

A Report on Progress of Water Conservation in Texas

Report to 84th Legislature
December 2014

Submitted by
Water Conservation Advisory Council
www.savetexaswater.org

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Council Members

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Regional Water Planning Groups

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Texas Commission on Environmental Quality

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Texas Parks and Wildlife Department

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TX State Soil and Water Conservation Board

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Mining and Recovery of Minerals

Brad Smith

Landscape Irrigation and Horticulture

Linda Christie

Water Control and Improvement Districts

Lara Zent

Rural Water Users

Donna Howe

Municipal Utility Districts

December 1, 2014

The Honorable Rick Perry
Governor, State of Texas

The Honorable David Dewhurst
Lieutenant Governor of Texas

The Honorable Joe Straus, III
Speaker, Texas House of Representatives

Re: Water Conservation Advisory Council Report

Dear Sirs:

It is our honor as members of Water Conservation Advisory Council (Council) to provide you with the fourth biannual report on water conservation progress in Texas. The Council was statutorily created by the 80th Texas Legislature in 2007 for the purpose to provide the Governor, Lieutenant Governor, Speaker of the House of Representatives, Legislature, and the general public with the resource of a select council with broad expertise in water conservation. This report contains the Council's activities and progress made in Texas water conservation over the past two years.

The Council operates under the mission to establish a professional forum for the continuing development of water conservation resources, expertise, and progress evaluation of the highest quality for the benefit of Texas—its state leadership, regional and local governments, and general public.

With the continuing drought in Texas, the Council strongly believes that water conservation will play a vital role in securing sufficient water for future generations of Texans.

The Council believes that with the passage of House Bill 4 in the most recent regular Legislative session, the voter approval of Proposition 6, and the findings in this report, meaningful water conservation will be accomplished in a prudent fiscally responsible way.

Throughout the past two years, the Council, working through its seven charges, has completed many activities such as the passage of 11 best management practices, continuing to expand the Blue Legacy Awards in Water Conservation with a new award category for manufacturing, and dialogue to champion water conservation strategies with all user groups.

Outside of their individual professional endeavors, the 23 members of the Council, as well as others participating as alternates and interested parties, have voluntarily provided numerous days of their time and countless efforts on Council activities. The members of the Water Conservation Advisory Council are honored to serve on the Council and are pleased to submit this forth biennial report to the elected leadership of the State of Texas.

Respectfully Submitted On Behalf of the 23 Members of the Council,

A handwritten signature in cursive script, appearing to read "C. E. Williams".

C. E. Williams
Presiding Officer for Members of the Council
Water Conservation Advisory Council

c: The Honorable Troy Fraser, Chairman, Senate Natural Resources
Committee

The Honorable Allan Ritter, Chairman, House Natural Resources
Committee

I. Executive Summary

With drought continuing across much of the state, water—and the efficient use of water—has remained a topic of utmost importance in Texas. With drought restrictions, new conservation measures, new water legislation, and approval of \$2 billion for water infrastructure—including a minimum of 20 percent for conservation and reuse—Texas clearly takes water seriously. Yet there is still much to do.

When the legislature created the Water Conservation Advisory Council, it sought a professional forum for the continuing development of water conservation resources, expertise, and evaluation of progress in that state. This report summarizes the Council’s activities and progress on the seven legislative charges as well as the focus for future council efforts.

Trends in water conservation implementation

The Texas Water Development Board now has five years of annual reporting data on the implementation of water conservation plans; however, due to several factors that can impact water use, including weather, it’s still too soon to do a trend analysis. Nevertheless, water providers are showing water savings from water conservation. Although the types of municipal water conservation measures being implemented by utilities varies considerably across the state—and the rate of progress in achieving conservation targets varies greatly as well—efforts to reduce water use and increase water efficiency are increasingly evident in utilities of all sizes and types in Texas. The Council continues to work with the Board and the Commission on encouraging compliance with reporting requirements, monitoring implementation and success of water conservation plans, and ensuring data quality and timeliness. A number of local, regional, state, and private entities have worked on increasing public awareness of water conservation, such as Dallas’ “Save Water. Nothing Can Replace It”; Pharr’s “Water is Life”; Austin’s “Water Wise”; and North Texas Municipal Water District’s and Texas Water Development Board’s “Water IQ: Know Your Water”, Texas Commission on Environmental Quality’s “Take Care of Texas”, and Texas Department of Agriculture’s public-private partnership “Texas Water Smart”.

For agriculture, producers continue to voluntarily adopt best management practices to improve irrigation efficiency; however, the data needed to assess and quantify the extent of this trend is not readily available. Monitoring trends in water use and conservation for the institutional, commercial, and industrial sectors is difficult. The Council plans to address these difficulties and work toward developing robust monitoring methods.

Monitor new technologies for possible inclusion by the Texas Water Development Board as best management practices in the Best Management Practices Guide developed by the Water Conservation Implementation Task Force

Over the past two years, the council worked on revising 11 agricultural and municipal best management practices. The Texas Water Development Board accepted and published these revisions on November 18, 2013, on the Texas Water Development Board’s Best Management

Practice Guide website. In addition, the brush control best management practice is currently being revised under the guidance of the Council's agricultural workgroup.

[Monitor the effectiveness of the statewide water conservation public awareness program and associated local involvement in implementation of the program](#)

“Water IQ: Know Your Water” is a Texas Water Development Board-managed statewide public awareness program that supports existing local water conservation efforts. Currently, 82 entities are Water IQ partners representing 1,080 of approximately 4,100 zip codes in Texas.

[Develop and implement a state water management resource library](#)

Since 2008 the Council has partnered with the Alliance for Water Efficiency in providing access to a national library of available water conservation resources including research, information, and tools. The Council website includes a link to the Alliance for Water Efficiency's clearinghouse, and a link to the Water Conservation Best Management Practices Guide was placed on the Alliance for Water Efficiency's website.

[Develop and implement a public recognition program for water conservation](#)

Since 2010, the Council has publicly recognized members of the municipal and agricultural sectors with an incomparable commitment to water conservation through the Blue Legacy Awards. The Council thus far has given awards in two broad categories: agriculture and municipal, with different municipal awards given based on population size. The 2013 agricultural awards went to Mr. Eddie Teeter, a producer, and the Harlingen Irrigation District—Cameron County No. 1. The Council has not yet awarded 2014 awards. The 2013 municipal awards went to City of Fort Worth Water Department, City of Georgetown Utility Systems, City of Round Rock Conservation Program, and Lower Colorado River Authority. The 2014 awards went to Cinco Ranch Municipal Utility District, City of Austin Water Utilities, City of New Braunfels, and City of Round Rock.

[Monitor the implementation of water conservation strategies by water users included in regional water plans](#)

In October 2012, the Texas Water Development Board changed its rules to require regional water planning groups to assess the implementation of water conservation strategies in their next regional water plans. Although it is still too soon for an analysis of all the regional water planning areas (initially prepared plans are not due until May 2015), two regions, C and H, shared preliminary survey results with the Council. These surveys suggest that municipal water conservation measures called for in the respective regional water plans are—with some exceptions—not being widely implemented. The exceptions include many wholesale and some retail water suppliers in Region C that are aggressively making progress in water conservation (for example, expanding adoption of no-more-than-twice-a-week outdoor watering restrictions on an ongoing basis) and the Goldwater Project in Region H, a pro-active effort to expand adoption of water conservation measures through detailed analysis of the cost and potential savings from pursuing those measures.

Monitor target and goal guidelines for water conservation to be considered by the Texas Commission on Environmental Quality and Texas Water Development Board

The Council provides input to the Texas Commission on Environmental Quality and the Texas Water Development Board on information related to water conservation. The counsel of the group has been needed often and most recently on the compilation of a report on sector-based reporting from the Texas Water Development Board to the Legislature due on January 1, 2015. Per Texas Water Code §16.043, the Texas Water Development Board, in consultation with the Texas Commission on Environmental Quality and the Council, developed a data collection and reporting program for municipalities and water utilities with more than 3,300 connections. The Council adapted a calculator developed by the state of New Mexico that allows water providers to submit water use data and make gallons per capita daily analyses on a more uniform basis. The calculator was posted on the Council website along with a solicitation for comments. Based on comments provided by testers and the public, Texas Water Development Board staff updated and revised the calculator to better meet the needs of users in Texas.

Advancing Water Conservation Efforts

A key function of the Council relates to advancing water conservation efforts across Texas. The Council works to promote knowledge and adoption of those practices, techniques, programs, and technologies that will protect water resources, reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, and increase the recycling and reuse of water so that a water supply is made available for future or alternative uses. The Council will continue to advance water conservation awareness in Texas and recognizes recent achievements and certain areas still in need of more focused attention.

Over the next couple of years, to support work on the tasks above, the Council plans to (1) compile more information on drought management strategies and results of implementation from water providers across Texas and distribute this information; (2) monitor efforts associated with the State Energy Conservation Office in requiring to coordinate existing energy and water management planning and reporting by state agencies and public institutions of higher education and mine information that may be useful for the non-public sector; (3) continue to monitor the Texas Water Development Board's efforts on developing a consolidated reporting database for water use, water-loss audits, and water conservation plan implementation, (4) work with the Board and others in identifying information on agricultural irrigation efficiency; (5) monitor the Board's activities on water loss reporting associated with financial assistance; (6) ascertain the scope of existing water conservation related programs at campuses across the state and determine what areas, if any, could be expanded in the future; and (7) assist the Texas American Water Works Association to implement a water conservation professional certification program for wholesale and municipal water suppliers.

Because of the drought, Texans have learned a great deal about the importance of water, where their water comes from, and how to use water more efficiently. The challenge will be to continue this awareness and efficiency as the drought continues, and especially after the drought ends.

II. Background and Operation of the Council

Recognizing the importance of conservation in meeting our future demand, the 80th Regular Session of the Texas Legislature in 2007 passed Senate Bill 3 and House Bill 4, which directed the Texas Water Development Board to appoint the members of the newly created Water Conservation Advisory Council (Council). The Council was created to provide the Governor, Lieutenant Governor, Speaker of the House of Representatives, Legislature, Texas Water Development Board, Texas Commission on Environmental Quality, political subdivisions, and the public with the resource of a select council with expertise in water conservation.

The Council operates under the mission *to establish a professional forum for the continuing development of water conservation resources, expertise, and progress evaluation of the highest quality for the benefit of Texas — its state leadership, regional and local governments, and general public*. The twenty-three members (listed below) represent many backgrounds and industries to best complete the charges.

The Council actively monitors trends in water conservation implementation and new technologies for possible inclusion in best management practices. The Council also researches, develops, and finalizes best management practices working with the Texas Water Development Board and the Texas Commission on Environmental Quality.

The Council, in partnership with the Texas Water Development Board, monitors the effectiveness of a statewide water conservation public awareness program, Water IQ: Know your water, and actively promotes the program among stakeholders. The www.SaveTexasWater.org website is maintained by the Council and provides information for the state water management resource library. The Council established the Blue Legacy Awards in Water Conservation, presented each year to those on the forefront of water conservation strategies and technologies.

The Water Conservation Advisory Council has designated support staff at the Texas Water Development Board. Staff assist the Council in their charges and provide administrative support for website development, meeting organization, information gathering, and other duties.

Table 1. Current Members of the Water Conservation Advisory Council

Interest Group	Member	Term Ends
Texas Commission on Environmental Quality	Mr. Chris Loft	2017
Texas Department of Agriculture	Dr. David Villarreal	2017
Texas Parks and Wildlife Department	Ms. Cindy Loeffler	2015
Texas State Soil and Water Conservation Board	Mr. John Foster	2019
Texas Water Development Board	Dr. Robert E. Mace	2017
Regional Water Planning Groups	Mr. C.E. Williams	2015
Federal Agencies	Mr. John Mueller	2017
Municipalities	Ms. Karen Guz	2017
Groundwater Conservation Districts	Ms. Stacey Steinbach	2019
River Authorities	Mr. James Parks	2015
Environmental Groups	Dr. Ken Kramer	2015
Irrigation Districts	Mr. Wayne Halbert	2019
Institutional Water Users	Mr. H.W. "Bill" Hoffman	2019
Professional Organizations-Water Conservation	Ms. Carole Baker	2019
Higher Education	Dr. Kevin Wagner	2015
Agricultural Groups	Mr. Jay Bragg	2019
Refining and Chemical Manufacturing	Mr. Karl Fennessey	2017
Electric Generation	Mr. Gary Spicer	2015
Mining and Recovery of Minerals	Ms. C.J. Tredway	2019
Landscape Irrigation and Horticulture	Mr. Brad Smith	2017
Water Control and Improvement Districts	Ms. Linda Christie	2019
Rural Water Users	Ms. Lara Zent	2015
Municipal Utility Districts	Ms. Donna Howe	2017

Table 2. Current Alternates of the Water Conservation Advisory Council

Interest Group	Alternates
Texas Commission on Environmental Quality	Ms. Jennifer Allis
Texas Department of Agriculture	Mr. Neal Carlton
Texas Parks and Wildlife Department	Ms. Lynne Hamlin
Texas State Soil and Water Conservation Board	Mr. Steve Bednarz
Texas Water Development Board	Ms. Jessica Kohlrenken
Regional Water Planning Groups	Mr. Mike Mahoney
Federal Agencies	Mr. Brian Wenberg
Municipalities	Ms. Ruthanne Beilue
Groundwater Conservation Districts	Mr. John Dupnik
River Authorities	Ms. Denise Hickey
Environmental Groups	Ms. Jennifer Walker
Irrigation Districts	Mr. Mike Irlbeck
Institutional Water Users	Mr. Eddie Trevino
Professional Organizations-Water Conservation	Ms. Nora Mullarkey
Higher Education	Dr. Calvin Finch
Agricultural Groups	Mr. Billy Howe
Refining and Chemical Manufacturing	Ms. Cindy Jordy
Electric Generation	Mr. Rick Jeanes
Mining and Recovery of Minerals	Ms. Debbie Hastings
Landscape Irrigation and Horticulture	Mr. Markus Hogue
Water Control and Improvement Districts	Mr. Dean Minchillo
Rural Water Users	Mr. Fred Aus
Municipal Utility Districts	Mr. Mark Froehlich

III. Acknowledgments

The Council appreciates the efforts of a number of Board staff in assisting the Council in its meetings and duties and in the preparation of this report. In particular, we are grateful for the efforts of Ms. Katherine Thigpen who serves as the Board's primary support for the Council and for Ms. Patsy Waters for her administrative support on Council activities.

IV. Introduction

Water is essential to all life on Earth and is vital to the thriving economy and environmental resources of Texas. Over the next fifty years, the population of Texas will almost double. More Texans require more water, further stressing our limited surface-water and groundwater resources. One of the easiest and most cost effective ways of increasing our water supply is to use the water we already have more efficiently.

The Texas Legislature recognized the importance of water conservation and, in 2007, created the Water Conservation Advisory Council to provide the Governor, Lieutenant Governor, Speaker of the Texas House of Representatives, the Legislature, the Texas Water Development Board, the Texas Commission on Environmental Quality, political subdivisions, and the public with the resource of a select council with expertise in water conservation. The legislature tasked the Council with specific charges:

- Charge 1: Monitor trends in water conservation implementation
- Charge 2: Monitor new technologies for possible inclusion by the Texas Water Development Board as best management practices in the Best Management Practices Guide developed by the Water Conservation Implementation Task Force
- Charge 3: Monitor the effectiveness of the statewide water conservation public awareness program and associated local involvement in implementation of the program
- Charge 4: Develop and implement a state water management resource library
- Charge 5: Develop and implement a public recognition program for water conservation
- Charge 6: Monitor the implementation of water conservation strategies by water users included in regional water plans
- Charge 7: Monitor target and goal guidelines for water conservation to be considered by the Texas Commission on Environmental Quality and Texas Water Development Board

The legislature directed the Council to deliver a report on progress made in relation to those charges to the Governor, Lieutenant Governor, and Speaker of the Texas House of Representatives no later than December 1 of each even-numbered year. This is the fourth such report to state leadership that briefly addresses each charge and identifies key findings for advancing water conservation efforts in Texas.

Trends in Population Growth and Water Demands

Population growth rates will vary considerably across the sixteen planning regions of the state (Figure 1). Some of the fastest growing areas of Texas include the Rio Grande Valley (in Region

M), the Dallas-Fort Worth Metroplex (in Region C), areas along the I-35 corridor in central Texas (in Regions G, K, and L), El Paso (in Region E), and portions of East Texas (Region D) (Figure 2).

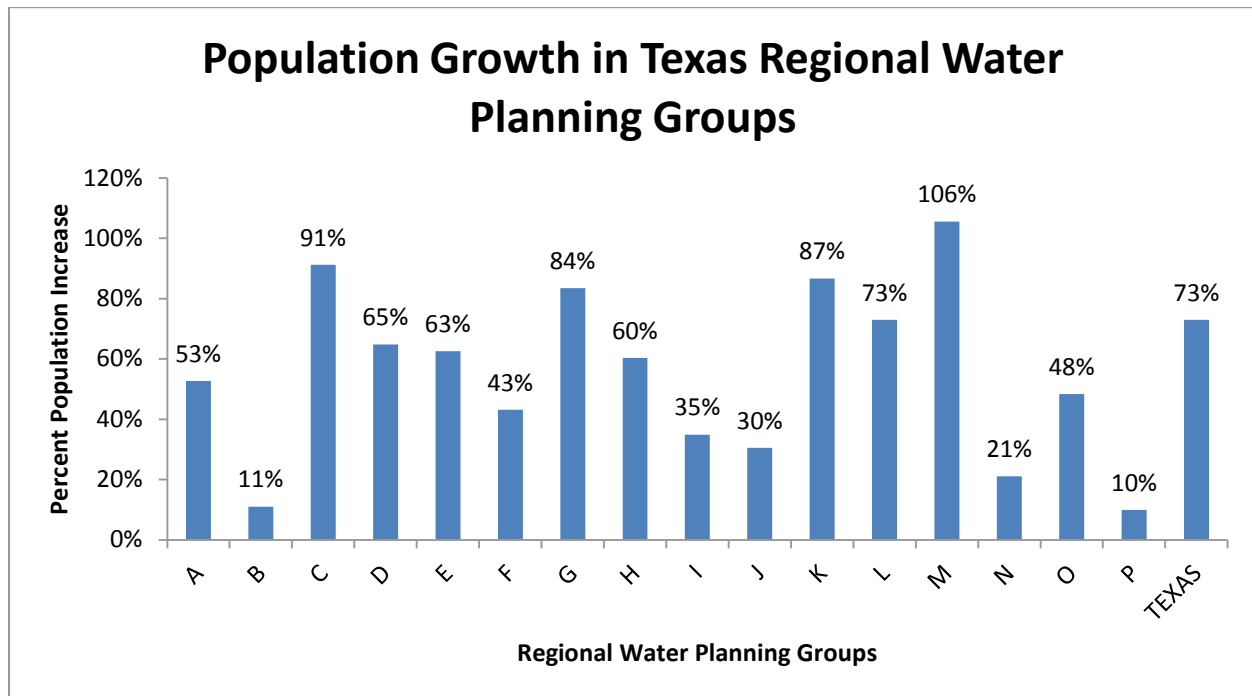


Figure 1. Projected Population Growth per Region, 2020 to 2070. Texas Water Development Board.

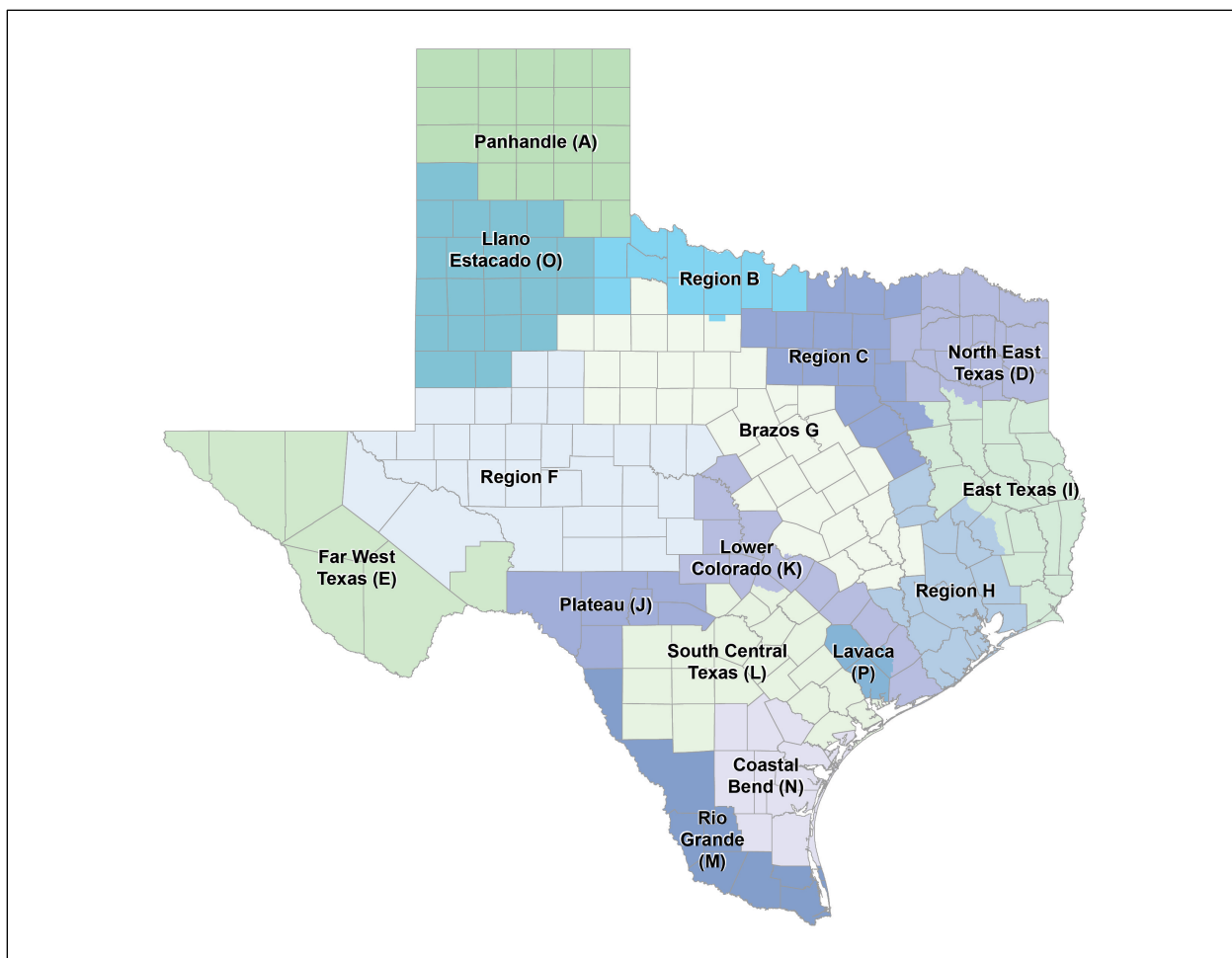


Figure 2. Regional Water Planning Areas of Texas. Texas Water Development Board.

