

Final Report for:
**Continued Statewide Delivery of the Texas Well
Owner Network (TWON)**
And
**Water Resources Education and Outreach for
Students and Teachers**

TSSWCB Contract #17-10

Prepared for:

Texas State Soil & Water Conservation Board

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Executive Summary

This report highlights a two-fold groundwater and surface water educational project to educate Texans on the maintenance of groundwater resources for well owners and to create and share STEM educational resources for Texan youth and educators regarding watershed health.

The Continued Statewide Delivery of the Texas Well Owner (TWON) Project (TSSWCB #17-10), implemented by Texas A&M AgriLife Extension Service's Texas Water Resources Institute (TWRI), the Department of Soil and Crop Sciences (SCSC), and the Department of Biological and Agricultural Engineering (BAEN) delivered 30 *Well Informed* trainings and 28 *Well Educated* trainings to 985 Texans across the state, and 1,240 well water screenings between January 2018 and March 2021. The implementation of these efforts are described at length in Part I of this report.

The TWON Project fostered the development and implementation of the ACCESS Water Project (also known as the Youth STEM Education component of the project) through efforts on behalf of TWRI, the Texas A&M AgriLife Research and Extension Center at Dallas, the Texas A&M University College of Engineering, the Texas A&M Engineering Experiment Station – Spark! PK-12 Engineering Education Outreach (Spark!), and the Texas A&M AgriLife Extension Service – Department of Biological and Agricultural Engineering. This effort, as detailed within Part II of this report, delivered nine Youth Education Training workshops, 14 Youth Education Community Events, 10 Youth Programming Events, and six Teacher Professional development workshops which collectively engaged 9,397 individuals across the United States, including 3,399 students, 80 teachers, two administrators, and other 5,916 individuals between October 2021 and July 2023. The entirety of this project was funded through a Clean Water Act 319(h) nonpoint source grant from the TSSWCB and the U.S. Environmental Protection Agency (EPA).

The goals of the TWON project were to improve and protect both groundwater and surface water quality by increasing awareness of water quality issues and knowledge of BMPs through improved private well management. Project goals were to be achieved through (1) 30 (approximately 10 per year) *Well Educated* programs, (2) 30 (approximately 10 per year) *Well Informed* programs, and (3) evaluation of the program to measure knowledge gained, BMPs adopted and to determine if modifications and improvements need to be made to the programs. Both versions of the program included opportunities for participants to have a water well sample screened for fecal indicator bacteria, nitrate and TDS. If water quality standards are exceeded, recommendations for determining contamination sources and resolving issues are provided.

The TWON project provided training to Texans regarding water quality and BMPs for protecting their wells and surface waters, which averts off-site transport of contaminants (bacteria and nutrients) to surface waters, prevents contamination of underlying aquifers, and safeguards the health of landowners and their families. As a result, this program supported on-going watershed protection planning efforts being conducted by TSSWCB and others by expanding the reach of these programs to additional audiences and resulting in greater BMP implementation for water quality improvement and protection. This project built upon and continued the impact of TSSWCB projects #10-04 and 13-08, "Preventing Water Quality Contamination Through the Texas Well Owner Network" and "Statewide Delivery of the Texas Well Owner Network."

The ACCESS Water Project also provided training and educational opportunities to Texans regarding water quality and watershed protection, but primarily focused on youth Texans as the audience as opposed to the adult audience targeted through the of TWON. The goals of the ACCESS Water Project included the identification of gaps within Texas' education systems on watershed-based topics and the development and implementation of new educational resources that meet the Texas Essential Knowledge and Skills requirements. The ACCESS Water Project has established an ongoing vehicle for impactful water education through Citizen and Community Science (CCS) water quality data collection by the detection of optical brightener presence/absence in waterways as an early warning indicator for human wastewater leaks (optical brightener sampling a.k.a. "Tamplimg"). To support continued engagement beyond the project period, an ArcGIS Online data collection Hub was created and, in partnership with The Meadows Center for Water and the Environment and the Texas Stream Team, will be launching as a national CCS program through SciStarter.org (beginning Fall 2023).

Part I:

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

Acknowledgements

This report on the Continued Statewide Delivery of the Texas Well Owner Network (TWON) highlights the trainings and screenings of the TWON 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

Introduction

Over 1,000,000 private water wells in Texas provide water to citizens in rural areas and increasingly to those living on small acreages in the 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 compromised water quality.

Management and protection of private water wells are under the control of the landowner, and therefore, depend primarily on education rather than regulation. To address these issues, which affect both surface water and groundwater, SCSC, BAEN and TWRI developed TWON to deliver a science-based, community-responsive education curriculum. TWON focuses on protecting groundwater quality and aquifer integrity, and also complements the successful Texas Watershed Steward program by emphasizing the importance of implementing Best Management Practices (BMPs). The two most common private well pollutants – fecal coliform bacteria and nutrients – are the most common cause of waterbody 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 that these contaminants are transported off-site and contribute to pollutant loadings in surface waterbodies.

This project continued statewide implementation of the TWON program, which built institutional and local capacity to improve and protect both well water and surface water quality by improving awareness of water quality issues and increasing knowledge of BMPs. The training included methods for safeguarding well water quality for landowners and their families and others relying on the availability of high-quality groundwater stored by aquifers. Because improved understanding of water quality, human impacts, and management practices to improve well and surface water quality will help to forestall off-site transport of coliform bacteria and nutrients to surface waters, TWON remains an effective tool to bring to bear in Water Protection Plans (WPP) and Total Maximum Daily Load (TMDL) implementation where investigations indicate bacterial and nutrient contributions. The program was delivered through (1) *Well Educated* programs of 4-6 hours, (2) *Well Informed* programs of 1-2 hours, and (3) evaluation of the program so that needed modifications and improvements can be made. Both versions of the program included opportunities for participants to have a water well sample screened for bacteria, nitrate and total dissolved solids (TDS). Program activities, deliverables, accounting and reporting were managed by TWRI in cooperation with SCSC and BAEN.

TWON Water Well Events

Trainings were delivered by the TWON Coordinator, BAEN and SCSC Program Specialists, and the SCSC Associate Professor and Extension Specialist, as appropriate. TWON educational programs were delivered in two forms: 1) *Well Informed* events were scheduled for areas where the watershed coordinator or County Extension Agent (CEA) recommended short and extremely focused events not lasting more than 2 hours, and 2) *Well Educated* programs were delivered in other areas for more comprehensive, specific topics through a 4- to 6-hour event.

Originally, the goal for this project was to present a minimum of 30 TWON *Well Informed* (approximately 10 each year) and 30 TWON *Well Educated* (approximately 10 each year) programs to provide wellhead protection information and recommendations for remediating well contamination. In addition, the press release is frequently republished on websites of the local Groundwater Conservation District, participating testing labs, watershed protection planning efforts and the local AgriLife Extension county office. We are not able to track or capture all the outlets. However, due to the COVID-19 Pandemic, a cancellation of in-person programming causing a switch to a virtual format resulted in slightly fewer programs than intended. During the outlined timeframe of January 2018 thru March 2021 a total of 30 *Well Informed* and 28 *Well Educated* programs were completed leaving a shortfall of just 2 programs that had been scheduled and then had to postponed due to the pandemic travel restrictions that were imposed on Texas A&M AgriLife Extension. See Table 1 for advertisements for TWON programs and Table 3 for list of *Well Educated* programs by county.

