acres. No information was found regarding the type and size of the dam. The project has an estimated firm yield of 35,840 ac-ft/yr and a project development cost of approximately $79.6 million dollars. The cost per ac-ft of firm yield on an annualized basis is $177 ($0.54/1,000 gallons). This site has apparently not been studied in detail as no information was found with regard to type and size of the dam, project firm yield or costs.

The USFWS and TPWD combined lists for threatened, endangered, or rare species lists seven birds, four fish, two mammals, three reptiles, and one insect to potentially occur or have habitat within the potential project location. There are no known existing or proposed wetland mitigation bank projects, ecologically unique stream segments of high importance, and no conservation easements that are located near or adversely affected by the potential Barkman reservoir. The analyses indicate that there are no recorded Superfund sites, municipal solid waste landfill sites, permitted industrial and hazardous waste locations, or air quality monitoring stations located within reservoir study area. Current NRCS (Natural Resource Conservation Service) data shows no hydric soil associations within the potential Big Pine reservoir footprint. The potential Big Pine reservoir is located within the Red River basin, which represents a negligible quantity of the remaining bottomland hardwood in Texas. The potential Big Pine reservoir is within and adjacent to the Sulphur River Bottom West site and listed as priority one: excellent quality bottomlands of high value to waterfowl.

The North East Texas Regional Water Planning Group does not recommend the designation of the potential Big Pine reservoir site as a unique reservoir site.

8.10.4 **Pecan Bayou**

The Pecan Bayou reservoir site is located in Red River County on Pecan Bayou, which is a tributary of the Red River. Previous studies have examined 20 alternative sites, of which three were chosen for evaluation. The alternative that would produce the greatest firm yield would have a storage capacity of 688 ac-ft and a surface area of 122 acres. This alternative would have an earthen dam approximately 2,950 feet long with a top elevation of 384 feet msl. The estimated firm yield of the project is 1,866 ac-ft/yr. The total cost to develop the project would be $21 million. The unit cost of water from the reservoir would be $906 per ac-ft of firm yield ($2.78/1,000). Potential beneficiaries of this project include municipal and industrial water users in the vicinity of the site in Red River County.

Based on a review of readily available information, there are potential ecologically unique streams of high importance, bottomland hardwoods, wetland mitigation banks, or conservation easements within or adjacent to the reservoir site. Analyses also indicate that there are no Superfund sites, municipal solid waste landfill sites, permitted industrial and hazardous waste locations, or air quality monitoring stations located within or adjacent to the reservoir study area. However, state and federal agency listings for threatened, endangered, or rare plant or animal species lists seven birds, four fish, three mammals, one mollusk, four reptiles, and one vascular plant species that potentially occur or have habitat in or near the project location. Also, available data indicates that there are three hydric soil associations within the reservoir site. The number of hydric soil associations does not indicate the number of potential wetlands, but rather that a wetland area could occur where these hydric soil associations exist.

The North East Texas Regional Water Planning Group does not recommend the designation of the potential Pecan Bayou reservoir site as a unique reservoir site.

A summary of key characteristics of the potential Pecan Bayou and Big Pine reservoir sites that were examined in the Red River Basin is provided in Table 8.4. Similar data for the others in the Red River Basin was not available.

8.10.5 **Dimple Reservoir**

The Dimple reservoir site is located in Red River County on White Oak Bayou, which is a tributary of Pecan Bayou, which is a tributary to the Red River. Previous studies have examined this site (HDR 1986). The studied storage capacity of the reservoir is 28,541 ac-ft and a surface area of 2,130 acres. This alternative would have an earthen dam approximately 1,000 feet long with a top elevation of 425 feet msl. The calculated firm yield of the project is 10,200 ac-ft/yr, utilizing the latest TCEQ Water Availability Model (Run 3) for the Red River Basin, and employing consensus planning criteria to account for environmental needs. The total cost to develop the project would be approximately $46 million, including pipeline. If the entirety of the firm yield is utilized, the unit cost of water from the reservoir would be $373 per ac-ft of firm yield ($1.14/1,000 gal). Potential beneficiaries of this project include municipal and irrigation water users in the vicinity of the site in Red River County.

Based on a review of readily available information, there are potential ecologically unique streams of high importance, bottomland hardwoods, wetland mitigation banks, or conservation easements within or adjacent to the reservoir site. The site lies upstream of Pecan Bayou, which is conditionally recommended herein as an ecologically unique stream segment, as it has been identified by the Texas Parks and Wildlife Department. State and federal agency listings for threatened, endangered, or rare plant or animal species lists seven birds, four fish, two mammals, five mollusks, four reptiles, and one insect species that potentially occur or have habitat in or near the project location. Also, available data indicates that there are three hydric soil associations within the reservoir site. The number of hydric soil associations does not indicate the number of potential wetlands, but rather that a wetland area could occur where these hydric soil associations exist.

The North East Texas Regional Water Planning Group does not recommend the designation of the potential Dimple reservoir site as a unique reservoir site.

A summary of key characteristics of the potential Pecan Bayou, Big Pine, and Dimple reservoir sites that were examined in the Red River Basin is provided in Table 8.4. Similar data for the others in the Red River Basin was not available.

Table 8.4 Potential Reservoir Sites in the Red River Basin

Reservoir Site	Conservation Storage (ac-ft)	Surface Area (acres)	Firm Yield (ac-ft/yr)	Total Project Development Cost ($1,000)	Annualized Cost Per ac-ft
Pecan Bayou	688	112	1,866	$15,000	$689
Big Pine	N/A	9200	35,840	$79,600	$179
Dimple	28,541	2,130	10,200	$33,900	$249

8.11 SABINE RIVER BASIN

A number of potential reservoir sites in the upper portion of the Sabine River Basin have been previously studied and were reviewed in the *Reservoir Site Assessment Study* (Appendix B), *2001 North East Texas Regional Water Plan*. These are the Big Sandy, Carl Estes, Carthage, Kilgore II, Prairie Creek, and Waters Bluff sites, each of which is described below.

8.11.1 Big Sandy

The Big Sandy reservoir site is located in Upshur and Wood counties at River Mile 10.6 of the Big Sandy Creek north of the City of Big Sandy. At an elevation of 336 feet msl, the conservation storage capacity of the reservoir would be 69,300 ac-ft and it would cover 4,400 surface acres. An earth fill dam 54 feet high and with a crest length of 2,175 feet would be constructed to create the impoundment. The outlet works would consist of a 10 foot diameter conduit controlled by two 4.5 foot by 10 foot gates.

The estimated firm yield of the Big Sandy Reservoir would be 46,600 ac-ft/yr. Total cost to develop the project is estimated to be $113.3 million. The annualized cost per ac-ft of firm yield would be $188 ($0.58/1,000 gallons). Potential beneficiaries of the project include municipal and industrial water users within the upper portion of the Sabine River Basin and/or water users outside of the basin. Recreation is another potential benefit of the project.

Based on available information, there are no potential ecologically unique streams of high importance, wetland mitigation banks, or conservation easements within or adjacent to the site. Analysis also indicates that there is one municipal solid waste landfill site and no Superfund sites, permitted industrial and hazardous waste locations, or air quality monitoring stations located within or adjacent to the reservoir study area. State and federal agency listings for threatened, endangered or rare species lists seven birds, four fish, three mammals, one mollusk, four reptiles, and one vascular plant to potentially occur or have habitat within the proposed project location. The reservoir site is also within and adjacent to two areas that have been classified by the U.S. Fish & Wildlife Service as having good quality bottomlands with moderate waterfowl benefits. The marsh area has previously been identified as a significant stream segment by TPWD. Also, available data indicates that there are two hydric soil associations within the reservoir site. The number of hydric soil associations does not indicate the number of potential wetlands, but rather that a wetland area could occur where these hydric soil associations exist.

The North East Texas Regional Water Planning Group does not recommend the designation of the potential Big Sandy reservoir site as a unique reservoir site.

8.11.2 **Carl Estes**

The Carl L. Estes reservoir site is located on the main-stem of the Sabine River at River Mile 479.7, approximately eight miles west of the City of Mineola. The reservoir would inundate land in portions of Rains, Wood, and Van Zandt Counties. The conservation storage capacity of the reservoir at an elevation of 379.0 feet msl would be 393,000 ac-ft and the reservoir would inundate 24,900 surface acres. The reservoir would have a flood pool elevation of 403.0 feet msl, which would store 1,205,200 ac-ft with a surface area of 44,000 acres. The dam would be approximately 15,800 feet in length and constructed of compacted earth fill. The flood spillway would be an uncontrolled ogee shaped spillway with a crest elevation of 403.0 feet msl. The outlet works for the dam would consist of a multilevel opening to a 180 inch diameter conduit through the dam and a stilling basin.

The optimal project size in terms of unit costs of water would provide a firm yield of 95,630 ac-ft/yr. The estimated cost to develop the reservoir is $553.3 million. The project would provide water at a unit cost of approximately $427 per ac-ft ($1.32 /1,000 gallons) of firm yield. Estimated costs may not accurately reflect bottomland hardwood mitigation costs. Potential beneficiaries of the project include municipal and industrial water users within the upper portion of the Sabine River Basin and/or water users in the Trinity River Basin. In addition to water supply, other potential benefits of the project include recreation, hydroelectric power generation, and flood control.

Based on readily available information, there are no potential ecologically unique streams of high importance or conservation easements within or adjacent to the reservoir site. The potential Carl Estes reservoir is within and adjacent to the Sulphur River Bottom West site and is listed as Priority 2 bottomland hardwoods: good quality bottomlands with moderate waterfowl benefits. There is a proposed wetland mitigation bank project that is located near the reservoir site. Analysis also indicates that there are two municipal solid waste landfill sites but no Superfund sites, permitted industrial and hazardous waste locations, or air quality monitoring stations located within or adjacent to the reservoir study area. State and federal agency listings for threatened, endangered, or rare plant or animal species indicate that seven birds, four fish, three mammals, one mollusk, four reptiles, and one vascular plant species potentially occur or have habitat in the project location. Also, available data indicates that there are four hydric soil associations within the reservoir site. The number of hydric soil associations does not indicate the number of potential wetlands, but rather that a wetland area could occur where these hydric soil associations exist. The project may negatively impact two downstream reaches of the Sabine River identified by TPWD as "significant stream segments" due to unique federal holdings and the bottomland hardwood.

The North East Texas Regional Water Planning Group does not recommend the designation of the potential Carl Estes reservoir site as a unique reservoir site.

8.11.3 Carthage

The Carthage reservoir site is located on the main stem of the Sabine River immediately upstream of the U.S. Highway 59 crossing and downstream of the City of Longview. The reservoir site is located in portions of four counties: Gregg, Harrison, Panola, and Rusk counties. At an elevation of 244 feet msl, the reservoir would have a conservation storage capacity of 651,914 ac-ft and surface area of 41,200 acres. The estimated firm yield of the project is 537,000 ac-ft/yr and the total cost to develop the project is approximately $658.9 million. On an annualized basis, the unit cost of water from the project would be approximately $92 per ac-ft of firm yield ($0.28/1,000 gallons). The potential beneficiaries of the project are municipal and industrial water users in the upper portions of the Sabine Basin and/or users outside of the basin. Other potential benefits include recreation, hydroelectric power generation, and flood control.

Based on available information, there are no, conservation easements within or adjacent to the reservoir site. There is one existing mitigation bank consisting of 175 acres that is located near the reservoir site. The potential Carthage reservoir is within and adjacent to the Lower Sabine River Bottom West site listed as priority one bottomland hardwood area described as excellent quality bottomlands of high value to waterfowl. There is one potential ecologically unique stream segment that was included on the TPWD list of candidate segments that would be impounded by the reservoir. Analyses also indicates that there are four municipal solid waste landfill sites, one Superfund site, and two permitted industrial and hazardous waste locations within or adjacent to the reservoir study area. There are no air quality monitoring stations in the area. State and federal agency listings for threatened, endangered, or rare plant or animal species lists seven birds, four fish, three mammals, one mollusk, four reptiles, and one vascular plant species that potentially occur or have habitat in or near the project location. Also, available data indicates that there are four hydric soil associations within the reservoir site. The number of hydric soil associations does not indicate the number of potential wetlands, but rather that a wetland area could occur where these hydric soil associations exist.

The North East Texas Regional Water Planning Group does not recommend the designation of the potential Carthage reservoir site as a unique reservoir site.

8.11.4 **Grand Saline Creek**

The City of Canton has identified a feasible strategy to meet future water supply needs as being the construction of a new 1,845 acre (24,980 ac-ft) reservoir on Grand Saline Creek, a tributary of Sabine River. This reservoir project was originally described in a 2008 report from Gary Burton Engineering, Inc. to the City of Canton, entitled Long-Term Water Study Surface Water Supply. The 2008 report identifies the project site, reservoir surface area, drainage area, and estimated construction costs for the reservoir, intake structure, transmission pipeline and water treatment plant expansion. From Burton (2008):

> The proposed reservoir is located within the Gulf Coastal Plain Region. The land surface is generally flat along the flood plains of the major streams, but is gently rolling otherwise. A heavy cover of soft (pine) and hardwoods are predominant in this area.
>
> The normal annual average runoff is approximately 10 inches per year or 550 acre-feet per square mile of basin drained. The annual average gross lake surface evaporation rate from 1950 - 1979 was approximately 54 inches, and the monthly average equaled or exceeded rainfall 5 months out of the year. The major aquifers are the [Carrizo-Wilcox]. The Queen City is a minor aquifer underlying the region. Groundwater recharge is from the infiltration of rainfall and runoff on the outcrop areas and direct charging from the streams and lakes. The groundwater is discharged naturally and artificially. Natural processes include springs, seeps, evaporation or movement of perched (shallow) ground water, and transpiration by trees and plants whose roots reach the water table. Artificial processes include pumping from water wells. The artificial processes are usually several times the natural processes. The surrounding lakes are Lake Fork, Lake Tawakoni, Lake Palestine, and Cedar Creek Lake.
>
> The land use for the study area consists of developed and undeveloped areas. The developed areas are primarily low density residential, with some light commercial and light industrial. Land use in the undeveloped areas includes agriculture (improved pasture), forestry, tree farming, and oil and gas production. The developed and undeveloped areas are both within and outside of the City limits. Historical development and land use trends have been influenced by three primary factors: (1) the oil and gas industry; (2) First Monday Trades Day; and (3) Dallas suburban expansion.

Based on readily available information, there are no potential ecologically unique streams of high importance, wetland mitigation banks, or conservation easements within or adjacent to the reservoir site. Analysis also indicates that there are no Superfund sites, municipal solid waste landfill sites, permitted industrial and hazardous waste locations, or air quality monitoring stations located within or adjacent to the reservoir site. Native prairie remnants and bottomland hardwood communities within the vicinity have been noted (Burton 2008). State and federal agency listings for threatened, endangered, or rare plant or animal species indicate there is the potential for the area to contain threatened and endangered species and their respective critical habitat(s). Aerial photographic interpretation of the region indicates there are forested and emergent wetlands approximate to these water bodies that are associated primarily with the floodplains of these streams. Streams associated with this site are considered waters of the United States, as defined in Chapter 33 of the Code of Federal Regulations Part 328.3(a) and are subject to jurisdiction of the USACE; therefore, coordination with the USACE would be necessary to obtain a Clean Water Act, Section 404 permit were this site to be developed.

The North East Texas Regional Water Planning Group does not recommend the designation of the potential Grand Saline Creek reservoir site as a unique reservoir site.

8.11.5 **Kilgore II**

The Kilgore II reservoir site is located on a tributary of the Sabine River, the upper portion of Wilds Creek near the City of Kilgore. The reservoir site is located within portions of Gregg, Rusk, and Smith counties. With a conservation pool elevation of 398 feet msl, the reservoir would have a conservation storage capacity of 16,270 ac-ft and a surface area of 817 acres. The estimated firm annual yield of the project is 5,500 ac-ft. Previous studies examined as part of the *Reservoir Site Assessment Study (*Appendix B), *2001 North East Texas Regional Water Plan* did not include cost estimates from which to prepare updated costs of reservoir development. The reservoir site has been previously studied as a potential local water supply source for the City of Kilgore.

Based on readily available information, there are no potential ecologically unique streams of high importance, bottomland hardwoods, wetland mitigation banks, or conservation easements within or adjacent to the reservoir site. Analysis also indicates that there are no Superfund sites, municipal solid waste landfill sites, permitted industrial and hazardous waste locations, or air quality monitoring stations located within or adjacent to the reservoir site. However, state and federal agency listings for threatened, endangered, or rare plant or animal species indicate that two fish species potentially occur or have habitat in or near the project location. Available data indicates that there are no hydric soil associations (i.e., potential wetlands) within the reservoir site.

The North East Texas Regional Water Planning Group does not recommend the designation of the potential Kilgore II reservoir site as a unique reservoir site.

8.11.6 **Prairie Creek**

As indicated previously, the Prairie Creek Reservoir is included as a recommended project in the Sabine River Authority's *Comprehensive Sabine Watershed Management Plan.* Development of the project would provide additional water supplies to municipal and industrial water users within the upper portion of the Sabine River Basin, particularly the Longview area. The reservoir site is located approximately 11 miles west of the City of

Longview in Gregg and Smith counties. The location of the dam site is immediately upstream of the FM 2207 crossing of Prairie Creek, which is a tributary of the Sabine River. With a conservation pool elevation of 318.0 feet msl, the storage capacity and surface area of the reservoir would be 45,164 ac-ft and 2,280 acres, respectively. At the probable maximum flood (PMF) elevation of 339.5 feet msl, the reservoir surface area would be 4,282 acres.

Previous studies of the Prairie Creek site envision a compacted earth fill dam, approximately 3,000 feet in length with a maximum height of 87 feet, which corresponds to an elevation of 245.0 feet msl. The spillway for the dam would be ogee shaped with a crest elevation of 300 feet msl with two 20 foot by 20 foot tainter gates for controlled floodwater releases. The outlet works would consist of a multilevel opening with a 66-inch diameter conduit through the dam and a stilling basin.

As part of the *Reservoir Site Assessment Study* (Appendix B), *2001 North East Texas Regional Water Plan,* the firm yield of the proposed Prairie Creek Reservoir was re-evaluated using the TWDB Daily Reservoir Analysis Model. This was performed to determine the firm yield of the project with consideration of the environmental pass-through requirements contained in the S*tate Consensus Environmental Guidelines Planning Criteria.* Previous studies estimated a firm yield of the project of 19,700 ac-ft/yr. Consideration of the environmental pass-through requirements reduces the estimated yield to 17,215 ac-ft/yr.

The Sabine River Authority is considering the Prairie Creek Reservoir as the first component of a larger project that would be developed in phases. The second phase would include diversion of flows from the Sabine River to the reservoir to develop a firm yield of approximately 29,685 ac-ft/yr and, ultimately, construction of a 90 inch pipeline from the Toledo Bend Reservoir to develop a total firm yield of 115,000 ac-ft/yr. The cost to develop the reservoir as a stand-alone project is estimated to be $80.3 million, which would provide water at an annualized cost of $366 per ac-ft of firm yield ($1.12/1,000 gallons). The diversion of flows from the Sabine River would increase the project development costs to $97.2 million and would reduce the unit cost of water to $258 per ac-ft ($0.80/1,000 gallons) of firm yield. The addition of supplies delivered to the Prairie Creek Reservoir from the Toledo Bend Reservoir would provide water supply at a unit cost of $237 per ac-ft of firm yield ($0.73/1,000 gallons).

Based on available information, there are no potential ecologically unique streams of high importance, wetland mitigation banks, or conservation easements within or adjacent to the site. There are no USFWS priority designated bottomland hardwood areas located within or adjacent to the proposed Prairie Creek reservoir; however, TPWD as estimated 12 percent of the area is of this habitat type. Analysis also indicates that there are no Superfund sites, municipal solid waste landfill sites, permitted industrial and hazardous waste locations, or air quality monitoring stations located within or adjacent to the reservoir study area. However, state and federal agency listings for threatened, endangered, or rare plant or animal species indicate that seven birds, four fish, three mammals, one mollusk, four reptiles, and one vascular plant species potentially occur or have habitat in or near the project location Also, available data indicates that there are four hydric soil associations within the reservoir site. The number of hydric soil associations does not indicate the number of potential wetlands, but rather that a wetland area could occur where these hydric soil associations exist.

The North East Texas Regional Water Planning Group supports the proposal of the Sabine River Authority to build Prairie Creek Reservoir, if used in conjunction with a pipeline from Toledo Bend, to supply water to both Region D and Region C.

8.11.7 **Waters Bluff**

The Waters Bluff reservoir site is located on the main stem of the Sabine River approximately 3.5 miles upstream of the U.S. Highway 271 crossing and approximately four miles west of the City of Gladewater. The reservoir site lies within portions of Smith, Upshur, and Wood counties. The reservoir would have a conservation storage capacity of 525,163 ac-ft at a conservation pool elevation of 303 feet msl and would cover 36,396 surface acres. The maximum flood pool elevation would be 314.7 feet msl. The dam for the Waters Bluff Reservoir would be a homogeneous earthen embankment 70 feet high with a crest elevation of 320 feet msl and a crest length of 11,000 feet. The spillway would be a concrete gravity ogee with a crest elevation of 276.0 feet msl, with eleven 40 foot wide by 28 foot high tainter gates for control.

As reported from previous studies, the estimated firm yield of Waters Bluff Reservoir would be 324,000 ac-ft/yr. Updated estimates of the costs to develop the reservoir are $663.7 million, with an annualized unit cost of water of $221 per ac-ft of firm yield ($0.48/1,000 gallons). The potential beneficiaries of the project are municipal and industrial water users in the upper portions of the Sabine Basin and/or users outside of the basin. Other potential benefits include recreation, hydroelectric power generation, and flood control.

There are two stream segments in or near the Waters Bluff reservoir site that the TPWD has identified as potential ecologically unique streams. There are also four existing or proposed wetland mitigation banks and two existing conservation easements within or near the reservoir site. The U.S. Fish & Wildlife Service has also identified areas within or near the site that are classified as having excellent quality bottomlands of high value to waterfowl habitat and good quality bottomlands with moderate waterfowl benefits. In addition, analyses indicate that there are six municipal solid waste landfill sites, but no Superfund sites, permitted industrial and hazardous waste locations, or air quality monitoring stations located within or adjacent to the reservoir study area. State and federal agency listings for threatened, endangered, or rare plant or animal species lists seven birds, four fish, three mammals, one mollusk, four reptiles, and one vascular plant species that potentially occur or have habitat in or near the project location. Also, available data indicates that there are six hydric soil associations within the reservoir site. The number of hydric soil associations does not indicate the number of potential wetlands, but rather that a wetland area could occur where these hydric soil associations exist.

The North East Texas Regional Water Planning group does not recommend the designation of the potential Waters Bluff reservoir site as a unique reservoir site. A summary of key characteristics of the six reservoir sites that were examined in the Sabine River Basin is provided in Table 8.5.

Table 8.5 Potential Reservoir Sites in the Sabine River Basin

Reservoir Site	Conservation Storage (ac-ft)	Surface Area (acres)	Firm Yield (ac-ft/yr)	Total Project Development Cost ($1,000)	Annual Cost Per ac-ft
Big Sandy	69,300	4,400	46,600	$113,300	$188
Carl Estes	393,000	44,900	95,630	$553,300	$427
Carthage	651,914	41,200	537,000	$658,900	$92
Grand Saline	24,980	1,845	1,810	$45,400	$3,087
Kilgore II	16,270	817	5,500	NA	NA
Prairie Creek	45,164	2,280	17,215	$80,300	$366
Prairie Creek with Diversion	45,164	2,280	29,685	$97,200	$258
Prairie Creek with Pipeline	45,164	2,280	115,000	$248,300	$237
Waters Bluff	525,163	36,396	324,000	$663,700	$221

8.12 SULPHUR RIVER BASIN

Five reservoir sites in the Sulphur River Basin were examined as part of the *Reservoir Site Assessment Study* (Appendix B)*, 2001 North East Texas Regional Water Plan*: Marvin Nichols I, Marvin Nichols II, George Parkhouse I, and George Parkhouse II. Each is described below.

As discussed in Chapter 6, Section 6.9, and will be expanded below, the NETRWPG opposes the reservoirs listed below and others similarly situated. The opposition includes the potential impacts of such reservoirs on the environmental flow needs, as well as the impact on agricultural and other natural resources that would result from the creation of the reservoir, the mitigation that would be required for creation of the reservoir, and the impacts on downstream flows to significant bottomland hardwoods and other flood plain forests.

8.12.1 Marvin Nichols I/IA

In the interim since the 2001 plan there have been three identified studies concerning the Marvin Nichols site. The Texas Forest Service produced the "The Economic Impact of the Proposed Marvin Nichols I Reservoir to the Northeast Texas Forest Service" in August 2002. In March of 2003 the Sulphur River Basin Authority (SRBA) had prepared "The Economic, Fiscal, and Developmental Impacts of the Proposed Marvin Nichols Reservoir Project". More recently, the Sulphur River Basin Feasibility Study has been an ongoing study performed for the SRBA and U.S. Army Corps of Engineers (USACE) by Freese and Nichols, Inc. and MTG Engineers and Surveyors (referred to hereafter as the 2014 SRBA Study). These three studies, along with previous efforts, have been presented to the NETRWPG and reviewed (results of the more recent SRBA study have been made available relatively recently in the planning process, and have been reviewed as information became available). The results of the studies present varying views of effects on the area concerning reservoir development in the Sulphur River Basin.

