

Statewide Delivery of the Texas Well Owner Network (TWON) Final Report

Texas Water Resources Institute TR-498
January 2017



Statewide Delivery of the Texas Well Owner Network (TWON)

FINAL REPORT

TSSWCB Contract #13-08

Prepared for:

Texas State Soil & Water Conservation Board

Authored and Prepared by:

Dr. Diane Boellstorff¹, Drew Gholson¹, Danielle Kalisek², John W. Smith¹, Ryan Gerlich³,
Dr. Kevin Wagner², Dr. Anish Jantrania³ and Dr. Travis Miller¹

¹Texas A&M AgriLife Extension Service, Department of Soil and Crop Sciences

²Texas A&M AgriLife Research, Texas Water Resources Institute

³Texas A&M AgriLife Extension Service, Department of Biological and Agricultural
Engineering

Texas Water Resources Institute Technical Report TR-498

January 2017



Funding provided through a Clean Water Act Section 319(h) grant from the Texas State Soil and Water Conservation Board and the U.S. Environmental Protection Agency

Table of Contents

List of Acronyms	2
Acknowledgements	3
Executive Summary	4
Introduction	5
TWON Materials	6
TWON Trainings and Screenings	6
Implementation	7
Figure 1. Attendees at the <i>Well Educated</i> program learned how to protect their well water and were able to have their well water analyzed.	8
Table 1. List of news releases and articles published about TWON <i>Well Educated</i> and <i>Well Informed</i> Programs, totaling 106 media mentions.	9
Table 2. Through the TWON program, 30 <i>Well Educated</i> 6-hour trainings were conducted in watersheds selected by the TWON team and TSSWCB.	14
Table 3. Through the TWON program, 25 <i>Well Informed</i> water screenings were conducted in watersheds selected by the TWON team and TSSWCB.	16
Figure 2. Map of TWON <i>Well Informed</i> screenings and <i>Well Educated</i> trainings with attendee volumes.	17
Evaluation	18
Conclusion	19

List of Acronyms

BAEN	Department of Biological and Agricultural Engineering, Texas A&M University
BMPs	Best management practices
EPA	U.S. Environmental Protection Agency
MCL	Maximum Contaminant Level
SCSC	Department of Soil and Crop Sciences, Texas A&M University
TMDL	Total maximum daily load
TSSWCB	Texas State Soil and Water Conservation Board
TWON	Texas Well Owner Network
TWRI	Texas Water Resources Institute
WPP	Watershed protection plan
USGS	U.S. Geological Survey

Acknowledgements

This report highlights the trainings and screenings of the *Statewide Delivery of the Texas Well Owner Network* project, funded by a federal Clean Water Act 319(h) Nonpoint Source grant provided by the Texas State Soil and Water Conservation Board and U.S. Environmental Protection Agency to the Texas A&M AgriLife Research and Texas A&M AgriLife Extension Service's Texas Water Resources Institute, in partnership with the Departments of Soil and Crop Sciences and Biological and Agricultural Engineering at Texas A&M University.

Special acknowledgement is given to:

- Well owners who invested their time to attend the Texas Well Owner Network trainings and screenings
- The U.S. Environmental Protection Agency and Texas State Soil and Water Conservation Board for providing support for these efforts.
- AgriLife county Extension agents for their support and coordination
- Watershed coordinators and river authorities for their participation and presenting local watershed information.
- Groundwater conservation districts for presenting information on local groundwater conditions and challenges

Executive Summary

The Texas A&M AgriLife Extension Service (AgriLife Extension), through the Departments of Soil and Crop Sciences (SCSC) and Biological and Agricultural Engineering (BAEN) and the Texas Water Resources Institute (TWRI), conducted 30 well owner trainings and 25 well owner screenings throughout the state of Texas through the Texas State Soil and Water Conservation Board (TSSWCB) project 13-08 “*Statewide Delivery of the Texas Well Owner Network*” funded through a Clean Water Act 319(h) nonpoint source grant from the TSSWCB and the U.S. Environmental Protection Agency (EPA).

Private well owners are independently responsible for monitoring the quality of their well water, and they are frequently at greater risk for exposure to compromised water quality. Since management and protection of private, domestic and irrigation water sources are under the control of the landowner, they depend primarily on education rather than regulation to protect their well water.

To help educate landowners about well water quality testing, protection and management, TWRI, SCSC and BAEN, parts of AgriLife Extension at Texas A&M University, developed the Texas Well Owner Network (TWON) with funding and support from TSSWCB and EPA. TWON was designed to deliver science-based, community-responsive education curriculum and focused on protecting groundwater quality and aquifer integrity.