Water demand projections through 2070 display an overall upward trend but do not match the rapid increase in population predicted over the same period. The six water use categories for which demands are projected include irrigation, livestock, manufacturing, mining, municipal, and steam-electric power. Of those categories, demand projections decrease over time for irrigation (by 17 percent) and mining (by 15 percent). The remaining categories have increasing projected demands, and the statewide projected water demand in 2070 is just over 21.5 million acre-feet per year (Figure 3).

Information on population growth and water demand projections come from the fourth cycle of regional water planning currently taking place across the state. Population and water demand projections were drafted by Texas Water Development Board staff and then reviewed by the regional water planning groups prior to being adopted by the Texas Water Development Board. Regional water planning groups use these data to assess water demands over a fifty year planning horizon.

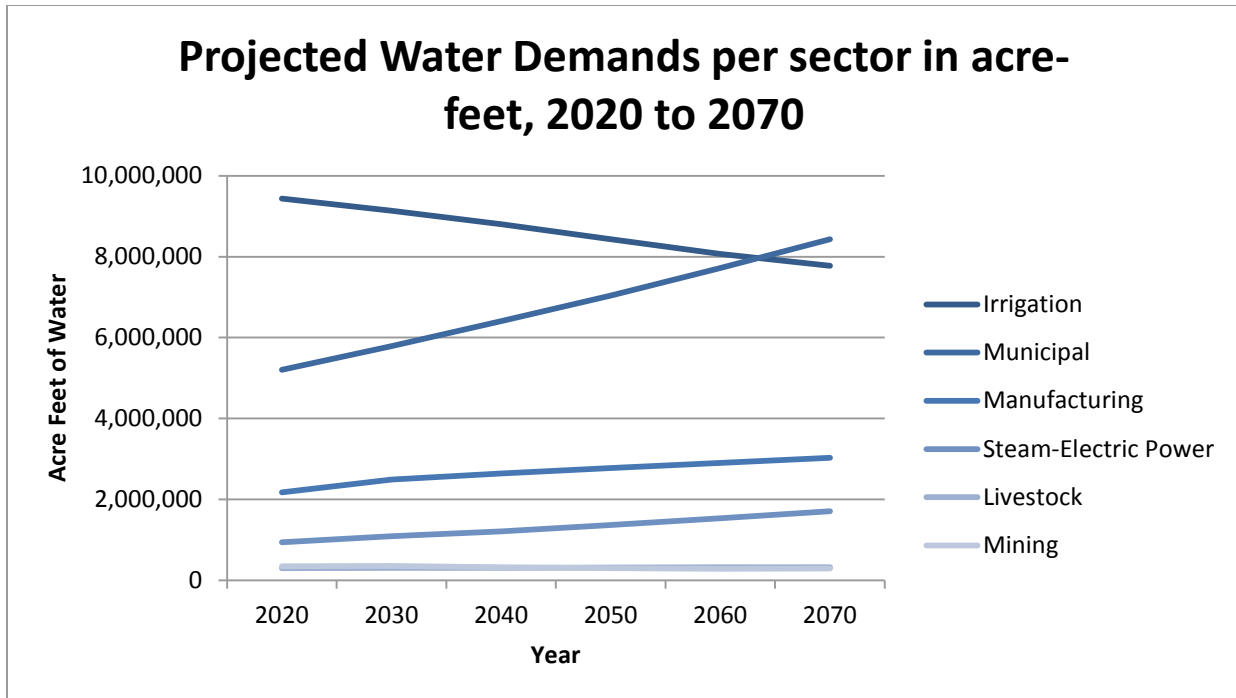


Figure 3. Projected Water Demands per Sector in Acre-feet, 2020 to 2070, Texas Water Development Board.

Water management strategies included in the regional plans aim to meet these projected future demands. The most recently approved state water plan envisions 24 percent of new water supplies—more than 2 million acre-feet per year (651.6 billion gallons per year)—resulting from implementation of municipal, agricultural, and industrial water conservation strategies by the year 2060. The next regional plans, to be completed in 2016 for inclusion in the 2017 Texas State Water Plan, could include additional conservation strategies. The Council continues working to ensure that all Texans understand that water conservation is critical to the future of our state. Throughout the past two years, the Water Conservation Advisory Council has completed 11 best management practices, awarded 10 Blue Legacy Awards in Water Conservation, created a new award category for manufacturing, and continued dialogue to champion water conservation strategies.

V. Summary of Progress

Charge 1: Monitor trends in water conservation implementation

As drought conditions persist throughout Texas, water conservation continues to be an issue of utmost importance. Implementation of water conservation and efficiency efforts at the state, regional, and local level range from policy initiatives (Appendix A) to implementing best management practices to developing public awareness campaigns. As the state confronts the challenges presented by continued population growth and growing demand for limited water supplies, efforts to implement water conservation measures are progressing.

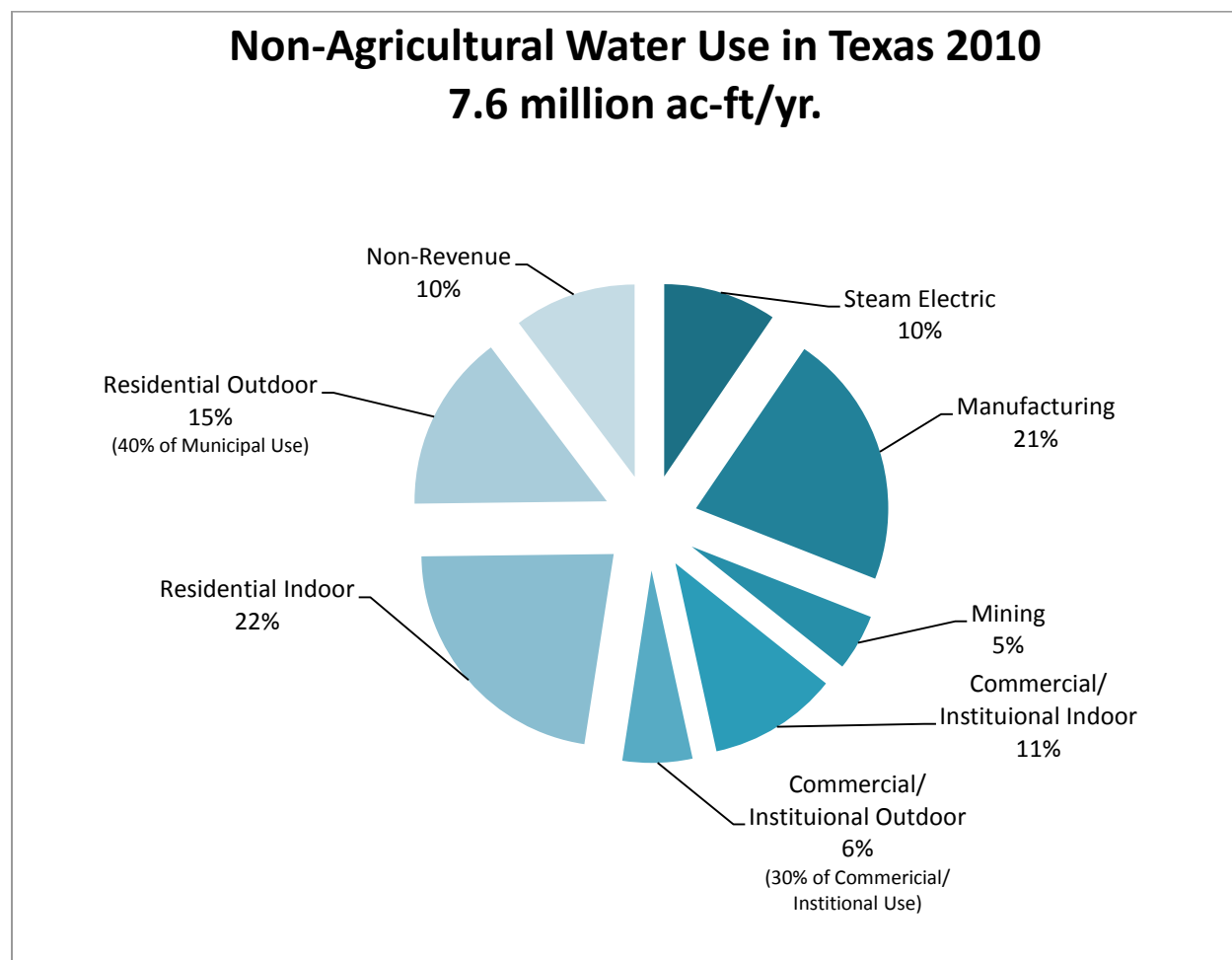


Figure 4. Non-Agricultural Water Use in Texas for 2010, Texas Water Development Board.

Municipal Water Conservation Efforts

At the state level, one of the most significant efforts relates to the requirements that certain utilities and entities develop water conservation plans and report on implementation progress. To improve the reporting of water conservation efforts in the state, the Texas Water Development Board and the Texas Commission on Environmental Quality have made improvements to their 2014 reporting forms, allowing for more detailed data collection. The Council continues to work

with the Board and the Commission on encouraging compliance with the requirements, monitoring implementation and success of water conservation plans, and ensuring data quality and timeliness.

Water conservation plans must include specific, quantified five-year and ten-year targets for water use, generally expressed in gallons per capita per day for total water use, residential water use, and water loss. Any entity that applies for certain new or amended surface water rights, a retail public water utility that provides service to 3,300 or more connections, and any retail public water utility that receives certain financial assistance from the Texas Water Development Board must submit a water conservation plan and an annual report on progress made toward implementing strategies in their water conservation plan. In addition, a water loss audit must be conducted and delivered annually to the Texas Water Development Board if the public water utility provides service to more than 3,300 connections or has an active financial obligation with the Texas Water Development Board. All retail water providers (about 3,500) are required to submit a water loss audit to the Board every five years as referenced in Table F.

Existing reporting requirements allow the Texas Water Development Board and the Texas Commission on Environmental Quality to collectively review conservation implementation efforts and water use by municipalities. The reports also include more long-term strategies for water conservation such as public education, metering, water accounting and savings from reuse, and leak detection.

The data compiled by Board staff from the past five years of annual water conservation reports are shown in Table A and Table B.

Table 3. Water Conservation Annual Report Data

	5- Year Goal	2009 Average	2010 Average	2011 Average	2012 Average	2013 Average
Total GPCD	147	156	142	162	148	148
Res GPCD	NA	101	114	105	94	82
Water Loss GPCD	19	17	18	19	21	20
Water Loss %	13	11	13	12	12	13
Water Reused%	8	6	6	6	7	6
Water Saved%	6	6	7	6	10	6

GPCD = gallons per capita daily; NA = not applicable

Table 4. Water Conservation Annual Report Activities

	2009	2010	2011	2012	2103
Meters Replaced	120,151	409,812	360,353	459,026	326,305
Leaks Repaired	110,387	138,129	194,587	154,674	96,991
Education Programs	198	227	354	301	308
Drought Plan Activated	55	47	230	168	164

Annual water conservation reports have been required to be submitted to TWDB since 2009. Identification of trends can be difficult since there are many factors that impact water use including weather. Data analyses and more quantitative measures of water conservation implementation will be conducted over time. Many Texas water utilities are doing their part to conserve water at their facilities and encourage customers to conserve water.

In 2014, the Texas Rural Water Foundation administered a water conservation survey to personnel at small and rural water utilities across Texas. The majority of survey participants report that their systems implement some type of water conservation measures. The results of this survey reveal that the majority of rural and small water utility personnel are at least aware of the importance of water conservation, particularly conservation by their customers, but may lack the resources necessary to implement robust and effective water conservation programs. These systems are less likely to have access to personnel, finances, and training resources necessary to implement effective programs geared towards either supply- or demand-side conservation.

Although the types of municipal water conservation measures being implemented by utilities varies considerably across the state—and the rate of progress in achieving conservation targets varies greatly as well—efforts to reduce water use and increase water efficiency are increasingly evident in utilities of all sizes and types in Texas. Tables C and D include snapshots of water conservation and reuse efforts being undertaken by a sampling of large city water utilities, small to mid-size city utilities, large rural systems, and even small rural water systems. By no means are the utilities represented an all-inclusive presentation of those implementing water conservation programs, only a representation of some of the measures being put into practice.

Table 5. Examples of Water Conservation Implementation in Urban Water Utilities

Name	Service population	Customer connections	Water conservation implementation
Austin Water	~1 million	261,000	Reduced per capita water use by 17% since 2008 as a result of regulations, conservation pricing, consumer incentives, a growing reclaimed water system, and comprehensive customer education.
City of Cedar Park	83,887	22,000	Launched a program using Water Smart software to create bimonthly reports for customers describing their water usage, alerting them to possible leaks, comparing their water usage to that of neighbors, and suggesting conservation actions.
City of College Station	85,000	22,000	Provides landscape irrigation evaluations for high water use customers, rebates for high-efficiency toilets and rainwater collection barrels, and updated the landscape irrigation ordinance to require minimum design and installation standards and water conservation technology.
Dallas Water Utilities	2.4 million	329,000	Saved over 200 billion gallons of water since 2001 through conservation efforts including distributing 65,400 new toilets and an ordinance adopted by the City of Dallas permanently limiting outdoor irrigation to a maximum of twice a week.
San Antonio Water System	1.7 million	448,000	Set a “dry year” target of 135 gallons per capita per day during conditions similar to the 2011 drought and is promoting programs such as GardenStyle SA to educate residents that drought hardy landscapes can be beautiful and increase the value of homes and businesses without increasing water bills.
City of Wichita Falls	104,000	34,700	Constructed a pipeline as part of its Direct Potable Reuse Project that treat five million gallons of wastewater a day, test it, and redistribute it into the city’s potable water supply.

Table 6. Examples of Water Conservation Implementation in Rural Water Utilities

Name	Service population	Customer connections	Water conservation implementation
Aqua WSC*	55,000	18,100	Replaced all water meters with electronic models and monitors them monthly for misreads; leak detection program prioritizes leak issues and tracks time it takes to repair those leaks.
East Medina County SUD ⁺	9,000	2,800	Plans to replace 10 percent of meters annually within the 45-year old system; uses a robust set of programs to increase water conservation and reduce facility and distribution line losses.
Green Valley SUD ⁺	30,000	7,500	Uses a SCADA (Supervisory Control and Data Acquisition) system to detect variations in normal water operation patterns and replaces waterlines with frequent outages or maintenance problems.
Mustang SUD ⁺	33,000	11,000	Reduced monthly water loss to ~6 percent by aggressively addressing leaks and recently added a public outreach and education staff person focused on water conservation awareness.
Fort Davis WSC*	1,234	660	Outfitted its office building with a rainwater harvesting system and encourages all new construction projects in the community to use grey water for outdoor irrigation.
Pattison WSC*	1,400	477	Established a water-wise garden at its office to demonstrate the benefits to customers; focusing conservation education efforts on children.

*Water Supply Corporation; +Special Utility District

Agricultural Water Conservation Efforts

According to the 2012 State Water Plan, agricultural production and associated irrigation practices amount to the largest water use sector in Texas. Texas Water Development Board staff compute annual estimates of applied irrigation water per county for use in the regional planning process. The procedure used to compute these estimates has evolved over time to include the best available methods and data. The very nature of the process reflects the difficulties in accounting for agricultural irrigation water use across the state: no accurate data currently exists for groundwater withdrawals used for approximately 75 percent of the irrigation in Texas. Similarly, it is difficult to monitor water conservation efforts in agriculture without getting precise data.

Agricultural producers must use water efficiently because their use affects their bottom line. Planting decisions can reflect both water availability and fluctuations in commodity pricing. Effective precipitation or lack thereof impacts the actual applied volume of irrigation water prior to planting and during the growing season; therefore, it is also difficult to forecast future irrigation water demands. Agricultural producers are tasked with conserving water while producing food and fiber, maintaining economic viability, and maintaining or increasing yields. Statewide, irrigation water use hovers around 9 million acre-feet per year and has been close to that number since the 1970s, but the amount of food and fiber produced has increased steadily due to improvements in irrigation efficiency and crop genetics.

Agricultural producers continue to voluntarily adopt best management practices to improve irrigation efficiency; however, the data needed to assess and quantify the extent of this trend is not readily available. The last statewide assessment of agricultural irrigation practices was conducted in 2001 and reported in TWDB Report 347, *Surveys of Irrigation in Texas*. The Council's agricultural work group is monitoring this need and will be exploring possible solutions. Continued updates to TWDB Report 347 are needed to properly evaluate agricultural irrigation use and conservation.

Institutional, Commercial, and Industrial Water Conservation Efforts

Institutional users include schools, hospitals, and nursing homes, while commercial users include offices, restaurants, and retail stores. Together, institutional and commercial water use can account for an estimated one third of municipal water use. The industrial portion includes water used in manufacturing, electric power generation, and mining operations.

Monitoring trends in water use and conservation for the institutional, commercial, and industrial sectors is difficult. To determine a metric similar to per capita water use requires site-specific 'population' information that depends on the type of facility and may be proprietary in nature. For commercial facilities, 'population' could be based on square feet of heated space for an office building, the number of occupied guest rooms for a hotel, meals served for a restaurant, or beds in a hospital. For industry, the 'population' factor is determined from output. In institutional, commercial, and industrial sectors these unique details and complexities complicate efforts to monitor water conservation trends. Possible metrics are included in the guidance and methodology for reporting on water conservation and water use document.

Future efforts within the Council should address these difficulties and work toward developing robust monitoring methods. Existing information such as economic data on output, tax records on size of facilities, health department data on the number of rooms in a hotel or, seats at a restaurant should be examined in developing an appropriate metric. This effort will also require the cooperation of the appropriate agencies and the institutional, commercial, and industrial sectors.

Water Conservation Public Awareness Efforts

Water conservation awareness and education are often cited in regional water plans as a water management strategy, and numerous awareness and education programs exist across the state. In monitoring water conservation programs and public awareness efforts, the Council found that consistent messaging supported by research and data proved most effective.

The Council also found that a number of local utilities would like to initiate and implement public awareness programs but are hampered by limited funding for water conservation efforts. The Council recognizes an immediate need for water conservation awareness and heightened messaging on a statewide level. An expansion of the capabilities and reach of the state's existing water conservation public awareness program, Water IQ, would increase the state-wide messaging of water conservation and public awareness of the importance of water conservation.

Regional and Local Efforts

Several regional and local public awareness programs exist: Dallas' "SAVE WATER. Nothing Can Replace It"; Pharr's "Water is Life"; Austin's "Water Wise"; and North Texas Municipal Water District's "Water IQ: Know Your Water". A number of utilities, entities, and agencies formed partnerships and networks to increase public awareness efforts around the state such as the North Texas, Central Texas, and Gulf Coast/Montgomery County Water Efficiency Networks (Appendix C). These collaborative groups provide a platform for information sharing and networking between water providers and have led to successful local water conservation initiatives. Establishing additional regional efficiency networks in other parts of the state would further messaging on water conservation to additional Texans.

State Agency Efforts

Texas Commission on Environmental Quality—Through its statewide campaign, the Commission provides water conservation tips, conservation success stories, and a pledge to "Take Care of Texas" at TakeCareOfTexas.org. Texas Commission on Environmental Quality staff also provide ongoing technical support to those entities required to prepare and implement water conservation plans. In addition, Commission staff provide water conservation outreach and education to water suppliers and the citizens of Texas through speaking engagements at workshops, conferences, and meetings.

Texas Department of Agriculture—"Texas Water Smart" is a public-private coalition focused on promoting simple, proactive steps to conserve water that homeowners and businesses across Texas can use. The Texas Department of Agriculture, the Texas Water Development Board, the Texas Commission on Environmental Quality, and Texas Parks and Wildlife are all sponsors of the program along with numerous private partners. Implementation of a full-scale outreach plan

using radio, television, newspaper, social media, and print material to educate Texans began in 2012. Additional information on the program can be found at TexasWaterSmart.com.

Texas Parks and Wildlife Department—Texas Parks and Wildlife conducts public awareness efforts with messages focused on the importance of water resources in our state’s natural and cultural environments. Special water-focused magazine editions explore the crucial issues facing water in Texas including allocations for wildlife and aquatic habitats. The website, TexasTheStateOfWater.org, includes “The Drought Survival Kit” and practical tips for how to “Help Wildlife, Save Your Yard, Cut Your Water Bill”.

Texas State Soil and Water Conservation Board—The agency has education and outreach programs that support and recognize conservation efforts. Teacher workshops held each summer by soil and water conservation districts focus on conservation and natural resource issues. Each year the Texas Conservation Awards Program recognizes and honors those who dedicate themselves and their talents to the conservation and wise use of renewable natural resources. A video library maintained by Texas State Soil and Water Conservation Board staff for the benefit of local districts and educators contains over 200 conservation-related videos available on request.