As noted in the Watershed Overview, SRBA (2014):

> "The Marvin Nichols project is representative of a more downstream location for new storage within the Sulphur River Basin. At least five locations for this dam have been considered. The Marvin Nichols project has been evaluated as an impoundment at multiple locations on White Oak Creek and multiple locations on the Sulphur River (FNI, 2000). In general, these alternative sites represent an attempt to locate the impoundment so as to minimize conflicts with Priority 1 bottomland hardwood habitats and oilfield activity while maintaining yield. A reservoir at the Marvin Nichols IA site is a recommended strategy for North Texas Municipal Water District, the Upper Trinity Regional Water District, and Tarrant Regional Water District in the 2006 and 2011 Region C Regional Water Plan and an alternative strategy for Dallas Water Utilities and the City of Irving in the 2011 plan."

The Marvin Nichols I reservoir site is located on the main stem of the Sulphur River at River Mile 114.7. The dam site is located upstream of the confluence of the Sulphur River and White Oak Creek. The reservoir site is located in Red River and Titus Counties about 120 miles east of the City of Dallas and about 45 miles west of the City of Texarkana. According to the 1997 *State Water Plan,* the potential beneficiaries of the Marvin Nichols I reservoir include municipal and industrial water users in the vicinity of the project within the Sulphur River Basin, water users in the Cypress Creek Basin, and/or water users in the Dallas-Ft. Worth Metroplex. Other potential benefits include recreation, hydroelectric power generation, and flood control.

With a conservation pool elevation of 312.0 feet msl, the conservation storage capacity of the Marvin Nichols I reservoir would be 1,369,717 ac-ft and the surface area would be 62,128 acres. At the probable maximum flood (PMF) elevation of 319.1 feet msl, the reservoir would store 1,864,788 ac-ft and have a surface area of 77,612 acres.

As envisioned in previous studies of the site, the dam for the Marvin Nichols I reservoir would consist of a 25,000 foot long earthen embankment dike built along the low stream divide between the Sulphur River and the White Oak Bayou. In addition, four dikes would be required at low points along the stream divide varying in length from 2,000 feet to 8,000 feet. The main dam would have a maximum height of 71 feet at the flood plain crossing. The flood spillway crest would be 940 feet long and would include nineteen 40 foot by 40 foot gates at a crest elevation of 285 feet msl.

Previous studies of the Marvin Nichols I site have estimated the firm yield of the project to be 624,000 ac-ft/yr. However, additional yield studies were performed as part of the *Reservoir Site Assessment Study* (Appendix B), *2001 North East Texas Regional Water Plan* using the recently completed TCEQ Water Availability Model (WAM) for the Sulphur River Basin and the TWDB Daily Reservoir Analysis Model. Reservoir operations simulations performed with these models, and with environmental releases as specified in the *Consensus Environmental Guidelines Planning Criteria*, indicated a firm yield of 550,842 ac-ft/yr for the Marvin Nichols I reservoir.

The yield for Marvin Nichols I Reservoir differs from the value given in the Region C report, which is 619,000 acre-feet per year. The difference in yield is the result of different assumptions with regards to the operation of the project:

- The North East Region's yield of 550,842 acre-feet is based on the assumption that Marvin Nichols I will impound only available unallocated flows, after satisfying the environmental flow requirements in accordance with the Consensus Water Planning (CWP) criteria. This assures that Wright Patman Reservoir, with a senior water right downstream of Marvin Nichols I, is full before Marvin Nichols I can impound any water.

- Regions C's yield of 619,100 acre-feet per year is based on an assumption that Marvin Nichols I could impound inflows so long as the ability to divert water from Lake Wright Patman is protected.

The yield simulation previously performed for the NETRWPG for the 2011 Region D Plan involved application of TCEQ's Sulphur River Basin WAM, which considers the seasonal variation of conservation storage in Lake Wright Patman, and a daily reservoir operations model used by the TWDB (SIMDLY), which allows passage of environmental flows in accordance with the state's criteria. The assumption used by Region C would require the negotiation of a written agreement between the operators of Marvin Nichols I and Wright Patman reservoirs (including the City of Texarkana, the water rights holder) before any application can be filed with the TCEQ for water rights for Marvin Nichols I Reservoir. Should that agreement happen in the future, it will enhance the yield of Marvin Nichols I Reservoir.

The estimated cost to develop the Marvin Nichols I reservoir, updated to September 2013 dollars, was $700.7 million. The total annualized cost of the reservoir (alone), including debt service and operations and maintenance costs, was $55.7 million, which resulted in a unit cost of roughly $101 per ac-ft of firm yield ($0.31/1,000 gallons).

More recently available information from the SRBA's 2014 Sulphur River Basin Feasibility Study is presented over the course of multiple reports, specifically:

1) Final Watershed Overview Report;
2) Comparative Environmental Assessment Report;
3) Socioeconomic Report;
4) Cost Rollup Report;
5) International Paper Impact Analysis;
6) Hydrologic Yields Report.

Regarding Marvin Nichols IA, per the SRBA Watershed Overview (2014):

> "The Marvin Nichols IA project would be located on the Sulphur River and Red River and Titus counties approximately halfway between the cities of Clarksville and Mount Pleasant. The top of the conservation pool would be at elevation 328 feet NGVD. At this elevation, the reservoir would have a storage capacity of 1,532,031 acre-feet. At this location, the reservoir would have a total drainage area of 1,889 square miles (of which 479 square miles are above Jim Chapman Lake.)
>
> The Marvin Nichols IA project would inundate 66,103 acres..."

A thorough suite of yield estimates for the Marvin Nichols IA project have been developed over the course of the SRBA (2014) study. Over the course of the analyses presented in the aforementioned reports, yields for various configurations of Marvin Nichols have been developed utilizing a modified version of the TCEQ WAM in which Lake Ralph Hall has been implemented, considering future sedimentation conditions and mitigated sediment conditions, employing alternative periods of record using a USACE model for comparative purposes, and considering alternative implementations of potential environmental flow requirements (i.e., no requirements or with criteria developed utilizing the Lyons method). Resultant firm yields from these analyses range from 193,800 ac-ft/yr, to 676,000 ac-ft/yr. The estimated total yield for Marvin Nichols 1A at an elevation of 328.0 ft. NGVD is 590,000 acre-feet/yr, although with environmental flows considered this yield decreases to 571,710 acre-feet/yr.

From the SRBA Cost Rollup Report (2014), comprehensive cost estimates for a suite of alternatives, including various configurations of Marvin Nichols project, have been developed. The methods for evaluating the costs are reportedly consistent with TWDB guidance on Regional Water Planning, which includes consideration of Interest During Construction (IDC) added to the estimated capital costs for the reservoirs as well as for the transmission systems (using a 6% annual interest rate on total borrowed funds, less a 4% rate of return on investment of unspent funds.

From this study, the estimated total capital cost to develop the Marvin Nichols IA reservoir, at elevation 328 ft. msl., at 2014 dollars, is $1.068 billion. Including transmission, the total capital cost of the project is $4.278 billion. The total annualized cost of the project, during debt service is $353.6 million, and after debt service is $86.9 million. Resultant unit costs developed for the SRBA study are presented for both with- and without environmental flow restrictions (developed from using the Lyons methodology). Without environmental flows, the unit cost during debt service is roughly $599.25 per ac-ft of firm yield ($1.84/1,000 gallons), and after debt service is approximately $147.40 per ac-ft of firm yield ($0.45/1,000 gallons). Unit costs with environmental flow requirements based on the Lyons method in place during debt service is roughly $618.42 per ac-ft of firm yield ($1.90/1,000 gallons). After debt service, unit costs with environmental flows is approximately $152.11 per ac-ft of firm yield ($0.47/1,000 gallons).

If, along with impacts from meeting environmental flow needs, the contractual relationship between the Metroplex members of the Joint Committee for Program Development (JCPD) and the SRBA is considered, whereby 20% of project yields would be dedicated to in-basin needs at no cost to SRBA, the unit costs to the Metroplex JCPD members based on their anticipated portion of the yield vary from those detailed above. During debt service, the unit cost is approximately $773.02 per ac-ft of firm yield ($2.37/1,000 gallons). After debt service, the unit cost is roughly $190.14 per ac-ft of firm yield ($0.58/1,000 gallons).

Based on available information, depending upon the configuration of Marvin Nichols under consideration, there do not appear to be potential ecologically unique streams of high importance, wetland mitigation banks, or conservation easements within or adjacent to the sites under consideration. However, two reaches of the Sulphur River within the project boundary have previously been identified by TPWD as significant stream segments based on the presence of unique federal holdings and a USFWS priority 1 bottomland woodland site. Additionally, TPWD has included one of these reaches on a recommended list of ecologically unique streams segments.

A review of available information also indicates that there are no Superfund sites, municipal solid waste landfill sites, permitted industrial and hazardous waste locations, or air quality monitoring stations located within or adjacent to the reservoir study area. However, state and federal agency listings for threatened, endangered, or rare plant or animal species identify seven birds, four fish, two mammals, three mollusks, four reptiles, and one insect that potentially occur or have habitat in or near the project location. The reservoir site is also within and adjacent to the Sulphur River Bottom west site, which is listed by the U.S. Fish & Wildlife Service as having excellent quality bottomlands of high value to waterfowl. Also, available data indicates that there are six hydric soil associations within the reservoir site. The number of hydric soil associations does not indicate the number of potential wetlands, but rather that a wetland area could occur where these hydric soil associations exist.

The SRBA (2014) Comparative Environmental Assessment Report presents the results of a comparative environmental assessment that includes Marvin Nichols IA. This assessment considered potential impacts to land resources, federal and state listed threatened and endangered species, cultural resources, and water quality. As detailed in Chapter 6 herein, the Marvin Nichols IA project was determined to have the highest impact on cultural resources, and was ranked the second highest overall in terms of environmental impacts when compared to the remaining alternative reservoir sites under consideration in that study.

The North East Texas Regional Water Planning Group does not recommend the designation of the potential Marvin Nichols I or Marvin Nichols IA reservoir sites as a unique reservoir site.

8.12.2 **Marvin Nichols II**

The Marvin Nichols II reservoir site is located on White Oak Creek, which is a tributary of the Sulphur River located primarily in Titus County. The site is immediately south of the proposed Marvin Nichols I reservoir site described above. Potential beneficiaries of the project include municipal and industrial water users in the vicinity of the project within the Sulphur River Basin, water users in the Cypress Creek Basin, and water users in the Dallas-Ft. Worth Metroplex. Other potential benefits include recreation, hydroelectric power generation, and flood control.

From the 2011 Region D Plan, at an elevation of 312.0 feet msl, the reservoir would have conservation storage capacity of 772,000 ac-ft and a surface area of 35,900 acres. The estimated firm yield of the project is 280,100 ac-ft/yr and the cost to develop the reservoir (alone) was determined to be approximately $392.7 million in 2013 dollars.

The SRBA (2014) Sulphur River Basin Feasibility Study has not explicitly evaluated the Marvin Nichols II reservoir site. Rather, this study considered potentially suitable dam locations and configurations further upstream on White Oak Creek. In particular, a site upstream of the City of Talco near the Talco gage was identified as an opportunity for an on-channel reservoir that could be hydraulically connected to the main stem of the Sulphur River, to take advantage of flows from both the White Oak Creek and Sulphur River watersheds.

Based on readily available information, there do not appear to be potential ecologically unique streams of high importance, or wetland mitigation banks, within or adjacent to the site. There is one conservation easement located within or adjacent to the footprint of the potential Marvin Nichols II reservoir. A review of available information also indicates that there are no Superfund sites, municipal solid waste landfill sites, permitted industrial and hazardous waste locations, or air quality monitoring stations located within or adjacent to the reservoir study area. However, state and federal agency listings for threatened, endangered, or rare plant or animal species lists seven birds, three fish, two mammals, three mollusks, and four reptiles that potentially occur or have habitat in or near the project location. The reservoir site is also within and adjacent to the Sulphur River Bottom west site, which is listed by the U.S. Fish & Wildlife Service as having excellent quality bottomlands of high value to waterfowl. Also, available data indicates that there are eight hydric soil associations within the reservoir site. The number of hydric soil associations does not indicate the number of potential wetlands, but rather that a wetland area could occur where these hydric soil associations exist.

The North East Texas Regional Water Planning Group does not recommend the designation of the potential Marvin Nichols II reservoir site as a unique reservoir site.

8.12.3 George Parkhouse I

The George Parkhouse I reservoir site is located approximately 18 miles northeast of the City of Sulphur Springs, on the South Fork of the Sulphur River, which forms the border between Delta and Hopkins Counties. The dam site would be located at River Mile 3.0 downstream of the existing Cooper Reservoir. Potential beneficiaries of the project include municipal and industrial water users within the Sulphur River Basin and/or water users in the Dallas-Ft. Worth Metroplex. Other potential benefits include recreation, hydroelectric power generation, and flood control.

From the SRBA (2014) Watershed Overview:

> “The top of the conservation pool would be at elevation 401 feet NGVD. At this elevation, the reservoir would have a storage capacity of 651,712 acre-feet. At this

> location, the reservoir would have a total drainage area of 654 square miles (of which 479 square miles are above Jim Chapman Lake.)"

The reservoir would inundate 28,362 acres. From the 2011 Region D Plan, the dam would consist of a 20,000 foot long earthen embankment constructed across the South Sulphur River with an additional half mile long earthen dike built across the low stream divide between the North Sulphur River and the South Sulphur River. The dam would have a gated ogee shaped flood spillway with a crest elevation of 390.0 feet msl and four 40 foot gated bays to discharge flood flows.

The estimated firm yield of the Parkhouse I reservoir is 124,300 ac-ft/yr, although with environmental flow needs this yield decreases to 118,707 ac-ft/yr. The total capital cost to develop the project, including the dam and spillway, land acquisition, conflict resolution, mitigation, permitting, transmission, and interest during construction, would be $1.3 billion. The project would provide water at a total annual cost, during debt service, of $103.6 million, and $20.9 million after debt service. Resultant unit costs developed for the SRBA study are presented for both with- and without environmental flow restrictions (developed from using the Lyons methodology). Without environmental flows, the unit cost during debt service is roughly $833.86 per ac-ft of firm yield ($2.56/1,000 gallons), and after debt service is approximately $168.57 per ac-ft of firm yield ($0.52/1,000 gallons). Unit costs with environmental flow requirements (based on the Lyons method) during debt service is roughly $873.15 per ac-ft of firm yield ($2.68/1,000 gallons). After debt service, unit costs with environmental flows applied are approximately $176.52 per ac-ft of firm yield ($0.54/1,000 gallons).

If, along with impacts from meeting environmental flow needs, the contractual relationship between the Metroplex members of the Joint Committee for Program Development (JCPD) and the SRBA is considered, whereby 20% of project yields would be dedicated to in-basin needs at no cost to SRBA, the unit costs to the Metroplex JCPD members based on their anticipated portion of the yield vary from those detailed above. During debt service, the unit cost is approximately $1,091.44 per ac-ft of firm yield ($3.35/1,000 gallons). After debt service, the unit cost is roughly $220.65 per ac-ft of firm yield ($0.68/1,000 gallons).

Based on available information, there are no potential ecologically unique streams of high importance, bottomland hardwoods, wetland mitigation banks, or conservation easements within or adjacent to the reservoir site. Analyses also indicates that there are no Superfund sites, municipal solid waste landfill sites, permitted industrial and hazardous waste locations, or air quality monitoring stations located within or adjacent to the reservoir study area. However, state and federal agency listings for threatened, endangered, or rare plant or animal species lists eight birds, three fish, two mammals, one mollusk, and three reptiles that potentially occur or have habitat in or near the project location. Also, available data indicates that there are two hydric soil associations within the reservoir site. The number of hydric soil associations does not indicate the number of potential wetlands, but rather that a wetland area could occur where these hydric soil associations exist.

The SRBA (2014) Comparative Environmental Assessment Report presents the results of a comparative environmental assessment that includes Parkhouse I. This assessment considered potential impacts to land resources, federal and state listed threatened and endangered species, cultural resources, and water quality. The Parkhouse I project was ranked third lowest overall in terms of environmental impacts when compared to the total seven alternative reservoir sites under consideration in that study.

The North East Texas Regional Water Planning Group does not recommend the designation of the potential George Parkhouse I reservoir site as a unique reservoir site.

8.12.4 George Parkhouse II

The George Parkhouse II reservoir site is located on the North Sulphur River at River Mile 5.0. The impoundment is approximately 15 miles southeast of the City of Paris, and would straddle the county line between Delta and Lamar Counties. The Parkhouse II site was recommended for development in the 1997 *State Water Plan*. Potential beneficiaries of the project include municipal and industrial water users within the Sulphur River Basin and/or water users in the Dallas-Ft. Worth Metroplex. Other potential benefits include recreation, hydroelectric power generation, and flood control. It should be noted that the development of the Marvin Nichols I reservoir would significantly delay or eliminate the need for this reservoir as a supply source for the Dallas-Ft. Worth Metroplex.

Previous studies have investigated a reservoir with a conservation pool elevation of 401.0 feet msl, which would have a conservation storage capacity and surface area of 243,600 ac-ft and 12,300 acres, respectively. With a probable maximum flood elevation of 415.7 feet msl, the Parkhouse II reservoir would have a surface area of 17,400 acres. The dam would have a gated ogee shaped flood spillway with a crest elevation of 390.0 feet msl. Flood discharges would be through eight 40 foot gated bays.

From the SRBA (2014) Watershed Overview:

> "The top of the conservation pool would be at elevation 410 feet NGVD. At this elevation, the reservoir would have a storage capacity of 330,871 acre-feet. At this location, the reservoir would have a total drainage area of 421 square miles, of which approximately 101 square miles is above the proposed Lake Ralph Hall. The Parkhouse II project would inundate 15,359 acres."

Previous studies of the George Parkhouse II reservoir site estimated the firm yield of the project to be 136,700 ac-ft without consideration of potential environmental pass-through requirements. A reevaluation of the project firm yield using the TCEQ WAM for the Sulphur River Basin and the TWDB Daily Reservoir Analysis Model performed for the 2011 Region D Plan indicated a firm yield with environmental releases of 131,850 ac-ft. At a cost of approximately $251.5 million to develop the reservoir, the annualized cost of water from the project would be $152 per ac-ft of firm yield ($0.47/1,000 gallons).

From the SRBA (2014) Cost Rollup Report, the estimated total yield of the Parkhouse II reservoir alternative would be 124,200 ac-ft/yr, although with environmental flow needs this yield decreases to 121,343 ac-ft/yr. The total capital cost to develop the project, including the dam and spillway, land acquisition, conflict resolution, mitigation, permitting, transmission, and interest during construction, would be $1.2 billion. The project would provide water at a total annual cost, during debt service, of $98.4 million, and $21.2 million after debt service. Resultant unit costs developed for the SRBA study are presented for both with- and without environmental flow restrictions (developed from using the Lyons methodology). Without environmental flows, the unit cost during debt service is roughly $792.62 per ac-ft of firm yield ($2.43/1,000 gallons), and after debt service is approximately $170.63 per ac-ft of firm yield ($0.52/1,000 gallons). Unit costs with environmental flow requirements (based on the Lyons method) during debt service is roughly $811.27 per ac-ft of firm yield ($2.49/1,000 gallons). After debt service, unit costs with environmental flows applied are approximately $174.64 per ac-ft of firm yield ($0.54/1,000 gallons).

If, along with impacts from meeting environmental flow needs, the contractual relationship between the Metroplex members of the Joint Committee for Program Development (JCPD) and the SRBA is considered, whereby 20% of project yields would be dedicated to in-basin needs at no cost to SRBA, the unit costs to the Metroplex JCPD members based on their anticipated portion of the yield vary from those detailed above. During debt service, the unit cost is approximately $1,014.09 per ac-ft of firm yield ($3.11/1,000 gallons). After debt service, the unit cost is roughly $218.30 per ac-ft of firm yield ($0.67/1,000 gallons).

Based on available information, there do not appear to be major natural resource conflicts at the reservoir site. There are no potential ecologically unique streams of high importance, wetland mitigation banks, priority designated bottomland hardwoods, or conservation easements within or adjacent to the site. A review of available information also indicates that there are no Superfund sites, municipal solid waste landfill sites, permitted industrial and hazardous waste locations, or air quality monitoring stations located within or adjacent to the reservoir study area. However, state and federal agency listings for threatened, endangered, or rare plant or animal species identify nine birds, five fish, two mammals, and three reptiles that potentially occur or have habitat in or near the project location. Also, available data indicates that there are six hydric soil associations within the reservoir site. The number of hydric soil associations does not indicate the number of potential wetlands, but rather that a wetland area could occur where these hydric soil associations exist.

The SRBA (2014) Comparative Environmental Assessment Report presents the results of a comparative environmental assessment that includes Parkhouse II. This assessment considered potential impacts to land resources, federal and state listed threatened and endangered species, cultural resources, and water quality. The Parkhouse II project was ranked second lowest overall in terms of environmental impacts when compared to the total seven alternative reservoir sites under consideration in that study. The North East Texas Regional Water Planning Group does not recommend the designation of the potential George Parkhouse II reservoir site as a unique reservoir site.

A summary of key characteristics of the four reservoir sites that have been examined in the Sulphur River Basin is provided in Table 8.6.

Table 8.6 Potential Reservoir Sites in the Sulphur River Basin

Reservoir Site	Conservation Storage (ac-ft)	Surface Area (acres)	Firm Yield (ac-ft/yr)	Reservoir Development Cost ($ Millions)	Total Capital Cost ($ Millions)	Unit Cost, with environmental flows ($/ac-ft)	
						During Debt Service	After Debt Service
Marvin Nichols I*	1,369,717	62,128	550,842	$ 635.3	Not Analyzed	87	Not Analyzed
Marvin Nichols IA	1,532,031	66,103	571,710	$ 1,067.7	$4,277.7	773	190
Marvin Nichols II*	772,000	35,900	280,100	$ 356.1	Not Analyzed	Not Analyzed	Not Analyzed
Parkhouse I	651,712	28,362	118,707	$ 458.2	$1,326.8	1,091	221
Parkhouse II	330,871	15,359	121,343	$ 375.1	$1,239.5	1,014	218

8.13 RECOMMENDATIONS FOR UNIQUE RESERVOIR SITE IDENTIFICATION, DEVELOPMENT AND RESERVOIR SITE PRESERVATION

8.13.1 Comments on the Texas Administrative Code With Regard to Reservoir Development

The North East Texas Regional Water Planning Group has previously received comments concerning the protection of natural resources as they relate to the building of new reservoirs in the Sulphur River Basin within the North East Texas region. Rule 358.3 (4) and (9) of the Texas Administrative Code (TAC), relating to Guidance Principles, would be violated in regard to the protection of the natural resources should reservoir development take place in the Sulphur River Basin within the North East Texas region. Specifically, the new reservoirs being contemplated in the North East Texas Region within the Sulphur River Basin would not be protective of the agricultural and natural resources in the region. This is germane since the region has more than adequate surface water supply within the basin to meet all of the needs within the Sulphur River Basin in the North East Texas Region as projected for the next 50 years.

It is the position of the North East Texas Water Planning Group that there will be unavoidable impacts on agricultural resources should there be further development of new reservoirs in the Sulphur River Basin within the North East Texas Region. TAC Rule 357.34(d)(3) cited above includes the requirement that the regional water planning group evaluate all water management strategies to determine the potential of feasibility by including quantitative reporting of several specific factors as follows:

(i) The net quantity, reliability, and cost of water delivered and treated for the end user's requirements during drought of record conditions, taking into account and reporting anticipated strategy water losses, incorporating factors used calculating infrastructure debt payments and may include present costs and discounted present value costs. Costs do not include distribution of water within a WUG after treatment;

(ii) Environmental factors including effects on environmental water needs, wildlife habitat, cultural resources, and effect of upstream development on bays, estuaries, and arms of the Gulf of Mexico. Evaluations of effects on environmental flows will include consideration of the Commission's adopted environmental flow standards under 30 TAC Chapter 298 (relating to Environmental Flow Standards for Surface Water). If environmental flow standards have not been established, then environmental information from existing site-specific studies, or in the absence of such information, state environmental planning criteria adopted by the Board for inclusion in the state water plan after coordinating with staff of the Commission and the Texas Parks and Wildlife Department to ensure that water management strategies are adjusted to provide for environmental water needs including instream flows and bays and estuaries inflows;

(iii) Impacts on agricultural resources;

Therefore, the North East Texas Regional Planning Group recognizes that there may be the possibility of recommendations from other planning groups that include further development of additional reservoirs in the Sulphur River Basin as a recommended water management strategy or as an alternative strategy. The NETRWPG opposes the development of such reservoirs unless it is demonstrated that there will be no significant adverse impacts on the water, agricultural and environmental resources within the North East Texas Region and the state. Furthermore, due to foreseeable detrimental impacts, the NETRWPG asserts strongly that the option of pursuing new major reservoirs in the Sulphur River Basin as a water management strategy or an alternative strategy should be viewed as inconsistent with the protection of natural resources within the region.

8.13.2 Recommendations for Unique Reservoir Site Identification and Preservation

The North East Texas Regional Water Planning Group recommends that any new reservoirs in Region D be pursued only after all other viable alternatives have been exhausted. The NETRWPG further recommends that no reservoir sites in the North East Texas Region be designated as unique reservoir sites in this plan or in the 2017 State Water Plan, excepting that the Region D RWPG does not challenge Marvin Nichols Reservoir as a unique reservoir site for the purposes of this Plan and the 2017 State Water Plan.