TWON trained Texans regarding water quality and best management practices for protecting wells and surface waters, which will avert off-site transport of contaminants (bacteria and nutrients) to surface waters, prevent contamination of underlying aquifers and safeguard the water quality and health of landowners and their families.

TWON is also an effective tool used in support of watershed protection planning and total maximum daily load implementation efforts where investigations indicate bacterial and nutrient contributions.

This was achieved by (1) delivery of TWON educational materials and trainings; and (2) evaluation and assessment of the program so needed modifications and improvements could be made. This project continued the work originally conducted under the *Preventing Water Quality Contamination through the Texas Well Owner Network* project #10-04.

Introduction

More than 1,000,000 private water wells in Texas provide water to citizens in rural areas and, increasingly, to those living on small acreages at the burgeoning rural-urban interface. Public drinking water supplies are generally of good quality and are monitored through requirements of the federal Safe Drinking Water Act; however, private well owners are independently responsible for monitoring the quality of their wells and frequently at greater risk for exposure to compromise water quality. Management and protection of private, domestic and irrigation water sources are under the control of the landowner, and therefore, depend primarily on education rather than regulation.

The U.S. Geological Survey (USGS, DeSimone et al. 2009) reported that nitrate was the most common contaminant in private wells derived from man-made sources at concentrations greater than EPA's Maximum Contaminant Levels (MCL) for public water supplies. A second finding, potentially affecting a greater portion of the population, was that total coliform bacteria, a broad group that includes bacteria from soil, water and animal feces, was detected in 34% of sampled wells. The MCL goal for coliform bacteria, including *Escherichia coli*, in drinking water is zero because this group is a predictor of the probable presence of pathogenic bacteria.

These broad findings of the USGS study are similar to those reported in Texas. For 2003–2008, Texas Water Development Board reported that for the 3,861 private water wells sampled, the percentage of wells exceeding the nitrate MCL varied from 2% to 50% each year, depending on which regions of Texas were targeted for sampling (www.twdb.state.tx.us/mapping/). Moreover, results of well screenings conducted by AgriLife Extension from 2003–2009 indicate that about 33% of Texas' private wells contained fecal coliform bacteria.

The two categories of the most common private well pollutants, fecal coliform bacteria and nutrients, also are the most frequent cause of stream impairment or concern in Texas. It is likely that in many cases, local release of fecal coliform bacteria and nutrients is not limited to contamination of the property owner's private well and these contaminants are transported off-site and contribute to pollutant loadings in surface waterbodies.

To address these issues affecting both surface water and groundwater, the Texas Water Resources Institute (TWRI) and the Departments of Soil and Crop Sciences (SCSC) and Biological and Agricultural Engineering (BAEN), parts of AgriLife Extension at Texas A&M University, developed the Texas Well Owner Network (TWON) designed to deliver a science-based, community-responsive education curriculum. TWON focused on protecting groundwater quality and aquifer integrity, but also complemented the successful Texas Watershed Stewards program by emphasizing best management practices (BMPs) addressing potential contamination of surface water by sources also contaminating private domestic and irrigation wells and jeopardizing aquifer integrity.

With continued Clean Water Act 319(h) funding from the EPA through the Texas State Soil and Water Conservation Board (TSSWCB), the *Statewide Delivery of the Texas Well Owner Network* program trained Texans regarding water quality and BMPs for protecting their wells and surface waters, which will avert off-site transport of contaminants (bacteria and nutrients) to surface waters, prevent contamination of underlying aquifers, and safeguard the water quality and health

of landowners and their families. As a result, this program supported ongoing watershed protection planning (WPP) efforts conducted by TSSWCB and others by expanding the reach of these programs to additional audiences and resulting in greater awareness, knowledge and implementation of BMPs for water quality improvement and protection.

Improved understanding of water quality, human impacts and management practices to improve well and surface water quality help to forestall off-site transport of coliform bacteria and nutrients to surface waters. Therefore, TWON is an effective tool for supporting WPP and total maximum daily load (TMDL) implementation efforts where investigations indicate bacterial and nutrient contributions. This was achieved by (1) delivery of TWON educational materials and trainings; and (2) evaluation and assessment of the program so that needed modifications and improvements could be made.

TWON Materials

The TWON team continued use of the TWON handbook, developed under the original *Preventing Water Quality Contamination through the Texas Well Owner Network* program to create a science-based, community-responsive TWON education curriculum, which is used to train private well owners.

The TWON handbook, *Texas Well Owner Network: Well Owner's Guide to Water Supply* (SC-029) is located [on the TWON website](#), or a hard copy can be ordered [through the AgriLife Extension Bookstore](#).