Texas A&M AgriLife—A member of The Texas A&M University System, Texas A&M AgriLife works to help fulfill the system’s land-grant mission of teaching, research, extension, and service. Texas A&M AgriLife Research is the state’s research and technology development agency in agriculture, natural resources, and the life sciences, and the Texas A&M AgriLife Extension Service is an education agency with a statewide network of professional educators, trained volunteers, and county offices. AgriLife Research supports water conservation in Texas through research, new technology development, and next-generation best management practices, and AgriLife Extension supports water conservation through training and educational programs on mitigating drought impacts and conserving water use in homes, landscapes, and production agriculture.

Texas Water Development Board—“Water IQ: Know Your Water” is a Board-managed statewide public awareness program that supports existing local water conservation programs by inviting water suppliers, utilities, state agencies, school districts, and nonprofit groups to become Water IQ partners. There is no cost to join, and partners can provide links to their local information via WaterIQ.org. Board staff supports the Council, develop and promote water conservation educational materials, and manage agricultural water conservation grant contracts. Staff also provides technical assistance related to water loss, water conservation plans, and annual implementation reports.

[Charge 2: Monitor new technologies for possible inclusion by the Texas Water Development Board as best management practices in the Best Management Practices Guide developed by the Water Conservation Implementation Task Force](#)

Thanks to efforts by interested stakeholders and the Council, best management practice guides exist for both the agricultural, industrial and municipal water use sectors. A discussion of progress and updates to those guides is described below. The industrial water use sector, including small manufacturing facilities, power production, and mining, would benefit from

development of a best management practice guide containing sound, proven practices for larger industries. In addition, the guide should address the needs of smaller manufacturers and also water conservation staff and officials who lack education and experience in water use efficiency in industrial operations. In addition, the TWDB website states that commercial and institutional are in the process of being developed by the Council.

In 2011, the Texas State Soil and Water Conservation Board and the Texas Water Development Board conducted a voluntary survey of irrigation districts to assess the extent of implementation of agricultural water conservation best management practices. Replacing district canals and laterals with pipelines were the most frequently employed best management practices. Implementation of best management practices varied widely among districts with some aggressively implementing water conservation best management practices and other districts doing little to nothing to implement best management practices.

Since publishing the previous version of this report in December 2012, 11 agricultural and municipal best management practices went through the public comment and revisions process. They were published November 18, 2013, on the Texas Water Development Board's Best Management Practice Guide website. The best management practices published are: Small Utility Outreach and Education, Athletic Fields Conservation, Conservation Ordinance Planning and Development, Partnerships with Non Profit Organizations, System Water Audit and Water Loss Control, Contour Farming, Conversion of Supplemental Irrigated Farmland to Dry, Furrow Dikes, Land Leveling, and the GPCD Calculator. The GPCD calculator was later converted to a resource document.

In addition, the brush control best management practice is currently being revised under the guidance of the Council's agricultural workgroup.

Charge 3: Monitor the effectiveness of the statewide water conservation public awareness program and associated local involvement in implementation of the program

"Water IQ: Know Your Water" is a Board-managed statewide public awareness program that supports existing local water conservation efforts. Water conservation public awareness is promoted through activities such as public outreach events, online and printed materials, and educational forums. Water IQ offers an easy-to-identify brand, a wide variety of materials, and a network of groups and communities dedicated to educating Texans about water conservation and the wise and efficient use of our natural resources. Additional information on the program can be found at WaterIQ.org. The program began following a 2004 study that found only 28 percent of Texans could identify the source of their drinking water.

The Water IQ website provides a search feature to locate local and regional water resources with a drop down menu of water providers and a zip code locator. The program also offers the ability to locate the source of one's drinking water, population projections, and gallons per capita per day usage. Through Water IQ, visitors to the site also have access to a calendar of events page with important and informative dates within the water resource community.

Currently, 82 entities are Water IQ partners representing 1,080 of approximately 4,100 zip codes in Texas.

North Texas Municipal Water District—The North Texas Municipal Water District was the first in Texas to implement the Water IQ: Know Your Water public awareness water conservation program in 2006 and has committed resources to implement WaterIQ on a yearly basis. To date, the District has committed in excess of \$13 million. The 2013–2014 Water IQ campaign “Quantifying Outdoor Watering to Indoor Use” compares a 30 minutes water cycle to either a 4 hour shower or 60 loads of dishwashing. The District’s campaign promotes easy, sensible water saving tips that not only extend our natural resource of water but also reduce the use of water during drought conditions and reduces the cost of water for consumers by delaying expensive treatment plant expansions or when a new water source will come online. Since 2006, the District estimates that yearly water consumption has decreased by 200 million gallons per day during peak summer months, or 12 to 15 percent annually. Through quantitative and qualitative surveys within the service area, the District can reach their target audience knowing consumers are more likely to conserve water if they know they will be saving money on their water bills while ensuring there is enough water for the future. Information on this program can be found at <http://northtexaswateriq.org/> and on Facebook at <https://www.facebook.com/ntmwdwateriq>.

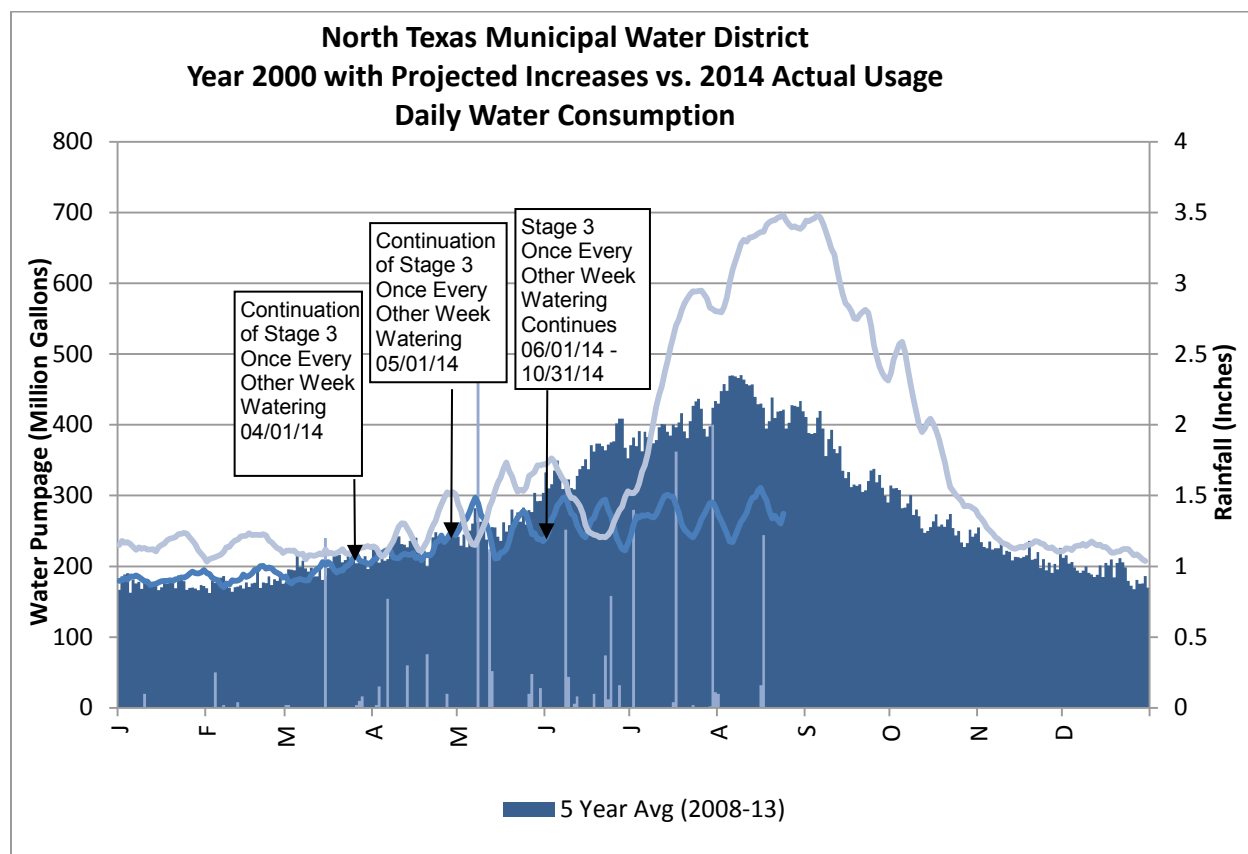


Figure 5. Year 2000 with Projected Increases vs. 2014 Actual Usage Daily Water Consumption, North Texas Municipal Water District.

Charge 4: Develop and implement a state water management resource library

Since 2008 the Council has partnered with the Alliance for Water Efficiency in providing access to a national library of available water conservation resources including research, information,

and tools. The Council website includes a link to the Alliance for Water Efficiency's clearinghouse, and a link to the Water Conservation Best Management Practices Guide was placed on the Alliance for Water Efficiency's website. Other information and links can be added by the Council, the Texas Water Development Board, the Texas Commission on Environmental Quality, or local entities as needed. Future efforts on this charge will focus on implementation and information management. The Council believes that Texas is best served by participating in this national effort so that reliable and quality resources will be available to a variety of audiences.

The Alliance for Water Efficiency is a stakeholder-based 501(c)(3) non-profit organization dedicated to the efficient and sustainable use of water. Located in Chicago, Illinois, they serve as a North American advocate for water efficient products and programs and provide information and assistance on water conservation efforts. The searchable water conservation resource library is online at www.allianceforwaterefficiency.org/resource-library/default.aspx.

Charge 5: Develop and implement a public recognition program for water conservation

Since 2010, the Council has publicly recognized members of the municipal and agricultural sectors with an incomparable commitment to water conservation through the Blue Legacy Awards. The Council feels that a visible and prestigious public recognition award program elevates the importance and awareness of water conservation related issues throughout Texas. The Council uses award recipient's success stories to encourage water conservation and promotes the winners themselves as credible spokespersons. Recently, the Council voted to combine efforts and celebrate all recipients together at one award ceremony during the Texas Legislative session. Beginning in 2015, the Blue Legacy Awards will be presented in conjunction with Texas Water Day held at the State Capital.

Blue Legacy Award—Agriculture

Though it often goes unrecognized, the agricultural industry is actively conserving and efficiently using water through everyday decisions, investments, and practices. The Blue Legacy Awards are open to any agricultural producer (individuals, families, or operations) or other entities wanting to showcase their success in agricultural water conservation. The operation or project must be located in Texas, and conservation efforts should be no more than five years old.

Winners are selected by an expert selection committee that represents farmers, ranchers, conservation groups, state agencies, and universities. The committee considers the use of best management practices, innovative technologies, leadership of the producer, and sustainability of the business as a whole.

Blue Legacy Award—Municipal

Municipal water use plays a fundamental role in supporting the state's economy and population and satisfies a wide range of residential, industrial, commercial, and institutional demands. In recent years, many areas of the state have demonstrated that municipal water conservation planning produces enormous benefits and is an integral part of water management. Communities around the state have taken significant strides in ensuring wise water use and have found conservation programs to be a cost effective method of meeting increased water demands while postponing expensive supply or capacity expansion.

Table 7. Previous Winners of the Blue Legacy Award in Agriculture

2013
Mr. Eddie Teeter
Harlingen Irrigation District—Cameron County No. 1
2012
Texas A&M AgriLife Extension Service—Panhandle District 1
Ogallala Aquifer Program
Texas Alliance for Water Conservation
Mr. Robert Meyer
2011
North Plains Groundwater Conservation District Agriculture Committee
D&D Farms and the Ford Family
Gertson Farms and the Gertson Family
Schur Farms and the Schur Family
2010
Mr. Jim Pawlik
Mr. Jim Hoffman

Table 8. Previous Winners of the Municipal Blue Legacy Award

2014
City of Austin Water Utilities
City of Round Rock
City of New Braunfels
Cinco Ranch Municipal Utility District
2013
City of Fort Worth Water Department
City of Round Rock Conservation Program
City of Georgetown Utility Systems
Lower Colorado River Authority
2012
Travis County Water Control & Improvement District No. 17
City of McKinney/Office of Environmental Stewardship
New Braunfels Utilities
San Antonio Water System
2011
The North Texas Municipal Water District
Fort Bend County Municipal Utility District #25

Awards are open to any public water supplier to showcase their water conservation success, including but not limited to municipalities, wholesale water providers, retail water providers, regional water suppliers, water supply corporations, water supply districts, and utility districts. One award may be given in each of the following categories:

- Retail or Wholesale Water Supplier—Metropolis [>500,000 population]
- Retail or Wholesale Water Supplier—Medium [100,001–500,000 population]
- Retail or Wholesale Water Supplier—Small [50,000–100,000 population]
- Retail or Wholesale Water Supplier—Rural [<50,000 population]
- River Authority or Regional Water District

Charge 6: Monitor the implementation of water conservation strategies by water users included in regional water plans

Included in the revised rules for regional water planning adopted by the Texas Water Development Board in October 2012 (specifically Rule § 357.45) is the requirement that regional water planning groups in their revised regional water plans “...shall describe the level of implementation of previously recommended water management strategies. Information on the progress of implementation of all water management strategies that were recommended in the previous RWP [regional water plan], including conservation and drought management water management strategies; and the implementation of projects that have affected progress in meeting the state’s future water needs.”

As a result of this requirement, the revised regional water plans that will be submitted to the Texas Water Development Board in 2015 for review and approval—which will be known as the 2016 regional water plans—should provide a more comprehensive overview of implementation of conservation water management strategies recommended in the 2011 regional water plans than is available in 2014. However, at least some of the regional water planning groups have already gathered or attempted to gather information on implementation of conservation strategies by water user groups within their respective regions.

Two of those regional planning groups and their consultants—in regions C and H (the two largest regions by population)—have shared the information they have obtained on conservation strategy implementation with the Water Conservation Advisory Council. The information is somewhat sparse, however, because most of it is dependent in large part upon water user groups responding to surveys about strategy implementation. Regional water planning groups do not have the authority to compel water user groups to provide this data, much less do the planning groups have the authority to require water user groups to implement any particular water management strategy, be it conservation or not. Moreover, even if a specific water user group intends to implement a conservation strategy, they may not choose to do so in the same time frame or to the same extent as recommended in the respective regional water plan.

With these realities in mind, however, it is instructive to review the preliminary data available from Regions C and H to get a sense of what is or is not happening “on the ground” with regard to the adoption of recommended water conservation strategies by water user groups in those regions. The 2012 State Water Plan envisions that approximately 24 percent of the state’s water

needs in 2060 will be met through conservation—7.2 percent from municipal water conservation (not including reuse). The Region C 2011 regional water plan projects that in 2060 slightly over 12 percent of that region’s water needs will be met through water conservation, all but a small fraction through municipal conservation (again, not including reuse). In terms of volume, Region C’s recommended municipal water conservation strategies are projected to account for 106,835 acre feet of water in the region by 2020 and almost 285,000 acre feet per year by 2060. The 2011 Region H regional water plan envisions 12 percent of water needs—183,933 acre feet of water—met by conservation (not including reuse) by 2060, with 7 percent—105,494 acre feet—accounted for by municipal conservation.

In Region C the planning group consultants conducted a survey of municipal water user groups in March 2013 to determine the level of implementation of conservation strategies recommended in the 2011 Region C regional water plan for those respective water user groups. The 2011 Region C plan (and the earlier 2006 plan) had identified two levels of water conservation strategies for municipal water user groups in the region with identified water needs during the 50-year planning horizon—a “basic” set of municipal water conservation practices and an “expanded” set of municipal water conservation practices.

The “basic” set of municipal water conservation practices recommended for certain water user groups in Region C included

- low cost plumbing fixture rules;
- public and school education;
- water use reduction due to increasing water prices;
- water system audit, leak detection and repair, and pressure control;
- new efficient residential clothes washer standards;
- water conservation pricing structure; and
- water waste prohibition.

The “expanded” set of municipal water conservation practices recommended for certain water user groups in Region C included

- coin-operated clothes washer rebate;
- residential customer water audit;
- ICI (industrial, commercial, institutional) water audit, water waste reduction, and site-specific conservation program; and
- reuse of treated wastewater effluent.

There were 217 water user groups in the Region C 2011 Regional Water Plan (submitted to the Texas Water Development Board in 2010) that have water needs identified in 2010 and 205 of those water user groups were classified as municipal. There were 204 Region C municipal water user groups for which “municipal water conservation: basic” was recommended as a strategy to meet their 2010 needs. There were 69 Region C municipal water user groups for which “municipal water conservation: expanded” was recommended as a strategy to meet their 2010 needs.

In the spring of 2013, the Region C regional water planning group consultants conducted a survey of the municipal water user groups in their region to determine the extent to which water

conservation and related measures identified in the 2011 regional water plan had been implemented or were planned for implementation. The response to the survey was minimal with only about 120 water user groups returning the survey; many of the responses were incomplete.

About 45 water user groups responding indicated that they had implemented “public and school education” (one of the measures in the basic set of water conservation practices) as a water conservation strategy in the past and/or were doing so currently. An additional 11 municipal water user groups who had not used public and school education as a conservation strategy in the past and/or were not doing so currently indicated that they planned to do so in the future. Half of the responding water user groups indicated that they had in the past or currently were using water audits and leak detection and repair, another part of the basic package, as a water conservation strategy. Slightly less than half of the respondents said that they had used a water conservation pricing structure as a conservation strategy in the past, were doing so now, and/or planned to do so in the future. Responses to questions about implementation of other “basic” conservation practices fell within the same pattern – either the respondents were not taking the time to respond or these practices have not been widely implemented.

Thirteen of the 84 water user groups for which the Region C plan recommended the expanded set of water conservation measures affirmatively responded to the spring 2013 survey that they had implemented or would implement in the future at least one of expanded conservation practices recommended to them to meet estimated current water needs. The rate of the response to the survey was low: Less than half of the 84 water user groups for which expanded municipal conservation was recommended for 2010 responded to the survey.

Despite a low response rate to the survey and what appears to be a low implementation rate of water conservation activities at this point—at least based on this preliminary information—there have been some notable conservation developments among major water utilities in the region in the past two or three years that are projected to have significant impacts in reducing water use. Most prominently are the actions taken by the Cities of Dallas, Fort Worth, and others to limit—on an ongoing basis, not just during the drought periods—outdoor landscape watering to no more than twice a week. This effort has been strongly supported by wholesale water suppliers in the region such as North Texas Municipal Water District and Tarrant Regional Water District, who are promoting this approach with all of their member and customer cities.

The 2011 Region H regional water plan advocated water conservation for all water users in the region and encouraged each water user group and provider to establish an aggressive water conservation goal. However, the plan states that it only reflects “water conservation as a water management strategy for water user groups with projected shortages and for those that specifically asked to reflect their program in the plan tables.” According to the Region H plan “[s]pecific water conservation strategies were tailored to WUG [water user group] water conservation plans that had been submitted to the Regional Water Planning Group. Approximately 10 WUG specific conservation strategies were developed for the 2011 Region H Water Plan. Water conservation savings were assigned in every decade to municipalities with WUG specific strategies whether or not the WUG was experiencing a shortage.”

The municipal water conservation plan template described in the 2011 Region H plan was general in nature but referenced the best management practices for water conservation found in the Water Conservation Best Management Practices Guide, Report 362, Texas Water Development Board (November 2004) that was produced by the Water Conservation Implementation Task Force, a predecessor to the Water Conservation Advisory Council. In 2013 the Region H water planning group consultants conducted a survey of municipal water user groups to determine the extent to which conservation recommended in the 2011 Region H water had been pursued or was under consideration by water user groups in the region. Only 47 water user groups responded to the survey, and those respondents included one industrial user, one water district primarily supplying agricultural water, and one river authority providing water on a wholesale basis. The majority of the municipal water utilities responding to the survey either did not answer or answered “no” to the questions regarding whether they had adopted or would consider adopting in the future the individual best management practices for water conservation recommended in the 2011 Region H regional water plan.

In addition to the limited information that the Region H planning group consultants were able to obtain through their 2013 survey of water user groups, additional information has been gathered from some water utilities in Harris County and neighboring counties as a result of the Goldwater Project (<http://goldwaterproject.com/>):

“The Goldwater Project for Region H is an undertaking by the Texas Water Foundation’s Carole Baker and Kip Averitt of Averitt & Associates. The Project quantifies and measures ongoing water conservation efforts within the 15-county Region H area. Participating water suppliers will receive reports that detail the cost and benefits of each of their water conservation strategies. The results of each water supplier’s report will be accumulated into one large report which will demonstrate the progress of Region H towards the conservation goal as set out in the Region H Water Plan.”

The Goldwater Project thus far has received monetary and other support from the Region H water planning group, the Cynthia and George Mitchell Foundation, San Jacinto River Authority, the Lone Star Groundwater Conservation District, the Harris-Galveston Coastal Subsidence District, and other entities and has recruited over 50 municipal water suppliers (municipalities and municipal utility districts) in the area to participate in the project. Those water suppliers combined account for over one-half of the population of Region H.

Project founder Kip Averitt and Project Director Stephen Cortes have conducted in-depth interviews with representatives of participating water suppliers to gather details about their current and planned water conservation practices. Those interviews have been followed by the preparation of individualized reports to each water supplier about water conservation measures that they might consider implementing and about how much water savings could be expected from adoption and implementation of those measures. The Goldwater Project is using a tracking tool developed by the Alliance for Water Efficiency to analyze and report on the expected water savings from the various water conservation measures that a water supplier might consider. An overall goal of the project is to help Region H eventually achieve the goals set by the regional water plan for meeting future water needs through municipal water conservation.

Initial findings of the Goldwater Project have been that overall—with some notable exceptions—water suppliers in the region are not on track to meet the water conservation goals in the 2011 Region H regional water plan. In the project’s first year report, provided to stakeholders and participants in May 2014, the project reported that “...except for pockets in Montgomery and Fort Bend counties and [the City of] Houston’s planned efforts – we found that virtually no utilities currently participating in the Goldwater Project are carrying out specific, measurable conservation strategies. Some have no plans to do so, while some have made plans to start.” The Goldwater Project’s first-year report goes on to say that “...the conservation being recommended by the Region H Planning Group just is not being pursued in most cases.”