The NETRWPG recognizes that there are 16 locations in NETRWPG area where the topography is such that the area could be classified as uniquely suitable as a reservoir site. The NETRWPG recognizes that the waters of the state of Texas belong to the citizens of Texas for their specific use, but it is also recognized that the properties rights belong to individuals. Local government should be recognized for the effect that major alterations to the local economy, such as the development of a unique reservoir site, will have on them. To address the issue of unique reservoirs and the accompanying property owners, industry, and local government concerns the NETRWPG would recommend that the following be instituted when a unique reservoir site is being considered and included in planning studies:

- The required mitigation area is to be acquired from the water planning region requesting the reservoir or other such region willing to provide the mitigation area.
- At the identification of a unique reservoir site as a water planning strategy, the property owners in the area of the unique reservoir site and the accompanying mitigation site or sites must be notified by the requesting entity of such intent.
- At the initiation of the appropriate studies for the identified unique reservoir site, a mitigation site study shall be completed as soon as possible to identify and preliminarily map the mitigation area.
- Property owners should be afforded compensation based on replacement value to the maximum allowed by law in addition to a fair market value approach.
- Property owners whose properties are directly inundated by a reservoir constructed for the purpose of interbasin transfers shall have the right to receive royalties for the water stored over the property taken as an ongoing compensation.

- Local government and other taxing entities shall have the right to direct payments in lieu of taxation for property lost and per ac-ft for waters stored in the reservoirs constructed in the NETRWPG area for transfer to other basins to replace the taxation lost due to property removed directly from the tax rolls. Direct payment in lieu of taxation may differ on stored water and transferred water.
- Local government, school districts and industry affected directly by the development of a reservoir proposed for interbasin transfer shall be aided and supported by the production of planning and remuneration for direct reduction of economic activity, resources and jobs.
- The NETRWPG area will retain a portion of the impounded water of the developed reservoir for future use by the region.

The development of reservoirs in the NETRWPG area as a future water source for other portions of the state would require interbasin transfer authorizations from the Texas Commission on Environmental Quality (TCEQ). Among its many provisions, S.B. 1 includes provisions (Texas Water Code, Section 11.085) requiring the TCEQ to weigh the benefits of a proposed new interbasin transfer to the receiving basin against the detriments to the basin supplying the water. S.B. 1 also established the following criteria to be used by the TCEQ in its evaluation of proposed interbasin transfers:

- The need for the water in the basin of origin and in the proposed receiving basin based on the period for which the water supply is requested, but not to exceed 50 years;
- Factors identified in the applicable approved regional water plans which address the following:
    - the availability of feasible and practicable alternative supplies in the receiving basin to the water proposed for transfer;
    - the amount and purposes of use in the receiving basin for which water is needed;
    - proposed methods and efforts by the receiving basin to avoid waste and implement water conservation and drought contingency measures;
    - proposed methods and efforts by the receiving basin to put the water proposed for transfer to beneficial use;
    - the projected economic impact that is reasonably expected to occur in each basin as a result of the transfer; and
    - the projected impacts of the proposed transfer that are reasonably expected to occur on existing water rights, instream uses, water quality, aquatic and riparian habitat, and bays and estuaries that must be assessed under Sections 11.147, 11.150, and 11.152 of [the Texas Water Code] in each basin. If the water sought to be transferred is currently authorized to be used under an existing permit, certified filing, or certificate of adjudication, such impacts shall only be considered in relation to that portion of the permit, certified filing, or certificate of adjudication proposed for transfer and shall be based on historical uses of the permit, certified filing, or certificate of adjudication for which amendment is sought;
- Proposed mitigation or compensation, if any, to the basin of origin by the applicant;

- The continued need to use the water for the purposes authorized under the existing permit, certified filing, or certificate of adjudication, if an amendment to an existing water right is sought; and
- The information required to be submitted by the applicant.

The NETRWPG supports the full application of the criteria for authorization of interbasin transfers contained in current state law. With regard to compensation to the basin of origin, the NETRWPG recommends that a portion of the firm yield of projects developed in the NETRWPG basins for interbasin transfer, be reserved for future use within the basin of origin. The specific terms of such compensation, along with other issues associated with development of the project (e.g., financing, operation of the reservoir, etc.), should be addressed by the appropriate representatives of the authority within the basin of origin, in coordination with the water districts and the entities in receiving regions and within the North East Texas Region that are seeking the additional water supply.

The NETRWPG also endorses the recommendation contained in the adopted *Comprehensive Sabine Watershed Management Plan* that the Sabine River Authority (SRA) develop the Prairie Creek Reservoir. Located centrally in the upper portion of the Sabine Basin, the proposed reservoir would enable the SRA to supply projected future manufacturing needs in Harrison County. As previously noted, the Prairie Creek Reservoir and Pipeline Project is being pursued by the Sabine River Authority at this time due to the conservation easement limitation on the Waters Bluff reservoir site. If the conservation easement were removed, the Water Bluff Reservoir would become the Sabine River Authority's top priority project to meet projected water needs in the upper Sabine River Basin.

The NETRWPG also has definite concerns about local property owners who would be directly impacted by reservoir construction. A particular concern is that landowners be compensated fairly for the value of any land acquired for reservoir development.

8.13.3 **Environmental Protection Agency and Corps of Engineers**

In March of 2008, the EPA and the COE *announced innovative new standards to promote no net loss of wetlands by improving wetland restoration and protection policies, increasing the effective use of wetland mitigation banks and strengthening the requirements for the use of in-lieu fee mitigation. The new standards clearly affirm the requirement to adhere to the "mitigation sequence' of "avoid, minimize and compensate".* The NETRWPG recommends that the Wetlands Compensatory Mitigation Rule be closely followed to minimize any impact on the region through the consideration of reservoirs and the mitigation thereof. The group strongly supports the requirement of the mitigation sequence of "avoid, minimize and compensate" should any new reservoirs in Region D be pursued.

8.13.4 Environmental Flows

It is the position of the North East Texas Regional Water Planning Group that there be no development of new reservoirs in the Black Cypress portion of the Cypress Creek Basin or the entire Sulphur River Basin within Region D, nor transfer of water out of these basins for that part that is within Region D until the flow needs for a sound ecological environment are defined for these basins through the process established in Senate Bill 3, 2007 Regular Session of the Texas Legislature. Those flow needs are defined as the low, pulse, and flood flows. No additional development should take place until the State has identified the environmental flows necessary to maintain the Black Cypress and Sulphur Rivers, and their tributaries, and established standards for the environmental flows for these basins.

The NETRWPG recognizes that other regional water planning groups may include recommendations for new reservoirs in the Sulphur River basins, or for the transfer of water out of these basins to basins in other regions, as part of their recommended water management strategies or as alternate strategies. It is the position of the NETRWPG that unless such proposed reservoirs or transfers include explicit recognition that the needs for environmental flows in the North East Texas Region must be satisfied first consistent with Senate Bill 3, that these strategies are inconsistent with the legislative mandate established by Senate Bill 3 and are inadequate in addressing the required quantitative reporting of environmental factors including effects on environmental water needs, such as required in TAC 357.34(d)(3).

Development of new reservoirs prior to determination of the water needs for environmental flows in the Sulphur River Basin would be premature. It is the position of the NETRWPG that proposed reservoirs or transfers need to be consistent with the protection of significant agricultural and natural resources of Region D and the State.

8.14 LEGISLATIVE RECOMMENDATIONS

TWDB rules for the 2016 regional water planning activities (31 TAC Chapter 357.43(a), (d), (e), and (f) also provide that:

(a) The RWPs shall contain any regulatory, administrative, or legislative recommendations developed by the RWPGs.

(d) Any other recommendations that the RWPG believes are needed and desirable to achieve the stated goals of state and regional water planning including to facilitate the orderly development, management, and conservation of water resources and prepare for and respond to drought conditions.

(e) RWPGs may develop information as to the potential impacts of any proposed changes in law prior to or after changes are enacted.

(f) RWPGs should consider making legislative recommendations to facilitate more voluntary water transfers in the region.

The approved scope of work for the development of the regional water plan for the North East Texas Region includes development of legislative recommendations for ecologically unique stream segments, ecologically unique reservoir sites and general recommendations to the state legislature on water planning actives as well as issues in the North East Texas Region.

Throughout the 2016 planning process, the one major policy issue that remained dominant during the meetings of the NETRWPG and received the most comment from the public during the public comment portion of the regular meetings was the designation of the Marvin Nichols reservoir site in the Sulphur River Basin as a water management strategy for providing water outside the Region. Issues that remained from the 2011 Region D plan are future interbasin transfers from the North East Texas Region; conversion from groundwater to surface water supplies; various regulatory policies of the Texas Commission on Environmental Quality; and, improvements to the regional water supply planning process. With regard to the regional water supply planning process, significant consideration and discussion has been given to the appropriateness of the use of Modeled Available Groundwater (MAG) amounts for establishing available groundwater supplies within a region with no regulatory entity in place, and the capability of interests within the region to be primarily responsible for the development of this availability. Each of these issues is briefly discussed in the section below. Also presented are the recommendations adopted by the NETRWPG on each issue.

8.14.1 **Recommendation: Marvin Nichols Reservoir Sites**

The Marvin Nichols Reservoir Sites (including but not limited to I, IA and II) in the Sulphur River Basin as designated in the 2001 plan has remained of great concern in the 2016 plan preparation. In December 2002 the NETRWPG amended the 2001 plan to change the designation of the sites from proposed sites to potential sites, but the issue has remained at each of the subsequent planning meetings.

In May 2005, the NETRWPG voted to completely remove the Marvin Nichols I site from the Region D Water plan. The 2006 and 2011 Region D Plans state that the Marvin Nichols I reservoir should not be included in any regional water plan as a water management strategy and not be included in the State Water Plan as a water management strategy. The NETRWPG stated that the Marvin Nichols I Reservoir was not consistent with protecting the timber, agricultural, environmental and other natural resources as well as third parties in the Region D area. Among the specific issues are basic rights of the property owners and the local governmental entities.

Based on the reasons set forth in Section 6.9 of this regional plan, it has been the position of the North East Texas Regional Water Planning Group that Marvin Nichols reservoir should not be included in the 2017 State Water Plan as a water management strategy. Region D continues to oppose Marvin Nichols Reservoir, but is willing to work with other regions to obtain water supplies from the Sulphur River Basin that do not involve new reservoir construction. As noted previously, the NETRWPG does not challenge Marvin Nichols Reservoir as a unique reservoir site for the purposes of this Plan.

Subject to the comments in Chapter 6, the following recommendations should apply to all reservoirs considered in NETRWPG area:

- All other alternatives such as conservation, alternate available water supply sources and water resources in existing reservoir's must be exhausted prior to consideration of new reservoir development.
- New mitigation rules must be considered, such as, requiring the mitigation area to be acquired from the basin or region requesting the new reservoir. It is believed to be too harsh a requirement to take property from a basin for a reservoir and then acquire more property from the same basin to mitigate the property taken for the new reservoir especially at a requirement of 2-10 times the reservoir property.
- Property owners must be afforded more rights when confronted with acquisition of their property. These rights should include, but not be limited to, proper notification of the consideration of acquisition in a timely manner; extent of considered acquisition; the maximum compensation possible including compensation based on replacement value; royalties for water stored above acquired properties as compensation for yielding ongoing earnings potential; and the additional rights for use of mitigation lands.
- Local governmental taxing agencies, including school districts, should receive direct payments in lieu of taxation for waters stored in the NETRWPG area reservoirs for transfer to other regions. This is considered partial replacement value for lost revenue for the local agencies.
- Local government, school districts and economic areas affected directly by the consideration of development of a reservoir site shall receive assistance for the recapture of lost resources, jobs, or income.
- The NETRWPG area will retain a portion of the impounded water of the developed reservoir for future use by the region.

Concerning the potential Marvin Nichols reservoir sites (including but not limited to I, IA and II) the North East Texas Regional Water Planning Group does not recommend any of the potential reservoir sites for designation as a Unique Reservoir Site. Also, the potential Marvin Nichols reservoir site as described in the Reservoir Site Protection Study, TWDB Report 370, published July 2008, is not recommended by the North East Texas Water Planning Group for designation as a unique Reservoir Site. As noted previously, the NETRWPG does not challenge Marvin Nichols Reservoir as a unique reservoir site for the purposes of this Plan.

8.14.2 **Recommendation: The Growth of Giant Salvinia**

The North East Texas Water Planning Group received a report from Lee Thomas, Northeast Municipal Water District, in October of 2009, concerning the presence of Giant Salvinia within the NETRWP Area.

Giant Salvinia is an invasive floating aquatic weed and presents a significant threat to the state resources because of its severe impacts in freshwater ecosystems. It adversely affects the biodiversity and functioning of wetlands and riparian ecosystems, water quality, water storage and distribution infrastructure, recreation and amenity values. It has often been described as one of the "world's worst weeds." Production losses combined with the control and management costs it has incurred annually reach a multi-billion dollar figure worldwide. The environmental costs will never be fully known but is well in excess of the management costs in dollar terms.

Specifically Giant Salvinia is a free-floating, sterile aquatic fern that reproduces by vegetative growth and fragmentation. Under normal conditions, up to three lateral buds may develop on each node. Salvinia typically passes through three vegetative growth forms starting with the primary juvenile or invasive form, followed by the secondary then tertiary forms. As growth progresses through each phase, the leaves become larger, begin to fold upwards and the plants become more compact. While the primary phase is easily distinguished from the tertiary, there are many factors that can affect the development of Giant Salvinia. In a rapidly expanding population, it is quite easy to find all three forms present. Under ideal growth conditions, it has been reported that Giant Salvinia can achieve extraordinary growth rates, doubling its biomass in as little as two days.

8.14.2.1 Background on Giant Salvinia

The North East Texas Regional Water Planning Group was informed of the presence of Giant Salvinia (*Salvinia molesta)* within the region by the October report. In that report it was stated that the presence of Giant Salvinia in the region is a relatively recent development but it has been noted to be expanding specifically in the Cypress Creek Basin. Giant Salvinia is a noxious, invasive aquatic plant that has significant adverse effects on affected wetlands and related environments and is an increasing threat to water quality.

Giant Salvinia has been found to be present in both Louisiana and Texas. In Texas it is present in Caddo Lake in the Cypress Creek Basin which is in the eastern most portion of the North East Texas Regional Water Planning Area. There are significant control measures underway in relation to Giant Salvinia infestations in Caddo Lake.

The impacts of Giant Salvinia are many and varied but essentially it reduces aquatic biodiversity by removing light from the water body. The removal of light kills all submerged plants and eventually their associated fauna below the floating infestation.

To maintain the health of our waterways by limiting the impact and restricting the spread of Giant Salvinia, community understanding about the dangers of Giant Salvinia must be raised in order to mitigate existing conditions and prevent further impact, introduction, and spread to surrounding aquatic habitats. Environmental impacts such as increased runoff, sedimentation and leaching of fertilizers can dramatically increase the establishment and spread of aquatic weed species. The possession of all species of the genus *Salvinia* is prohibited under Texas State law. Despite this law, the transportation of Giant Salvinia from one water body to another continues.

Control of Giant Salvinia is very difficult especially in high value wetlands which may contain endangered species. While integrated use of biological control and herbicides is successfully used in some locations, there are fewer effective options in riverine and wetland habitats. Most efforts, therefore, involve methods that are time consuming, intensive and expensive.

8.14.2.2 Environmental, Social and Economic Impacts of Giant Salvinia

Public safety and health are endangered by the presence of Giant Salvinia as it is known to encourage breeding of disease-carrying pests by providing a perfect habitat for larval development; these include mosquito vectors of malaria and West Nile virus. The development of thick floating mats can provide a dangerous platform for children and animals. Animals frequently mistake the dense carpets of Giant Salvinia for firm ground and fall into the water body underneath.

Giant Salvinia greatly reduces the aesthetic value of water bodies by an accumulation of litter, water stagnation and development of foul odors. Increased numbers of mosquitoes and midges, aside from any public health issue, can severely reduce visitor numbers and length of stay at aquatic venues.

Giant Salvinia disrupts use of waterways for recreation, boating, fishing and swimming. Heavy infestations prevent access by boats and recreational fishing is impeded. Swimming is dangerous, if not impossible, in dense infestations.

The presence of Giant Salvinia impacts water storage facilities and distribution infrastructure. These facilities have been adversely affected through the blocking of irrigation channels and pump intakes. Blockage of channels and pumps can increase pumping times and costs, and can lead to expensive repairs or significantly reducing the time between planned maintenance events. By accelerating the amount of water removed from storage through plant transpiration, the presence of Giant Salvinia can have a significant effect on water quantity.

Giant Salvinia modifies the environment by shading out submerged aquatic plants and lowering oxygen levels causing animal deaths, some of which may be endangered species. Dense infestations could eventually kill most plant life normally found below water level and much aquatic life will either die out or relocate. This loss of aquatic biodiversity could be devastating to the environmentally unique areas. General water quality is also degraded through decomposing plant material and dramatically increasing water loss through transpiration. Giant Salvinia has negatively impacted at least one RAMSAR wetland (Caddo Lake) in addition to thirteen major reservoirs in Texas.

The direct costs of control of the menace and the associated management activities are affecting many governmental as well as private budgets. Chemical and mechanical costs incurred by local, state, and federal government agencies along with private control programs are likely to be in excess of $250,000 per year per water body. Some government authorities keep breeding tanks of the leaf eating weevil called Salvinia weevil (*Cyrtobagous salviniae)* to assist in dealing with Giant Salvinia infestations in their region. This may help reduce the long-term cost in controlling Giant Salvinia, but colonies of the weevil have yet to be established in the North East Texas Water Planning Region due to the colder climate.

The education and outreach to the public is an ongoing effort. It is important to educate the public of the threat Giant Salvinia on the water resources of the State and how to identify Giant Salvinia. Hopefully, the public can lower the rate of spread of infestation and will report possible new infestations and assist with methods of mitigation. This is an area where efforts need to be extended by government and industry in the State.

8.14.2.3 Local, State, and Federal Government Efforts

The North East Texas Water Planning Group recommends that available State funds be dedicated to the control of Giant Salvinia and that governmental sources provide additional resources when available, such as enactment of complementary legislation to support control efforts and prevent distribution of Giant Salvinia. The Texas Legislature is also recommended to approve legislation that will assist local and state officials in controlling the spread and elimination of existing infestations of the plant.

It is further recommended by the North East Water Planning Group that the local and state governments adopt the following:

- Continue to research and develop efficient, effective and appropriate control techniques;
- Provide extension and education services to urban and industry stakeholders;
- Support enforcement of legislation and control measures;
- Ensure that Giant Salvinia is identified in local, regional, and State level pest management plans;
- Coordinate with landholder, community and industry interest groups to cooperatively manage and control Giant Salvinia infestations;
- Research and develop best management practices;
- Monitor water pollution;
- Periodically inspect all water bodies for Giant Salvinia; and
- Promote reporting of new Giant Salvinia infestations.

The North East Texas Regional Water Planning Group also recommends to the appropriate State and Federal governmental departments adopt the following actions:

- Develop awareness campaigns to discourage the transportation and/or possession of Giant Salvinia;
- Eradicate infestations where feasible, and ensure Giant Salvinia control is undertaken on all federally managed land.

8.14.3 **Recommendation: Toledo Bend Reservoir and Pipeline**

At the previous request of the Sabine River Authority the NETRWPG recommends that the Toledo Bend Reservoir be designated a supply strategy for meeting the upper Sabine Basin needs within the NETRWPG area and a supply option for Region C. This reservoir along with the proposed pipeline from Toledo Bend to the Prairie Creek Reservoir will eventually be used as a supply source for the upper Sabine Basin.

8.14.4 **Recommendation: Concerning Oil and Gas Wells**

The NETRWPG recommends that the Texas Railroad Commission review the practices and regulations concerning the protection of the fresh water supply located in the aquifers that supply much of East Texas with fresh water as to the regulation of the drilling, maintaining and plugging of oil or gas wells with regards to public fresh water supply wells.

In a report presented December 9, 2004, by Mr. Tommy Konezak, Kilgore, Texas, and summarized here the NETRWPG heard that approximately 40,000 wells have been drilled in the East Texas Field since it opened. Since these production wells penetrate some of the essential aquifers that supply much of the east Texas fresh water there is adequate opportunity for contamination of the fresh water supply. Current regulations require public water supply wells to have a 150 foot sanitary easement in relation to a petroleum well, but there is no similar requirement for the drilling of an oil or gas well as regards to public water supply wells. The initial drilling of a petroleum well allows for the placement of 100 feet of surface pipe on a well even though the aquifer may have 800 feet of formation. The plugging of wells termed dry holes has not kept up with the times and the existing regulations should be enforced strictly.

8.14.5 **Recommendation: Concerning Mitigation**

The North East Texas Regional Planning Group recommends that any planning group or entity proposing a new reservoir or any other water management strategy should address the subject of mitigation in conjunction with any and all feasibility studies. As evidenced in Section 6.9 of this plan, a study on possible mitigation effects should be undertaken and completed in conjunction with any and all feasibility studies. Information should include estimates of mitigation, predication ratios, and other information useful to landowners potentially affected by mitigation requirements. Also, any new reservoir proposed by a planning group must be accompanied by a map of the proposed reservoir and a map of the land proposed to be mitigated, including proposed acreage.

The North East Texas Regional Water Planning Group recognizes that the rules concerning mitigation and the method of accomplishing mitigation have recently evolved. Some suggested references to update for mitigation rules and information are the *National Wetlands Mitigation Action Plan* (www.mitigationactionplan.gov), the EPA *Mitigation Banking Factsheet* (www.epa.gov/owow/wetlands/facts/fact16.html), the EPA *Wetlands Compensatory Mitigation Rule* (www.epa.gov/wetlandmitigation) and the *Corps Regulatory Program* (www.usace.army.mil/inet/functions/cw/cecwo/reg). The following information was derived in part from these references.

The preference for Mitigation Banking was first conceived in 1983 when the U. S. Fish and Wildlife Service supported their establishment. This program was well positioned to provide easier monitoring, long-term stewardship, and unambiguous transfer of liability for success from the permittee to the banker. The EPA in the *Mitigation Banking Factsheet* has stated that the advantages of the mitigation-banking program are to:

- Reduce uncertainty over whether the compensatory mitigation will be successful in offsetting project impacts;
- Assemble and apply extensive financial resources, planning and scientific expertise not always available to many permittee responsible compensatory mitigation proposals;
- Reduce processing times and provide more cost effective compensatory mitigation opportunities; and
- Enable the efficient use of limited agency resources in the review and compliance monitoring of compensatory mitigation projects because of consolidation.

The EPA and the USACE announced in March of 2008 new standards to promote the "no net loss of wetlands" by improving wetland restoration and protection policies, increasing the effective use of wetland mitigation banks and strengthening the requirements for the use of in-lieu fee mitigation. These standards clearly affirm the requirement to adhere to the "mitigation sequence" of "avoid, minimize and compensate". The permittee must first avoid and minimize the impact on the wetland and then compensate for unavoidable impacts. The term here "to compensate" is specifically directed at the wetland or other aquatic feature being impacted.

A mitigation bank may be created when a government agency, private corporation, non-profit organization, or other entity undertakes the prescribed activities required under a formal agreement with a regulatory agency. The value assigned to a mitigation bank is through "compensatory mitigation credits". The bank's instrument identifies the number of credits available for sale and requires the use of ecological assessment techniques to certify that those credits provide the required ecological functions. The Compensatory Mitigation Rule identifies and clarifies the consideration of watershed scale factors in the selection of appropriate mitigation sites. Mitigation credits utilized by "banks" now allow for a more varied use of options. Mitigation proposals may use on-site (i.e., located close to the impact) and in-kind (i.e., replacement of the same ecological type as the impacted resource). In addition the rule clarifies the consideration of watershed-scale factors in the selection of appropriate mitigation sites. This clarification may increase the practical viability of mitigation proposals involving off-site or out-of-kind replacement with the regard to use of "compensatory mitigation credits". These replacement processes will still provide appropriate resource replacement in ways that are beneficial to the watershed. The USACE is the final decision maker regarding whether a proposed compensatory mitigation option provides appropriate compensation to receive a permit.

The USACE has been recommended to adopt a "watershed-based approach" (although a consensus definition has yet to be established) to compensatory mitigation as stated in the *New Wetlands Mitigation Rules* (www.epa.gov/fedrgstr/EPA-WATER/2006/March/Day-28/w1969.htm). The watershed approach is based on a formal watershed plan being developed jointly by Federal, State and/or local environmental managers in consultation with the affected stakeholders. The affected stakeholders include the local sponsors and landowners of the proposed project and the proposed mitigation sites. Project sponsors are tasked with making a reasonable effort, commensurate with the scope and scale of the project and impacts, to obtain as much information as possible prior to the design of the compensatory mitigation project.

The design of compensatory mitigation projects does involve a case-by-case decision making process. This is due to the variables that are encountered on the different projects. While decision-making relies on the scientific expertise of wetlands program staff and broad based stakeholder participation, project sponsors may propose compensatory mitigation based on the watershed approach using information from other sources. Such information includes: current trends in habitat loss or conversion, cumulative impacts of past development activities, current development trends, the presence and needs of sensitive species, site conditions that favor or hinder the success of mitigation projects, chronic environmental problems such as flooding or poor water quality, and local watershed goals and priorities.