To increase delivery of these educational materials to a greater audience, the educational materials were transformed into an online format that is more readily available to the public. These materials are on the TWON website at <http://twon.tamu.edu/fact-sheets/>.

TWON Trainings and Screenings

SCSC worked with TSSWCB and other state and local organizations to select locations for well water screenings (*Well Informed*) and trainings (*Well Educated*) to be conducted during this project. SCSC coordinated efforts with organizations already involved in WPP/TMDL processes or that are planning future WPP/TMDL processes.

Through this project, 30 *Well Educated* trainings were conducted with more than 1,420 private well owners who attended to become familiar with groundwater resources, septic system maintenance, well maintenance, water conservation, water quality and water treatment. In addition, 25 *Well Informed* events were delivered throughout the course of the project to provide wellhead protection information and recommendations for remediating well contamination. Participants could also collect and bring their own well water for analysis. Almost 1,800 water samples were analyzed through the *Well Informed* events.

SCSC, working with BAEN, TWRI, TSSWCB and others, selected priority locations for these events. SCSC coordinated these efforts with state agencies and organizations already involved in WPP/TMDL processes or that are planning future WPP/TMDL processes in specific watersheds.

Implementation

Programs were held in the priority watersheds selected by the TWON team and TSSWCB. With assistance from SCSC, TWRI developed and disseminated informational materials to actively market *Well Informed* water screenings and *Well Educated* TWON trainings, including news releases, social media postings, newsletter announcements, public/conference presentations, flyers, etc. TWRI also included information on the TWON program in their *txH₂O* magazine, *Conservation Matters* email newsletter and helped distribute news releases to the media through *AgriLife Today* as well as through the TWRI Facebook page and Twitter. In addition, a TWON *Well Read* email newsletter was sent out occasionally with updates and links to resources regarding groundwater and wells. As a result of these materials, popular media in the watersheds where these programs were held also published some of these news releases. The list of TWON articles that were published can be found in Table 1.

Thirty *Well Educated* 4- to 6-hour TWON trainings ranging from 4 to 6 hours were delivered through this project to a total of 1,420 participants to increase local understanding of the factors that can adversely impact well water quality and provide access to the knowledge and tools that can be employed to prevent and/or resolve them. Trainings were delivered by the TWON Coordinator and a combination of the BAEN and SCSC Program Specialists and the SCSC Assistant Professor and Extension Specialist. The TWON handbook was distributed to all participants, the standardized presentations were delivered, well water samples were collected and analyzed and additional resources such as the TWON Fact Sheets were available in print as well as online. Attendees at *Well Educated* programs are shown in Figure 1.

Well Informed water screening events were delivered to provide wellhead protection information and recommendations for remediating well contamination, as needed. Screenings were delivered by the SCSC Assistant Professor and Extension Specialist, TWON Coordinator and/or the SCSC Program Specialist, as appropriate. While 20 well screening events were in the original scope of work, 25 screening events were delivered during the course of this project with nearly 1,800 water samples analyzed. These *Well Informed* screening events included an overview of the topics discussed in more detail during the comprehensive *Well Educated* TWON trainings.

Both the *Well Informed* screening and *Well Educated* training events, participants arrived with private well water samples, collected using the Soil, Water and Forage Testing Laboratory water collection procedures (<http://soiltesting.tamu.edu/files/waterweb1.pdf>), which were screened for fecal coliform bacteria, nitrate and salinity concentrations. The participants' cost for the screenings was typically around \$5–\$15 per sample. For those with positive results, remediation instructions and/or a recommendation and instructions were given for sending follow-up samples to an accredited National Environmental Laboratory Accreditation Conference laboratory to perform drinking water analyses.

Well screening events were scheduled for watersheds where county Extension agents anticipated that greater attendance would result from short and extremely focused events not lasting more than two hours. In areas where water bodies are listed as impaired for bacteria, where WPP work groups or TSSWCB requested it, or where residents were experiencing a high frequency of well-related issues, the project team encouraged scheduling of more comprehensive, 4- to 6-hour *Well Educated* TWON trainings.

During most of the trainings, results of bacterial screenings are not available before the training is completed. Bacterial screening results and, as appropriate, remediation instructions or recommendation for additional testing are forwarded to the participants, which allows participants to receive bacterial screening results privately. As a result of the *Well Educated* training, participants more clearly understand the relationships between practices in or near the well and the quality of water available for drinking and irrigation by their families and by other families pumping from the same formation.

The list of watersheds, dates and locations for the completed TWON *Well Educated* trainings and *Well Informed* screenings are in Tables 2 and 3. In addition, a map showing attendee volumes at each location is in Figure 2.



Figure 1. Attendees at the *Well Educated* program learned how to protect their well water and were able to have their well water analyzed.