SCSC collaborated with TSSWCB and other state and local organizations to select locations for TWON events. SCSC coordinated efforts with state agencies and organizations already involved in WPP/TMDL processes or who are planning future WPP/TMDL processes in specific watersheds. The following map depicts the entirety of Well Educated Trainings and Well Informed Trainings completed between the inception of TWON and March of 2021.

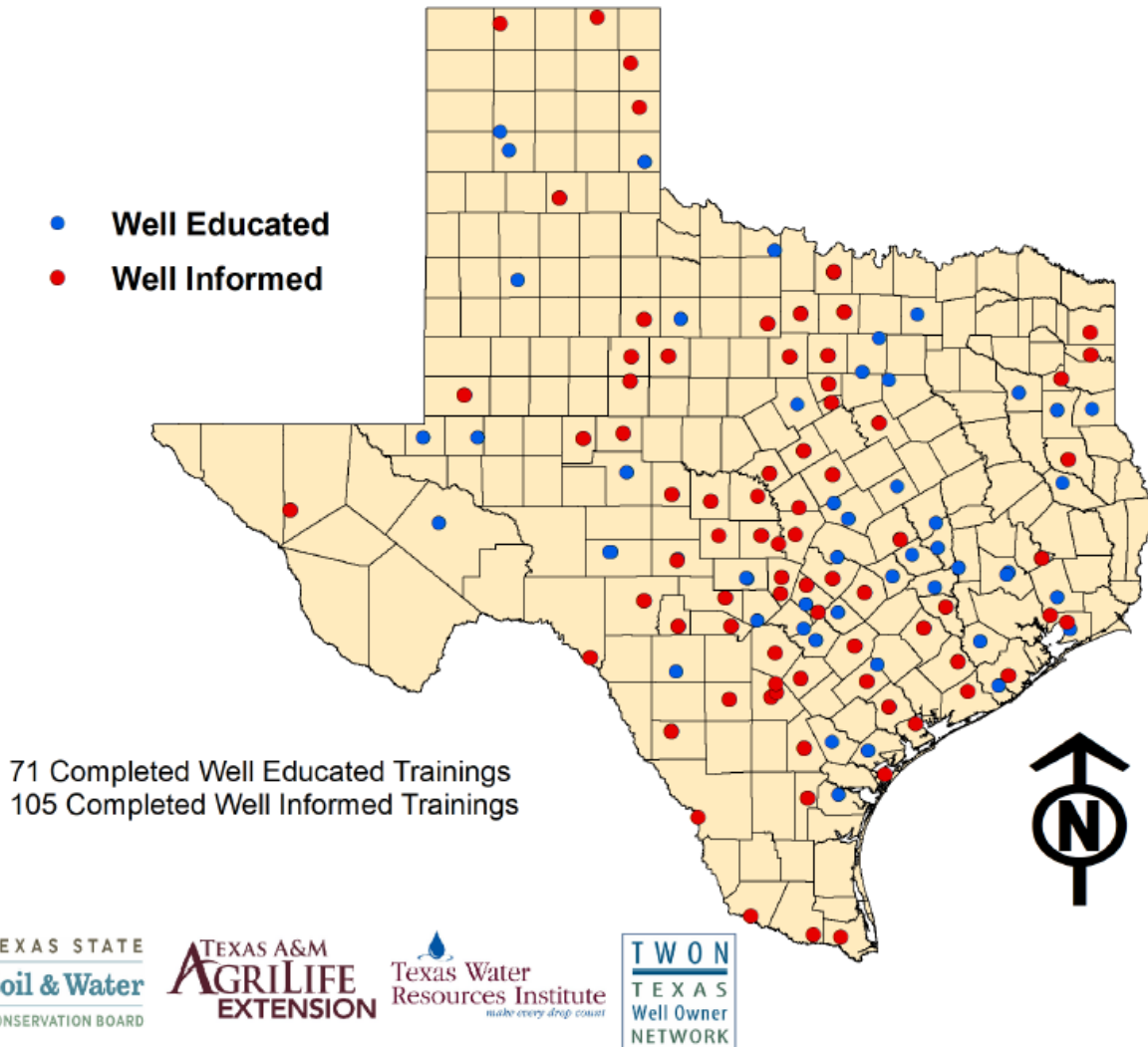


Table 1. List of news releases and articles published about TWON Programs

Newspaper/Outlet	2020	Title
<i>AgriLife Today</i>	10/08/2020	Virtual training for water well owners set Oct. 13
<i>AgriLife Today</i>	10/08/2020	Virtual training for water well owners set Oct. 15
<i>AgriLife Today</i>	10/07/2020	Private well water screening set for Oct. 28 in Groesbeck
<i>AgriLife Today</i>	08/25/2020	Water wells should be tested after a flood
<i>AgriLife Today</i>	06/30/2020	Private water well screening set for July 27-28 in Levelland
<i>Bryan-College Station Eagle</i>	02/02/2020	Water well owner training set for Feb.5 in College Station
<i>Bryan-College Station Eagle</i>	01/24/2020	Training for well owners offered on Feb. 5
<i>Leon County Today</i>	01/21/2020	Water Well Owner Training set for Feb. 5 in College Station
<i>AgriLife Today</i>	01/15/2020	Water Well Owner Training set for Feb. 5 in College Station
	2019	
<i>Bryan-College Station Eagle</i>	10/01/2019	Private water well screening set for Oct. 15 in Orange
<i>AgriLife Today</i>	09/30/2019	Private water well screening set for Oct. 15 in Orange
<i>Longview News-Journal</i>	12/29/2019	Texas Well Owner Network
<i>Longview News-Journal</i>	12/24/2019	East Texas Landowners Conference set Jan. 17 in Carthage
<i>Bryan-College Station Eagle</i>	12/01/2019	Private water well workshop scheduled for Dec. 9 in Brenham
<i>Sealy News</i>	11/21/2019	Water well workshop Dec. 9 in Brenham
<i>AgriLife Today</i>	11/13/2019	Water well owner training set for Dec. 9 in Brenham
<i>Bryan-College Station Eagle</i>	11/03/2019	Water well owner training set for Nov. 19 in Lincoln
<i>AgriLife Today</i>	11/03/2019	Water well owner training set for Nov. 19 in Lincoln
<i>Bryan-College Station Eagle</i>	11/01/2019	Water well owner training set for Nov. 19 in Groesbeck
<i>AgriLife Today</i>	11/01/2019	Water well owner training set for Nov. 19 in Groesbeck
<i>Texas Water Resources Institute</i>	10/25/2019	Texas Well Owner Network Well Educated Training - Groesbeck
<i>Victoria Advocate</i>	10/19/2019	Expert ready to help residents protect water system
<i>AgriLife Today</i>	10/12/2019	Water well owner training set for Nov. 5 in Bay City
<i>Bryan-College Station Eagle</i>	10/11/2019	Water well owner training set for Nov. 5 in Bay City