As noted, there have been exceptions to this overall finding. For example, the Goldwater Project found through its interview process with participating water suppliers that The Woodlands Joint Powers Agency, which serves 11 municipal utility districts in Montgomery County, has initiated a number of water conservation and related measures in the past few years. Among those activities are

- increased residential water rates;
- implementation of an increasing tiered water rate for commercial accounts;
- adoption of a defined year-round watering schedule that limits outdoor irrigation to no more than two days per week;
- offer of rebates for water saving devices on outdoor landscape irrigation systems;
- offer of complimentary irrigation system evaluation and provision of a detailed report on items that need correcting to achieve the most efficiency from an existing system;
- insertion of water conservation tips in each water bill; and
- presentations at community and neighborhood meetings to promote water conservation and educate the public.

Another positive finding from the Goldwater Project’s first year report is that their analysis indicates that by and large if the municipal water utilities participating in the project implement the water conservation measures the project evaluated at even modest rates of adoption those utilities could achieve the water savings necessary to meet their share of the water conservation goals in the 2011 Region H regional water plan. Presumably this means that higher rates of adoption might allow Region H to expand its reliance on municipal water conservation to meet part of the region’s future water needs.

The Goldwater Project used 16 municipal water conservation measures for their evaluation. These 16 were the measures determined to be the most cost-effective conservation actions out of the total 29 measures that are included in the Alliance for Water Efficiency’s conservation tracking tool. The selected measures primarily focus on water use by single-family residences and by industrial, commercial, and institutional sectors. The Goldwater Project compared on a county-by-county basis the Region H plan’s estimates of water needs to be met through municipal conservation and the gross savings to be anticipated if the 16 conservation measures were adopted by water user groups at an implementation rate of 1 percent per year for each of the five years beginning in 2015. The project’s analysis indicates that even at that very modest adoption rate the gross savings from those conservation measures would meet or exceed the Region H projected needs to be met through water conservation by 2020 for each of the counties

in the region except for Fort Bend County. Presumably a more aggressive adoption rate in Fort Bend County might achieve or exceed the regional target for that county as well.

Of course, the key point is that in order to achieve the regional target for municipal conservation those measures must actually be adopted and implemented. The Goldwater Project's first year report recognizes and discusses the challenges to implementation. However, the project is preparing individual reports for each of its participating municipal utilities to show the costs of implementing and the savings anticipated from each of the 16 conservation measures, which should help to demonstrate the feasibility and effectiveness of pursuing these conservation actions. That should have a positive impact on progress in implementing municipal water conservation called for in the Region H plan. The next biennial report from the Water Conservation Advisory Council should be able to provide a preliminary evaluation of the impact of the Goldwater Project on promoting and accelerating implementation of water conservation measures in Region H.

In conclusion, an initial look at Region C and Region H—based on a very limited amount of information—suggests that municipal water conservation measures called for in the respective regional water plans are—with some exceptions—not being implemented widely, calling into question whether municipal water conservation goals incorporated into those plans will be met without an acceleration of efforts to undertake conservation measures. Even though the data provided here relates only to regions C and H, this assessment probably holds true for many, if not most, other water planning regions in the state.

On the other hand, many wholesale and some retail water suppliers in Region C are aggressively making progress in water conservation (for example, expanding adoption of no-more-than-twice-a-week outdoor watering restrictions on an ongoing basis), and the Goldwater Project in Region H is a pro-active effort to expand adoption of water conservation measures in that region through detailed analysis of the cost and potential savings from pursuing those measures. These efforts may provide models for the other water planning regions in how to work to achieve their municipal water conservation targets.

In addition, the new options for funding conservation projects through the State Water Implementation Fund for Texas (SWIFT) and State Water Implementation Revenue Fund for Texas (SWIRFT) and the 2013 changes to state law authorizing the use of Property Assessed Clean Energy (PACE) funding for water efficiency improvements by commercial and industrial water users may encourage certain water user groups to implement conservation measures that are called for in the 2011 regional water plans or will be included as water management strategies in the 2016 plans.

Additionally House Bill 3605 passed by the 83rd Legislature requires TWDB, in considering an application for financial assistance from a retail public water utility serving 3,300 or more connections, to evaluate the utility's water conservation plan for compliance with TWDB's best management practices for water conservation and issue a report to the utility detailing the results of that evaluation. The TWDB is also required to submit to the Legislature a written summary of the results of the evaluations noted above no later than January 1 of each odd-numbered year.

These efforts may also serve to increase awareness of water conservation and perhaps increase implementation.

Charge 7: Monitor target and goal guidelines for water conservation to be considered by the Texas Commission on Environmental Quality and Texas Water Development Board

The Water Conservation Advisory Council provides input to the Texas Commission on Environmental Quality and the Texas Water Development Board on information related to water conservation.

Discussion of Conservation Goals

Per Texas Water Code §16.043, the Texas Water Development Board, in consultation with the Texas Commission on Environmental Quality and the Council, shall develop a data collection and reporting program for municipalities and water utilities with more than 3,300 connections. Not later than January 1 of each odd-numbered year beginning in 2015, the Texas Water Development Board shall submit to the legislature a report that includes the most recent data relating to (1) statewide water usage in the residential, industrial, agricultural, commercial, and institutional sectors and (2) the data collection and reporting program developed.

Sector-Based Reporting

In 2011, Senate Bill 181 was passed requiring the Board and the Commission, in consultation with the Water Conservation Advisory Council, to develop a uniform, consistent methodology and guidance for calculating water use and conservation. Municipalities or water utilities are to use them in their efforts to develop water conservation plans and prepare annual reports and five-year implementation reports.

The methodology establishes a sector-based analysis that can be used by water providers for the primary purpose of evaluating internal water conservation trends and needs. This reporting tool can be highly beneficial to water providers by providing more specific detail on the water use sectors and their usage. With well-defined and consistent analysis of data and information per sector, water providers and user groups can develop effective conservation initiatives and programs.

The guidance and methodology document is provided to retail water providers and certain other water use sectors as a guide for preparation of water use reports, water conservation plans, and reports on water conservation efforts. The document describes the methods for identifying and determining certain numerical data used in various reporting requirements and enables entities to complete their conservation and water use reporting forms in a consistent and uniform manner. The guidance document can be found online at www.twdb.state.tx.us/conservation/doc/SB181Guidance.pdf.

The key points of the methodology include:

- identifying how a municipality or water utility should calculate total water use in gallons per capita per day;

- identifying how a municipality or water utility should calculate water use in the residential sector, including both single-family and multi-family residences, in gallons per capita per day;
- identifying how a municipality or water utility could determine water use using non-population dependent metrics in the industrial, agricultural, commercial, and institutional sectors;
- identifying how an agricultural entity or industrial entity should report on their water use and implementation of their water conservation plan; and
- requiring that an entity report the most detailed level of water use data currently available to the entity; however, it is recognized that some utility systems will have only minimum separation of water use by sectors.

The Board will submit a written report to the Legislature by January 1, 2015, detailing the data reported through this methodology in the 2013 Water Use Survey.

Measuring Water Conservation: Gallons Per Capita Daily

The Council adapted a calculator developed by the state of New Mexico that allows water providers to submit water use data and make gallons per capita daily analyses on a more uniform basis. The calculator was posted on the Council website along with a solicitation for comments. Based on comments provided by testers and the public, Texas Water Development Board staff updated and revised the calculator to better meet the needs of users in Texas.

In the future, it would be useful to extend the functions of the calculator beyond simple data input and analyses to include population and water use projections. That would allow water providers to set targets and goals and to better understand the measured effects of their conservation efforts. The Council strongly emphasizes the importance of sector-based analysis in monitoring target and goal guidelines for water conservation.

A simple comparison of total gallons per capita per day among Texas municipal water providers may lead to inaccurate conclusions about comparative water use efficiencies among those providers. As metric, total gallons per capita daily has its limitations. Geographic differences such as climate, source-water characteristics, and service population characteristics strongly influence the water use profiles of municipal water providers. Total gallons per capita daily takes into account all water use sectors served by a system including residential, industrial, commercial, institutional, and agricultural water uses. This metric divides the total use by a population number even though not all water use sectors may be population dependent.

The state's current reporting requirements primarily serve purposes related to water use permitting, water use volume, and assessments of water supply planning. Table #F is a brief summary of the current conservation reporting requirements administered at the state level.

Table 9. Water Conservation Reporting Requirements

Report Name	Who is Required to Report	When is Report Due
Water Conservation Plan	Retail public water suppliers with 3,300 or more connections.	Water conservation plans are submitted to TWDB by May 1 every five years.
	Entities receiving financial assistance greater than \$500,000 from TWDB.	Water conservation plans are submitted to TWDB by May 1 every five years.
	Water conservation plans are required for municipal, industrial, and irrigation surface water right applications: <ul style="list-style-type: none"> • A non-irrigation surface water right greater than 1,000 acre-feet per year, or • An irrigation surface water right greater than 10,000 acre-feet per year. 	Water conservation plans for non-irrigation water right holders of 1,000 acre-feet or more and irrigation water right holders of 10,000 acre-feet or more are submitted to TCEQ by May 1 every five years.
Water Conservation Annual Report	Entities currently required to have a water conservation plan on file with TWDB or TCEQ must submit a conservation annual report.	Water conservation annual reports are to be submitted to the TWDB by May 1.
Water Loss Audit	All entities with retail water connections must submit a water loss audit once every five years.	Water loss audits are to be submitted to TWDB once every five years by May 1; the next due date is May 1 of 2016.
	Any retail public water supplier receiving financial assistance from TWDB must submit a water loss audit annually.	Any retail public water supplier receiving financial assistance from TWDB is required to submit a water loss audit annually by May 1.
	Any retail public water supplier with more than 3,300 connections must submit a water loss audit annually.	Any retail public water supplier with more than 3,300 connections is required to submit a water loss audit to TWDB annually by May 1.
Water Use Survey	Entities using surface water or groundwater for municipal, industrial, power generation or mining purposes are required by Texas Water Code §16.012(m) to submit a water use survey.	The water use survey is to be submitted to TWDB every year by March 1. TWDB maintains the list of entities deemed necessary to complete the annual survey.
Five-year Implementation Report	A non-irrigation surface water right greater than 1,000 acre-feet per year, or an irrigation surface water right greater than 10,000 acre-feet per year.	The water conservation implementation report is submitted to TCEQ once every five years.
Drought Contingency Plan	All Retail Public Water Suppliers	Drought contingency plans for Retail Public Water Suppliers with 3,300 or more connections are submitted to TCEQ every five years. Drought contingency plans for Retail Public Water Suppliers with less than 3,300 connections should have their plan on file and available for TCEQ every five years.
	Wholesale Public Water Suppliers	
	Irrigation Districts	
	Water rights applicants for municipal use	

VI. Advancing Water Conservation Efforts

The mission statement of the Council is to establish a professional forum for the continuing development of water conservation resources, expertise, and progress evaluation of the highest quality for the benefit of Texas—its state leadership, regional and local governments, and general public. A key function of the Council relates to advancing water conservation efforts across Texas.

The Council works to promote knowledge and adoption of those practices, techniques, programs, and technologies that will protect water resources, reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, and increase the recycling and reuse of water so that a water supply is made available for future or alternative uses. Effective water conservation is achieved by both water suppliers and end users. It is, therefore, imperative that the public, businesses, and industry become more aware of the need to conserve and motivated to implement water conservation practices.

Conservation programs prove to be more effective when they are supplemented with data, resources, and expertise. Furthermore, it is necessary to have a means of evaluating progress to fairly and accurately assess which efforts are achieving the greatest savings from the level of resources that are being committed. The Council will continue to advance water conservation awareness in Texas and recognizes recent achievements and certain areas still in need of more focused attention.

Action by the 83rd Texas Legislature on Water Conservation

The 83rd Texas Legislature passed House Bill 4, Senate Joint Resolution 1, and House Bill 1025 which, upon voter approval of Proposition 6, resulted in the creation of the State Water Implementation Fund for Texas (also known as SWIFT) and the State Water Revenue Fund of Texas. The legislation appropriated \$ 2 billion from the Economic Stabilization Fund to assist in the financing of priority projects in the state water plan to ensure the availability of adequate water resources. The legislation also directs the Texas Water Development Board to undertake to use at least 20 percent of the funds to support water conservation and reuse projects and at least 10 percent of the funds to support projects serving rural or agricultural communities. These actions almost assuredly advance water conservation in Texas.

Legislation also provided for direct resources for consolidating data for the annual reports required to be submitted to the Texas Water Development Board. Board staff have been active in the devolvement of a consolidated data base that will allow duplicative data to flow or automatically be populated from the annual water use survey to the annual water loss audit to the annual water conservation report. The first phase, allowing the transfer of data from the water use survey to the water loss audit is expected to be completed by December 2014 and will be in use for the reporting of 2014 data. The second phase will allow for the transfer of data from these two reports into the water conservation report. Not only will this be of convenience for the utilities that will no longer be required to submit duplicative data, but should also allow for consistent and ideally more accurate data be used across all the reports. The entire process

should be more accurate and efficient with the on-line reporting system which will be designed to make the information available to interested parties.

House Bill 857 requires each retail public water utility with more than 3,300 connections to conduct a water audit annually to determine its water loss and to submit that audit to the Texas Water Development Board. A retail public water utility with 3,300 or less connections will continue to be required to conduct and submit a water audit once every five years computing the utility's system water loss during the preceding year. The initial annual water audits were to be submitted by May 1, 2014.

Senate Bill 198 prevents a property owners' association from prohibiting or restricting a property owner from using drought-resistant landscaping or water-conserving natural turf but allows an association to require the property owner to submit a detailed description of a plan for the installation of such landscaping or turf for review and approval by the association to ensure to the extent practicable maximum aesthetic compatibility with other landscaping in the subdivision. The legislation also states that the association may not unreasonably deny or withhold approval of the plan or unreasonably determine that the proposed installation is aesthetically incompatible.

Appendix A contains actions taken by the 83rd Texas Legislature in the regular session to advance water conservation, curb water loss, and respond to drought conditions.

Agricultural Water Conservation Incentives

Economic incentives encourage the adoption of voluntary agricultural water conservation best management practices to secure adequate water supplies for future generations of Texans. Limited access to cost-share funding for producers and irrigation districts and the fact that many of the irrigation conservation strategies in the State Water Plan do not have a sponsoring entity present a challenge to implementation of those strategies, which account for approximately 1.5 million acre-feet or 17 percent of water supplies in the 2060 decade.

Producers often participate in economic incentive programs that encourage adoption of voluntary agricultural water conservation best management practices. Funding dispersed through state and federal water conservation programs can be documented, but the additional contributions to water conservation made by individual farmers and ranchers throughout the state are often overlooked because they are unreported and difficult to estimate.

Numerous state and federal agencies have established programs to provide grants, low cost loans, or financial incentives to encourage agricultural water conservation. Additional information on incentive programs and efforts by state and federal agencies can be found in Appendix F.

Drought Planning

Drought planning and management are vital components in addressing the Texas water challenge. Though often assigned a negative connotation and thought of as an undesirable, restrictive action taken only in a water emergency, drought planning is actually an efficient way to reduce water demands during times of drought and to sustain existing water supplies.

Arguments that drought management rules and water use restrictions discourage economic development and cost a community jobs have been disproven by Texas cities with strong drought management rules and equally strong economic and population growth. A discussion on drought planning and management can be found in Appendix J.

As a result, water conservation continues to be an issue of utmost importance. An increase in knowledge of water source, the heightened increase in awareness and education of water efficient best management practices is paramount. Implementation of water conservation and efficiency efforts at the state, regional, and local level range from policy initiatives (Appendix A) to implementing best management practices to developing public awareness campaigns. As the state confronts the challenges presented by continued population growth and growing demand for limited water supplies, efforts to implement water conservation measures are progressing. Through the implementation of water management strategies in response to drought and water supply hardship, water efficiency, water conservation, education and awareness can all be improved upon.

Drought demand management differs from conservation demand management. During droughts it is often necessary to achieve water use reductions quickly. This is usually achieved through education and regulation. Conservation reductions are planned for more gradual and permanent results. The two processes often intersect with lessons learned during drought resulting in new standard practices for conservation. The results in water use reduction during drought also inform water supply plans for the future.

The Council believes that drought planning and management can and should be used more and encourages new attitudes and innovative thinking on perceived costs of “drought restrictions”, landscaping options, and supply side improvements in cost efficiency achieved by reducing peak water demands. Drought conditions in Texas and across the globe have focused attention on how water providers manage supplies and how well drought plans accomplished stated goals.

The lessons learned from the experiences of others should be used to inform updated plans in Texas. The Alliance for Water Efficiency has compiled the research paper “Water Conservation and Efficiency Market Transformation Study” which summarizes strategies and results from many regions of the world. The current Texas drought provides an opportunity to learn about reduction strategies and results. The Council plans to compile more information on drought management strategies and results of implementation from water providers across Texas. This information will then be dispersed through professional associations and the Council’s web site.

Energy Water Nexus

Historically, the emphasis of Energy Water Nexus research has been to examine relationships between the water needed to produce energy and the energy needed to treat water and wastewater and to pump water. The Energy Water Nexus must extend to the use of water and energy at the end users’ level including cooling towers for air conditioning, hot water use, and residential commercial and industrial equipment using both energy and water. Research in these areas could yield both significant energy and water savings.

The 83rd Texas Legislature passed Senate Bill 700 to coordinate existing energy and water management planning and reporting by state agencies and public institutions of higher education. The State Energy Conservation Office is designing a template for use when submitting semiannual energy and water management plans for reducing utilities. The Office must also now submit an evaluation and status report to the Governor's office and Legislative Budget Board every other year prior to legislative session. Continued understanding of higher efficiency options could promote additional energy and water savings. The Council will watch these efforts closely and mine information that may be useful for the non-public sector.

Enhanced Data Collection, Verification, and Analysis

Precise data are needed in order to analyze and make informed decisions regarding water use and conservation efforts across all water use sectors. The difficulties in collecting verifiable data on water use that can be analyzed to gauge outcomes of conservation efforts are well documented. These difficulties vary by water use sector and therefore solutions vary as well.

For example, in the agricultural sector numerous water conservation and irrigation efficiency projects exist across the state, but there is a dearth of specific information on the effectiveness of the efforts. Collecting results-based information regarding agricultural irrigation efficiency projects should be prioritized. Making information available publicly while protecting the privacy of agricultural producers will inform future efforts and create new opportunities for water conservation in the agricultural sector.

In the municipal sector there are numerous reports that many utilities are required to submit annually. The Water Use Survey, the Water Loss Audit and the Annual Water Conservation Report are examples of separate reports that ask for some of the same information and data. These reports provide opportunities for more quantitative measures of water conservation implementation. Completing these various reports enables utilities and suppliers to better track their water usage and water losses and identify where to target conservation programs. There are, however, some issues with the plans and reports. Entities approach the reports with various levels of interest and capability so the quality of reporting varies; therefore, the resulting information may be questionable in some cases. Other issues that impact accurate assessments of water conservation concern the year-to-year variations in water use due to weather and the more gradual year-to-year variations due to changes in the types of uses (institutional versus residential) in high growth areas. While planning and reporting of water conservation is not required of all water suppliers, the Texas Water Development Board estimates that there are water conservation plans for about 80 percent of the water used in Texas for municipal purposes.

The 83rd Texas Legislature provided resources to the Texas Water Development Board to develop an online consolidated database to ease the reporting process, remove the need for duplicative entries and provide a process that can be more accurate and efficient and make the information available to others.

There are several compelling reasons to improve the processes associated with data collection. The data will be available for others to get a sense of performance and it would be easier to assess progress, areas of weakness and to propose programs and information for improvements. A final reason to enable the sharing of information is because this will improve reports and raise

expectations. The Council will continue to monitor the Board's efforts on a consolidated database and work with the Board and others in identifying information on agricultural irrigation efficiency.

Water Loss Audits

Water loss audits should be completed with serious thought given to each data input. The American Water Works Association international model of water audits has been designed to help utilities better understand where their water losses are occurring and to place a financial value on the losses. The value of this information is high to water utilities and to the communities they serve. Hence, the conclusions from the audits may be weak or completely false if the data inputs are not thoughtful and accurate.

There are many reasons to be concerned about water loss audit reports that understate water losses due to inaccuracies in total production volume data or other challenges. The largest concern is that communities under-reporting their water losses are using more water than they realize. This is a fundamental problem for long-term water planning. Another challenge is that under-reporting water loss sets unrealistic expectations in the public and with media. This makes it harder for utilities to be realistic in their reporting and to have realistic plans to improve. The State of California has found that initial audits completed by water utilities are often faulty. Efforts conducting water loss audits in Georgia have found similar challenges. Given these experiences, it is expected that feedback and a learning process will have to take place in order to get the best gains from the water loss audits required in Texas.

The good news is that it is possible to review water loss audit reports and identify potential problems. Texas Water Development Board has modeled the state water loss audit reports on the American Water Works Association reporting system. Fortunately, this system includes a clear method for reviewing each level of input to the audit. There are also several areas where calculations within the model can indicate that some portion of the input may not have been done correctly. Experts who are experienced looking at water loss audit reports can spot these problematic areas. The Council suggests that some expert review of water loss audit data be done and that utilities with "red flag" entries on the audits receive special attention to help them improve. If Board staff cannot do this task, a contract with a third party should be considered. Over the next biennium, the Council will monitor the Board's activities on water loss reporting associated with financial assistance.

Public Awareness

Public awareness and education are critical components in achieving water conservation goals across all sectors and are often cited in the regional water plans as part of a water management strategy. Public awareness programs are active in a number of areas across the state; however, in many regions utilities and service providers simply do not have the resources to develop their own public awareness programs. Water IQ: Know Your Water provides these entities with resources, information, and tools to spread conservation messaging in their local communities. This program reaches multiple and varying audiences successfully because the water conservation message is consistent and supported with research and data. The current program is limited and only allows TWDB to provide basic services such as maintenance of a website, periodic updates to educational literature, and limited attendance at public community events.