Table 1. List of news releases and articles published about TWON *Well Educated* and *Well Informed* Programs, totaling 106 media mentions.

Media Source	Title	Date
AgriLife Today	Water well screening set for March 10 in Longview	2/14/14
Longview News-Journal.com	Water well screening set for March 10-11	2/23/2014
North Texas e-News	Water well screening set for March 10 in Longview	3/1/2014
AgriLife Today	Private water well screening set for April 9 in San Marcos, Austin	3/6/2014
AgriLife Today	Private water well screening set for April 23 in Jourdanton and Pearsall	3/19/2014
AgriLife Today	Private water well screening April 21 in South Texas	3/24/2014
Bandera County Courier	Bandera Water Series shares valuable info on water issues	4/3/2014
AgriLife Today	Texas well-owner training set for May 22 in Conroe	4/14/2014
NewFiber.com	Texas well-owner training set for May 22 in Conroe	4/14/2014
DOTF	Water Well Screening Coming to South Texas Counties	4/15/2014
AgriLife Today	Well-owner training set for May 12 in Wichita Falls	4/25/2014
YourGlenRoseTX.com	Well-owner training set for May 12 in Wichita Falls	4/25/2014
The Cattleman	Texas Well Owner Network Trains Residents on Water Well Issues	5/1/2014
The Eagle	Well owner workshop set May 22 in Conroe	5/8/2014
Your Houston News	LSGCD, A&M AgriLife offering well owner maintenance class	5/12/2014
AgriLife Today	Texas well-owner training set for June 6 in Hamilton	5/21/2014
AgriLife Today	Texas well-owner training set for July 24 in Fredericksburg	6/27/2014
Texas Farm Bureau	Well owner training set for July 24, Fredericksburg	6/30/2014
AgriLife Today	Texas well-owner training set for July 23 in Sonora	7/1/2014

Media Source	Title	Date
The Cameron Herald	Groundwater summit topics include managing, protecting resources	7/10/2014
AgriLife Today	Texas well-owner training set for Aug. 2 in Brazoria	7/16/2014
Alice Echo	Texas water well network	7/18/2014
AgriLife Today	Texas well-owner training set for Aug. 7 in Yoakum	7/21/2014
Sweetwater Reporter	Private water well screening set for July 30 in Sweetwater	7/21/2014
Victoria Advocate	Texas Well Owners Network educational program to be hosted Aug. 7	7/22/2014
AgriLife Today	Texas well-owner training set for Aug. 19 in Robstown	7/23/2014
Texas Farm Bureau	Well owner training set for Aug. 7, Yoakum	7/23/2014
AgriLife Today	Texas well-owner training set for Aug. 20 in Refugio	7/24/2014
The Facts	Texas well-owner training set for Aug. 2 in Brazoria	8/2/2014
Alice Echo	Well-owner training planned for Robstown	8/7/2014
Nueces County Record Star	Well-owner training planned for Robstown	8/8/2014
Corpus Christi Caller Times	Texas Well Owner Network training	8/19/2014
Jack County Herald	Private water well screening set for Oct. 20 in Jacksboro	9/17/2014
The Community News	Well water testing available	9/18/2014
AgriLife Today	Private water well screenings set for October in Jack, Montague, Palo Pinto and Parker counties	9/21/2014
Mineral Wells Index	Regional water well screening dates set for October	10/1/2014
Weatherford Democrat	Residents to have opportunity to test wells	10/2/2014
Lake Country Sun	Well water testing this month	10/2/2014
Permianshale.com	Residents to have opportunity to test wells	10/4/2014
Jack County Herald	County well water testing set for Oct. 20	10/5/2014
The Community News	Well water testing available	10/22/2014
Jack County Herald	Extension hosts water testing	10/27/2014

