



# 2012 Annual Report

RED RIVER GROUNDWATER CONSERVATION DISTRICT

# Board of Directors

## Fannin County

George "Butch" Henderson, President	8/31/2013
Harold Latham, Member	8/31/2015
Don Morrison, Member	8/31/2013

## Grayson County

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Don Wortham, Secretary/Treasurer	8/31/2013
David Gattis, Member	8/31/2013
Mark Patterson, Member	8/31/2015

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Debi Atkins, Finance Officer
Laurie Killian, Accounting Assistant
Alan Moore, Operations Supervisor
Wayne Parkman, Field Technician
Carmen Catterson, Secretary/Mapping Technician
Carolyn Bennett, Administrative Assistant/Project Coordinator
Theda Anderson, Clerk

## Introduction

In 1997 Senate Bill 1, enacted by the Texas Legislature, confirmed a state policy that “groundwater conservation districts... are the state’s preferred method of groundwater management through rules developed, adopted and promulgated by a district...” Subsequently, the Texas Commission on Environmental Quality issued a report in 2007 advising that one or more groundwater conservation districts would need to be created in the 13-county area of North Central Texas, including the Counties of Fannin and Grayson. Red River Groundwater Conservation District (“District”) was created by the Act of May 25, 2009, 81<sup>st</sup> Texas Legislature for Fannin and Grayson Counties. Three directors are appointed to Fannin County and four directors are appointed to Grayson County. The District’s boundaries are coterminous with the boundaries of Fannin and Cooke Counties.

As required by Chapter 36 of the Texas Water Code, the District provides for conserving, preserving, protecting, recharging and preventing the waste of groundwater. The Board of Directors of the District adopted its Temporary Rules August 29, 2011. The adopted Rules provide protection to existing wells, prevent waste, promote conservation, provide a framework that will allow availability and accessibility of groundwater for future generations, protect the quality of the groundwater in the recharge zone of the aquifer, insure that the residents of Fannin and Grayson Counties maintain local control over their groundwater, and operate the District in a fair and equitable manner for all residents of the District.

The District is committed to manage and protect the groundwater resources within its jurisdiction and to work with others to ensure a sustainable, adequate, high quality and cost effective supply of water, now and in the future. The District will strive to develop, promote, and implement water conservation, augmentation, and management strategies to protect water resources for the benefit of the citizens, economy and environment of the District. The preservation of this most valuable resource can be managed in a prudent and cost effective manner through conservation, education, and management. Any action taken by the District shall only be after full considerations and respect has been afforded to the individual property rights of all citizens of the District.

## General Manager's Report

In May of 2012 the District adopted their Management Plan. As required by the Management Plan, this Annual Report is presented to the Board of Directors in an effort to apprise them of the status of the goals included in the Management Plan approved by the Texas Water Development Board.

Mandatory well registration began April 1, 2012. This applies to all existing non-exempt wells, and all new wells drilled after April 1, 2012. All new wells must be approved and registered before construction begins.

Temporary Rules were reviewed in August to determine if any amendments were necessary to reduce the amount of waste of groundwater within the District. During this meeting the Board requested the staff to collect more information on waste and provide it to the Board in the Annual Report. Staff has subsequently collected water loss audits for all cities/entities for which this report was filed with the Texas Water Development Board. A report compiled with information provided by the Texas Water Development Board water loss audits is attached (Appendix A).

Temporary Rules were reviewed again December 12, 2012. The Board voted to change the water production report due dates and billing dates from semi-annually to quarterly. This will allow for better accounting procedures.

The Temporary Rules were revised to allow registrant 360 days from the date of approval of the application for completion, with the well report filed within 60 days of completion. An additional revision was included allowing greater than 240 days for completion of non-exempt wells based on size and complexity of the well, but not to exceed 2 years. The registrant may, however, apply for an additional one year for a fee of \$100.00.

A provision was added to the Temporary Rules to require accurate driller's report/log, to be included with the well report submitted to the District. A meter sealing policy was established. Enforcement action was adopted for non-exempt well owners not complying with meter requirements.

The Board also voted to add a minor violation for drilling an exempt or non-exempt well with an expired well registration. A major violation was set for tampering with or disabling a required meter or tampering with a District seal.



## Management Goals

The District Management Plan, adopted May 17, 2012, provides that an Annual Report be prepared by the General Manager and staff of the District, covering the activities of the District, including information concerning the District's performance in regards to achieving the District's management goals and objectives.

### A. Providing for the Most Efficient Use of Groundwater

A.1 Objective: District to require all new water wells constructed within the boundaries of the District are to be registered with the District.

A.1 Performance Standard: Number of wells registered for each year to be included in Annual Report.

*To demonstrate completion of Performance Standard A.1, the number of exempt and permitted (non-exempt) wells registered or permitted by the District for 2012 is given in Table A1.*

Table A1: Number of Exempt and Non-Exempt (Permitted) Wells Registered or Permitted by the District in 2012	
Number of exempt wells registered	63
Number of non-exempt wells permitted	265
TOTAL	328

A.2 Objective: At least once per year District will evaluate District Rules to identify any amendments necessary to reduce the amount of waste of groundwater within the boundaries of the District.

A.2 Performance Standard: Discussion of annual evaluation of District Rules to determine if any amendments are necessary to reduce the amount of waste of groundwater will be included in Annual Report.

*This performance standard was met, the Board of Directors met August 21, 2012 and discussed the District Rules to determine if any amendments were necessary to reduce the amount of waste of groundwater that needed to be included in the Annual Report. No amendments were found to be necessary to the District Rules at this time to reduce waste of groundwater.*

*The Board of Directors requested the staff collect information on waste and provide it in the Annual Report. Attached is information collected (Appendix A) using data from the Water Loss Audits that were requested from the Texas Water Development staff. TWDB staff informed RRGCD staff water loss audits are required every five years (2005, 2010, etc.) However, some audits were submitted voluntarily in 2011, and the information collected from these is also included in Appendix A. The apparent losses are*

*meter malfunctions, etc., while real losses are line breaks, leaks, flushing, etc.*

**B. Controlling and Preventing Waste of Groundwater**

- B.1 Objective: District will annually provide information to the public on eliminating and reducing wasteful practices in the use of groundwater by publishing information on groundwater waste reduction on the District's website at least once a year.
- B.1 Performance Standard: Copy of information on groundwater waste reduction will be provided on the District's website and the information published on the website will be included in the District's Annual Report to be provided to the Board of Directors.

*This performance standard was met, the following was published on the District's website during 2012:*

## **Water Conservation**

### **Links**

[Home Water Works home water usage water calculator](#)  
[25 things you can do to save water](#)  
[Water Conservation Advisory Council](#)  
[Texas Water Foundation](#)  
[Texas Water Conservation Association](#)  
[Water IQ](#)

### **Brochures**

[A Watering guide for Texas Landscape](#)  
[Water Conservation for Industries, Businesses, and Institutions](#)  
[Water Conserving Tips](#)  
[Conserving Water Indoors](#)  
[Conserving Water Outdoors](#)  
[Agricultural Water conservation Irrigation Water Use Management Best Management Practices](#)  
[Agricultural Water Conservation Best Management Practices Overview](#)

### **Brochures in Spanish**

[Cuarenta Y Nueve Consejos Practicos Para Conservar Agua \(Forty-Nine Water Saving Tips\)](#)  
[Xeriscape \(Xeriscape - Principles and Benefits\)](#)  
[The Dillos Demonstrate Wordless Water Conservation](#)

## Articles

[Why Most Texas Haven't Turned to Graywater Recycling](#)

StateImpact Texas

[One Less Gallon We Have To Pump](#)

Texas Coop Power

[Water For All](#)

Texas Coop Power

[Private-public partnership aims to save water](#)

San Antonio Express

[Taking the Ick Factor Out of Recycled Water](#)

New York Times

[Agriculture commissioner urges water conservation](#)

Times Record News

[In wake of Texas drought, water and politics mix](#)

Austin American-Statesman

- B.2 Objective: District will encourage the elimination and reduction of groundwater waste through the collection of water-use fee for non-exempt production wells within the District.

Performance Standard: Annual reporting of the total fees paid and total groundwater used by non-exempt wells will be included in Annual Report. The District set a water-use fee of \$0.06/1,000 gallons.

Because the District is relatively new, 2012 fees were billed based on 2010 usage. Annual reporting of the total fees paid and the total groundwater used by non-exempt wells will begin with the 2013 Annual Report, which is due January 2014.

- C. **Controlling and Preventing Subsidence: This goal is not applicable to the Red River Groundwater Conservation District.**

- D. **Conjunctive Surface Water Management Issues**

- D.1 Objective: District will participate in regional water planning process by attendance of General Manager or Board Member at one of the Region C Regional Water Planning Group meetings to encourage development of surface water supplies to meet the needs of user groups within the District.

- D.1 Performance Standard: Attendance of District representative at Region C Water Planning Group meetings will be noted in Annual Report.

*This performance standard was met. Board Member Latham and General Manager Chapman attended the two Region C Water Planning Group meetings held during 2012, (August 30, 2012 and December 3, 2012).*

- E. **Natural Resource Issues: This goal is not applicable to the Red River Groundwater Conservation District.**

- F. **Drought Conditions**

- F.1 Objective: Palmer Drought Severity Index ("PDSI") will be downloaded monthly to District website [redrivergcd.org](http://redrivergcd.org) and the District's rainfall map will be updated monthly as well.

- F.1 Performance Standard: District will assess status of drought in the District quarterly and prepare a briefing to the Board of Directors. Downloaded PDSI maps and rainfall maps will be included with copies of the quarterly briefings in the Annual Report.

*This performance standard was met. PDSI maps and rainfall maps downloaded monthly are included in the Quarterly Reports on the drought conditions, which are a part of this Report. (See Appendix B)*

**G. Conservation, Recharge Enhancement, Rainwater Harvesting, and Brush Control**

- G.1 Objective (Conservation): The District will submit at least one article regarding water conservation for publication each year to at least one newspaper of general circulation in Fannin and Grayson Counties.

- G.1 Performance Standard (Conservation): Copy of article included in Annual Report to Board of Directors.

*This performance standard was met. Copy of article published by the Herald Democrat, newspaper of general circulation in Fannin and Grayson Counties, is included as an attachment to this report. (See Appendix C)*

- G.2 Objective (Rainwater Harvesting): District to provide information on rainwater harvesting each year by offering new information regarding rainwater harvesting on the District website at least once a year.

- G.2 Performance Standard (Rainwater Harvesting): District's Annual Report will provide copies of information regarding rainwater harvesting that was posted on website for the past year.

*This performance standard was met. The following information regarding rainwater harvesting has been posted on the District's website during 2012:*

**Rainwater Harvesting**

[TWDB Rainwater Harvesting Information](#)

[Texas Water by Texas A&M](#)

[TWDB Rainwater Harvesting Manual](#)

**Articles**

[Save It for a Sunny Day](#)

[Texas Coop Power](#)

[Rainwater Harvesting FAQ](#)

[Texas Coop Power](#)

- G.3 Objective (Brush Control): District will evaluate State Brush Control Plan as it is revised from time to time (at least once per year) and determine whether projects within the District will increase groundwater resources of the District.

- G.3 Performance Standard (Brush Control): District's Annual Report will include a copy of the most recent brush control information pertaining to the District.

*This performance standard was met. A report was provided at the December 12, 2012 meeting to the Board of Directors, and is included in this report. (See Appendix D)*

Goals related to Recharge Enhancement and Precipitation Enhancement are not applicable to the Red River Groundwater Conservation District.

#### **H. Addressing in Quantitative Manner the Desired Future Conditions**

- H.1 Objective: Within three (3) years of Groundwater Management Plan adoption, the District will develop a Groundwater Monitoring Program within the District.

- H.1 Performance Standard: Upon development, the District Groundwater Monitoring Program will be attached to the Annual Report.

*This objective will be addressed in the future, within three years of adoption of the Plan.*

- H.2 Objective: Once the District's Monitoring Program has been approved, water level measurements will be conducted at least annually on wells within the District.

- H.2 Performance Standard: Annual evaluation of water-level trends and the adequacy of the monitoring network to monitor aquifer conditions within the District and comply with the aquifer resources desired future conditions. Evaluation to be included in Annual Report.

*This objective will be addressed in the future, when the Groundwater Monitoring Program is established.*

- H.3 Objective: Monitor non-exempt pumping within the District for use in evaluating the District's compliance with aquifer desired future conditions.

- H.3 Performance Standard: Annual reporting of groundwater used by non-exempt wells will be included in Annual Report.

*This will begin in 2013.*

## **APPENDIX A**

**Water Loss Information  
Collected from TWDB Water Loss Audit Reports**

**Red River Groundwater Conservation District****Water Loss Information collected from Texas Water Development Board Water Audit Reports  
2010**

<b><u>City/Entity</u></b>	<b><u>Apparent Losses<sup>(1)</sup></u></b> (gallons)	<b><u>Real Losses<sup>(2)</sup></u></b> (gallons)	<b>2010</b> <b><u>Water Losses</u></b> (gallons)
Bells	138,332	1,480,319	1,618,651
Dial WSC	708,747	3,224,628	3,933,375
Desert WSC	2,195,324	7,591,165	9,786,489
Ector	262,088	3,173,932	3,436,020
Gunter	2,723,882	16,419,868	19,143,750
Ladonia	223,682	3,638,576	3,862,258
Leonard	853,880	22,556,010	23,409,890
Luella SUD	2,651,811	11,235,990	13,887,801
Marilee SUD	3,887,613	21,857,113	25,744,726
Pink Hill WSC	1,115,927	7,337,978	8,453,905
Pottsboro	3,990,619	4,052,255	8,042,874
Sherman	115,812,159	384,388,280	500,200,439
Southmayd	813,229	486,164	1,299,393
SW Fannin SUD	1,851,912	36,125,194	37,977,106
Starr WSC	743,743	6,532,413	7,276,156
Tioga	887,773	5,603,143	6,490,916
Tom Bean	17,758,697	24,335,117	42,093,814
White Shed WSC	1,424,989	9,118,846	10,543,835
Whitewright	3,417,517	11,210,034	14,627,551
Windom	19,423	137,286	156,709

(1) Meter malfunction/accuracy, systematic data handling discrepancy, unauthorized consumption.

(2) Reported breaks and leaks, unreported loss.



**Red River Groundwater Conservation District**

**Water Loss Information collected from Texas Water Development Board Water Audit Reports  
2011**

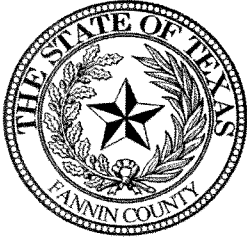
<u>City/Entity</u>	<u>Apparent Losses<sup>(1)</sup></u> (gallons)	<u>Real Losses<sup>(2)</sup></u> (gallons)	2011
			<u>Water Losses</u> (gallons)
Honey Grove	2,926,864	22,711,861	25,638,725
Pottsboro	5,283,134	4,767,151	10,050,285
Tom Bean	4,236,912	37,856,902	42,093,814
Windom	20,798	-100,791	-79,993

(1) Meter malfunction/accuracy, systematic data handling discrepancy, unauthorized consumption.

(2) Reported breaks and leaks, unreported loss.

## **APPENDIX B**

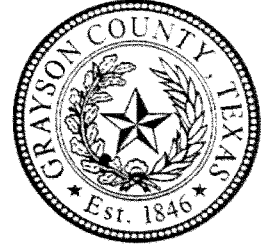
**General Manager's Quarterly Reports  
Assessment of Status of Drought in the District**



# RED RIVER

## GROUNDWATER CONSERVATION DISTRICT

FANNIN COUNTY AND GRAYSON COUNTY



General Manager's Quarterly Report  
December 2012

### Management Plan Assessment of the Status of Drought in the District

**Management Objective F.1** – On a monthly basis, the District will download the updated Palmer Drought Severity Index (“PDSI”) map and update the District’s rainfall map posted on the District’s website: <http://www.redrivergcd.org/Conservation.html>.

**Performance Standard F.1** – Quarterly the District will make an assessment of the status of drought in the District and prepare a quarterly briefing to the Board of Directors. The downloaded PDSI maps and rainfall maps will be included with copies of the quarterly briefing in the District Annual Report.

The following is a quarterly report on the existing drought conditions:

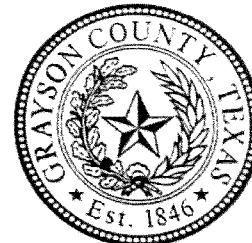
As of December 31, 2012 the Texas Water Development Board Drought Information Summary reflected the North Central Texas Area to be slightly dry or favorably moist in crop moisture index, in a moderate drought according to the Palmer Drought Severity Index, precipitation moderately dry, high risk for fire according to the Keetch-Byram Drought Index, Reservoir Storage Index near normal, and Stream Flow Index near normal.

As shown on the following PDSI drought maps, the North-Central Texas area moved into a severe drought by November. The U.S. Seasonal Drought Outlook provided by the National Weather Service predicts the drought in this area of Texas will persist or intensify.

District staff will continue to update PDSI maps on the website monthly.



## RED RIVER GROUNDWATER CONSERVATION DISTRICT FANNIN COUNTY AND GRAYSON COUNTY



District staff participated in a webinar provided by Texas Water/Wastewater Agency Response Network ("TXWARN") on January 25, 2013. Mike Howe, the TXWARN administrator, hosted the webinar.

Mr. Howe informed the participants that TXWARN is an agency that was created after Hurricane Katrina to assist water and wastewater systems. Utilities help other utilities through a mutual aid agreement. This system has grown nationwide, with all states currently participating except a few in the process of development. If a disaster has occurred, assistance from the state may be requested through TXWARN. Mr. Howe stated the goal of TXWARN is to build resiliency, with the following objectives:

1. Continuity of drinking water and wastewater services in preparedness, response and recovery planning
2. Identify and implement key response and recovery strategies to maintain public health and public confidence
3. Increase the understanding of how the water sector is interdependent with other critical infrastructure sectors
  - a. Public health
  - b. Emergency services
  - c. Critical manufacturing
  - d. Electrical generation

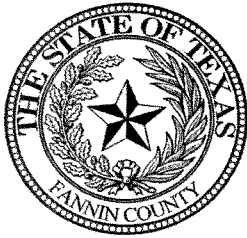
TXWARN provides efficiency in moving equipment/crews to utilities in disasters.

Bob Rose, Meteorologist with the Lower Colorado River Authority provided a presentation during the webinar. Mr. Rose stated Texas is currently in the third year of drought, forecasted weather patterns feature below normal rainfall. The current weather pattern is neutral – in between El Nino and La Nina. Texas has a trend to be dry in a neutral pattern. The current pattern is similar to the 1950's drought of record. The outlook is for below normal rainfall in February through April, with normal rainfall during May, June and July. Sea surface temperature anomalies are being experienced. Water temperatures are above normal for this time of year, which indicates water temperatures have not cooled off much over the winter, and may cause an active hurricane season. The tropics COULD bring rainfall to Texas, however, there is also a possibility of La Nina. The drought during 2013 could match 2012, with the possibility of a very dry summer.

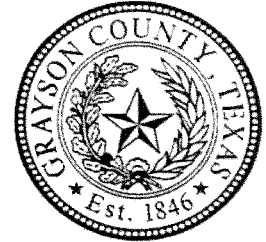
Mike Bewley, with the Texas Division of Emergency Management, provided a presentation regarding decision-making authority and states of disaster. One of his discussion points was directed at temporary water outages during a disaster. Reservoir levels in Texas during January are trending toward uncharted territory, very low. Mr. Bewley stated current circumstances

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[http://www.gtua.org/red\\_river\\_gcd.asp](http://www.gtua.org/red_river_gcd.asp)



## RED RIVER GROUNDWATER CONSERVATION DISTRICT FANNIN COUNTY AND GRAYSON COUNTY



throughout Texas are not good, and are not looking to get better. Therefore, vulnerable systems need to be identified so they may be monitored. Vulnerable systems, or "At Risk" systems are defined as systems having 180 days or less of potable water.

Should an emergency occur, state agencies will waive normal activities and establish a reliable water supply for the utility system experiencing the emergency. Utilities/Cities should plan to survive for 96 hours, the amount of time that normally passes until federal government arrives on the scene.

Alexander Hinz, TCEQ Public Water Section, provided a presentation concerning drought and public water systems. Mr. Hinz stated TCEQ maintains a database and tracks systems' drought status. The TCEQ Emergency Drinking Water Task Force holds weekly meetings. At Risk Systems are reviewed bi-weekly. As of January 25, 2013 Mr. Hinz stated there are 19 "At Risk" systems in Texas being contacted on a weekly basis. This led to the formation of the Emergency Drinking Water Task Force. This Task Force:

- Meets weekly to discuss the status of "At Risk" systems
- Discusses solutions tailored for each system
- Discuss what assistance can be provided
- Discuss coordination of resources to accomplish the goals of the task force

Fifteen water systems will receive grant funds from the Texas Department of Agriculture, for a maximum of \$350,000.

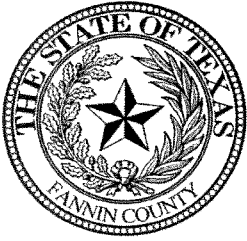
TCEQ Financial, Managerial and Technical ("FMT") assistance is provided to water systems

- Coordination with funding agencies
- Expedited agency review of exceptions to rules
- Expedited agency review of plans and specifications

FMT will provide a rate study for a water system without charge. The agency will also assist with drafting a Drought Contingency Plan.

In order to survive a disaster, water systems need to have a Drought Contingency Plan with appropriate triggers, be prepared to provide water under varying hydrological conditions, and have proper financing planning (rates).

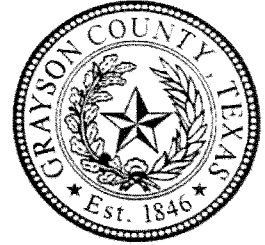
Trent Jennings, TCEQ Water Availability Division, provided a presentation regarding Drought Planning in Texas. Mr. Jennings reviewed Drought Contingency Plans vs. Water Conservation Plans. Drought Contingency Plans are used when necessary. Water Conservation Plans are on-going means of conserving water.



## **RED RIVER**

### **GROUNDWATER CONSERVATION DISTRICT**

FANNIN COUNTY AND GRAYSON COUNTY



#### **Drought Contingency Plan Requirements:**

- Public Involvement
- Ongoing Education
- Coordination with Regional Water Planning Groups
- Triggering Criteria
- Response Stages
- Specific, Quantified Targets
- Management Measures
- Variances
- Enforcement and Adoption
- Wholesale Customers – Compliance with TWC 11.039

Mr. Jennings informed the participants that drought contingency plans should be revised as often as necessary, especially as triggers change over time. Water systems managers should not wait for the drought to worsen, planning should already be underway.

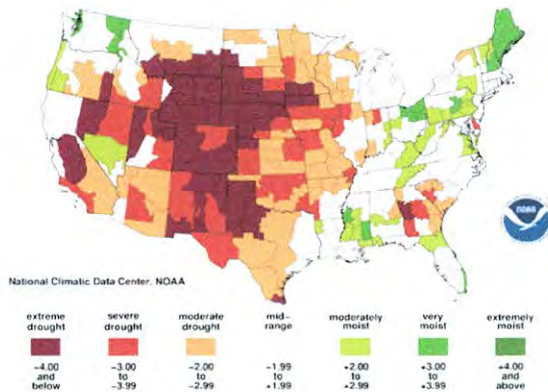


# RED RIVER GROUNDWATER CONSERVATION DISTRICT

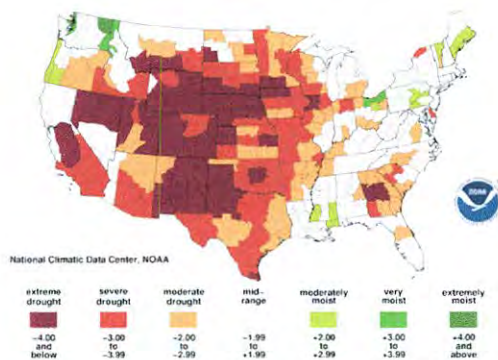
## FANNIN COUNTY AND GRAYSON COUNTY



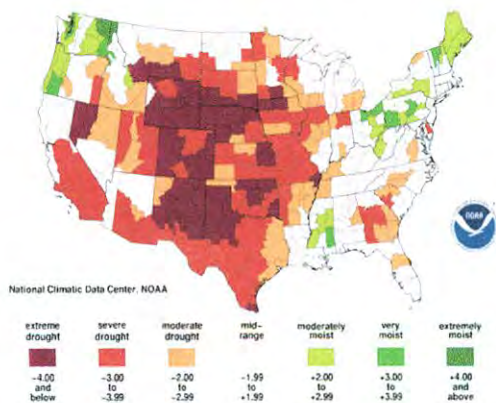
Palmer Hydrological Drought Index  
October, 2012



Palmer Hydrological Drought Index  
November, 2012



Palmer Hydrological Drought Index  
December, 2012

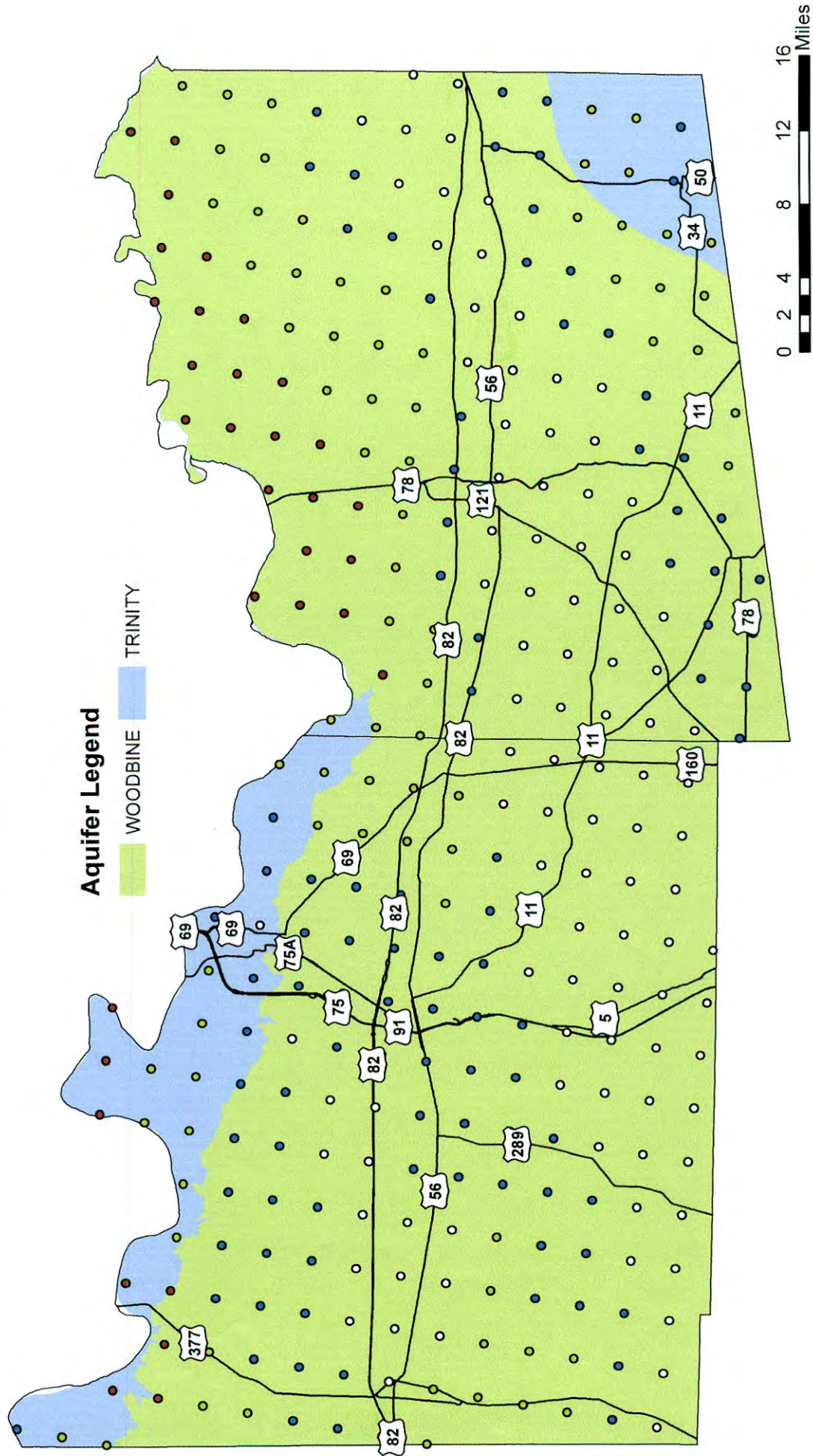


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# Rainfall Totals for October 2012



Red River Groundwater Conservation District  
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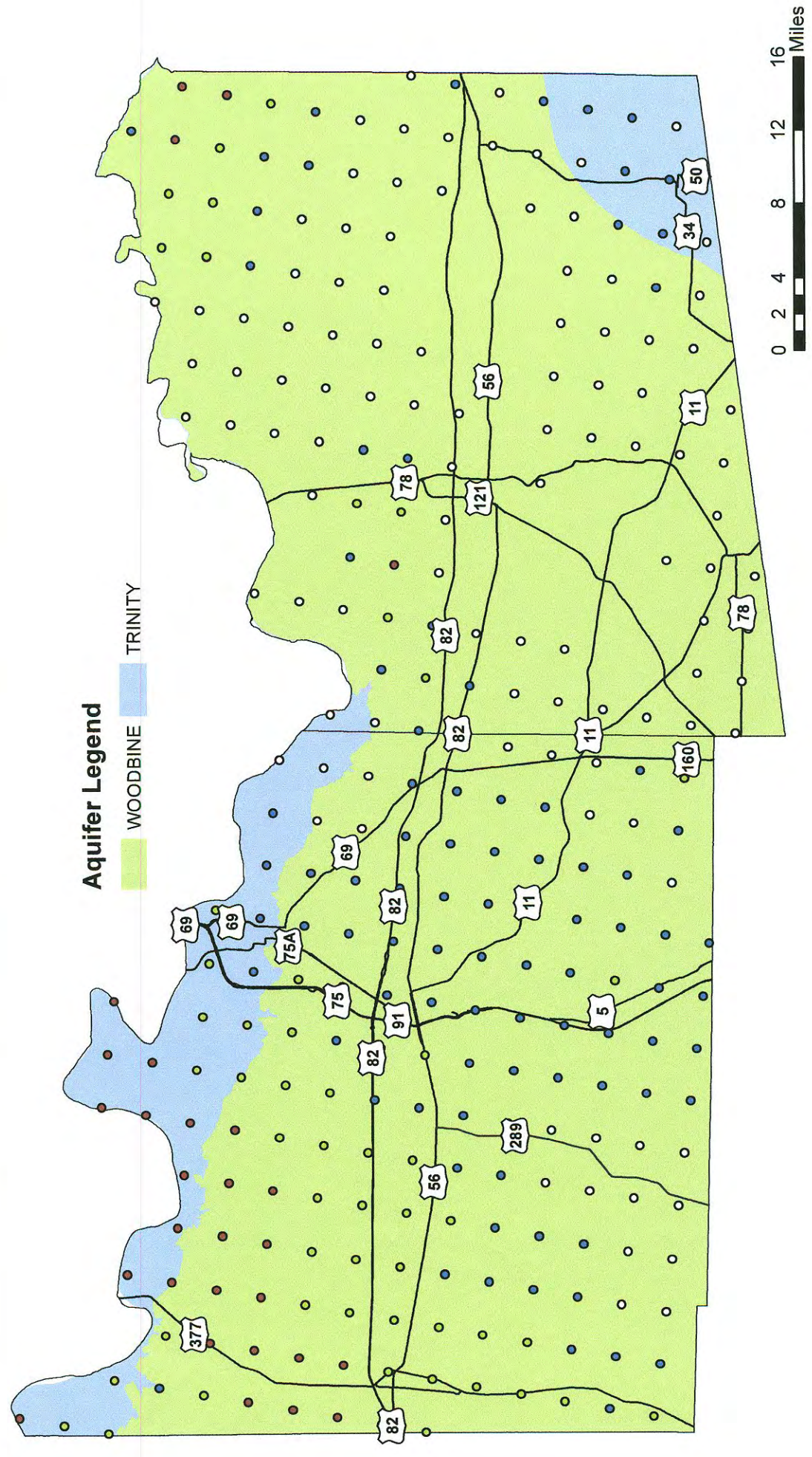
Data Source:  
National Weather Service  
Precipitation Analysis

### Rainfall in Inches

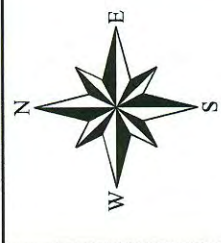
○	0.60 - 1.08	●	1.57 - 2.26
●	1.09 - 1.56	●	2.27 - 3.22



# Rainfall Totals for November 2012



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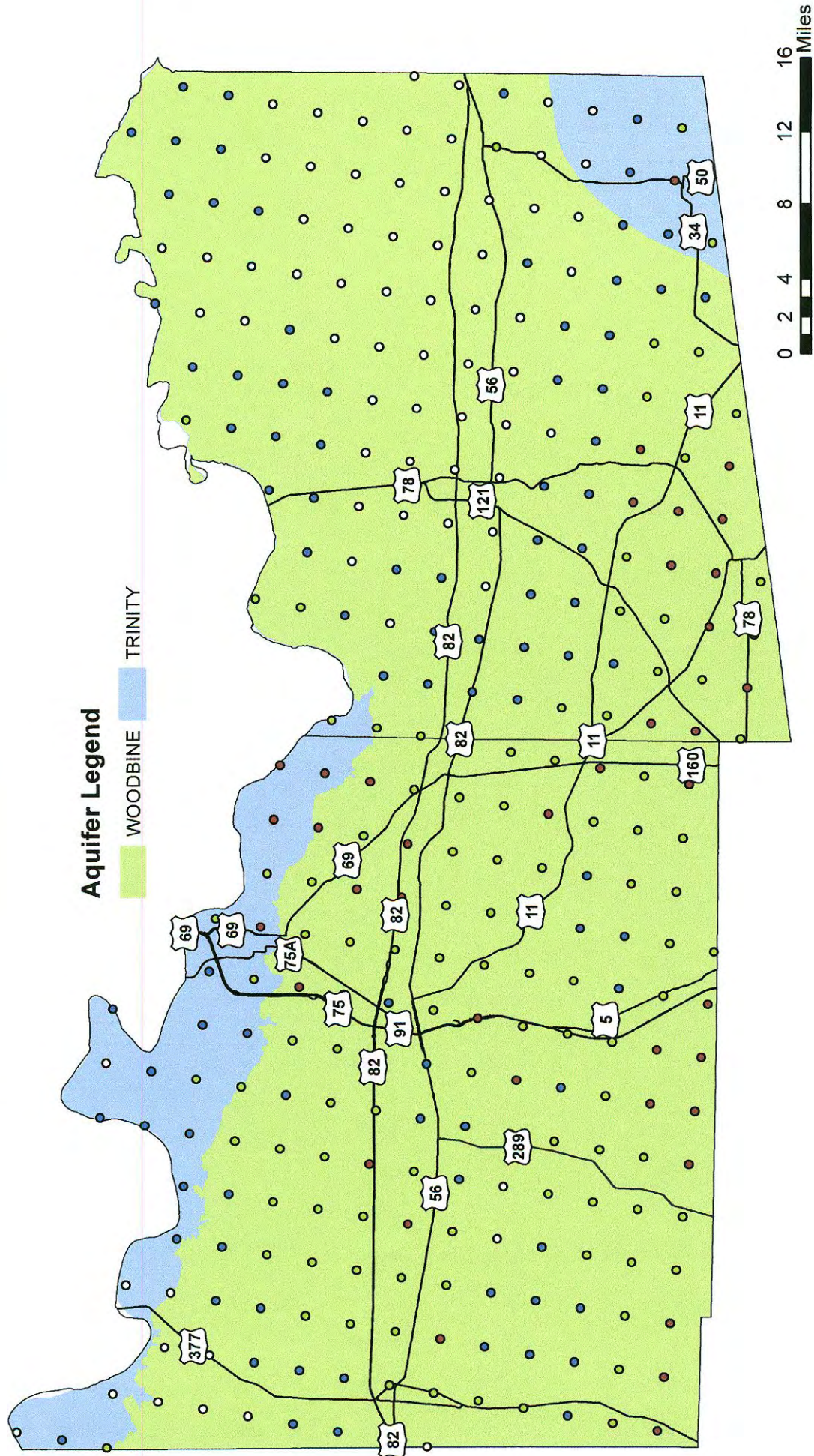