8.14.6 **Recommendation: Future Interbasin Transfers from the North East Texas Region**

The North East Texas Region currently supplies surface water to other areas of the state through interbasin transfers and is identified in the current state water plan as a likely source of additional future water supply for various entities in Region C. Specifically, the 1997 State Water Plan includes recommendations that one or more new reservoirs be developed in the Sulphur River Basin as a source of future water supply for the Dallas-Ft. Worth Metroplex. In addition to potential future water transfers from the North East Texas Region to Region C, there may also be water management strategies for meeting needs within the North East Texas Region that will involve conveyance of supplies from one river basin to another within the region.

Among its many provisions, S.B. 1 includes provisions (Texas Water Code, Section 11.085) requiring the Texas Commission on Environmental Quality (TCEQ) to weigh the benefits of a proposed new interbasin transfer to the receiving basin against the detriments to the basin supplying the water. However, these provisions relate only to river basins of origin, not to the water planning regions of origin. S.B. 1 established the following criteria to be used by the TCEQ in its evaluation of proposed interbasin transfers:

- The need for the water in the basin of origin and in the proposed receiving basin based on the period for which the water supply is requested, but not to exceed 50 years;
- Factors identified in the applicable approved regional water plans which address the following:
    - the availability of feasible and practicable alternative supplies in the receiving basin to the water proposed for transfer;
    - the amount and purposes of use in the receiving basin for which water is needed;
    - proposed methods and efforts by the receiving basin to avoid waste and implement water conservation and drought contingency measures;

  - proposed methods and efforts by the receiving basin to put the water proposed for transfer to beneficial use;
  - the projected economic impact that is reasonably expected to occur in each basin as a result of the transfer; and
  - the projected impacts of the proposed transfer that are reasonably expected to occur on existing water rights, instream uses, water quality, aquatic and riparian habitat, and bays and estuaries that must be assessed under Sections 11.147, 11.150, and 11.152 of [the Texas Water Code] in each basin. If the water sought to be transferred is currently authorized to be used under an existing permit, certified filing, or certificate of adjudication, such impacts shall only be considered in relation to that portion of the permit, certified filing, or certificate of adjudication proposed for transfer and shall be based on historical uses of the permit, certified filing, or certificate of adjudication for which amendment is sought;
- Proposed mitigation or compensation, if any, to the basin of origin by the applicant;
- The continued need to use the water for the purposes authorized under the existing permit, certified filing, or certificate of adjudication, if an amendment to an existing water right is sought; and
- The information required to be submitted by the applicant.

As an added protection to water rights and water users in a basin of origin, S.B. 1 also included a requirement that amending an existing water right for a new interbasin transfer would result in the water right acquiring a new priority date. The effect of this requirement is to give all other water rights in the basin of origin a higher priority than the amended right.

Current state law and policy regarding interbasin transfers of surface water provide a useful starting point for inter-regional discussions on the development of a new reservoir in the Sulphur River Basin. Several of the criteria that TCEQ is to consider in its review of interbasin transfers are of particular relevance, including:

- Future needs for water supply in the Sulphur River Basin;
- Economic impacts of future reservoir development and interbasin transfer on the Sulphur River Basin;
- Environmental impacts; and
- Mitigation of impacts to Sulphur River Basin and compensation for the interbasin transfer.

8.14.7 Recommendation: Designation of Wholesale Water Providers

The North East Texas Regional Water Planning Group supports the designation of a Wholesale Water Provider (WWP) as described in the Texas Administrative Code §357.10(30) as:

> Any person or entity, including river authorities and irrigation districts, that has contracts to sell more than 1,000 acre-feet of water wholesale in any one year during the five years immediately preceding the adoption of the last regional water plan. The regional water planning groups shall include as wholesale water providers other persons and entities that enter or that the regional water planning group expects or recommends to enter contracts to sell more than 1,000 acre-feet of water wholesale during the period covered by the plan.

The NETRWPG supports the granting of a designation of WWP for an entity within Region D depending upon a written request from that entity to the NETRWPG that demonstrates said entity has entered or the RWPG expects or recommends to enter into contracts to sell more than 1,000 acre-feet of water wholesale during the period covered by the plan, including the designation of expected demand and the expected supply. Without a request that includes sufficient identification of expected contractual demand and expected supply, the NETRWPG cannot plan for such an entity. With this noted, Region D expects that the water supply out of Lake Wright Patman will continue to be with Texarkana and Riverbend Water Resources District control as Wholesale Water Providers.

8.14.8 **Recommendation: Future Water Needs**

A widely held view within the North East Texas Region is that future water needs within the region must be assured before additional interbasin transfers are permitted. Many residents of the region express support for future reservoir development and interbasin transfers provided the region's long term water demands are met. This sentiment is supported by TWDB rules for regional water planning, which require that the evaluation of interbasin transfer options include consideration of "…the need for water in the basin of origin and in the proposed receiving basin."

The results of the supply and demand assessment for the North East Texas Region indicate that at the regional level, currently legally available surface and groundwater supplies are adequate to meet projected needs through 2070. This conclusion also applies for each of the river basins within the region. More importantly, however, the supply and demand assessment indicates that 68 individual water user groups are projected to experience shortages during the planning period, including several in the Sulphur River Basin. However, a majority of these shortages are projected to occur in small communities and rural areas and it is generally believed that local water supply options will be the preferred strategy for meeting those needs.

The issue of how much water is needed in the North East Texas Region for local use is not as simple as just comparing estimates of existing water supply to projections of future water demand. It should be remembered that the water demand projections adopted by the NETRWPG and the TWDB for development of the regional plan are based largely on an extrapolation of past growth trends. While this is a common and accepted method for forecasting future conditions, there are nonetheless significant uncertainties in the projections.

Shifting demographics and economic and technological change could result in substantially higher demand for water in the North East Texas Region than is currently projected. For example, there is an observed trend over the past decade in many areas of the U.S. of higher population growth in small and medium sized cities and rural areas. This has been attributed in part to advancements in telecommunications and the evolving information and service based economy, which no longer requires a concentration of labor in large cities. Another factor is the aging of the population and the trend toward retirement in rural areas. Also, development of a new reservoir in the Sulphur Basin could, itself, act as a significant catalyst for economic development and growth in the area. In fact, some in the planning region have expressed interest in building reservoirs as part of an overall regional economic development strategy. Results from the recent SRBA (2014) Sulphur River Basin Feasibility Study suggest a wide variety of potential demands in the region, many significantly higher than those estimates developed for regional planning.

Such factors suggest that the NETRWPG may want to review a possible policy recommendation regarding the definition of "need" in the basin of origin. Some members have also suggested broadening the test of need for interbasin transfers to consideration of projected needs throughout the *region* of origin, not just the basin of origin.

8.14.9 Recommendation: Economic and Environmental Impacts

The NETRWPG recommends considering potential economic and environmental impacts associated with reservoir development. For example, a significant amount of taxable private property could be removed from local tax rolls thereby increasing the tax burden on other property owners. The effects of new development are uncertain and likely include both negative and positive consequences.

Reservoir development would also alter the natural environment, perhaps resulting in significant losses of ecologically valuable wetlands and riparian areas. However, state and federal regulations require that such impacts be minimized and mitigated to the extent possible, often through the set-aside and protection of other valuable ecological resources. Some water planners in the region have expressed the concern that mitigation requirements for large reservoirs in one basin might have to be met by restricting uses of riparian areas in other basins, thus limiting future possibilities for development at those sites.

8.14.10 Recommendation: Compensation for Reservoir Development and Interbasin Transfers

Perhaps the most important consideration in inter-regional discussions regarding reservoir development and interbasin transfers is the question of compensation. A common view is that future interbasin transfers should be of direct benefit to both the basin-of-origin and the receiving basin. As noted in the case of future water needs, RWPG members have also expressed strong interest in the distribution of benefits to the region as well as the basin of origin. In essence, it is a question of equity or fairness. There are several ways that compensation for the transfer of additional water supplies from the Sulphur Basin could be approached. Examples include:

- Retaining ownership of water rights by an entity in the basin of origin with a portion of the water transferred out of basin under long term contract;
- Reserving some portion of the yield of a new reservoir for future use within the basin of origin;
- Setting rates on water sales sufficient to cover both the costs of developing and operating a new reservoir plus additional revenues for other purposes (e.g., supporting the functions of the local project sponsor); and
- Direct payments to the governmental entities in the impacted area.

Given the significance and implications of new reservoir development and future interbasin transfers across regional lines, the NETRWPG should consider adopting a policy statement addressing the issue of future water needs within the basins of origin and/or within the North East Texas Region as a whole, economic and environmental impacts of reservoir development, and inter-regional equity and compensation issues. It should be noted the issue of compensation is applicable to all reservoir development whether an interbasin transfer is contemplated or not.

8.14.11 Recommendation: Conversion of Public Water Supplies to Surface Water from Groundwater

Many water suppliers in the North East Texas Region rely solely on local groundwater supplies. Most of these suppliers will likely continue to use groundwater for future needs. However, in some areas, groundwater supplies will not be adequate to meet future needs and alternative sources of supply need to be considered. Also, in many areas of the region, groundwater supplies are of poor quality and do not meet current state and federal drinking water standards. Where groundwater supplies are available but are of poor quality, one supply strategy could be to develop additional groundwater with advanced treatment. However, because of the cost of treatment, and particularly the cost of disposal of the waste streams, acquisition of surface water supplies may be the most economically viable alternative.

Acquisition of surface water supplies would require that there be both legal and physical access to surface water supplies. Some communities may be in relatively close proximity to an existing surface water source but do not have access to those supplies because the water is fully committed to other users. In other cases, the physical infrastructure required to transport surface water from its source to a user does not exist and may be too costly.

Building regional water supply systems may offer the potential for significant cost savings in acquiring new water supplies and improving the reliability and quality of supplies. For some small water systems, regional approaches to water supply may be the only economically viable approach to conversion from groundwater to surface water. Connecting a number of independent systems can take many forms. It can include the development of regional water supply facilities, the physical consolidation or interconnection of two or more existing water systems or the management of two or more independent systems by a single entity. Some local water providers and customers may object to loss of direct local control over the system, or they may feel that cost sharing formulas are unfair. For such reasons, each proposal for a regional system must be considered on a case-by-case basis.

8.14.12 Recommendation: Texas Commission on Environmental Quality (TCEQ) Regulations

The TCEQ minimum requirement of 0.6 gallons per minute per connection for public drinking water systems is a significant issue for many water providers in the North East Texas Region. Currently, this requirement is not directly reflected in TWDB rules relating to regional water planning. Many providers indicate that this requirement exceeds the real needs of water users and would require major additions to supplies, storage, and delivery capacities. In areas of marginal groundwater quantity, numerous wells may be required. Well spacing of approximately one half mile between wells means new well fields would occupy extensive geographic areas. In order to protect the investment in a new field from the effects of the rule of capture, providers must also purchase enough land to provide a buffer around the targeted supply. These new well fields might have to be located at remote sites, possibly triggering complaints, common in other parts of the state, of one population mining groundwater at the expense of the exporting area. Costs of new pipeline construction are also a major concern.

Methyl Tertiary Butyl Ether (MTBE) and other contaminants pose a significant threat to water supply sources in the North East Texas Region, as the recent incident at Lake Tawakoni illustrated all too well. There are two dimensions to this issue. On the one hand, the NETRWPG has urged TCEQ to phase out the use of MTBE specifically, and both the state and federal regulators across the country are looking for substitute components for reformulated gasoline. Aside from the regulatory imposition of the use of MTBE (and this is only one of many potential contaminants that can find their way into drinking water sources), there is the additional lesson from the Tawakoni experience that those providers with more than one water source were best able to deal with that crisis. It is desirable for water user groups with vulnerable sources to plan on emergency access to backup supplies.

TCEQ regularly updates its list of streams, lakes and other water bodies that fail to meet the water quality standards established for specific water uses. Many of these water bodies are drinking water sources. This issue differs from the MTBE contamination episode at Lake Tawakoni, which was an accidental spill that was removed from the system in a matter of weeks. That temporary circumstance did not have a long term effect on overall water quality of the lake. The planning process needs to take account, however, of continuing problems in drinking water sources that may lead to placement on the state list such as: low dissolved oxygen levels, excessive waste loads, mercury and other contaminants, etc.

The NETRWPG adopted the following recommendations with regard to TCEQ regulatory policies:

- There should be consistency between TWDB rules for Regional water supply planning and TCEQ rules for drinking water systems with regard to minimum requirements for water supply;
- TCEQ should expedite the effort to replace MTBE in reformulated gasoline with additives that do not pose a risk to drinking water supplies.

8.14.13 Recommendation: Improvements to the Regional Water Planning Process

a) The NETRWPG believes that the regional water planning process should provide greater flexibility in development of water demand projections. TWDB rules and guidelines regarding population and water demand projections tend to confine rural and smaller urban areas to past rates of growth without allowing for consideration of alternative scenarios for future growth and economic development initiatives. Because the region has a relatively small population and water demands, the impact of a major new water user, such as a paper mill or a power plant, could dramatically alter the water supply and demand equation at a county or even basin level. There is no mechanism in the current process to provide for these potential increases, until the five year review period.

   TWDB rules also build into municipal water demand projections conservation assumptions which may be unrealistic. In rural areas that already have low rates of per capita use, there often is an increase in per capita use as development takes hold in the area. Assumptions about conservation in these areas that already use far less on a per capita basis than the very large and rapidly growing urban areas could have the effect of limiting future development. There are more than 30 water user groups in the North East Texas Region with per capita usage levels well below the 115 gallons per capita per day (gpcpd) level set as the "floor" by the NETRWPG. Some usage rates are in the 70-80 gpcpd range, a sharp contrast with large urban areas where 200 gpcpd or more is not uncommon. Landscape watering, a prime target for urban water conservation programs, is much less prevalent in rural areas. Further, the housing stock is not undergoing rapid growth or replacement, thus reducing the potential impact of plumbing fixture efficiency standards.

   The North East Texas Regional Water Planning Group recommends that the TWDB should revise procedures for calculating water demand reduction projections contained in its conservation scenarios by recognizing a floor for the application of demand reduction for rural and small city areas where the per capita water consumption levels are already very low.

b) Further, for the present round of planning, the TWDB established a floor for water demand at 60 gpcpd. In previous rounds, the RWPGs were allowed the capability to establish individual floors, whereby Region D used an amount of 115 gpcpd. It appears inappropriate to assume that usage less than 115 gpcpd can be sustained over the long-term planning horizon. For those communities using in excess of 250 gallons per day, it should be noted that TWDB planning rules for this current round of planning are enabling 50 year forecasts for systems using 4 times or more than another community.

This rule, as applied, is inherently unfair, and eliminates small per capita usage systems from ever having a normal usage, as it basically confines that system to always serving an area that is constraining growth. The growth cannot be higher usage (water usage generally increases as disposable income per household increases) with the TWDB methodology as presently applied.

The NETRWPG recommends that the TWDB allow the RWPGs to establish individual regional thresholds of gpcpd for a given region, as this provides a more equitable solution for the establishment of future demands in the region.

c) The NETRWPG recommends additional funding is made available to allow for greater scrutiny of rural water supply entities at the Sub-Water User Group (Sub-WUG) level. For this round of regional planning, such entities are aggregated and represented within the plan as a “County-Other” WUG. Where necessary, extra effort has been given to identify and evaluate the needs for entities within this “County-Other” category, but with limited funding in the present round as compared to previous rounds the level of overall effort to distinguish these entities has been necessarily diminished. Additional funding affords the capability to more rigorously evaluate these smaller, rural entities, which comprise a significant portion of the Region D population, as was done in previous rounds of regional planning.

d) Lastly, recent analyses in the Sulphur River Basin (SRBA Watershed Study; 2014) suggest that although the historic Drought of Record for the basin is 1951 to 1956, a more significant drought occurs between 2002 and 2006. As a result, the SRBA study suggests the official TCEQ “Sulphur WAM misses the critical drought” that forms the basis for calculations of firm supply, since the official TCEQ WAM for the Sulphur River Basin is based upon historic data from 1940 to 1996. Given the proximity of this river basin to the remaining river basins within the North East Texas Region, it is not unreasonable to consider similar hydroclimatologies existing in the remaining basins. If a worse drought exists than the current Drought of Record utilized in the official TCEQ WAMs, this poses additional uncertainty with regard to the modeled firm yields and reliabilities upon which water supplies in the North East Texas Region are based.

Thus, the NETRWPG recommends that the TCEQ initiate a process to appropriately update the Red River, Sabine, Cypress, and Sulphur Water Availability Models (WAMs) in a manner consistent with these WAMs’ original development, to reflect more recent information on the hydroclimatology of the river basins in the North East Texas Region, and provide additional certainty to resultant calculations of firm supplies in the Region. Further, existing official WAMs utilized by TCEQ in the permitting process should be made readily available in time for use in the regional water planning process.

8.14.14 Recommendation: Establishment of Available Groundwater Supply in a Region

The North East Texas Region is overlain partly by two separate GMA's (8 and 11). With no Groundwater Conservation Districts (GCD) in the Region, a large portion of the Region has no voting representation on either board. Significant opposition to the formation of Groundwater Conservation Districts within the boundaries of Region D has been noted during the 2016 planning process

The NETRWPG recommends that the availability of groundwater supplies within a region with no Groundwater Conservation Districts should be established by the regional water planning group for that region. Such an approach affords the opportunity for local representation to establish existing and future groundwater supply, and remains consistent with the "bottom-up" approach established by Senate Bill 1 for regional water planning. This proposed transfer of responsibility for determination of the available supply of groundwater for regional planning purposes may not be expanded or construed to vest the regional water planning group with any of the other responsibilities or enforcement powers held by properly established Groundwater Conservation Districts per Section 16 of the Texas Water Code.

The NETRWPG supports the passage of SB 1101 as introduced by Senator Kevin Eltife, and HB 3942 as introduced by Representative Chris Paddie.

8.14.15 Recommendation: Wright Patman Lake/Reservoir

The North East Texas Regional Water Planning Group recommends that before any new reservoirs are planned in the North East Texas Water Planning Area, the alternative of raising the level of the Wright Patman Lake /Reservoir be considered.

8.14.16 Recommendation: Standardize Statistics Used For Conservation Assessments

The North East Texas Regional Water Planning Group (Region D) recommends that the Texas Legislature standardize the method used to derive the statistic known as "gpcpd" (gallons per capita per day) and also known as "municipal per capita usage". The justification for this recommendation is demonstrated by the need to have a successful conservation program in areas that are projected to need water management strategies. NETMWD supports conservation as a water management strategy for any entity that has a gpcpd ratio greater than the goal of 140 gpcpd. Assessing the progress of communities engaged in conservation will be more reliable with a standardized method for comparison.

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CHAPTER 9 INFRASTRUCTURE FINANCING ANALYSIS

9.1 INTRODUCTION

The Infrastructure Financing Report (IFR) requirement was incorporated into the regional water planning process in response to Senate Bill 2 (77th Texas Legislature). The Texas Administrative Code, 31 TAC 357.44 requires that regional water planning groups shall assess and quantitatively report on how individual local governments, regional authorities, and other political subdivisions in their RWPA propose to finance recommended water management strategies.

According to TWDB guidelines, the primary objectives of the IFR are:

- To determine the number of political subdivisions with identified needs for additional water supplies that will be unable to pay for their water infrastructure needs without some form of outside financial assistance.
- To determine how much of the infrastructure costs in the regional water plans cannot be paid for solely using local utility revenue sources.
- To determine the financing options proposed by political subdivisions to meet future water infrastructure needs (including the identification of any State funding sources considered).
- To determine what role(s) the Regional Water Planning Groups (RWPG) propose for the State in financing the recommended water supply projects.

9.2 METHODOLOGY

The NETRWPG obtained the IFR survey form developed by the TWDB. In order to help insure statewide consistency, no deviations were allowed by TWDB from the standard survey questions. The NETRWPG then attempted to contact all of the water user groups (WUGs) with recommended water management strategies involving capital costs identified in this round of planning. WUGs with strategies involving only contract reneewals were not contacted, since it is assumed that no capital improvements would be required.

Historically, responses to mailed surveys in Region D have been nominal. Anticipating this, the primary means of implementing the survey was via telephone calls, supplemented by emails containing the survey when requested or necessary. The information obtained from the surveys is included in Table 9.1. Groundwater strategies with multiple entries represent decadal implementation of groundwater projects per aquifer/basin/county.

9.3 COUNTY AGGREGATES

For county aggregate WUGs (i.e., manufacturing, agriculture, etc.), for which needs were identified during the planning period and where no political subdivision is responsible for providing water supplies, the NETRWPG considered potential fuding mechanisms for meeting the water management strategies.

Table 9.1 Infrastructure Financing Report Survey Results

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
BI COUNTY WSC	D	DRILL NEW WELLS (BI COUNTY WSC, QUEEN, CYPRESS, CAMP, 2060)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
BI COUNTY WSC	D	DRILL NEW WELLS (BI COUNTY WSC, QUEEN, CYPRESS, CAMP, 2060)	D	CONSTRUCTION FUNDING	No survey response	
BI COUNTY WSC	D	DRILL NEW WELLS (BI COUNTY WSC, QUEEN, CYPRESS, CAMP, 2060)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
BI COUNTY WSC	D	DRILL NEW WELLS (BI COUNTY WSC, QUEEN, CYPRESS, CAMP, 2070)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
BI COUNTY WSC	D	DRILL NEW WELLS (BI COUNTY WSC, QUEEN, CYPRESS, CAMP, 2070)	D	CONSTRUCTION FUNDING	No survey response	
BI COUNTY WSC	D	DRILL NEW WELLS (BI COUNTY WSC, QUEEN, CYPRESS, CAMP, 2070)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
BI COUNTY WSC	D	DRILL NEW WELLS (BI COUNTY WSC, QUEEN, CYPRESS, UPSHUR, 2060)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
BI COUNTY WSC	D	DRILL NEW WELLS (BI COUNTY WSC, QUEEN, CYPRESS, UPSHUR, 2060)	D	CONSTRUCTION FUNDING	No survey response	
BI COUNTY WSC	D	DRILL NEW WELLS (BI COUNTY WSC, QUEEN, CYPRESS, UPSHUR, 2060)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
CADDO BASIN SUD	D	CONSERVATION, WATER LOSS CONTROL - CADDO BASIN SUD	C	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
CADDO BASIN SUD	D	CONSERVATION, WATER LOSS CONTROL - CADDO BASIN SUD	C	CONSTRUCTION FUNDING	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
CADDO BASIN SUD	D	CONSERVATION, WATER LOSS CONTROL - CADDO BASIN SUD	C	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
CANTON	D	DRILL NEW WELLS (CANTON, CARRIZO-WILCOX, SABINE)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$202,400.00	2016
CANTON	D	DRILL NEW WELLS (CANTON, CARRIZO-WILCOX, SABINE)	D	CONSTRUCTION FUNDING	$488,000.00	2016
CANTON	D	DRILL NEW WELLS (CANTON, CARRIZO-WILCOX, SABINE)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
CASH SUD	D	CASH WSC - INCREASE DELIVERY INFRASTRUCTURE TO PURCHASE ADDITIONAL WATER FROM NTMWD Q-180	C	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$0.00	
CASH SUD	D	CASH WSC - INCREASE DELIVERY INFRASTRUCTURE TO PURCHASE ADDITIONAL WATER FROM NTMWD Q-180	C	CONSTRUCTION FUNDING	$0.00	
CASH SUD	D	CASH WSC - INCREASE DELIVERY INFRASTRUCTURE TO PURCHASE ADDITIONAL WATER FROM NTMWD Q-180	C	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
CASH SUD	D	CONSERVATION, WATER LOSS CONTROL - CASH SUD	C	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$0.00	
CASH SUD	D	CONSERVATION, WATER LOSS CONTROL - CASH SUD	C	CONSTRUCTION FUNDING	$0.00	
CASH SUD	D	CONSERVATION, WATER LOSS CONTROL - CASH SUD	C	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
CELESTE	D	DRILL NEW WELLS (CELESTE, WOODBINE, SABINE, 2050)	D	PLANNING, DESIGN, PERMITTING &	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
				ACQUISITION FUNDING		
CELESTE	D	DRILL NEW WELLS (CELESTE, WOODBINE, SABINE, 2050)	D	CONSTRUCTION FUNDING	No survey response	
CELESTE	D	DRILL NEW WELLS (CELESTE, WOODBINE, SABINE, 2050)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
CELESTE	D	DRILL NEW WELLS (CELESTE, WOODBINE, SABINE, 2070)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
CELESTE	D	DRILL NEW WELLS (CELESTE, WOODBINE, SABINE, 2070)	D	CONSTRUCTION FUNDING	No survey response	
CELESTE	D	DRILL NEW WELLS (CELESTE, WOODBINE, SABINE, 2070)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
CLARKSVILLE	D	CONTRACT WITH TEXARKANA AND TREATED WATER PIPELINE TO DEKALB (CLARKSVILLE, SULPHUR)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$1,581,000.00	2020
CLARKSVILLE	D	CONTRACT WITH TEXARKANA AND TREATED WATER PIPELINE TO DEKALB (CLARKSVILLE, SULPHUR)	D	CONSTRUCTION FUNDING	$8,472,000.00	2025
CLARKSVILLE	D	CONTRACT WITH TEXARKANA AND TREATED WATER PIPELINE TO DEKALB (CLARKSVILLE, SULPHUR)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
COUNTY-OTHER, HUNT	D	DRILL NEW WELLS (COUNTY-OTHER HUNT, NACATOCH, SABINE, 2030)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$1,796,000.00	2020
COUNTY-OTHER, HUNT	D	DRILL NEW WELLS (COUNTY-OTHER HUNT, NACATOCH, SABINE, 2030)	D	CONSTRUCTION FUNDING	$600,000.00	2020