Media Source	Title	Date
AgriLife Today	Texas well-owner training set for Jan. 27 in San Antonio	1/9/2015
AgriLife Today	Well-owner training set for Jan. 28 in Seguin	1/12/2015
New Braunfels Herald Zeitung	Water well class set Jan. 28	1/14/2015
Pleasanton Express	Texas well-owner training and screening opportunity set for Jan. 27 in San Antonio	1/14/2015
AgriLife Today	Texas well-owner training set for Feb. 5 in Navasota	1/15/2015
Wilson County News	Training for well owners set for Jan. 27	1/21/2015
The Eagle	Area well owners invited to clinic to clear up questions, concerns	1/25/2015
AgriLife Today	Texas well-owner training set for Feb. 19 in Round Rock	1/26/2015
The Eagle Land & Livestock Post	Texas well-owner training set for Feb. 5 in Navasota	2/1/2015
Pleasanton Express	Private water well screening in Jourdanton and Pearsall	2/25/2015
The Monitor	Private water well testing slated in March for Lower Rio Grande Valley	3/5/2015
AgriLife Today	Texas well-owner training set for May 28 in Double Bayou	5/6/2015
Texas Environmental News	Texas well-owner training set for May 28 in Liberty	5/8/2015
AgriLife Today	Texas well-owner training set for May 28 in Liberty	5/8/2015
Texas Farm Bureau	Well Owner Training slated for May 28, Double Bayou	5/12/2015
The Vindicator	Texas Well Owner Network Program (Liberty)	5/13/2015
The Vindicator	Texas well-owner training set for May 28 in Double Bayou	5/13/2015
The Baytown Sun	Water well training May 28 (Double Bayou)	5/15/2015
AgriLife Today	Water talks set for June 22-26 in the Devils River Basin	6/4/2015
Del Rio News-Herald	Water Talks Workshops to be held June 22-26 in Devils River Basin	6/5/2015
Texas A&M AgriLife Extension	Water Talks Workshops June 22-26	6/5/2015
AgriLife Today	Water well training set for July 18 in Brazoria	7/2/2015
Bandera County Courier	Abandoned well plugging program at BCragd	7/30/2015

Media Source	Title	Date
AgriLife Today	Private water well screening set for Sept. 9 in Hillsboro	8/11/2015
The Reporter (Hillsboro)	Well Water Testing Offered by Extension Service	8/20/2015
AgriLife Today	Private water well screenings set for October in North Texas counties	9/17/2015
Mineral Wells Index	Private water well screenings set for Palo Pinto, Parker counties	9/23/2015
Lake Country Sun	Water well screenings available	9/25/2015
Star-Telegram (Weatherford News)	Private water well screening set for Parker County	10/6/2015
Weatherford Democrat	AgriLife Extension program tests well-water	10/20/2015
AgriLife Today	Water well owner training set for Nov. 20 in Cuero	10/23/2015
AgriLife Today	Texas Well Owner Network publication wins education materials award	12/17/2015
Conservation Matters	Texas Well Owner Network publication wins education materials award	12/18/2015
AgriLife Today	Texas Well Owner Network receives AgriLife Extension team Superior Service Award	1/12/2016
AgriLife Today	Water well owner training set for March 30 in Gatesville	3/3/2016
Bryan, College Station.NET	Water well owner training set for March 30 in Gatesville	3/3/2016
Wn.com	Water well owner training set for March 30 in Gatesville (Texas A&M AgriLife Extension Service)	3/4/2016
AgriLife Today	Water well owner training set for March 31 in Salado	3/7/2016
Wn.com	Water well owner training set for March 31 in Salado (Texas A&M AgriLife Extension Service)	3/7/2016
AgriLife Today	Private water well screenings set for April in several South Texas counties	3/14/2016
Salado Village Voice	Water well owner training in Salado slated for March 31	3/17/2016
KRGV	Water Well Screenings in the Valley	3/18/2016
AgriLife Today	Water well owner training set for April 13 in Lincoln	3/24/2016
Wn.com	Water well owner training set for April 13 in Lincoln (Texas A&M AgriLife Extension Service)	3/24/2016

Media Source	Title	Date
Pleasanton Express	Private Water Well Screening Set For April 20th and 21st In Surrounding Counties, Private Well Owners Invited To Participate	3/30/2016
Pleasanton Express	Private Water Well Screenings in Atascosa McMullen counties	4/6/2016
The Brownsville Herald	Well water screening event set for Monday	4/14/2016
AgriLife Today	Water well trainings, screenings set for May in West Texas	4/20/2016
Department of Soil & Crop Sciences	Water well trainings, screenings set for May in West Texas	4/21/2016
AgriLife Today	Water well owner training set for Aug. 3 in Angleton	7/22/2016
Texas Outdoorsmen	Water well owner training set for Aug. 3 in Angleton	7/22/2016
AgriLife Today	Water well owner training set for Aug. 18 in Crowley	7/24/2016
Texas Outdoorsmen	Water well owner training set for Aug. 18 in Crowley	7/24/2016
Public.	Water Well Owner Training Set For Aug. 18 In Crowley	7/24/2016
AgriLife Today	Texas Well Owner Network teaming up with Healthy South Texas	7/31/2016
Texas Outdoorsmen	Texas Well Owner Network teaming up with Healthy South Texas	7/31/2016
AgriLife Today	Water well owner training set for Sept. 8 in Henderson	8/9/2016
Texas Outdoorsmen	Water well owner training set for Sept. 8 in Henderson	8/9/2016
AgriLife Today	Results show water well testing in Texas is important	9/19/2016
Texas Outdoorsmen	Results show water well testing in Texas is important	9/19/2016
phys.org	Results show water well testing in Texas is important	9/20/2016
AgriLife Today	Water well owner training set for Nov. 2 in Wheelock	10/13/2016
theeagle.com	AgriLife offers training session for well owners	11/1/2016
Killeen Daily Herald	Annual water conference scheduled Wednesday	11/12/2016

Table 2. Through the TWON program, 30 *Well Educated* 6-hour trainings were conducted in watersheds selected by the TWON team and TSSWCB.