<i>AgriLife Today</i>	10/10/2019	Water well owner training set for Nov. 7 in Gatesville
<i>Bryan-College Station Eagle</i>	10/10/2019	Water well owner training set for Nov. 7 in Gatesville
<i>AgriLife Today</i>	10/10/2019	Multi-county water well screenings set for Permian Basin area in October
<i>Bryan-College Station Eagle</i>	10/08/2019	Private water well screening set for Oct. 16 in Chambers, Jefferson counties
<i>AgriLife Today</i>	10/08/2019	Private water well screening set for Oct. 16 in Chambers, Jefferson counties
<i>Orange Leader</i>	10/02/2019	Free Water Well Testing
<i>Bryan-College Station Eagle</i>	10/01/2019	Private water well screening set for Oct. 15 in Orange
<i>AgriLife Today</i>	09/19/2019	Water wells need to be tested after flood
<i>Victoria Advocate</i>	05/24/2019	Private water well screening is critical
<i>Jacksboro Herald-Gazette</i>	02/20/2019	Private Water Well Screening set for April 11
<i>AgriLife Today</i>	02/09/2019	Texas Well Owner Network trainings set for Feb. 22 in Marlin
<i>AgriLife Today</i>	01/22/2019	Texas Well Owner Network trainings set for DFW area in February
<i>Jacksboro Herald-Gazette</i>	02/20/2019	Private Water Well Screening set for April 11
<i>AgriLife Today</i>	02/09/2019	Texas Well Owner Network trainings set for Feb. 22 in Marlin
<i>AgriLife Today</i>	01/22/2019	Texas Well Owner Network trainings set for DFW area in February
	2018	
<i>AgriLife Today</i>	12/20/2018	Experts: Get private well water screened after flooding to ensure safety
<i>East Texas Press</i>	11/6/2018	Water well owner training set for Nov. 7 in Lufkin
<i>Conservation Matters</i>	11/02/2018	Has your private water well flooded? What now?
<i>AgriLife Today</i>	11/01/2018	Well owner network offers screening Nov. 5 in Mason
<i>The Llano News</i>	10/31/2018	Is Your Water Safe? Llano Flooded Water Well Screening November 6th.
<i>Lufkin Daily News</i>	10/28/2018	EXTENSION NEWS: Water well training, testing opportunity coming up on Nov. 7
<i>KLTV7</i>	10/24/2018	Water well training and testing opportunity
<i>AgriLife Today</i>	10/22/2018	Water well owner training set for Nov. 7 in Lufkin
<i>AgriLife Today</i>	09/28/2018	Water well owner training set for Oct. 18 in Beeville

<i>The Panola Watchman</i>	09/25/2018	Texas Well Owner Network Trainings
<i>Conservation Matters</i>	09/11/2018	TWON hosting screenings Sept. 18 in Leming, San Antonio
<i>Conservation Matters</i>	09/11/2018	Water well owner training set for Sept. 25 in Carthage
<i>Texas State Soil and Water Conservation Board Events</i>	09/11/2018	Texas Well Owner Network Workshop in Milano
<i>Texas State Soil and Water Conservation Board Events</i>	09/11/2018	Texas Well Owner Network Workshop in Caldwell
<i>Texas State Soil and Water Conservation Board Events</i>	09/10/2018	Water well owner training set for Sept. 25 in Carthage
<i>Texas State Soil and Water Conservation Board</i>	09/4/2018	Texas Well Owner Network in San Angelo
<i>Texas State Soil and Water Conservation Board</i>	09/4/2018	Texas Well Owner Network in Odessa
<i>AgriLife Today</i>	09/4/2018	Water well owner training set for Sept. 25 in Carthage
<i>AgriLife Today</i>	08/19/2018	Private water well screening set for Sept. 18 in Leming
<i>AgriLife Today</i>	08/18/2018	Rainwater harvesting, turf management training Sept. 20-21 in Boerne, San Antonio
<i>AgriLife Today</i>	08/18/2018	Private water well screening set for Sept. 18 in San Antonio
<i>AgriLife Today</i>	08/10/2018	Water sample screening campaign in August in Burleson, Milam counties
<i>Southwest Farm Press</i>	08/07/2018	Water well owner training set for Aug. 21 in Odessa, other locations
<i>AgriLife Today</i>	08/05/2018	Well owner training slated for Aug. 22 in San Angelo
<i>AgriLife Today</i>	08/04/2018	Water well owner training set for Aug. 21 Odessa
<i>News Channel 10 KFDA Amarillo</i>	07/11/2018	Educational event to provide residents with water wells essentials for testing water
<i>AgriLife Today</i>	06/23/2018	Water well owner training set for July 26 in Bellville
<i>AgriLife Today</i>	06/09/2018	Water well trainings, screenings set for July in the Panhandle
<i>Gilmer Mirror</i>	05/24/2018	Well Owner Network Program Helps Texans Protect Private Water Wells
<i>Texas State Soil and Water Conservation News</i>	05/24/2018	Well Owner Network Program Helps Texans Protect Private Water Wells
<i>ReporterNews.com</i>	05/18/2018	Water well owner training set
<i>AgriLife Today</i>	05/12/2018	Water well owner training set for May 31 in Hamilton

<i>Bryan, College Station.net</i>	05/12/2018	Water well owner training set for May 31 in Hamilton
<i>Savewatertexas.org</i>	04/19/2018	Water well owner training April 24 in Stephenville
<i>Texas State Soil and Water Conservation Board Events</i>	04/19/2018	Texas Well Owner Network Workshop for Bosque River Watershed
<i>Conservation Matters</i>	04/19/2018	Water well owner training set for April 24 in Stephenville
<i>The Stephenville Chamber</i>	04/19/2018	Water Well Owner Training – Texas Well Owner Network
<i>Middle Trinity Groundwater Conservation District</i>	04/18/2018	Texas Well Owner Network Training
<i>AgriLife Today</i>	04/04/2018	Water well owner training April 24 in Stephenville
<i>AgriLife Today</i>	03/21/2018	Texas Well Owner Network honored with prestigious state environmental award
<i>AgriLife Today</i>	02/12/2018	Additional free testing available for private water well owners affected by Hurricane Harvey
<i>Victoria Advocate</i>	02/04/2018	Test water wells yearly
<i>The Baytown Sun</i>	02/01/2018	Free water well testing in Chambers County
<i>Victoria Advocate</i>	01/18/2018	Flooded water wells pose health concerns
<i>AgriLife Today</i>	01/17/2018	Water well screenings offered to counties affected by Hurricane Harvey
<i>Southwest Farm Press</i>	01/15/2018	Water contamination in coastal Texas still an issue after hurricane, another round of testing available
<i>Victoria Advocate</i>	01/09/2018	Free water screenings planned
<i>The Bay City Tribune</i>	01/07/2018	Water well screenings offered for counties affected by Harvey
<i>Rebuild Texas</i>	01/05/2018	Water well screenings offered in January for counties affected by Hurricane Harvey
<i>AgriLife Today</i>	01/04/2018	Water well screenings offered in January for counties affected by Hurricane Harvey
	2017	
<i>AgriLife Today</i>	11/29/2017	More free testing available for private water well owners affected by Hurricane Harvey
<i>Southwest Farm Press</i>	11/29/2017	Farmers, ranchers near hurricane ravaged coast reminded to test water wells
<i>Virginia Tech Collegiate Times</i>	11/25/2017	Virginia Tech water research team studies contamination in Texas and Florida well waters