In addition to Water IQ, other local and regional programs across the state also provide effective water conservation messaging and awareness. An expanded and balanced approach would develop a comprehensive public awareness program strategy both before and during a severe drought. The approach could consist of implementation of a statewide, balanced communication mix that creates added-value support for local and regional outreach programs.

Water Conservation Education Grants

Realizing the importance of conservation education in meeting long-term water needs, the 83rd Texas Legislature appropriated \$1 million out of General Revenue for the biennium for grants to water conservation education groups which were awarded by a competitive process that required private matching funds. Ten applications were received, totaling \$2.3 million. Five applications were approved by the Texas Water Development Board at their July 10, 2014 board meeting. The Council will monitor implementation of these education projects.

Research Opportunities in Water Conservation

Municipal and industrial water users are the fastest growing water user groups in Texas, but very few research or academic programs exist on this topic other than those focused on horticultural and landscape irrigation research. This could lead to an impending shortage of trained professionals in these areas. Institutions of higher learning in Texas are encouraged to address the lack of specific research and focused courses that cover:

- commercial and institutional water use and associated equipment;
- air conditioning and industrial cooling including analysis of systems that reduce both energy and water use;
- benchmarks and quantification of water use and water conservation savings within the urban and industrial water use sectors;
- implementation of urban and industrial water conservation measures,
- the capture and use of alternate on-site sources of water; and
- development of new water efficient technologies and equipment.

Future research should also examine the use of water and energy at the end users level including cooling towers for air conditioning; hot water use; and residential, commercial, and industrial equipment.

Research and analysis are also needed to verify water conservation savings from outdoor landscape irrigation measures, such as the Texas Commission on Environmental Quality irrigation standards for new systems, communities with permanent limits on landscape watering, irrigation technologies such as soil moisture sensors, and the use of drip versus spray irrigation.

An increased emphasis should be placed on incorporating more economic considerations into water conservation research. This topic is typically absent or not well defined in the current literature. For example, agricultural researchers have been quite adept at developing technical alternatives related to saving water, but a primary consideration influencing implementation at the field level is tied to the economic impact on the individual farm.

Research and education are keys to meeting future water demands in Texas. Institutions of higher learning play a vital role in addressing water conservation issues through traditional academic methods and also through on-campus efforts and service learning projects. The Council plans to ascertain the scope of existing water conservation related programs at campuses across the state and determine what areas, if any, could be expanded in the future. This could be accomplished through a brief survey and compiled into the next biennial report for the Legislature.

Training and Certification for Water Conservation Professionals

The Council plans to assist the Texas American Water Works Association to implement a water conservation professional certification program for wholesale and municipal water suppliers. The Texas American Water Works Association plans to modify a certification program already developed and in use by other national American Water Works Association chapters. The training program is expected to provide water professionals in Texas the opportunity to advance their knowledge and skills in the area of water conservation. The program is also expected to provide employers, municipalities, policy makers, and other stakeholders with assurances of an individual's level of competence. The goal is for the certification to be the mark of the most qualified, educated and influential water conservation professional in the State.

Water efficiency training for managers and facility engineers of commercial and institutional operations would contribute to advancing water conservation efforts in Texas. Development of training and certification programs similar to those available for energy use is essential and would ensure that operators of these facilities can and will achieve maximum water use efficiency. This is especially true for publicly funded facilities such as schools, county and municipal facilities, state-supported universities, and other public institutions.

APPENDIX A:

Appendix A contains the actions taken by the 83rd Texas Legislature to advance water conservation, curb water loss, and respond to drought conditions. It is not an exhaustive enumeration of all the water-related legislation that might be characterized at least in part as fostering these objectives. For example, it does not discuss all the water funding legislation passed by the Legislature.

The Governor signed all of the bills summarized here, and all of the items in the appropriations bill are available for expenditure in the 2014–2015 biennium. All of the bills described below became effective September 1, 2013 (certain provisions of specific bills may take effect at later times), with two exceptions: Senate Bill 385 became effective September 1, 2013 and the provisions noted below in House Bill 4 became effective only after the passage of a proposed constitutional amendment by Texas voters on November 5, 2013.

Appropriations (Senate Bill 1)

The Texas Legislature retained current funding and staffing levels for the Texas Water Development Board's base Water Conservation Education & Assistance activities (Strategy A.3.1. in the TWDB appropriations)—\$1,380,848 each fiscal year—and added the following new funding:

- \$1 million out of General Revenue for FY 2014 for grants to water conservation education groups to be awarded by a competitive process that may require private matching funds
- \$1.8 million for FY 2014 and \$1.8 million for FY 2015 out of the Agricultural Water Conservation Fund for the Texas Alliance for Water Conservation Demonstration Project, a partnership project in the Texas Southern High Plains to enhance agricultural water efficiency to extend the life of the Ogallala Aquifer
- \$1.5 million for FY 2014 and \$1.5 million for FY 2015 from General Revenue to be used for grants to groundwater conservation districts for agricultural water conservation (grants will go only to districts which require metering of water use and may only be used to offset half the cost of each meter)

The Texas Legislature provided \$407,414 for FY 2014 and \$326,474 for FY 2015 from General Revenue to the TWDB as part of its appropriations for Water Resources Planning (Strategy A.2.2) to develop an online tool to consolidate reporting requirements related to the water use survey, annual water loss report, and annual water conservation report and make those reports viewable by the public online.

Legislation

The Texas Legislature passed the following bills and sent them to the Governor:

House Bill 4 (Ritter, et al./Fraser): among its extensive provisions for establishing a new fund for implementation of the state water plan and for restructuring the Texas Water Development Board, House Bill 4 does the following:

- Requires the Board to undertake to apply not less than 20 percent of the money disbursed in each five-year period to support projects, including agricultural irrigation projects, that are designed for water conservation or reuse
- Requires the Board to undertake to apply not less than 10 percent of the money disbursed in each five-year period to support projects for rural political subdivisions or agricultural water conservation
- Prohibits the use of state financial assistance for a water project if the applicant has failed to submit or implement a water conservation plan
- Requires regional water planning groups in their prioritization of projects for state financial assistance to consider at a minimum such factors as the feasibility, viability, sustainability, and cost-effectiveness of a project—factors which should work in favor of conservation projects
- Requires the Board in its process for prioritization of projects to receive state financial assistance to consider (among other criteria) the demonstrated or projected effect of the project on water conservation, including preventing the loss of water (taking into consideration whether the applicant has filed a water audit that demonstrates the applicant is accountable with regard to reducing water loss and increasing efficiency in the distribution of water)

House Bill 857 (Lucio III/Hegar): requires each retail public water utility with more than 3,300 connections to conduct a water audit annually to determine its water loss and to submit that audit to the TWDB [a retail public water utility with 3,300 or less connections will continue to be required to conduct and submit a water audit once every five years computing the utility's system water loss during the preceding year]. The initial annual water audit must be submitted by May 1, 2014.

House Bill 1461 (Aycock/Fraser): requires each retail public water utility required to file a water audit with the Board to notify each of the utility's customers of the water loss reported in the water audit. The Texas Commission on Environmental Quality will adopt rules to implement this requirement, but the notice may be done through the utility's annual consumer confidence report or on the next bill the customer receives after the water audit is filed.

House Bill 2615 (Johnson/Fraser): increases the penalty for failure of a water rights holder to submit an annual water use report to the Commission [only about 60 percent of water rights holders outside watermaster areas reported their annual water use by the deadline] and requires the Commission to establish a process for submitting these reports electronically through the internet

House Bill 2781 (Fletcher/Campbell): makes a number of changes in current law governing the use and oversight of rainwater harvesting systems:

- Requires a privately owned rainwater harvesting system with a capacity of more than 500 gallons that has an auxiliary water supply to have a specified mechanism for ensuring physical separation between the rainwater system and the auxiliary supply [to prevent any possible contamination]
- Requires the permitting staff of each county and municipality with a population of 10,000 or more whose work relates directly to permits involving rainwater harvesting to receive appropriate training (provided by the Board) regarding rainwater harvesting standards

House Bill 3604 (Burnam, Lucio III/Hegar): requires an entity to implement its water conservation plan and its drought contingency plan, as applicable, when it is notified that the Governor has declared its respective county or counties as a disaster area based on drought conditions; clarifies the authority of the Commission to enforce this requirement.

House Bill 3605 (Burnam, et al./Hegar): does the following:

- Requires a retail public water utility that receives financial assistance from the Board to use a portion of that assistance—or any additional assistance provided by the Board—to mitigate the utility’s system water loss if based on its water audit the water loss meets or exceeds a threshold to be established by Board rule
- Requires the Board in passing on an application for financial assistance from a retail public water utility serving 3,300 or more connections to evaluate the utility’s water conservation plan for compliance with the Board’s best management practices for water conservation and issue a report to the utility detailing the results of that evaluation
- Requires the Board not later than January 1 of each odd-numbered year to submit to the Legislature a written summary of the results of the evaluations noted above
- Requires plans and specifications submitted to the Board with an application for financial assistance to include a seal by a licensed engineer affirming that the plans and specifications are consistent with and conform to current industry design and construction standards

Senate Bill 198 (Watson/Dukes): prevents a property owners’ association from prohibiting or restricting a property owner from using drought-resistant landscaping or water-conserving natural turf but allows an association to require the property owner to submit a detailed description of a plan for the installation of such landscaping or turf for review and approval by the association to ensure to the extent practicable maximum aesthetic compatibility with other landscaping in the subdivision; the legislation also states that the association may not unreasonably deny or withhold approval of the plan or unreasonably determine that the proposed installation is aesthetically incompatible

Senate Bill 385 (Carona/Keffer): authorizes a municipality or a county or a combination thereof to establish and implement a program to provide directly or through a third party financing for a permanent improvement to real property that is intended to decrease water or energy consumption or demand, with the repayment of the financing of a qualified project to be done through an assessment collected with property taxes on the assessed property; sets out the

procedures, requirements, and options by which such a program may be established, implemented, and operated by the local government through contracts and other mechanisms

Senate Bill 654 (West/Anchia): specifically grants to municipalities the authority to enforce through a civil action ordinances related to water conservation measures, including watering restrictions [although some municipalities have taken the position that they already had this authority, this legislation makes it clear that they do and gives municipalities more flexibility in enforcing water conservation ordinances since there may be a reluctance to use criminal law in this regard]

Senate Bill 700 (Hegar/Kacal, Raney): does the following:

- Requires the State Energy Conservation Office to develop a template for state agencies and higher education institutions to use in preparing their respective comprehensive energy and water management plan (such a plan is already required)
- Requires each agency and higher education institution to set percentage goals for reducing its use of water, electricity, gasoline, and natural gas and include those goals in its energy and water management plan
- Requires that plan to be updated annually (currently updates are required biennially)
- Requires State Energy Conservation Office biennially to report to the Governor and the Legislative Budget Board the state and effectiveness of management and conservation activities of the agencies and higher education institutions
- Requires State Energy Conservation Office to post that report on its website

APPENDIX B

This appendix contains information related to water conservation reports. The Council compiled data from several entities throughout the state to provide examples of what they are doing to conserve water.

Numerous local water conservation programs around the state have been implemented by utilities. Each program is unique not only in its activities but its approach and goals based on the particular needs of the utility, such as limited water resources, water quality, peak demands, and customer base. Utilities should have conservation programs both for their own operations and procedures and for their customers. Operational programs can include meter testing and repair, leak detection, rate structuring, or water reuse. Customer programs can range from simple public awareness by providing brochures or bill messages, to classroom programs, to landscape water days and times, to water use audits, and rebate programs for landscapes or plumbing fixtures. Many of these local programs can be viewed on the Water IQ website (www.wateriq.org) by searching a zip code or from the drop down list of partner utilities.

Although efforts to reduce water use and increase water efficiency are increasingly evident in utilities of all sizes and types in Texas, the types of water conservation measures being implemented varies considerably across the state—and the rate of progress in achieving conservation targets varies greatly as well. Water conservation priorities and initiatives vary between urban and rural systems, and the barriers to water conservation implementation are also different between these two demographics. Snapshots of water conservation and reuse efforts being undertaken by a sampling of large city utilities and small-to-mid-size utilities, followed by highlights from large and small rural systems are provided below. By no means are the utilities represented an all-inclusive presentation of those implementing water conservation programs, only a representation of some of the measures being put into practice.

Municipal Water Systems

Large City Utilities

Austin Water (City of Austin)	
Location	Central Texas
Serves	City of Austin (Travis & Williamson Counties)
Population	951,329
Customer Connections	216,000
<p>Austin has embraced water conservation as a core value since 1983 with efforts including regulations, conservation pricing, consumer incentives, a growing reclaimed water system, and comprehensive customer education. As the city continues to grow, and as the program matures beyond traditional conservation incentives, Austin Water is shifting its focus to outdoor water use regulations and improvements in water loss control as well as more in-depth evaluations of commercial buildings and irrigation systems to identify untapped conservation potential. Austin Water also partners with national research organizations to evaluate water use trends and conducts pilot programs to study technology and practices locally. Currently, Austin continues to</p>	

manage through the continued drought in Central Texas with once-per-week watering restrictions that have been in place almost continuously since 2011. Combined with long-term conservation and reuse initiatives, these measures have succeeded in reducing Austin's per-capita water use 17 percent since 2008 and in reducing Austin's demand on the Highland Lakes water system by at least 80,000 acre-feet in the last three years.

City of Dallas Water Utilities	
Location	North Texas
Serves	City of Dallas, 23 major wholesale treated water customers, & 4 wholesale raw water customers
Population	2.4 million
Customer Connections	329,000
<p>Water conservation continues to play an integral role in Dallas' long range water supply strategy. Since 2001, the City's conservation efforts have worked in tandem to save over 200 billion gallons of water. These achievements have been accomplished through phased implementation of best management practices under the following major elements:</p> <ul style="list-style-type: none"> • City Leadership and Commitment • Education and Outreach • Rebate and Incentive Programs <p>The City Leadership and Commitment element is manifested by the visible efforts and actions of the City of Dallas with respect to its own water use. Examples include promoting water conservation practices at city owned facilities through competitive grant funding and enhancing water conservation-oriented policies such as the recently adopted ordinance amendment limiting outdoor irrigation to a maximum of twice per week. The Education and Outreach element is anchored by the Save North Texas Water public awareness campaign. Through Dallas' long-standing partnership with the Tarrant Regional Water District, the conservation message is carried across the Dallas/Fort Worth area and media dollars are leveraged by both entities. Dallas' rebate and incentive programs offer targeted customer groups financial motivation to conserve water. For example, over 65,400 toilets have been distributed through the City's New Throne for Your Home toilet voucher program.</p>	

San Antonio Water System	
Location	South Central Texas
Serves	Bexar County & parts of Medina & Atascosa Counties
Population	1.7 million
Customer Connections	448,000
<p>San Antonio has shown its passion for water conservation for 20 years. Hundreds of thousands of individuals have chosen to use conservation programs at their homes and businesses. The progress made on fixture retrofits has allowed San Antonio to move on from toilet retrofits and invest in other ways to save. The 2012 Water Management Plan recognizes the strategic importance of helping customers use less discretionary water during hot and dry times. The per capita target set uses the record drought year of 2011 as a baseline and sets the 2020 goal of reducing dry year per capita to 135 during similar conditions. San Antonio Water System's conservation programs are aimed even more at ways to help customers manage landscapes without applications of excess water. Efficiency retrofits and repairs for customers in poverty still remain in the extensive conservation menu of options for customers. Some of the new</p>	

challenges being addressed include improved management of landscape water use at homes and business campuses where automatic irrigation is increasing the volatility of customer demand. Programs like the WaterSaver Landscape Coupons and irrigation efficiency rebates have helped thousands of citizens make permanent changes and helping them use less water during dry times. Thousands more have changed their practices through expert consultations and education outreach events. The GardenStyle SA message being promoted through neighborhood fairs, education programs, expert consultations and web-based education. The core of the GardenStyle SA message is that landscapes can be beautiful, drought hardy and increase the value of homes and businesses without increasing the water bill in the summer.

Small to Mid-Size City Systems

City of College Station	
Location	Central Texas
Serves	City of College Station (Brazos County)
Population	85,000
Customer Connections	22,000
<p>The City of College Station has placed a priority on implementing strategies for improving water use efficiency, reducing water loss, and increasing water reuse. Since its last water conservation plan update in 2009, the City of College Station has implemented a number of programs designed to reduce peak water demand, promote long-term water conservation, and reduce demand on the potable water system. These programs include landscape irrigation evaluations for high water use customers, providing rebates for high-efficiency toilets and rainwater collection barrels, and updating its landscape irrigation ordinance requiring minimum design and installation standards and water conservation technology. In 2011, the City's first reclaimed water project came online, providing recycled water for irrigation of athletic fields at Veterans Park & Athletic Complex. Since 2009, the City of College Station has partnered with Texas A&M Agrilife Research to study the effectiveness of water conservation methods designed to reduce outdoor residential water use. This successful partnership is being expanded with funding from the Brazos Valley Groundwater Conservation District to install weather stations throughout the community and develop a website to provide weather-based watering recommendations for customers.</p>	

City of Cedar Park	
Location	Central Texas
Serves	City of Cedar Park (Williamson & Travis Counties)
Population	83,887
Customer Connections	22,000
<p>The City of Cedar Park is committed to conserving water through education and public outreach initiatives as well as a water reuse program and specific conservation projects. The city recently completed the Brushy Creek Sports Park Irrigation project in which the park's irrigation source water was converted from potable water to reclaimed water from the Cedar Park Water Reclamation Facility. The city also recently launched a program in which WaterSmart software is used to create bimonthly reports for customers that describe their water usage, alert them to possible leaks, compare their water usage to that of neighbors, and suggest conservation actions. A rain barrel sale is underway, and the city website includes water conservation tips and</p>	

information about drought tolerant landscaping. The city makes an effort to help customers understand where their water comes from (it is sourced from Lake Travis, which has ongoing low levels) and why water restrictions are necessary. Stage 3 drought restrictions are currently in effect, limiting outdoor irrigation with sprinklers to once per week. The city website includes a brief video and two innovative graphics describing the restrictions.

City of Wichita Falls	
Location	North Texas
Serves	City of Wichita Falls (Wichita County)
Population	104,000
Customer Connections	34,700
<p>After two years of extremely limited rainfall and increased frequency of extreme high temperatures, water conservation is certainly a priority at Wichita Falls as is alternate water source development. Besides offering the public conservation information and tips on their website, the city provides several videos on its city channel describing practical conservation actions. The city has seen significant reductions in peak water use through drought restrictions on outdoor watering and has sought to curb water use in many other aspects of daily life such as at commercial car washes, golf courses, and even restaurants. Wichita Falls also strongly encourages the eleven potable water retailers it supplies to limit their water use to 65 percent of their pre-drought average monthly water use. Wichita Falls recently completed a 45-day verification period for their new emergency direct potable reuse project, and also began a contract to use cloud seeding over the six-month rainy period to try to increase runoff to their source lakes. The city made a concerted effort to keep the public informed about and generate support for the direct potable reuse project, providing outreach through the public information office and creating a YouTube video featuring local health professionals and professors in Wichita Falls lending their support. Local media has been very supportive of the direct potable reuse effort as well as publicizing the drought restrictions; one particularly enthusiastic radio station even plays a “rain song” every hour on the hour.</p>	

Trophy Club Municipal Utility District No. 1	
Location	North Texas
Serves	Town of Trophy Club & parts of Town of Westlake (Denton & Tarrant Counties)
Population	8,463
Customer Connections	2,800
<p>Trophy Club Municipal Utility District No. 1 has adopted and implemented both supply- and demand-side conservation measures in Trophy Club, Texas. The district changes out 10 to 15 percent of service meters annually and has installed smart meters at an even higher proportion in the last several years. The district also recently installed a new main intake meter to fix the problem of the old meter ‘measuring low’ and thus not accounting for the true amount of water used. The district works aggressively to replace old and leaking pipes, upgrading about one major water line a year. In general, operations are conducted with conservation in mind. For instance, the district works closely with the district fire department to ensure reasonable flushing while meeting Texas Commission on Environmental Quality requirements. The district provides customers with conservation information through a variety of media including online resource links, pamphlets, children’s coloring books, trivia games at community</p>	

events, and open house events with presentations about water-wise practices. Customers receive ‘leak cards’ with their monthly bill and have access to colored tablets to detect toilet leaks. Customer response has been generally positive, with some residents even sharing success stories on the district’s Facebook page.

Rural Water Systems

In 2014 the Texas Rural Water Foundation administered a water conservation survey to personnel at small and rural water utilities across Texas. Over 150 respondents answered questions about the methods they use to conserve water at their facilities (supply side) and to encourage water conservation by their customers (demand side). Twenty-three percent of respondents report that water conservation is a high priority at their systems, and 57 percent of respondents report that water conservation is an equal priority with other system needs. While 91 percent of respondents say their systems have an adopted water conservation plan, only 32 percent of respondents budget for water conservation measures, many of whom specified that they dedicate less than 10 percent of their budgets to these efforts. Seventy percent of respondents believe that water conservation by their customers is the most important type of water conservation, versus the 22 percent who believe that supply-side conservation at their facilities is the most essential. Seventy-one percent of respondents believe that their customers waste the largest amount of water on outdoor irrigation, while only 12 percent report that daily household uses waste the most water.

The majority of survey participants report that their systems implement some type of water conservation measures. Fifty-eight percent implement conservation pricing while 37 percent use conservation marketing/advertising. About half of respondents indicate that they use promotional materials from water conservation campaigns, such as Water IQ and other materials from the Texas Water Development Board, materials from the Texas Commission for Environmental Quality, or materials from local river authorities and groundwater conservation districts. A minority participates in direct outreach to their communities; eighteen percent give educational presentations at schools and 16 percent present at community meetings. Fifty-five percent of respondents say someone on their staff has attended a water conservation event within the last two years. However, only 30 percent of respondents say their staff has completed a ‘bottom-up’ water audit of their system, which involves a thorough examination of both real and apparent losses in all system operations. About half of participants say a basic, top-down water loss audit has been completed at their systems.