Watershed	Major Aquifer	Date	City	County	Attendees
Medina	Trinity	March 22, 2014	Bandera	Bandera	65
Buffalo Creek	Seymour	May 12, 2014	Wichita Falls	Wichita	156
San Jacinto River	Gulf Coast	May 22, 2014	Conroe	Montgomery	64
Leon River	Trinity	June 6, 2014	Hamilton	Hamilton	30
Upper Llano River	Edwards-Trinity	July 23, 2014	Sonora	Sutton	32
Pedernales	Edwards-Trinity Plateau	July 24, 2014	Fredericksburg	Gillespie	67
Lower San Bernard River	Gulf Coast	August 2, 2014	Brazoria	Brazoria	67
Lavaca	Gulf Coast	August 7, 2014	Yoakum	Dewitt	73
Lower Nueces River	Gulf Coast	August 19, 2014	Robstown	Nueces	45
Copano Bay	Gulf Coast	August 20, 2014	Refugio	Refugio	26
San Antonio River	Edwards BFZ	January 27, 2015	San Antonio	Bexar	35
Geronimo and Alligator Creek	Carrizo-Wilcox	January 28, 2015	Seguin	Guadalupe	53
Navosota River	Gulf Coast	February 5, 2015	Navasota	Grimes	37
San Gabriel River	Edwards	February 19, 2015	Round Rock	Williamson	46
Double Bayou	Gulf Coast	May 28, 2015	Double Bayou	Chambers	31
Cedar Bayou	Gulf Coast	May 28, 2015	Liberty	Liberty	23
Upper Devils River	Edwards-Trinity	22-26 June-15	Sonora	Sutton	34
Lower Devils River	Edwards-Trinity	22-26 June-15	Del Rio	Val Verde	36
Bastrop Bayou	Gulf Coast	July 18, 2015	Brazoria	Brazoria	21
Lower Guadalupe	Gulf Coast	November 20, 2015	Cuero	DeWitt	62
Leon River	Trinity	March 30, 2016	Gatesville	Coryell	51
Leon River	Trinity/Edwards BFZ	March 31, 2016	Salado	Bell	40
Middle Yequa Creek	Carrizo-Wilcox	April 13, 2016	Lincoln	Lee	39
Big Creek-Brazos River	Gulf Coast	April 27, 2016	Rosenburg	Fort Bend	13

Pecos River	Pecos Valley	May 17, 2016	Kermit	Loving/Winkler	24
Pecos River	Pecos Valley	May 18, 2016	Odessa	Ector	46
Bastrop Bayou	Gulf Coast	August 3, 2016	Angleton	Brazoria	58
Village Creek-Lake Arlington	Trinity	August 18, 2016	Crowley	Tarrant	32
Cedar Creek Reservoir	Carrizo-Wilcox	September 8, 2016	Henderson	Rusk	68
Brazos River	Carrizo-Wilcox	November 2, 2016	Wheelock	Robertson	46
TOTAL ATTENDEES					1,420

Table 3. Through the TWON program, 25 *Well Informed* water screenings were conducted in watersheds selected by the TWON team and TSSWCB.