<i>Victoria Advocate</i>	11/18/2017	Free testing available for private water wells
<i>KRIS Corpus Christi News</i>	11/03/2017	Texas A&M AgriLife Extension Service free private well testing
<i>Baytown Sun</i>	11/02/2017	Free water well contamination testing returns
<i>Aransas Pass Progress</i>	11/01/2017	Free testing available for private water well owners affected by hurricane
<i>AgriLife Today</i>	10/27/2017	Additional free testing available for private water well owners affected by Hurricane Harvey
<i>Houston Chronicle</i>	10/27/2017	Miss the last round of well water testing? Texas A&M offers another chance
<i>Houston Chronicle</i>	10/25/2017	Private water wells in Texas test positive for contamination after Harvey
<i>WSLS</i>	10/24/2017	Virginia Tech tests well water samples for hurricane victims
<i>WDBJ7</i>	10/19/2017	VT Flint Water Team testing well water from Texas and Florida hurricane victims
<i>Port Lavaca Wave</i>	10/03/2017	Free testing for water wells affected by floods
<i>Victoria Advocate</i>	09/29/2017	Free well test kits available from Extension Service

Table 2. Water screenings by county

Watershed	Date	County	Participants/Samples
Copano Bay	1/29/2018	Aransas	50
Lavaca River Watershed	1/30/2018	Calhoun, Victoria	69
Lavaca River Watershed	1/31/2018	Matagorda	50
Middle Canadian, Lower Beaver	7/17/2018	Ochiltree	39
Palo Duro Watershed	7/17/2018	Sherman	12
Middle Canadian	7/18/2018	Hemphill	56
Middle North Fork Red	7/18/2018	Wheeler	10
Lower San Antonio	9/18/2018	Atascosa	17
Upper San Antonio River	9/19/2018	Bexar	32
Llano	11/5/2018	Burnet	18
Llano	11/5/2018	San Saba	13
Llano	11/6/2018	Llano	77
Llano	11/6/2018	Mason	30
Lake O' Pines	3/25/2019	Cass	39
Geronimo/Alligator Creeks	4/8/2019	Hood	59
Middle Brazos - Palo Pinto	4/8/2019	Palo Pinto	27
Middle Brazos - Palo Pinto	4/8/2019	Parker	90
Upper West Fork Trinity	4/9/2019	Montague	66
Eagle Mountain Reservoir	4/10/2019	Wise	59
Lake O' Pines	3/25/2019	Cass	45
Upper Llano River	5/8/2019	Kimble	21
Lavaca River Watershed	5/13/2019	Victoria	90
Copano Bay	5/14/2019	Refugio	13
Adams & Cow Bayous	10/16/2019	Orange	56
Double Bayou	10/17/2019	Chambers	43
Monument-Seminole Draws	10/20/2019	Andrews	52
Upper Mustang Draw	10/21/2019	Martin	12
Upper Beals Creek	10/21/2019	Howard	33
Smyer Oil Field-Yellow House Draw	7/28/2020	Hockley, Lubbock, Lamb	42
Navasota River	10/29/2020	Limestone	20
TOTAL PARTICIPANTS/SAMPLES			1240

Table 3. Well Educated Programs by County

Watershed	Date	County	Participants/Samples
Upper Llano River	11/14/2017	Kimble	24
Bosque River	4/24/2018	Erath, Comanche	44
Leon River	5/31/2018	Hamilton	18
Upper North Fork Red	7/19/2018	Potter	30
Mill Creek	7/26/2018	Austin	61
Big Creek-Brazos River	8/1/2018	Fort Bend	15
Pecos River	8/21/2018	Ector	47
Middle & South Concho Rivers	8/22/2018	Tom Green	36
Davidson & Middle Yegua Creek	9/11/2018	Burleson	85
Davidson & Middle Yegua Creek	9/12/2018	Milam	30
Middle Sabine	9/25/2018	Panola	52
Copano Bay	10/18/2018	Bee	41
Attoyac Bayou	11/7/2018	Angelina	49
Eagle Mountain Reservoir	2/4/2019	Collin	14
Village Creek-Lake Arlington, Joe Pool	2/5/2019	Tarrant	21
Lavon Lake	2/6/2019	Ellis	15
Deer Creek	2/22/2019	Falls	17
Lampasas	8/8/2019	Lampasas	92
Davidson & Middle Yegua Creek	9/9/2019	Burleson	58
Davidson & Middle Yegua Creek	9/9/2019	Milam	39
Tres Palacios	11/5/2019	Matagorda	41
Leon River	11/7/2019	Coryell, Hamilton	10
Navasota River	11/14/2019	Limestone	30
Middle Yegua Creek	11/19/2019	Lee, Bastrop	21
Mill Creek	12/9/2019	Washington, Austin	46
Navasota River	2/5/2020	Brazos, Robertson	20
Nueces Headwaters	10/13/2020	Real, Kinney, Uvalde	15
Upper Devils River	10/15/2020	Sutton, Kimble, Edwards	14
TOTAL PARTICIPANTS/SAMPLES			985

TWON Educational Topics and Materials

Educational materials such as the TWON Handbook, factsheets and PowerPoint modules developed through TSSWCB projects #10-04 and #13-08, "Preventing Water Quality Contamination Through the Texas Well Owner Network" and "Statewide Delivery of the Texas Well Owner Network," were again used for this project. The TWON education curriculum emphasizes BMPs for safeguarding private well water quality and aquifer integrity. The curriculum and publications include the following topics:

- Interpretation of well water screening results
- Watershed and groundwater hydrology and the importance to neighbors and the public of safeguarding aquifer integrity and groundwater quality
- Proper siting of drinking water wells and avoiding improper well construction techniques
- Proper maintenance and protection of the wellhead
- Proper household waste management
- Improperly sited and functioning on-site wastewater treatment systems
- Maintenance, aging and failure of on-site wastewater treatment systems
- Effects of land use changes on well water quality
- Locating and properly plugging abandoned wells

Well Water Analyses

For both TWON *Well Educated* and *Well Informed* events, participants were encouraged to drop off private well water samples, collected using the Soil, Water and Forage Testing Laboratory water collection procedures (<http://soiltesting.tamu.edu/files/waterweb1.pdf>). Samples were screened for nitrate, salinity concentrations and arsenic for areas where these contaminants are of concern according to the Texas NPS Management Program Appendix D Groundwater Constituents of Concern Report. For participants with positive results, remediation instructions and/or a recommendation and instructions were given for sending follow-up samples to an accredited NELAC laboratory to perform drinking water analyses.