Data Source:  
National Weather Service  
Precipitation Analysis

## Rainfall in Inches



# Rainfall Totals for December 2012



Red River Groundwater Conservation District  
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Data Source:  
National Weather Service  
Precipitation Analysis

### Rainfall in Inches

○	1.69 - 2.08	●	2.34 - 2.61
●	2.09 - 2.33	●	2.62 - 3.15





## Search the CPC

Go

## Outlooks

Discussion  
Archive  
U.S. Monthly Temp.  
& Prec.  
U.S. Seasonal Temp.  
& Prec.  
Verification

## Monitoring and Data

GIS Data  
U.S. Weekly Drought  
Monitor  
Drought  
Soil Moisture

## About Us

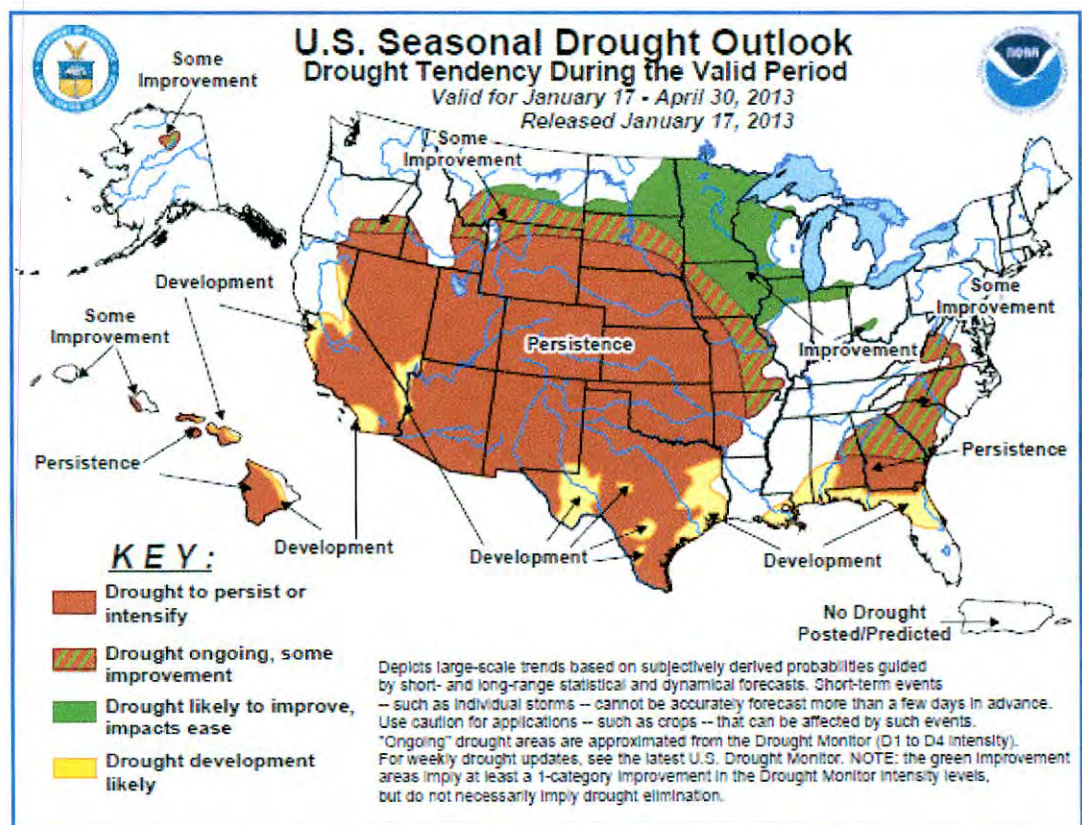
Our Mission  
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CPC Web Team



# U.S. Seasonal Drought Outlook



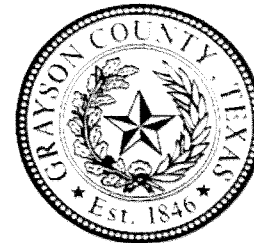
(Click on image to enlarge)

[PDF Version of Seasonal Drought Outlook Graphic](#)

**Latest Seasonal Assessment** - Since the beginning of 2013, drier and colder weather prevailed over the West after a relatively wet December. In the Great Basin and central Rockies, 2-week temperature departures averaged 10 to 20 degrees F below normal. Farther east, however, a series of slow-moving cold fronts embedded with surface lows brought surplus precipitation to the southern Plains (eastern New Mexico and Texas), parts of the central Plains (western Oklahoma and central Kansas), and the lower Mississippi, Tennessee, and Ohio Valleys, providing some relief from the drought. Portions of the northern Rockies and Plains and upper Midwest also saw above normal year-to-date precipitation.



**RED RIVER**  
**GROUNDWATER CONSERVATION DISTRICT**  
FANNIN COUNTY AND GRAYSON COUNTY



General Manager's Quarterly Report  
September 2012

Management Plan  
Assessment of the Status of Drought in the District

**Management Objective F.1** – On a monthly basis, the District will download the updated Palmer Drought Severity Index (“PDSI”) map and update the District’s rainfall map posted on the District’s website: <http://www.redrivergcd.org/Conservation.html>.

**Performance Standard F.1** – Quarterly the District will make an assessment of the status of drought in the District and prepare a quarterly briefing to the Board of Directors. The downloaded PDSI maps and rainfall maps will be included with copies of the quarterly briefing in the District Annual Report.

The following is a report on the existing drought conditions. The current drought began in 2010. Recently, the situation has improved in the District boundaries; however, the drought does not yet appear to be over. As of September 7, 2012 the Texas Water Development Board Drought Information Summary reflected the North Central Texas Area to be abnormally dry in crop moisture index, in a moderate drought according to the Palmer Drought Severity Index, precipitation near normal, very high risk for fire according to the Keetch-Byram Drought Index, Reservoir Storage Index near normal, and Stream Flow Index moderately low.


As shown on the following PDSI drought maps, the North-Central Texas area moved slowly into a moderate drought stage by July. Recent rainfall has helped. However, the U.S. Seasonal Drought Outlook provided by the National Weather Service predicts the drought in this area of Texas will persist or intensify. While the drought in the District area is not as severe as it was in 2011, it is predicted to continue.

District staff will continue to update PDSI maps on the website monthly.

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for Texas

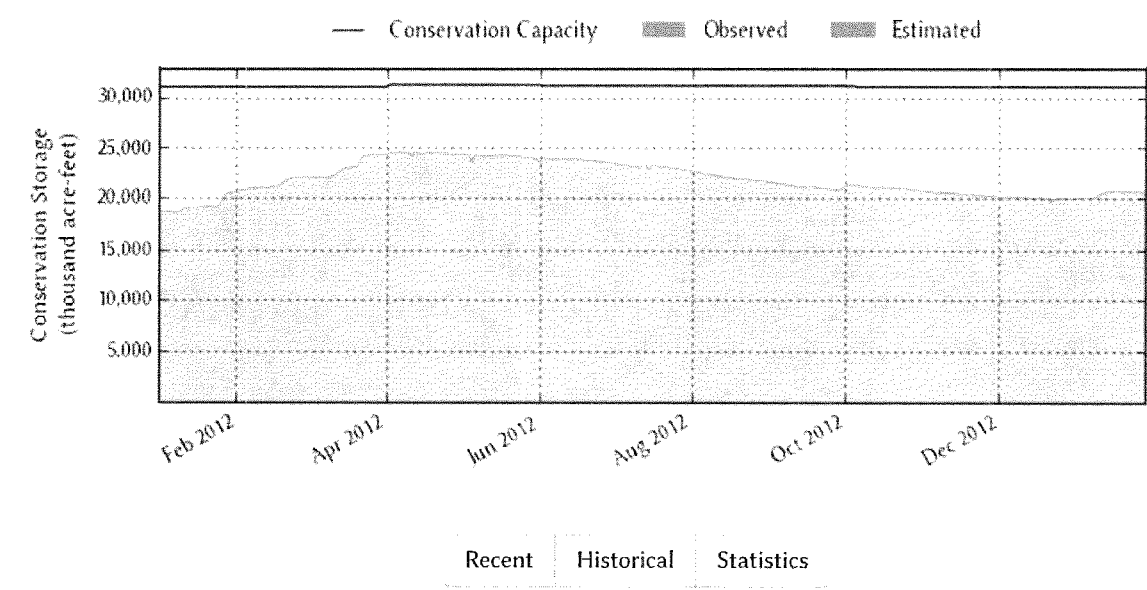


STATEWIDE (/RESERVOIRS/STATEWIDE)    BY REGIONAL WATER PLANNING AREA ▾

BY RIVER BASIN ▾    BY MUNICIPAL AREA ▾    ABOUT ▾

# Texas Reservoirs

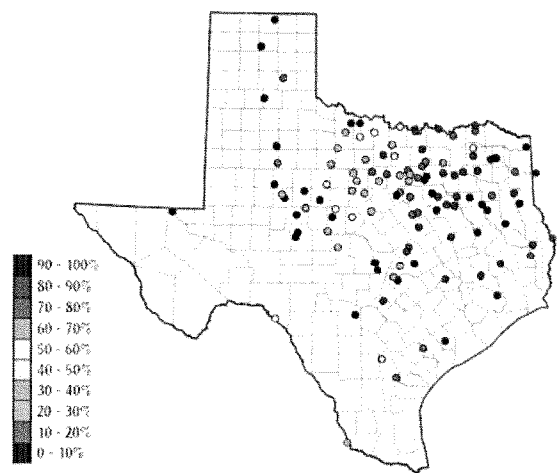
Monitored Water Supply Reservoirs are 66.6% full on 2013-01-29 \*



	Date	Percent Full	Reservoir Storage (acre-ft)	Conservation Storage (acre-ft)	Conservation Capacity (acre-ft)
Today	2013-01-29	66.6	24,907,472	20,800,340	31,215,396
Yesterday	2013-01-28	66.6	24,911,773	20,800,994	31,215,396
1 week ago	2013-01-22	66.8	25,117,388	20,866,000	31,215,396
1 month ago	2012-12-29	64.7	24,408,158	20,193,953	31,215,396

	Date	Percent Full	Reservoir Storage (acre-ft)	Conservation Storage (acre-ft)	Conservation Capacity (acre-ft)
3 months ago	2012-10-29	67.3	25,320,765	21,001,453	31,207,673
6 months ago	2012-07-29	73.3	27,462,957	22,959,310	31,331,304
1 year ago	2012-01-29	66.4	25,574,517	20,731,581	31,215,396

\* Water supply reservoirs include reservoirs which provide water for all beneficial purposes such as power generation, recreation, and municipal water supply. Today's total is subject to change as data are updated. See footnotes on individual lakes for cases where special conditions apply.



(/reservoirs/statewide/recent-conditions.png)

Recent Conditions

Reservoir	Percent Full	Water Level (ft)	Height Above Conservation Pool (ft)	Total Storage (acre-ft)	Conservation Storage (acre-ft)	Surface Area (acres)
Abilene (/reservoirs/individual/abilene) as of 2013-01-28	6.8	1,996.35	-15.95	416	416	- n.a. -
Addicks (/reservoirs/individual/addicks) <sup>1</sup> as of 2013-01-28	0.0	69.24	-44.76	49	0	- n.a. -
Alan Henry (/reservoirs/individual/alan-henry) as of 2013-01-28	73.7	2,209.79	-10.21	69,857	69,857	2,183
Amistad (/reservoirs/individual/amistad) <sup>2</sup>	43.7	1,073.30	-43.70	1,229,175	804,210	31,112
Amon G Carter (/reservoirs/individual/amon-g-carter) as of 2013-01-28	61.8	914.39	-5.61	12,290	12,290	- n.a. -



Reservoir	Percent Full	Water Level (ft)	Height Above Conservation Pool (ft)	Total Storage (acre-ft)	Conservation Storage (acre-ft)	Surface Area (acres)
<i>Aquila (/reservoirs/individual/aquila) as of 2013-01-28</i>	77.4	533.97	-3.53	34,537	34,431	2,592
<i>Arlington (/reservoirs/individual/arlington) as of 2013-01-28</i>	72.4	544.04	-5.96	29,109	29,077	1,802
<i>Arrowhead (/reservoirs/individual/arrowhead) as of 2013-01-28</i>	40.2	913.74	-12.26	94,807	94,807	8,050
<i>Athens (/reservoirs/individual/athens) as of 2013-01-28</i>	- n.a. -	437.19	-2.81	- n.a. -	- n.a. -	- n.a. -
<i>Austin (/reservoirs/individual/austin)</i>	95.4	492.10	-0.70	23,489	22,880	1,540
<i>B A Steinhagen (/reservoirs/individual/b-a-stenhagen) as of 2013-01-28</i>	77.8	81.46	-1.54	52,110	52,099	8,717
<i>Bardwell (/reservoirs/individual/bardwell) as of 2013-01-28</i>	83.6	418.50	-2.50	38,892	38,542	2,932
<i>Barker (/reservoirs/individual/barker) <sup>3</sup> as of 2013-01-28</i>	0.0	72.46	-34.54	4	0	- n.a. -
<i>Belton (/reservoirs/individual/belton) as of 2013-01-28</i>	82.4	587.34	-6.66	358,717	358,717	10,813
<i>Benbrook (/reservoirs/individual/benbrook) as of 2013-01-28</i>	68.7	685.82	-8.18	58,878	58,878	2,924
<i>Bob Sandlin (/reservoirs/individual/bob-sandlin) as of 2013-01-28</i>	77.7	332.26	-5.24	159,098	148,187	7,711
<i>Bonham (/reservoirs/individual/bonham) as of 2013-01-28</i>	71.9	561.82	-3.18	7,941	7,929	830
<i>Brady Creek (/reservoirs/individual/brady-creek) as of 2013-01-28</i>	23.6	1,726.90	-16.10	6,860	6,860	- n.a. -
<i>Bridgeport (/reservoirs/individual/bridgeport) as of 2013-01-28</i>	57.9	821.11	-14.89	212,128	212,128	8,911
<i>Brownwood (/reservoirs/individual/brownwood) as of 2013-01-28</i>	55.8	1,414.26	-10.34	71,836	71,836	4,485

Reservoir	Percent Full	Water Level (ft)	Height Above Conservation Pool (ft)	Total Storage (acre-ft)	Conservation Storage (acre-ft)	Surface Area (acres)
Buchanan (/reservoirs/individual/buchanan)	42.5	992.25	-27.75	380,494	365,292	13,314
Caddo (/reservoirs/individual/caddo) 4	100.0	168.83	0.33	137,761	29,850	- n.a. -
Canyon (/reservoirs/individual/canyon) as of 2013-01-28	82.1	900.22	-8.78	311,054	310,983	7,211
Cedar Creek (/reservoirs/individual/cedar-creek) as of 2013-01-28	86.1	319.14	-2.86	555,412	555,313	29,978
Champion Creek (/reservoirs/individual/champion-creek) as of 2013-01-28	9.0	2,038.70	-44.30	3,762	3,762	- n.a. -
Choke Canyon (/reservoirs/individual/choke-canyon) as of 2013-01-28	46.5	202.96	-17.54	323,182	323,173	16,775
Cisco (/reservoirs/individual/cisco) as of 2013-01-28	38.4	1,498.57	-21.43	9,989	9,989	- n.a. -
Coleman (/reservoirs/individual/coleman) as of 2013-01-28	46.7	1,704.06	-13.44	17,805	17,787	1,142
Coleta Creek (/reservoirs/individual/coleta-creek) as of 2013-01-28	77.9	95.10	-2.90	24,185	24,185	- n.a. -
Colorado City (/reservoirs/individual/colorado-city) as of 2013-01-28	33.8	2,052.77	-17.43	10,594	10,274	- n.a. -
Conroe (/reservoirs/individual/conroe) as of 2013-01-28	86.6	198.02	-2.98	360,357	360,306	17,911
Corpus Christi (/reservoirs/individual/corpus-christi) as of 2013-01-28	15.7	77.17	-16.83	40,622	40,323	6,386
Crook (/reservoirs/individual/crook) as of 2013-01-28	73.1	473.55	-2.45	6,738	6,723	966
Cypress Springs (/reservoirs/individual/cypress-springs) as of 2013-01-28	92.4	376.41	-1.59	61,707	61,707	3,120
Daniel (/reservoirs/individual/daniel) as of 2013-01-28	29.2	1,268.52	-9.48	2,809	2,729	- n.a. -

Reservoir	Percent Full	Water Level (ft)	Height Above Conservation Pool (ft)	Total Storage (acre-ft)	Conservation Storage (acre-ft)	Surface Area (acres)
<i>E V Spence (/reservoirs/individual/e-v-spence) as of 2013-01-28</i>	5.2	1,834.13	-63.87	26,781	26,781	2,147
<i>Eagle Mountain (/reservoirs/individual/eagle-mountain) as of 2013-01-28</i>	74.6	643.50	-5.60	134,255	134,255	7,603
<i>Electra (/reservoirs/individual/electra) as of 2013-01-28</i>	0.0	- n.a. -	- n.a. -	0	0	- n.a. -
<i>Elephant Butte (/reservoirs/individual/elephant-butte) 5</i>	9.2	4,308.78	-98.22	180,818	180,818	- n.a. -
<i>Falcon (/reservoirs/individual/falcon) 2</i>	36.6	268.60	-32.50	725,340	567,701	37,090
<i>Fork (/reservoirs/individual/fork) as of 2013-01-28</i>	82.8	398.81	-4.19	532,570	501,127	23,545
<i>Fort Phantom Hill (/reservoirs/individual/fort-phantom-hill) as of 2013-01-28</i>	50.0	1,624.79	-11.11	35,016	35,010	2,454
<i>Georgetown (/reservoirs/individual/georgetown) as of 2013-01-28</i>	64.0	779.32	-11.68	23,645	23,564	975
<i>Graham (/reservoirs/individual/graham) as of 2013-01-28</i>	68.7	1,069.98	-6.32	31,134	31,120	1,977
<i>Granbury (/reservoirs/individual/granbury) as of 2013-01-28</i>	72.0	687.72	-5.28	93,133	92,168	5,724
<i>Granger (/reservoirs/individual/granger) as of 2013-01-28</i>	100.0	504.05	0.05	50,984	50,779	4,216
<i>Grapevine (/reservoirs/individual/grapevine) as of 2013-01-28</i>	77.0	528.85	-6.15	126,885	126,884	5,657
<i>Greenbelt (/reservoirs/individual/greenbelt) as of 2013-01-28</i>	11.6	2,619.46	-44.54	7,730	6,830	- n.a. -
<i>Halbert (/reservoirs/individual/halbert) as of 2013-01-28</i>	84.9	366.37	-1.63	5,122	5,122	540
<i>Hords Creek (/reservoirs/individual/hords-creek) as of 2013-01-25</i>	0.0	1,883.80	-16.20	165	0	- n.a. -

Reservoir	Percent Full	Water Level (ft)	Height Above Conservation Pool (ft)	Total Storage (acre-ft)	Conservation Storage (acre-ft)	Surface Area (acres)
<i>Houston (/reservoirs/individual/houston) as of 2013-01-28</i>	100.0	42.20	0.47	110,609	102,876	9,555
<i>Houston County (/reservoirs/individual/houston-county) as of 2013-01-28</i>	100.0	260.17	0.17	17,885	17,113	1,343
<i>Hubbard Creek (/reservoirs/individual/hubbard-creek) as of 2013-01-28</i>	29.5	1,162.59	-20.72	102,413	95,121	6,999
<i>Hubert H Moss (/reservoirs/individual/hubert-h-moss) as of 2013-01-28</i>	87.5	712.13	-2.87	21,156	21,059	1,010
<i>Inks (/reservoirs/individual/inks)</i>	93.0	887.25	-1.25	13,284	12,990	755
<i>J B Thomas (/reservoirs/individual/j-b-thomas) as of 2013-01-28</i>	0.5	2,203.06	-54.94	1,762	1,089	426
<i>Jacksonville (/reservoirs/individual/jacksonville) as of 2013-01-28</i>	97.4	421.43	-0.57	25,076	25,014	1,143
<i>Jim Chapman (/reservoirs/individual/jim-chapman) as of 2013-01-28</i>	57.7	433.03	-6.97	188,751	150,153	13,615
<i>Joe Pool (/reservoirs/individual/joe-pool) as of 2013-01-28</i>	91.8	520.04	-1.96	162,603	161,066	- n.a. -
<i>Kemp (/reservoirs/individual/kemp) as of 2013-01-28</i>	24.8	1,120.79	-23.21	61,048	60,922	4,223
<i>Kickapoo (/reservoirs/individual/kickapoo) as of 2013-01-28</i>	40.8	1,034.08	-10.92	35,043	35,043	3,328
<i>Lavon (/reservoirs/individual/lavon) as of 2013-01-28</i>	61.4	483.31	-8.69	252,432	249,460	15,742
<i>Leon (/reservoirs/individual/leon) as of 2013-01-28</i>	67.0	1,368.61	-6.39	17,705	17,705	- n.a. -
<i>Lewisville (/reservoirs/individual/lewisville) as of 2013-01-28</i>	74.7	516.32	-5.68	456,225	420,551	22,964
<i>Limestone (/reservoirs/individual/limestone) as of</i>	83.4	360.09	-2.91	173,440	173,438	11,333

Reservoir	Percent Full	Water Level (ft)	Height Above Conservation Pool (ft)	Total Storage (acre-ft)	Conservation Storage (acre-ft)	Surface Area (acres)
2013-01-28						
Livingston (/reservoirs/individual/livingston) as of 2013-01-28	100.0	131.20	0.20	1,758,840	1,741,900	- n.a. -
Lost Creek (/reservoirs/individual/lost-creek) as of 2013-01-28	85.7	1,004.78	-4.72	10,243	10,243	- n.a. -
Lyndon B Johnson (/reservoirs/individual/lyndon-b-johnson)	98.6	824.75	-0.25	129,358	110,115	6,040
Mackenzie (/reservoirs/individual/mackenzie) as of 2013-01-28	8.0	3,007.35	-92.65	3,692	3,671	- n.a. -
Martin (/reservoirs/individual/martin) as of 2013-01-28	80.6	302.75	-3.25	60,576	60,576	4,225
Medina (/reservoirs/individual/medina) as of 2013-01-28	8.9	990.77	-73.43	22,636	22,636	1,109
Meredith (/reservoirs/individual/meredith) <sup>6</sup> as of 2013-01-28	0.0	2,841.57	-94.93	20,215	0	1,741
Millers Creek (/reservoirs/individual/millers-creek) as of 2013-01-28	26.7	1,319.46	-14.54	8,419	7,136	775
Mineral Wells (/reservoirs/individual/mineral-wells) as of 2013-01-28	75.1	859.85	-3.15	5,074	5,074	- n.a. -
Monticello (/reservoirs/individual/monticello) as of 2013-01-28	100.0	340.57	0.57	35,918	34,740	2,053
Mountain Creek (/reservoirs/individual/mountain-creek) as of 2013-01-28	100.0	457.75	0.75	22,791	20,776	- n.a. -
Murvaul (/reservoirs/individual/murvaul) as of 2013-01-28	100.0	265.60	0.30	39,320	38,285	3,587
Nacogdoches (/reservoirs/individual/nacogdoches) as of 2013-01-28	98.5	278.73	-0.27	38,937	38,935	2,159

Reservoir	Percent Full	Water Level (ft)	Height Above Conservation Pool (ft)	Total Storage (acre-ft)	Conservation Storage (acre-ft)	Surface Area (acres)
Natural Dam (/reservoirs/individual/natural-dam) <sup>7</sup> as of 2013-01-28	48.6	2,447.34	-9.66	26,537	26,537	- n.a. -
Navarro Mills (/reservoirs/individual/navarro-mills) as of 2013-01-28	97.3	424.21	-0.29	48,471	48,470	4,645
New Terrell City (/reservoirs/individual/new-terrell-city) as of 2013-01-28	81.5	502.08	-1.92	7,005	6,994	768
Nocona (/reservoirs/individual/nocona) as of 2013-01-28	49.8	818.11	-9.39	10,979	10,675	927
North Fork Buffalo Creek (/reservoirs/individual/north-fork-buffalo-creek) as of 2013-01-28	6.1	1,030.47	-17.53	952	952	- n.a. -
O C Fisher (/reservoirs/individual/o-c-fisher) as of 2013-01-02	0.2	1,849.93	-58.07	217	216	- n.a. -
O H Ivie (/reservoirs/individual/o-h-ivie) as of 2013-01-28	22.4	1,516.58	-34.92	124,426	124,426	- n.a. -
Oak Creek (/reservoirs/individual/oak-creek) as of 2013-01-28	29.9	1,982.35	-17.65	11,738	11,738	- n.a. -
O' the Pines (/reservoirs/individual/o%27-the-pines) as of 2013-01-28	74.3	224.74	-3.76	179,895	177,747	15,015
Palestine (/reservoirs/individual/palestine) as of 2013-01-28	94.6	344.07	-0.93	352,976	352,971	21,878
Palo Duro (/reservoirs/individual/palo-duro) as of 2013-01-28	2.1	2,837.37	-54.63	1,590	1,248	- n.a. -
Palo Pinto (/reservoirs/individual/palo-pinto) as of 2013-01-28	61.0	862.08	-5.22	17,118	16,710	1,824
Pat Cleburne (/reservoirs/individual/pat-cleburne) as of 2013-01-28	73.2	728.83	-4.67	19,043	19,043	1,392
Pat Mayse (/reservoirs/individual/pat-mayse)	81.2	447.02	-3.98	96,503	92,343	5,082

Reservoir	Percent Full	Water Level (ft)	Height Above Conservation Pool (ft)	Total Storage (acre-ft)	Conservation Storage (acre-ft)	Surface Area (acres)
<i>Possum Kingdom (/reservoirs/individual/possum-kingdom) as of 2013-01-28</i>	72.8	990.09	-9.91	393,335	393,335	12,685
<i>Proctor (/reservoirs/individual/proctor) as of 2013-01-28</i>	62.6	1,156.88	-5.12	34,703	34,703	3,449
<i>Ray Hubbard (/reservoirs/individual/ray-hubbard) as of 2013-01-28</i>	85.6	432.30	-3.20	387,037	387,037	19,769
<i>Ray Roberts (/reservoirs/individual/ray-roberts) as of 2013-01-28</i>	86.6	628.62	-3.88	682,952	682,629	26,128
<i>Red Bluff (/reservoirs/individual/red-bluff) as of 2013-01-28</i>	0.0	2,801.35	-25.78	16,309	0	- n.a. -
<i>Richland-Chambers (/reservoirs/individual/richland-chambers) as of 2013-01-28</i>	85.1	311.07	-3.93	950,247	925,323	40,068
<i>Sam Rayburn (/reservoirs/individual/sam-rayburn) as of 2013-01-28</i>	88.8	161.46	-2.94	2,555,344	2,536,388	105,013
<i>Somerville (/reservoirs/individual/somerville) as of 2013-01-28</i>	88.2	236.35	-1.65	129,678	129,678	10,296
<i>Squaw Creek (/reservoirs/individual/squaw-creek) as of 2013-01-28</i>	100.0	775.55	0.55	153,021	151,250	3,206
<i>Stamford (/reservoirs/individual/stamford) as of 2013-01-28</i>	26.7	1,405.62	-11.18	13,789	13,786	1,923
<i>Stillhouse Hollow (/reservoirs/individual/stillhouse-hollow) as of 2013-01-28</i>	84.3	616.08	-5.92	192,127	192,073	5,529
<i>Sulphur Springs (/reservoirs/individual/sulphur-springs) as of 2013-01-28</i>	83.5	457.27	-1.68	14,814	14,814	- n.a. -
<i>Sweetwater (/reservoirs/individual/sweetwater) as of 2013-01-28</i>	0.0	2,097.37	-19.13	1,668	0	- n.a. -



Reservoir	Percent Full	Water Level (ft)	Height Above Conservation Pool (ft)	Total Storage (acre-ft)	Conservation Storage (acre-ft)	Surface Area (acres)
<i>Tawakoni (/reservoirs/individual/tawakoni) as of 2013-01-28</i>	81.9	433.00	-4.50	714,110	714,102	33,400
<i>Texana (/reservoirs/individual/texana) as of 2013-01-28</i>	91.9	42.56	-1.44	146,927	146,659	8,837
<i>Texoma (/reservoirs/individual/texoma) <sup>8</sup></i>	84.8	611.60	-5.40	2,151,559	1,075,776	65,026
<i>Toledo Bend (/reservoirs/individual/toledo-bend) <sup>9</sup> as of 2013-01-28</i>	86.6	168.53	-3.47	3,875,450	1,935,675	- n.a. -
<i>Travis (/reservoirs/individual/travis)</i>	38.9	631.55	-49.45	454,138	432,530	9,409
<i>Twin Buttes (/reservoirs/individual/twin-buttres) as of 2013-01-28</i>	0.0	1,891.01	-49.19	136	0	- n.a. -
<i>Tyler (/reservoirs/individual/tyler) as of 2013-01-28</i>	74.7	371.18	-4.20	61,595	54,653	4,083
<i>Waco (/reservoirs/individual/waco) as of 2013-01-28</i>	85.7	458.55	-3.45	161,219	161,020	7,497
<i>Waxahachie (/reservoirs/individual/waxahachie) as of 2013-01-28</i>	91.3	530.00	-1.50	10,443	9,903	615
<i>Weatherford (/reservoirs/individual/weatherford) as of 2013-01-28</i>	60.4	888.78	-7.22	10,769	10,746	883
<i>White River (/reservoirs/individual/white-river) as of 2013-01-28</i>	4.6	2,343.16	-29.04	3,331	1,365	489
<i>Whitney (/reservoirs/individual/whitney) as of 2013-01-28</i>	70.0	524.44	-8.56	388,488	387,629	16,402
<i>Worth (/reservoirs/individual/worth) as of 2013-01-28</i>	61.2	591.08	-2.92	24,018	14,942	3,011
<i>Wright Patman (/reservoirs/individual/wright-patman) as of 2013-01-28</i>	100.0	223.53	2.93	190,860	122,593	25,820

**footnotes**

<sup>1</sup> Addicks Reservoir is a flood control lake. It is not used for water

supply and under normal conditions it is empty.

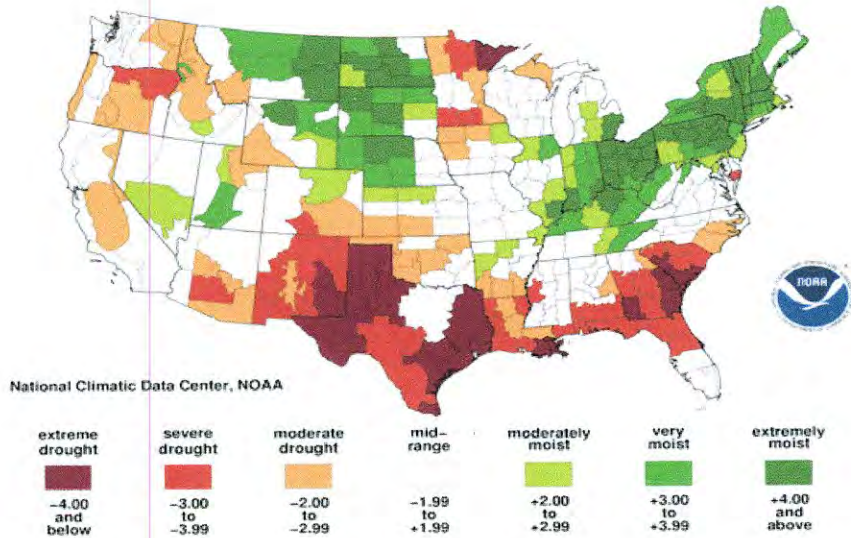
- <sup>2</sup> Lake Amistad and Lake Falcon straddle the border of Texas and Mexico. By treaty, Texas has rights to 56.2% of the total conservation capacity of Amistad and 58.6% of the total conservation capacity of Falcon. The fraction of the actual storage that belongs to Texas is formally determined biweekly by the International Boundary Water Commission (<http://www.ibwc.state.gov/>) (IBWC). The IBWC is the legal repository of data related to this lake for treaty purposes and official versions of the datasets should be obtained directly from them. Numbers displayed here pertain to the Texas share.
- <sup>3</sup> Barker Reservoir is a flood control lake. It is not used for water supply and under normal conditions it is empty.
- <sup>4</sup> Caddo Lake straddles the border of Texas and Louisiana, Texas has rights to 50% of Lake Caddo's total conservation capacity. Numbers displayed here pertain to the Texas share.
- <sup>5</sup> Elephant Butte Lake is located in New Mexico. Texas does not have direct rights to any of its water, but the city of El Paso receives 50% of its water supply from this source.
- <sup>6</sup> Lake Meredith is governed by the Canadian River Compact. The States of New Mexico, Texas and Oklahoma are all parties to the compact created by agreement of the three states and the federal government in 1950. According to the compact, New Mexico can hold 200,000 acre-feet in Ute Lake before it has to release water to Texas. Texas also can only hold 500,000 acre-feet in Lake Meredith before it has to release water for Oklahoma. Approximately 5% of Amarillo's water supply comes from Lake Meredith.
- <sup>7</sup> Natural Dam Lake is a flood control lake. It is not used for water supply and under normal conditions it is empty.
- <sup>8</sup> Lake Texoma straddles the border of Texas and Oklahoma, Texas has rights to 50% of Lake Texoma's total conservation capacity. Numbers displayed here pertain to the Texas share.
- <sup>9</sup> Toledo Bend Reservoir straddles the border of Texas and Louisiana, Texas has rights to 50% of Toledo Bend Reservoir's total conservation capacity. Numbers displayed here pertain to the Texas share.