The results of this survey reveal that the majority of rural and small water utility personnel are at least aware of the importance of water conservation, particularly conservation by their customers, but lack the resources necessary to implement robust and effective water conservation programs. These systems are less likely to have access to the time, personnel, finances and training resources necessary to implement effective programs geared towards either supply- or demand-side conservation. Thirty-eight percent of survey participants report that the biggest barrier to implementing conservation programs is a lack of personnel or time, while 21 percent cite a lack of financial resources. Phone interviews with utility personnel reveal that most systems have some conservation components, but these are often limited to demand-side efforts requiring little personnel time and cost, such as providing informational pamphlets to customers. Conservation measures such as leak detection, meter replacement, household audits, and

rebate/retrofit programs are sometimes beyond the financial reach of these systems. Fifty-nine percent of survey respondents say that leak identification is the most difficult step in the water conservation process, while 39 percent cite ensuring meter accuracy, 26 percent say enforcement against water wasters, and 23 percent identify enforcement against theft of service as the most difficult step. Notably, more than half of participants (52 percent) say encouraging water conservation among their customers is the most difficult step in water conservation.

Utility personnel at rural and small systems require technical training and assistance to implement water efficiency and conservation measures at their facilities. Most water conservation resources for water utility personnel are specific to the needs of urban or mid-to-large size utilities. Small and/or rural utility systems have different water use profiles and organizational structures, which necessitates approaches tailored to these characteristics. For example, leak detection and ensuring meter accuracy are particularly challenging for rural utilities, which may be explained by the extensive distribution networks required to serve sparsely populated rural areas and the limited manpower of small utilities. Assistance with completing comprehensive, ‘bottom-up’ water loss audits would greatly help systems to prioritize solutions and to understand the monetary costs of inaction. Some utility personnel are as yet unconvinced that water conservation is beneficial; some survey respondents cite lost revenue and pressure from their governing boards to sell more water, especially under “take or pay” arrangements with water suppliers. These systems require assistance with conservation pricing and long-term water supply planning.

Small Rural Systems

Although many government, non-profit, and private sector programs exist to encourage water conservation, most programs are tailored to the needs of urban or mid to size large size utilities. Small and/or rural utility systems have different water use profiles and organizational structures. These systems are less likely to have access to the time, personnel, finances and training resources necessary to implement effective programs geared towards either supply- or demand-side conservation. Most systems have some conservation components, but these are often limited to demand-side efforts requiring little personnel time and cost, such as providing informational pamphlets to customers. Robust supply-side conservation measures, such as leak detection, meter replacement, and rebate/retrofit programs, are sometimes beyond the financial reach of these systems. The following are examples of conservation efforts instituted by small systems.

Fort Davis Water Supply Corporation	
Location	West Texas
Serves	Fort Davis (Jeff Davis County)
Population	1,234
Customer Connections	660
Water conservation is a way of life in Fort Davis. This is reflected at the Fort Davis Water Supply Corporation, where water conservation is always a high priority. The corporation has an adopted water conservation plan and provides numerous conservation pamphlets at their office in both English and Spanish along with leak detection kits. The corporation office building is outfitted with a rainwater harvesting system that irrigates the office’s flower beds and is also used as a display for visitors. Corporation staff gives presentations with conservation information	

to local groups, including the Chihuahuan Desert Research Institute and the local chapter of Texas Cattlewomen. Although Fort Davis is not an incorporated city and therefore the corporation cannot leverage city ordinances, they do encourage the community to reuse grey water for outdoor irrigation in all new construction projects. Fort Davis Water Supply Corporation prides itself on a very quick leak response rate; the staff aims to fix leaks the same day they are detected. The public is good about reporting these leaks, which reflects a broader commitment to water conservation within the community.

Pattison Water Supply Corporation	
Location	Gulf Coast
Serves	City of Pattison (Waller County)
Population	1,400
Customer Connections	477
<p>Though Pattison Water Supply Corporation is currently benefiting from full ponds and saturated ground conditions, the system is not waiting for a drought disaster to hit to begin water conservation outreach and education efforts. General Manager Connie Turner has used open source resources online, including materials from the American Water Works Association and the Texas Commission on Environmental Quality's Take Care of Texas campaign, to put together 'goodie bags' with water conservation tips and stickers for children. Connie believes directing their marketing towards children will help teach parents as well and also has conservation pamphlets available for adults. These pamphlets were recently disbursed at an appreciation dinner and an open house. The corporation also provides information about xeriscaping and gives tours of their new water-wise garden at their office, which has generated interest among customers.</p>	

Large Rural Systems

Some rural water systems serve populations greater than 10,000, but the population they serve is dispersed over a large geographic area. Because of the amount of pipeline these systems must maintain in order to reach all of their customers, pipeline leak detection and maintenance play a significant role in large rural systems' supply-side water conservation efforts. These systems typically have staff and resources to institute effective supply and demand-side conservation program.

Aqua Water Supply Corporation	
Location	Central Texas
Serves	Most of Bastrop County & Parts of Travis, Lee, Caldwell, Fayette & Williamson Counties
Population	55,000
Customer Connections	18,100
<p>Aqua Water Supply Corporation in Bastrop, Texas, believes that "conserving is a new way of life", and is committed to both supply- and demand-side conservation efforts. Aqua's Water Conservation Manager, Chuck Kellogg, speaks about water issues at community events, such as home owner association meetings and at elementary schools. Customers also receive messages encouraging water conservation in their monthly bills and newsletters. Aqua is involved in the U.S. Environmental Protection Agency's WaterSense program as well as the Irrigation Association and the Alliance for Water Efficiency; in fact, Mr. Kellogg presented at the Alliance</p>	

for Water Efficiency's WaterSmart conference in Las Vegas last year and sits on their product efficiency committee. Aqua recently replaced all of its meters with electronic models and monitors them monthly for misreads. The team also closely monitors usage; if a household has a high monthly usage they are contacted to ensure there is no unreported leakage. Aqua uses a leak detection program to prioritize leak issues and keep track of how long it takes to repair them. The corporation completes water audits annually and plans to use the Alliance for Water Efficiency's Water Conservation Tracking Tool to further evaluate the system's efficiency and make improvements this year.

East Medina County Special Utility District	
Location	Central Texas
Serves	Medina County
Population	9,000
Customer Connections	2,800
<p>East Medina County Special Utility District has a robust set of programs to increase water conservation and reduce losses within their facilities and distribution lines. At 45 years old, the system is aging; many of the older meters are 'running slow'. The district aims to replace about 10 percent of meters annually and also completes spot testing and calibration. In the past, the district has received grants from the Edwards Aquifer Authority to complete acoustic leak detection tests and has also borrowed testing equipment through the Texas Water Development Board. The district recently signed a \$2.25 million contract to replace nearly six miles of water mains with the most severe leaks. The district also sends out water conservation information to customers through their quarterly newsletters and at community presentations. Customers are offered a rebate for low flow toilets and clothes washers that are purchased locally in Medina County. Superintendent Bruce Alexander explains that many customers, including those in the agriculture community, are aware of the need to conserve water sourced from the Edwards Aquifer. Mr. Alexander represents retail public water utilities on the Stakeholder Committee for the Habitat Conservation Plan for the Edwards Aquifer, ensuring that the district is up to date on the latest conservation efforts.</p>	

Green Valley Special Utility District	
Location	Central Texas
Serves	Parts of Guadalupe, Comal & Bexar Counties
Population	30,000
Customer Connections	7,500
<p>Water conservation has always been an important part of system operations at Green Valley Special Utility District, where the goal is to practice year-round conservation instead of only during periods of drought. Currently, the district is making conservation a priority message to customers and is reviewing and updating their water conservation plan, and their drought plan including drought stage restrictions and watering schedules. The district's monthly newsletter includes water saving tips, and the district offers in-home visits with customers to discuss their logged water use patterns and suggest conservation practices. The district has an elaborate SCADA system that is used daily to detect variations in normal operation patterns. The district replaces waterlines with frequent outages or maintenance problems, and crews are vigilant about identifying connections with high usage and other irregularities.</p>	

Mustang Special Utility District	
Location	North Central Texas
Serves	Denton County
Population	33,000
Customer Connections	11,000
<p>Mustang Special Utility District has aggressively addressed leaks and water loss in their system and now tracks water usage very closely. In 2013, the district completed a three year, system-wide leak detection program; the biggest leaks were given the highest priority and fixed immediately, but all leaks have now been resolved. While completing this program, the district took the opportunity to use GPS to locate all of their valves and hydrants, which are now part of an active GIS water model database. They use this database to track their water usage and losses very carefully, such as monitoring leaks, flushing, and fire department use. Generally the district's monthly water loss is now around 5 to 6 percent (this is also partly the result of the addition of new infrastructure due to high population growth in the area). On the demand side of their operations, the district just added a staff person tasked with public outreach and education, which will prominently feature water conservation awareness. This staff person will give presentations at schools and community meetings to demonstrate concepts such as the hydrological cycle, the water lost from even a small hole in a pipe, and how much water is required to water a lawn and will hand out conservation paraphernalia. Additionally, the district is one of the founding members of the Upper Trinity Conservation Trust, whose goal is to preserve riparian areas in the region to be used as buffer zones for storm water runoff from new developments.</p>	

APPENDIX C:

This appendix provides examples of public outreach and conservation programs throughout the state.

Austin Water Utility

Austin Water Utility (austintexas.gov/department/water-conservation) uses a wide variety of public outreach and education programs, including

- program advertising and information about watering restrictions;
- presentations and booths on water conservation techniques and available programs for a variety of interest groups;
- a Water Conservation Speakers Bureau;
- providing 13-month usage graphs on customer bills and online;
- providing water conservation training and workshops to licensed irrigators, landscape contractors, and homeowners; and
- the Dowser Dan Show, an original and highly popular assembly program that teaches kids (and teachers) about water conservation.

El Paso Water Utility

In April 2012, El Paso Water Utilities (www.lessismoreep.org/) launched its bilingual multimedia water conservation campaign built around the rallying cry “Less is the New More”. Rooted deeply in social norming, the campaign painted water waste as a gluttonous taboo and water conservation as a simple, responsible choice. El Paso Water Utility’s campaign included television and radio commercials, social media, newspaper ads, billboards, aggressive media relations, and sponsorships at festivals and home improvement workshops. All components integrated the “Less is the New More” branding and drove users to the utility’s one-stop water conservation website. By cohesively branding all campaign elements, the campaign not only helped reduce year-to-date consumption, it also initiated an ongoing “Less is the New More” conversation with customers and stakeholders. The utility envisions that conversation as an essential tool in maintaining community buy-in as drought and resulting water conservation measures continue beyond 2012. Concurrent with the campaign, El Paso Water Utilities offers educational programs and presentations to area schools, organizations and community events. Educational programs are tailored to different audiences but they all encourage conservation. On an annual average, the utility delivers 300 educational programs to more than 13,000 attendees.

High Plains Underground Water Conservation District

The High Plains Underground Water Conservation District No. 1 in Lubbock began its public information and education program with the inception of its monthly newsletter, *The Cross Section*, in June 1954. Since then, a wide range of programs and activities have been implemented to educate the public about the importance of water and water conservation within the district’s 16-county service area. These include a newly-redesigned website incorporating social media, news releases, staff media interviews, 60-second radio public service

announcements, 30-second TV public service announcements, staff presentations at civic and professional meetings, displays and exhibits at public venues, and various water conservation brochures and reports that are available to the public. In addition, High Plains Underground Water Conservation District No. 1 provides water conservation outreach to students through classroom presentations and sponsorship of the WaterWise™ education program. Additional information is available at www.hpwd.com/programs-and-activities/information-education-programs.

North Texas Municipal Water District

The North Texas Municipal Water District was the first in Texas to implement the Water IQ public awareness water conservation program in 2006, and their 2012–2013 Water IQ campaign “Lawn vs. Lake” promotes wise and efficient landscape watering. North Texas Municipal Water District’s campaign promotes easy, sensible water saving tips that not only extend our natural resource of water but also reduce the cost of water for consumers. Since 2006, the district estimates that yearly water consumption has decreased by 200 million gallons per day during peak summer months, or 12 to 15 percent annually. Through quantitative and qualitative surveys within the service area, the district can reach their target audience knowing consumers are more likely to conserve water if they know they will be saving money on their water bills while ensuring there is enough water for the future. Information on this program can be found at northtexaswateriq.org/.

Tarrant Regional Water District and Dallas Water Utilities

Tarrant Regional Water District supplies raw water to more than 1.8 million people in North Texas with a service area that spans across 11 counties. Dallas Water Utilities serves nearly 2.4 million people in 28 communities in six counties. Both water suppliers rely on surface water from reservoirs to meet the demands of their customers.

Since 2009, Tarrant Regional Water District and Dallas Water Utilities have joined efforts to promote water conservation to more than six million people in the North Texas region. Through a public outreach campaign entitled “Save Water. Nothing can replace it”, the two entities have sought to educate the public on how to increase water efficiency and reduce water waste. Beginning in 2011, the campaign created the Lawn Whisperer—a humorous character that talks to lawns and relays messages about how to save water outdoors. The campaign relies on an array of television, radio, and print mediums to reach audiences. But the Lawn Whisperer really shines in the realm of social media through a growing legion of more than 2,000 Facebook fans and public appearances at numerous community events. Tarrant Regional Water District and Dallas Water Utilities have a combined budget of approximately \$2 million per year to fund the campaign’s creative and advertising expenses. Due to the popularity of the character, Tarrant Regional Water District and Dallas Water Utilities will enlist The Lawn Whisperer’s talents for a third consecutive year to continue educating North Texas residents on smart ways to save water. Because of their public outreach efforts and other water conservation measures, both entities are observing significant declines in water usage, which are adding up to billions of gallons each year. To learn more about water efficiency and the Lawn Whisperer visit savenorthtexaswater.com/.

Texas Corn Producers Board and the Natural Resources Conservation Service

The Texas Corn Producers Board and the Natural Resources Conservation Service began a cooperative effort in 2009 to promote agricultural water conservation in the High Plains of Texas through information and educational programs. This led to the creation in 2011 of the “Water Grows Jobs” campaign targeting the Lubbock and Amarillo media markets. The primary message of the campaign is how agricultural water conservation efforts are vital to sustaining the region’s economy in the future with the slogan “Water grows jobs, let’s make it last.” The campaign includes the creation of the [watergrowsjobs.org](http://www.watergrowsjobs.org) website, a 10-minute video on the economic importance of irrigated agriculture in the region, a three part video on the benefits of drip irrigation, and three 30-second video public service announcements that ran on Lubbock and Amarillo broadcast stations. The website is frequently updated with articles about the Natural Resources Conservation Service’s Ogallala Aquifer Initiative, water conserving irrigation practices, and regional economic studies. The ongoing partnership between corn producers and the Natural Resources Conservation Service includes presentations and information booths at agricultural shows and conservation conferences throughout the state. Additional information is available at www.watergrowsjobs.org.

Turfgrass Producers of Texas

The turfgrass sodded on lawns, playing fields, golf courses, parks, and other green spaces throughout the state demands a significant volume of water. While the water used to maintain turfgrass is justifiably associated with municipal or institutional use, turfgrass is generally grown on farms, then cut and transported to urban areas.

Since 2003, Turfgrass Producers of Texas has funded approximately \$800,000 in research to identify drought tolerant species, to improve irrigation systems, and to define water use requirements for turfgrass. Research initiatives include:

- The identification of 25 turfgrass varieties that are able to withstand a 60-day drought.
- Support for the Specialty Crop Research Initiative at the Texas A&M University Dallas Center to develop drought and salinity tolerant Bermuda, St. Augustine, Zoysia, Seashore Paspalum and Ryegrass species.
- Independent breeding programs to develop and release improved varieties of Zoysia, Bermuda, and Buffalo grass that require less water, fertilizer and mowing.

The Turfgrass Producers of Texas has also been an active participant in the Texas Water Smart program; cooperated with the Texas Turfgrass Irrigation Association to develop YouTube videos stressing the need for proper irrigation techniques using efficient water conserving systems; and coordinated with Texas A&M University to establish the Turfgrass Lab in College Station.

APPENDIX D:

This appendix provides information related to research and water conservation opportunities beyond outdoor water use and landscape irrigation.

According to the Texas Water Development Board projections, the water needs of the municipal and industrial sectors will continue to grow over the next fifty years. Opportunities for water conservation exist within all sectors, but documenting water saved as a result of implementing best management practices is difficult because of multiple factors. One of the problems relates to the lack of university level research on water conservation outside of agricultural and landscape/horticulture programs.

A 2012 report by Hermitte and Mace¹, titled "The Grass is Always Greener... Outdoor Residential Water Use in Texas" examined residential outdoor water use based on metered data and found that, on average, 31 percent of household use was for landscape irrigation. Trend lines of data from the sixteen cities selected for further investigation showed an increase in outdoor water use over time.

To answer the question of why outdoor water use appears to be on the rise in light of increased efforts within these cities and across the state requires further research. Are these communities implementing conservation programs—either of their own design or related to, for example, legislation passed in 2007 establishing irrigation standards meant to increase water conservation? And if so, how can water savings be monitored and documented so that successful, proven practices can be associated with established metrics?

Another opportunity for water conservation research relates to documenting savings related to drought related (temporary) or long-term outdoor watering restrictions. Specifically, how to show that without these measures in place, the outdoor watering in these communities would have been higher? An opportunity for research at the university level exists regarding the use of irrigation technologies such as soil moisture sensors as well. A 2012 study by Dukes and Haley² at the University of Florida showed a 65 percent reduction in applied irrigation water for soil moisture control system versus set time systems. Would the results be as significant for communities in Texas?

If the 2012 Hermitte and Mace study determined that an average of 31 percent of household water use occurs outdoors, then approximately 69 percent is used elsewhere. That fact in itself presents both a research opportunity and a challenge. Similarly, the majority of water used in the industrial, commercial, and institutional sector is for non-landscape purposes.

¹ http://www.twdb.texas.gov/publications/reports/technical_notes/

² Haley, M. B., M. D. Dukes. 2012. [Validation of Landscape Irrigation Reduction with Soil Moisture Sensor Irrigation Controllers](#). *Journal of Irrigation and Drainage Engineering*, 138(2), 135–144.

A summary of water audit data from thirty large facilities in Fort Worth shows in Figure #10 that irrigation typically represents less than twenty percent of total water usage.

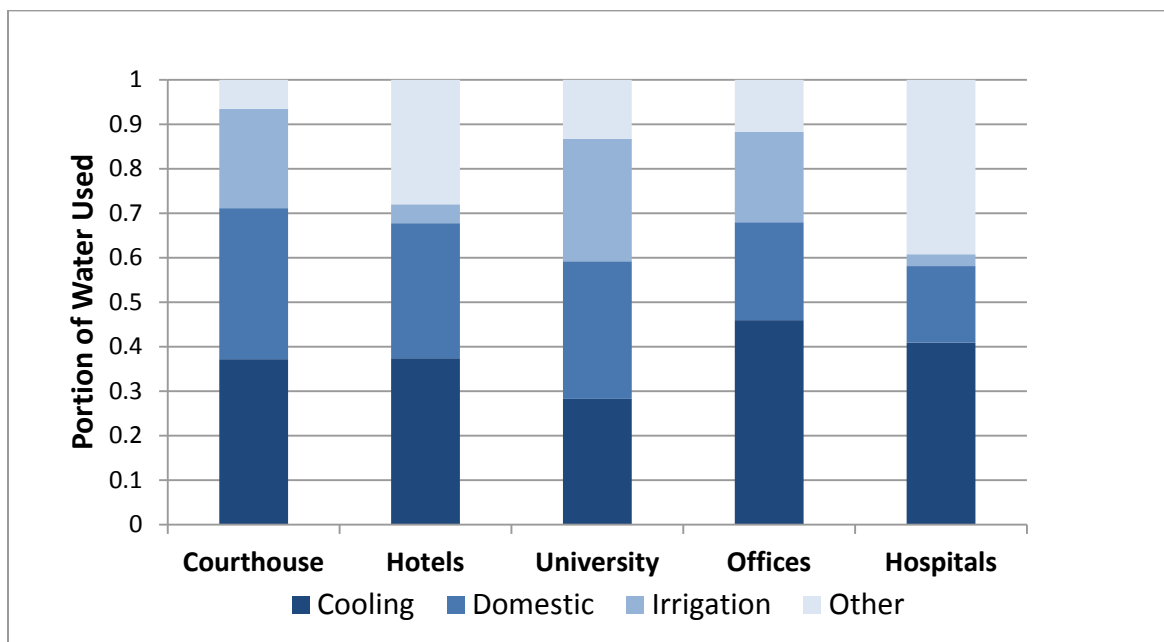


Figure 9. Summary of Water Audit Data from 30 Large Downtown Facilities in Fort Worth, Texas, Texas Water Development Board.

Similarly, the next figure shows water used for landscape irrigation from these selected commercial facilities in Austin is highly variable.