Screening for E. coli bacteria was conducted on-site or at Texas A&M University by the SCSC Program Specialist. Participants were also issued a discounted voucher to be taken to the nearest cooperating NELAC-certified lab. Bacterial screening results and as appropriate, remediation instructions or recommendations for additional testing were emailed or mailed to the participants, which allowed them to receive bacterial screening results privately.

Participants were responsible for the cost of their water sample screening analysis (approximately \$10/sample depending on the laboratory or supplies used). Previous experience with private well water screenings has indicated that requiring a nominal fee improves attendance because the community perceives the program as being developed for all rather than targeting those with financial need. However, for underserved and student audiences, and by individual request through the CEA or watershed coordinator, costs of analyses were underwritten by the project through the purchase of necessary supplies. See Table 2 for number of water screenings performed by county.

As a result of the training, participants more clearly understood the relationships between practices in or near their well and the quality of water available for their families and other families pumping from the same formation.

Evaluation and Conclusion

An evaluation approach that was developed through TSSWCB projects #10-04 and #13-08 was used to measure both knowledge and behavior changes of program participants. A pre-test/post-test evaluation strategy was implemented at the beginning and end of each training event. The pre-test asked knowledge-based questions and the post-test will measure knowledge change of participants. In addition, the post-test included 'intentions to change' questions that focused on behaviors that participants should adopt based on what they have learned.

Knowledge gain as measured by pre/post-tests administered at the trainings: pre-test scores averaged 52% correct answers, while post-test scores averaged 77% correct.

- Post-training evaluation:
 - 99% of participants were satisfied with the *Well Educated* training.
 - The value of participating in the program as estimated by attendees was an average of \$794 or a total of \$1,766,650 for TWON3 participants.
- Intentions to Adopt Behavior Change:
 - 85% of participants will test their well annually.
 - 70% of participants will pump their septic system regularly.
 - 99% of participants will remove hazards from their well house.
 - 93% of participants with a deteriorated or open well will plug or cap the well.

Additionally, a one year follow-up evaluation instrument was also administered to participants; emails were sent to program participants to determine which practices were adopted one year after the program.

- One-year follow-up survey results:
 - 66% shared the resources/materials with others who were not at the training.
 - 96% of those needing to clean out hazards from their well house had done so.
 - For participants with septic tanks that needed pumping, 37% had pumped their septic tanks within 6 months following the program. An additional 3% were planning to have their tanks pumped soon and 60% of participants said pumping of the septic system was not need at this time.
 - 13% of participants who needed to had plugged or capped their unused/deteriorated wells following the program. An additional 5% were planning to have their wells plugged/plugged soon.
 - 3% of participants who had wells near contamination sources (pet shelters, livestock yards, etc.) moved the sources following the program, and another 10% had plans to move sources soon and 87% said that the well was not near a contamination source.

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* and *Well Informed* events were delivered to 2,225 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* and *Well Informed* programs, 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.

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, 1-year follow-up surveys showed that 66% of participants had shared the resources and materials with others who were not at the training. Also, most of those participants (96%) needing to clean out hazards from their well house had already done so. For participants with septic tanks needing to be pumped, 37% had them pumped within the 6 months, and an additional 3% were still planning to have them pumped soon.

The successful implementation of the Texas Well Owner Network program will continue through the project *Continued Statewide Delivery of the Texas Well Owner Network* (TWON #4), TSSWCB project #20-03.

Appendix



MARKING INSTRUCTIONS
 CORRECT: ● INCORRECT: ✘ ☒ ☑

Texas Well Owner Network Well Screening Evaluation

Your views on the quality and effectiveness of Extension programs are extremely important. Please take a few minutes to tell us about your experience with this activity. Your answers to the following questions will help us better meet your needs. Please do not write your name on this form so that your responses are anonymous. Thank you!

1. For each item listed below, mark the ONE number in the left column that best describes your level of understanding BEFORE the program; then mark the ONE number in the right column that best describes your level of understanding AFTER the program.

Your understanding of . . .	None					Poor					Fair					Good					Excellent									
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					
TCEQ is required to enforce the Safe Drinking Water Act in Texas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowing who to contact if I have an abandoned water well to plug	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
That TCEQ maintains the list of EPA-certified NELAP labs for potable water analysis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maximum Containment Level (MCL) guidelines for public health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
TCEQ considers a water well to be abandoned if it has not been used for how long?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Critical factors regarding fecal coliform levels in private water wells	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Minimum distance separation between a drain field of conventional septic or the spray field of an aerobic wastewater treatment system and a water well	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maximum Contaminant Level for fecal coliform is zero	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Elevated levels of Nitrate-N cause Methemoglobinemia	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Secondary drinking water standards differ from primary standards, which deal with contaminants that affect human health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. Please indicate your intentions to adopt each item listed below, or indicate if you have already adopted the item listed, or if it does not apply to your situation.

Practice or technology that could be adopted . . .	Plan to Adopt	Undecided	Will not Adopt	Already Adopted	Not Applicable
Test my well water once a year	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pump my septic system regularly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Remove hazards from well house	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Plug or cap any abandoned wells on property	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Apply Best Management Practices to address high nitrate, if found present, from screening	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Apply Best Management Practices to address positive reading of Fecal Coliform bacteria	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. Estimate how valuable your participation in the water educational program has been to you:

\$100 - \$249 \$250 - \$499 \$500 - \$999 \$1,000 - \$2,499 \$2,500 or more

Thank you!





Texas Well Owner Network Pre Test

1. Residents using private water wells are responsible for protection and maintenance of their own water systems.

- True False Unsure

MARKING INSTRUCTIONS

CORRECT: ● INCORRECT: ✘ ☹ ☹

2. Wells should be completed in accordance to Texas state law AND with local groundwater conservation district rules.

- True False Unsure

3. The Maximum Contaminant Level for nitrate-nitrogen is:

- 5 ppm 10 ppm 15 ppm 20 ppm Unsure

4. At a minimum, how far should livestock and pet pens be kept from private water supplies?

- At least 150 feet At least 50 feet At least 100 feet Unsure

5. Which of the following will you find on a properly constructed water well?

- 5 feet of annular cement
 A distance of at least 50 ft. from the property line
 A sloping slab that extends 1 foot in all direction
 Unsure

6. An abandoned well is:

- A well that no one claims ownership of
 A capped well that is not in use
 A well that has not been in use for at least 6 months
 Unsure

7. Which type of drinking water standard is associated with pollutants that cause aesthetic problems like tastes, odors and staining?