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
COUNTY-OTHER, HUNT	D	DRILL NEW WELLS (COUNTY-OTHER HUNT, NACATOCH, SABINE, 2030)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
COUNTY-OTHER, HUNT	D	DRILL NEW WELLS (COUNTY-OTHER HUNT, NACATOCH, SABINE, 2040)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$1,796,000.00	2030
COUNTY-OTHER, HUNT	D	DRILL NEW WELLS (COUNTY-OTHER HUNT, NACATOCH, SABINE, 2040)	D	CONSTRUCTION FUNDING	$600,000.00	2030
COUNTY-OTHER, HUNT	D	DRILL NEW WELLS (COUNTY-OTHER HUNT, NACATOCH, SABINE, 2040)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
COUNTY-OTHER, HUNT	D	DRILL NEW WELLS (COUNTY-OTHER HUNT, NACATOCH, SABINE, 2050)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$1,796,000.00	2040
COUNTY-OTHER, HUNT	D	DRILL NEW WELLS (COUNTY-OTHER HUNT, NACATOCH, SABINE, 2050)	D	CONSTRUCTION FUNDING	$600,000.00	2040
COUNTY-OTHER, HUNT	D	DRILL NEW WELLS (COUNTY-OTHER HUNT, NACATOCH, SABINE, 2050)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
COUNTY-OTHER, HUNT	D	DRILL NEW WELLS (COUNTY-OTHER HUNT, NACATOCH, SABINE, 2060)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$1,796,000.00	2050
COUNTY-OTHER, HUNT	D	DRILL NEW WELLS (COUNTY-OTHER HUNT, NACATOCH, SABINE, 2060)	D	CONSTRUCTION FUNDING	$600,000.00	2050
COUNTY-OTHER, HUNT	D	DRILL NEW WELLS (COUNTY-OTHER HUNT, NACATOCH, SABINE, 2060)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
COUNTY-OTHER, HUNT	D	GREENVILLE TIE-IN PIPELINE (COUNTY-OTHER HUNT, SABINE)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$6,316,000.00	2060
COUNTY-OTHER, HUNT	D	GREENVILLE TIE-IN PIPELINE (COUNTY-	D	CONSTRUCTION FUNDING	$19,354,000.00	2060

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
		OTHER HUNT, SABINE)				
COUNTY-OTHER, HUNT	D	GREENVILLE TIE-IN PIPELINE (COUNTY-OTHER HUNT, SABINE)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
CRYSTAL SYSTEMS INC	D	DRILL NEW WELLS (CRYSTAL SYSTEMS INC, QUEEN, SABINE, 2020)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$0.00	
CRYSTAL SYSTEMS INC	D	DRILL NEW WELLS (CRYSTAL SYSTEMS INC, QUEEN, SABINE, 2020)	D	CONSTRUCTION FUNDING	$0.00	
CRYSTAL SYSTEMS INC	D	DRILL NEW WELLS (CRYSTAL SYSTEMS INC, QUEEN, SABINE, 2020)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
CRYSTAL SYSTEMS INC	D	DRILL NEW WELLS (CRYSTAL SYSTEMS INC, QUEEN, SABINE, 2040)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$0.00	
CRYSTAL SYSTEMS INC	D	DRILL NEW WELLS (CRYSTAL SYSTEMS INC, QUEEN, SABINE, 2040)	D	CONSTRUCTION FUNDING	$0.00	
CRYSTAL SYSTEMS INC	D	DRILL NEW WELLS (CRYSTAL SYSTEMS INC, QUEEN, SABINE, 2040)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
CRYSTAL SYSTEMS INC	D	DRILL NEW WELLS (CRYSTAL SYSTEMS INC, QUEEN, SABINE, 2050)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$0.00	
CRYSTAL SYSTEMS INC	D	DRILL NEW WELLS (CRYSTAL SYSTEMS INC, QUEEN, SABINE, 2050)	D	CONSTRUCTION FUNDING	$0.00	
CRYSTAL SYSTEMS INC	D	DRILL NEW WELLS (CRYSTAL SYSTEMS INC, QUEEN, SABINE, 2050)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
CRYSTAL SYSTEMS INC	D	DRILL NEW WELLS (CRYSTAL SYSTEMS INC, QUEEN, SABINE, 2070)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$0.00	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
CRYSTAL SYSTEMS INC	D	DRILL NEW WELLS (CRYSTAL SYSTEMS INC, QUEEN, SABINE, 2070)	D	CONSTRUCTION FUNDING	$0.00	
CRYSTAL SYSTEMS INC	D	DRILL NEW WELLS (CRYSTAL SYSTEMS INC, QUEEN, SABINE, 2070)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
CRYSTAL SYSTEMS INC	D	SMTH-CYS - INFRASTRUCTURE	I	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$0.00	
CRYSTAL SYSTEMS INC	D	SMTH-CYS - INFRASTRUCTURE	I	CONSTRUCTION FUNDING	$0.00	
CRYSTAL SYSTEMS INC	D	SMTH-CYS - INFRASTRUCTURE	I	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
CUMBY	D	DRILL NEW WELLS (CUMBY, NACATOCH)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
CUMBY	D	DRILL NEW WELLS (CUMBY, NACATOCH)	D	CONSTRUCTION FUNDING	No survey response	
CUMBY	D	DRILL NEW WELLS (CUMBY, NACATOCH)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
GILMER	D	DRILL NEW WELLS (GILMER, QUEEN, CYPRESS)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$0.00	
GILMER	D	DRILL NEW WELLS (GILMER, QUEEN, CYPRESS)	D	CONSTRUCTION FUNDING	$0.00	
GILMER	D	DRILL NEW WELLS (GILMER, QUEEN, CYPRESS)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
GREENVILLE	D	CHAPMAN RAW WATER PIPELINE AND NEW WTP (GREENVILLE, SULPHUR)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
GREENVILLE	D	CHAPMAN RAW WATER PIPELINE AND NEW WTP	D	CONSTRUCTION FUNDING	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
		(GREENVILLE, SULPHUR)				
GREENVILLE	D	CHAPMAN RAW WATER PIPELINE AND NEW WTP (GREENVILLE, SULPHUR)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
GREENVILLE	D	TOLEDO BEND TIE-IN PIPELINE (GREENVILLE, SABINE)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
GREENVILLE	D	TOLEDO BEND TIE-IN PIPELINE (GREENVILLE, SABINE)	D	CONSTRUCTION FUNDING	No survey response	
GREENVILLE	D	TOLEDO BEND TIE-IN PIPELINE (GREENVILLE, SABINE)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
GREENVILLE	D	WTP EXPANSION (GREENVILLE, SABINE)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
GREENVILLE	D	WTP EXPANSION (GREENVILLE, SABINE)	D	CONSTRUCTION FUNDING	No survey response	
GREENVILLE	D	WTP EXPANSION (GREENVILLE, SABINE)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
HICKORY CREEK SUD	D	CONSERVATION, WATER LOSS CONTROL - HICKORY CREEK SUD	C	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
HICKORY CREEK SUD	D	CONSERVATION, WATER LOSS CONTROL - HICKORY CREEK SUD	C	CONSTRUCTION FUNDING	No survey response	
HICKORY CREEK SUD	D	CONSERVATION, WATER LOSS CONTROL - HICKORY CREEK SUD	C	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, TRINITY, TRINITY, 2050)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, TRINITY, TRINITY, 2050)	D	CONSTRUCTION FUNDING	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, TRINITY, TRINITY, 2050)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, TRINITY, TRINITY, 2060)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, TRINITY, TRINITY, 2060)	D	CONSTRUCTION FUNDING	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, TRINITY, TRINITY, 2060)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, TRINITY, TRINITY, 2070)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, TRINITY, TRINITY, 2070)	D	CONSTRUCTION FUNDING	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, TRINITY, TRINITY, 2070)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, WOODBINE, SABINE, 2040)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, WOODBINE, SABINE, 2040)	D	CONSTRUCTION FUNDING	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, WOODBINE, SABINE, 2040)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, WOODBINE, SABINE, 2050)	D	PLANNING, DESIGN, PERMITTING &	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
				ACQUISITION FUNDING		
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, WOODBINE, SABINE, 2050)	D	CONSTRUCTION FUNDING	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, WOODBINE, SABINE, 2050)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, WOODBINE, SABINE, 2060)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, WOODBINE, SABINE, 2060)	D	CONSTRUCTION FUNDING	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, WOODBINE, SABINE, 2060)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, WOODBINE, SABINE, 2070)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, WOODBINE, SABINE, 2070)	D	CONSTRUCTION FUNDING	No survey response	
HICKORY CREEK SUD	D	DRILL NEW WELLS (HICKORY CREEK SUD, WOODBINE, SABINE, 2070)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
IRRIGATION, BOWIE	D	DRILL NEW WELLS (BOWIE IRRIGATION, CARRIZO-WILCOX, SULPHUR)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
IRRIGATION, BOWIE	D	DRILL NEW WELLS (BOWIE IRRIGATION, CARRIZO-WILCOX, SULPHUR)	D	CONSTRUCTION FUNDING	No survey response	
IRRIGATION, BOWIE	D	DRILL NEW WELLS (BOWIE IRRIGATION, CARRIZO-WILCOX, SULPHUR)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
IRRIGATION, BOWIE	D	DRILL NEW WELLS (BOWIE IRRIGATION, NACATOCH, RED)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
IRRIGATION, BOWIE	D	DRILL NEW WELLS (BOWIE IRRIGATION, NACATOCH, RED)	D	CONSTRUCTION FUNDING	No survey response	
IRRIGATION, BOWIE	D	DRILL NEW WELLS (BOWIE IRRIGATION, NACATOCH, RED)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
IRRIGATION, HARRISON	D	DRILL NEW WELLS (IRRIGATION HARRISON, CARRIZO-WILCOX, CYPRESS)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
IRRIGATION, HARRISON	D	DRILL NEW WELLS (IRRIGATION HARRISON, CARRIZO-WILCOX, CYPRESS)	D	CONSTRUCTION FUNDING	No survey response	
IRRIGATION, HARRISON	D	DRILL NEW WELLS (IRRIGATION HARRISON, CARRIZO-WILCOX, CYPRESS)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
IRRIGATION, HARRISON	D	DRILL NEW WELLS (IRRIGATION HARRISON, CARRIZO-WILCOX, SABINE)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
IRRIGATION, HARRISON	D	DRILL NEW WELLS (IRRIGATION HARRISON, CARRIZO-WILCOX, SABINE)	D	CONSTRUCTION FUNDING	No survey response	
IRRIGATION, HARRISON	D	DRILL NEW WELLS (IRRIGATION HARRISON, CARRIZO-WILCOX, SABINE)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
IRRIGATION, HOPKINS	D	DRILL NEW WELLS (IRRIGATION HOPKINS, CARRIZO-WILCOX, CYPRESS)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
IRRIGATION, HOPKINS	D	DRILL NEW WELLS (IRRIGATION HOPKINS, CARRIZO-WILCOX, CYPRESS)	D	CONSTRUCTION FUNDING	No survey response	
IRRIGATION, HOPKINS	D	DRILL NEW WELLS (IRRIGATION HOPKINS, CARRIZO-WILCOX, CYPRESS)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
IRRIGATION, HOPKINS	D	DRILL NEW WELLS (IRRIGATION HOPKINS, CARRIZO-WILCOX, SABINE)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
IRRIGATION, HOPKINS	D	DRILL NEW WELLS (IRRIGATION HOPKINS, CARRIZO-WILCOX, SABINE)	D	CONSTRUCTION FUNDING	No survey response	
IRRIGATION, HOPKINS	D	DRILL NEW WELLS (IRRIGATION HOPKINS, CARRIZO-WILCOX, SABINE)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
IRRIGATION, HOPKINS	D	SULPHUR SPRINGS RAW WATER PIPELINE (IRRIGATION HOPKINS, SULPHUR)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
IRRIGATION, HOPKINS	D	SULPHUR SPRINGS RAW WATER PIPELINE (IRRIGATION HOPKINS, SULPHUR)	D	CONSTRUCTION FUNDING	No survey response	
IRRIGATION, HOPKINS	D	SULPHUR SPRINGS RAW WATER PIPELINE (IRRIGATION HOPKINS, SULPHUR)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
IRRIGATION, HUNT	D	DRILL NEW WELLS (IRRIGATION HUNT, NACATOCH, SABINE)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
IRRIGATION, HUNT	D	DRILL NEW WELLS (IRRIGATION HUNT, NACATOCH, SABINE)	D	CONSTRUCTION FUNDING	No survey response	
IRRIGATION, HUNT	D	DRILL NEW WELLS (IRRIGATION HUNT, NACATOCH, SABINE)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
IRRIGATION, LAMAR	D	PAT MAYSE RAW WATER PIPELINE (IRRIGATION LAMAR, RED)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
IRRIGATION, LAMAR	D	PAT MAYSE RAW WATER PIPELINE (IRRIGATION LAMAR, RED)	D	CONSTRUCTION FUNDING	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
IRRIGATION, LAMAR	D	PAT MAYSE RAW WATER PIPELINE (IRRIGATION LAMAR, RED)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
IRRIGATION, VAN ZANDT	D	DRILL NEW WELLS (IRRIGATION VAN ZANDT, QUEEN, NECHES)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
IRRIGATION, VAN ZANDT	D	DRILL NEW WELLS (IRRIGATION VAN ZANDT, QUEEN, NECHES)	D	CONSTRUCTION FUNDING	No survey response	
IRRIGATION, VAN ZANDT	D	DRILL NEW WELLS (IRRIGATION VAN ZANDT, QUEEN, NECHES)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2020)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$507,500.00	2018
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2020)	D	CONSTRUCTION FUNDING	$1,227,500.00	2018
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2020)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2030)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$231,500.00	2028
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2030)	D	CONSTRUCTION FUNDING	$407,500.00	2028
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2030)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2040)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$231,500.00	2038
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2040)	D	CONSTRUCTION FUNDING	$407,500.00	2038

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2040)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2050)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$231,500.00	2050
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2050)	D	CONSTRUCTION FUNDING	$407,500.00	2050
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2050)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2060)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$463,000.00	2060
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2060)	D	CONSTRUCTION FUNDING	$815,000.00	2060
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2060)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2070)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$231,500.00	2070
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2070)	D	CONSTRUCTION FUNDING	$407,500.00	2070
LINDALE	D	DRILL NEW WELLS (LINDALE, QUEEN, SABINE, 2070)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
LINDALE	D	SMTH-LDL-INFRASTRUCTURE	I	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING		
LINDALE	D	SMTH-LDL-INFRASTRUCTURE	I	CONSTRUCTION FUNDING		
LINDALE	D	SMTH-LDL-INFRASTRUCTURE	I	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY		

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
MACBEE SUD	D	CONSERVATION, WATER LOSS CONTROL - MACBEE SUD	C	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$0.00	
MACBEE SUD	D	CONSERVATION, WATER LOSS CONTROL - MACBEE SUD	C	CONSTRUCTION FUNDING	$0.00	
MACBEE SUD	D	CONSERVATION, WATER LOSS CONTROL - MACBEE SUD	C	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
MANUFACTURING, CASS	D	DRILL NEW WELLS (MANUFACTURING CASS, CARRIZO-WILCOX , CYPRESS)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MANUFACTURING, CASS	D	DRILL NEW WELLS (MANUFACTURING CASS, CARRIZO-WILCOX , CYPRESS)	D	CONSTRUCTION FUNDING	No survey response	
MANUFACTURING, CASS	D	DRILL NEW WELLS (MANUFACTURING CASS, CARRIZO-WILCOX , CYPRESS)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MANUFACTURING, HARRISON	D	TOLEDO BEND INTAKE AND RAW WATER PIPELINE (MANUFACTURING HARRISON, SABINE)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MANUFACTURING, HARRISON	D	TOLEDO BEND INTAKE AND RAW WATER PIPELINE (MANUFACTURING HARRISON, SABINE)	D	CONSTRUCTION FUNDING	No survey response	
MANUFACTURING, HARRISON	D	TOLEDO BEND INTAKE AND RAW WATER PIPELINE (MANUFACTURING HARRISON, SABINE)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MANUFACTURING, LAMAR	D	DRILL NEW WELLS (MANUFACTURING LAMAR, BLOSSOM, RED)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MANUFACTURING, LAMAR	D	DRILL NEW WELLS (MANUFACTURING LAMAR, BLOSSOM, RED)	D	CONSTRUCTION FUNDING	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
MANUFACTURING, LAMAR	D	DRILL NEW WELLS (MANUFACTURING LAMAR, BLOSSOM, RED)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MANUFACTURING, RED RIVER	D	DRILL NEW WELLS (MANUFACTURING RED RIVER, TRINITY, SULPHUR)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MANUFACTURING, RED RIVER	D	DRILL NEW WELLS (MANUFACTURING RED RIVER, TRINITY, SULPHUR)	D	CONSTRUCTION FUNDING	No survey response	
MANUFACTURING, RED RIVER	D	DRILL NEW WELLS (MANUFACTURING RED RIVER, TRINITY, SULPHUR)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MANUFACTURING, TITUS	D	DRILL NEW WELLS (MANUFACTURING TITUS, QUEEN, CYPRESS)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MANUFACTURING, TITUS	D	DRILL NEW WELLS (MANUFACTURING TITUS, QUEEN, CYPRESS)	D	CONSTRUCTION FUNDING	No survey response	
MANUFACTURING, TITUS	D	DRILL NEW WELLS (MANUFACTURING TITUS, QUEEN, CYPRESS)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MANUFACTURING, UPSHUR	D	DRILL NEW WELLS (MANUFACTURING UPSHUR, QUEEN, CYPRESS, 2020)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MANUFACTURING, UPSHUR	D	DRILL NEW WELLS (MANUFACTURING UPSHUR, QUEEN, CYPRESS, 2020)	D	CONSTRUCTION FUNDING	No survey response	
MANUFACTURING, UPSHUR	D	DRILL NEW WELLS (MANUFACTURING UPSHUR, QUEEN, CYPRESS, 2020)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MANUFACTURING, UPSHUR	D	DRILL NEW WELLS (MANUFACTURING UPSHUR, QUEEN, CYPRESS, 2060)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MANUFACTURING, UPSHUR	D	DRILL NEW WELLS (MANUFACTURING	D	CONSTRUCTION FUNDING	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
		UPSHUR, QUEEN, CYPRESS, 2060)				
MANUFACTURING, UPSHUR	D	DRILL NEW WELLS (MANUFACTURING UPSHUR, QUEEN, CYPRESS, 2060)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MANUFACTURING, VAN ZANDT	D	DRILL NEW WELLS (MANUFACTURING VAN ZANDT, CARRIZO-WILCOX, NECHES, 2020)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MANUFACTURING, VAN ZANDT	D	DRILL NEW WELLS (MANUFACTURING VAN ZANDT, CARRIZO-WILCOX, NECHES, 2020)	D	CONSTRUCTION FUNDING	No survey response	
MANUFACTURING, VAN ZANDT	D	DRILL NEW WELLS (MANUFACTURING VAN ZANDT, CARRIZO-WILCOX, NECHES, 2020)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MANUFACTURING, VAN ZANDT	D	DRILL NEW WELLS (MANUFACTURING VAN ZANDT, CARRIZO-WILCOX, NECHES, 2050)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MANUFACTURING, VAN ZANDT	D	DRILL NEW WELLS (MANUFACTURING VAN ZANDT, CARRIZO-WILCOX, NECHES, 2050)	D	CONSTRUCTION FUNDING	No survey response	
MANUFACTURING, VAN ZANDT	D	DRILL NEW WELLS (MANUFACTURING VAN ZANDT, CARRIZO-WILCOX, NECHES, 2050)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MARSHALL	D	INCREASE EXISTING CONTRACT (MARSHALL, CYPRESS)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$1,187,000.00	2055
MARSHALL	D	INCREASE EXISTING CONTRACT (MARSHALL, CYPRESS)	D	CONSTRUCTION FUNDING	$3,551,000.00	2055
MARSHALL	D	INCREASE EXISTING CONTRACT (MARSHALL, CYPRESS)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
MARTIN SPRINGS WSC	D	DRILL NEW WELLS (MARTIN SPRINGS WSC, CARRIZO-WILCOX, SABINE, 2060)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$0.00	
MARTIN SPRINGS WSC	D	DRILL NEW WELLS (MARTIN SPRINGS WSC, CARRIZO-WILCOX, SABINE, 2060)	D	CONSTRUCTION FUNDING	$0.00	
MARTIN SPRINGS WSC	D	DRILL NEW WELLS (MARTIN SPRINGS WSC, CARRIZO-WILCOX, SABINE, 2060)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
MARTIN SPRINGS WSC	D	DRILL NEW WELLS (MARTIN SPRINGS WSC, CARRIZO-WILCOX, SABINE, 2070)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$0.00	
MARTIN SPRINGS WSC	D	DRILL NEW WELLS (MARTIN SPRINGS WSC, CARRIZO-WILCOX, SABINE, 2070)	D	CONSTRUCTION FUNDING	$0.00	
MARTIN SPRINGS WSC	D	DRILL NEW WELLS (MARTIN SPRINGS WSC, CARRIZO-WILCOX, SABINE, 2070)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
MINING, GREGG	D	DRILL NEW WELLS (MINING GREGG, CARRIZO-WILCOX, CYPRESS)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MINING, GREGG	D	DRILL NEW WELLS (MINING GREGG, CARRIZO-WILCOX, CYPRESS)	D	CONSTRUCTION FUNDING	No survey response	
MINING, GREGG	D	DRILL NEW WELLS (MINING GREGG, CARRIZO-WILCOX, CYPRESS)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MINING, GREGG	D	DRILL NEW WELLS (MINING GREGG, CARRIZO-WILCOX, SABINE, 2020)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MINING, GREGG	D	DRILL NEW WELLS (MINING GREGG,	D	CONSTRUCTION FUNDING	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
		CARRIZO-WILCOX, SABINE, 2020)				
MINING, GREGG	D	DRILL NEW WELLS (MINING GREGG, CARRIZO-WILCOX, SABINE, 2020)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MINING, GREGG	D	DRILL NEW WELLS (MINING GREGG, CARRIZO-WILCOX, SABINE, 2030)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MINING, GREGG	D	DRILL NEW WELLS (MINING GREGG, CARRIZO-WILCOX, SABINE, 2030)	D	CONSTRUCTION FUNDING	No survey response	
MINING, GREGG	D	DRILL NEW WELLS (MINING GREGG, CARRIZO-WILCOX, SABINE, 2030)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MINING, HARRISON	D	DRILL NEW WELLS (MINING HARRISON, CARRIZO-WILCOX, CYPRESS, 2020)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MINING, HARRISON	D	DRILL NEW WELLS (MINING HARRISON, CARRIZO-WILCOX, CYPRESS, 2020)	D	CONSTRUCTION FUNDING	No survey response	
MINING, HARRISON	D	DRILL NEW WELLS (MINING HARRISON, CARRIZO-WILCOX, CYPRESS, 2020)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MINING, HARRISON	D	DRILL NEW WELLS (MINING HARRISON, CARRIZO-WILCOX, CYPRESS, 2030)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MINING, HARRISON	D	DRILL NEW WELLS (MINING HARRISON, CARRIZO-WILCOX, CYPRESS, 2030)	D	CONSTRUCTION FUNDING	No survey response	
MINING, HARRISON	D	DRILL NEW WELLS (MINING HARRISON, CARRIZO-WILCOX, CYPRESS, 2030)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MINING, HARRISON	D	DRILL NEW WELLS (MINING HARRISON, CARRIZO-WILCOX, CYPRESS, 2040)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
MINING, HARRISON	D	DRILL NEW WELLS (MINING HARRISON, CARRIZO-WILCOX, CYPRESS, 2040)	D	CONSTRUCTION FUNDING	No survey response	
MINING, HARRISON	D	DRILL NEW WELLS (MINING HARRISON, CARRIZO-WILCOX, CYPRESS, 2040)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MINING, HARRISON	D	DRILL NEW WELLS (MINING HARRISON, CARRIZO-WILCOX, SABINE)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MINING, HARRISON	D	DRILL NEW WELLS (MINING HARRISON, CARRIZO-WILCOX, SABINE)	D	CONSTRUCTION FUNDING	No survey response	
MINING, HARRISON	D	DRILL NEW WELLS (MINING HARRISON, CARRIZO-WILCOX, SABINE)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MINING, HUNT	D	DRILL NEW WELLS (MINING HUNT, NACATOCH , SABINE)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MINING, HUNT	D	DRILL NEW WELLS (MINING HUNT, NACATOCH , SABINE)	D	CONSTRUCTION FUNDING	No survey response	
MINING, HUNT	D	DRILL NEW WELLS (MINING HUNT, NACATOCH , SABINE)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MINING, MARION	D	DRILL NEW WELLS (MINING MARION, CARRIZO-WILCOX, CYPRESS, 2020)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MINING, MARION	D	DRILL NEW WELLS (MINING MARION, CARRIZO-WILCOX, CYPRESS, 2020)	D	CONSTRUCTION FUNDING	No survey response	
MINING, MARION	D	DRILL NEW WELLS (MINING MARION, CARRIZO-WILCOX, CYPRESS, 2020)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MINING, MARION	D	DRILL NEW WELLS (MINING MARION, CARRIZO-WILCOX, CYPRESS, 2030)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
MINING, MARION	D	DRILL NEW WELLS (MINING MARION, CARRIZO-WILCOX, CYPRESS, 2030)	D	CONSTRUCTION FUNDING	No survey response	
MINING, MARION	D	DRILL NEW WELLS (MINING MARION, CARRIZO-WILCOX, CYPRESS, 2030)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MINING, SMITH	D	DRILL NEW WELLS (MINING SMITH, QUEEN, SABINE)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MINING, SMITH	D	DRILL NEW WELLS (MINING SMITH, QUEEN, SABINE)	D	CONSTRUCTION FUNDING	No survey response	
MINING, SMITH	D	DRILL NEW WELLS (MINING SMITH, QUEEN, SABINE)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MINING, SMITH	D	SMTH-MIN-INFRASTRUCTURE	I	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MINING, SMITH	D	SMTH-MIN-INFRASTRUCTURE	I	CONSTRUCTION FUNDING	No survey response	
MINING, SMITH	D	SMTH-MIN-INFRASTRUCTURE	I	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MINING, UPSHUR	D	DRILL NEW WELLS (MINING UPSHUR, QUEEN , CYPRESS/SABINE, 2020)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
MINING, UPSHUR	D	DRILL NEW WELLS (MINING UPSHUR, QUEEN , CYPRESS/SABINE, 2020)	D	CONSTRUCTION FUNDING	No survey response	
MINING, UPSHUR	D	DRILL NEW WELLS (MINING UPSHUR, QUEEN , CYPRESS/SABINE, 2020)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
MINING, UPSHUR	D	DRILL NEW WELLS (MINING UPSHUR, QUEEN , CYPRESS/SABINE, 2030)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
MINING, UPSHUR	D	DRILL NEW WELLS (MINING UPSHUR, QUEEN , CYPRESS/SABINE, 2030)	D	CONSTRUCTION FUNDING	No survey response	
MINING, UPSHUR	D	DRILL NEW WELLS (MINING UPSHUR, QUEEN , CYPRESS/SABINE, 2030)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
NORTH HUNT SUD	D	CONSERVATION, WATER LOSS CONTROL - NORTH HUNT SUD	C	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$0.00	
NORTH HUNT SUD	D	CONSERVATION, WATER LOSS CONTROL - NORTH HUNT SUD	C	CONSTRUCTION FUNDING	$0.00	
NORTH HUNT SUD	D	CONSERVATION, WATER LOSS CONTROL - NORTH HUNT SUD	C	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
NORTH HUNT SUD	D	DELTA COUNTY PIPELINE (NORTH HUNT SUD, SULPHUR)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$1,175,000.00	2060
NORTH HUNT SUD	D	DELTA COUNTY PIPELINE (NORTH HUNT SUD, SULPHUR)	D	CONSTRUCTION FUNDING	$599,000.00	2060
NORTH HUNT SUD	D	DELTA COUNTY PIPELINE (NORTH HUNT SUD, SULPHUR)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
R-P-M WSC	D	DRILL NEW WELLS (R-P-M WSC, CARRIZO-WILCOX, NECHES, 2020)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
R-P-M WSC	D	DRILL NEW WELLS (R-P-M WSC, CARRIZO-WILCOX, NECHES, 2020)	D	CONSTRUCTION FUNDING	No survey response	
R-P-M WSC	D	DRILL NEW WELLS (R-P-M WSC, CARRIZO-WILCOX, NECHES, 2020)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
R-P-M WSC	D	DRILL NEW WELLS (R-P-M WSC,	D	PLANNING, DESIGN, PERMITTING &	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOfNeed
		CARRIZO-WILCOX, NECHES, 2030)		ACQUISITION FUNDING		
R-P-M WSC	D	DRILL NEW WELLS (R-P-M WSC, CARRIZO-WILCOX, NECHES, 2030)	D	CONSTRUCTION FUNDING	No survey response	
R-P-M WSC	D	DRILL NEW WELLS (R-P-M WSC, CARRIZO-WILCOX, NECHES, 2030)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
R-P-M WSC	D	DRILL NEW WELLS (R-P-M WSC, CARRIZO-WILCOX, NECHES, 2050)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
R-P-M WSC	D	DRILL NEW WELLS (R-P-M WSC, CARRIZO-WILCOX, NECHES, 2050)	D	CONSTRUCTION FUNDING	No survey response	
R-P-M WSC	D	DRILL NEW WELLS (R-P-M WSC, CARRIZO-WILCOX, NECHES, 2050)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
R-P-M WSC	D	DRILL NEW WELLS (R-P-M WSC, CARRIZO-WILCOX, NECHES, 2060)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
R-P-M WSC	D	DRILL NEW WELLS (R-P-M WSC, CARRIZO-WILCOX, NECHES, 2060)	D	CONSTRUCTION FUNDING	No survey response	
R-P-M WSC	D	DRILL NEW WELLS (R-P-M WSC, CARRIZO-WILCOX, NECHES, 2060)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
TEXARKANA	D	DREDGE WRIGHT PATMAN (TEXARKANA)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$31,395,000.00	2050
TEXARKANA	D	DREDGE WRIGHT PATMAN (TEXARKANA)	D	CONSTRUCTION FUNDING	$174,467,000.00	2050
TEXARKANA	D	DREDGE WRIGHT PATMAN (TEXARKANA)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
TEXARKANA	D	RIVERBEND STRATEGY (TEXARKANA)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$10,787,000.00	2016
TEXARKANA	D	RIVERBEND STRATEGY (TEXARKANA)	D	CONSTRUCTION FUNDING	$106,329,000.00	2019
TEXARKANA	D	RIVERBEND STRATEGY (TEXARKANA)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
WASKOM	D	DRILL NEW WELLS (WASKOM, CARRIZO-WILCOX, CYPRESS, 2020)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$176,000.00	2018
WASKOM	D	DRILL NEW WELLS (WASKOM, CARRIZO-WILCOX, CYPRESS, 2020)	D	CONSTRUCTION FUNDING	$269,000.00	2019
WASKOM	D	DRILL NEW WELLS (WASKOM, CARRIZO-WILCOX, CYPRESS, 2020)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
WASKOM	D	DRILL NEW WELLS (WASKOM, CARRIZO-WILCOX, CYPRESS, 2050)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$176,000.00	2048
WASKOM	D	DRILL NEW WELLS (WASKOM, CARRIZO-WILCOX, CYPRESS, 2050)	D	CONSTRUCTION FUNDING	$269,000.00	2049
WASKOM	D	DRILL NEW WELLS (WASKOM, CARRIZO-WILCOX, CYPRESS, 2050)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
WASKOM	D	DRILL NEW WELLS (WASKOM, CARRIZO-WILCOX, CYPRESS, 2060)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$176,000.00	2058
WASKOM	D	DRILL NEW WELLS (WASKOM, CARRIZO-WILCOX, CYPRESS, 2060)	D	CONSTRUCTION FUNDING	$269,000.00	2059
WASKOM	D	DRILL NEW WELLS (WASKOM, CARRIZO-WILCOX, CYPRESS, 2060)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
WASKOM	D	DRILL NEW WELLS (WASKOM, CARRIZO-WILCOX, CYPRESS, 2070)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$176,000.00	2068
WASKOM	D	DRILL NEW WELLS (WASKOM, CARRIZO-WILCOX, CYPRESS, 2070)	D	CONSTRUCTION FUNDING	$269,000.00	2069
WASKOM	D	DRILL NEW WELLS (WASKOM, CARRIZO-WILCOX, CYPRESS, 2070)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
WINONA	D	DRILL NEW WELLS (WINONA, QUEEN, SABINE)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$192,000.00	2048
WINONA	D	DRILL NEW WELLS (WINONA, QUEEN, SABINE)	D	CONSTRUCTION FUNDING	$503,000.00	2049
WINONA	D	DRILL NEW WELLS (WINONA, QUEEN, SABINE)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	
WOLFE CITY	D	DRILL NEW WELLS (WOLFE CITY, WOODBINE, SULPHUR, 2050)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
WOLFE CITY	D	DRILL NEW WELLS (WOLFE CITY, WOODBINE, SULPHUR, 2050)	D	CONSTRUCTION FUNDING	No survey response	
WOLFE CITY	D	DRILL NEW WELLS (WOLFE CITY, WOODBINE, SULPHUR, 2050)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
WOLFE CITY	D	DRILL NEW WELLS (WOLFE CITY, WOODBINE, SULPHUR, 2060)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
WOLFE CITY	D	DRILL NEW WELLS (WOLFE CITY, WOODBINE, SULPHUR, 2060)	D	CONSTRUCTION FUNDING	No survey response	
WOLFE CITY	D	DRILL NEW WELLS (WOLFE CITY, WOODBINE, SULPHUR, 2060)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	