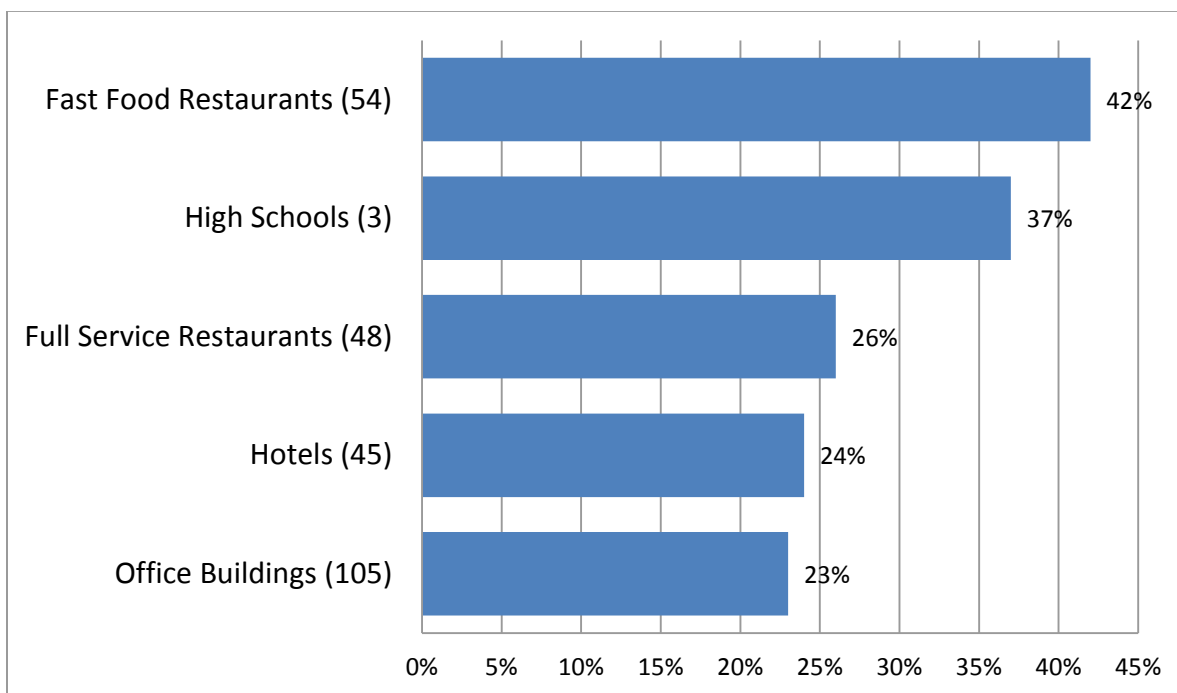


Figure 10. Percent Irrigation Use at Selected Austin Commercial Facilities. Number in Parentheses Indicates Sample Size. Texas Water Development Board.

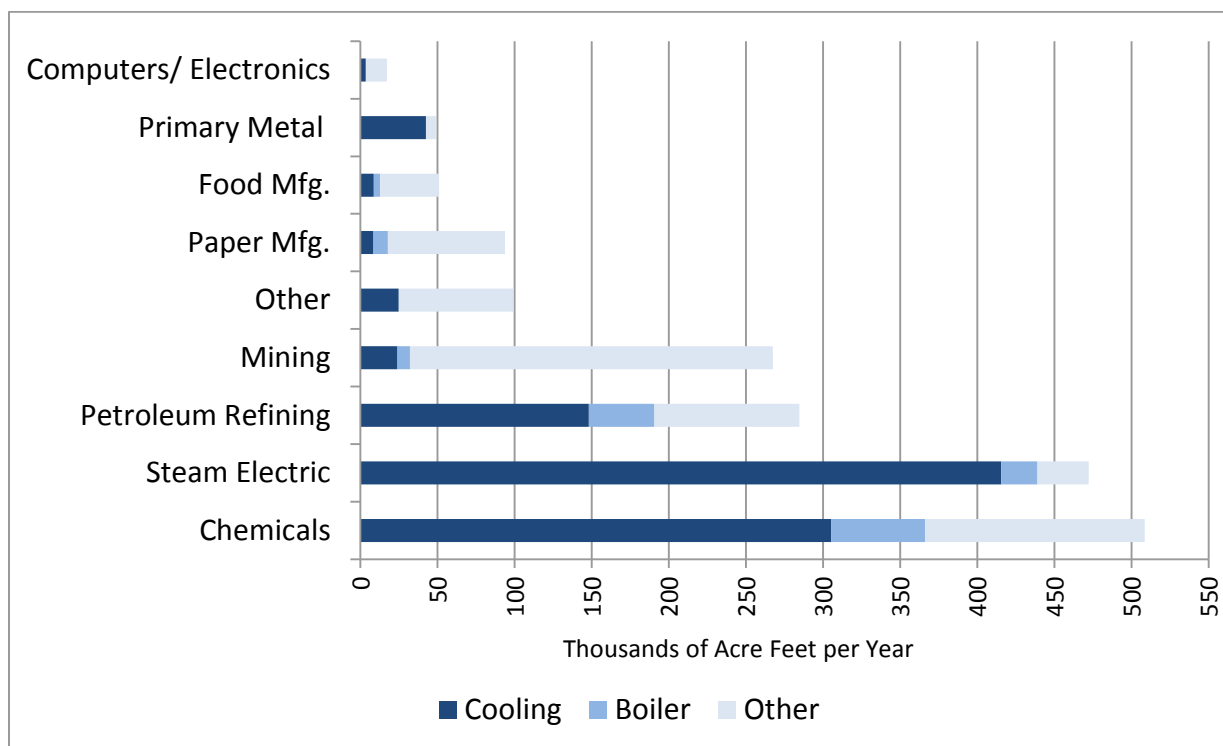


Figure 11. Industrial Water Use in Texas 2010, Data from Texas Water Development Board.

Figure 11 shows another way to examine industrial water use³. These data were obtained from the Texas Water Development Board for the year 2010.

Each figure shows an example of the kind of analyses that can be performed on water use data outside of landscape applications; however, these are just snapshots of specific data sets. Large scale water conservation analyses and related research at the university level is critically lacking. Specific opportunities for additional analysis include

- commercial and institutional water using equipment,
- the energy water nexus of air conditioning and industrial cooling including examining systems that reduce both energy and water use,
- quantifying water use and water savings within the urban and industrial water use sectors,
- determining acceptance and implementation of urban and industrial water conservation measures,
- investigating all aspects of the capture and use of alternate on-site sources of water, and
- developing new water efficient technologies and equipment.

³ Data were obtained from the Texas Water Development Board for the year 2010. Use included direct sales to industries, residential use, non-revenue water actual loss (mainly leaks) and the difference which is taken to be commercial and institutional sales. It does not include self-supplied water by larger industrial users. The data is from the 586 cities, of the 940 surveyed, that provided estimates of residential sales.

APPENDIX E:

This appendix contains a discussion on the need for more economic evaluations within agricultural water conservation research.

Researchers have been quite adept at developing technical alternatives related to saving water, but a primary consideration influencing implementation at the field level is tied to the economic impact on the individual farm. Yet, this is an area that is typically lacking or not well defined in research. Ultimately, research will only be implemented if the recommended practices or systems prove to be economically viable and sustainable.

An increased emphasis should be placed on incorporating the following economic considerations into research on a routine basis to provide the greatest chance that it will actually be adapted and prove useful:

- Developing an easy to use spreadsheet that provides for a wide scale of operations from large to small.
- While providing an estimated upfront cost to implement, the spreadsheet should incorporate options for the cost of money (loans) over a capitalized time frame. This would allow the producer to input information reflecting their actual loan rates.
- The impact of potential incentives should also be built into the program to allow producer inputs reflecting either an estimated cost or actual quotes to complete the work both with and without incentives.
- The program should itemize savings by line item when applicable. For example, if the installation of a new irrigation system reduces labor costs by 50 percent, then those savings should be reflected as an annual expense that would offset a portion of the installation cost. Another example would involve any system of irrigation water management that reduces pumping by even a small amount not only saves water—it also saves fuel costs.
- The potential impact on yields when converting from the old to new system needs to be built into the program.
- A realistic cost associated with annual maintenance of the new approach.

All these options need to be combined in such a way so that a realistic pay-back time can be developed to reflect the realities at the farm level. In conclusion, it is recommended that an increased emphasis on economics be tied to research by working to develop standard language in grant or research proposals that provides for an easy to use spreadsheet addressing items such as those discussed above.

APPENDIX F:

This appendix provides information on state and federal agencies that have established programs to provide grants, low cost loans, or financial incentives to encourage agricultural water conservation.

The Texas State Soil and Water Conservation Board has several major programs that address agricultural water conservation issues. The Water Quality Management program implements agricultural best management practices that enhance both water quality and water quantity. The main objective of the Water Supply Enhancement Program is water conservation. The Flood Control Program contributes to water conservation by trapping sediment that would otherwise reduce the capacity of the state's major reservoirs. As a statewide agency, the Texas State Soil and Water Conservation Board works closely with the 216 local soil and water conservation districts and the U.S. Department of Agriculture's Natural Resources Conservation Service to provide federal financial cost share assistance and technical assistance to agricultural landowners and producers. A statewide study of agricultural best management practices implementation through the Texas State Soil and Water Conservation Board and Natural Resources Conservation Service programs estimated the water savings over a three year period were more than 450,000 acre-feet per year of water. Details of the study are available in the report, *An Assessment of Water Conservation, Report to the 82nd Legislature, March 2012*, which is posted online at http://www.twdb.texas.gov/publications/reports/special_legislative_reports/doc/TWDB_TSSWC_B_82nd.pdf

The Texas State Soil and Water Conservation Board also has education and outreach programs that support and recognize conservation. Several teacher workshops are held each summer by soil and water conservation districts in cooperation with the Texas State Soil and Water Conservation Board on conservation and natural resource issues. Each year, the Texas State Soil and Water Conservation Board and the Association of Texas Soil and Water Conservation Districts co-sponsor the Texas Conservation Awards Program to recognize and honor those who dedicate themselves and their talents to the conservation and wise use of renewable natural resources. The Association of Texas Soil and Water Conservation Districts has a conservation related video library that is maintained by Texas State Soil and Water Conservation Board staff on their behalf for the benefit of local districts and educators. Currently, there are over 200 conservation-related videos in the library available to districts and teachers.

In 2011, the Texas State Soil and Water Conservation Board and the Texas Water Development Board conducted a voluntary survey of irrigation districts to assess the extent of best management practices implemented by irrigation districts. Replacing district canals and laterals with pipelines were the most frequently employed best management practices. Implementation of best management practices varies widely among districts. Some districts have aggressively implemented water conservation best management practices while many others have the potential for additional implementation and conservation.

The Texas Brush Control Program (now the Water Supply Enhancement Program) provides cost-share assistance to landowners to remove undesirable brush species that plague many areas of the state. Based on a U.S. Department of Agriculture report in 1967, in Texas alone, brushy species

may use an estimated 3.5 trillion acre-feet of water annually making targeted brush control a needed conservation strategy.

Texas Water Development Board

Implementation of agricultural water conservation measures and best management practices accounts for approximately 1.5 million acre-feet or 17 percent of new water supplies from recommended strategies in the 2060 decade according to the 2012 State Water Plan. The Texas Water Development Board's Agricultural Water Conservation Fund provides a dedicated source of funding to eligible political subdivisions, public universities, and other state agencies to advance agricultural water conservation in the state.

The Agricultural Water Conservation Grants program annually makes \$600,000 available for eligible water conservation projects. Through participation in this program, eligible applicants may involve producers in demonstration projects, voluntary irrigation metering programs, or research projects. The main benefit received by producers participating in most of the projects funded is in the form of education on tools available and/or cost-share of metering equipment. Through the Agricultural Water Conservation Program, the Board has funded a number of demonstration projects which are discussed in more detail below.

Texas Alliance for Water Conservation

The Texas Alliance for Water Conservation is a producer-led demonstration funded by the State of Texas through the Texas Water Development Board. The Alliance, partnered with the Texas Coalition for Sustainable Integrated Systems Research long-term integrated systems research at Texas Tech University, provides for research, demonstration, and implementation to reduce water use while ensuring the economic viability of agriculture in the Texas High Plains. The primary objectives of the project are to demonstrate water use reduction, maintain or enhance profitability, compare crops and technologies that conserve water, and encourage adoption of efficient irrigation.

The Texas Water Development Board initially provided a \$6.2 million agricultural water conservation demonstration initiative grant to the project in 2004 through Texas Tech University in collaboration with Texas A&M AgriLife Extension, the High Plains Underground Water Conservation District, industry representatives, and agricultural producers in Floyd and Hale counties.

Demonstrations of cropping systems range from continuous monoculture to fully integrated crop, livestock, and forage systems and include dryland and irrigated cropping. The project demonstrates improved irrigation technologies such as subsurface drip and precision center pivot systems. Decision-making aids are available for matching crop type to water supply, proper scheduling of irrigation, and financial analysis aimed at meeting the dual goals of water conservation and profitable production.

Results thus far have been beneficial to agricultural water conservation efforts:

- Water savings potential by adopting improved irrigation technologies and water efficient crops.

- Industry and producer mutual benefits from field demonstrations of new products and services.
- Increased attention paid by producers to avoiding over-irrigation by monitoring water use.

The Project has received national recognition by the American Water Resources Association for excellence in sustainable water management and won several awards including the Water Conservation Advisory Council's Blue Legacy Award in Agriculture for the project itself and for producer partners Glenn Schur and Eddie Teeter.

During the 83rd regular legislative session in 2013, the Texas Water Development Board received direction through the General Appropriations Act to provide another \$3.6 million in agricultural water conservation grant funds to extend the project through the 2019 crop season. The new phase will include training workshops for enhanced decision-aid tools and additional field demonstration sites in the Southern High Plains. All project reports and outreach information can be found at www.tawc.us

Texas Project for Ag Water Efficiency

The Texas Project for Ag Water Efficiency is a long-term agricultural water conservation project in the Lower Rio Grande Valley. In 2004, the Texas Water Development Board awarded a 10-year \$3.8 million agricultural demonstration initiative grant to the Harlingen Irrigation District to research, demonstrate, and publicize ways to conserve and manage irrigation via surface water in Willacy, Cameron, and Hidalgo counties. Project partners include Texas A&M AgriLife Extension FARM Assistance, Texas A&M University–Kingsville, Texas A&M Citrus Center, Texas A&M AgriLife Research in Weslaco, Delta Lake Irrigation District, U.S. Department of Agriculture, Texas State Soil & Water Conservation Board, and local producers.

Efforts to increase ag water efficiency and conservation must account for two interrelated elements: (1) delivery of water from the river by irrigation districts and (2) application of water on-farm by producers. Farmers can be efficient in applying surface water to their crops to the extent that that water is efficiently delivered to them by their irrigation district.

And “efficient” doesn’t necessarily imply expensive nor radical changes. The Project has looked for, analyzed, demonstrated, proven, and promoted adaptations that build on long-established water management practices. Data from years of careful research and analysis conclusively show substantial savings in water use are possible with certain low-cost modifications. Project results are relevant not only to the Lower Rio Grande but also to other surface-water applications in Texas.

Real-time information on operations and the ability to make immediate adjustments are critical for district efficiency which, though hard to measure, translates directly into on-farm efficiencies. Water is delivered on-time and in the requested amounts; the irrigator does not have to do more with less. The Project has developed plans and technical specs that districts can use to build their own telecomm infrastructures with low-cost, off-the shelf components. The Lower Colorado River Authority and El Paso Irrigation District are early adaptors of the Project’s autogates.

Narrow-border flood in citrus and surge in cotton, sugarcane, and other row crops adapt traditional flood irrigation techniques with minimal investment but with substantial savings in water use *plus* increased net cash farm income. Texas A&M analyses show narrow-border flood can reduce water use by 33 percent and surge from 22 to 52 percent. Sugarcane and citrus, high-value crops with water needs well in excess of rainfall amounts typical for their growing seasons, are the biggest users of irrigation water in the region. Using surge with sugarcane and narrow-border flood with citrus in the region could conserve from 69,000 to 90,000 acre-feet of water annually.

The major task still facing the Project is continued outreach to secure widespread acceptance and implementation of these proven strategies. Fortunately, the Project simultaneously commenced field demonstrations and construction on the Rio Grande Center for Ag Water Efficiency, next to the Harlingen Irrigation District's river pumping plant. The Center was specifically designed to provide hands-on training in both district automation and on-farm water management.

For district personnel, the Center features a simulated canal system, complete with automated gates and telemetry, where trainees experience first-hand the efficiencies of integrated operations over manual methods for controlling flow and managing canal levels for agricultural water conservation.

For farmers, the Center offers classes in various irrigation techniques proven locally to save water and still produce a net cash farm income. Other workshops focus on readily available tools for irrigating more efficiently, including using soil moisture sensors and linking into evapotranspiration networks for precision irrigation scheduling.

Both producers and districts also can calibrate flow meters at the Center and learn the various ways of metering on closed and open systems. This type of public service is available at only two other facilities in the United States. Across Texas, ongoing drought and dwindling water supplies make the need to calibrate and verify meters increasingly important. In 2013, the Project calibrated 40 meters for other irrigation districts in the region, installed and repaired meters for additional districts, repaired meters for growers, and even consulted on meters for a municipal water district.

Recently the Center launched a series of workshops for producers in surge irrigation in support of the Surge Valve Cooperative, an initiative of the Rio Grande Regional Water Authority based on Texas AWE findings. In 2013, the Authority was awarded a U.S. Bureau of Reclamation WaterSMART grant that heavily subsidizes the costs of a surge valve for producers and provides training in its use. In return, cooperators keep data on water use and experiences and provide peer-to-peer information throughout the agricultural community in the Lower Rio Grande Valley. The Project is providing in-kind support by recruiting participants, hosting and conducting training, and gathering and analyzing results.

The Project was honored with the 2011 Texas Environmental Excellence Award for Agriculture and the 2013 Blue Legacy Award for Agriculture. All project information and data on these proven water saving strategies for use both in-district and on-farm can be found online at www.TexasAWE.org/.

U.S. Department of Agriculture–Natural Resources Conservation Service

The U.S. Department of Agriculture–Natural Resources Conservation Service assisted Texas agricultural producers with implementation of water conservation measures through the use of Farm Bill programs such as the Environmental Quality Incentives Program and the Agricultural Water Enhancement Program. Included in these programs are water conservation practices that improve irrigation efficiency (such as pipelines, drip irrigation systems, precision application center-pivot systems, land leveling, and irrigation water management including flow meters), enhance water yield and infiltration (brush management, furrow diking, and rangeland and pastureland management), or protect the ground surface from evaporation including no till and reduced tillage operations. Agricultural producers through long-term (up to 10 years) cost-share contracts with the U.S. Department of Agriculture–Natural Resources Conservation Service apply these practices.

Natural Resources Conservation Service financial assistance can fund irrigation improvements such as high efficiency center pivots, micro irrigation systems, pipelines, irrigation water management (including flow meters and chemigation valves), land leveling, and certain agronomic practices like reduced tillage or no-till that can reduce evaporation from the soil. The Service provided approximately \$32 million in financial assistance through the Agricultural Water Enhancement Program and over \$392 million through the Environmental Quality Incentives Program during the previous Farm Bill years of 2009 to 2013.

Under the Environmental Quality Incentives Program, the Service gives priority to applications that demonstrate a reduction in water use by the agricultural operation. During fiscal years 2011 and 2012, Environmental Quality Incentives Program cost-share payments to agricultural producers for applying water conservation practices totaled \$23 million through 1,494 contracts.

The Agricultural Water Enhancement Program is a funded subprogram of the Environmental Quality Incentives Program and is designed to target areas or regions with specific water quantity and quality improvement efforts. As part of Environmental Quality Incentives Program, the Agricultural Water Enhancement Program operates through contracts with producers to plan and implement conservation practices to protect ground and surface water and improve water quality in project areas established through partnership agreements. Producers may participate individually in Agricultural Water Enhancement Program or collectively through a partnership project. During fiscal years 2011 and 2012, Agricultural Water Enhancement Program cost-share payments to agricultural producers for applying water conservation practices totaled \$7.3 million through 510 contracts.

The statewide financial assistance provided by the Agricultural Water Enhancement Program over a five-year period was \$11.1 million (2009), \$4.4 million (2010), \$5.2 million (2011), \$6.8 million (2012), and \$4.6 million (2013). The statewide funding provided by the Environmental Quality Incentives Program over the same time frame was \$64.1 million (2009), \$76.1 million (2010), \$85.2 million (2011), \$76.0 million (2012), and \$91.1 million (2013). Funding through the Agricultural Water Enhancement Program was specifically targeted to water conservation efforts while the Environmental Quality Incentives Program funding addressed a wide variety of environmental concerns with most funds reflecting local priorities. Therefore, while the Environmental Quality Incentives Program was not specifically tied to water conservation

efforts, a significant portion was utilized for that purpose. For example, in the Texas panhandle where most of the irrigation occurs, the 2009–2013 totals for these two programs provided a combined \$71.0 million for water conservation practices.

The U.S. Department of Agriculture’s Agricultural Research Service funded the on-going Ogallala Aquifer Program to focus research efforts on developing new water management technologies to sustain rural economies associated with this critical aquifer. It represents a combined effort of faculty, researchers, and specialists from Kansas State University, Texas A&M University, Texas Tech University, U.S. Department of Agriculture’s Agricultural Research Service, and West Texas A&M University.

The Ogallala Aquifer Program was established in 2003 to develop new water conservation technologies and practices. Research highlights to date include (1) economic assessment of various water conservation strategies, (2) improved management strategies for subsurface drip and deficit irrigation, (3) improved irrigation scheduling techniques, (4) improved practices for dryland farming, and (5) technologies for water conservation in confined animal feeding operations and animal processing plants.

APPENDIX G:

The 83rd Legislature passed Senate Bill 700 to harmonize existing energy/water management planning and reporting by state agencies and public institutions of higher education. The State Energy Conservation Office is designing a template for use when submitting semiannual energy and water management plans for reducing utilities. The State Energy Conservation Office will also now submit an evaluation and status report to the Governor's office and Legislative Budget Board every other year prior to legislative session.

Historically, the emphasis of the energy water nexus research has been to examine relationships between the water needed to produce energy and the energy needed to treat water and wastewater and to pump water. The Energy Water Nexus must extend to the use of water and energy at the end users level including cooling towers for air conditioning, hot water use, and residential commercial and industrial equipment using both energy and water. Research in these areas could yield both significant energy and water savings.

The following graphs illustrate the importance of examining the energy water nexus of the end user. As figures 1 and 2 show, cooling tower water use is significant in the commercial and institutional sectors in Texas. Figures 3 and 4 show that most of our industrial use is for cooling and boiler makeup.