- Primary Secondary Possible Unsure

8. Which of the following pollutants often comes from the use of fertilizers or manure?

- Nitrates Radon Iron Unsure

9. You should have your well tested for coliform bacteria_____.

- At least once
 Every 3 years and anytime you notice a difference in taste or smell
 Annually and each time the well is opened or repaired
 Unsure

43221



Continue on the other side

MARKING INSTRUCTIONS

CORRECT: ● INCORRECT: ✖ ✘ ✙ ✚

10. Once a well is contaminated, drilling a new well is the only option for the homeowner.
 True False Unsure
11. It is not important for a homeowner to keep records regarding well installation, maintenance, repairs, or water testing because all professionals keep records that can be accessed later.
 True False Unsure
12. Which of these water treatments is not used to kill bacteria?
 Ultraviolet radiation Shock chlorination Water softener Unsure
13. Which are more likely to be contaminated with bacteria?
 Deep, drilled wells Shallow, dug wells Unsure
14. Which of the following pollutants may cause health problems?
 Iron bacteria Hydrogen sulfide Lead Chloride Unsure
15. The Texas Commission on Environmental Quality (TCEQ) is responsible for plugging/decommissioning abandoned wells.
 True False Unsure
16. The Environmental Protection Agency (EPA) drinking water regulations apply to private water wells.
 True False Unsure
17. The presence of coliform bacteria in a water supply indicates that often dangerous pathogens may also be present.
 True False Unsure
18. Once water enters the ground and reaches the water table, the time it stays in the ground varies from . . .
 A few hours to a few days
 A few hours to a few months
 A few hours to a few hundred years
 A few hours to a few thousand years
 Unsure
19. How deep does your well need to be to ensure that the water you are drawing into your well is protected from surface contamination?
 At least 10 feet
 At least 50 feet
 At least 100 feet
 There is no specific depth that ensures protection
 Unsure

43221

*Thank you.*



Texas Well Owner Network Post Test

1. Residents using private water wells are responsible for protection and maintenance of their own water systems.

True False Unsure

MARKING INSTRUCTIONS

CORRECT: ● INCORRECT: ☒ ☓ ☑ ☐

2. Wells should be completed in accordance to Texas state law AND with local groundwater conservation district rules.

True False Unsure

3. The Maximum Contaminant Level for nitrate-nitrogen is:

5 ppm 10 ppm 15 ppm 20 ppm Unsure

4. At a minimum, how far should livestock and pet pens be kept from private water supplies?

At least 150 feet At least 50 feet At least 100 feet Unsure

5. Which of the following will you find on a properly constructed water well?

5 feet of annular cement
 A distance of at least 50 ft. from the property line
 A sloping slab that extends 1 foot in all direction
 Unsure

6. An abandoned well is:

A well that no one claims ownership of
 A capped well that is not in use
 A well that has not been in use for at least 6 months
 Unsure

7. Which type of drinking water standard is associated with pollutants that cause aesthetic problems like tastes, odors and staining?

Primary Secondary Possible Unsure

8. Which of the following pollutants often comes from the use of fertilizers or manure?

Nitrates Radon Iron Unsure

9. You should have your well tested for coliform bacteria_____.

At least once
 Every 3 years and anytime you notice a difference in taste or smell
 Annually and each time the well is opened or repaired
 Unsure

28697



Continue on the other side

MARKING INSTRUCTIONS

CORRECT: ● INCORRECT: ☒ ☓ ☹ ☹

10. Once a well is contaminated, drilling a new well is the only option for the homeowner.
 True False Unsure
11. It is not important for a homeowner to keep records regarding well installation, maintenance, repairs, or water testing because all professionals keep records that can be accessed later.
 True False Unsure
12. Which of these water treatments is not used to kill bacteria?
 Ultraviolet radiation Shock chlorination Water softener Unsure
13. Which are more likely to be contaminated with bacteria?
 Deep, drilled wells Shallow, dug wells Unsure
14. Which of the following pollutants may cause health problems?
 Iron bacteria Hydrogen sulfide Lead Chloride Unsure
15. The Texas Commission on Environmental Quality (TCEQ) is responsible for plugging/decommissioning abandoned wells.
 True False Unsure
16. The Environmental Protection Agency (EPA) drinking water regulations apply to private water wells.
 True False Unsure
17. The presence of coliform bacteria in a water supply indicates that often dangerous pathogens may also be present.
 True False Unsure
18. Once water enters the ground and reaches the water table, the time it stays in the ground varies from . . .
 A few hours to a few days
 A few hours to a few months
 A few hours to a few hundred years
 A few hours to a few thousand years
 Unsure
19. How deep does your well need to be to ensure that the water you are drawing into your well is protected from surface contamination?
 At least 10 feet
 At least 50 feet
 At least 100 feet
 There is no specific depth that ensures protection
 Unsure

28897

*Thank you.*

Part II: Youth STEM Education Component of the Continued Statewide Delivery of the Texas Well Owner Network (TWON)



Contributors include:

Texas Water Resources Institute, Texas A&M AgriLife Research and Extension Center at Dallas,
Texas A&M University College of Engineering, Texas A&M Engineering Experiment Station – Spark! PK-12
Engineering Education Outreach,
Texas A&M AgriLife Extension Service – Department of Biological and Agricultural Engineering

Prepared for the Texas State Soil and Water Conservation Board
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Texas Water Resources Institute
Texas A&M University System
College Station, Texas 77840-2118
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The Youth STEM Education Component of the Continued Statewide Delivery of TWON was hosted and coordinated by the Texas Water Resources Institute, part of Texas A&M AgriLife Research, the Texas A&M AgriLife Extension Service, and the College of Agriculture and Life Sciences at Texas A&M University

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Texas A&M Engineering
Experiment Station