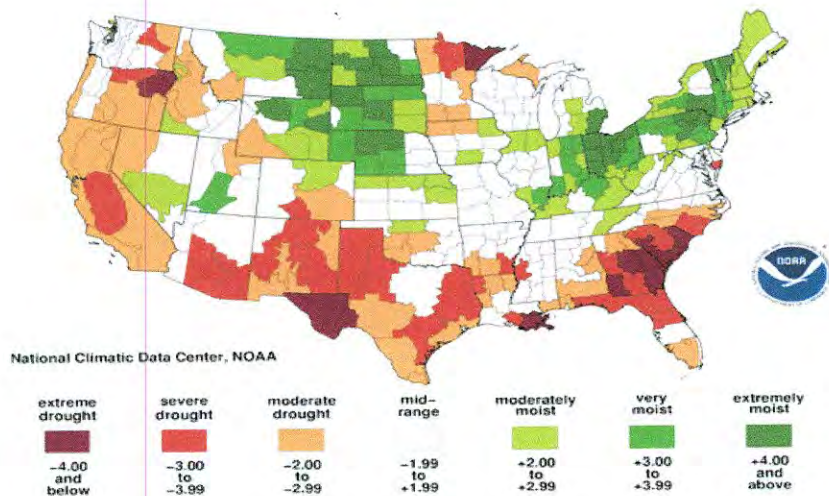
# RED RIVER GROUNDWATER CONSERVATION DISTRICT FANNIN COUNTY AND GRAYSON COUNTY



## Palmer Hydrological Drought Index January, 2012



## Palmer Hydrological Drought Index February, 2012



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Sherman, TX 75090  
(800) 256-0935 fax: (903) 786-8211

[http://www.gtua.org/red\\_river\\_gcd.asp](http://www.gtua.org/red_river_gcd.asp)

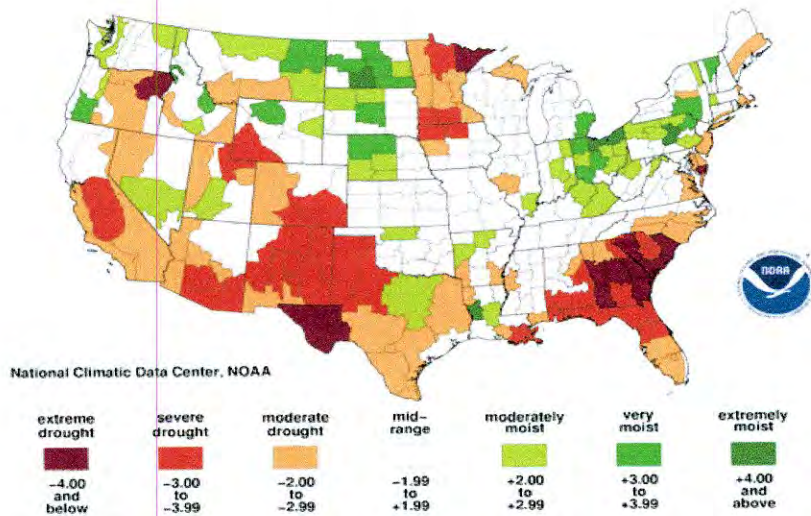


# RED RIVER GROUNDWATER CONSERVATION DISTRICT

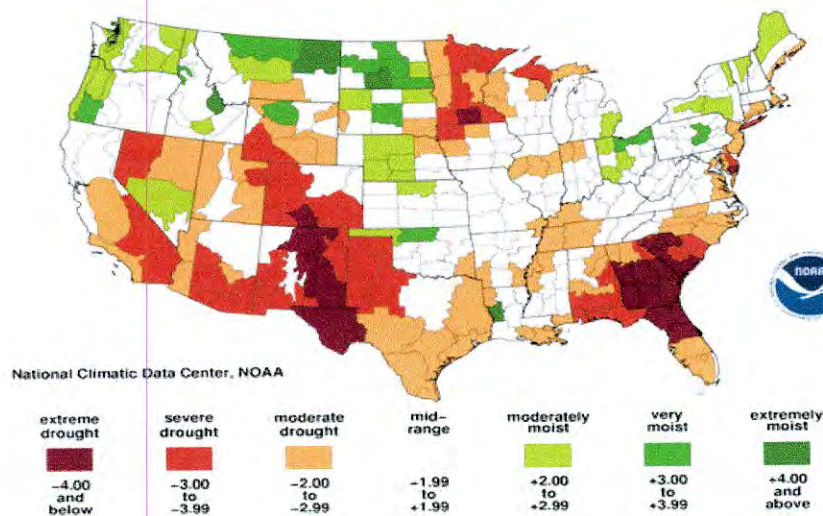
FANNIN COUNTY AND GRAYSON COUNTY



## Palmer Hydrological Drought Index March, 2012



## Palmer Hydrological Drought Index April, 2012



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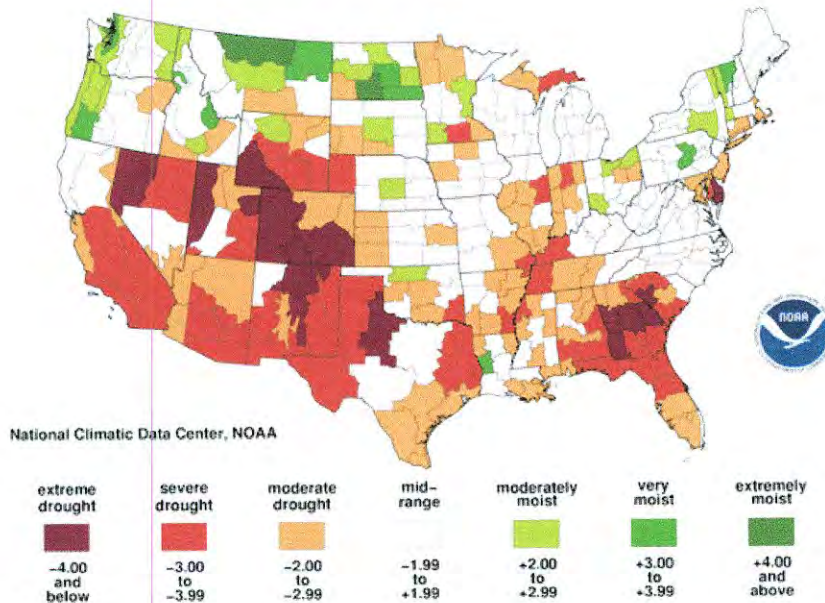


# RED RIVER GROUNDWATER CONSERVATION DISTRICT

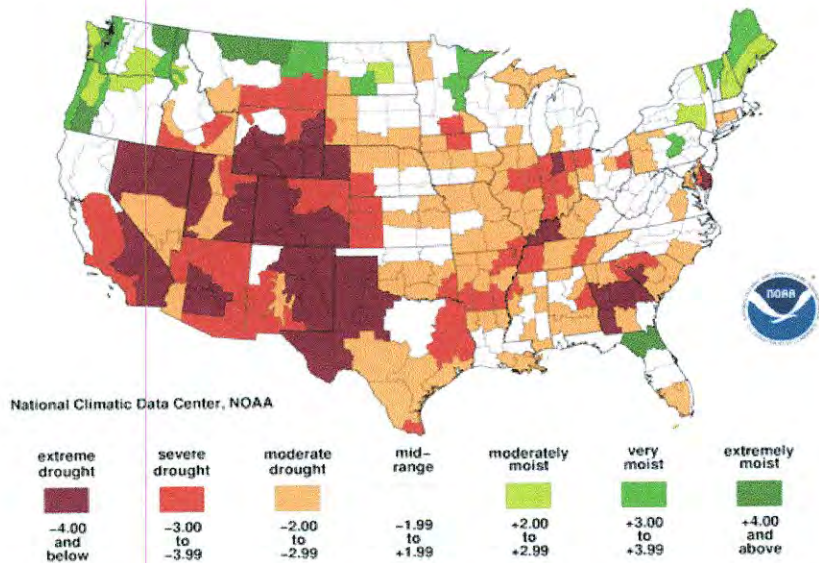
FANNIN COUNTY AND GRAYSON COUNTY



## Palmer Hydrological Drought Index May, 2012



## Palmer Hydrological Drought Index June, 2012



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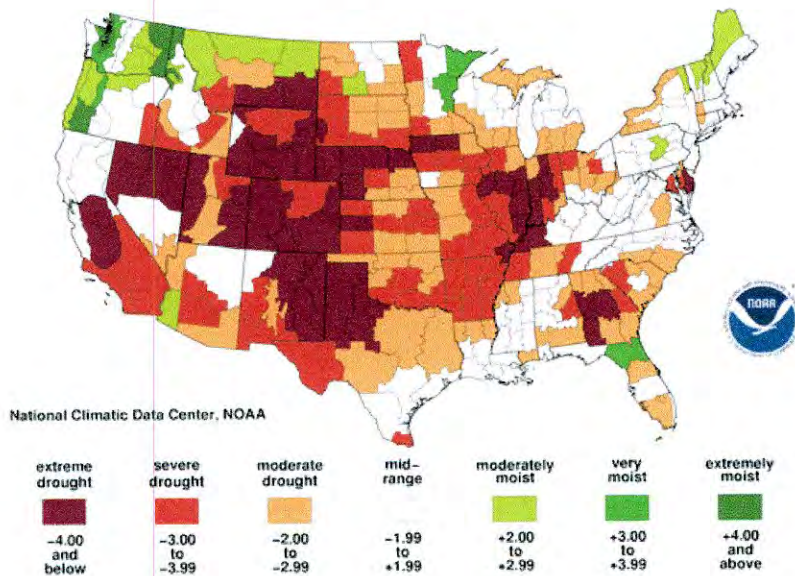
# RED RIVER

## GROUNDWATER CONSERVATION DISTRICT

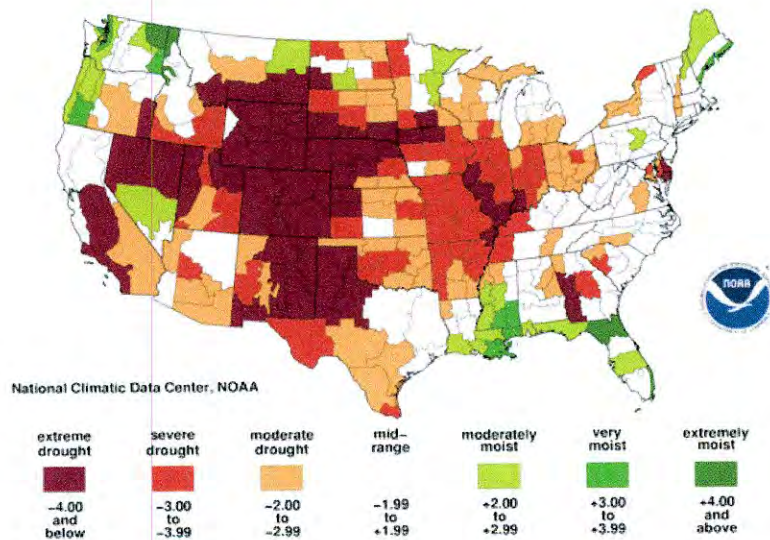
FANNIN COUNTY AND GRAYSON COUNTY



### Palmer Hydrological Drought Index July, 2012



### Palmer Hydrological Drought Index August, 2012

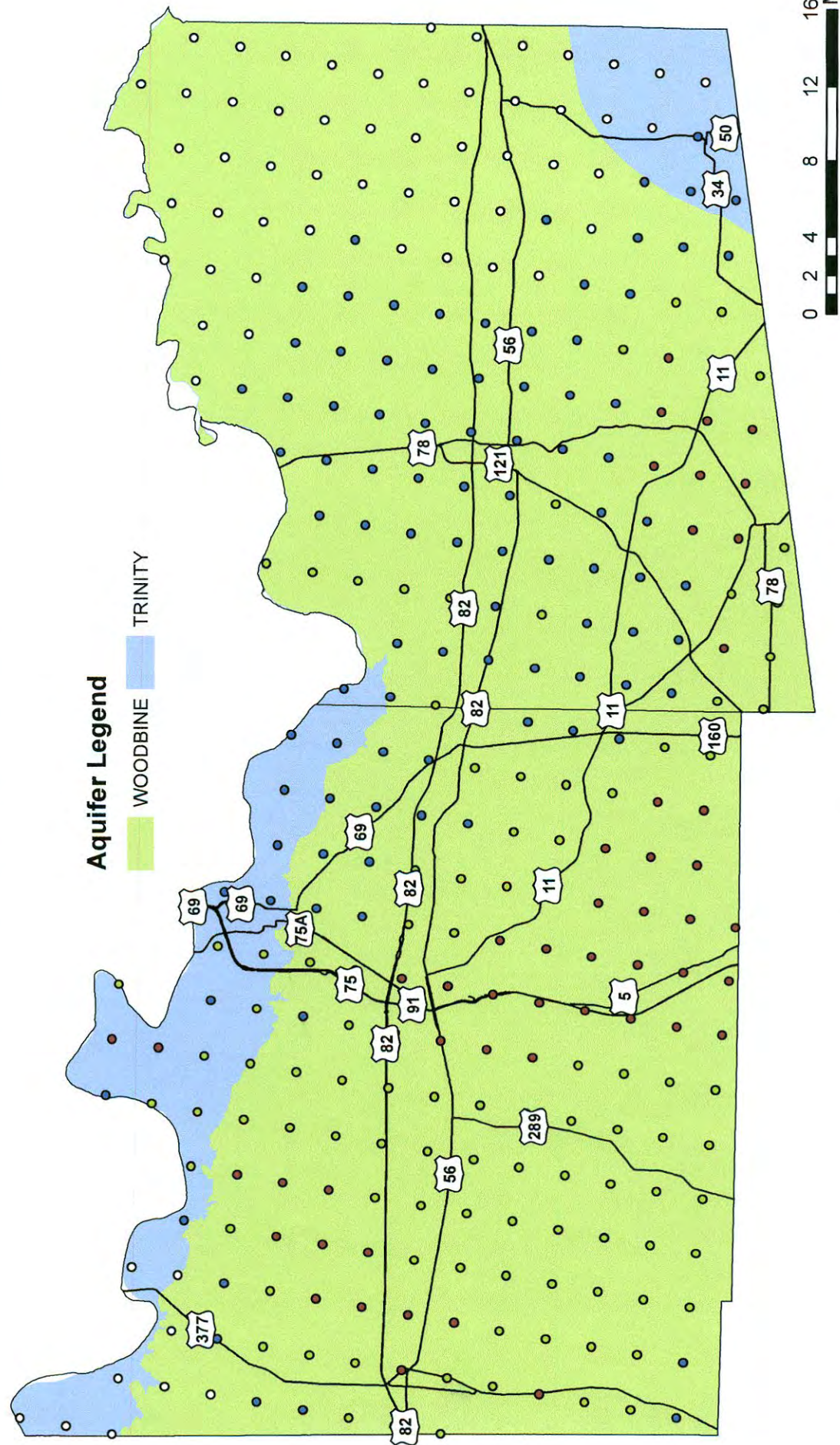


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[http://www.gtua.org/red\\_river\\_gcd.asp](http://www.gtua.org/red_river_gcd.asp)



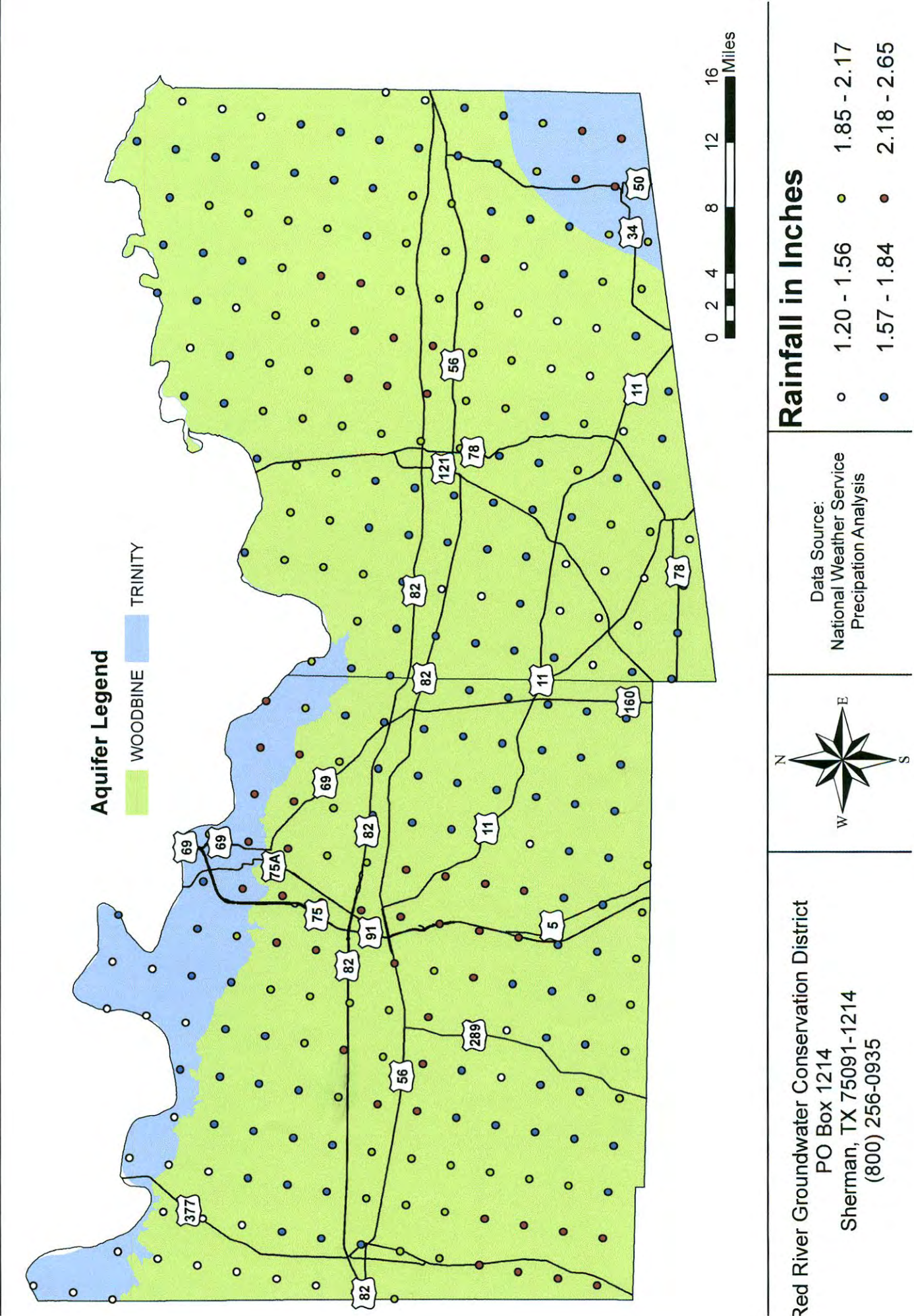
# Rainfall Totals for January 2012



<p>Red River Groundwater Conservation District PO Box 1214 Sherman, TX 75091-1214 (800) 256-0935</p>	<p>Data Source: National Weather Service Precipitation Analysis</p>	<p><b>Rainfall in Inches</b></p> <p>○ 4.31 - 5.57   ● 6.45 - 7.22</p> <p>● 5.58 - 6.44   ● 7.23 - 8.17</p>
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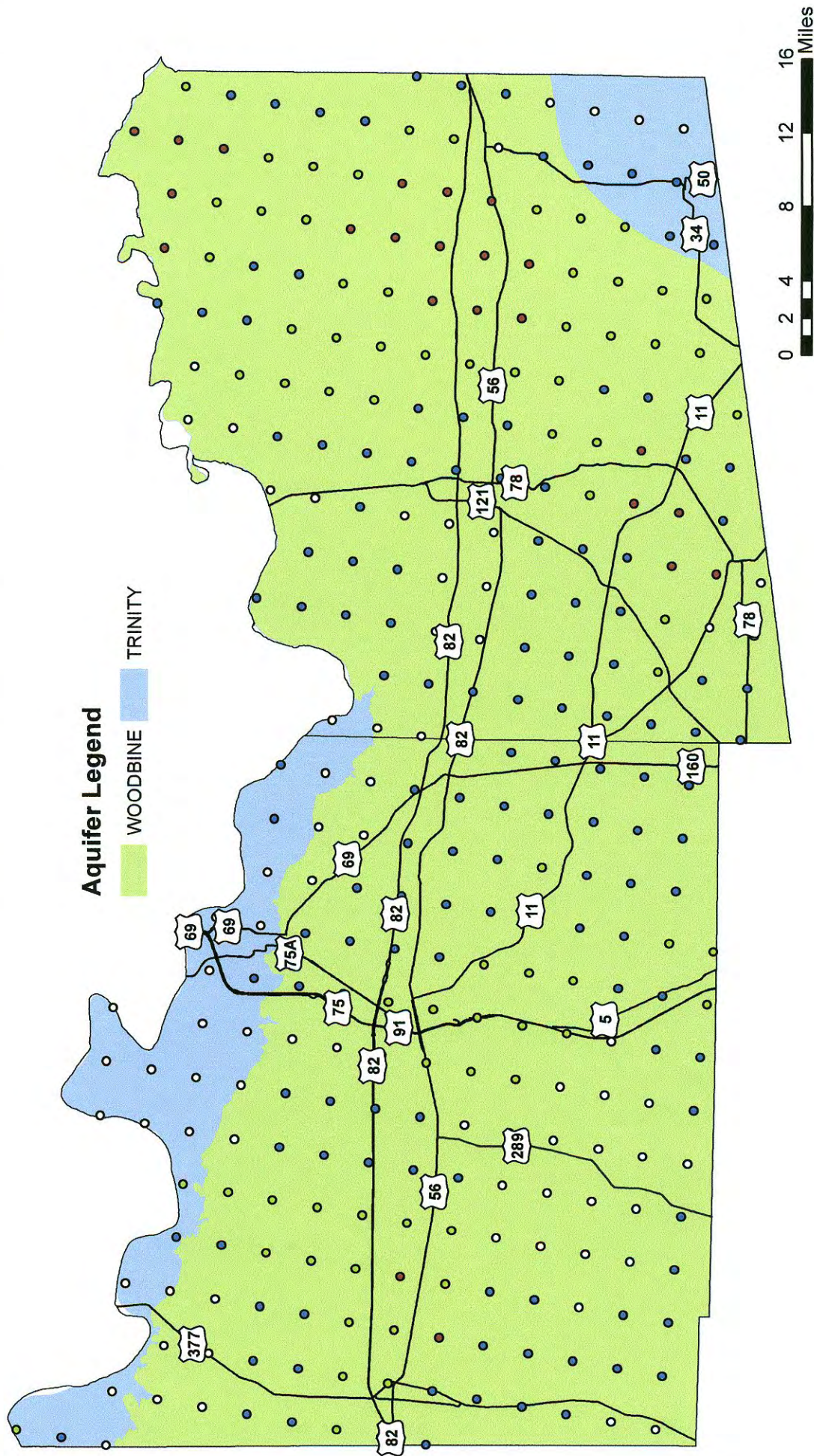


# Rainfall Totals for February 2012





# Rainfall Totals for March 2012



## Rainfall in Inches

Data Source:  
National Weather Service  
Precipitation Analysis

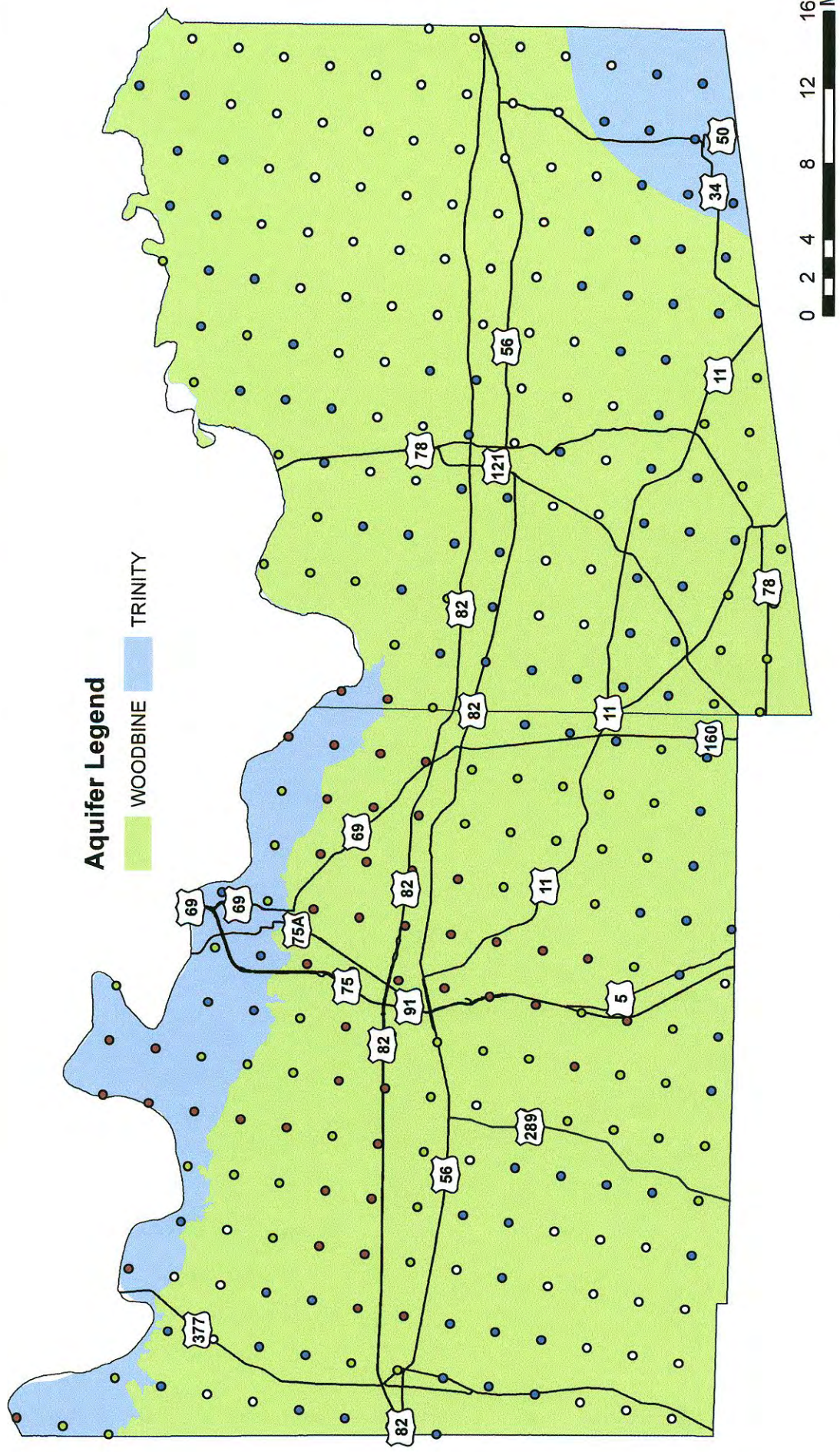


Red River Groundwater Conservation District  
PO Box 1214  
Sherman, TX 75091-1214  
(800) 256-0935

- 4.75 - 6.02
- 6.03 - 6.63
- 6.64 - 7.57
- 7.58 - 9.86



# Rainfall Totals for April 2012



Red River Groundwater Conservation District  
 PO Box 1214  
 Sherman, TX 75091-1214  
 (800) 256-0935



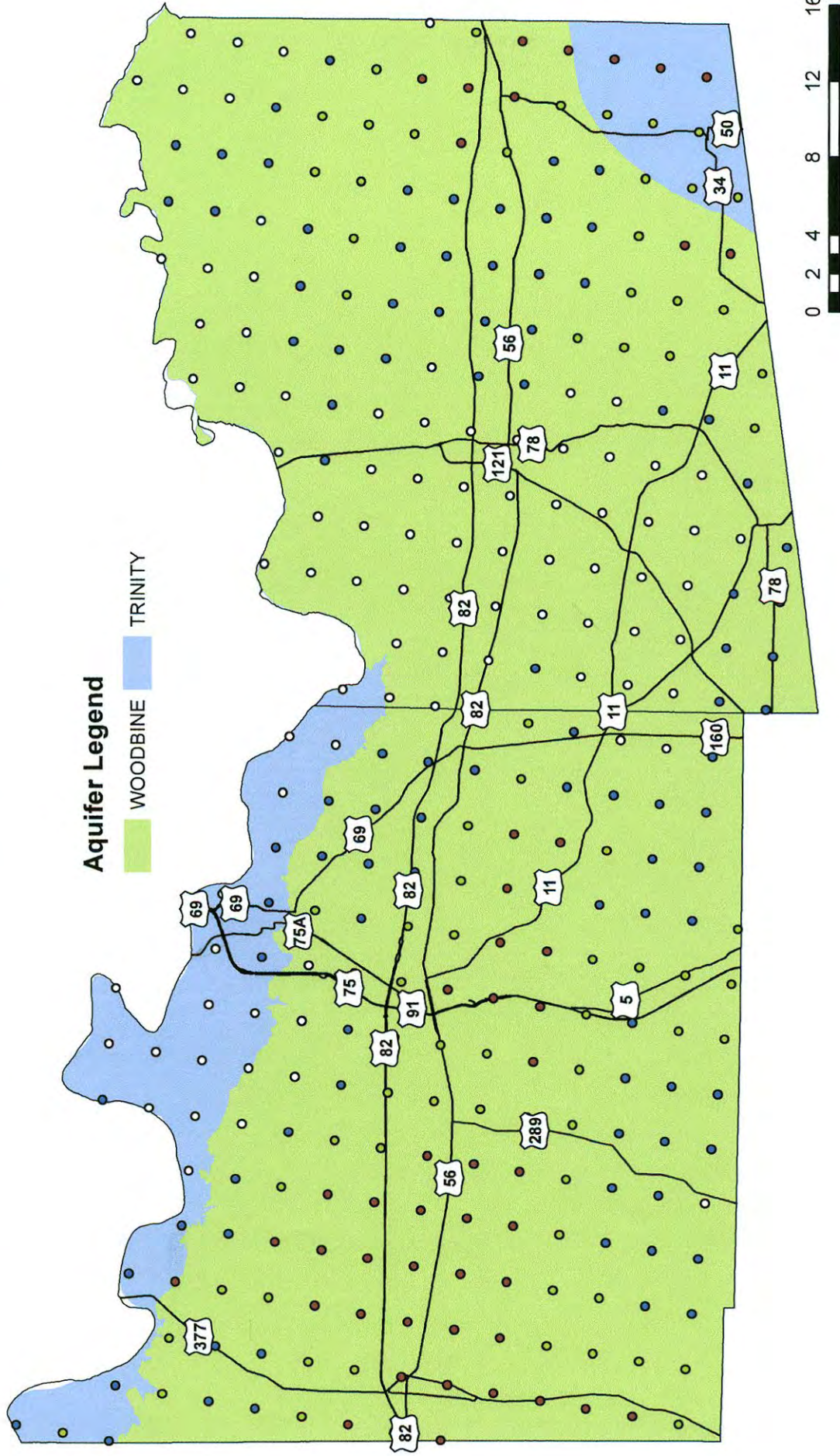
Data Source:  
 National Weather Service  
 Precipitation Analysis

## Rainfall in Inches

- 1.13 - 1.88
- 1.89 - 2.48
- 2.49 - 3.26
- 3.27 - 4.77



# Rainfall Totals for May 2012



## Rainfall in Inches

○	1.71 - 2.71	●	3.52 - 4.25
●	2.72 - 3.51	●	4.26 - 5.98

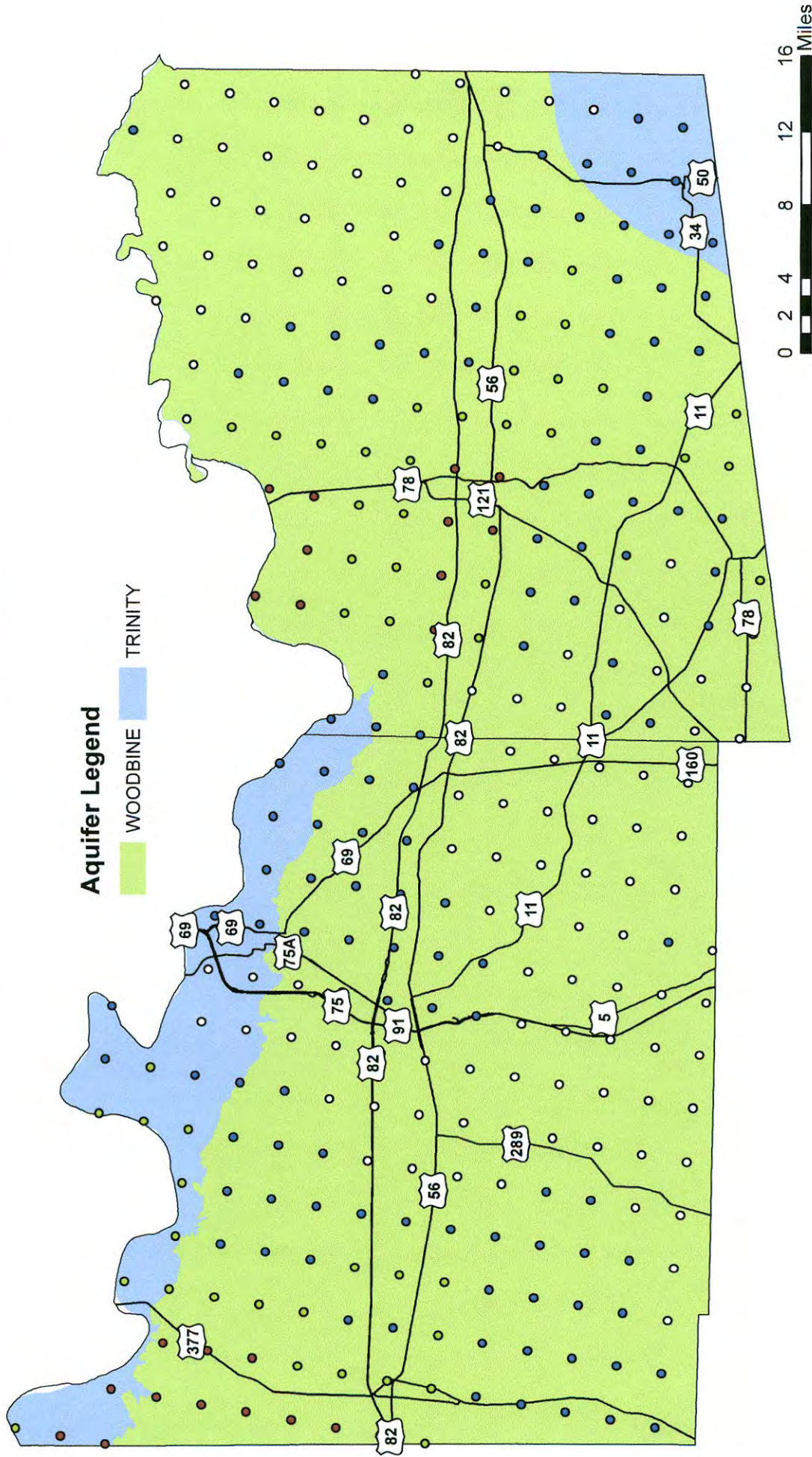
Data Source:  
National Weather Service  
Precipitation Analysis



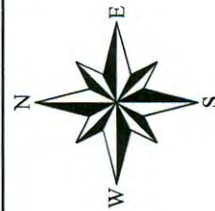
Red River Groundwater Conservation District  
PO Box 1214  
Sherman, TX 75091-1214  
(800) 256-0935



# Rainfall Totals for June 2012



Red River Groundwater Conservation District  
 PO Box 1214  
 Sherman, TX 75091-1214  
 (800) 256-0935