SponsorEntity Name	Sponsor Entity Primary Region	ProjectName	WMS Project Sponsor Region	IFRElementName	IFRElementValue	YearOf Need
WOLFE CITY	D	DRILL NEW WELLS (WOLFE CITY, WOODBINE, SULPHUR, 2070)	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	No survey response	
WOLFE CITY	D	DRILL NEW WELLS (WOLFE CITY, WOODBINE, SULPHUR, 2070)	D	CONSTRUCTION FUNDING	No survey response	
WOLFE CITY	D	DRILL NEW WELLS (WOLFE CITY, WOODBINE, SULPHUR, 2070)	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	No survey response	
CANTON	D	INDIRECT REUSE	D	PLANNING, DESIGN, PERMITTING & ACQUISITION FUNDING	$1,344,000.00	2016
CANTON	D	INDIRECT REUSE	D	CONSTRUCTION FUNDING	$3,643,200.00	2016
CANTON	D	INDIRECT REUSE	D	PERCENT STATE PARTICIPATION IN OWNING EXCESS CAPACITY	0%	

In the North East Texas Region, there are twenty-seven (27) WUGs with water needs and corresponding water management strategies where no political subdivision is responsible for providing water supply. Since there is no one entity that is responsible for water supply, these WUGs were not sent an IFR survey form. During determination of the water management strategies, information regarding the cause of the water supply shortages was used to determine what types(s) of funding might be sought to provide water supply. County aggregate needs in the North East Texas Region are for irrigation, manufacturing, mining, and steam electric WUGs. Water shortages for steam electric, manufacturing, and mining WUGs are anticipated due to projected increases in customers and accordant demands over the planning horizon. Irrigation needs are projected due to increasing agricultural growth projected for the region. The NETRWPG has determined that since facilities associated with these WUGs are normally owned by private companies that are not eligible for State or Federal assistance, financing for these WMSs will likely come from private funding, unless the WMS is associated with the purchase of supply from a political subdivision.

There are only three (3) county aggregate WUGs for which a purchase from a political subdivision is recommended and there is an associated capital cost:

- Lamar Irrigation - Pat Mayse Raw Water Pipeline in 2020 for purchase from the City of Paris, at a projected total capital cost of $3,717,000;
- Hopkins Irrigation - Sulphur Springs Raw Water Pipeline in 2020 for purchase from the City of Sulphur Springs, at a projected total capital cost of $4,758,000; and
- Harrison County Manufacturing - Toledo Bend Intake and Raw Water Pipeline in 2020 for purchase from the Sabine River Authority, at a total capital cost of $498,773,000.

The NETRWPG notes, however, that it is unlikely that the Hopkins Irrigation WMS will be implemented, as the more likely strategy to be implemented is the development of additional groundwater wells, given the lack of a groundwater conservation district (GCD) in the region.

9.4 SURVEY FINDINGS

The NETRWPG identified 71 entities with needs during this planning round. Thirty-three of these entities have contractual shortages, meaning that a simple renewal or increase of existing water purchase contracts has been recommended and will not require capital expenditure or new sources of supply. Since there is no capital funding required to meet this type of water need, entities with contractual shortages were not included in the IFR process. County aggregate WUGs are mentioned above. There are thus a total of 22 WUGs with water shortages that require capital costs and were involved in the IFR survey process.

The RWPG consultants contacted (or attempted to contact) each of the 22 entities with water management strategies requiring capital costs via phone and/or email. Questions from the TWDB survey form regarding anticipated fuding sources that the WUG might access to implement the water management strategy. Once attempts had been made to contact all 22 WUGs, the survey results were compiled into Table 9.1. Completed survey forms have been included in the Appendix to Chapter 9.

Survey findings are as follows:

- 14 WUGs were successfully contacted and have been included in the IFR survey process.
- 9 WUGs who responded to the survey indicated their intent to seek some level of financial assistance from the State.
- 5 WUGs who responded to the survey indicated they do not, at present, intend to seek some level of financial assistance from the State.
- As in previous rounds of the Water Planning Process, comments were received indicating the State should provide assistance through grants or interest-free loans for smaller projects. Many of the smaller systems could use financial assistance for projects less than $300,000.
- Many of the entities within Region D qualify as rural, and seek to ensure that such a qualification is considered by the State when financial aid is sought.

CHAPTER 10 ADOPTION OF PLAN AND PUBLIC PARTICIPATION

The North East Texas Regional Water Planning Group (NETRWPG) is most sensitive to the public's participation and the process used to extract their concerns and comments. This Chapter summarizes how the public participated in the preparation of the plan, were kept informed and ultimately participated in the adoption of the plan. The public's comments and the NETRWPG responses to specific comments are documented. There is a copy of all written public comments received in Chapter 10 of Appendix C along with notes of oral comments made during the process.

10.1 INTRODUCTION

The NETRWPG has long recognized the critical importance of public participation at all stages of the planning process. Because this is largely a region of small cities and towns scattered over a large area, which lacks mass media to cover the entire region, it is especially difficult to extend opportunities for participation to each of the 19 counties. There is no central concentration of population, for example, where the NETRWPG could hold public hearings. Therefore, the NETRWPG elected to hold its public and regular meetings at the Civic Center in Mount Pleasant, Titus County. There is no newspaper within the region comparable to that of the Dallas Morning News in Region C or the San Antonio Express News in the South Central Texas Region. Instead, developing press relationships required regular contact with a half-dozen daily newspapers and dozens of weekly papers. Outreach to citizen organizations and private interest groups as well as to public officials also required regular calls and visits to every county in the Region. The NETRWPG has provided opportunity at every occasion for public participation and input. A summary of the communication program and of the public participation program is included herein.

10.2 PUBLIC PARTICIPATION PROCESS

The communication program to the public and the planning group has taken several different methods. These are as follows:

10.2.1 Public Comment Opportunities at NETRWPG Meetings

Every regular meeting of the NETRWPG was noticed as a public meeting under the Texas Open Meetings Act and was attended by approximately 50 persons in addition to the planning group members. Those attending represented many sectors of the public, including water provider organizations, local government officials, members of the business community, farmers, representatives of area councils of government, utility officials, environmentalists, community activists, and members of the general public. Comments and responses from these meetings have been included in meeting minutes and press release summaries.

10.2.2 Public Hearing Prior to Submission of TWDB Funding Proposal

As required by TWDB rules, the NETRWPG held an initial public meeting to gather comment and ideas from the public before submitting a proposed scope of work and budget to the TWDB for consideration prior to the regional planning process.

10.2.3 Public Hearing on the Initially Prepared Plan

As required by TWDB rules, the NETRWPG held a public hearing on the Initially Prepared Plan to solicit public input on aspects of the plan. The hearing was held in Mount Pleasant in Titus County on July 14, 2015, and was attended by approximately 50 persons from the public and 24 NETRWPG members. Comments made at the public hearing are summarized in Chapter 10 of Appendix C of this report.

10.2.4 Outreach and Survey of Water Providers

One of the exceptional aspects of the planning process in the North East Texas Region was the outreach process to involve every water provider in the region. This was done for two reasons. First, the NETRWPG wanted a review of population and water demand data provided by the TWDB. Second, the consultant team surveyed water providers to gather a large volume of information about current water supplies, current and projected water demands, and the management and policy problems encountered by these organizations in their day-to-day operations and long-term planning. This was an invaluable source of information provided by the public outreach process.

10.2.5 Development of a Public Participation Plan

From the beginning of this planning period, the NETRWPG emphasized the importance of public outreach and education. The consultant team worked closely with NETRWPG members, the Regional Administrator (the Northeast Texas Municipal Water District), and the NETRWPG Chairs Bret McCoy and Linda Price. The public outreach program consisted of two principal elements: public comment periods at the conclusion of each meeting and making information available to interested citizens via the Chairs and NETRWPG representatives.

10.2.6 Interviews With NETRWPG Members

An important method of identifying issues of public concern was the opportunity for public comment at the end of all meetings. These opportunities for public comment allowed the NETRWPG to identify the issues involved in regional water planning. Once these issues had been identified the NETRWPG members were requested to form recommendations and comment on the issues. These resulted in the recommendations and comments which are contained herein.

10.2.7 Contacts with Media

All meetings were posted as required and were attended by members of the media. In addition to distributing news releases, reporters and editors at major papers in the region were contacted directly. Through the efforts of these reporters and editors, several major stories were published and aided in educating the public about the regional planning process. There is an absence of a metropolitan area in the region containing major media, rendering television and radio coverage impractical. Most information was disseminated by daily and weekly newspapers in the NETRWPG area. The NETMWD, administrator of the NETRWPG, was identified as a contact point for news releases because of the knowledge about water planning and access by the public.

10.2.8 Reports Filed with Public Authorities

Pursuant to the rules, the NETRWPG made copies of the Initially Prepared Plan available for public inspection in the County Clerk's office of each county within the North East Texas Region, in at least one public library in each county, and in each county where a potential water management strategy for the region is located. The IPP was also available on the internet, and in the administrator’s office in Hughes Springs in Cass County, although the office is in Morris County.

10.3 PUBLIC MEETINGS AND HEARINGS

10.3.1 Public Hearings and Comments on the Initially Prepared Plan

The NETRWPG conducted public comment sessions at the conclusion of each NETRWPG meeting. The prescribed public hearing was held on July 14, 2015, at Mount Pleasant in Titus County to allow interested persons to comment on issues affecting water planning. All oral and written comments were recorded and were considered by the NETRWPG in the Adopted Regional Water Plan. This meeting was scheduled to allow the public to make comments prior to the completion of the adopted Regional Water Plan that was being drafted.

All public comments provided either orally or in writing at the public meetings and hearing as well as comments received by interested parties who were not able to attend any of the public sessions were summarized and considered by the NETRWPG prior to adoption of the final Regional Water Plan.

The public comment sessions were well-publicized with news releases, a NETRWPG newsletter distribution, and advance notice at a previous NETRWPG monthly public meeting. Approximately 50 people attended the public comment session in Mount Pleasant. Not all of the individuals, however, chose to make oral or written comments.

10.3.2 **Summary of the July 14, 2015, Public Hearing**

In advance of the July 14, 2015 public hearing held to solicit comments on the NETRWPG Initially Prepared Plan; the hearing was well-publicized with news releases, and advance notice at a previous NETRWPG monthly public meeting.

Most of those attending the public hearing and presenting oral comments opposed the inclusion of Marvin Nichols Reservoir as a Water Management Strategy in the Region D Plan, Region C Plan, and State Water Plan.

For the City of Clarksville, Mayor Ann Rushing and City Manager Wayne Dial expressed support for leaving all water management strategies open for the City, requesting all identified strategies be recommended by the NETRWPG.

Regarding the consideration of a reservoir on Grand Saline Creek for the City of Canton, a number of individuals expressed their opposition to the inclusion of this reservoir as a strategy, citing concerns as to the actual need for the water, the accuracy of projected growth, and impacts to landowners. Oral comments were also given by multiple representatives of the City of Canton, including Mayor Lou Ann Everett, and City Council members Shawn Stewart, Cynthia Malouf, and Connie Odic, all voicing support for usage of the same language as was used in the 2011 Region D Plan, including the reservoir on Grand Saline Creek as an alternative strategy.

10.3.3 **Synopsis of the Oral and Written Comments**

At the July 14, 2015 Public Hearing in Mount Pleasant, Titus County, there were 17 individuals who requested to spea, 7 of which providing comment cards (presented in Chapter 10 of Appendix C of this Plan). Prior to the final date for public comments, September 14, 2015, a total of 25 comments on the 2015 Region D IPP were received. Table 10.1 summarizes all 25 comments received (note that several comments received include multiple items). Subsequent to the receipt of comments,the comments were organized into three categories. These three groups are described as follows:

Group 1 - Comments, fourteen (14), which reflect the opinion of the commenter but do not specifically request any changes in the Initially Prepared Plan (IPP). These comments are typically thought of as being more generic in nature.

Group 2 - Comments, four (4), which represent facts which are incorrectly stated or need additional clarity to improve the quality of the IPP. These comments may necessitate changes in the document but are consistent with the intent of the IPP.

Group 3 - Comments, eleven (11), which recommend or request changes in the IPP which require more direction. These comments required more discussion and decision making by the voting members of the NETRWPG. These comments were presented in more detail for consideration of adoption or rejection by the NETRWPG, with input included from various commenters when requested.

Table 10.1 Summary of Comments on the 2015 Region D IPP

Date	Name	Entity	Format	Subject	Level	No.
5/8/2015	Mayor Richard Lawrence	City of Canton	Written	Supports Grand Saline Reservoir, wells, and reuse	3	1
7/3/2015	Gus Metz	South Rains SUD	Written	Correct numbers and add words	2	2
7/14/2015	Wayne Dial	City of Clarksville	Oral and Written	Supports leaving all options open for City	3	3
7/14/2015	Mayor Ann Rushing	City of Clarksville	Oral and Written	Supports leaving all options open for City	3	4
7/14/2015	Eileen Collins	Self	Oral and Written	Against Marvin Nichols	1	5
7/14/2015	Baker Bledsoe	Self	Oral and Written	Against Marvin Nichols	1	6
7/14/2015	Lindy Guest	Self	Oral and Written	Against Marvin Nichols	1	7
7/14/2015	Brian Strohman	Self	Oral	Against Marvin Nichols	1	8
7/14/2015	Lawrence Greer	Self	Oral and Written	Against Canton Reservoir	3	9
7/14/2015	Jimmy Hare	Self	Oral	Against Canton Reservoir	3	10
7/14/2015	Cary Hilliard	Self	Oral	Against Canton Reservoir	3	11
7/14/2015	Nina Holt	Self	Oral	Against Marvin Nichols	1	12
7/14/2015	John Brooks	Self	Oral and Written	Against Marvin Nichols	1	13
7/14/2015	Peggy Harrison	Atlanta ISD	Oral	Against Marvin Nichols	1	14
7/14/2015	Sharon Nabors	Self	Oral	Against Marvin Nichols	1	15
7/14/2015	Mayor Lou Ann Everett	City of Canton	Oral	Supports Grand Saline Reservoir, wells, and reuse	3	16
7/14/2015	Shawn Stewart	City of Canton	Oral	Supports Grand Saline Reservoir, wells, and reuse	3	17
7/14/2015	Cynthia Malouf	City of Canton	Oral	Supports Grand Saline Reservoir, wells, and reuse	3	18
7/14/2015	Connie Odic	City of Canton	Oral	Supports Grand Saline Reservoir, wells, and reuse	3	19
7/28/2015	Cary Hilliard	Self	Written	Against Canton Reservoir	1	20
8/11/2015	Jim Davis, et. al.	Bi-County WSC	Written	Supports Marvin Nichols	1	21
				Requests update to groundwater analyses	2	22

Date	Name	Entity	Format	Subject	Level	No.
8/12/2015	Mayor Ann Rushing, et. al.	City of Clarksville	Written	Supports Marvin Nichols	1	23
8/27/2015	Oran Caudle	Caudle Consulting	Written	Against Marvin Nichols, identifies alternative strategies	1	24
9/1/2015	Mike Russell	SRBA	Written to TWDB	Recommends designation as a WWP in the State Water Plan	3	25
9/11/2015	Ross Melinchuk	TPWD	Written	Recommends quantitative reporting of environmental factors	2	26
				Recommends consideration of impacts to springs	2	27
				Supports many of the policy recommendations in the IPP	1	28
				Provides summary of potential impacts from Patman reallocation	1	29

Written comments as submitted, along with responses to comments, are shown in Chapter 10 of Appendix C. Group 3 comments were addressed by topic, as shown below:

A. City of Clarksville Water Management Strategy Options
B. City of Canton Water Management Strategy Options
C. Designation of Wholesale Water Provider

At its October 21, 2015 meeting, the NETRWPG took action on Topic A to adopt as a recommended WMS the Pipeline to DeKalb for the purchase of available Wright Patman supply from the City of Texarkana/Riverbend Water Resources District. Further, the NETRWPG adopted the identification of alternative water management strategies including construction of Dimple Reservoir, construction of a new well field and reverse osmosis treatment facilities, and construction of a treated water pipeline connecting to Lamar County WSD for supply from the City of Paris. Lastly, the NETRWPG adopted the following language for inclusion in the Final Plan:

> At present, considerable uncertainty exists in each of the identified feasible water management strategies for the City of Clarksville. The NETRWPG supports any efforts by the City of Clarksville to further study all potential strategies to identify the best approach for the City to meeting all of its future water supply needs, and such a study should be considered consistent with the 2016 North East Texas Regional Water Plan.