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- Education Service Center Region 15 for hosting an ACCESS Water Educator Professional Development Workshop as well as inviting Spark! to provide training for educators on a water-focused engineering design challenge on rainwater harvesting systems at their facility in San Angelo, Texas
- The Science Teachers Association of Texas for approving an ACCESS Water Educator Professional Development Workshop as an extended session at their Conference for the Advancement of Science Teaching (CAST) 2022 in Dallas, Texas
- Lake Dallas ISD for hosting an ACCESS Water Educator Professional Development Workshop at Lake Dallas Middle School in Lake Dallas, Texas
- The Meadows Center for Water and the Environment at Texas State University for hosting an ACCESS Water Educator Professional Development Workshop at Spring Lake Hall in San Marcos, Texas
- Texas A&M AgriLife Extension Services, Tarrant County for hosting two ACCESS Water Educator Professional Development Workshops in Fort Worth, Texas
- Bess Reisberg, Education Manager, The Meadows Center for Water and the Environment at Texas State University, for collaborating and planning the deployment of the ACCESS Water Educator Professional Development Workshops
- Lindsay O’Gan, 8th Grade Science Educator, Danforth Junior High, Wimberley ISD, Wimberley, Texas for piloting the ACCESS Water program with her students, providing curriculum resources, assisting with presenting at several ACCESS Water Educator Professional Development Workshops, and presenting at the 2023 Citizen Science Association conference, C*Sci 2023, in Tempe, Arizona
- Steven Baringer, County Extension Agent, Denton County 4-H & Youth Development, Denton AgriLife for promoting and assisting with scheduling an ACCESS Water Educator Professional Development Workshop in the Dallas area
- Brittnay Meyer, County Extension Agent Home Horticulture, Texas A&M AgriLife Extension Services, Tarrant County for promoting and assisting with scheduling two ACCESS Water Educator Professional Development Workshops in the Fort Worth area
- The Texas A&M University Nuclear Power Institute for inviting Spark! to participate in their community outreach event, Science on Saturday in Bay City, Texas
- The Texas A&M University Student Engineers’ Council for inviting Spark! to participate in their community event EnVision Conference in College Station, Texas
- Bryan ISD, Spring Branch ISD, and Brenham ISD for inviting Spark! to provide student engagement activities that focused on water education, nonpoint-source pollution, water resources, and water management
- Steve Evans, Director of Partnerships and Development at EarthXTV, for providing a free exhibitor booth at the EarthX community event for Spark! to share water education outreach focused on the United Nations Sustainable Goals
- Dale Bransom, Owner and Camp Leader North, Summer Science Caravan, for bringing Houston area secondary students to a summer camp community engagement event for Spark! to provide a water-focused engineering design activity on water efficiency

EXECUTIVE SUMMARY

Successful management of water quality within watersheds depends on the informed engagement of diverse communities, especially in states such as Texas with limited water resources and which are experiencing areas of rapid population growth. Community education programs for water quality have been included in the watershed protection planning processes for decades, with numerous resources devoted to delivering water quality education programs for the public and especially for youth audiences. However, the majority of these programs are not standardized or shared widely, with limited efforts to evaluate materials for impact or successful improvements to statewide youth water education in Texas. The Youth STEM Education Component of the Continued Statewide Delivery of the Texas Well Owner Network, also known as the Youth STEM Education Project, and now as the ACCESS (Active Citizen and Community Education for Science Standards) Water Project, addressed current gaps in the education of Texas' students on watershed science and water quality protection. Working closely with K-12 water educators, professionals and researchers, our team developed a comprehensive set of resources to fill existing gaps and provide accessible opportunities for youth across the state to be community ambassadors for water quality.

ACCESS WATER
ACTIVE CITIZEN AND COMMUNITY EDUCATION FOR SCIENCE STANDARDS
TEACHER WORKSHOPS

I REALLY enjoyed this PD!
It was excellent, and I definitely walked out with specific tools I can use.
7th/8th grade Science Teacher

"I feel empowered to bring this back to my kids and ready to implement and support my students learning."
HS Environmental Science Teacher

"After attending the ACCESS workshop..."

"I can do a better job giving my students hope for the future, and they will feel like they can actually make a difference in the world"

"I will be able to seamlessly integrate into my courses without much effort."

"My students will become more familiar with their local water bodies and have a deeper understanding about the issues."

Project Reach
(as of December 2022)

- 42 Teachers Trained
- 6000+ Students reached
- 105 CIS products (maps, Storymaps) created by teachers and students

Social Media Engagement

TikTok:

- 93 videos
- 8,845 views

Instagram:

- 7121 views

Facebook:

- 5844 views

"It was the most enjoyable PD I have gone to!"
7th/8th grade Science Teacher

The ACCESS Water Team:
Texas Water Resources Institute (TWRI)
Texas A&M AgriLife Extension
Texas A&M Engineering Experiment Station (TEES) and SPARK!
Sponsored by: Texas State Soil and Water Conservation Board

Based on an initial Water Education Needs Assessment through educator, community and professional networks, the project team identified priority community events, 4-H youth opportunities and target educational materials to meet project goals. Education gaps identified from the community assessment, as well as the research expertise of our team and Texas Essential Knowledge and Skills (TEKS) requirements, the project team developed new youth educational materials, which were piloted and co-refined with participating educators over the course of the project period into the **Texas ACCESS Water Curriculum and Teacher Guide Classroom Toolkit** (see Appendix A). Tested and improved by educators across the state through train-the-trainer **ACCESS Water Educator Professional Development Workshops** (see Appendix F) and facilitated by an open-access **ArcGIS Online Hub** for ongoing volunteer water quality data collection (see Appendix B), the ACCESS Water Curricular Toolkit is designed to meet Texas' K-12 water quality education needs with an innovative, sustainable learning platform for youth education.

The project also directed team members, which included staff from the Texas Water Resources Institute (TWRI), the Texas A&M AgriLife Research and Extension Center at Dallas, the Texas A&M University College of Engineering, the Texas A&M Engineering Experiment Station – Spark! PK-12 Engineering Education Outreach (Spark!), and the Texas A&M AgriLife Extension Service – Department of Biological and Agricultural Engineering, to engage in several relevant conferences and community events to relay the project's successes and provide the project's educational resources to professionals and members of the public outside of the team members' organizations.

The project was funded by the U.S. Environmental Protection Agency (EPA) through the Texas State Soil and Water Conservation Board (TSSWCB), was managed by TWRI and supports TSSWCB's Texas Nonpoint Source Management Program's goal of protecting and restoring water quality through successful and empowering educational engagement with the public. The project made direct contact with 9,397 individuals across the nation, including 3,399 students, 80 teachers, two administrators, and other 5,916 individuals (including professionals and parents) through the project team members' engagement at relevant conferences and community events.

Results of Program Goals

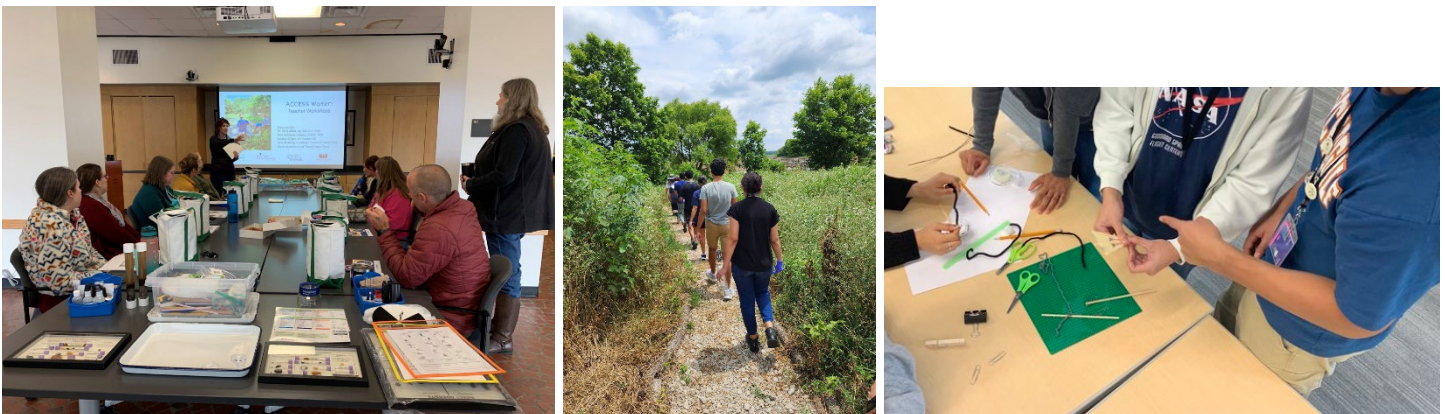
During the project period (Fall 2021 through end of Summer 2023) the project team completed the following events which coordinated with Texas AgriLife County Extension Agents, Texas independent school districts, and relevant non-profit organizations (refer to ACCESS Water Project Events Map for locations).