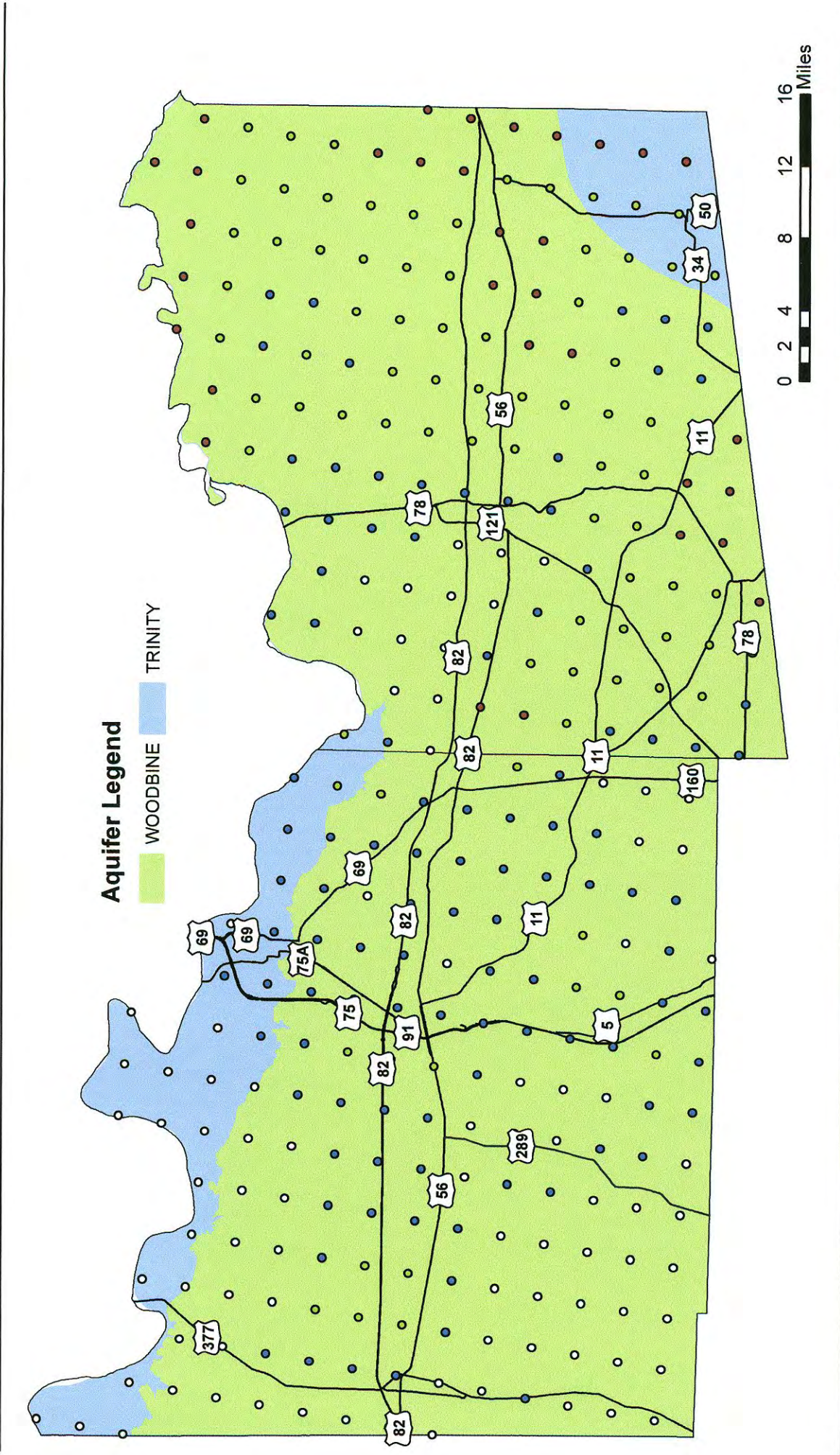
Data Source:  
 National Weather Service  
 Precipitation Analysis

## Rainfall in Inches

- 1.47 - 2.63
- 2.64 - 3.62
- 3.63 - 4.80
- 4.81 - 6.87



# Rainfall Totals for July 2012



Red River Groundwater Conservation District  
PO Box 1214  
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(800) 256-0935

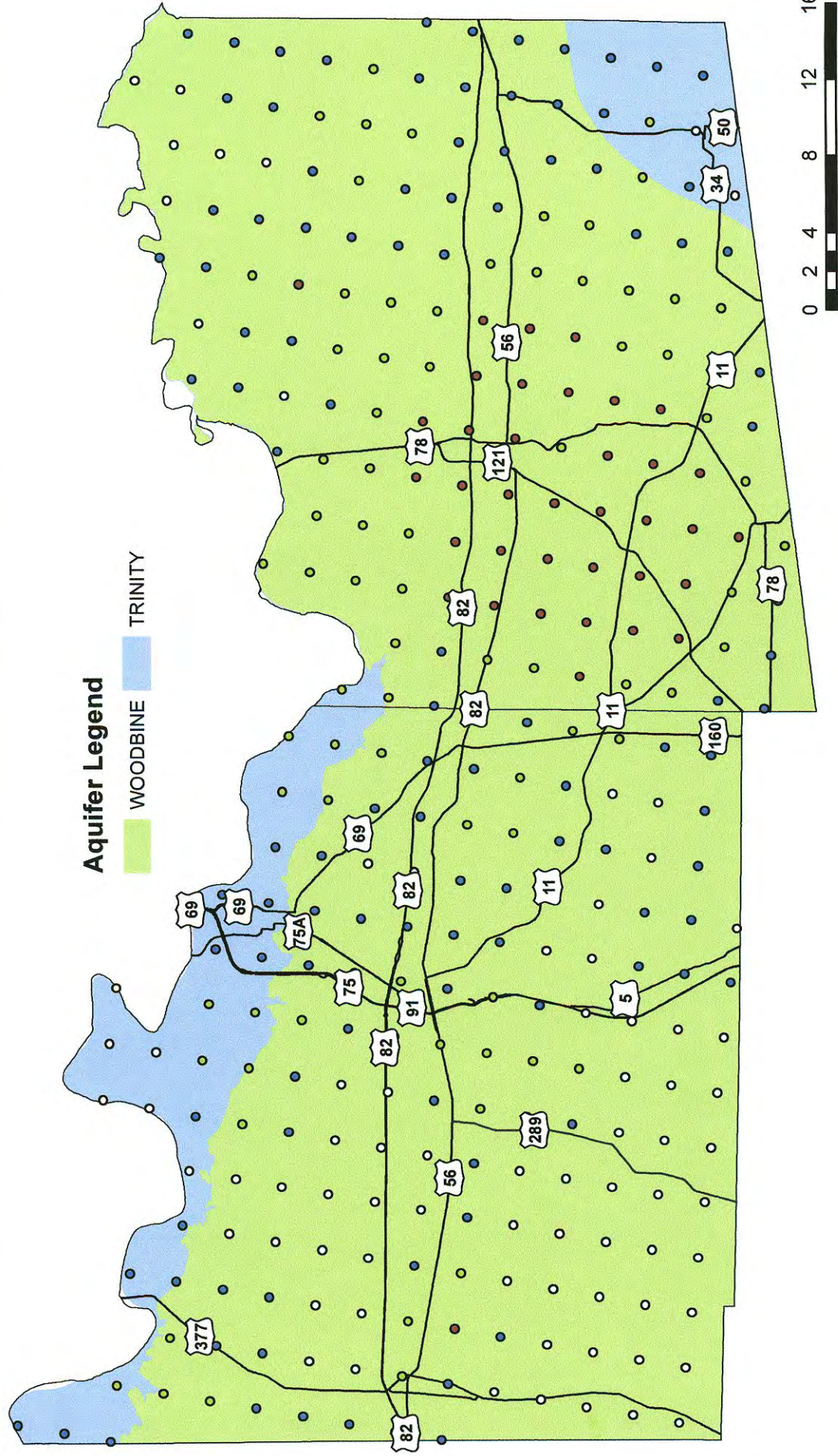
Data Source:  
National Weather Service  
Precipitation Analysis

**Rainfall in Inches**

- 0.16 - 1.49
- 1.50 - 2.56
- 2.57 - 3.88
- 3.89 - 7.47



# Rainfall Totals for August 2012



Red River Groundwater Conservation District  
 PO Box 1214  
 Sherman, TX 75091-1214  
 (800) 256-0935



Data Source:  
 National Weather Service  
 Precipitation Analysis

## Rainfall in Inches

- 1.53 - 2.72
- 2.73 - 3.74
- 3.75 - 5.28
- 5.29 - 8.29

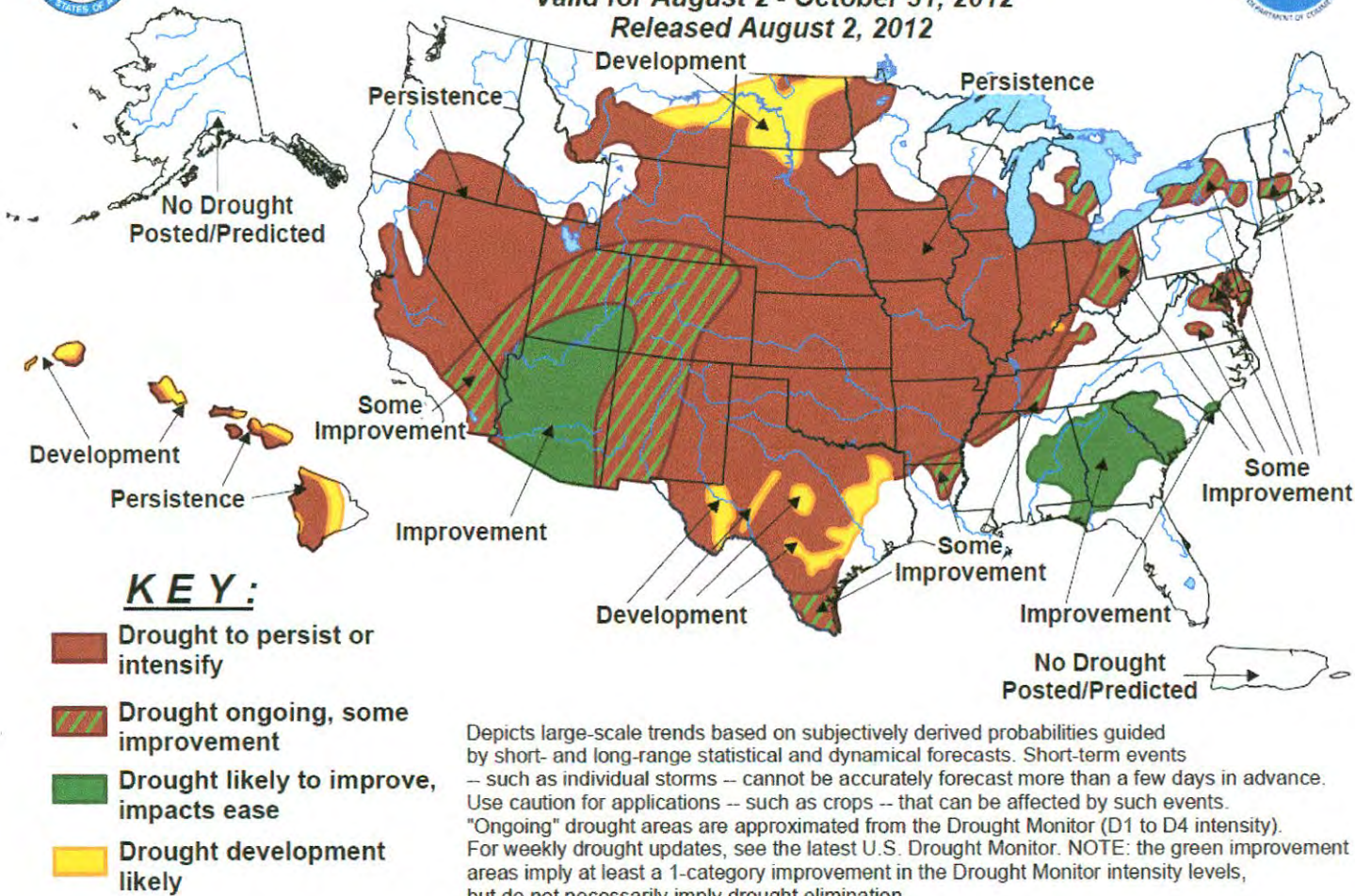




# U.S. Seasonal Drought Outlook

## Drought Tendency During the Valid Period

Valid for August 2 - October 31, 2012  
Released August 2, 2012



Temperatures in the eastern half of the Nation have quickly moderated after a cold start to the year. Elsewhere, mostly dry weather exacerbated drought conditions in the Southwest, central Plains and western Corn Belt, and eastern Gulf and southern Atlantic Coasts. In Hawaii, shower activity has increased during the past 2 weeks, mostly falling on windward locations and northern islands.

During the upcoming three months, a much drier pattern is expected across the southern third of the Nation (from central California to the eastern Gulf Coast). This limits the prospects for further drought improvements during the latter end of the wet season in California, Nevada, and western Arizona, and in fact increases the probabilities for drought development and deterioration in the tri-State area. This also marks a change from recent wet conditions in the southern Plains and western Gulf Coast as drought development and persistence is forecast for Texas by the end of April. Similarly, drought development and persistence is possible in the eastern Gulf Coast States, but less likely further north. In contrast, enhanced probabilities of surplus precipitation and subnormal temperatures across the northern U.S. (from the northern Rockies eastward to the upper Midwest and into the western Corn Belt) increase the odds for drought improvement. Some improvement is possible across the middle Mississippi Valley and the Piedmont, the latter area from wetness forecast for the rest of the month.

With odds favoring subnormal February and FMA rainfall, drought conditions should persist across the leeward sides of Hawaii's southern islands and possibly expand toward windward sides during the latter end of the winter rainy season. However, recent and forecasted short-term shower activity across the northern islands had increased enough for some improvement in Kauai and Oahu. In northwestern Alaska, with the odds favoring above-normal February precipitation, the Koyukuk Basin of Alaska was changed from persistence to some improvement in anticipation of increasing its snow pack for late spring melting.

**Forecaster: D. Miskus**

**Next Outlook issued: February 7, 2013 at 8:30 AM EDT**

### Seasonal Drought Outlook Discussion

NOAA/ National Weather Service  
National Centers for Environmental Prediction  
Climate Prediction Center  
5830 University Research Court  
College Park, Maryland 20740  
Page Author: Climate Prediction Center Internet Team  
Page last modified: January 17, 2013

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## **APPENDIX C**

### **Publications**

## Gardener: A drought-survival guide for lawns

JOE LAMP'L  
SCRIPPS HOWARD NEWS SERVICE

Many of us want so desperately to keep our lawns looking lush and green no matter what the conditions, we actually love them to death, or nearly so. To elaborate, watering less, mowing less and fertilizing less not only conserves resources and time, but it's also a lot less stressful on our lawns during such demanding conditions. That's a win-win.

Water less. In times of drought, the natural tendency is to pour on the water, when you're able. Of course, there are likely watering restrictions or all-out bans, which must be followed. So first things first. You may be pleasantly surprised to know that lawns can go longer than you think without water. Most lawns recover surprisingly well with moderate water, even after long periods without it.

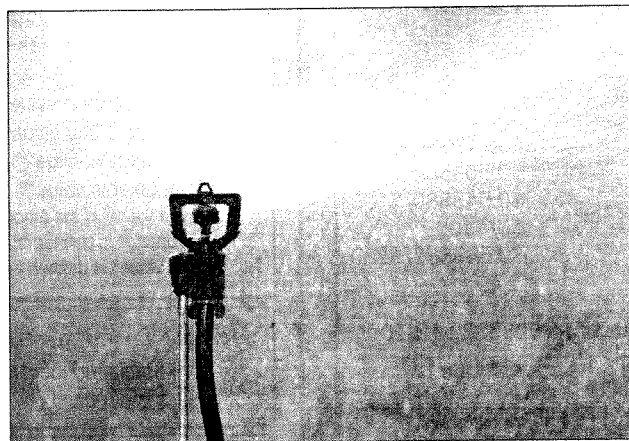
Timing matters. When you do water, it's important to do so at the right time -- early in the morning. This minimizes the time the grass blades stay wet. Too much moisture too long is asking for problems. Water is a big vector for many plant diseases, especially fungus. So by watering the lawn early in the morning, when the air is still calm

and cool, irrigation is most efficient and healthier for all your plants and lawn.

Never water the lawn in the middle of the day, even when water is abundant. On average, only about half the water leaving your sprinkler will make it to the soil surface due to wind drift and evaporation. Bottom line, it's just plain wasteful and inefficient.

Water less frequently but when you water, do so deeply. Lawns thrive on about an inch of water per week. The better the soaking per application, the more deeply the water seeps into the soil and away from the evaporative effects of sun, heat and wind. As conditions at the surface dry out, water deeper in the soil is available where roots will train themselves to grow to get to the source. Conversely, if we water every day or every other day, for short intervals, the water never really has a chance to soak deeper into the soil and roots grow only as far as needed to get to the water. That's bad. It makes for a drought-intolerant lawn. The deeper the roots the healthier the shoots.

Mow higher. Taller grass blades are good for several reasons, especially in drought. Generally, roots grow as needed to support their above-ground growth. So by mowing less, and



JOHN DEERE/SHNS

**Watering less, mowing less, and fertilizing less not only conserves resources and time, it's also a lot less stressful on lawns suffering in drought conditions.**

allowing the blades to grow taller, roots grow deeper.

Mowing higher also is less stressful on the grass blades. With all pruning and cutting, the general rule is to never take more than a third of the total growth at one time. And that is especially true of lawns. Cutting more can add stress to an already stressful situation. As lawns are trying to conserve resources, inducing stress requires responses from the plants at the worst possible time. And plants that are under stress are naturally more susceptible to pests and diseases.

Allowing the grass blades to grow taller also helps shade the soil surface and reduces evaporation, and

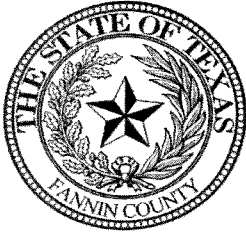
water and nutrient competition from weeds that thrive in sunnier exposures.

Fertilize less. Fertilizing during drought or other times of stress induces your lawn to use resources it needs to conserve, thereby depleting precious reserves and making your lawn more susceptible to problems. The optimal time to fertilize is during active growth, not dormancy, as in drought conditions.

*Joe Lamp'l, host of "Growing a Greener World" on PBS, is a master gardener and author. For more information, visit [www.joegardener.com](http://www.joegardener.com). For more stories, visit [scrippsnews.com](http://scrippsnews.com).*

## **APPENDIX D**

### **Annual Review of Texas State Soil & Water Conservation Board State Brush Control Plan**



# **RED RIVER**

## **GROUNDWATER CONSERVATION DISTRICT**

FANNIN COUNTY AND GRAYSON COUNTY

Annual Review

of

Texas State Soil & Water Conservation Board

State Brush Control Plan Dated September 2009

December 12, 2012



Red River Groundwater Conservation District Management Plan Objective G.3 – Brush Control – requires that the District evaluate the State Brush Control Plan at least once each year to determine whether projects within the District will increase groundwater resources of the District. The most recent State Brush Control Plan ("Plan") is the September 2009 Plan by the Texas State Soil & Water Conservation Board ("TSSWCB"). The Plan is currently being revised. According to Johnny Oswald, Project Supervisor for the Texas Brush Control Program, in 2010 the TSSWCB went through a Sunset review and is changing the implementation of the program. New rules were put into effect in July 2012. Mr. Oswald indicated the Plan should be updated in early 2013.

Staff has reviewed the latest Plan available (2009), and the following information from the Plan is offered for the Board's review. A complete copy of the Plan is will be available at the Board meeting, in the event you would like to review the Plan.

The following report was prepared using the TSSWCB State Brush Control Plan dated September 2009:

The U.S.D.A. Natural Resource Conservation Service ("NRCS") estimates that brush in Texas uses about 10 million acre-feet of water annually, versus 15 million acre-feet per year for current human use. Possible benefits of brush control affecting water supplies are: additions to State water supplies, recharge of groundwater aquifers, and spring flow enhancement. The TSSWCB in cooperation with TAES, TWDB, USDA-NRCS, UCRA and LCRA have conducted several feasibility studies to determine economic benefits of the use of brush control to enhance water yield.

The Texas Legislature authorized the TSSWCB in 1985 through local Soil and Water Conservation Districts to conduct a program that includes cost-share assistance for the "selective control, removal, or reduction of noxious brush such as mesquite, salt cedar, or other brush species that consume water to a degree that is detrimental to water conservation." The TSSWCB also has been mandated to designate

areas of critical need in the State in which to implement the Brush Control Program. Water needs and potential water yields that may be captured and used for public benefit are the primary considerations cited by the TSSWCB for determining the location of publicly funded (i.e. cost-share) brush control projects. Determination of the efficiencies with which controlling brush can yield additional water requires the evaluation of the intrinsic properties of the geology, soil, flora, and topography unique to each watershed and their interactions with each other in response to climatic conditions. Other criteria to be considered for selecting sites for brush control water cost and the potential impact on threatened or endangered species.

Investigation has taken place in several areas of the State concerning water yield following brush control. These studies indicate water savings of about 26,400 gallons/acre/year for treating heavy mesquite in an area that receives about 20 inches of average annual rainfall. Juniper, mesquite, and salt cedar have been shown to drastically reduce water yield in a watershed.

Fannin County lies in the Post Oak Savannah and Blackland Prairies. Grayson County lies in the Cross Timbers and Prairies, and the Blackland Prairies. The following are the trees and brush found in each area according to the Plan:

Post Oak Savannah (Fannin County): Short oak trees occur in association with tallgrasses. Thicketization occurs in the absence of recurring fires or other methods of woody plant suppression. This distinctive pattern of predominantly post oak and blackjack oak in association with tallgrasses also characterizes the vegetation of the Cross Timbers and Prairies vegetational area. Associated trees are elms, junipers, hackberries and hickories. Characteristic understory vegetation includes shrubs and vines such as yaupon, American beautyberry, coralberry, greenbriar and grapes.

Blackland Prairies (Fannin and Grayson Counties): Mesquite, huisache, oak and elm are common invaders on poor-condition rangelands and on abandoned cropland. Oak, elm, cottonwood and native pecan are common along drainages.

Cross Timbers and Prairies (Grayson County): The Cross Timbers and Prairies area in North Central Texas includes the Cross Timbers, Grand Prairie, and North Central Prairies land resource areas. The North Central Prairies are interspersed with rapidly drained sandstone and shaley ridges and hills occupied by scrub live oak, juniper and mesquite. Past mismanagement and cultivation have caused the uplands to be covered mostly by scrub oak, mesquite and juniper with mid-and shortgrass understories. The bottomland trees are primarily hardwoods such as pecan, oak and elm, but have been invaded by mesquite. Characteristic understory shrubs and vines include skunkbrush, saw greenbriar, bumelia and poison-ivy.

Increasing water yields with rangeland management involves many factors, including but not limited to climatic factors, vegetation factors, soil factors, and topographic factors. In order for a project to be eligible for State funding, it must be in a brush control area delineated by the State Board. The State Board will delineate brush control areas eligible for brush control projects and cost-share funding where

a water need exists based on the most recent regional water plan and where brush control has a strong potential to increase water yield. Watershed studies will consider the following criteria:

- Brush type, density, and canopy cover
- Geology and soils data
- Water needs or potential needs
- Hydrology
- Potential water yield
- Wildlife concerns
- Economics
- Landowner interest

As funds become available, watershed studies, which include water yield modeling, will be used by the State Board as a tool for delineating brush control areas. The State Board works with the TWDB and the regional planning groups to identify regional water needs.

Brush control areas are delineated by the State Board based on requests from local entities. To be eligible, the area must have water needs documented in the most recent water plan, and brush control must have the potential to increase water yield. Currently, 18 watersheds have been designated as brush control areas based on water need.

1. North Concho River Watershed
2. Twin Buttes Reservoir Watershed
3. Upper Colorado River Watershed
4. Pedernales River Watershed
5. Pecos River Watershed (Saltcedar)
6. Canadian River (Saltcedar)
7. Hubbard Creek Lake (Saltcedar)
8. Edwards Aquifer recharge zone
9. Nueces River Basin
10. Concho River Basin
11. Frio River Basin
12. Palo Pinto Lake Basin
13. Lake Fort Phantom Hill Basin
14. Lake Brownwood Basin
15. Lake Arrowhead Basin
16. Guadalupe River
17. Carrizo/Wilcox Aquifer
18. Bosque/Steel Creek

Watershed studies have been conducted in the following areas:

- North Concho River Basin
- Edwards Aquifer recharge zone
- Nueces River Basin
- Wichita River Basin
- Concho River Basin
- Upper Colorado River Basin
- Pedernales River Basin
- Canadian River Basin
- Frio River Basin
- Palo Pinto Lake Basin
- Lake Fort Phantom Hill Basin
- Lake Brownwood Basin
- Lake Arrowhead Basin
- Hubbard Creek Lake (Local Study)
- Pecos River (Local Study)

Local soils and water conservation districts or other agencies in cooperation with districts may develop project proposals within the State. The proposals should be submitted to the State Board for its prioritization and approval. The State Board, on its own initiative, may initiate projects development in cooperation with local soil and water conservation districts. A proposal must denote sufficient interest by a group of landowners and operators in a brush control area or part of a brush control area designated by the State Soil and Water Conservation Board to allow for eventual completion of the project.

**Summary by Red River Groundwater Conservation District Staff:**

The TSSWCB has not conducted studies in the watersheds of the Red River Groundwater Conservation District (Fannin and Grayson Counties) to date. These studies are conducted in areas determined to be most critical, and as funds are available to the TSSWCB. There are currently no brush control areas delineated by the TSSWCB within the Red River Groundwater Conservation District.

A program addressing brush control by the District does not appear to be feasible at this time, as it does not appear to be cost effective without assistance through the cost-share program offered by the State. A link has been placed on the District website to the AgriLife Extension Texas A&M System for brush control information: <http://texnat.tamu.edu/about/brush-busters/>.

References:

Texas State Soil & Water Conservation Board, *State Brush Control Plan, September 2009* (attached, Exhibit A)



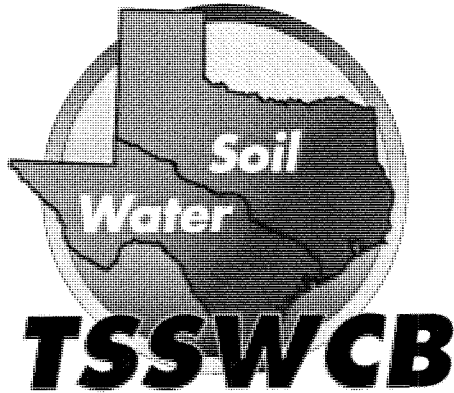
**Exhibit A**

**Texas State Soil & Water Conservation Board**

**State Brush Control Plan**

**September 2009**

# TEXAS STATE SOIL & WATER CONSERVATION BOARD



## STATE BRUSH CONTROL PLAN

Revised 2009

**SEPTEMBER 2009**



## **Texas State Soil and Water Conservation Board**

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# Table of Contents

<b>Section I: Introduction.....</b>	<b>1</b>
<b>Section II: Description of the Problem.....</b>	<b>3</b>
2.1 Regional Overview of General Vegetative Communities .....	3
2.2 Brush in Texas.....	11
<b>Section III: Increasing Water Yields with Rangeland Management.....</b>	<b>13</b>
3.1 Increased Water Yield in Texas.....	15
<b>Section IV: The Brush Control Law.....</b>	<b>17</b>
4.1 Overview .....	17
4.2 Responsibilities of the State Board Under Title 7, Chapter 203, Texas Agriculture Code.....	18
<b>Section V: Brush Control Projects .....</b>	<b>19</b>
5.1 Overview of Brush Management Program .....	19
5.2 Brush Control Area Delineation .....	19
5.3 Project Development .....	22
5.4 State Board Approval and Prioritization .....	23
5.5 Project Implementation .....	26
<b>Section VI: Cost-share Program.....</b>	<b>29</b>
6.1 General Criteria .....	29
6.2 Cost-share Agreement .....	29
6.3 Brush Control Methods .....	29
6.4 Maintenance of Brush Management.....	30
6.5 Certification of Practice Implementation.....	30
6.6 Cost-share Payments .....	30
<b>References.....</b>	<b>31</b>
<b>Appendix I:The Brush Control Law .....</b>	<b>34</b>
<b>Appendix II: Brush Control Rules .....</b>	<b>42</b>

# **Texas State Soil and Water Conservation Board**

## **State Brush Control Plan**

2009 Update

### **Section I: Introduction**

The demand for water in Texas is expected to increase by 27 percent, from almost 17 million acre-feet of water in 2000 to 21.6 million acre-feet in 2060. Texas is going to need an additional 8.8 million acre-feet of water by 200 if new water supplies are not developed. In 2060, slightly more than 85 percent of the state's population is projected to have water needs (Texas Water Development Board 2007). The ability to meet the water needs will significantly impact growth and economic well-being. The U.S.D.A Natural Resource Conservation Service (NRCS) estimates that brush in Texas uses about 10 million ac-ft of water annually, versus 15 million ac-ft per year for current human use. Possible benefits of brush control affecting water supplies are: additions to State water supplies, recharge of groundwater aquifers, and spring flow enhancement. Economic benefits of the use of brush control to enhance water yield have been estimated by several feasibility studies across the state by the Texas State Soil and Water Conservation Board (TSSWCB) in cooperation with TAES, TWDB, USDA-NRCS, UCRA, and LCRA. Brush control appears an economically feasible option for water yield enhancement in a number of the watersheds studied. (Upper Colorado River Authority, 1998; Brush Control Feasibility Studies, <http://www.tsswcb.state.tx.us/en/reports>) Some issues related to potential benefits, beneficiaries, and funding that are not yet adequately defined may limit the potential public investment in this program. (Walker and Dugas 1998)

In 1985, the Texas Legislature authorized the Texas State Soil and Water Conservation Board through local Soil and Water Conservation Districts to conduct a program that includes cost-share assistance for the "selective control, removal, or reduction of noxious brush such as mesquite, salt cedar, or other brush species that consume water to a degree that is detrimental to water conservation." The Texas State Soil and Water Conservation Board is also mandated to designate areas of critical need in the State in which to implement the Brush Control Program. Recently there has been renewed interest in brush control to increase water yield. A review of the Texas Water Plan (Texas Water Development Board 2006) shows few recommended water development projects for approximately the two-thirds of the state that lies west of I-35. Most of the conveyance and all of the proposed new major reservoirs in the State are east of I-35. The siting of these projects is consistent with climatic patterns that result in much higher runoff and greater potential for capture and transfer of water in the eastern part of the State. In West Texas, brush control and cloud seeding are the two principal options for increasing water yield.

Water yield following brush control has been investigated in several areas of the State. Studies by Thurow and Hester (1997), Carlson et al. (1990) and Weltz and Blackburn (1995) show that at sites with precipitation ranging from about 12 to 35 inches per year, the majority of precipitation is used for evapotranspiration (ET). Following brush removal (original cover: 36% juniper, 24% oak) sixteen percent of the precipitation went to deep drainage compared to none for the untreated watershed, an amount equal to 100,500 gallons/acre/year (Thurow and Hester 1997). The results of a TSSWCB funded multi-year study (Saleh et al. 2009) on the net water consumptive effects of upland mesquite control on evapotranspiration, published in the September/October 2009 issue of the Soil and Water Conservation Journal, found that significant water savings can be realized from control of upland mesquites. The study was conducted using a paired site approach at which evapotranspiration measurements were collected using the eddy covariance technique and comparatively analyzed. The findings indicate that during the four year period from 2005 - 2008 the treated site consumed approximately 0.7 inches less water per year than did the control

site. These results, when extrapolated to the entire North Concho River watershed, very closely align with values predicted by the SWAT model in the *North Concho River Watershed Brush Control Planning, Assessment & Feasibility Study* (Upper Colorado River Authority. 1998), which indicated water savings of about 26,400 gallons/acre/year for treating heavy mesquite in an area that receives about 20 inches of average annual rainfall.

A major difference between controlling juniper (*Juniperus ashei* Bucholz) compared to mesquite is that control of juniper results in a much greater reduction in ET. This difference is due to the greater interception of rainfall by juniper and its evergreen nature compared to mesquite, and because juniper is normally associated with shallow sites, which facilitates the deep percolation of the water not lost to ET.

Water needs and potential water yields that may be captured and used for public benefit are the primary considerations for determining the location of publicly funded (i.e. cost-share) brush control projects. Determination of the efficiencies with which controlling brush can yield additional water requires the evaluation of the intrinsic properties of the geology, soil, flora, and topography unique to each watershed and their interactions with each other in response to climatic conditions. Other criteria to be considered for selecting sites for brush control water cost and the potential impact on threatened or endangered species.

Public benefit in the form of additional water depends on landowner participation and proper implementation and maintenance of the appropriate brush control practices. It is also important to understand that rancher participation in a Brush Control Program will primarily depend on the rancher's expected economic consequences resulting from participation. With this in mind, the analyses described in this report are predicated on the objective of limiting rancher costs associated with participation in the Program to no more than the benefits that would be expected to accrue to the rancher as a result of participation.

Literature summarizing water yield studies in the western U.S. and data from the Edwards Plateau in Texas indicate that a significant increase in water yield is possible if brush cover is converted to grassland or open savanna and if the area receives about 18 inches/year or more rainfall. Documentation of water yield potential in other portions of Texas and improvements in the operation of the existing simulation models have been constrained by a lack of funding committed to watershed scale research (Thurow, 1998).

## Section II: Description of the Problem

Numerous written descriptions by early European settlers, summarized by Smeins et al. (1997), characterize most of Texas rangelands as grassland or open savanna. Prior to European settlement, grazing pressure tended to be light and/or periodic, thus allowing a robust stand of grass to establish. Most tree seeds deposited in a healthy grassland die soon after they germinate because they are unable to compete with the established grass for water and light. The few tree seedlings that are able to survive the competition with grass tend to perish in wildfires which periodically occur in "natural" rangelands. Thus, with fire and light grazing pressure, grasslands and savannas are stable and sustainable ecosystems characteristic of many Texas rangelands.

European settlement of rangelands altered the grazing and fire characteristics which had previously enabled grasslands to dominate the landscape. Continuous, often heavy, livestock grazing pressure reduced the ability of grasses to suppress tree seedling establishment. Furthermore, some invasive woody species (e.g., juniper and mesquite) have noxious chemicals in their leaves, resulting in livestock tending to avoid browsing the tree seedlings while repeatedly grazing the adjacent, palatable grasses. This selective grazing behavior gives unpalatable tree seedlings a competitive advantage over grasses. European settlers tended to aggressively suppress fires, a task made easier because continuous, heavy grazing pressure removed the fuel needed to carry a fire. Removal of fire and/or heavy grazing pressure created an environment that favored increased dominance of shrubs and trees in what had previously been grasslands or savannas. This pattern of vegetation change coincides with European settlement of rangelands throughout the world (Archer 1994).

Large increases in woody cover can adversely affect ranching operations by increasing the costs of management and decreasing the livestock carrying capacity. Therefore, ranchers have a vested interest in controlling brush. For example, analysis of the 80 square mile Cusenbary Draw watershed near Sonora, Texas revealed that investments in brush control by ranchers were able to keep overall brush cover within the watershed between 22% to 24% between 1955 and 1990 (Redeker et al. 1998). Some of the pastures within the watershed did not have any brush control applied. Brush cover on those sites increased to 37% over the same period. This illustrates the increase in shrub cover over a 35-year period that is possible in the area without a proactive policy of brush control.

Ranches throughout several regions of Texas are increasingly being subdivided into smaller parcels that are used mainly for recreation (Rowan 1994). According to survey data from the Edwards Plateau, landowners are less inclined to invest in brush control if they are not reliant on livestock income (Garriga 1998). As the demographics of rangeland owners shift away from an emphasis on livestock production, and as long as fire continues to be suppressed, it is likely that woody cover will continue to increase unless incentives are provided to encourage brush management.

Saltcedar poses a somewhat different problem. It was introduced into the western U.S. as an ornamental in the 1800's and has spread throughout Texas and the Southwest. Once established, saltcedar dominates all vegetation along rivers, lakes and streams and consumes vast quantities of water.

### 2.1 Regional Overview of General Vegetative Communities

Texas is a diverse State with a broad range of climate and soil types. Within the combinations of soils and climates, there are distinctive vegetative communities that predominate. Gould, et al. (1960) described these general vegetative communities as follows. Although these descriptions may not be currently accurate in all details, they provide a general overview of the State.