Watershed	Major Aquifer	Date	City	County	Samples
Lake O' The Pines	Carrizo-Wilcox	February 5, 2014	Jefferson	Marion	26
Caddo Lake	Carrizo-Wilcox	March 10, 2014	Longview	Gregg	26
Upper San Marcos River	Gulf Coast	April 10, 2014	San Marcos	Hays	58
Atascosa River	Carrizo-Wilcox	April 23, 2014	Pleasanton	Atascosa	49
Lower Guadalupe	Carrizo-Wilcox	April 24, 2014	Carrizo Springs	Dimmit	48
Sweetwater Creek	Edwards-Trinity Plateau	July 30, 2014	Sweetwater	Nolan	68
Upper West Fork Trinity	Trinity	October 20, 2014	Jacksboro	Jack	75
Upper West Fork Trinity	Trinity	October 22, 2014	Montague	Montague	60
Upper West Fork Trinity	Trinity	October 23, 2014	Weatherford	Parker	134
Atascosa River	Carrizo-Wilcox	March 10, 2015	Jourdanton	Atascosa	62
Arroyo	Gulf Coast	March 13, 2015	San Benito	Cameron	89
Llano	Hickory	May 12, 2015	Llano	Llano	36
Lampasas River	Trinity/ Edwards	March 14, 2015	Goldthwaite	Mills	32
Brazos River	Trinity	Sept. 10, 2015	Hillsboro	Hill	9
Lake Granbury	Trinity	October 20, 2015	Glen Rose	Somervell	76
Upper West Fork Trinity	Trinity	October 21, 2015	Palo Pinto	Palo Pinto	155
Eagle Mountain Reservoir	Trinity	October 22, 2015	Decatur	Wise	96
San Marcos	Trinity	April 12, 2016	Johnson City	Blanco	109
Onion and Barton Creeks	Trinity/Edwards BFZ	April 13, 2016	Austin	Hays/Travis	58
Arroyo	Gulf Coast	April 19, 2016	Weslaco	Hidalgo	112
Pecos River	Edwards - Trinity	May 18, 2016	Van Horn	Culberson	17
Laguna Madre	Gulf Coast	August 9, 2016	Falfurrias	Brooks	37
Laguna Madre	Gulf Coast	August 10, 2016	Hebbronville	Jim Hogg	26
Rio Grande	Gulf Coast	August 11, 2016	San Isidro	Starr	33
Santa Gertrudis Creek	Gulf Coast	August 11, 2016	Benavides	Duval	16
TOTAL SAMPLES					1,507