This language is included in the appropriate locations relating to the City of Clarksville within the Final 2016 Region D Plan.

At its October 21, 2015 meeting, the NETRWPG also took action on Topic B, adopting as recommended water management strategies the development of a new well and indirect reuse for the City of Canton. The NETRWPG also adopted the identification of a new reservoir on Grand Saline Creek as an alternative water management strategy, including the following language as appropriate within the Final 2016 Region D Plan:

> Because of substantial disagreement over future population and water demands, the City has requested the following alternate strategy:
>
> The strategy to meet future needs "is with surface water from a proposed reservoir on Grand Saline Creek. The City of Canton has provided to NETRWPG resolutions from three other cities in Van Zandt County supporting the reservoir project. This show of support indicates that a regional surface water reservoir could possibly replace the groundwater strategies for other Van Zandt County public water supplies with projected deficits. However, due to the time typically required to obtain the necessary permits to impound surface water, the City plans to construct one or two additional wells, or implement a reuse option in the interim to meet increasing demands due to population growth and the First Monday influence." This alternative wording should be considered consistent with this plan in the event that population growth in the potential service area significantly exceeds current NETRWPG projections.

Regarding Topic C relating to the designation of an entity as a Wholesale Water Provider, the following language was included as a legislative recommendation in the Final 2016 Region D Plan, and adopted at the November 18, 2015 meeting of the NETRWPG:

> **Recommendation: Designation of Wholesale Water Providers**
>
> The North East Texas Regional Water Planning Group supports the designation of a Wholesale Water Provider (WWP) as described in the Texas Administrative Code §357.10(30) as:
>
>> Any person or entity, including river authorities and irrigation districts, that has contracts to sell more than 1,000 acre-feet of water wholesale in any one year during the five years immediately preceding the adoption of the last regional water plan. The regional water planning groups shall include as wholesale water providers other persons and entities that enter or that the regional water planning group expects or recommends to enter contracts to sell more than 1,000 acre-feet of water wholesale during the period covered by the plan.
>
> The NETRWPG supports the granting of a designation of WWP for an entity within Region D depending upon a written request from that entity to the NETRWPG that demonstrates said entity has entered or the RWPG expects or recommends to enter into contracts to sell more than 1,000 acre-feet of water wholesale during the period covered by the plan, including the designation of expected demand and the expected supply. Without a request that includes sufficient identification of expected contractual demand and expected supply, the NETRWPG cannot plan for such an entity. With this noted, Region D expects that the

water supply out of Lake Wright Patman will continue to be with Texarkana and Riverbend Water Resources District control as Wholesale Water Providers.

10.4 TEXAS WATER DEVELOPMENT BOARD

The Texas Water Development Board reviewed the Initially Prepared Plan and submitted comments on their findings by letter to Mrs. Linda Price, Chairman, North East Texas Regional Water Planning Group, dated August 6, 2015.

This letter (presented in Chapter 10 of Appendix C) included thirteen (13) Level 1 comments, and five (5) Level 2 comments. A memorandum providing responses to each of these comments is included in Chapter 10 of Appendix C.

10.5 REGION C AND REGION D INTERREGIONAL CONFLICT IN THE 2016 INITIALLY PREPARED REGIONAL PLANS

Documents pertaining to the 2016 Interregional Conflict Resolution process are included in Chapter 10 of Appendix C. Underlined items in the text below indicate a document that is included in this Appendix.

The 2016 Initially Prepared Region C Water Plan (IPP) contained a strategy called "Sulphur Basin Supplies" which consisted of the combination of supply from raising the conservation pool at Lake Wright Patman (to elevation 232.5 msl) and from a proposed Marvin Nichols Reservoir at elevation 313.5 msl (41,722-acre footprint). In the Region C IPP, Sulphur Basin Supplies was a recommended strategy for Tarrant Regional Water District, North Texas Municipal Water District, and Upper Trinity Regional Water District, and was an alternative strategy for the cities of Dallas and Irving. This strategy was shown to be online by 2050.

On July 21, 2015, the North East Texas Regional Water Planning Group (Region D) notified TWDB (by letter) of their objection to the inclusion of the Marvin Nichols Reservoir in the 2016 Region C Initially Prepared Plan.

On August 6, 2015 TWDB responded with a memorandum to Regions C and D regarding a Potential Interregional Conflict between Regional Water Plans for Regions C and D. In this memo, TWDB invited Regions C and D to submit briefs on the issue of whether an interregional conflict exists and notified the Regions that TWDB (the Board) would consider the matter of whether an interregional conflict did exist at its Board Meeting on September 9, 2015. Each Region was invited to give a 15 minute oral presentation to the TWDB Board at that meeting.

On August 24, 2015 Region C submitted a letter brief to TWDB asserting that an interregional conflict did not exist on the basis that the Board had previously reviewed and resolved the interregional conflict in the 2011 Regional Plan ruling in favor of keeping the Marvin Nichols strategy in the regional plan.

On September, 9, 2015 TWDB held a Board meeting at which the Board heard presentations from both Region C and D. The minutes from this meeting reflect that TWDB found that an interregional conflict did exist between the 2016 Region C and Region D Initially Prepared Plans and set forth a path by which Regions C and D would participate in mediation to resolve the conflict. TWDB directed each region and TWDB to designate representatives to participate in this mediation.

At its September 23, 2015 public meeting, the Region D Planning Group designated four representatives to participate in this mediation.

Mediation took place on October 5, 2015 resulting in an agreement to resolve the conflict. The terms of the agreement are as follows:

- Region C will move the Marvin Nichols Reservoir as a designated strategy to the year 2070 in its 2016 regional water plan;

- Region C will support Region D's effort to obtain Texas Water Development Board funding to study alternative water supplies to Marvin Nichols Reservoir for the process of the 5th cycle of regional water planning for Regions C and D, resulting in the development of the 2021 regional water plans;

- Region C will adopt a resolution to recommend that water suppliers in Region C not submit any water rights applications for new reservoirs that would be located in Region D through the end of the 5th cycle of regional water planning; and

- Region D agrees that it will not challenge Marvin Nichols Reservoir as a unique reservoir site through the end of the 5th cycle of regional planning.

Both Regions C and D were to seek ratification of the agreement by their respective regional water planning groups and to seek inclusion of the language relating to the terms of the agreement in their region's adopted 2016 regional water plans. At their October 21, 2015 public meeting the North East Texas Regional Water Planning Group (Region D) ratified this agreement. Revisions were made to the Final 2016 Region D Water Plan to reflect the terms of the agreement, particularly that Region D will not challenge Marvin Nichols Reservoir as a unique reservoir site through the end of the 5th cycle of regional planning. The Wright Patman portion of the Sulphur Basin Supplies strategy is still shown beginning in 2050.

10.6 ATTACHMENTS

The following attachments are included in Appendix C (see Table of Contents, Appendix C for specific locations) of the Final 2016 North East Texas Regional Water Plan:

- Texas Water Development Board Comments.

- Written responses to Texas Water Development Board Comments.

- Summary Table of Comments.

- Written comments submitted by individuals and organizations at the public hearing.
- Written comments on the IPP received during the public comment period.
- Written comments from the TPWD.
- Recorded comments at the July 14, 2015 Public Hearing.
- Written Responses to All IPP Comments.
- Interregional Conflict Resolution Process Documents

10.7 CERTIFICATION OF FINAL PLAN

This document is the certified Final 2016 North East Texas Regional Water Plan, being complete and adopted by the North East Texas Regional Water Planning Group at its November 18, 2015 public meeting.

CHAPTER 11 IMPLEMENTATION AND COMPARISON TO PREVIOUS REGIONAL WATER PLAN

11.1 IMPLEMENTATION OF PREVIOUS REGIONAL WATER PLAN

As a result of new statutory requirements from SB 660 (82nd Legislative Session) the planning rules (31 TAC §357.45(a)) require that each Region report the level of implementation of previously recommended WMSs meeting needs. The content of this newly required section in the plans is largely supported by data summaries based on information provided by RWPGs through DB17 during the planning cycle.

11.1.1 Implementation Survey Process

Information needed to report on implementation of the previous RWP was collected through a survey. The RWPGs and their technical consultants contacted the project sponsors to fill in the data.

Additional methods considered for identifying implemented projects include:

1. Tracking changes since the last plan including:
   - Changes in existing WUG or WWP supplies (e.g., water provider reporting a previously recommended WMS as an existing supply in the 2016 RWP)
   - Identifying WMSs that are not recommended in latest plan, possibly due to implementation.
2. Use of TWDB funding records to identify projects (WIF, State Participation, DWSRF, EDAP etc.)
3. Conservation implementation reports submitted to TWDB (i.e., conservation volumes are higher from previous report).

11.1.2 Survey Content and Data Format

Surveys were distributed to all of the identified WUGs within the Region D Planning Area. In addition to questions regarding existing supplies, the survey included questions regarding what, if any, changes to water supply sources occurred since the 2011 Region D Plan. A relatively small percentage of responses were received. The results of this survey are presented in Table 11.1 below, with more detailed results presented in Chapter 11 of Appendix C.

Table 11.1 Projects Implemented since 2011 Region D Plan

WUG	Project Description
Alba	Groundwater
Bethel-Ash WSC	None
Bi County WSC	Groundwater
Big Sandy	None
Blossom	None
Bright Star Salem	New/Revised Contract (SRA)
Canton	Groundwater
Cash SUD	None
Clarksville	Groundwater
Combined Consumers SUD	None
Cooper	Permit (Big Creek Lake)
Crooked Creek WSC	Groundwater
Crystal Systems Inc	Groundwater
Cumby	None
Cypress Springs SUD	None
Detroit	None
East Mountain	None
Edgewood	None
Gill WSC	None
Golden WSC	None
Hallsville	None
Hawkins	None
Josephine	None
Liberty City WSC	Groundwater
Lindale	None
Lindale Rural WSC	Groundwater
Little-Hope Moore WSC	Groundwater
Lone Oak	None
Lone Star	None
MacBee SUD	None
Maud	New/Revised Contract (Texarkana)
Mineola	Groundwater
Mount Pleasant	None
Nash	None
New Hope SUD	None
North Hopkins WSC	New/Revised Contract (Sulphur Springs)
Paris	None

WUG	Project Description
Pittsburg	Groundwater
Pritchett WSC	Groundwater
Redwater	None
Reno	None
Smith County MUD	None
S. Tawakoni WSC	Permit (Tawakoni)
Starrville Friendship WSC	Groundwater
Talley WSC	Groundwater
Texarkana	None
Tryon Road SUD	None
Waskom	Groundwater
West Gregg SUD	Groundwater
Woodland Harbor	New/Revised Contract (Bi-County WSC)

11.2 COMPARISON TO PREVIOUS REGIONAL WATER PLAN

This section includes a brief summary demonstrating how the 2016 Region D Plan differs from the previous 2011 Region D Plan. Comparisons include summary tables and other graphics, as appropriate, that concisely convey the changes between plans for the North East Texas Region. Comparisons of the two RWPs are provided in the following categories:

- Water demand projections;
- Drought of record and the hydrologic and modeling assumptions on which the plans are based;
- Water availability at the sources;
- Existing water supplies of WUGs;
- WUG and WWP needs;
- Recommended and alternative WMSs; and
- Any other aspects of the plans that the RWPG chose to compare.

The comparisons include a brief explanation of the underlying reasons for the changes that occurred regarding each of the above categories, where appropriate. Note that for the purposes of the 2011 Region D Plan, the planning period analyzed was 2010 – 2060, whereas for the current 2016 Region D Plan the planning period analyzed is 2020 – 2070. Thus, no comparisons are presented for the 2010 or 2070 decades herein.

11.2.1 Water Demand Projections

Projected regional water demands within the North East Texas Region as presented in Chapter 5, Table 5.1, of this plan are represented in Table 11.2. As stated in Chapter 5.1.1, manufacturing will remain the dominant water use in the region, accounting for roughly 52 percent of water demand at present and 48 percent of water demand in 2070. Projected regional water demands within the North East Texas Region as presented in Chapter 4, Table 4.38, of the 2011 RWP are presented in Table 11.3.

Table 11.2 2016 Population and Water Demand Projections Summary for the North East Texas Region

Total Regional Projection	2020	2030	2040	2050	2060	2070
Population	**831,469**	**907,531**	**988,859**	**1,089,197**	**1,211,979**	**1,370,438**
Water Demand (ac-ft)						
Municipal	134,310	142,631	152,536	166,385	184,540	208,132
Manufacturing	332,070	355,072	377,273	396,249	425,638	457,217
Irrigation	40,866	40,737	40,442	39,913	39,413	39,138
Steam Electric	96,574	112,905	132,815	157,084	186,668	222,648
Mining	7,115	7,748	7,670	7,280	6,914	6,795
Livestock	23,237	23,281	23,220	23,116	23,036	23,042
Total Water Demand (ac-ft)	**634,172**	**682,374**	**733,956**	**790,027**	**866,209**	**956,972**

Table 11.3 2011 Population and Water Demand Projections Summary for the North East Texas Region

Regional Total Projection	2020	2030	2040	2050	2060
Population	**843,027**	**908,748**	**978,298**	**1,073,570**	**1,213,095**
Water Demand (ac-ft/yr)					
Municipal Water Demand	128,711	136,749	145,404	158,458	178,178
Manufacturing Water Demand	328,568	351,427	373,504	392,387	421,496
Irrigation Water Demand	15,415	15,329	15,182	14,949	14,728
Steam Electric Water Demand	96,492	112,809	132,703	156,951	186,509
Mining Water Demand	9,605	10,108	10,595	11,111	11,625
Livestock Water Demand	26,736	26,785	26,698	26,554	26,441
TOTAL WATER DEMAND (ac-ft/yr)	**605,527**	**653,207**	**704,086**	**760,410**	**838,977**

Comparisons of projected demands by decade for each WUG type are displayed in Figures 11.1 – 11.6. While these summaries of demands are informative, it should be noted that individually, significant differences exist between the two plans with respect to demands. Demands for small municipalities and rural areas are now significantly less, given that for the present round of planning a floor of 60 gpcd was established by the TWDB, rather than the 115 gpcpd adopted by the NETRWPG in the previous round of planning.

The figures below demonstrate that the projected municipal demands for the 2016 Region D Plan have increased since the 2011 Plan. The projected demands for irrigation have increased as well, while manufacturing and steam electric demands have remained relatively unchanged. Mining and livestock demands have decreased from the previous round of planning. Differences in the projections for demands between the planning periods are likely due to a number of different factors, some of which may include changes in regional population (the present planning effort has now incorporated data from the 2010 census which were not available for the previous round of planning, water conservation practices, and reductions in mining activities.