#### 2.1.1. *Pineywoods*

The Pineywoods area lies entirely within the Gulf Coastal Plains, which extend into Texas for 75 to 125 miles west of the Louisiana border. The area is a nearly level to gently undulating, locally hilly, forested plain. Upland soils are generally acid, sandy loams and sands over gray, yellow, red, or mottled sandy loam to clay subsoils. Bottomland



soils are generally light brown to dark gray, acid to calcareous, loamy to clayey alluvial. Acid loamy soils are extensive in the flood plains of minor streams. The dominant vegetation type is a mixed pine-hardwood forest on the uplands and a mixed hardwood forest on the lowlands. Native pines are loblolly (*Pinus taeda*), shortleaf (*P. echinata*), and longleaf (*P. palustris*). Slash pine (*P. elliotii*), a native of the southeastern United States, has been widely planted on thousands of acres. Hardwoods grow in mixed stands with pines in the uplands but are generally dominant along major streams. The principal hardwoods in the region are sweetgum (*Liquidambar styraciflua*), oaks (*Quercus*), water tupelo (*Nyssa aquatica*), blackgum (*N. sylvatica*), magnolias (*Magnolia*), elms (*Ulmus*), cottonwoods (*Populus*), hickories (*Carya*), walnuts (*Juglans*), maples (*Acer*), American beech (*Fagus grandifolia*), ashes (*Fraxinus*), and baldcypress (*Taxodium distichum*).

Many species of shrubs, vines, forbs, and grasses occupy the forest floor, prairies, and cutover areas not used for cropland. In the mixed pine-hardwood forests, bluestem grasses and forbs make up a large proportion of the herbage in openings. Grasses commonly associated with forests are blackseed needlegrass (*Piptochaetium avenaceum*), Virginia wildrye (*Elymus virginicus*), Canada wildrye (*E. canadensis*), purpletop (*Tridens flavus*), broadleaf woodoats (*Chasmanthium latifolium*), narrowleaf woodoats *Chasmanthium sessiliflorum*, eastern little bluestem (*Schizachyrium scoparium* var. *divergens*), giant cane (*Arundinaria gigantea*), carpetgrass (*Axonopus*), and brownseed paspalum (*Paspalum plicatulum*). Typical prairie vegetation is present on locally included clay prairie sites. Rosette grasses (*Dichanthelium*) and paspalums (*Paspalum*) are common grasses throughout the area.

Common understory shrubs and vines are southern wax-myrtle (*Myrica cerifera*), American beautyberry (*Callicarpa americana*), grapes (*Vitis*), blueberries (*Vaccinium*), hawthorns (*Crataegus*), greenbriars (*Smilax*), rattan-vine (*Berchemia scandens*), trumpet honeysuckle (*Lonicera sempervirens*), dewberries (*Rubus*), yellow jessamine (*Gelsemium sempervirens*), and poison ivy (*Rhus toxicodendron*). The area is noted for its flowering understory shrubs such as dogwoods (*Cornus*), redbud (*Cercis canadensis*), and black-haws (*Viburnum*). Characteristic forb species are wild indigos (*Baptisia*), sennas (*Cassia*), tickclovers (*Desmodium*), milkpeas (*Galactia*), clovers (*Trifolium*), vetches (*Vicia*), and goldenrods (*Solidago*), whereas sedges (*Carex* and *Cyperus*) and beakrushes (*Rhynchospora*) are common grasslike plants. Several species of orchids (Orchidaceae) are found only in this area.

Timber production is the leading land use in the Pineywoods. Forest grazing, tame pasture, feed grains, forages, fruits, and vegetables are secondary common land uses. Pine plantations and tame pastures currently occupy many areas previously forested or cultivated. Introduced grasses such as bermudagrass (*Cynodon dactylon*), dallisgrass (*Paspalum dilatatum*), and bahiagrass (*Paspalum notatum*) and the cultivation of legumes and use of fertilizer make this a highly productive pasture area. The forests, rangelands, and pastures are used for timber, livestock, wildlife habitat, recreation, and water production. The major livestock enterprise is the cow-calf operation. Herbage production in forests is generally negatively influenced by forest overstory canopy. Reservoirs provide recreation, including fishing, hunting, and swimming.

### **2.1.2. Gulf Prairies and Marshes**

The Gulf Prairies and Marshes, covering approximately 500,000 acres, are on a narrow strip of lowlands adjacent to the coast and the barrier islands (e.g., Padre Island), which extend from Mexico to Louisiana. The Gulf Prairies, about 9 million acres, include the nearly flat plain extending 30 to 80 miles inland from the Gulf Marshes.

The Gulf Prairies and Marshes are a low, wet, marshy coastal area, commonly covered with saline water, and range from sea level to a few feet in elevation. The Gulf Prairies are nearly level and virtually undissected plains having slow surface drainage and elevations from sea level to 250 feet.

Soils of the Gulf Marshes are dark, poorly drained sandy loams and clays, and light neutral sands, typically showing little textural change with depth. The loamy and clayey soils are commonly saline and sodic. Prairie soils are dark, neutral to slightly acid clay loams and clays in the northeastern parts. Further south in the subhumid Coastal Bend, the soils are less acidic. A narrow band of light acid sands and darker loamy to clayey soils stretches along the coast. Inland from the dark clayey soils is a narrow belt of lighter acid fine sandy loam soils with gray to brown, and red

mottled subsoils. Soils of the river bottomlands and broad deltaic plains are reddish brown to dark gray, slightly acid to calcareous, loamy to clayey alluvial.

The original vegetation types of the Gulf Prairie were tallgrass prairie and post oak savannah. However, trees and shrubs such as honey mesquite (*Prosopis glandulosa*), oaks (*Quercus*), and acacia (*Acacia*) have increased and thickened in many places. Characteristic oak species are live oak (*Quercus virginiana*) and post oak (*Q. stellata*). Typical acacias are huisache (*Acacia smallii*) and blackbrush (*A. rigidula*). Bushy sea-ox-eye (*Borreria frutescens*), a dwarf shrub, is also typical.

Principal climax grasses of the Gulf Prairie are Gulf cordgrass (*Spartina spartinae*), big bluestem (*Andropogon gerardii* var. *gerardii*), little bluestem (*Schizachyrium scoparium*), indiangrass (*Sorghastrum nutans*), eastern gamagrass (*Tripsacum dactyloides*), gulf muhly (*Muhlenbergia capillaris*), tanglehead (*Heteropogon contortus*), and many species of Panicum and Paspalum. Common increasers and invaders are yankeeweed (*Eupatorium compositifolium*), broomsedge bluestem (*Andropogon virginicus*), smutgrass (*Sporobolus indicus*), western ragweed (*Ambrosia psilostachya*), tumblegrass (*Schedonnardus paniculatus*), threeawns (*Aristida*), and many annual forbs and grasses. Pricklypear (*Opuntia*) are common throughout the area. Characteristic forbs include asters (*Aster*), Indian paintbrush (*Castilleja indivisa*), poppy mallows (*Callirhoe*), phloxes (*Phlox*), bluebonnets (*Lupinus*), and evening primroses (*Oenothera*) (Jones 1982).

The Gulf Marsh areas, being variously salty, support species of sedges (*Carex* and *Cyperus*), rushes (*Juncus*), bulrushes (*Scirpus*), several cordgrasses (*Spartina*), seashore saltgrass (*Distichlis spicata* var. *spicata*), common reed (*Phragmites australis*), marshmillet (*Zizaniopsis miliacea*), longtom (*Paspalum lividum*), seashore dropseed (*Sporobolus virginicus*), and knotroot bristlegrass (*Setaria geniculata*). Marshmillet and maidencane (*Panicum hemitomon*) are two of the most important grasses of the fresh-water marshes of the upper coast. Common aquatic forbs are pepperweeds (*Lepidium*), smartweeds (*Polygonum*), docks (*Rumex*), bushy seedbox (*Ludwigia alternifolia*), green parrotfeather (*Myriophyllum pinnatum*), pennyworts (*Hydrocotyle*), water lilies (*Nymphaea*), narrowleaf cattail (*Typha domingensis*), spiderworts (*Tradescantia*), and duckweeds (*Lemna*). Common halophytic herbs and shrubs on salty sands are spikesedges (*Eleocharis*), fimbries (*Fimbristylis*), glassworts (*Salicornia*), sea-rockets (*Cakile*), maritime saltwort (*Batis maritima*), morningglories (*Ipomoea*), and bushy sea-ox-eye (Jones 1982).

The low marshy areas provide excellent natural wildlife habitat for upland game and waterfowl. The higher elevations of the Gulf Marshes are used for livestock and wildlife production. Ranch units are mostly in large landholdings. These marshes and barrier islands contain most of our National Seashore parks. Urban, industrial, and recreational developments have increased in recent years. Most land is not well suited for cultivation because of periodic flooding and saline soils. The Gulf Prairies are used for crops, livestock grazing, wildlife production, and increasingly for urban and industrial centers. About one-third of the area is cultivated mostly for rice, sorghum, corn, and tame pastures. Bermudagrass and several introduced bluestems (*Dichanthium* and *Bothriochloa*) are common tame pasture grasses.

In the Gulf Prairies and Marshes, ranches are primarily cow-calf operations that use forage produced from rangeland and tame pasture. Some of the area is cropped. Zebu or crossbreeds having Zebu blood are the most widely adapted and used cattle. Recreation, hunting, and fishing provide excellent multiple-use opportunities in the Gulf Prairies and Marshes.

Of all the areas in Texas, the Gulf Prairies and Marshes have seen the greatest industrial development in history since World War II. Chief concentration has been from Orange and Beaumont to Houston, and much of the development has been in petrochemicals. Corpus Christi, the surrounding Coastal Bend region, and Brownsville and the adjacent Lower Rio Grande Valley area are rapidly developing naval, agricultural, and industrial sections.

### **2.1.3. Post Oak Savannah**

The Post Oak Savannah lies just to the west of the Pineywoods and mixes considerably with the Blackland Prairies area in the south. This area includes the entire Claypan land resource area of Texas, which is part of the Southern Coastal Plains. The Post Oak Savannah is a gently rolling, moderately dissected wooded plain.

Upland soils are gray, slightly acid sandy loams, commonly shallow over gray, mottled or red, firm clayey subsoils. They are generally droughty and have claypans at varying depths, restricting moisture percolation. The bottomland soils are reddish brown to dark gray, slightly acid to calcareous, loamy to clayey alluvial. Short oak trees occur in association with tallgrasses. Thicketization occurs in the absence of recurring fires or other methods of woody plant suppression. This distinctive pattern of predominantly post oak and blackjack oak (*Quercus marilandica*) in association with tallgrasses also characterizes the vegetation of the Cross Timbers and Prairies vegetational area. Associated trees are elms, junipers (*Juniperus*), hackberries (*Celtis*), and hickories. Characteristic understory vegetation includes shrubs and vines such as yaupon (*Ilex vomitoria*), American beautyberry, coralberry (*Symphoricarpos orbiculatus*), greenbriar, and grapes.

Climax grasses are little bluestem, indiangrass, switchgrass (*Panicum virgatum*), silver bluestem (*Bothriochloa saccharoides*), Texas wintergrass (*Stipa leucotricha*), brownseed paspalum, purpletop, narrow leaf woodoats (*Chasmanthium sessiliflorum*), and beaked panicum (*Panicum anceps*). Lower successional species include brownseed paspalum, threeawn, broomsedge bluestem, splitbeard bluestem (*Andropogon ternarius*), rosette grasses, and lovegrasses (*Eragrostis*).

Forbs similar to the true prairie species are wild indigo, indigobush (*Amorpha fruticosa* var. *augustifolia*), senna, tickclover, lespedezas (*Lespedeza*), prairie clovers (*Petalostemon*), western ragweed, crotons (*Croton*), and sneezeweeds (*Helenium*).

The area is well suited to grain crops, cotton, vegetables, and fruit trees. It was extensively cropped through the 1940's, but many acres have since been returned to native vegetation or tame pastures. Pasturelands have frequently been seeded with introduced species such as bermudagrass, bahiagrass, weeping lovegrass (*Eragrostis curvula*), and clover.

Deer, turkey, quail, and squirrel are perhaps the most economically important wildlife species for hunting enterprises although many other small mammals and birds exist in the region. The major livestock enterprise is mixed cow-calf-yearling operations with many small herds on small landholdings. Livestock use either tame pastures, native pastures, or the woodland areas for forage throughout the year. Wheat, oats, and rye are often planted for winter pasture.

### **2.1.4. Blackland Prairies**

The Blackland Prairie area intermingles with the Post Oak Savannah in the southeast and has divisions known as the San Antonio and Fayette Prairies. This rolling and well-dissected prairie represents the southern extension of the true prairie that occurs from Texas to Canada.

The upland blacklands are dark, calcareous shrink-swell clayey soils, changing gradually with depth to light marls or chalks. Bottomland soils are generally reddish brown to dark gray, slightly acid to calcareous, loamy to clayey and alluvial. The soils are inherently productive and fertile, but many have lost productivity through erosion and continuous cropping.

This once-luxuriant tallgrass prairie was dominated by little bluestem, big bluestem, indiangrass, tall dropseed (*Sporobolus asper* var. *asper*), and Silveus dropseed (*S. silveanus*). Minor species such as sideoats grama (*Bouteloua curtipendula*), hairy grama (*B. hirsuta*), Mead's sedge (*Carex meadii*), Texas wintergrass, and buffalograss (*Buchloe dactyloides*) have increased with grazing pressure. Common forbs are asters (*Aster*), prairie bluet (*Hedyotis nigricans* var. *nigricans*), prairie-clover, and late coneflower (*Rudbeckia serotina*). Common legumes include snoutbeans (*Rhynchosia*) and vetch. Mesquite, huisache, oak, and elm are common invaders on poor-condition

rangelands and on abandoned cropland. Oak, elm, cottonwood, and native pecan (*Carya*) are common along drainages.

About 98 percent of the Blackland Prairie was cultivated to produce cotton, sorghum, corn, wheat, and forages during the latter part of the 19th century and the first part of the 20th century. Since the 1950's, pasture and forage crops for the production of livestock have increased, and now only about 50 percent of the area is used as cropland. Tame pastures occupy more than 25 percent of the land area, and the rest is used as rangeland. Small remnants of native vegetation exist for grazing or for native hay production. Livestock production with both cow-calf and steer operations are the major livestock use. Winter cereals are used extensively for livestock grazing in conjunction with tame pasture forages. Potential is good for increased production of food and fiber crops as well as forages. Mourning dove and bobwhite quail on the uplands and squirrel along streams are the most important game species.

### **2.1.5. Cross Timbers and Prairies**

The Cross Timbers and Prairies area in North Central Texas includes the Cross Timbers, Grand Prairie, and North Central Prairies land resource areas. This area represents the southern extension of the Central Lowlands and the western extreme of the Coastal Plains.

The wide variances in geologic formations bring about sharp contrasts in topography, soils, and vegetation. Upland soils of both the East and West Cross Timbers are light, slightly acid loamy sands and sandy loams with yellowish brown to red clayey subsoils. Bottomland soils have small, dark, neutral to calcareous clayey areas, and loamy alluvial soils occur along the minor streams. Upland soils are dark, deep to shallow, and stony calcareous clays with subsoils of lighter, limy earths and limestone fragments. Bottomland soils are reddish brown, loamy to clayey calcareous alluvial. The North Central Prairies are interspersed with rapidly drained sandstone and shaley ridges and hills occupied by scrub live oak, juniper, and mesquite. Uplands are brown, sandy loam to silt loam, slightly acid soils over red to gray, neutral to alkaline clayey subsoils. Bottomland soils are brown to dark gray, loamy and clayey, neutral to calcareous, and alluvial.

Climax vegetation is composed primarily of big bluestem, little bluestem, indiangrass, switchgrass, Canada wildrye, minor amounts of sideoats grama, blue grama (*Bouteloua gracilis*), hairy grama, Texas wintergrass, and buffalograss. The minor species have generally increased with grazing. Invaders are hairy tridens (*Erioneuron pilosum*), Texas grama (*Bouteloua rigidiseta*), red lovegrass (*Eragrostis secundiflora*), wild barleys (*Hordeum*), threeawns, fringed-leaf paspalum (*Paspalum setaceum* var. *ciliatifolium*), and tumble windmillgrass (*Chloris verticillata*). This area once contained significant amounts of prairie forbs such as western ragweed, littenout sedge (*Carex microrhyncha*), heath aster (*Aster ericoides*), gayfeathers (*Liatris*), lespedeza, sageworts (*Artemisia*), and tephrosias (*Tephrosia*) (Dyksterhuis 1948).

Past mismanagement and cultivation have caused the uplands to be covered mostly by scrub oak, mesquite, and juniper with mid-and shortgrass understories. The bottomland trees are primarily hardwoods such as pecan, oak, and elm but have been invaded by mesquite. Characteristic understory shrubs and vines include skunkbush (*Rhus aromatica*), saw greenbrier (*Smilax bona-nox*), bumelia (*Bumelia lanuginosa*), and poison-ivy.

About 75 percent of the Cross Timbers and Prairies vegetational area is used as range and pasture. Major crops on the sandy Cross Timber soils are peanuts, fruits, sorghum, wheat, oats, corn, and forages. Dairy operations are common, but beef cattle cow-calf operations are the predominant livestock activities. Sheep and goat operations occur in the southern parts. Most holdings are small mixed farming and ranching operations.

White-tailed deer, raccoon, squirrel, quail, and mourning dove are locally plentiful and provide some commercial hunting. Stock ponds and lakes on tributaries of the Brazos River (Hubbard Creek and Possum Kingdom Lake) and the Trinity River provide recreational fishing.

### 2.1.6. South Texas Plains

The South Texas Plains lie south of a line from San Antonio to Del Rio. This area is the western extension of the Gulf Coastal Plains merging with the Mexico Plains on the west. The area is a nearly level to rolling, slightly to moderately dissected plain. Upland soils are of three groups: dark, clayey soils over firm clayey subsoils; grayish to reddish brown, loamy to sandy soils; and brown loamy soils. Gray, clayey, saline, and sodic soils are extensive on the coastal fringe, along with Galveston deep sands. Bottomlands are typically brown to gray, calcareous silt loams to clayey alluvial soils.

The original vegetation was an open grassland or savannah-type along the coastal areas and brushy chaparral-grassland in the uplands. Originally, oaks and mesquite and other brushy species formed dense thickets only on the ridges, and oak, pecan, and ash were common along streams. Continued grazing and cessation of fires altered the vegetation to such a degree that the region is now commonly called the Texas Brush Country. Many woody species have increased, including mesquite, live oak, acacia, brazil (*Zizyphus obovata*), spiny hackberry (*Celtis pallida*), whitebrush (*Aloysia gratissima*), lime pricklyash (*Zanthoxylum fagara*), Texas persimmon (*Diospyros texana*), shrubby blue sage (*Salvia ballotiflora*), and lotebush (*Zizyphus obtusifolia*).

Characteristic grasses of the sandy loam soils are seacoast bluestem (*Schizachyrium scoparium* var. *littorale*), bristlegasses (*Setaria*), paspalums, windmillgrasses (*Chloris*), silver bluestem, big sandbur (*Cenchrus myosuroides*), and tanglehead. The dominants on the clay and clay loams are silver bluestem, Arizona cottontop (*Digitaria californica*), buffalograss, common curlymesquite (*Hilaria belangeri*), and species of *Setaria*, *Pappophorum*, and *Bouteloua*. Low saline areas are characterized by gulf cordgrass, seashore saltgrass, alkali sacaton (*Sporobolus airoides*), and switchgrass. Forbs include pricklypear, orange zexmania (*Zexmania hispida*), bush sunflowers (*Simsia*), velvet bundleflower (*Desmanthus velutinus*), tallowweeds (*Plantago*), lazy daisies (*Aphanostephus*), Texas croton (*Croton texensis*), and western ragweed. Grasses of the oak savannahs are mainly little bluestem, Indiangrass, switchgrass, crinkleawn (*Trachypogon secundus*), and species of *Paspalum*. Pricklypear is characteristic throughout most of the area. Forbs generally associated with all but the most saline soils are bush sunflower, orange zexmania, shrubby oxalis (*Oxalis berlandieri*), white milkwort (*Polygala alba*), American snoutbean (*Rhynchosia americana*), and greenthread (*Thelesperma nuecense*).

Because the South Texas Plains lie almost entirely below the hyperthermic line, introduced tropical species do well. The introduced species buffelgrass (*Cenchrus ciliaris*) has proliferated and is common on loamy to sandy soils in the western half of the area. Coastal bermudagrass, kleingrass (*Panicum coloratum*), and rhodesgrass (*Chloris gayana*) are also common introduced species in tame pastures.

Range is the major land use, but irrigated and dryland cropping of cotton, sorghum, flax, small grains, and forages are also important. Citrus, vegetables, and sugarcane do well in the Lower Rio Grande Valley. Many acres are in large landholdings, such as the King Ranch. Livestock production is primarily cow-calf range operations, and wildlife production for hunting and recreational use is becoming increasingly important. The South Texas Plains vegetational area is known nationwide for its large white-tailed deer. Quail, mourning dove, turkey, feral pigs, and javelina are other major game species. Stocker operations and feedlot operations are intermixed with cow-calf operations. Sheep and goat enterprises, once common throughout the area, are now confined mostly to the northern part because of coyote predation. Integrated use of range, crops, and forages is increasing as is vegetable and peanut production where irrigation is possible.

### 2.1.7. Edwards Plateau

The Edwards Plateau area includes 1.45 million acres known as the Granitic Central Basin in Llano and Mason Counties. The Balcones Escarpment forms the distinct boundary of the Edwards Plateau on its eastern and southern borders and outlines what is known as the Texas Hill Country.

The area is a deeply dissected, rapidly drained stony plain having broad, flat to undulating divides. The original vegetation was grassland or open savannah-type plains with tree or brushy species found along rocky slopes and

stream bottoms. Tallgrasses such as cane bluestem (*Bothriochloa barbinodis* var. *barbinodis*), big bluestem, indiangrass, little bluestem, and switchgrass are still common along rocky outcrops and protected areas having good soil moisture. These tallgrasses have been replaced on shallow xeric sites by midgrasses and shortgrasses such as sideoats grama, buffalograss, and Texas grama.

The western part of the area comprises the semiarid Stockton Plateau, which is more arid and supports short-to midgrass mixed vegetation. The climax grasses are cane bluestem, little bluestem, sideoats, hairy grama, common curlymesquite, buffalograss, fall witchgrass (*Leptoloma cognatum* var. *cognatum*), and Tridens and Elymus. Tobosa (*Hilaria mutica*) forms dense stands in conjunction with burrograss (*Scleropogon brevifolius*). Common forbs are Engelmann daisy (*Engelmannia pinnatifida*), orange zexmania, bush sunflower, western ragweed, and sneezeweed. Bitterweed (*Hymenoxys odorata*), broadleaf milkweed (*Asclepias latifolia*), smallhead sneezeweed (*Helenium microcephalum*), broomweeds (*Amphiachyris* and *Gutierrezia*), prairie coneflower (*Ratibida columnifera*), mealycup sage (*Salvia farinacea* var. *farinacea*), tasajillo (*Opuntia leptocaulis*), and pricklypear are common on overgrazed ranges.

Common woody species are live oak, sand shin oak (*Quercus havardii*), post oak, mesquite, and juniper. The eastern and southern edges of the Stockton Plateau support dense stands of ashe juniper (*Juniperus ashei*), whereas redberry juniper (*Juniperus pinchotii*) increases to the north and west.

The Edwards Plateau is 98 percent rangeland; arable lands are found only along narrow streams and some divides. The rangeland is used primarily for mixed livestock (combinations of cattle, sheep, and goats) and wildlife production. The area is the major wool-and mohair-producing region in the United States, providing perhaps 98 percent of the nation's mohair. It also supports the largest deer population in North America. Most ranches are managed for livestock as the major enterprise, but wildlife production is becoming increasingly important. Exotic big-game ranching is becoming important, and axis, sika, and fallow deer and blackbuck antelope are increasing in number (Traweek 1985). Management for all resources, livestock, wildlife, and recreation, provides the best use of the rangeland although other products such as cedar oil and wood products have local importance. Forage, food, and fiber crops such as sorghum, peanuts, plums, and peaches are well adapted to arable land.

### **2.1.8. Rolling Plains**

The Rolling Plains area (24 million acres) coincides with the Rolling Plains land resource area of the southern Central Lowlands. The area is between the High Plains and the Cross Timbers and Prairies in the northern part of the state. It is a nearly level to rolling plain having moderate to rapid surface drainage. Soils of the uplands are pale brown to reddish brown to dark grayish brown, neutral to calcareous sandy loams, clay loams, and clays. Saline soils are common, as are shallow and stony soils with pockets of deep sand. Bottomlands have only minor areas of reddish brown, loamy to clayey, calcareous alluvial soils.

The original prairie vegetation included tall-, mid-, and shortgrasses such as little bluestem, big bluestem, sand bluestem (*Andropogon gerardii* var. *paucipilus*), sideoats grama, indiangrass, switchgrass, hairy grama, blue grama, and buffalograss on the uplands, and Canada wildrye, and western wheatgrass (*Elytrigia smithii*) on the moister sites. Buffalograss, common curlymesquite, tobosa, threeawns, sand dropseed (*Sporobolus cryptandrus*), and hooded windmillgrass (*Chloris cucullata*) are more common on the more xeric or overgrazed sites. Climax forbs include western yarrow (*Achillea millefolium*), broadleaf milkweed, Lambert crazyweed (*Oxytropis lambertii*), prairie coneflower, and slimleaf scurfpea (*Psoralea tenuiflora*). Western ragweed and annual broomweed are common invaders. Plant retrogression under continued overgrazing and reduction of fires is from a mid- and tallgrass-dominated community to shortgrasses, shrubs, and annuals.

Mesquite, lotebush, pricklypear, algerita (*Berberis trifoliolata*), and tasajillo are common invaders on all soils. Shinnery oak and sand sagebrush (*Artemisia filifolia*) invade the sandy lands, and redberry juniper has spread from rocky slopes to grassland areas. Dense stands of these species can be found throughout the Rolling Plains on overgrazed rangeland and abandoned cropland.

More than 75 percent of the area is rangeland, but dryland and irrigated sorghum, small grain, cotton, and forages are important crops. Livestock production, the major enterprises being cow-calf and yearling operations, includes use of rangeland forage, crop residue, and winter cereals. The intermixing of rangeland and cropland allows habitat for wildlife such as mourning dove, quail, white-tailed deer, and turkey, providing good to excellent recreational hunting opportunities.

#### **2.1.9. High Plains**

The High Plains area is part of the Southern Great Plains. It is separated from the Rolling Plains by the Llano Estacado Escarpment and dissected by the Canadian River Breaks in the northern part. Notable canyons include Tule and Palo Duro along the Caprock. This relatively level plateau contains many shallow siltation depressions, or playa lakes, which sometimes cover as much as 40 acres and contain several feet of water after heavy rains. These depressions support unique patterns of vegetation within their confines.

The upland soils are dark brown to reddish brown, mostly deep, neutral to calcareous clay and clay loams in the north to sandy loams and sands in the south. Caliche is present under many soils at various depths, especially on the Potter series. The original vegetation of the High Plains was variously classified as mixed prairie, shortgrass prairie, and in some locations on deep, sandy soils as tallgrass prairie. Blue grama, buffalograss, and galleta (*Hilaria jamesii*) are the principal vegetation on the clay and clay loam sites. Characteristic grasses on sandy loam soils are little bluestem, western wheatgrass, sideoats grama, and sand dropseed. Shinnery oak and sand sagebrush are restricted to sandy sites. The High Plains area characteristically is free from brush, but sand sagebrush and western honey mesquite (*Prosopis glandulosa* var. *torreyana*) have invaded the sandy and sandy loam sites along with pricklypear and yucca (*Yucca*). Several species of dropseeds (*Sporobolus*) are abundant on coarse sands. Various aquatic species such as curltop smartweed (*Persicaria lapathifolia*) are associated with the playa lakes. Forbs common to deep hardlands are slimleaf scurfpea, prairie coneflower, croton, fineleaf woollywhite (*Hymenopappus filifolius* var. *cinereus*), woolly loco (*Astragalus mollissimus* var. *mollissimus*), plains beebalm (*Monarda pectinata*), and tallow-weed (*Plantago patagonia*).

About 60 percent of the area is cropland, half of which is irrigated. Cotton, corn, sorghum, wheat, vegetables, and sugar beets are major crops. Winter cereals are used for stocker operations in preparation for feedlotting on the extensive grain supplies produced on the High Plains. Rangeland grazing is important on about 40 percent of the area. Few cow-calf operations exist, but stocker operations are common.

High winds, dry winters, and low annual rainfall present problems for cultivation and erosion control. As ground-water availability diminishes, use of pasture and range for livestock production increases.

Antelope were once common, but now only remnant populations provide hunting. Quail and mourning dove are abundant, and mule deer, turkey, and exotic aoudad sheep provide hunting along the breaks and canyons of the Caprock. Many playa lakes provide excellent migratory waterfowl habitat.

#### **2.1.10. Trans-Pecos**

The **Trans-Pecos** area in Far West Texas is traversed by the eastern chain of the Rocky Mountains into the Basin and Range Province and is typical of the southwestern United States. Guadalupe Peak, having an elevation of 8,751 feet, of the Guadalupe Mountains, is the highest point in Texas. Surrounding peaks are El Capitan, Shumard, Bartlett, and Pine Top, all exceeding 8,000 feet. Mount Emory in the Chisos Mountains and Mount Locke in the Davis Mountains are 7,825 feet and 8,382 feet high, respectively. Notable canyons and gorges are Santa Elena, Boquillas, and Mariscal on the Big Bend of the Rio Grande; and McKittrick in the Guadalupe Mountains.

Uplands soils are mostly light reddish-brown to brown clay loams, clays, and sands over reddish, loamy to clayey, calcareous, gypsic or saline subsoils. These include many areas of shallow soils and rocklands. Sizeable areas of deep sands exist. Drainage is rapid in the mountains, slow in the basins, and absent in the bolsons.



The original vegetation ranged from desert grassland and desert shrub on lower slopes and elevations through juniper, pinyon pine (*Pinus edulis*), and Mexican pinyon (*P. cembroides*) at mid elevations. The mountains support ponderosa pine (*Pinus ponderosa*) and forest vegetation on the higher slopes. Principal vegetation types of the basins are creosotebush (*Larrea tridentata*), tarbush (*Flourensia cernua*), catclaw acacia (*Acacia greggii*), catclaw mimosa (*Mimosa biuncifera*), whitethorn (*Acacia constricta*), yucca and juniper savannahs, and tobosa flats. Alkali sacaton and species of saltbush (*Atriplex*) occur on saline soils. Characteristic species of the plateaus and canyons are chino grama (*Bouteloua breviseta*), leatherstem (*Jatropha dioica* var. *dioica*), ocotillo (*Fouquieria splendens*), candelilla (*Euphorbia antisyphilitica*), lechuguilla (*Agave lecheguilla*), and sotols (*Dasyllirion*).

The grass vegetation, especially on the higher mountain slopes, includes many southwestern and Rocky Mountain species not present elsewhere in Texas. Examples are Arizona fescue (*Festuca arizonica*) and mountain muhly (*Muhlenbergia montana*). On the desert flats, black grama (*Bouteloua eriopoda*) and tobosa have mostly been replaced by burrograss and fluffgrass (*Dasyochloa pulchella*). More productive sites have numerous species of grama (*Bouteloua*), muhly (*Muhlenbergia*), dropseed (*Sporobolus*), and perennial threeawn (*Aristida*) grasses. At the higher elevations, little bluestem and Texas bluestem (*Schizachyrium cirratum*), sideoats and blue grama, pinyon ricegrass (*Piptochaetium fimbriatum*), wolftail (*Lycurus phleoides*), and several species of *Stipa* are common.

Poisonous plants present considerable problems in this harsh environment. Major toxic species are threadleaf groundsel (*Senecio douglasii*), broom snakeweed (*Gutierrezia sarothrae*), rayless goldenrod (*Isocoma wrightii*), sacahuista (*Nolina texana*), lechuguilla, twoleaf senna (*Cassia roemeriana*), and loco (*Astragalus*).

Under poor grazing management, range sites become more xeric, and perennial grassland vegetation gives way to desert shrub and annual forbs and grasses. Creosotebush and tarbush complexes now cover some 15 million acres of former desert grassland in the Trans-Pecos area. Tobosa draws, which once produced considerable forage, were invaded by burrograss and annuals as grazing pressure increased. Without the cover of perennial grass, the soils are subject to sheet and arroyo erosion from the intense summer thunderstorms.

More than 95 percent of the area remains as rangeland. Irrigated crops along the Rio Grande and other small drainages contribute to the economy. Cotton, alfalfa, sorghum, cantaloupe, sugar beets, grapes, and vegetables are grown. Most ranching operations are for livestock (cattle and sheep) production although management for mule deer, antelope, dove, and quail is important. Most livestock operations are cow-calf, and some stockers are carried over to use forages and irrigated fields.

## 2.2 Brush in Texas

All major land resource areas (MLRA) in Texas have significant brush infestations; however, different species predominate in different regions. Table 2.1 shows the major brush species and level of infestation in Texas based on brush surveys in 1982 and 1987 and 1991. These acreages illustrate the magnitude of Texas' brush problem. While not all species of brush are significant users of water, prickly pear, for example, others such as juniper, mesquite, and salt cedar have been shown to drastically reduce water yield in a watershed.

In addition, landowners are reporting increased infestations of huisache and Carrizo cane (Arrondo Donax).

**Table 2.1. Acres of brush for different species and density ranges in Texas from USDA-NRCS 1982 and 1987 brush surveys. (compiled from TSSWCB, 1991)**

<i>Species</i>	Light Canopy 1-10% Cover		Moderate Canopy 11-30% Cover		Heavy Canopy >30% Cover	
	<i>1982</i>	<i>1987</i>	<i>1982</i>	<i>1987</i>	<i>1982</i>	<i>1987</i>
Agarito	8,370,500	5,336,100	303,500	272,700	29,500	11,600
Ashe juniper	4,398,300	2,875,300	2,000,800	1,949,300	1,214,700	1,904,400
Baccharis	288,800	122,000	44,200	25,700	7,000	9,000
Blackbrush	3,780,100	2,167,200	2,068,400	2,445,000	602,200	623,000
Blackjack oak	765,700	401,700	365,700	164,200	52,500	50,500
Broom snakeweed	5,560,300	2,607,700	1,987,700	2,512,800	270,600	967,200
Catclaw acacia	7,045,400	3,554,200	611,600	335,700	13,700	1,700
Cenizo	258,300	107,300	12,500	21,000	0	0
Chinese Tallow <sup>1</sup>						507,400
Condalia/lotebush	9,168,400	6,991,700	551,100	594,000	88,300	23,100
Creosotebush	4,830,600	4,212,500	3,027,000	2,324,300	246,200	134,800
Eastern red cedar	633,800	374,700	166,900	101,000	97,000	27,900
Elbowbush	331,600	174,800	69,700	60,800	13,600	1,600
Elms	1,939,800	996,000	671,400	553,500	315,600	341,100
Granjeno	4,939,400	3,374,100	486,000	735,000	86,800	1,200
Guajillo	1,975,400	1,162,300	981,200	1,081,600	239,600	401,200
Huisache	745,700	589,900	194,000	145,500	63,500	46,600
Live oak	6,067,500	4,321,000	3,401,500	4,141,600	1,112,500	1,076,100
Macartney rose	176,100	70,300	56,900	146,000	21,900	0
Mesquite	32,162,700	24,936,500	14,690,900	16,670,800	4,262,900	5,610,000
Post oak	2,027,200	1,277,500	1,642,300	1,524,900	1,642,400	1,536,200
Prickly pear	28,688,500	19,642,000	1,686,100	2,176,200	170,900	189,200
Redberry juniper	6,900,600	6,133,600	2,532,400	2,707,800	414,700	558,300
Saltcedar <sup>2</sup>					563,500	
Sand sagebrush	2,764,300	2,494,600	1,032,700	1,168,800	239,800	292,700
Sand shinoak	301,600	60,100	350,200	257,200	362,000	600,900
Tarbush	2,301,600	2,083,300	791,300	594,900	50,300	85,500
Tasajillo	4,475,800	3,092,000	271,500	283,100	16,600	0
Texas persimmon	5,833,600	3,315,900	850,600	767,600	124,200	54,400
Twisted acacia	1,061,500	748,000	156,800	181,600	0	0
Whitebrush	2,593,500	1,663,000	605,800	763,000	184,400	318,800
Yaupon	831,000	515,900	568,700	654,100	322,600	205,300
Yucca	13,353,800	8,279,600	601,300	499,300	12,600	0

1. Chinese tallow infestation for 1990 from a 1991 survey by NRCS. Infestation by the year 2000 was estimated at over 900,000 acres. Percent canopy cover was not provided.