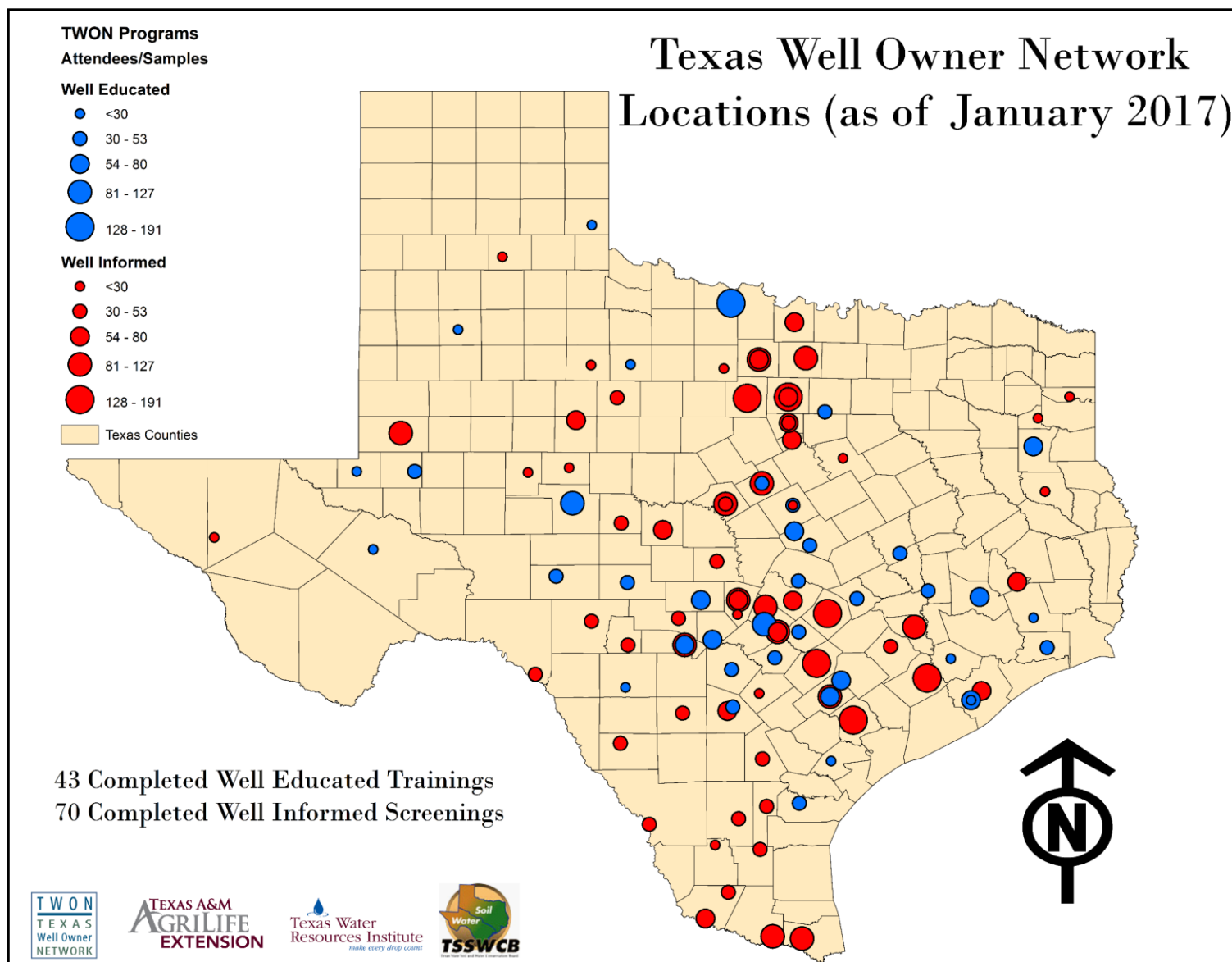


Figure 2. Map of TWON *Well Informed* screenings and *Well Educated* trainings with attendee volumes.

Evaluation

To measure both knowledge and behavior changes of individuals participating in the program, evaluations were developed and delivered. SCSC developed and delivered pre-test/post-test evaluations to evaluate increased knowledge by participants at TWON trainings regarding program principles, appropriate BMPs and other activities; to address proper private well management; to evaluate participant satisfaction with the program; and to evaluate participant's intentions to change their behavior as a result of the TWON training. Outcomes for the programs are shown below:

Knowledge gained as measured by pre/post-tests administered at the trainings: pre-test scores averaged 54% correct answers, while post-test scores averaged 84% correct.

- Post-training evaluation:
 - 97% of participants were satisfied with the *Well Educated* training.
 - The value of participating in the program as estimated by attendees was an average of \$752 or a total of \$1,331,810 for all 2013 participants.
- Intentions to adopt behavior change:
 - 85% of participants will test their well annually.
 - 83% of participants will pump their septic system regularly.
 - 96% of participants will remove hazards from their well house.
 - 85% of participants with a deteriorated or open well will plug or cap the well.

In addition, a 6-month follow-up survey was developed and delivered online to assess behavior changes adopted and other activities, such as the number of neighbors contacted, by TWON training participants. The online survey link is emailed to past participants 6 months after attending the training. SCSC analyzes the results using descriptive, correlational and analysis of variances statistical procedures. Outcomes from the 6-month follow-up are shown below:

- Six-month follow-up survey results:
 - 75% shared the resources/materials with others who were not at the training.
 - 90% of those needing to clean out hazards from their well house had done so.
 - For participants with septic tanks that needed pumping, 55% had pumped their septic tanks within 6 months following the program. An additional 29% were planning to have their tanks pumped soon.
 - 36% of participants who needed to had plugged or capped their unused/deteriorated wells following the program. An additional 40% were planning to have their wells plugged soon.
 - 74% of participants who had wells near contamination sources (pet shelters, livestock yards, etc.) moved the sources following the program, and another 21% had plans to move sources soon.

Conclusion

The continued implementation of the TWON *Well Educated* trainings and *Well Informed* screenings was and continues to be highly successful. The materials continue to be used for trainings and screenings to help educate landowners on how to protect and manage their well water.

Through this continuation project, *Well Educated* trainings were delivered to nearly 1,420 participants to increase local understanding of factors that can adversely impact well water quality and provide access to the knowledge and tools that can be employed to prevent and/or resolve them. The TWON handbook was distributed to all participants, standardized presentations were delivered, water well samples were collected and analyzed and additional resources such as the TWON Fact Sheets are available in print or online. As a result of the *Well Educated* training, participants have the ability to clearly understand the relationships between practices in or near the well and the quality of water available for drinking and irrigation by their families and by other families pumping from the same formation.

Well Informed water screening events were delivered to provide wellhead protection information and recommendations for remediating well contaminates. There were 25 screening events delivered during the course of this project including more than 1,800 water samples.

Evaluations were given to all participants to measure both knowledge and behavior changes of individuals participating in the programs. A pre-test/post-test was developed and delivered. Outcomes showed that most participants were satisfied with the events and the majority of participants intend to adopt behavior changes, such as testing their well water annually, pumping their septic system regularly, removing hazards from their well house and plugging or capping deteriorated or open wells.

In addition, 6-month follow-up surveys showed that 75% of participants had shared the resources and materials with others who were not at the training. Also, most of those participants (90%) needing to clean out hazards from their well house had already done so. For participants with septic tanks needing to be pumped, 55% had them pumped within the 6 months, and an additional 29% were still planning to have them pumped soon.

The efforts above are continuing and expanding through TSSWCB project 17-56 “*Continued Statewide Delivery of the Texas Well Owner Network.*”