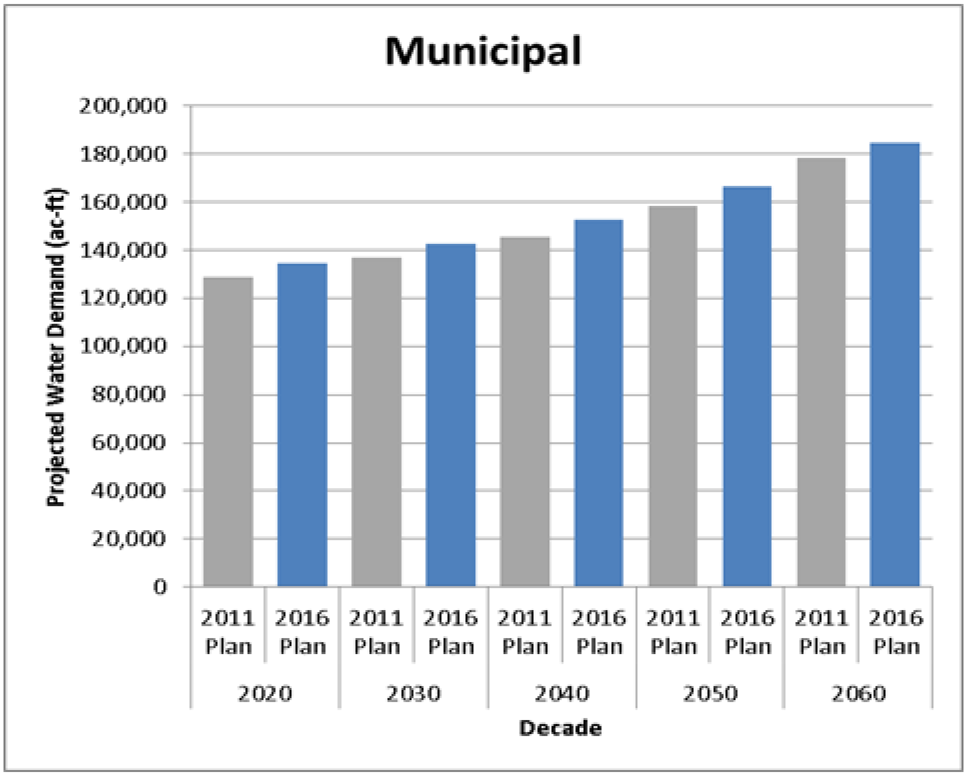

Figure 11.1 Comparison of Projected Municipal Demands in Region D by Decade

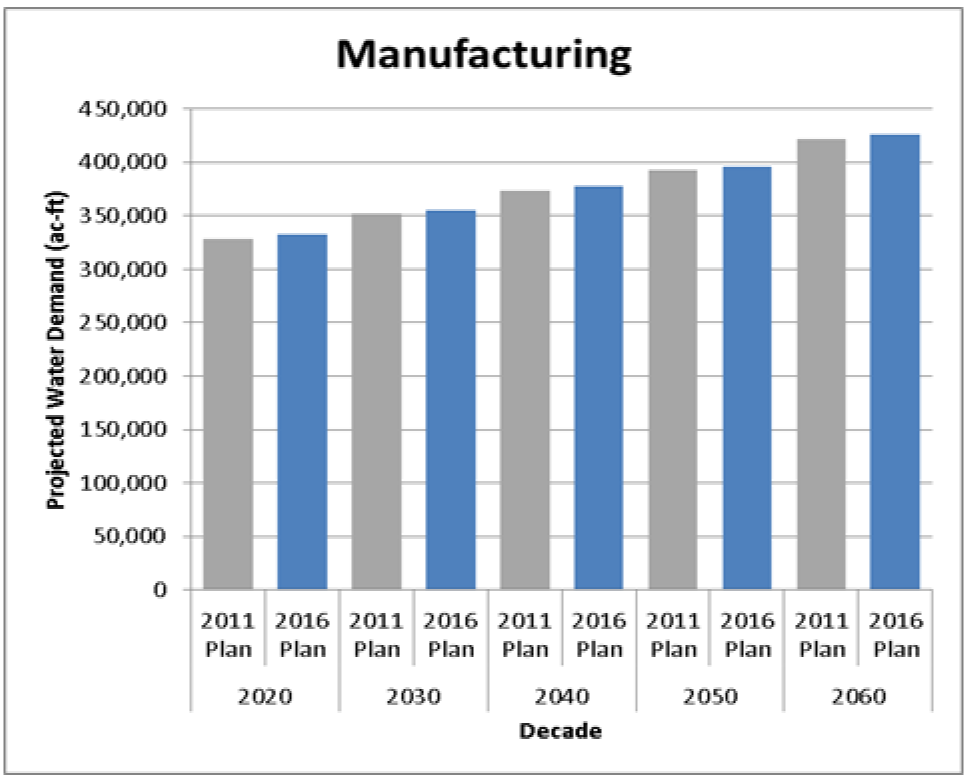

Figure 11.2 Comparison of Projected Manufacturing Demands in Region D by Decade

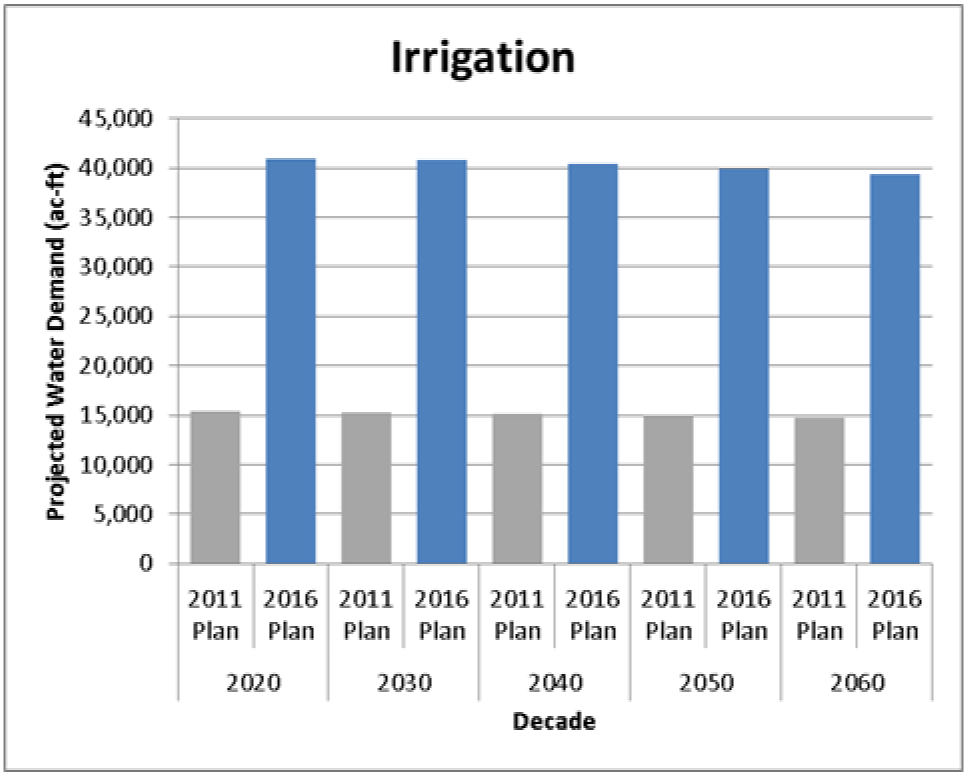

Figure 11.3 Comparison of Projected Irrigation Demands in Region D by Decade

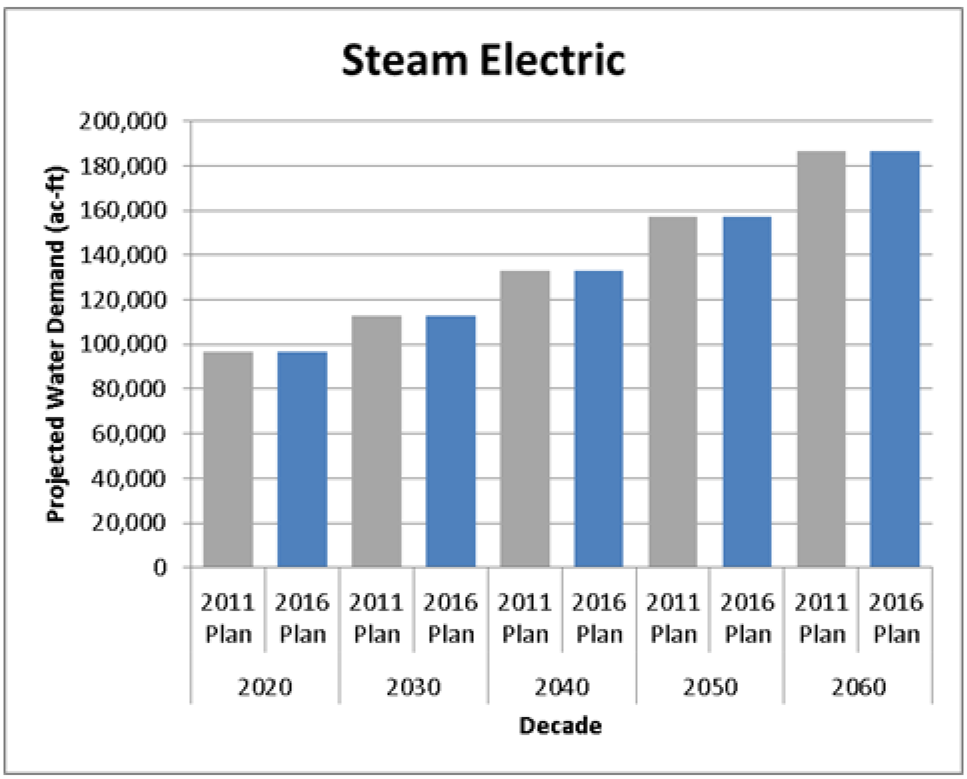

Figure 11.4 Comparison of Projected Steam Electric Demands in Region D by Decade

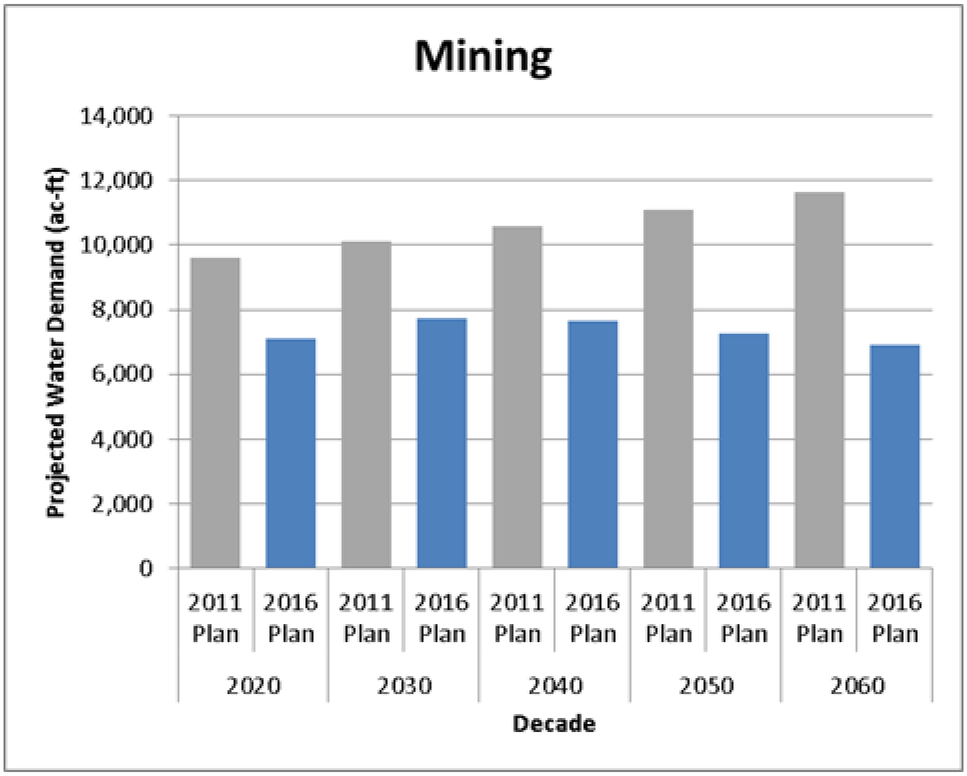

Figure 11.5 Comparison of Projected Mining Demands in Region D by Decade

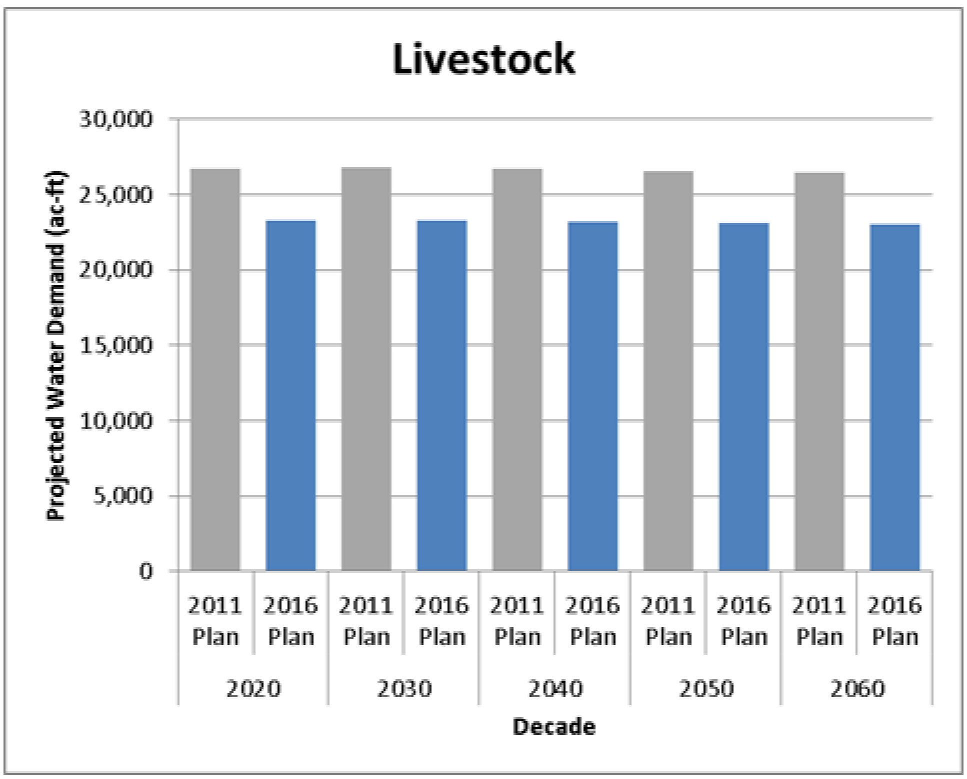

Figure 11.6 Comparison of Projected Mining Demands in Region D by Decade

11.2.2 **Drought of Record and the Hydrologic and Modeling Assumptions**

A new component of the 2016 Region D planning process introduced for this planning cycle is Regional Drought Planning, which essentially expands the conceptualization and application of drought planning by specific entities to encompass the entire North East Texas Region. Chapter 7 herein contains a thorough discussion on this matter.

As stated in Chapter 7, for the purpose of this planning cycle, the drought of the 1950s has been declared the Drought of Record (DOR). This drought is the key drought period represented and utilized in the official TCEQ Water Availability Models (WAMs) for the river basins within the North East Texas Region. While subsequent major droughts have occurred in Region D, the TCEQ has not yet indicated that a more recent drought should be utilized for the consideration of firm supplies using the Water Availability Models.

The principal use of the WAM modeling performed for the 2016 Region D Plan was for the determination of firm, 100% reliable supplies in the region. Consistent with TWDB guidelines, the NETRWPG elected to use the TCEQ's official WAM models (Run 3), reflecting full permitted demands (by priority) with the assumption of no return flows. With the exception of updates to the official WAMs, this was the same reported approach for the development of the 2011 Plan. Firm yields for Pat Mayse and Crook Reservoirs were utilized from a study performed by HDR for the City of Paris in the same manner as was done for the 2011 Region D Plan.

11.2.3 **Water Source Availability**

For the 2016 Region D Plan, the surface water supply available to the region during drought-of-record hydrologic conditions is approximately 1.28 million ac-ft/yr. This represents more than 77 percent of the total amount of water presently available to the region from all sources (i.e., groundwater and other local sources). For the 2011 Plan, the surface water supply available to the region during drought-of-record hydrologic conditions was reported to be approximately 1.47 million ac-ft/yr (approximately 60% of the total amount of water characterized as available to the region at that time). A comparison of these differences in the earliest and latest comparable decades between plans is displayed in Figure 11.7. This decrease in surface water supplies is largely due to increased accuracy in the characterization of existing supplies available under current legal and infrastructure constraints.

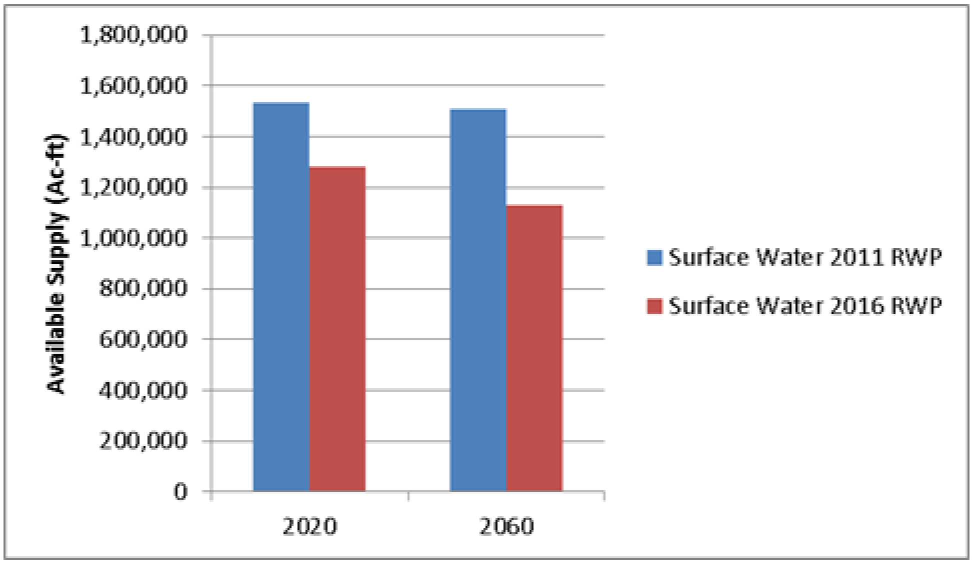

Figure 11.7 Comparison of Surface Water Supplies within Region D (2020 and 2060)

Nearly 288,000 ac-ft./yr. of water supply, or 18 percent of the total water supply is estimated to be available from groundwater sources for the present 2016 Plan. For the 2011 Plan, the amount of estimated total groundwater supply was nearly 309,000 ac-ft/yr, or 40 percent of the total water supply estimated to be available from groundwater sources at present. This decrease in the available groundwater supply is largely due to the new utilization of Modeled Available Groundwater (MAG) amounts as a limit to the amount of available groundwater supply in a region. Of particular concern is that such a limit has no regulatory enforceability within Region D, as no Groundwater Conservation Districts exist within the planning area.

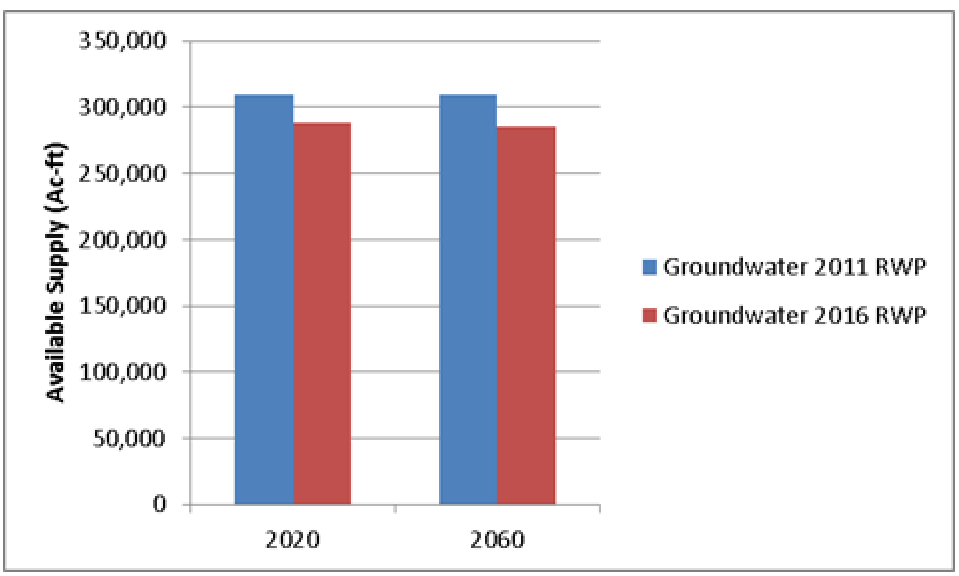

Figure 11.8 Comparison of Groundwater Supplies within Region D (2020 and 2060)

Supplies available from reuse remained relatively similar between the 2011 and 2016 Region D Plans, as demonstrated in Figure 11.9.

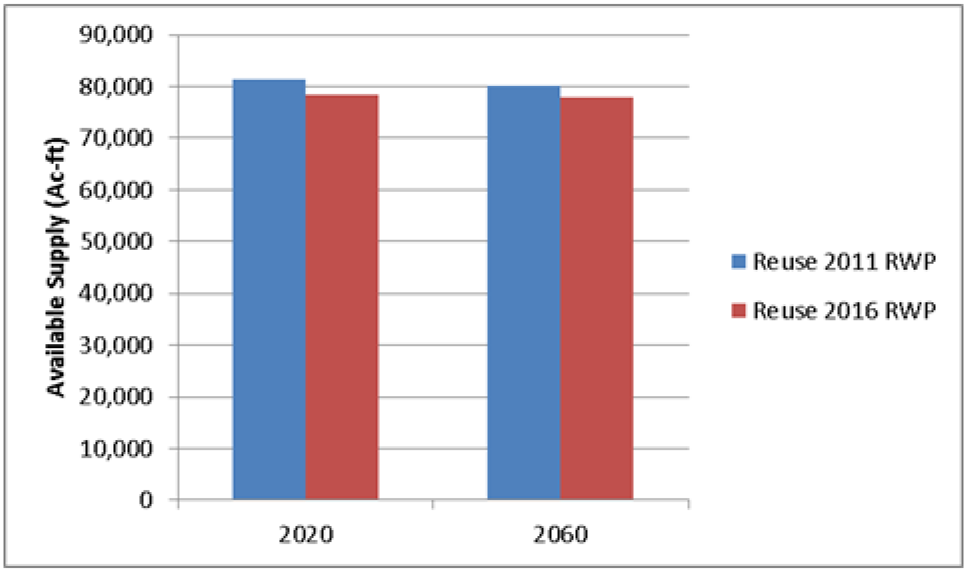

Figure 11.9 Comparison of Reuse Supplies within Region D (2020 and 2060)

11.2.4 **Existing WUG Water Supplies**

Region supplies summarized by use category from the 2016 Plan and the 2011 Plan are presented for comparison in Figure 11.10. A county by county comparison of municipal supplies for the 2016 and 2011 Region D Plans is presented in Table 11.4.

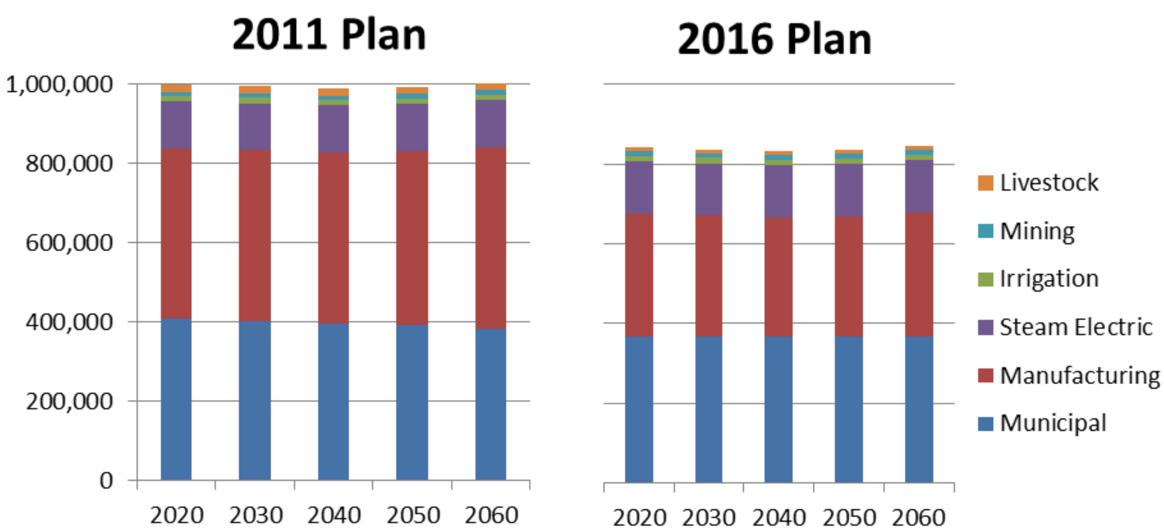

Figure 11.10 Comparison of Regional Supplies by Use Category

Table 11.4 Decadal Comparison of Municipal WUG Supplies by County

WUG Supply Comparison by County		2020	2030	2040	2050	2060
BOWIE COUNTY	County Total - Round IV	3,688	3,757	3,820	3,757	3,722
	County Total - Round III	60,773	54,284	48,045	42,149	32,307
	Round IV minus Round III	-57,085	-50,527	-44,225	-38,392	-28,585
CAMP COUNTY	County Total - Round IV	3,194	3,206	3,215	3,257	3,264
	County Total - Round III	14,242	14,248	14,253	14,258	14,263
	Round IV minus Round III	-11,048	-11,042	-11,038	-11,001	-10,999
CASS COUNTY	County Total - Round IV	5,740	5,800	5,859	5,933	5,931
	County Total - Round III	9,875	9,956	10,038	10,120	10,120
	Round IV minus Round III	-4,135	-4,156	-4,179	-4,187	-4,189
DELTA COUNTY	County Total - Round IV	2,955	2,887	2,872	2,852	2,820
	County Total - Round III	2,373	2,289	2,281	2,257	2,225
	Round IV minus Round III	582	598	591	595	595
FRANKLIN COUNTY	County Total - Round IV	5,178	5,187	5,139	5,090	4,968
	County Total - Round III	7,127	7,150	7,169	7,169	7,169
	Round IV minus Round III	-1,949	-1,963	-2,030	-2,079	-2,201
GREGG COUNTY	County Total - Round IV	44,249	45,376	45,487	45,638	50,835
	County Total - Round III	70,718	70,673	70,641	70,615	70,667
	Round IV minus Round III	-26,469	-25,297	-25,154	-24,977	-19,832
HARRISON COUNTY	County Total - Round IV	19,624	19,755	19,854	19,971	15,152
	County Total - Round III	44,306	44,459	44,532	44,561	44,690
	Round IV minus Round III	-24,682	-24,704	-24,678	-24,590	-29,538
HOPKINS COUNTY	County Total - Round IV	23,014	22,661	22,231	22,044	21,571
	County Total - Round III	22,661	22,308	21,890	21,697	21,236
	Round IV minus Round III	353	353	341	347	335
HUNT COUNTY	County Total - Round IV	17,221	21,389	21,934	25,518	28,173
	County Total - Round III	44,057	43,824	43,820	44,724	46,535
	Round IV minus Round III	-26,836	-22,435	-21,886	-19,206	-18,362
LAMAR COUNTY	County Total - Round IV	38,186	37,886	37,610	37,367	36,904
	County Total - Round III	42,922	42,681	42,456	42,249	41,819
	Round IV minus Round III	-4,736	-4,795	-4,846	-4,882	-4,915
MARION COUNTY	County Total - Round IV	3,474	3,474	3,474	3,474	3,474
	County Total - Round III	10,791	10,791	10,791	10,791	10,791
	Round IV minus Round III	-7,317	-7,317	-7,317	-7,317	-7,317
MORRIS COUNTY	County Total - Round IV	3,565	3,565	3,565	3,531	3,532
	County Total - Round III	13,390	13,390	13,390	13,390	13,390
	Round IV minus Round III	-9,825	-9,825	-9,825	-9,859	-9,858

WUG Supply Comparison by County		2020	2030	2040	2050	2060
RAINS COUNTY	County Total - Round IV	2,733	3,952	3,946	3,932	3,917
	County Total - Round III	3,780	3,794	3,785	3,764	3,741
	Round IV minus Round III	-1,047	158	161	168	176
RED RIVER COUNTY	County Total - Round IV	2,237	1,989	1,325	1,325	1,325
	County Total - Round III	3,561	3,557	3,553	3,553	3,553
	Round IV minus Round III	-1,324	-1,568	-2,228	-2,228	-2,228
SMITH COUNTY	County Total - Round IV	10,288	10,792	11,340	12,099	13,064
	County Total - Round III	9,461	9,995	10,536	11,499	12,723
	Round IV minus Round III	827	797	804	600	341
TITUS COUNTY	County Total - Round IV	8,539	8,369	8,075	7,849	8,438
	County Total - Round III	10,908	10,594	10,263	10,867	9,193
	Round IV minus Round III	-2,369	-2,225	-2,188	-3,018	-755
UPSHUR COUNTY	County Total - Round IV	8,921	8,956	8,977	9,002	9,010
	County Total - Round III	15,374	15,414	15,436	15,454	15,479
	Round IV minus Round III	-6,453	-6,458	-6,459	-6,452	-6,469
VAN ZANDT COUNTY	County Total - Round IV	11,699	14,819	14,942	15,097	15,073
	County Total - Round III	13,086	13,281	13,414	13,531	13,639
	Round IV minus Round III	-1,387	1,538	1,528	1,566	1,434
WOOD COUNTY	County Total - Round IV	12,263	13,014	13,003	12,986	12,969
	County Total - Round III	10,240	10,279	10,274	10,266	10,259
	Round IV minus Round III	2,023	2,735	2,729	2,720	2,710
TOTAL	**County Total - Round IV**	**226,768**	**236,834**	**236,668**	**240,722**	**244,142**
	County Total - Round III	**409,645**	**402,967**	**396,567**	**392,914**	**383,799**
	Round IV minus Round III	**-182,877**	**-166,133**	**-159,899**	**-152,192**	**-139,657**

As mentioned previously, changes in supplies between the last and present round of planning for Region D are largely attributable to MAG limitations defining the available groundwater supply to the region, utilization of firm, 100% reliability under Drought-of-Record conditions through application of the official TCEQ WAM models for each river basin, and greater accuracy in the characterization of the legal and infrastructure capabilities of each WUG to accessing available sources.

11.2.5 WUG and WWP Needs

As discussed in Chapter 4 herein, an analysis of supply and demand for each user revealed that 71 WUGs within Region D are projected to experience shortages during the 2020 – 2070 planning period. For the 2011 Region D Plan, a similar analysis identified 61 entities with identified needs over the 2010 – 2060 period. A comparison of the identified needs, by WUG type, between the 2011 and 2016 Region D Plans is presented in Table 11.5.

Table 11.5 Comparison of Projected Needs by WUG Category

WUG Category	2011 RWP		2016 RWP	
	2020	2060	2020	2060
Municipal	-3,166	-20,329	-22,341	-39,003
Manufacturing	0	0	-61,557	-120,136
Irrigation	0	0	-30,763	-29,589
Livestock	0	0	0	0
Mining	0	0	-2,888	-1,700
Steam Electric	-12,366	-77,469	-32,643	-117,157
Total	**-15,532**	**-97,798**	**-150,192**	**-307,585**

Although the number of entities with projected needs are somewhat comparable between plans, as evidenced in Table 11.5, a significantly greater amount of needs (>300 percent by 2060) have been identified during the development of the 2016 Region D Plan.

The NETRWPG has identified 17 wholesale water providers (WWPs) and WUG Sellers, as follows:

Wholesale Water Provider	Municipal Water Suppliers
Cherokee Water Company	City of Emory
Commerce Water District	City of Greenville
Lamar County Water Supply District	City of Longview
Franklin County Water District	City of Marshall
Northeast Texas Municipal Water District	City of Mt. Pleasant
Sabine River Authority	City of Paris
Sulphur River MWD	City of Sulphur Springs
Titus County FWD #1	City of Texarkana
Cash SUD	

For the present 2016 Plan, no WWPs were identified as having a need, and a total of three WUG Sellers (Greenville, Marshall, and Texarkana) are projected to have insufficient available supplies to meet customer demands. In the 2011 Plan, two WWPs were projected to have insufficient available supplies: Cash SUD and Franklin County WD.

The increases in overall needs between the 2016 and 2011 Region D Plans are due to a number of factors. With lower amounts of projected supplies, an increased identification of needs is to be expected.

11.2.6 Recommended and Alternative Water Management Strategies

The methodological approach adopted by the NETRWPG for the evaluation of Water Management Strategies (WMSs) between plans was the same. All potentially feasible strategies were considered for each WUG with an identified need, per TWDB guidelines. This approach ultimately focused upon four predominant categories of WMSs for Region D WUGs, namely:

- Advanced Water Conservation;
- Water Reuse;
- New or additional Groundwater wells; and
- Additional Surface Water supplies utilizing existing sources

A total of 98 strategies have been recommended in the 2016 Plan, a significant increase from the 47 strategies recommended in the 2011 Plan, largely due to the higher demands and lower supplies determined to be available for the present round of planning. A comparison between the two Region D Plans between the recommended WMSs by source type and county is presented in Table 11.6.

The 2011 Region D Plan presented a single alternative strategy (for the City of Canton), whereas 19 alternative strategies have been identified for the 2016 Plan.

Table 11.6 Comparison of Recommended WMS Amounts by County and Type

County	Source Type	2011 RWP		2016 RWP	
		2020	2060	2020	2060
Bowie	Surface Water	1,473	3,013	16,652	19,291
	Groundwater	0	0	5,240	4,338
Camp	Surface Water	0	0	0	0
	Groundwater	193	718	0	161
Cass	Surface Water	0	0	11,508	30,116
	Groundwater	0	0	151	151
Delta	Surface Water	0	36	0	0
	Groundwater	0	0	0	0
Franklin	Surface Water	0	0	0	0
	Groundwater	0	0	0	0
Gregg	Surface Water	0	40	0	0
	Groundwater	162	1,076	280	393
Harrison	Surface Water	0	14,184	61,501	114,079
	Groundwater	385	774	2,058	1,934
Hopkins	Surface Water	0	0	1,306	1,335
	Groundwater	0	35	820	960

County	Source Type	2011 RWP		2016 RWP	
		2020	2060	2020	2060
Hunt	Surface Water	13,448	34,825	11,425	29,306
	Groundwater	135	2,132	225	3,777
Lamar	Surface Water	2	7,494	18,993	26,574
	Groundwater	0	0	0	0
Marion	Surface Water	0	0	0	0
	Groundwater	0	0	432	648
Morris	Surface Water	0	0	9,757	12,295
	Groundwater	0	0	0	0
Rains	Surface Water	239	277	0	0
	Groundwater	0	0	0	0
Red River	Surface Water	0	0	94	577
	Groundwater	0	0	0	391
Smith	Surface Water	0	0	317	435
	Groundwater	0	1,242	1,610	4,402
Titus	Surface Water	0	31,909	29,896	80,247
	Groundwater	0	0	45	45
Upshur	Surface Water	0	0	0	0
	Groundwater	0	0	754	1,613
Van Zandt	Surface Water	0	0	1	3
	Groundwater	424	1,377	699	1,005
Wood	Surface Water	0	0	0	0
	Groundwater	403	403	0	0
Total		**16,864**	**99,535**	**173,764**	**334,076**
Total Surface Water		**15,162**	**91,778**	**161,450**	**314,258**
Total Groundwater		**1,702**	**7,757**	**12,314**	**19,818**

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