2. Saltcedar infestation from 1982 USDA-NRCS brush survey.

## Section III: Increasing Water Yields with Rangeland Management

Water yield (runoff and deep drainage) can be estimated using the following water balance equation:

$$\text{Runoff} + \text{Deep Drainage} = \text{Precipitation} - \text{Evapotranspiration}.$$

The components of the water balance equation are defined as follows:

**Evapotranspiration.** The combination of transpiration and evaporation where:

**Transpiration.** The process by which water vapor is released to the atmosphere by passing through leaf tissue.

**Evaporation.** The process by which water vapor enters the atmosphere from the soil or surface water.

Another source of evaporation is precipitation that has adhered to plants which then directly passes back to the atmosphere — this is known as interception loss.

**Runoff.** Water that exits the watershed via overland flow.

**Deep Drainage.** Water that exits the watershed via percolating through the soil beyond the reach of plant roots.

This implies that water yield can be increased if evapotranspiration can be decreased through vegetation management (Thurrow 1998).

Many variables influence the degree to which water will exit a site via evapotranspiration, runoff or deep drainage.

**Climatic factors.** Precipitation characteristics such as amount, intensity, distribution over time, and form (i.e., rain or snow) influence the likelihood of runoff and deep drainage. It is more likely that runoff will occur when the rainfall is intense and/or occurs as large, prolonged storms. Deep drainage is most likely during prolonged rainy periods. If the rainfall is gentle and occurs in a series of small storms the chance for water yield is much lower.

The potential evapotranspiration rate is influenced by temperature, humidity and wind. In an arid environment the water will quickly evaporate from the soil and the transpiration demand from plant leaves will be very high. A high potential evapotranspiration rate lowers the chances that water will have the time needed to percolate through the soil profile and escape uptake by plant roots. Many aquifers have a better chance of recharging during the winter because many of the plants have lost their leaves and because the low temperature results in a low evapotranspiration rate.

**Vegetation factors.** The leaf surface area and type of cover determine the amount of water that can be held in the canopy and evaporate back to the atmosphere (interception loss). At the Texas Agriculture Experiment Station in Sonora, Texas it was documented that juniper and the associated litter have an annual interception loss averaging 73% of precipitation, compared with 46% interception loss for live oak and 14% interception loss for grass (Thurrow and Hester 1997). These data dramatically indicate that the amount of water reaching the soil is markedly different among vegetation types. The leaf surface area and type of cover also influence the amount of water that will return to the atmosphere via transpiration. On rangelands with a dense juniper cover essentially all of the rainfall returns to the atmosphere by either evaporation (in the form of interception loss) or transpiration (i.e., the small amount of water that does reach the soil is taken up by the trees). Therefore, rangeland with dense juniper cover would have little potential for water yield compared to a grassland, which has a much lower evapotranspiration loss and allows more water to leave the site via either runoff or deep drainage.

The amount and type of cover are often the most important variables affecting infiltration rate (water movement into the soil) at a particular site. Plant cover dissipates the erosive energy of raindrops before they strike the soil. If cover is not present, the pores into the soil will likely be clogged with soil particles dislodged by raindrop impact. This creates a “wash-in” layer at the soil surface which restricts infiltration and accelerates erosion. In extreme situations a crust forms on the soil surface. Since maintenance of productivity potential is an inherent characteristic of sound range management, accelerated erosion resulting from degraded infiltration characteristics is not acceptable. It is,

therefore, important to maintain a type of cover that will protect the soil while having as little evapotranspiration loss as possible. On Texas rangelands, a healthy grass cover can hold the soil in place and will have the lowest evapotranspiration (and highest water yield) of the sustainable vegetation cover options.

**Soil factors.** The texture and structure of the soil is a primary determinant of how fast water can percolate through the soil. The textural and structural characteristics combined with soil depth determine how much water can be stored in the soil after it has had a chance to drain (field capacity). The geologic characteristics underlying the soil influence the amount of and rate at which water will exit a site via deep drainage. For example, the Edwards Plateau is characterized by shallow soils with a rapid infiltration rate underlain by fractured limestone. Consequently, the potential for deep drainage leading to aquifer recharge is high. Deep, coarse-textured soils, such as those overlying the Carrizo-Wilcox aquifer, also have a high aquifer recharge potential because of their rapid transmissive characteristics and low water retention capacity. These characteristics make it likely that much of the water yield associated with a change from brush to grass dominance will occur as deep drainage. In contrast, a typical site in the Rolling Plains ecoregion of North-Central Texas is characterized by deep silty clay soil with a high water retention capacity and a slow drainage rate. As a result, very little water is lost to deep drainage (Carlson et al. 1990). The same is true of the clay soils of the Blackland Prairie ecoregion. Any extra water yield associated with a change from brush to grass dominance on a site with poor deep drainage potential will likely occur as runoff.

**Topographic factors.** The steepness and length of slope affects the potential for runoff and the erosion hazard. It is generally accepted forestry practice that trees should not be cleared from hillsides with a 20% slope or more (FAO 1977). Many areas in Central Texas with slopes of this magnitude were historically forested “cedar breaks,” probably because the associated rocky character made it difficult for them to sustain a natural fire. These sites should not be considered for brush control efforts intended to increase water yield.

The basis for using brush management to increase water yield is founded on the premise that shifting vegetation composition from species associated with high evapotranspiration potential (trees and shrubs) to species with lower evapotranspiration potential (grass) will increase water yield. Water yield tends to decrease as woody cover increases because, compared to grasses, trees and shrubs have:

- (1) a more extensive canopy which catches precipitation which evaporates back to the atmosphere (i.e., interception loss),
- (2) a greater leaf area from which transpiration can occur,
- (3) a more extensive root system with greater access to soil water,
- (4) a greater ability to extract water from very dry soil, and
- (5) many invasive woody species that are evergreen allowing rapid resumption of water use when it becomes available (as opposed to most grasses which senesce during dry periods and require time to re-establish green tissue).

Climate and soil traits influence whether reduction in transpiration and interception losses resulting from brush to grass conversion would be offset by increased evaporation from soil. An analysis of climate, evapotranspiration, and field runoff measurements indicated that sites with tree and shrub communities in the Colorado River basin of the western U.S. need to receive over 18 inches/year of precipitation and need to have a potential evapotranspiration of over 15 inches/year to yield significantly more water if converted to grasslands (Hibbert 1983). Since all regions of Texas have a potential evapotranspiration of over 15 inches/year, these data suggest that a reasonable criteria for deciding where brush control is likely to increase water yield is to concentrate on areas that receive at least 18 inches of rain/year.

In general, conversion of cover from brush to grass does not influence water yield on sites that receive less than 18 inches/year because the extra water that reaches the ground and the reduced transpiration loss is offset by high evaporation from the soil. An exception to this is saltcedar which grows in riparian areas and extracts water from shallow aquifers recharged by the source stream or waterbody. Studies in many other forest and rangeland

ecosystems throughout the world corroborate that a water yield increase can occur when the dominant vegetation cover is shifted from brush to grass (cf. Douglass, 1983; Jofre and Randal, 1993) in areas that receive at least 18 inches/year precipitation and have at least 15 inches/year potential evapotranspiration.

### **3.1 Increased Water Yield in Texas**

Very few field studies in Texas have attempted to measure water yield enhancement by brush control at a catchment scale. Research on the Texas A&M Agricultural Research Station at Sonora shows that there is a very significant water yield potential associated with converting brush to grassland on a site with these characteristics (over 18 inches of rain/year, shallow soils with high infiltration rates overlying fractured limestone, dense juniper oak woodland cleared and replaced with shortgrass and midgrass species). These data were collected over a 10-year period from seven 10-acre catchments and supplemented with data on water movement through the soil using 45 x 45 x 30 inch weighing lysimeters.

Similar estimates of vegetation effects on water yield were made for the Cusenbary Draw Watershed, which includes part of the Texas Agriculture Experiment Station at Sonora within the watershed. The Cusenbary Draw Watershed estimates were derived independently of the field data estimates and were obtained using the Simulation of Production and Utilization of Rangelands (SPUR-91) model (Redeker et al. 1998). The SPUR-91 model has been validated to be an effective tool for estimating water yield and livestock carrying capacity on range sites throughout Texas (Carlson et al. 1995, Carlson and Thurow 1996). Aerial photographs were used to form a composite photograph of the watershed for both 1955 and 1990. The amount of woody cover in 1955 and 1990 and the rate of change between these dates was calculated using image analysis technologies on each of the five range sites delineated within the watershed (Redeker 1998). Literature and expert opinion were used to validate and refine the aerial photo composition estimates of woody (juniper, oak, mesquite) and herbaceous (bunchgrass, shortgrass, forbs) cover.

Both the field study and modeling investigations conclude that water yield increases exponentially as brush cover declines in the treated area (i.e., very little change in water yield from dense brush canopy cover to about 15% brush canopy cover and a rapid rise in water yield from 15% to 0% brush canopy cover). These findings imply that it is necessary to remove most of the brush in the treatment area to maximize water yield potential. This conclusion is corroborated by numerous anecdotal observations by ranchers and agency personnel with brush control experience in the region (cf. Kelton 1975, Willard et al. 1993). The exponential pattern of water yield increase relative to a decrease in brush cover has also been postulated for the Colorado River Basin (Hibbert 1983). The exponential relationship is believed to occur because the intraspecific competition among trees (Ansley et al. 1998) and interspecific competition with herbaceous vegetation results in little increase in water yield until the tree density becomes sparse. In other words, trees have a capability for luxuriant water use. If a stand is thinned the remaining trees will in a short time expand their root systems to use the extra water. Only when the thinning reduces tree cover to less than about 15% in a specific area is there a potential for significant yields of water. It should be noted that the brush canopy reflects the average density over the treated area, not necessarily the total number of plants in a watershed. For example, 25% of a watershed could be left untreated to allow for wildlife habitat, while the remaining 75% could be treated to 0% canopy cover. Then the 75% of the watershed that is treated could have a significant improvement in water yield, while the untreated portion would have no change from the present condition.

In an attempt to summarize these scientific findings, Dr. Allan Jones and Lucas Gregory of the Texas Water Resource Institute, Texas A & M AgriLife conclude:

For several decades, land managers have cleared brush species, such as mesquite and juniper (cedar), and observed increases in spring and streamflows. Scientists have also conducted numerous studies in which they have measured the effects of brush removal on different species of rangeland hydrology. These include the amount of rainfall that is intercepted and held by the plant leaves, surface runoff, spring flow, water use by individual plants and plant

communities, fluctuation of shallow water tables, and streamflows. Considering this very diverse information, many scientists agree on several points:

1. The roots of some brush species extract water from greater depths than do grasses and forbs, and brush control can reduce the total amount of water used by vegetation.
2. Brush and other deep-rooted vegetation growing over shallow aquifers near streams can be expected to use large amounts of groundwater, likely reducing the amount in both the interconnected stream and aquifer.
3. Removal of brush like juniper and live oak from upland areas some distance from streams may increase streamflow and/or recharge aquifers especially when:
  - a. The brush canopy is dense and intercepts substantial amounts of rainfall (for example: dense juniper [cedar] or live oak strands), effectively reducing the amount of rainfall reaching the soil surface, and
  - b. Soils, subsoils and/or geologic strata are permeable, and streams in the area are fed by seeps and springs. Water can quickly percolate below the roots of grasses and forbs and move through subsurface pathways to local streams or aquifers.
4. Brush control in upland areas is unlikely to increase significantly water yields if soils and geologic formations are not conducive to increased runoff and/or subsurface flows to streams or to aquifers.
5. For brush control to have substantial long-term impacts on water yield, most or all of the woody vegetation in the treated area should be killed, and regrowth of brush and herbaceous vegetation should be controlled so that it is less dense and more shallow rooted than the pretreatment vegetation.
6. New science-based tools can help pinpoint locations where brush control should substantially increase water flows in streams.
7. A geographically targeted brush control program with careful scientific verification of impacts is needed to guide long-term brush control policies (Jones and Gregory 2008).

Beginning in 1998, TSSWCB, in cooperation with TAES, TWDB, USDA-NRCS, UCRA, LCRA has conducted watershed feasibility modeling studies to estimate the potential water yield in thirteen watersheds across Texas. Each watershed was divided into subbasins, and the potential water yield for each of the subbasins was estimated.

- North Concho River Basin
- Edwards Aquifer recharge zone
- Nueces River Basin
- Wichita River Basin
- Concho River Basin
- Upper Colorado River Basin
- Pedernales River Basin
- Canadian River Basin
- Frio River Basin
- Palo Pinto Lake Basin
- Lake Fort Phantom Hill Basin
- Lake Brownwood Basin
- Lake Arrowhead Basin

These studies have been invaluable in guiding the brush control program. Additional watershed studies are still needed in areas with watershed needs if funding becomes available.

## **Section IV: The Brush Control Law**

### **4.1 Overview**

The Texas Brush Control Program was created by Senate Bill 1083 of the 69<sup>th</sup> Legislature in 1985. SB1083 amended Title 7, Agriculture Code by adding Chapter 203, Brush Control. The Brush Control Program was amended in 2003 by Senate Bill 1828 of the 78<sup>th</sup> Regular Legislature. The responsibility for the Program is given to the Texas State Soil and Water Conservation Board. Appendix I contains Chapter 203 of the Agricultural Code.

Some key points in the law are as follows:

- Sec. 203.001. “Brush Control” is defined
- Sec. 203.011. The Board, with assistance of local districts, shall administer the brush control program.
- Sec. 203.012. The Board, after consulting with local districts, shall adopt rules to carry out this chapter.
- Sec. 203.013. Responsibilities may be delegated to local districts.
- Sec. 203.016. The Board shall consult with the Texas Water Development Board; the Texas Department of Agriculture, and the Parks and Wildlife Department.
- Sec. 203.051. The Board shall prepare and adopt a State brush control plan.
- Sec. 203.052. The Board shall hold a hearing on the proposed plan.
- Sec. 203.053. Criteria for ranking areas are specified. The board shall give priority to areas with the most critical water conservation needs with the highest potential for substantial water conservation.
- Sec. 203.054. The Board shall review the plan every two years.
- Sec. 203.055. The Board must approve all methods used to control brush.
- Sec. 203.056. Before January 31 of each year, the Board must report to the governor, speaker, and lieutenant governor on the activities of the program during the previous year.
- Sec. 203.101 Each district may administer the aspects of the brush control program within their jurisdiction.
- Sec. 203.102. The Board shall prepare and distribute information to each district concerning procedures for processing cost-sharing assistance applications.
- Sec. 203.103. Districts may accept and comment on applications for cost-sharing. After review, the district shall submit the application and comments to the Board.
- Sec. 203.104. Districts may inspect and supervise projects within their jurisdiction on behalf of the board..
- Sec. 203.151. A cost-sharing program is created.
- Sec. 203.152. A “Brush Control Fund” is created.
- Sec. 203.154. The State’s portion of the cost-sharing is limited to 70 percent. Special provisions for political subdivisions and cost-sharing on public lands and a Board exception for a project in joint participation with a federal program is provided in the law.
- Sec. 203.156. Applications for cost-sharing must be filed with the district in which the land for the project is located.
- Sec. 203.157 – 203.158. Considerations and conditions of application approval are specified.
- Sec. 203.160. The board or a designated district shall negotiate contracts with successful applicants.
- Sec. 203.161. Districts may administer State money as required by a cost-sharing contract.



#### **4.2 Responsibilities of the State Board Under Title 7, Chapter 203, Texas Agriculture Code**

1. The Board has jurisdiction over and shall administer the Brush Control Program.
2. The Board shall adopt reasonable rules that are necessary to carry out the Program.
3. The Board shall consult with the Texas Parks and Wildlife Department.
4. The board shall prepare and adopt a State Brush Control Plan
  - a. must include a comprehensive strategy for managing brush in those areas where brush is contributing to a substantial water conservation problem
  - b. must designate areas of critical need in the State
5. The Board shall hold a hearing on the proposed plan.
6. The Board shall review the plan every two years.
7. The Board must report to the Governor, Speaker, and Lieutenant Governor on the activities of the Program during the previous year.
8. The Board must approve all brush control methods used under the Program.
9. The Board shall prepare and distribute all the information necessary for participation in the Program to all districts.
10. If the demand for cost-share funds is greater than funds available, the Board may establish priorities favoring the most critical areas that would have the greatest water conservation benefits.
11. The Board or a district delegated by the board is responsible for receiving and approving individual applications for cost-share assistance.
12. The Board or a designated district shall negotiate contracts with successful applicants.
13. The Board or a designated district must certify that the work to be cost-shared has indeed been completed before the State's share of the cost is paid.
14. The State or a designated district must administer State money as required by a cost-share contract.

## **Section V: Brush Control Projects**

The State Board will work closely with other State agencies to utilize their expertise and resources in the process of developing and implementing brush control studies and projects. Wildlife habitat and endangered species issues will be coordinated with Texas Parks and Wildlife. The expertise of researchers at various Texas University systems will be utilized in watershed modeling and critical area delineation. Resources for landowner education will be provided by Texas AgriLife Extension. The State Board will cooperate with the Texas Water Development Board on groundwater and streamflow monitoring, regional water needs, and regional water plans. The State Board will consult with the Texas Department of Agriculture on effects to agriculture. Cooperation with USDA-NRCS will be essential in developing and implementing individual landowner plans. River Authorities will provide local and regional knowledge into the planning process.

### **5.1 Overview of Brush Management Program**

Brush management will be accomplished through a series of watershed or sub-watershed projects in which brush management shows a strong potential to significantly increase water yield. The process will be briefly summarized here, and each element of the process will then be discussed in further detail. The elements of the brush management plan are:

- Brush Control Areas
- Project Development
- Project Approval and Prioritization
- Project Implementation

The State Board may delineate brush control areas in which a water need exists based on the most recent regional water plan and in which brush control has a strong potential to increase water yield. Brush control area delineation will be based on watershed studies—scientific studies, modeling, climate, hydrology—brush infestation, and water needs. Soil and water conservation districts will manage individual projects. Within a brush control area, districts may develop brush control projects where there is sufficient local support. Project proposals will be submitted to the State Board for approval. After receiving a project proposal, the State Board, through staff and other experts, may conduct additional feasibility studies of the project area. A project that meets all requirements may then be approved by the State Board. If there are more project proposals than can be supported by available cost-share funds, the State Board will prioritize the projects, favoring the areas with the most critical water needs and the projects that will be most likely to produce substantial water yields and are cost effective. The State Board will approve brush control methods on the State level and furnish the list to districts for use in developing individual plans. The State Board, with the input of local districts and landowners, will set cost-share rates for individual projects. Districts may contract with landowners to develop and implement individual brush control plans within project areas. Landowners may then implement brush control plans and receive cost-share payments upon completion of the brush control practices specified in the individual plans.

### **5.2 Brush Control Area Delineation**

In order for a project to be eligible for State funding, it must be in a brush control area delineated by the State Board. However, being in a brush control area does not guarantee that a project will be funded since the need for brush control funds is much greater than the available funding. The State Board will delineate brush control areas eligible for brush control projects and cost-share funding where a water need exists based on the most recent regional water plan and where brush control has a strong potential to increase water yield. Water yield potential will be estimated based on the most recent scientific evidence available. Studies conducted by the State Board and local soil and water conservation districts in cooperation with other State agencies, universities, landowners, and other local interests

have estimated potential water yield in many watersheds across the State. Watershed studies will consider the following criteria:

- Brush type, density, and canopy cover
- Geology and soils data
- Water needs or potential needs
- Hydrology
- Potential water yield
- Wildlife concerns
- Economics
- Landowner interest

Because of the many factors involved in developing a successful project such as willingness of the local people to participate, landowner cooperation, social and economic considerations, and wildlife concerns, project applications may come from the local level.

### ***5.2.2 Watershed Studies***

As funding becomes available, watershed studies, which include water yield modeling, will be used as a tool for delineating brush control areas. These studies may be done in cooperation with other State agencies, universities, and local entities. Specific watersheds for studies will be determined by the State Board in consultation with SWCDs, other State and local agencies, and universities or as determined by the Texas Legislature. Factors that weigh heavily in watershed studies include brush type and density, water needs of the area, and potential water yield. Studies may also be conducted by local or other entities and submitted to the State Board for consideration.

#### **5.2.2.1 Brush Type, Density, and Canopy Cover**

Table 2.1 shows the predominant brush species and the level of infestation statewide. TSSWCB (1991) updated this survey with 1987 natural resources inventory data and compiled the species infestation on the basis of the eighteen Major Land Resource Areas in Texas. All areas of the State have significant brush infestation problems.

Recent research shows that brush canopy cover must be reduced to below about 15% on specific areas where treatment occurs for brush removal to have a significant effect on enhanced water yield. Reducing brush cover to below 15% on treated acreage exponentially increases water yield (Thurrow, 1998).

#### **5.2.2.2 Water Needs**

Many towns and cities in Texas are now or will in the future suffer water shortages. Since the major purpose of the Brush Control Program is to provide additional yield from the rangeland watersheds of the State, a major consideration in delineating areas or prioritizing projects will be the benefit to water users. After evaluating water needs, the information will be used to assist in identifying areas with the most critical water conservation needs.

The Texas Water Development Board (TWDB) updated the State Water Plan in 2007 (TWDB, 2007) and is in the process of updating it again. Texas has subdivided the State into sixteen water planning regions. Each of these regions has developed a regional water plan. All of the regions have significant water needs over the next fifty years and will need a variety of tools, from water conservation to developing alternative supplies to meet their needs.

The State Board will work with the regional planning groups and the TWDB to identify regional water needs.

### 5.2.2.3 Potential Water Yield

Knowledge exists to make fairly accurate predictions as to rangeland areas where potential is high for increasing water yields. Jones and Gregory 2008 summarized the current state of scientific knowledge about the effects of brush control on rangelands, with emphasis on Texas and the southwestern United States. Their findings are summarized as follows:

- The roots of some brush species extract water from greater depths than do grasses and forbs, and brush control can reduce the total amount of water used by vegetation. .
- Brush and other deep-rooted vegetation growing over shallow aquifers near streams can be expected to use large amounts of ground water, likely reducing the amount in both the interconnected stream and aquifer.
- Removal of brush like juniper and live oak from upland areas may increase streamflow and/or recharge aquifers, especially when:
  - The brush canopy is dense and intercepts substantial amounts of rainfall (for example, dense juniper [cedar] or live oak stands), effectively reducing the amount of rainfall reaching the soil surface, and
  - Soils, subsoils and/or geologic strata are permeable, and streams in the area are fed by seeps and springs. Water can quickly percolate below the roots of grasses and forbs and subsurface pathways can conduct water from the uplands to local streams or aquifers.
- Brush control in upland areas is unlikely to significantly increase water yields if soils and geologic formations are not conducive to increased runoff and/or subsurface flows to streams or to aquifers.
- For brush control to have substantial long-term impacts on water yield, most or all of the woody vegetation in the treated area should be killed, and regrowth of brush and herbaceous vegetation should be controlled.
- New science-based tools can help pinpoint locations where brush control should substantially increase water flows in streams.

### ***5.2.3 Brush Control Area Delineation***

Brush control areas are delineated by the State Board based on requests from local entities. To be eligible, the area must have water needs documented in the most recent regional water plan, and brush control must have the potential to increase water yield. Currently 18 watersheds have been designated as brush control areas based on water need.

- North Concho River Watershed.
- Twin Buttes Reservoir Watershed.
- Upper Colorado River Watershed.
- Pedernales River Watershed.
- Pecos River Watershed. (Saltcedar)
- Canadian River (Saltcedar)
- Hubbard Creek Lake (Saltcedar)
- Edwards Aquifer recharge zone
- Nueces River Basin
- Concho River Basin

- Frio River Basin
- Palo Pinto Lake Basin
- Lake Fort Phantom Hill Basin
- Lake Brownwood Basin
- Lake Arrowhead Basin
- Guadalupe River
- Carrizo/Wilcox Aquifer
- Bosque/Steel Creek

#### ***5.2.4 Completed Watershed Studies***

Watershed studies have been conducted in the following areas:

- North Concho River Basin
- Edwards Aquifer recharge zone
- Nueces River Basin
- Wichita River Basin
- Concho River Basin
- Upper Colorado River Basin
- Pedernales River Basin
- Canadian River Basin
- Frio River Basin
- Palo Pinto Lake Basin
- Lake Fort Phantom Hill Basin
- Lake Brownwood Basin
- Lake Arrowhead Basin
- Hubbard Creek Lake (Local study)
- Pecos River (Local study)

### **5.3 Project Development**

Local soil and water conservation districts or other agencies in cooperation with districts may develop project proposals within the State. The proposals will be submitted to the State Board for its prioritization and approval. The State Board, on its own initiative, may initiate project development in cooperation with local soil and water conservation districts.

#### ***5.3.1 Sponsorship—Soil and Water Conservation Districts***

Local soil and water conservation districts, along with landowners, will be the keys to the development of successful brush control projects. Districts have experience in the development and implementation of locally initiated projects similar to brush control projects. When local interest is such that action is deemed necessary, someone must lead and

coordinate the effort. Soil and water conservation districts are qualified to assume this role. They are accessible to anyone and they especially have considerable experience in working with landowners and landusers, both individually and as a group. If a potential project area is larger than a single district, several districts may cooperate on the project development and implementation.

A district may administer aspects of the Brush Control Program within any brush control area located within the jurisdiction of that district. The State Board must prepare information on the Brush Control Program and procedures for cost-sharing and provide this information to each SWCD. Districts may accept, review, and comment on individual applications for cost-share, and submit them to the State Board for action. Districts may inspect and supervise projects within their jurisdictions. Subchapter D, Sections 203.101 – 203.104 of the Brush Control Law (Appendix I) describes the powers and duties of districts in administering brush control projects. Districts, landowners, and other agencies will have the opportunity for input into all aspects of brush control projects.

### ***5.3.2 Requirements of Project Proposals***

1. A proposal must denote sufficient interest by a group of landowners and operators in a brush control area or a part of a brush control area designated by the State Soil and Water Conservation Board to allow for the eventual completion of the project.
2. A valid proposal must show adequate sponsorship by one or more soil and water conservation districts. Enlisting additional sponsors such as cities, counties, other political subdivisions, etc. could be beneficial to the project and is encouraged.
3. The soil and water conservation district involved must agree to take leadership and coordinate the project through implementation.
4. The project area proposed in the proposal should be of sufficient size to provide a significant potential gain in the water yield from the brush control area where the project is located.
5. The proposal should provide as much evidence as possible that the acreage to be treated within the project area does have the potential to improve water yields. Subjects that should be addressed are:
  - (a) size and location of the area
  - (b) brush – type, density, and canopy cover
  - (c) water needs or potential needs
  - (d) potential yield
  - (e) wildlife compatibility to the project
  - (f) landowner cooperation
  - (g) ability of participants to pay their share of the cost
  - (h) types of treatment measures
  - (i) completion schedule
6. Proposals should be submitted as required by the State Board to the Texas State Soil and Water Conservation Board, P. O. Box 658, Temple, Texas 76503.

The State Board will provide assistance to districts in the development of project proposals as needed.

## **5.4 State Board Approval and Prioritization**

Being in a brush control area does not guarantee that a project will be funded since the need for brush control funds is much greater than the available funding. If more projects have been submitted than funds are available to support, the State Board will prioritize the projects.



#### ***5.4.1 Watershed Studies***

The State Board will most likely be involved with all project proposals during the proposal development phase. Considerable information will have to be gathered to meet the requirements of the project proposal. The final document should give a fairly accurate assessment of the potential for that particular project. In most cases, this information will have been developed as part of a watershed study. If a proposal is developed for an area in which a watershed study has not been conducted, the State Board may authorize a watershed study. Once the proposal is complete and has been received by the State Board it may be necessary to conduct a preliminary feasibility review of the proposal.

This review has two basic purposes:

- To determine if the information about the potential project is complete and sufficient to meet requirements for approval by the State Board.
- To make a determination of the relative merit of the project for use by the State Board in setting priorities.

After determination has been made that the proposal meets requirements each of the project prioritization criteria will be applied to the project proposal. The project area will be ranked in each category and this ranking will be a part of the feasibility determination by the State Board. Any other information relating to the viability of the project or relating to the prioritization of the project may be included.

#### ***5.4.2 Project Approval***

A project proposal received by the State Board may be approved or disapproved after a feasibility review is conducted in the project area. Two requirements must be met before approval will be granted.

1. The proposal must include in as much detail as possible all of the information described in Section 5.3.2. This information must show that in the best judgment of those preparing the proposal the project area will meet minimum requirements to be feasible.
2. The feasibility review must show that the application is indeed complete and accurate and meets minimum requirements in all six-project prioritization criteria.

If the proposal meets the requirements set forth by the State Board it will be approved. This approval signifies that the project is viable and should be considered in the prioritization process.

Project proposals that are disapproved may be reconsidered after a review is done in the project area.

#### ***5.4.3 Prioritization of the Project for Implementation***

The amount of cost-share funding appropriated as well as the general economic condition of farming and ranching will play a large part in determining feasibility of individual projects. Provision must be made, however, to select the projects that will be most effective in reaching the goals of the Program.

Section 203.159 of the Agriculture Code states that (a) If the demand for funds under the cost sharing program is greater than funds available, the board shall establish priorities favoring the areas with the most critical water conservation needs and projects that will be most likely to produce substantial water conservation.

The project prioritization criteria discussed in Section 5.4.4 were developed to give the State Board an impartial way to evaluate each project proposal. This will allow the Board to objectively view new proposals in relation to proposals that have been on the books for some time. Because the ranking process points out deficiencies, projects with a low priority may be upgraded through improvements in those areas in which they are weak.

#### ***5.4.4 Project Prioritization Criteria***

##### **Brush Control Conservation Strategy**

A high priority will be given to those projects in areas in which regional planning groups have identified brush control as a conservation strategy for meeting water needs in the most recent State Water Plan.

##### **Water Needs or Potential Needs**

Information on water needs in a watershed will be obtained on a project-by-project basis from the Texas Water Development Board. In addition, the State Board will work with the regional water planning groups to determine needs within the planning regions for brush control projects.

##### **Brush—Type, Density, and Canopy Cover**

A list of brush species in the State will be developed ranking each species according to its water use potential. This ranking will also include information on the minimum density and canopy cover for each species to make control cost effective. The first list of brush type, density, and canopy cover will be the best estimated of knowledgeable range scientists. As more research becomes available the list will be revised as needed.

The brush species list will be used during the feasibility review to establish that the brush infestation in the proposed area meets minimum requirements for a successful brush control project. After this is established, the type, density, and canopy cover of the brush will be ranked as to severity, and this will be a factor in the overall ranking of the project.

##### **Potential Yield**

This is summarized in Section 5.2.

##### **Considerations**

Section 203.016 of the law states that “The board shall consult the Texas Water Development Board in regard to the effects of the Brush Control Program on water quantity; the department [Texas Department of Agriculture] in regard to the effects of the Brush Control Program on agriculture; and the Parks and Wildlife Department in regard to the effects of the Brush Control Program on fish and wildlife”.

The Texas Parks and Wildlife Department, the Texas Water Development Board, the Texas Department of Agriculture, and other agricultural interests in the affected area shall be notified of project work group meetings. The TPWD will provide technical assistance to the work groups for their consideration in developing and implementing brush control projects. The Texas Water Development Board will review projects and cooperate on water yield monitoring projects.

Historically, incorporating fish and wildlife concerns into the planning and implementation of brush control and revegetation projects has had a high priority. If properly included in brush control planning, maintenance and even enhancement of wildlife habitats is possible through activities such as identification of priority grassland restoration areas for wildlife.

The Texas Parks and Wildlife Department is presently involved with the State Board in coordinating the fish and wildlife aspects of the Program. Parks and Wildlife personnel will be included in the watershed studies and will help determine the feasibility of project proposals. They will be asked to provide a prioritized listing of the wildlife species in the area with the effect that the proposed brush control project would have on them.

Applicants will be notified that the Texas Parks and Wildlife Department provides free technical guidance to landowners regarding the management of wildlife resources and habitats on their lands.

### **Landowner Cooperation**

Cooperation of the landowners and operators in the project area is the key to a successful program. The State Brush Control Program is voluntary in nature, and therefore, treating sufficient acreage to achieve the desired results depends upon landowner interest and participation.

During the watershed study, estimates will be made as to the minimum acreage that can be treated and still show significant results. Landowners and operators controlling sufficient acreage to meet or exceed this figure must show significant interest for a district to have a viable project.

The project prioritization process will take place after the watershed studies are completed so more exact figures will be available concerning the acreage necessary for an optimum project. Those prospective projects showing sufficient landowner interest to meet these acreage figures will receive the highest ranking.

### **Time Elements**

This criteria is somewhat related to landowner cooperation. The project that has landowners and operators ready, willing, and able to proceed will receive preference. Obviously planning and implementation take a certain amount of time, but generally projects with excessively long timetables reflect a lower degree of landowner cooperation.

## **5.5 Project Implementation**

Once a project has been approved and funding made available, the responsible soil and water conservation district will begin implementation. Project implementation requires the following elements.

### ***5.5.1 Practice Selection***

The State Board, in consultation with districts, will approve a list of practices that are eligible for cost-share statewide (Section VI Cost-share Program). These practices may include chemical and mechanical methods and prescribed burning. The local district will select and approve from this list the practices that are applicable to its specific project. For example, in some areas, there may be legal restrictions on certain chemicals, or there may be endangered species requirements, or other local issues that would preclude using some of the statewide practices in a specific project area. This local list will be used in developing individual plans. Results of watershed studies may be used to evaluate control options and their feasibility.

Identifiable units must be established for each practice. An identifiable unit must be either all or an essential part or subdivision of a practice that when carried out is complete within itself and can be clearly identified. For example, an identifiable unit could be a certain acreage that can be clearly marked on the ground and on a site map so that the district can positively identify a unit of land and certify that treatment has been completed on that unit of land. An identifiable unit also can be managed independently as to maintenance of the practice. Establishment of identifiable units and an average cost or a specified maximum cost permits cost-share payments to be made to producers when an identifiable unit is treated. A list of practices, applicable cost-share rates, average costs or specified maximum costs will be developed for each identifiable unit.

### ***5.5.2 Site Eligibility Determination***

Before individual landowner plans can be developed, decisions will have to be made in each project area concerning the practices, which will be eligible for cost sharing on certain general categories of land. First an evaluation will be performed to group similar combinations of topography, soils, land use, or grazing systems into categories. Then each category of land will be assigned a set of practices that will be eligible for cost sharing. These categories should be broad enough to allow maximum flexibility on the part of the landowner but still discourage excessive project costs. Generally certain land classes with a certain brush canopy would be eligible for a given set of practices. Some

practices may be excluded in some areas for reasons such as unfeasibility, wildlife considerations, or local, state, or federal regulation.