Advances in technologies such as geothermal air conditioning, hybrid cooling towers, the use of the heat from micro-turbines to operate desiccant cooling systems, and similar technologies could significantly reduce cooling tower water use. In a similar manner, equipment found in hospitals, restaurants, laundries, and the home that use both energy and water need to be researched and challenges given to develop more efficient equipment.

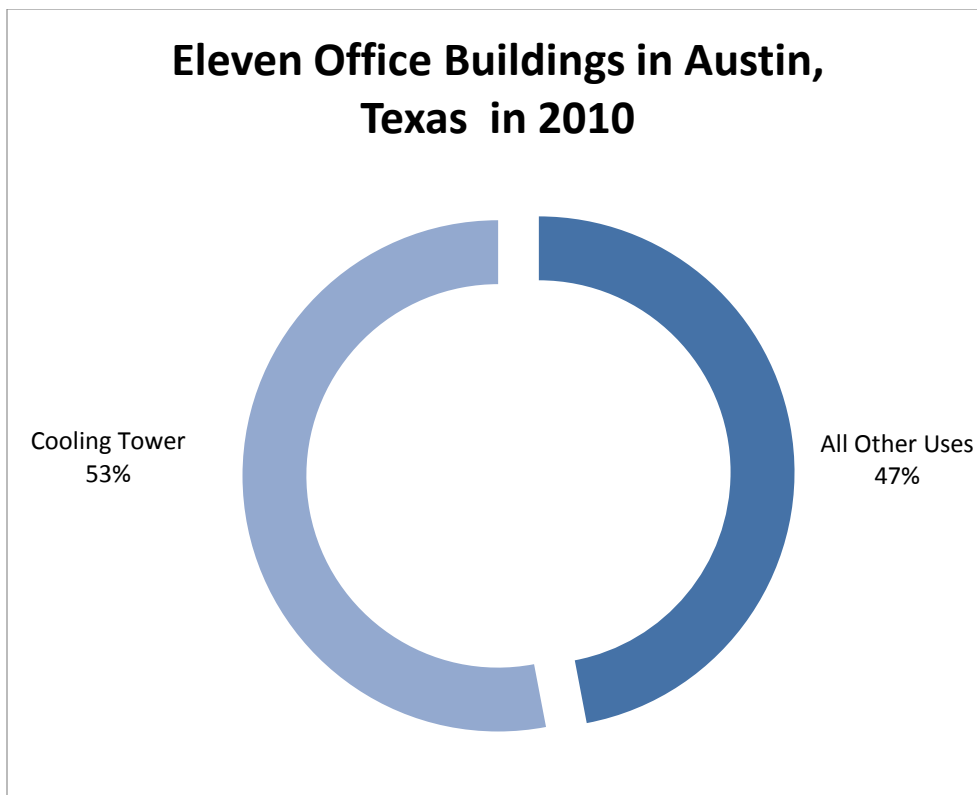


Figure 12. Eleven Office Buildings in Austin, Texas in 2010, Texas Water Development Board.

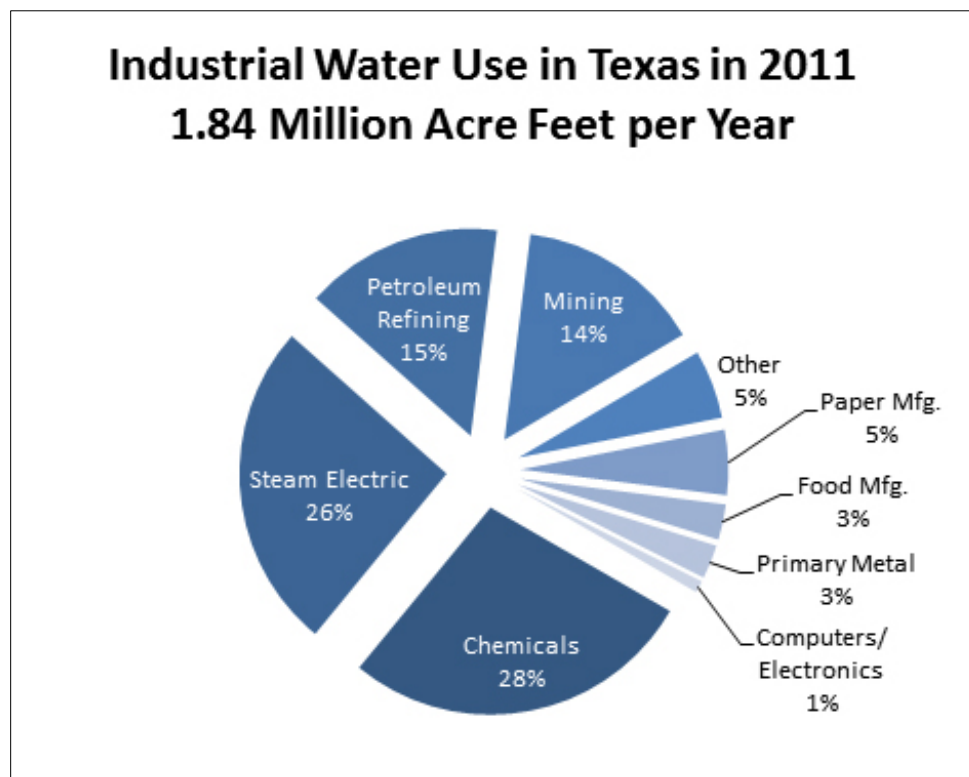


Figure 13. Industrial Water Use in Texas in 2011, Texas Water Development Board.

APPENDIX H:

This appendix contains information about usage of best management practices.

Best management practice guidelines are resources that make it possible for experts to share lessons learned with others. There is a great deal of conservation expertise in Texas and practitioners who are willing to share their knowledge and finding with others. The value of this shared information is tremendous to water users wishing to try similar techniques.

The Water Conservation Advisory Council has made progress on updating best management practices, and, as a result, the Texas Water Development Board has posted several updated best management practices over the past several years. This has been accomplished working with volunteer conservation practitioners. The Council plans to continue this process as a cost-effective way to share current knowledge of conservation techniques. One area that is left to address is industrial water use. As Figure 14 shows, industrial water use can be a big part of water sales by cities.

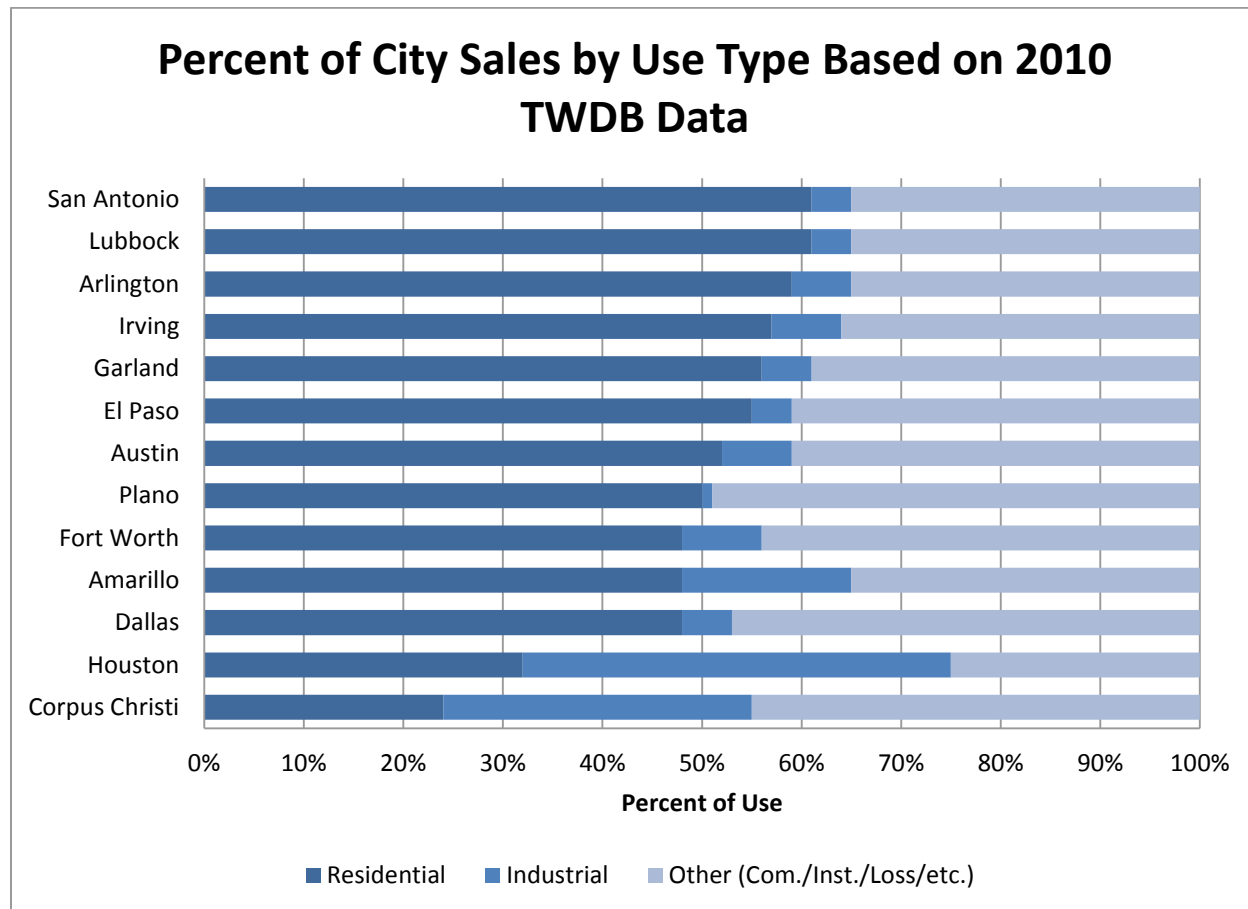


Figure 14. Percent of City Sales by User Type for 2010, Data from Texas Water Development Board.

Industries often develop independent water sources not associated with municipal use. Figure 15 shows that manufacturing, power production, and mining account for approximately a third of all

non-agricultural water use. The Council expects to develop best management practices for industrial users in the future.

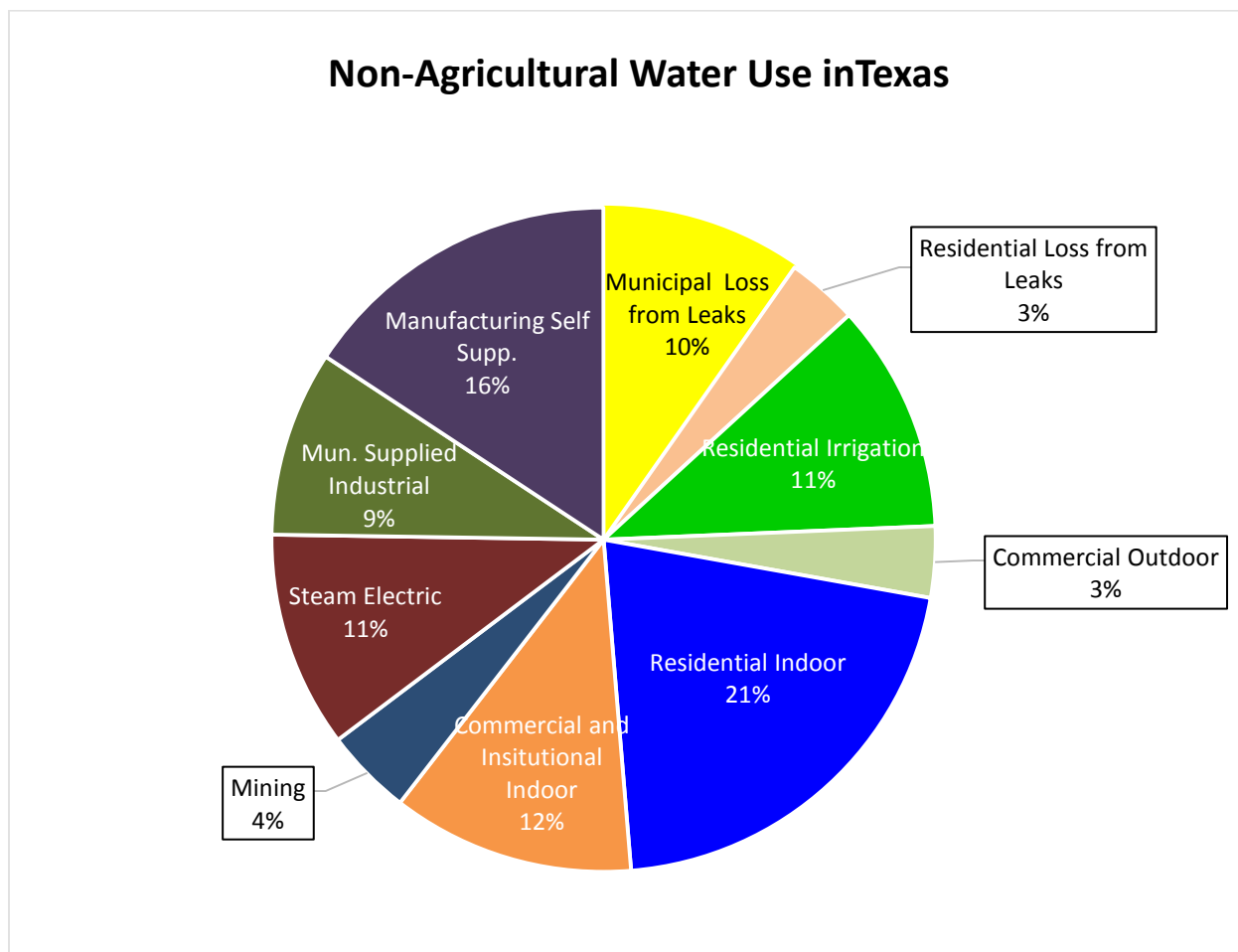


Figure 15. Non-agricultural Water Use in Texas 2010, Data from Texas Water Development Board.

As with any category of water use, industrial (manufacturing, power production, and mining) should have best management practice guides developed. The difference is that the audience is not necessarily large industry where technically sophisticated personnel already often have knowhow to reduce water use. The guide should contain sound, proven practices for larger industries, but beyond that, the guide should address the needs of smaller manufacturers and also water conservation staff and officials who need to be educated on water efficiency in industrial operations.

APPENDIX I:

This appendix contains information regarding water conservation related programs at Texas A&M University.

Texas A&M Water Initiative

Wide ranging water conservation research has been initiated by Texas A&M University using funding provided by the Texas Legislature. Several projects have recently been initiated to help develop technology to advance implementation of the state water plan. Examples of initiated research include:

- Significant expansion of water reuse using electron beam (eBeam) technology
- Spatial variability of evapotranspiration, rainfall and other parameters in urban environments as related to further deployment of the WaterMyYard Program
- Achieving household water-use efficiency using automated metering infrastructure
- Development of a landscape irrigation runoff mitigation system
- A new platform for maximizing irrigation water use efficiency under drought, reduced flows and water restrictions
- Assessment of brackish and saline aquifers and flowback waters as source waters for hydraulic fracture fluids in Texas unconventional resource development
- Timely management of limited irrigated crops in Texas using an empirically-based model and innovative information dashboard technology

It is expected that these and other research will provide significant advancements in the near future.

Water Conservation and Technology Center

In 2012, Texas A&M AgriLife Research, Texas A&M AgriLife Extension Service, Texas A&M Engineering Experiment Station, and Texas A&M University–San Antonio jointly established the Water Conservation and Technology Center in San Antonio with the goal of accelerating development and adoption of new and innovative technologies to solve emerging water problems and meet future water supply needs. The science and technology created through the Center is regionally focused to support the state's critical water requirements and integrate strong public/private partnerships. The center focuses on applied research and development, testing and validation, technology transfer and training and extension education in the following areas:

- Water conservation
- Water reuse
- Groundwater desalination
- Energy development and water use

Irrigation Technology Program

The Irrigation Technology Program, administered through the Texas A&M AgriLife Extension Service and the Department of Biological and Agricultural Engineering at Texas A&M University, works to:

- Promote efficient irrigation and water conservation while maintaining profitable agricultural production and quality urban landscapes
- Help coordinate irrigation research and extension programs of the Texas A&M University System
- Develop new facilities, capabilities and programs for irrigation research, education and service
- Test and verify equipment
- Develop minimum design and performance standards for irrigation systems

Current programs supported by the Irrigation Technology Program include Irrigation District Engineering and Assistance, School of Irrigation, and Texas ET Network. The Irrigation District Engineering and Assistance Program (IDEA) includes (1) educational services and technical assistance for irrigation districts and (2) applied research in GIS-based management systems and rapid assessment methods for prioritized rehabilitation projects based on water saving potential. The School of Irrigation, established in 1994, conducts research and educational programs supporting the Texas Irrigation Industry. The school was established to promote landscape irrigation auditing and management in Texas through training and auditor certification. To date, the School of Irrigation has provided educational opportunities to over 2,500 individuals, certifying over 500 Texas Landscape Irrigation Auditors. Finally, the Irrigation Technology Program supports the Texas ET Network, which contains weather information, current and average evapotranspiration data, and irrigation watering recommendations for locations across the state.

Texas Water Star Program

The Texas A&M AgriLife Extension Service recently established the Texas Water Star Program to act as an umbrella program in Texas's seven major urban counties—Bexar, Dallas, El Paso, Fort Bend, Harris, Tarrant, and Travis—to coordinate existing efforts such as Earth-Kind®, Xeriscape™, Texas Smartscape®, WaterWise, YardSmart, and Texas Water Smart. Working with groundwater conservation districts, regional water planning groups, water districts and utilities, river authorities, and councils of government, Texas Water Star is identifying new ways to improve water conservation in recreational, public, and residential landscapes, major users of urban water resources. The program targets professional groundskeepers, turfgrass and landscape managers, and other service providers in urban areas, focusing on five major solutions:

- Efficient irrigation systems
- Irrigation evaluations and auditing
- Plant selection to conserve water
- Best management practices to improve plant water use
- Proper application of fertilizers and pesticides

Other practices targeted include soil analysis and preparation, turf management, mulching, rainwater harvesting, and rain gardens.

In 2013, the program concentrated on irrigation and landscape evaluation, working with AgriLife Extension agents and Texas Master Gardeners to improve irrigation efficiency in urban landscapes. Residents may take the 40-Gallon Challenge, a program that began in 2011 to encourage daily household and business water-saving measures such as reducing irrigation run times by two minutes and using a broom instead of a water hose to clean driveways and sidewalks (see 40gallonchallenge.org).

Extension is also conducting a Sports Athletic Field Education (SAFE) workshop and an Earth-Kind landscape school emphasizing best practices and low-water-use plants for sports fields and home or business landscapes. Extension agents in each urban county are conducting at least four applied research or result-demonstration projects on irrigation efficiency in landscapes. Webinars, blogs, social media, websites, and radio and television ads will also be part of this educational effort.

Among the major resources for the Texas Water Star Program will be publications and presentations from the College of Agriculture and Life Sciences Departments of Biological and Agricultural Engineering, Horticulture, Soil and Crop Sciences, and Agricultural Economics; the Texas Water Resources Institute; AgriLife Extension specialists; Texas A&M AgriLife Research faculty; Texas A&M University System institutes; federal and state agencies; and local water utilities.

AgriLife Extension agents in each county will work with a local Texas Water Star committee to plan and implement educational programs. The primary roles of AgriLife Extension will be to provide unbiased, research-based information; train water-conservation educators; and provide public outreach through educational demonstrations. Through this information and outreach, Extension is helping support city drought and water emergency plans, water conservation plans, landscape ordinances, and irrigation rules. By bringing together Texas's best water-conservation experts to get the word out, the Texas Water Star Program is helping make every drop count and saving this precious resource to make our future more secure.

APPENDIX J:

This appendix contains information related to drought management in Texas. The Council plans to continue its active involvement in drought-related activities.

Drought Management was thought of, and still may be thought of, by some as an undesirable action imposed by a water purveyor in a water emergency. The connotation was usually negative in that the imposition of drought restrictions meant that the water purveyor had failed in its requirement to provide adequate reserves to meet the water demands of its constituency.

That attitude has been questioned. The new thinking is that drought management is an efficient and sustainable way to reduce the need for water resources to meet excessive water demands in infrequent but regular drought conditions.

What that means is that the expensive water resources for those specifically high demand periods would not have to be supported with revenues year in and year out when they were not needed. The costs are especially hard to bear when the peak water needs are largely used for landscape watering. The good news is that well adapted landscapes are very capable of surviving during drought periods without the peak water.

Other arguments that have been presented that appear to be untrue are that drought management rules, including water use restrictions, discourage economic development and cost a community jobs. There are examples in Texas of cities with strong drought management rules that also lead the way with high economic and population growth.

The landscape industries in those same cities have had to adjust their businesses but profits and employment have not been reduced for the industry as creative businesses find new opportunity in water efficient plantings, cultural practices and water efficiency technology.

Drought management is an important option in meeting the Texas water challenge. It can and should be used more. To encourage its use, new attitudes and innovative thinking on “costs of drought restrictions”, landscape options, cost efficiencies achieved by reducing peak water demands can be pursued.

Drought demand management differs from conservation demand management. During droughts it is often necessary to achieve water use reductions quickly. This is usually achieved through education and regulation. Conservation reductions are planned for more gradual and permanent results. The two processes often intersect with lessons learned during drought resulting in new standard practices for conservation. The results in water use reduction during drought also inform water supply plans for the future. A realistic and effective drought demand management strategy can reduce the need for new supplies. In contrast an ineffective or overly optimistic drought demand management strategy can result in crisis during dry times.

Fortunately there is more information available today for drought planning than ever before. Recent droughts in Texas, other parts of the United States and Australia have tested the drought plans of many. The lessons learned from the experiences of others should be used to inform updated plans in Texas. The Alliance for Water Efficiency has compiled a research paper titled “Water Conservation and Efficiency Market Transformation Study” which summarizes strategies and results from many regions of the world. The Texas drought of recent years has some lessons closer to home about reduction strategies and results.

The Water Conservation Advisory Council plans to compile more information on drought management strategies and results from Texas water providers. This information can then be dispersed through professional associations and the Council’s web site.