### ***5.5.3 Wildlife Considerations—Planning for Wildlife Objectives***

The basic concern of the wildlife manager in implementing any brush management system has to do with the design and retention of a brush mosaic. Patterning of brush treatments is driven by wildlife considerations more than by any other set of management objectives. The design of a favorable habitat mosaic will be considered for each specific project plan. Following are some general guidelines for planning for wildlife.

The types of brush control patterns used will depend upon the terrain in the area to be treated. To a great degree, natural terrain features will dictate the types and conformation of patterns.

Sufficient brush cover should be left along watercourses, which usually serve as wildlife travel lanes. The width of the strips to be left for most wildlife can be determined by visual inspection. The strips of brush should be wide enough to prevent seeing through them at most points from December through February when most species have lost their leaves. All natural wildlife travel ways, which would include watercourses, saddles between ridges, headers or canyon beginnings, extensions of ridges, and any unusually high-quality wildlife food plants should be left.

When cleared strips extend for great distances, a belt or block of brush should be left every 200 to 300 yards to break up the open spaces and provide covered travel lanes for wildlife. In South Texas where the terrain is relatively flat with no prominent features, alternate strips of cleared areas and brush produce good results, although clearing in an irregular pattern is more desirable. In large areas the strips can be established in gently curving patterns to block excessive views, and belts or blocks of brush can be left at desirable intervals across cleared areas. Brush strips should be left along drainage areas or draws used as natural travel ways by wildlife.

Where cleared areas tend to be excessively large, islands of brush should be left interspersed within the cleared areas to provide escape cover. As with brush strips, the islands should be large enough that they cannot be seen through from December through February. Where islands do not provide sufficient escape cover, extensions or necks of brush can be left for escape cover and travel ways to prominent terrain features frequented by wildlife.

During the initial planning of a brush control operation, extreme care should be taken to retain the many different types of woody food and cover plants necessary to maintain a resident wildlife population of all species. For example, woody plants or brush species are necessary to wild turkey populations, not only as food producing plants, but also as cover and roosting timber. Existing winter roost timber should be left standing. In association with this, brush and smaller trees under or adjacent to the roosting areas should be retained. Turkeys require cover as they enter and depart the roost and while loafing under the roost trees. Sufficient quantities of food-producing woody species such as chittum, hackberry, lotebush, oak, pecan, and elm also should be maintained.

Following mechanical treatment, some areas will require reseeding. The seeding mix should include forbs that benefit wildlife.

The improvement in range conditions through brush management will increase the available food supply for wildlife and domestic livestock. This additional food supply will improve the quality of the animals being produced. Brush should be managed in conjunction with sound range management practices.

Although some basic rules for brush management may be applied to all treated areas, the topography, types of vegetation, and wildlife species present on each ranch unit and even from pasture to pasture within a ranch will be different. Therefore, an on-the-ground inspection of the entire ranch is necessary prior to formulating sound management plans.

It is likely that only a few candidate pattern/treatment combinations will emerge for which equipment is locally available and which suits the preferences of ranch management. These should be ranked by wildlife specialists in terms of their utility for satisfying game management objectives from a biological point of view. Interaction and

compromise among management objectives should result in further limitation of options and finally result in identification of the candidate system that shows most promise for meeting the goals of the Program.

#### ***5.5.4 Cost-Share Rate***

Soil and water conservation districts will set average costs and maximum costs for each practice to be used in a project. The cost-share rate to be used for each practice will also be set by the district with advice from the State Board based on data developed as part of the watershed study. The cost-share rate set by the district cannot exceed the maximum cost-share rate set by the State Board. Details of the cost-share program are in Section VI

#### ***5.5.5 Completion Schedule***

Proper timing and sequence of land treatment are essential to successful implementation of any conservation program. This is true concerning either the entire project or individual landowner plans. One major factor that enters into a state cost-share program is the time limits placed on the use of state money. State funds are appropriated on a biannual basis. This will allow only two-year contracts at a maximum even though the entire project may take several years to complete.

#### ***5.5.6 Individual Landowner Plans***

The responsible districts, with any needed technical assistance provided by the NRCS field office, TPWD, and/or Texas State Soil and Water Conservation Board, will assist landowners with development of individual plans for brush management for the purposes of increasing watershed yield. The extent and methods of brush management included in each plan will be determined in accordance with specifications in the *Field Office Technical Guide*, as approved by the local districts. Each plan will include implementation of sound grazing management following treatment. Based on these plans, the district may enter into contracts with the landowners for the application of brush management.

Each cost-share agreement will include a maintenance agreement by which the landowner agrees to maintain the brush management practice for a period of ten years after implementing the plan.

## **Section VI: Cost-share Program**

### **6.1 General Criteria**

Subchapter E, Section 203.151 of the Agriculture Code created a cost-sharing program to be administered under Chapter 203 and rules adopted by the board. Section 203.152 of the law created the brush control fund, which is a special fund in the State treasury to be used to provide the State's share of the cost of brush control projects. Sections 203.156, 203.157, and 203.158 discuss individual applications for cost-share assistance, and Section 203.160 set out the requirements for contracts between soil and water conservation districts and individual landowners. Section 203.161 provides for the administration of cost-share funds.

The Texas State Soil and Water Conservation Board adopted rules (Appendix II) to administer the brush control cost-share program (31 TAC §§ 517.22 - 517.37) with the following program characteristics:

1. Not more than 70 percent of the total cost of a single brush control project may be made available as the state's share in cost sharing. (Section 203.154 (a) Texas Agriculture Code)
2. Funds will be allocated from the State Brush Control Fund
3. Requests for allocations will be part of brush control project proposals submitted by SWCDs.
4. Approval of allocations. The State board shall consider, approve, reject, or adjust funding requests based on priority of projects (Section 5.4), and amount of available funding. Only districts for which the State Board has approved a project are eligible for cost-share funds.

### **6.2 Cost-share Agreement**

Soil and water conservation districts may enter into cost-share agreements with individual landowners. Cost share agreements must be based on an approved brush control plan developed by the landowners with assistance provided through the conservation district. Only those costs directly associated with removal of brush, as specified in the watershed study for that watershed, are eligible for cost-share assistance.

### **6.3 Brush Control Methods**

The Soil and Water Conservation Board is directed to approve all methods of brush control used under this program. The Board may approve methods of controlling brush based on a finding that the method:

1. has proven effective and efficient for controlling brush,
2. is cost efficient,
3. has beneficial impact on wildlife habitat,
4. will maintain topsoil to prevent erosion or siltation of rivers or streams, and
5. allows for revegetation of the area with plants that are beneficial to livestock and wildlife after brush is removed.

The Board will approve brush control methods for each brush control project based upon information from the watershed study along with other data or information the Board deems relevant. approved methods will be transmitted to the appropriate conservation districts when funding allocations are approved.



#### **6.4 Maintenance of Brush Management**

Cost-share agreements must contain a commitment on the part of the landowner to maintain areas for which cost-share funding for brush control is received for a period of ten years after the initial brush control is accomplished if funding is available through state funds. Maintenance includes periodically retreating the area with appropriate brush control methods to prevent brush reinfestation over the duration of the contract period. Maintenance treatments will be scheduled as needed according to specifications in the *Field Office Technical Guide*. Cost-share rates will be based on the present value of the cost, including maintenance cost over the ten-year period.

#### **6.5 Certification of Practice Implementation**

Upon completion of brush control on any identifiable unit of land, the district may certify to the Board that the practice has been implemented in accordance with specifications on that portion of the planned area.

#### **6.6 Cost-share Payments**

Based upon certification by the conservation district that brush control has been implemented according to specifications on all or any identifiable unit of land in a brush control plan, the Board may process a request for payment of cost-share funds and cause payment to be made directly to the landowner.

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# **Appendix I: The Brush Control Law**

## **Agriculture Code**

### **CHAPTER 203. BRUSH CONTROL**

#### **SUBCHAPTER A. GENERAL PROVISIONS**

##### **Sec. 203.001. Definitions.**

In this chapter:

- (1) "Board" means the State Soil and Water Conservation Board.
- (2) "District" means a soil and water conservation district created under Chapter 201 of this code.
- (3) "District board" means the board of directors of a soil and water conservation district created under Chapter 201 of this code.
- (4) "Brush control" means:
  - (A) the selective control, removal, or reduction of noxious brush such as mesquite, prickly pear, salt cedar, or other phreatophytes that consume water to a degree that is detrimental to water conservation; and
  - (B) the revegetation of land on which this brush has been controlled.

Added by Acts 1985, 69<sup>th</sup> Leg., Ch. 655, Sec. 1, eff. Aug. 26, 1985. Amended by Acts 2003, 78<sup>th</sup> R. Leg., ch. 983, Sec. 12, eff. Sept. 1, 2003.

##### **Sec. 203.002. Creation of Program.**

The Texas Brush Control Program is created and shall be implemented, administered, operated, and financed as provided by this chapter.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985.



## SUBCHAPTER B. ADMINISTRATIVE PROVISIONS

### **Sec. 203.011. Authority of Board.**

The board has jurisdiction over and, with the assistance of local districts, shall administer the Brush Control Program under this chapter.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985. Amended by Acts 2003, 78<sup>th</sup> R. Leg., ch. 983, Sec. 6, eff. Sept. 1, 2003.

### **Sec. 203.012. Rules.**

The board, after consulting with local districts, shall adopt reasonable rules that are necessary to carry out this chapter.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985. Amended by Acts 2003, 78<sup>th</sup> R. Leg., ch. 983, Sec. 6, eff. Sept. 1, 2003.

### **Sec. 203.013. Authority of Districts.**

Each district may carry out the responsibilities provided by Subchapter (d) as delegated by the board.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985. Amended by Acts 2003, 78<sup>th</sup> R. Leg., ch. 983, Sec. 6, eff. Sept. 1, 2003.

### **Sec. 203.014. Personnel.**

The board may employ or contract with any person necessary to assist the board or a district to carry out this chapter.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985.

### **Sec. 203.015. Expenditures.**

In addition to any other expenditures authorized by this subchapter, the board may make expenditures provided by the General Appropriations Act.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985.

### **Sec. 203.016. Consultation.**

The State Soil and Water Conservation Board shall consult with:

- (1) the Texas Water Development Board in regard to the effects of the Brush Control Program on water quantity;
- (2) the department in regard to the effects of the Brush Control Program on agriculture; and
- (3) the Parks and Wildlife Department in regard to the effects of the Brush Control Program on fish and wildlife.

Added by Acts 1985, 69<sup>th</sup> Leg., Ch. 655, Sec. 1, eff. Aug. 26, 1985. Amended by Acts 2003, 78<sup>th</sup> R. Leg., ch. 983, Sec. 6, eff. Sept. 1, 2003.

## SUBCHAPTER C. GENERAL POWERS AND DUTIES OF BOARD

### **Sec. 203.051. State Plan.**

The board shall prepare and adopt a State Brush Control Plan that shall:

- (1) include a comprehensive strategy for managing brush in all areas of the state where brush is contributing to a substantial water conservation problem; and
- (2) rank areas of the state in need of a Brush Control Program, as provided by Section 203.053.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985. Amended by Acts 2003, 78<sup>th</sup> R. Leg., ch. 983, Sec. 6, eff. Sept. 1, 2003.

### **Sec. 203.052. Notice and Hearing.**

- (a) Before the board adopts the plan under Section 203.051 of this code, the board shall call and hold a hearing to consider a proposed plan.
- (b) Not less than 30 days before the date the hearing is to be held, the board shall mail written notice of the hearing to each district in the state. The notice must:
  - (1) include the date and place for holding the hearing;
  - (2) state the purpose for holding the hearing; and
  - (3) include instructions for each district to submit written comments on the plan.
- (c) At the hearing, representatives of a district and any other person may appear and present testimony including information and suggestions for any changes in the proposed plan. The board shall enter into the record any written comments received on the proposed plan and shall consider all written comments and testimony before taking final action on the plan.
- (d) After the conclusion of the hearing, the board shall consider the testimony including the information and suggestions made at the hearing and in written comments, and after making any changes in the proposed plan that it finds necessary, the board shall adopt the plan.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985. Amended by Acts 2003, 78<sup>th</sup> R. Leg., ch. 983, Sec. 7, eff. Sept. 1, 2003.

### **Sec. 203.053. Criteria for Evaluating Brush Control Areas.**

- (a) In ranking areas under the plan, the board shall consider:
  - (1) the location of various brush infestations;
  - (2) the type and severity of brush infestations;
  - (3) the various management methods that may be used to control brush; and
  - (4) the amount of water produced by a project and the severity of water shortage in the project area; and
  - (5) any other criteria that the board considers relevant to assure that the Brush Control Program can be most effectively, efficiently, and economically implemented.

- (b) In designating critical areas, the board shall give priority to areas with the most critical water conservation needs and in which brush control and revegetation projects will be most likely to produce substantial water conservation.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985. Amended by Acts 2003, 78<sup>th</sup> R. Leg., ch. 983, Sec. 8, eff. Sept 1, 2003.

#### **Sec. 203.054. Amending Plan.**

At least every two years the board shall review and may amend the plan to take into consideration changed conditions. Amendments to the plan shall be made in the manner provided by this chapter for adopting the original plan.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985.

#### **Sec. 203.055. Approved Methods for Brush Control.**

- (a) The board shall study and must approve all methods used to control brush under this chapter considering the overall impact of the project.
- (b) The board may approve a method for use under the cost-sharing program provided by Subchapter E if the board finds that the proposed method:
  - (1) has proven to be an effective and efficient method for controlling brush;
  - (2) is cost efficient;
  - (3) will have a beneficial impact on the development of water sources and wildlife habitat;
  - (4) will maintain topsoil to prevent erosion or silting of any river or stream; and
  - (5) will allow the revegetation of the area after the brush is removed with plants that are beneficial to stream flows, groundwater levels, livestock and wildlife.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985. Amended by Acts 2003, 78<sup>th</sup> R. Leg., ch. 983, Sec. 8, eff. Sept 1, 2003.

#### **Sec. 203.056. Report.**

- (a) Before January 31 of each year, the board shall submit to the governor, the speaker of the house, and the lieutenant governor a report of the activities of the Brush Control Program during the immediately preceding calendar year.
- (b) The board may make copies of this report available on request to any person and may charge a fee for each report that will allow the board to recover its costs for printing and distribution.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985.

## SUBCHAPTER D. POWERS AND DUTIES OF DISTRICTS

### **Sec. 203.101. General Authority.**

Each district may administer the aspects of the Brush Control Program within the jurisdiction of that district.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985. Amended by Acts 2003, 78<sup>th</sup> R. Leg., ch. 983, Sec. 8, eff. Sept. 1, 2003.

### **Sec. 203.102. Provide Information Relating to Program.**

The board shall prepare and distribute information to each district relating generally to the Brush Control Program and concerning the procedures for preparing, filing, and obtaining approval of an application for cost sharing under Subchapter E of this chapter.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985.

### **Sec. 203.103. Acceptance and Comment on Application.**

- (a) Each district may accept for transmission to the board applications for cost sharing under Subchapter E of this chapter and may examine and assist the applicant in assembling the application in proper form before the application is submitted to the board.
- (b) Before a district submits an application to the board, it shall examine the application to assure that it complies with rules of the board and that it includes all information and exhibits necessary for the board to pass on the application.
- (c) At the time that the district examines the application, it shall prepare comments and recommendations relating to the application and the district board may provide comments and recommendations before they are submitted to the board.
- (d) After reviewing the application, the district board shall submit to the board the application and the comments and recommendations.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985.

### **Sec. 203.104. Supervision of Projects.**

- (a) Each district on behalf of the board may inspect and supervise projects within its jurisdiction in which state money is provided under Subchapter E of this chapter.
- (b) Each district board exercising the duties under Subsection (a) of this section shall periodically report to the board relating to this inspection and supervision in the manner provided by board rules.
- (c) The board may direct a district to manage any problem that arises under a cost-sharing contract for brush control in that district and to report to the board.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985.

## SUBCHAPTER E. COST SHARING FOR BRUSH CONTROL

### **Sec. 203.151. Creation of Cost-Sharing Program.**

As part of the Brush Control Program, a cost-sharing program is created to be administered under this chapter and rules adopted by the board.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985.

### **Sec. 203.152. Brush Control Fund.**

- (a) The brush control fund is a special fund created in the State Treasury to be used as provided by this subchapter.
- (b) The brush control fund consists of legislative appropriations, money transferred to that fund from other funds by law, and other money required by law to be deposited in the brush control fund.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985.

### **Sec. 203.153. Use of Money in Brush Control Fund.**

Money deposited to the credit of the brush control fund shall be used by the board to provide the state's share of the cost of brush control projects approved under this subchapter and other necessary expenditures as provided by the General Appropriations Act.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985.

### **Sec. 203.154. Limit on Cost-Sharing Participation.**

- (a) Not more than 70 percent of the total cost of a single brush control project may be made available as the state's share in cost sharing.
- (b) A person is not eligible to participate in the State Brush Control Program or to receive money from the State Brush Control Program if the person is simultaneously receiving any cost-share money for brush control on the same acreage from a federal government program.
- (c) The board may grant an exception to Subsection (b) if the board finds that joint participation of the State Brush Control Program and any federal Brush Control Program will:
  - (1) enhance the efficiency and effectiveness of a project;
  - (2) lessen the state's financial commitment to the project; and
  - (3) not exceed 80 percent of the total cost of the project.
- (d) A political subdivision is eligible for cost sharing under the Brush Control Program, provided that the state's share may not exceed 50 percent of the total cost of a single project.
- (e) Notwithstanding any other provision of this Section, 100 percent of the total cost of a single project on public lands may be made available as the state's share in cost sharing.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985. Amended by Acts, 76<sup>th</sup> Leg, eff. Sep.1, 1999. Amended by Acts 2003, 78<sup>th</sup> R. Leg., ch. 983, Sec. 9, eff. Sept 1, 2003.



### **Sec. 203.155. Limit to Critical Areas and Approved Methods.**

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985. Repealed by Acts 2003, 78<sup>th</sup> R. Leg., ch. 983, Sec. 12, eff. Sept. 1, 2003.

### **Sec. 203.156. Application for Cost Sharing.**

A person, including a political subdivision, that desires to participate with the state in a brush control project and to obtain cost-sharing participation by the state shall file an application with the district board in the district in which the land on which the project is to be accomplished is located. The application must be in the form provided by board rules.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985. Amended by Acts 2003, 78<sup>th</sup> R. Leg., ch. 983, Sec. 10, eff. Sept. 1, 2003.

### **Sec. 203.157. Considerations in Passing on Application.**

In passing on an application for cost sharing, the board shall consider:

- (1) the location of the project;
- (2) the method of control that is to be used by the project applicant;
- (3) the plans for revegetation;
- (4) the total cost of the project;
- (5) the amount of land to be included in the project;
- (6) whether the applicant for the project is financially able to provide his share of the money for the project;
- (7) the cost-share percentage, if an applicant agrees to a higher degree of financial commitment;
- (8) any comments and recommendations submitted by a local district, the department, the Texas Water Development Board or the Parks and Wildlife Department; and
- (9) any other pertinent information considered necessary by the board.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985. Amended by Acts 2003, 78<sup>th</sup> R. Leg., ch. 983, Sec. 10, eff. Sept. 1, 2003.

### **Sec. 203.158. Approval of Application.**

The board may approve an application if, after considering the factors listed in Section 203.157 and any other relevant factors, the board finds:

- (1) the owner of the land fully agrees to cooperate in the project;
- (2) the method of eradication is a method approved by the board under Section 203.055; and
- (3) the project is a higher priority than other projects submitted in accordance with the board's plan.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985.

### **Sec. 203.159. Priority of Projects.**

- (a) If the demand for funds under the cost-sharing program is greater than funds available, the board may establish priorities favoring the areas with the most critical water conservation needs and projects that will be most likely to produce substantial water conservation.
- (b) The board shall give more favorable consideration to a particular project if the applicants individually or collectively agree to increase the percentage share of costs under the cost-share arrangement.
- (c) The amount of land dedicated to the project that will produce significant water conservation from the eradication of brush is a priority.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985. Amended by Acts 2003, 78<sup>th</sup> R. Leg., ch. 983, Sec. 10, eff. Sept. 1, 2003.

### **Sec. 203.160. Contract for Cost Sharing.**

- (a) On approval of an application by the board, the board or the governing board of the designated district shall negotiate contracts with the successful applicants in the project area.
- (b) The board or designated district board shall negotiate a contract with the successful applicant subject to:
  - (1) the conditions established by the board in approving the application;
  - (2) any specified instructions provided by the board; and
  - (3) board rules.
- (c) On completion of the negotiations by the district board, it shall submit the proposed contract to the board for approval.
- (d) The board shall examine the contract and if the board finds that the contract meets all the conditions of the board's resolution, instructions, and rules, it shall approve the contract and provide to the individual on completion of the project the money that constitutes the state's share of the project.
- (e) The board may develop guidelines to allow partial payment of the state's share of a brush control project as certain portions or percentages of contracted work are completed, but state money may not be provided in advance for work remaining to be done.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985.

### **Sec. 203.161. Administration of Expenditures.**

The district board may administer expenditure of the state's share of the money required by a cost-sharing contract and shall report periodically to the board on the expenditure of those funds in the manner required by the board.

Added by Acts 1985, 69<sup>th</sup> Leg., ch. 655, Sec. 1, eff. Aug. 26, 1985.

## **Appendix II: Brush Control Rules**

### **Administrative Code**

#### **TITLE 31. NATURAL RESOURCES AND CONSERVATION**

##### **PART 17. Texas State Soil and Water Conservation Board**

##### **CHAPTER 517. Financial Assistance**

##### **Subchapter B. Cost-Share Assistance for Brush Control**

**RULE §517.22. Purpose.** The purpose of this program is to provide the needed incentive to landowners or operators for the implementation of brush control consistent with the purpose of conserving water.

**RULE §517.23. Definitions.** For the purposes of these rules the following definitions shall apply.

- (1) **Allocated funds**--Funds budgeted through the State Board for cost-share assistance.
- (2) **Applicant**--An eligible person who applies for cost-share assistance.
- (3) **Available funds**--Allocated funds that have not been obligated.
- (4) **Average costs**--The constructed cost, which is based on actual costs and current cost estimates, considered necessary to carry out a conservation practice.
- (5) **Brush control**--The selective control, removal, or reduction of noxious brush such as mesquite, juniper, salt cedar, or other phreatophytes that, as determined by the State Board, consumes water to a degree that is detrimental to water conservation; and the revegetation of land on which this brush has been controlled.
- (6) **Brush control area**--An area evaluated according to criteria established in §517.25 of this title and allocated cost-share funds by the Texas State Soil and Water Conservation Board.
- (7) **Brush control area working group**--The working group established in each brush control area to carry out the roles and responsibilities listed in §517.28(c) of this title. Membership is made up of Soil and Water Conservation District directors from each Soil and water Conservation District in a brush control area.
- (8) **Brush control contract**--A legally binding 10-year agreement between the applicant, Soil and Water Conservation District, and Texas State Soil and Water Conservation Board whereby the applicant agrees to implement all brush control practice(s) for which cost-share is to be provided in accordance with standards established by the Texas State Soil and Water Conservation Board. Only practice(s) that the Texas State Soil and Water Conservation Board has approved and are included in an approved brush control plan are eligible for inclusion in the brush control contract.
- (9) **Brush control plan**--A site-specific plan for implementation of brush control, sound range management practices, and other soil and water conservation land improvement measures. It includes a record of the eligible person's decisions made during planning and the resource information needed for implementation and maintenance of the plan that has been reviewed and approved by the Soil and Water Conservation District.
- (10) **Cost-share assistance**--An award of money made to an eligible person for brush control pursuant to the purpose(s) for which the funds were appropriated.
- (11) **Cost-share rate**--The percent of the cost of brush control to be awarded an eligible person based on actual cost not to exceed average cost.

(12) Eligible land--Those lands within a brush control area that are eligible for application of brush control using cost-share assistance.

(13) Eligible person--Any individual, partnership, administrator for a trust or estate, family-owned corporation, or other legal entity who as an owner, lessee, tenant, or sharecropper participates in an agricultural or wildlife operation within a brush control area and is a cooperator with the local Soil and Water Conservation District shall be eligible for cost-share assistance.

(14) Field Office Technical Guide, herein referred to as FOTG--The official Natural Resources Conservation Service guidelines criteria, and standards for planning and applying conservation practices, management measures, and works of improvement that have the purpose of solving or reducing the severity of natural resource use problems or taking advantage of resource opportunities.

(15) Natural Resources Conservation Service, herein referred to as NRCS--An agency of the United States Department of Agriculture.

(16) Operator--Any person(s), firm or corporation with a contractual arrangement with the owner of the land that grants operational control of an agricultural enterprise.

(17) Obligated funds--Monies from a brush control area's allocated funds that have been committed to an applicant after final approval of the brush control contract by the Soil and Water Conservation District and Texas State Soil and Water Conservation Board.

(18) Performance agreement--A component of the brush control contract whereby the eligible person receiving the benefit of cost-share assistance provides written agreement to the Soil and Water Conservation District to perform brush control in accordance with standards established by the Texas State Soil and Water Conservation Board and the terms of the brush control contract.

(19) Priority system--The system devised collectively by the brush control area working group, under guidelines of the State Board, for ranking brush control applications and for facilitating the disbursement of allocated funds in line with the brush control area's priorities.

(20) Program year--The period from September 1 through August 31.

(21) Soil and Water Conservation District, herein referred to as SWCD--A government subdivision of this state and a public body corporate and politic, organized pursuant to the Agriculture Code of Texas, Chapter 201.

(22) State Board--The Texas State Soil and Water Conservation Board organized pursuant to the provisions of the Agriculture Code of Texas, Chapter 201.

(23) Texas Department of Agriculture, herein referred to as TDA--The government agency of this state organized pursuant to the Agriculture Code of Texas, Title 2, Chapter 11.

(24) Texas Parks and Wildlife Department, herein referred to as TPWD--The government agency of this state organized pursuant to the Parks and Wildlife Code of Texas, Title 2, Chapter 11.

(25) Texas Water Development Board, herein referred to as TWDB--The government agency of this state organized pursuant to the Water Code of Texas, Title 2, Subtitle A, Chapter 6.

(26) Water Conservation--The process of reducing water consumption and/or preventing future increases in water consumption. As related to the Brush Control Program, the process of reducing water consuming brush and subsequently, the enhancement of available water resources.

RULE §517.24. State Brush Control Plan.

(a) The State Board shall prepare and adopt a state brush control plan. The State Board shall review and may amend the plan at least every two years to take into consideration changed conditions.

(b) The State Brush Control Plan shall:

(1) include a comprehensive strategy for managing brush in all areas of the state where brush is contributing to a substantial water conservation problem, and

(2) rank areas of the state in need of a brush control program considering the criteria established in §517.25.

(c) Before the State Board adopts the plan, the State Board shall call and hold a public hearing to consider a proposed plan.

(1) In addition to providing notice in the Texas Register, the State Board shall mail written notice of the hearing to each SWCD in the state not less than 30 days before the date the hearing is to be held. The notice must include the date and place for holding the hearing state the purpose for holding the hearing and include instructions for each district to submit written comments on the proposed plan.

(2) At the hearing, representatives of a SWCD and any other person may appear and present testimony including information and suggestions for any changes in the proposed plan. The State Board shall enter into the record any written comments received on the proposed plan and shall consider all written comments and testimony before taking final action on the plan.

(3) After the conclusion of the hearing, the State Board shall consider the testimony including the information and suggestions made at the hearing and in written comments, and after making any changes in the proposed plan that it finds necessary, the State Board shall adopt the plan.

RULE §517.25. Evaluating Brush Control Areas

(a) The State Board, in cooperation with affected SWCDs, other agencies, universities, and appropriate local interests, shall evaluate and rank brush control areas.

(b) Evaluations shall, where appropriate, assess brush type, density, and location; management methods; revegetation options; geology and soils data; water needs or potential needs; hydrology; potential water yield; wildlife concerns; economics; and landowner interest. The TPWD shall be consulted when evaluating wildlife concerns. The TWDB shall be consulted in regards to the effects of the brush control program on water quantity. The TDA shall be consulted in regards to the effects of the brush control program on agriculture.

(c) Specific areas for evaluation will be determined by the State Board in consultation with SWCDs, other agencies, and universities. SWCDs may submit written requests to the State Board for evaluation of areas for brush control.

(d) The State Board shall consider water needs of the area and potential for water yield when selecting areas for evaluation.

(e) Following evaluation, the State Board shall rank brush control areas considering:

(1) the location of various brush infestations;

(2) the type and severity of brush infestations;

(3) the various management methods that may be used to control brush;



- (4) the amount of water produced by a project and the severity of water shortage in the project area;
  - (5) the cost effectiveness of utilizing brush control to conserve water;
  - (6) the potential water quality impacts;
  - (7) the availability of funding; and
  - (8) any other criteria that the State Board considers relevant to assure that the brush control program can be most effectively, efficiently, and economically implemented.
- (f) In ranking brush control areas, the State Board shall give priority to areas with the most critical water conservation needs and in which brush control and revegetation projects will be most likely to produce substantial water conservation.

**RULE §517.26. Administration of Funds**

**(a) Project Development.**

- (1) SWCDs or other agencies in cooperation with SWCDs may develop project proposals in accordance with criteria established in the State Brush Control Plan.
- (2) Project proposals shall be submitted to the State Board for its prioritization and approval.
- (3) The State Board may initiate project development in cooperation with SWCDs.

**(b) Priority of Projects.**

- (1) When prioritizing and approving projects, the State Board shall consider criteria established in the State Brush Control Plan.
  - (2) If the demand for funds under the cost-sharing program is greater than funds available, the State Board shall establish priorities favoring the areas with the most critical water conservation needs and projects that will be most likely to produce substantial water conservation.
  - (3) The State Board shall give more favorable consideration to a particular project if the participants agree to a lesser cost-share rate than that established by the State Board.
  - (4) The quantity of stream flows or groundwater or water conservation from the control of brush is a consideration in assigning priority.
- (c) Allocation of funds. Allocations of resources shall be based on priority considerations and may be adjusted throughout the year as available funds and brush control area needs and priorities change in order to achieve the most efficient use of state funds.
- (d) Requests for allocations. Brush control area working groups may submit written requests for cost-share allocations to the State Board.
- (e) Approval of allocations. The State Board shall consider and approve, reject, or adjust allocations giving consideration to relative need for funding, workload and fund balances, as well as other information deemed necessary by the State Board.

**RULE §517.27. Approval of Brush Control Methods**

- (a) The State Board, in consultation with SWCDs, shall study and must approve all methods used to control brush considering the overall impact of the project.

(b) The State Board may approve a method for cost-sharing if the State Board finds that the proposed method:

- (1) has proven to be an effective and efficient method for controlling brush;
- (2) is cost efficient;
- (3) will have a beneficial impact on the development of water sources and wildlife habitat;
- (4) will conserve topsoil to prevent erosion or silting of any river or stream; and/or
- (5) will allow the revegetation of the area after the brush is removed with plants that are beneficial to stream flows, groundwater levels, and livestock and wildlife.

(c) Approved methods shall be designated in program guidance established by the State Board.

(d) Request for approval of brush control methods. Brush control area working groups, as established by §517.28(b), may submit written requests to the State Board for approval of brush control methods for a brush control area.

#### RULE §517.28. Powers and Duties of SWCDs

(a) The State Board has delegated the responsibilities in this section to the SWCDs.

(b) Establishment and composition of critical area working group.

(1) In each brush control area allocated funding by the State Board, a brush control area working group shall be established, composed of SWCD directors from each SWCD in the brush control area.

(2) The State Board shall serve as the facilitator for the brush control area working group.

(3) Agencies, universities, landowners and appropriate local interests may serve in an advisory capacity to the brush control area working group, but shall not have voting privileges.

(4) The brush control area working group shall hold an organizational meeting to:

(A) establish final membership

(i) SWCDs may elect to not participate by providing written notification of their decision.

(ii) In establishing the membership, each participating SWCD shall have one vote.

(iii) As approved by participating SWCDs within a brush control area, SWCDs may be allowed to have more than one SWCD director serve on the brush control area working group.

(iv) Once final membership is established, each member shall have one vote only.

(B) establish operating procedures

(i) The brush control area working group shall elect a chairman.

(ii) The brush control area working group shall establish the quorum necessary for decision-making. Only those members present shall be eligible to vote. Voting by proxy shall not be allowed.

(iii) The brush control area working group may establish attendance requirements and other necessary procedures.

(c) The brush control area working group shall:

- (1) designate, from the State Board approved list, those brush control methods that will be eligible for cost-share;
- (2) establish maximum cost-share rates not to exceed maximums set by the State Board in §517.29(d);
- (3) develop average cost annually for each practice designated not to exceed costs established by the State Board;
- (4) establish annually the maximum amount of cost-share available to each applicant not to exceed the maximum set by the State Board;
- (5) administer the cost-share program within the funds allocated by the State Board;
- (6) establish, under guidelines of the State Board, the priority system to be used for evaluation of applications;
- (7) establish the period(s) of time for accepting applications;
- (8) announce the cost-share program;
- (9) establish the minimum amount of brush acreage that must be enrolled within sub-basins of the brush control area in order to qualify for funding;
- (10) prioritize applications under the working group approved priority system; and
- (11) submit meeting minutes, membership, and established operating procedures to the State Board.

(d) Each SWCD in the brush control areas allocated funding shall:

- (1) accept and process cost-share applications;
- (2) keep accurate records and logs of applications;
- (3) determine eligibility for cost-share assistance according to the criteria listed in §517.30. If an applicant's land is in more than one SWCD, the respective SWCDs will review the application and agree to oversee all works and administrate all contracts from one SWCD or prorate between the SWCDs;
- (4) provide or arrange for technical assistance for eligible applicants according to priority established by the brush control area working group;
- (5) examine brush control plans and contracts to assure inclusion of all necessary information and exhibits and that the criteria established in §517.33 are met;
- (6) prepare comments and recommendations relating to the brush control plan and contract for submittal to the State Board;
- (7) approve brush control plans and contracts that meet FOTG requirements on management units included in the brush control plan;
- (8) forward SWCD approved brush control plans and contracts to the State Board for quality control and execution of contract;
- (9) once approved by the State Board, notify the applicant that his/her contract has been approved for cost-share and to proceed with implementation as outlined in the applicant's brush control plan;

- (10) file a copy of the approved contract;
- (11) certify to the State Board that conservation land treatment measures have been completed according to standards and specifications prior to payment;
- (12) submit required reports to the State Board; and
- (13) as directed by the State Board, manage any problem that arises under a cost-sharing contract for brush control in that SWCD and report to the State Board.

**RULE §517.29. Cost-share for Brush Control**

- (a) Basis for cost-share. Cost-share shall be based on actual cost not to exceed average cost.
- (b) Average costs.
  - (1) The State Board, in consultation with SWCDs in the brush control area, shall establish average costs for each practice considering the results of completed evaluations.
  - (2) The brush control area working group shall develop average costs annually for each approved practice not to exceed the average costs established by the State Board.
  - (3) The brush control area working group may submit a written request to the State Board to increase the average costs established for each practice.
- (c) Maximum cost-share amount available.
  - (1) The maximum cost-share assistance that an eligible person may receive under the program in any one year, and the lifetime maximum cost-share assistance that an eligible person may receive is unrestricted by the State Board.
  - (2) The brush control area working group may establish the maximum cost-share assistance that an eligible person may receive under the program in any one year, and the lifetime maximum cost-share assistance that an eligible person may receive.
- (d) Cost-share rates.
  - (1) The State Board shall establish, in program guidance, the cost-share rate for each practice approved for the brush control area considering the results of the completed evaluations.
  - (2) Not more than 70% of the total cost of a single brush control project may be made available as the state's share in cost sharing.
  - (3) 100% of the total cost of a single project on public lands may be made available as the state's share in cost sharing.
  - (4) The brush control area working group shall establish cost-share rates, not to exceed those established by the State Board.

**RULE §517.30. Eligibility for Cost-share Assistance**

- (a) Eligible person.
  - (1) Any individual, partnership, administrator for a trust or estate, family-owned corporation, or other legal entity who as an owner, lessee, tenant, or sharecropper participates in an agricultural or wildlife operation

within a brush control area and is a cooperator with the local SWCD shall be eligible for cost-share assistance.

(2) A political subdivision is eligible for cost sharing under the brush control program, provided that the state's share may not exceed 50% of the total cost of a single project.

(b) Ineligible person.

(1) A person is not eligible to participate in the state brush control program or to receive money from the state brush control program if the person is simultaneously receiving any cost-share money for brush control on the same acreage from a federal government program.

(2) The State Board may grant an exception if the State Board finds that joint participation of the state brush control program and any federal brush control program will enhance the efficiency and effectiveness of a project, lessen the state's financial commitment to the project, and not exceed 80% of the total cost of the project.

(c) Eligible land. To be eligible for cost-share assistance, the land must be within a brush control area and fall into any of the following categories:

(1) land within the state that is privately owned by an eligible person;

(2) land leased by an eligible person over which the applicant has adequate control extending through the term of the contract period and written permission of the landowner; or

(3) land owned by the state, a political subdivision of the state, or a nonprofit organization that holds land in trust for the state.

(d) Ineligible lands. Allocated funds shall not be used on land outside of a brush control area or land not used for agricultural or wildlife production.

(e) Eligible purposes. Cost-share assistance shall be available only for brush control included in an approved brush control plan and contract and determined to be needed by SWCDs to conserve water.

(f) Eligible practices. Brush control methods, which the State Board has approved and which are included in the applicant's approved brush control plan and contract, shall be eligible for cost-share assistance. The brush control area working group shall designate their list of eligible methods from those approved by the State Board.

(g) Requirement to file an application. In order to qualify for cost-share assistance, an eligible person, including political subdivisions, shall file an application with the local SWCD.

(h) Requirement to develop a brush control plan. In order to qualify for cost-share assistance, an eligible person, including political subdivisions, shall develop a brush control plan. Brush control plans shall meet resource management system requirements on acres planned, as set forth in the FOTG.

(i) Persons authorized to sign applications and contracts. All applications, contracts, and performance certifications shall be signed by:

(1) the eligible person;

(2) any person designated to represent the eligible person, provided an appropriate notarized durable power of attorney has been filed with the SWCD office; or

(3) the responsible person or administrator, in cases of trusts or estates, provided that letters of administration or letters of testamentary have been submitted to the SWCD in lieu of a power of attorney.



RULE §517.31. Responsibility of Applicants

- (a) Applicants shall complete and submit an application form as provided by the State Board;
- (b) Applicants shall complete a SWCD cooperative agreement if the applicant is not already a SWCD cooperator;
- (c) Where an applicant does not have an approved brush control plan and has not determined the anticipated total cost of the proposed measure(s), he/she shall obtain a brush control plan approved by the local SWCD;
- (d) Applicants shall complete, sign, and submit a cost-share contract based on the approved brush control plan to the SWCD along with any amendments to the contract;
- (e) After being notified of approval, applicants may request technical assistance through the SWCD to design and lay out the approved brush control or request approval of alternate sources of technical assistance;
- (f) Applicants shall perform the approved brush control or secure any approved contractor(s) needed and all contractual or other agreements necessary to perform the approved brush control. Cost-share will not be allowed for work begun before the application is approved; and
- (g) Applicants shall supply the documents necessary to verify completion of the approved brush control along with copies of receipts for work to be cost-shared.

RULE §517.32. Applications for cost-share

- (a) A person who desires to participate with the state in a brush control project and to obtain cost-sharing participation by the state shall file an application with the SWCD in the SWCD in which the land on which the project is to be accomplished is located.
- (b) Applications held in abeyance because of lack of funds. In those cases where funds are not available, the applications will be held by the SWCD until allocated funds become available or until the end of the program year. The SWCD may shift all unfunded applications held in abeyance because of lack of funds that are on hand at the end of a program to the new program year or require all new applications, as it deems appropriate.
- (c) Applications denied for reasons other than lack of funds. Applications for funds, which are denied by the SWCD directors for other than lack of funds, shall be retained in the records of the SWCD in accordance with the SWCD's established record retention policy. Written notification of the denial shall be provided to the applicant along with the reason(s) that the application was denied.
- (d) Applications withdrawn. An application may be withdrawn by the applicant at any time prior to receipt of cost-share assistance by notifying the SWCD in writing that withdrawal is desired. Applications withdrawn by the applicant shall be retained in the records of the SWCD in accordance with the SWCD's established record retention policy.

RULE §517.33. Contracts for Cost-share

- (a) According to the priority of an application, the SWCD shall negotiate a ten-year brush control contract with the successful applicant in the brush control area subject to:
  - (1) Guidelines established by the State Board.
  - (2) Development of a brush control plan. As a condition for receipt of cost-share assistance for brush control, the eligible person receiving the benefit of such assistance shall agree to develop a brush control plan.

(3) Signature of a performance agreement. As a condition for receipt of cost-share assistance for brush control, the eligible person receiving the benefit of such assistance shall agree to perform the brush control in accordance with standards established by the State Board and the terms of the cost-share agreement. Completion of the performance agreement and the signature of the eligible person are required prior to payment.

(4) Management of treated areas.

(A) Requirements for follow-up brush control will be included in the cost-share contract with management recommendations outlined in the eligible person's brush control plan. These will be reviewed with the eligible person prior to signature and initiation of the cost-share contract. Requirements for follow-up brush control are subject to funding availability.

(B) The SWCD may require refund of any or all of the cost-share paid to an eligible person when acres where brush control was applied has not been managed in compliance with applicable standards and specifications for the practice in accordance with the terms of the cost-share contract as agreed to by the eligible person.

(C) In cases of hardship, death of the participant, or at the time of transfer of ownership of land where brush control has been applied using cost-share assistance and the term of the contract has not expired, the participant, heir(s), or buyer(s) respectively, must agree to properly manage the treated area or the participant, heir(s) or the buyer by agreement with seller must refund all or a portion of the cost-share funds received for the practice as determined by the SWCD. The State Board, on a case-by-case basis in consultation with the SWCD, may grant a waiver to this requirement.

(b) Criteria to consider. In approving a contract for cost sharing, the SWCD, in accordance with criteria established by the brush control area working group, shall consider:

- (1) the location of the project;
- (2) the method of control that is to be used by the applicant;
- (3) the plans for revegetation;
- (4) the total cost of the brush control;
- (5) the amount of land to be included;
- (6) whether the applicant is financially able to provide the applicant's share of the money for the brush control;
- (7) the cost-share percentage, if an applicant agrees to a higher degree of financial commitment;
- (8) any comments and recommendations submitted by the TDA, TWDB, or TPWD; and
- (9) any other pertinent information considered necessary by the SWCD.

(c) Approval of contracts. The SWCD may approve a contract if, after considering the factors listed in §517.33(c) and any other relevant factors, the SWCD finds:

- (1) the owner of the land fully agrees to cooperate in the project;
- (2) the method of control is a method approved by the brush control area working group; and
- (3) the brush control is to be carried out in an area eligible for funding as prioritized under the State Brush Control Plan.

(d) On completion of the negotiations by the SWCD, it shall submit the proposed contract to the State Board for execution.

(e) The State Board shall examine the contract and if the State Board finds that the contract meets all the conditions established in this section and the guidelines, it shall execute the contract and provide to the individual on completion of the project the money that constitutes the state's share of the project.

(f) Amending contracts.

(1) In the event that an adjustment to the estimated cost of brush control is necessitated by the final design, the applicant shall either agree to assume the additional cost or complete and submit an amendment to his/her contract for cost-share to the SWCD for approval or denial by the SWCD.

(2) The amount of funds obligated for brush control may be adjusted, provided funds are available and the adjustment is considered a priority according to the brush control area working group priority system.

(3) In the event additional funds are not available, the brush control may be redesigned, if possible, to a level commensurate with available funds, provided the redesign still meets standards established by the State Board; or the applicant can agree to assume full financial responsibility for the portion of the cost of brush control in excess of the amount authorized.

(g) Audits. It is the policy of the State Board to develop and implement audit guidelines that adequately safeguard assets administered within the purview of this agency in a cost effective manner.

(1) All parties to the contract are subject to audit by the State Board and/or SWCD for a period of two years after termination of the contract.

(2) The State Board and/or SWCD shall have access to all relevant applicant records, including all records of contractors and/or subcontractors that are pertinent to the contract, for the purpose of verifying compliance of contracts with the provisions of this subchapter and other state requirements. All parties shall maintain copies of performance certifications, contractor billing, and cancelled checks for a period of two years after termination as applicable to each party.

(3) The State Board and/or SWCD may withhold funds under this subchapter from applicants found to be in violation of the terms of the contract, this subchapter or other state requirements and may require applicants to reimburse the State Board for funds claimed and received in violation of this subsection or other state requirements.

(4) The State Board and/or SWCD may terminate a contract, in whole or in part, or negotiate a contract amendment in the event of a failure to comply with the terms of the contract provided that no such action may be effected unless the applicant is given not less than ten days written notice (delivered by certified mail, return receipt requested).

(A) Upon receipt of a termination action, applicant will promptly discontinue all services affected, and deliver all materials and deliverables as may have been accumulated by applicant in performing this contract whether completed or in the process.

(B) If the State Board terminates this contract then, without prejudice to any other right or remedy of the State Board, applicant will be reimbursed for actual incurred costs that are allowable and eligible limited to the total maximum amount of the contract.

#### RULE §517.34. Payment to Recipients

(a) The SWCD shall determine eligibility of the applicant to receive payment of cost-share assistance, and provide certification to the State Board that measure(s) have been installed consistent with the FOTG.

(b) Upon satisfactory receipt of performance certifications, invoices, and other required documentation the State Board shall cause payment for cost-share assistance to be issued to the applicant.

(c) Partial payment can be requested for brush control methods completed on identifiable land units as they are completed, provided required management can be applied.

(d) State money may not be provided in advance for work remaining to be done.

**RULE §517.35. Determining status of brush control during transfer of land ownership**

(a) A seller of agricultural land with respect to which a performance agreement is in effect may request the SWCD to inspect the practice. If the practice has been properly managed the SWCD shall issue a written statement that the seller has satisfactorily managed the treated area as of the date of the statement.

(b) The buyer of lands covered by a performance agreement may also request that the SWCD inspect the lands to determine whether the treated area has been properly managed as of the date of the inspection. If so, the SWCD will provide the buyer with a statement specifying the extent of compliance or noncompliance as of the date of the statement.

(c) The seller and the buyer, if known, shall be given notice of the time of inspection so that they may be present during the inspection to express their views as to compliance.

**RULE §517.36. Reporting and Accounting**

The State Board shall receive and maintain required reports showing the unobligated balance of funds for each brush control area as shown on each ledger at the close of the last day of each month.

**RULE §517.37. Consultation with Other Agencies**

(a) The State Board shall consult with the Texas Parks and Wildlife Department (TPWD), the Texas Water Development Board and the Texas Department of Agriculture as set forth in §203.016, Agriculture Code.

(b) The Texas Parks and Wildlife Department, the Texas Water Development, the Texas Department of Agriculture and other agricultural interests in the affected area shall be notified of all critical area working group meetings. The TPWD will provide technical assistance to the critical area working group in the development and implementation of the brush control plans.

(c) Comments and recommendations from the TPWD shall be considered when passing on applications for cost-share.

(d) Applicants shall be notified that the TPWD provides free technical guidance to landowners regarding the management of wildlife resources and habitats on their lands.

## **APPENDIX E**

### **Financial Information**

**RED RIVER GROUNDWATER  
CONSERVATION DISTRICT  
ANNUAL FINANCIAL REPORT  
YEAR ENDED DECEMBER 31, 2011**

**RUTHERFORD, TAYLOR & COMPANY, P.C.**  
*Certified Public Accountants*  
2802 Washington Street  
Greenville, Texas 75401  
(903) 455-6252



RED RIVER GROUNDWATER CONSERVATION DISTRICT  
ANNUAL FINANCIAL REPORT  
YEAR ENDED DECEMBER 31, 2011

**TABLE OF CONTENTS**

	<u>Page Number</u>
<u>Independent Auditor's Reports:</u>	
Report on Basic Financial Statements .....	3
Report on Internal Control over Financial Reporting and on Compliance and Other Matters Based on an Audit of Financial Statements Performed in Accordance with <i>Government Auditing Standards</i> .....	4
Management's Discussion and Analysis (Required Supplementary Information).....	6
<u>Basic Financial Statements:</u>	
Government-wide Financial Statements:	
Statement of Net Assets .....	11
Statement of Activities .....	12
Fund Financial Statements:	
Balance Sheet – Governmental Funds .....	13
Statement of Revenues, Expenditures and Changes in Fund Balances of Governmental Funds .....	14
Notes to the Basic Financial Statements .....	15
<u>Required Supplementary Information:</u>	
Budgetary Comparison Schedule .....	19

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INDEPENDENT AUDITOR'S REPORT

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Board of Directors  
Red River Groundwater Conservation District

We have audited the accompanying financial statements of the governmental activities and each major fund of the Red River Groundwater Conservation District (District) as of and for the year ended December 31, 2011, which collectively comprise the District's basic financial statements as listed in the accompanying table of contents. These basic financial statements are the responsibility of the District's management. Our responsibility is to express opinions on these basic financial statements based on our audit.

We conducted our audit in accordance with auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the basic financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the basic financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall basic financial statement presentation. We believe that our audit provides a reasonable basis for our opinions.

In our opinion, the basic financial statements referred to above present fairly, in all material respects, the respective financial position of the governmental activities and each major fund of the Red River Groundwater Conservation District, as of December 31, 2011, and the respective changes in financial position, and cash flows, where applicable, thereof for the year then ended, in conformity with accounting principles generally accepted in the United States of America.

In accordance with *Government Auditing Standards*, we have also issued our report dated June 29, 2012, on our consideration of the District's internal control over financial reporting and on our tests of its compliance with certain provisions of laws, regulations, contracts and grant agreements and other matters. The purpose of that report is to describe the scope of our testing of internal control over financial reporting and compliance and the results of that testing, and not to provide an opinion on internal control over financial reporting or on compliance. That report is an integral part of an audit performed in accordance with *Government Auditing Standards* and should be considered in assessing the results of our audit.

Accounting principles generally accepted in the United States of America require that the management's discussion and analysis and budgetary comparison information be presented to supplement the basic financial statements. Such information, although not a part of the basic financial statements, is required by the Governmental Accounting Standards Board, who considers it to be an essential part of financial reporting for placing the basic financial statements in an appropriate operational, economic or historical context. We have applied certain limited procedures to the required supplementary information in accordance with auditing standards generally accepted in the United States of America, which consisted of inquiries of management about the methods of preparing the information and comparing the information for consistency with management's responses to our inquiries, the basic financial statements, and other knowledge we obtained during our audit of the basic financial statements. We do not express an opinion or provide any assurance on the information because the limited procedures do not provide us with sufficient evidence to express an opinion or provide any assurance.

June 29, 2012  
Greenville, Texas

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REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING AND ON COMPLIANCE  
AND OTHER MATTERS BASED ON AN AUDIT OF FINANCIAL STATEMENTS PERFORMED IN  
ACCORDANCE WITH GOVERNMENT AUDITING STANDARDS

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Board of Directors  
Red River Groundwater Conservation District

We have audited the financial statements of the governmental activities and each major fund of the Red River Groundwater Conservation District (District) as of and for the year ended December 31, 2011, which collectively comprise the District's basic financial statements and have issued our report thereon dated June 29, 2012. We conducted our audit in accordance with auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States.

Internal Control over Financial Reporting

In planning and performing our audit, we considered the District's internal control over financial reporting as a basis for designing our auditing procedures for the purpose of expressing our opinions on the financial statements, but not for the purpose of expressing an opinion on the effectiveness of the District's internal control over financial reporting. Accordingly, we do not express an opinion on the effectiveness of the District's internal control over financial reporting.

A *deficiency in internal control* exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct misstatements on a timely basis. A *material weakness* is a deficiency, or combination of deficiencies, in internal control such that there is a reasonable possibility that a material misstatement of the entity's financial statements will not be prevented, or detected and corrected on a timely basis.

Our consideration of internal control over financial reporting was for the limited purpose as described in the first paragraph of this section and was not designed to identify all deficiencies in internal control over financial reporting that might be deficiencies, significant deficiencies or material weaknesses. We did not identify any deficiencies in internal control over financial reporting that we consider to be material weaknesses, as defined above.

## Report on Internal Control – Continued

### Compliance and Other Matters

As part of obtaining reasonable assurance about whether the District's basic financial statements are free of material misstatement, we performed tests of its compliance with certain provisions of laws, regulations, contracts, and grant agreements, noncompliance with which could have a direct and material effect on the determination of financial statement amounts. However, providing an opinion on compliance with those provisions was not an objective of our audit, and accordingly, we do not express such an opinion. The results of our tests disclosed no instances of noncompliance or other matters that are required to be reported under *Government Auditing Standards*.

This report is intended solely for the information and use of the Board of Directors, management, and others within the District and is not intended to be and should not be used by anyone other than these specified parties.

June 29, 2012  
Greenville, Texas

RED RIVER GROUNDWATER CONSERVATION DISTRICT  
MANAGEMENT'S DISCUSSION AND ANALYSIS  
YEAR ENDED DECEMBER 31, 2011

The Red River Groundwater Conservation District (District) is pleased to present its financial statements. This required supplementary information presents our discussion and analysis of the District's financial performance during the year ended December 31, 2011. Please read this section in conjunction with the basic financial statements which follow this section.

## FINANCIAL HIGHLIGHTS

- The District's combined total net assets were \$ 29,157 at December 31, 2011.
- During the year, the District's expenses were \$ 29,157 less than the \$ 148,117 generated in fees and other revenues.
- The General Fund presents a year end fund balance of \$ 29,157.

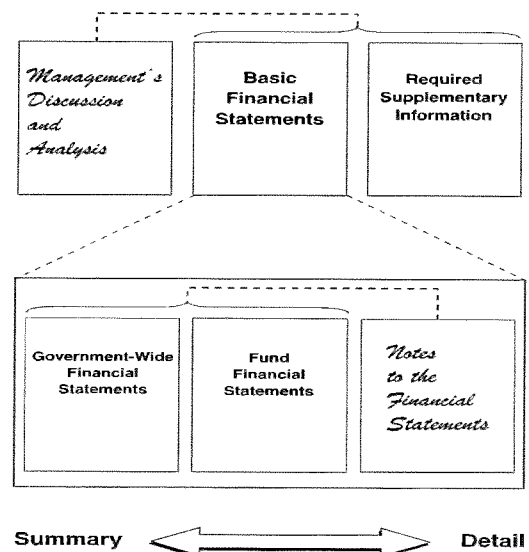
## OVERVIEW OF THE FINANCIAL STATEMENTS

In addition to this Management's Discussion and Analysis, this report consists of government-wide financial statements, fund financial statements, and the notes to the financial statements. The first two statements are condensed and present a government-wide view of the District's finances. The government-wide statements are designed to be more corporate-like in that all activities are consolidated into a total for the District.

### *Basic Financial Statements*

- The Statements of Net Assets focuses on resources available for future operations. In simple terms, the statement presents a snapshot of the assets of the District, the liabilities it owes, and the net difference. The net difference is further separated into amounts restricted for specific purposes, if any, and unrestricted amounts. The information presented in this statement is reported on the accrual basis of accounting.
- The Statement of Activities focuses on gross and net costs of the District's programs and the extent to which such programs rely on general revenues. The statement summarizes and simplifies the users analysis to determine the extent to which programs are self-supporting and/or subsidized by general revenues.
- Fund financial statements focus separately on individual funds, including assets liabilities and fuel equity. Separate revenues and expenditures analysis are presented to each major fund.
- The notes to the financial statements provide additional disclosures required by governmental accounting standards and provide information to assist the reader in understanding the District's financial condition.

Figure A-1, Required Components of the District's Annual Financial Report



RED RIVER GROUNDWATER CONSERVATION DISTRICT  
MANAGEMENT'S DISCUSSION AND ANALYSIS  
YEAR ENDED DECEMBER 31, 2011

**FINANCIAL ANALYSIS OF THE DISTRICT AS A WHOLE**

Net assets may serve over time as a useful indicator of a government's financial position. For the District, the total combined net assets were \$ 29,157 at year end. A comparative condensed summary of the District's statements of net assets is typically presented here. As this is the first year of operations for the District, the prior year column contains no data.

Red River Groundwater Conservation District's Net Assets			Table A-1
	2011	2010	Total Percentage Change 2010 - 2011
<b>Assets:</b>			
Cash and Cash Equivalents	\$ (1,212)	\$ -	100.00%
Receivables	58,533	-	100.00%
<b>Total Assets</b>	<b>\$ 57,321</b>	<b>\$ -</b>	<b>100.00%</b>
<b>Liabilities:</b>			
Current Liabilities	\$ 28,164	\$ -	100.00%
<b>Total Liabilities</b>	<b>\$ 28,164</b>	<b>\$ -</b>	<b>100.00%</b>
<b>Net Assets:</b>			
Unrestricted	29,157	-	100.00%
<b>Total Net Assets</b>	<b>\$ 29,157</b>	<b>\$ -</b>	<b>100.00%</b>

At current year end, the District's total assets (100%) represents Fines and Fees Receivable, net of Allowance for Doubtful Accounts. As of December 31, 2011, the District had yet to procure any fixed assets or debt.

The District's liabilities consist of accounts payable for items or services received during the year, but not paid out in cash until after year end.

Unrestricted net assets represent amounts available for future spending.



RED RIVER GROUNDWATER CONSERVATION DISTRICT  
MANAGEMENT'S DISCUSSION AND ANALYSIS  
YEAR ENDED DECEMBER 31, 2011

**CHANGES IN NET ASSETS**

The District's total revenues were \$ 148,117, in water pumping fees from members of the District.

The total cost of all services was \$ 118,960, for organizational and legal fees, and administration of the program.

A condensed summary of the District's statements of activities and changes in net assets for the years ended December 31, 2011 and 2010 is typically presented here. As this is the first year of operations for the District, the prior year column contains no data.

Changes in Red River Groundwater Conservation District's Net Assets			Table A-2
	2011	2010	Total Percentage Change 2010 - 2011
Operating Revenues:			
Charges for Services	\$ 148,117	\$ -	100.00%
Total Revenues	\$ 148,117	\$ -	100.00%
Operating Expenses:			
Administrative Services	\$ 118,960	\$ -	100.00%
Total Expenses	\$ 118,960	\$ -	100.00%
Increase (Decrease) in Net Assets	\$ 29,157	\$ -	100.00%

**FINANCIAL ANALYSIS OF THE DISTRICT'S FUNDS**

The governmental funds of the District reported revenues of \$ 148,117 during the current year, with total expenditures of \$ 118,960. As this is the first year of operations for the District, prior year comparison is not available.

**BUDGETARY HIGHLIGHTS**

The District's Board of Directors adopted a final operating budget for the 2011 fiscal year, based on anticipated receipts and expenditures (unaudited), prior to year end. The budget encompasses all the activities of the District, which would normally include both revenues and expenditures.

RED RIVER GROUNDWATER CONSERVATION DISTRICT  
MANAGEMENT'S DISCUSSION AND ANALYSIS  
YEAR ENDED DECEMBER 31, 2011

**CAPITAL ASSETS AND DEBT ADMINISTRATION**

**Capital Assets**

As of December 31, 2011, the District has not yet invested in any capital assets.

**Debt**

As of December 31, 2011, the District has not yet entered into any debt agreements. The District has no outstanding long-term debt at year end.

**ECONOMIC FACTORS AND NEXT YEAR'S BUDGET AND RATES**

The District adopted the next year's budget to provide for the developing nature of the services provided by the District, which will increase over the current year.

**CONTACTING THE DISTRICT'S FINANCIAL MANAGEMENT**

This financial report is designed to provide our citizens, taxpayers, investors and creditors with a general overview of the District's finances and to demonstrate the District's accountability for the money it receives. If you have any questions about this report or need additional financial information, contact Jerry Chapman, General Manager for the District.

## BASIC FINANCIAL STATEMENTS

RED RIVER GROUNDWATER CONSERVATION DISTRICT  
STATEMENT OF NET ASSETS  
DECEMBER 31, 2011

	Governmental Activities
<b>ASSETS</b>	
Current Assets:	
Cash and Cash Equivalents	\$ (1,212)
Fines and Fees Receivable, Net	58,533
Total Current Assets	<u>\$ 57,321</u>
 <b>Total Assets</b>	 <u><u>\$ 57,321</u></u>
 <b>LIABILITIES</b>	
Current Liabilities:	
Accounts Payable	\$ 28,164
Total Current Liabilities	<u>\$ 28,164</u>
 Total Liabilities	 <u>\$ 28,164</u>
 <b>NET ASSETS</b>	
Unrestricted	<u>29,157</u>
 Total Net Assets	 <u>\$ 29,157</u>
 <b>Total Liabilities and Net Assets</b>	 <u><u>\$ 57,321</u></u>

The accompanying notes are an integral part of these financial statements.

RED RIVER GROUNDWATER CONSERVATION DISTRICT  
STATEMENT OF ACTIVITIES  
YEAR ENDED DECEMBER 31, 2011

Functions/Programs	Expenses	Program Revenues		Net (Expense) Revenue and Changes in Net Assets
		Charges for Services	Operating Grants and Contributions	Governmental Activities
Governmental Activities:				
Administration	\$ 118,960	\$ 148,117	\$ -	\$ 29,157
Total Governmental Activities	\$ 118,960	\$ 148,117	\$ -	\$ 29,157
Total Primary Government	\$ 118,960	\$ 148,117	\$ -	\$ 29,157
General Revenues:				
Interest Income				\$ -
Total General Revenues				\$ -
Change in Net Assets				\$ 29,157
Net Assets - Beginning (January 1)				-
Net Assets - Ending (December 31)				\$ 29,157

The accompanying notes are an integral part of these financial statements.

RED RIVER GROUNDWATER CONSERVATION DISTRICT  
BALANCE SHEET - GOVERNMENTAL FUNDS  
DECEMBER 31, 2011

	General Fund
<b>ASSETS</b>	
Current Assets:	
Cash and Cash Equivalents	\$ (1,212)
Fines and Fees Receivable	60,363
Allowance for Uncollectible Accounts	(1,830)
Total Current Assets	<u>\$ 57,321</u>
 <b>Total Assets</b>	 <u><u>\$ 57,321</u></u>
 <b>LIABILITIES</b>	
Current Liabilities:	
Accounts Payable	\$ 28,164
Total Current Liabilities	<u>\$ 28,164</u>
 <b>Total Liabilities</b>	 <u><u>\$ 28,164</u></u>
 <b>Equity</b>	
Unrestricted	\$ 29,157
Total Equity	<u>\$ 29,157</u>
 <b>Total Liabilities &amp; Equity</b>	 <u><u>\$ 57,321</u></u>

The accompanying notes are an integral part of these financial statements.



RED RIVER GROUNDWATER CONSERVATION DISTRICT  
STATEMENT OF REVENUES, EXPENSES AND CHANGES  
IN FUND BALANCE - GOVERNMENTAL FUNDS  
YEAR ENDED DECEMBER 31, 2011

	General Fund
<b>OPERATING REVENUES</b>	
Groundwater Usage Fees	\$ 148,117
<b>Total Operating Revenues</b>	<b>\$ 148,117</b>
<b>OPERATING EXPENSES</b>	
Administration	\$ 100,995
Legal Fees	17,965
<b>Total Operating Expenses</b>	<b>\$ 118,960</b>
<b>Operating Revenue (Expenses)</b>	<b>\$ 29,157</b>
<b>Net Change in Fund Balance</b>	<b>\$ 29,157</b>
Fund Balance - Beginning (January 1)	-
<b>Fund Balance - Ending (December 31)</b>	<b>\$ 29,157</b>

The accompanying notes are an integral part of these financial statements.

RED RIVER GROUNDWATER CONSERVATION DISTRICT  
NOTES TO THE BASIC FINANCIAL STATEMENTS  
YEAR ENDED DECEMBER 31, 2011

A. Summary of Significant Accounting Policies

The basic financial statements of the Red River Groundwater Conservation District (District) have been prepared in conformity with accounting principles generally accepted in the United States of America (GAAP) applicable to governmental units. The Governmental Accounting Standards Board (GASB) is the accepted standard setting body for establishing governmental accounting and financial reporting principles.

1. Reporting Entity

The Red River Groundwater Conservation District (District), is a political subdivision of the State of Texas, created under the authority of Article XVI, Section 59, Texas Constitution, and operating pursuant to the provisions of the Texas Water Code, Chapter 36, and Senate Bill 2497, Acts of the 81<sup>st</sup> Texas Legislature, Regular Session, 2010. The District encompasses the North Texas counties of Grayson and Fannin. The Board of Directors (Board), a six member group constituting an on-going entity, is the level of government which has governance responsibilities over all activities within the jurisdiction of the District. The Board is not included in any other governmental "reporting entity" as defined in Section 2100, Codification of Governmental Accounting and Reporting Standards, since Board members are appointed, have decision making authority, the power to designate management, the responsibility to significantly influence operations and primary accountability for fiscal matters.

As required by accounting principles generally accepted in the United States of America, the basic financial statements of the reporting entity include those of the District (primary government) and its component units. There are no component units included in these basic financial statements.

2. Basis of Presentation – Basis of Accounting

*Government-wide Statements* – The statement of net assets (SNA) and the statement of activities (SOA) include the financial activities of the overall government, except for fiduciary activities. Eliminations have been made to minimize the double-counting of internal activities. Governmental activities generally are financed through taxes, intergovernmental revenues, and other non-exchange transactions.

The statement of activities (SOA) presents a comparison between direct expenses and program revenues for each function of the District's governmental activities. Direct expenses are those that are specifically associated with a program or function and therefore, are clearly identifiable to a particular function. The District does not allocate indirect expenses in the statement of activities. Program revenues include (a) fees, and other charges paid by the recipients of goods or services offered by the programs and (b) grants and contributions that are restricted to meeting the operational or capital requirements of a particular program. Revenues that are not classified as program revenues, including taxing entities allocations and investments, are presented as general revenues.

*Fund Financial Statements* – The fund financial statements provide information about the District's funds, with separate statements presented for each fund category. The emphasis of fund financial statements is on major governmental funds, each displayed in a separate column. Any remaining governmental funds are aggregated and reported as non-major funds.

RED RIVER GROUNDWATER CONSERVATION DISTRICT  
NOTES TO THE BASIC FINANCIAL STATEMENTS  
YEAR ENDED DECEMBER 31, 2011

A. Summary of Significant Accounting Policies (Continued)

District accounts are organized on the basis of funds, each of which is considered a separate accounting entity. Governmental resources allocated to individual funds are recorded for the purpose of carrying on specific activities in accordance with laws, regulations or other appropriate requirements. The fund types and funds utilized by the District are described below:

Governmental fund types include the following –

The *General Fund* is used to account for financial resources used for general operations. This is a budgeted fund and any fund balances are considered resources available for current operations. All revenues and expenditures not required to be accounted for in other funds are accounted for in this fund.

3. **Measurement Focus - Basis of Accounting**

*Government-wide Statements* – These financial statements are reported using the economic resources measurement focus. The government-wide financial statements are reported using the accrual basis of accounting. Revenues are recorded when earned and expenses are recorded at the time liabilities are incurred, regardless of when the related cash flows take place. Non-exchange transactions, in which the District gives (or receives) value without directly receiving (or giving) equal value in exchange, include taxing entity allocations. Revenue from grants, entitlements, and donations are recognized in the fiscal year in which all eligibility requirements have been satisfied.

*Fund Financial Statements* – The modified accrual basis of accounting is used for the governmental fund types. This basis of accounting recognizes revenue in the accounting period in which they become both measurable and available and it recognizes expenditures in the accounting period in which the fund liability is incurred, if measurable, except for un-matured interest on general long term debt, which is recognized when due. Expenditures related to certain compensated absences and claims and judgments are recognized when the obligations are expected to be liquidated with expendable available financial resources.

4. **Receivable and Payable Balances**

The District believes that sufficient detail of receivable and payable balances is provided in the financial statements to avoid the obscuring of significant components by aggregation. Therefore, no disclosure is provided which disaggregates those balances.

B. Deposits, Securities and Investments

The District's funds are deposited and invested in the American Bank of Texas, Sherman, Texas. At December 31, 2011, all District cash deposits appeared to have been covered by FDIC insurance or by pledged securities held by other banks in the name of the depository bank. The District's deposits appear to have been properly secured throughout the fiscal year.

GASB Statement No. 40 requires a determination as to whether the District was exposed to the following specific investment risks at year end and if so, the reporting of certain related disclosures:

**Custodial Credit Risk**

Deposits are exposed to custodial credit risk if they are not covered by depository insurance and the deposits are uncollateralized, collateralized with securities held by the pledging financial institution, or collateralized with securities held by the pledging financial institution's trust department or agent but not in the District's name.

RED RIVER GROUNDWATER CONSERVATION DISTRICT  
NOTES TO THE BASIC FINANCIAL STATEMENTS  
YEAR ENDED DECEMBER 31, 2011

B. Deposits, Securities and Investments (Continued)

Investment securities are exposed to custodial risk if the securities are uninsured, are not registered in the name of the government, and are held by either the counterparty or the counterparty's trust department or agent but not in the District's name. At year end, the District does not appear to be exposed to custodial credit risk.

C. Risk Management

The District is exposed to various risks of loss related to torts; theft of, damage to and destruction of assets; errors and omissions; injuries to employees; and natural disasters. During the year ended December 31, 2011, the District purchased commercial insurance to cover these liabilities. There were no significant reductions in coverage in the last fiscal year, and there were no settlements exceeding insurance coverage in the past year.

D. Litigation

The District does not appear to be involved in any pending litigation as of December 31, 2011.

E. Subsequent Events

Subsequent events have been evaluated through June 29, 2012, which is the date the financial statements were available to be issued. There do not appear to be any events occurring after year end that would or could have an impact on the financial statements at December 31, 2011 as presented.

## REQUIRED SUPPLEMENTARY INFORMATION

RED RIVER GROUNDWATER CONSERVATION DISTRICT  
GENERAL FUND  
BUDGETARY COMPARISON SCHEDULE  
YEAR ENDED DECEMBER 31, 2011

	Budgeted Amounts		Actual	Variance with Final Budget Positive (Negative)
	Original	Final		
<b>OPERATING REVENUES</b>				
Groundwater Usage Fees	\$ 150,000	\$ 150,000	\$ 148,117	\$ (1,883)
Total Operating Revenues	\$ 150,000	\$ 150,000	\$ 148,117	\$ (1,883)
<b>OPERATING EXPENSES</b>				
Administration	\$ 111,500	\$ 149,000	\$ 100,995	\$ 48,005
Legal Fees	7,500	9,000	17,965	(8,965)
Total Operating Expenses	\$ 119,000	\$ 158,000	\$ 118,960	\$ 39,040
Change in Net Assets	\$ 31,000	\$ (8,000)	\$ 29,157	\$ 37,157
Net Assets - Beginning (January 1)	-	-	-	-
<b>Net Assets - Ending (December 31)</b>	<b>\$ 31,000</b>	<b>\$ (8,000)</b>	<b>\$ 29,157</b>	<b>\$ 37,157</b>