- Developed and led **9 Youth Education Training workshops** for students
- Participated in **14 Youth Education Community Events**
- Presented at **6 professional conferences** (2 national, 4 statewide)
- **10 Youth Programming Events**
- Developed and led **6 Teacher Professional development workshops**
 - **64 Middle and High School educators** trained to conduct Citizen Science water quality monitoring

Beyond these project deliverables, the ACCESS Water Project has established an ongoing vehicle for impactful water education through Citizen and Community Science (CCS) water quality data collection by the detection of optical brightener presence/absence in waterways as an early warning indicator for human wastewater leaks (optical brightener sampling a.k.a. “Tamplimg”). To support continued engagement beyond the project period, an ArcGIS Online data collection Hub was created and, in partnership with The Meadows Center for Water and the Environment and the Texas Stream Team, will be launching as a national CCS program through SciStarter.org (beginning Fall 2023).



Thanks to support from TSSWCB for this project, the ACCESS Water Project team was able to reach diverse groups in and near priority watersheds across the state with critical programming and professional development training for educators and students. With the development of a comprehensive TEKS-aligned educator toolkit, an online CCS framework for engagement, and numerous training and education events, the ACCESS Water Project has created an ongoing, innovative platform for unprecedented community engagement with watershed management and education. As a result of the ACCESS Water Educator Professional Development Workshops, in which each of the 64 participating middle or high school educators will teach 100-200 students every year, ACCESS Water materials have the potential to continue reaching up to 6,000 - 12,000 middle and high school students annually. With publicly accessible resources and connections with ongoing research, the impact of the ACCESS Water Project on Texas youth, as well as on their families, friends and communities, could continue to grow exponentially.



INTRODUCTION

Across Texas' waterbodies, the management and protection of water quality continues to be a key issue influencing the development of watershed-based plans. The development of watershed-based plans helps Texas water professionals deliver funding, resources, and strategies to affected watershed areas that, when implemented effectively, can help lead to significant improvements in water quality across the state. An essential strategy in the watershed-based planning process is an effective education and outreach campaign. Education and outreach efforts towards communities on water quality and nonpoint source pollution bring needed awareness to a community's current water quality situation and influences long-term behavioral changes. However, the impacts of these educational programs can be varied, with participant learning gains and potential behavioral changes as only part of the equation. Other impacts such as building social frameworks for sustained change, likelihood to share learning within peer groups, and integration with ongoing research have shown to be crucial for long-term water quality impacts (Ardoin et al. 2020, Wang and Chermok 2021, and Everett et al. 2021).

Citizen and Community Science (CCS) has emerged as an effective tool to increase the impacts of environmental education programs through active participation of non-professionals in scientific research. CCS, especially when included in K-12 education, creates a platform for sustained engagement with local water issues and can also be a tool to deliver educational programming and measure the impacts of participant engagement (Bonney et al. 2009, Phillips et al. 2018, Dalida et al. 2018, Albus et al. 2020, Ardoin et al. 2020). This can be especially impactful for youth audiences, with the technology and active learning components which help prepare students for future careers.

A typical education and outreach campaign within watershed-based planning often solely targets Texas adults and youth are not often incorporated into the outreach effort. According to the US Census Bureau, population estimates for the state of Texas in 2022 estimated that 24.8 percent of the total Texas population (over 30 million) was comprised of individuals who were under the age of 18 (US Census Bureau 2022). These millions of young people will be the future stakeholders, landowners and the water workforce of Texas, with a growing need for water education in the face of increased system pressure. In addition, youth programming can reach wider and more diverse audiences, as adult watershed programming is often elective meaning participants are limited to those who select to attend, whereas K-12 school audiences are more representative of the actual community population. To date, there has not been a state programming standard to educate our future leaders on the importance of watershed-based planning and protection of Texas' surface water quality. Therefore, it is imperative for Texas' teachers to obtain and utilize efficient and cost-effective resources that may promote watershed-based planning efforts and protections for water quality within their curricula. Such resources should include educational material on watershed protection, pollution sources, pollution identification and control measures, and other relevant environmental topics and interactive activities that raise awareness on nonpoint source pollution.

A report by the Texas Education Agency (TEA) reported that enrollment in Texas public schools had increased by 8.6 percent in just a 10-year period; the 2021-2022 total enrollment indicated a total enrollment of 5,427,370 students (Enrollment in Texas Public Schools 2021-22 2022). Texas teachers interact with numerous students and have the capability to make worthwhile impacts and provide opportunities for Texas youth to understand how they may better their local environments and waterways. Efforts made through the Youth STEM Education Component of the Continued Statewide Delivery of the TWON, also known as the ACCESS have equipped Texas students and teachers with the necessary tools and resources to bring increased knowledge and opportunities towards protecting and preserving water quality in Texas' waterbodies through CCS, leadership empowerment, and accessible educational opportunities.

To develop and implement the Youth STEM Education Project, TWRI worked with project partners (see Table 1) from the Texas A&M AgriLife Research and Extension Center at Dallas (AgriLife Dallas), the Texas A&M University College of Engineering – Spark!, the Texas A&M Engineering Experiment Station (TEES), and the Texas A&M AgriLife Extension Service – Department of Biological and Agricultural Engineering (BAEN).

The team first conducted a review of existing education materials to identify what was currently available for teachers and students regarding educational resources on the protection of watersheds and water quality. Next, the team modified existing educational resources, developed new educational resources, and coincidentally planned educational workshops and events that individually targeted teachers, students, and communities with goals of delivering educational resources and inspiring action to engage in leadership roles regarding the education of students and peers and the stewardship of water resources in local communities within priority watersheds. These workshops and events utilized the new resources

to educate and equip those in attendance with the projects’ new tools to engage in actions that promote the understanding, identification of and management of nonpoint source pollution in Texas watersheds. See this report’s section, “Program Development,” for a summary of how the project’s resources were developed.

The project’s main resources that were developed, utilized, and shared with program attendees included the ACCESS Water Educator Professional Development Workshops, online CCS and water education resources, classroom research toolkits, curricula for teachers (aligned with the Texas Essential Knowledge and Skills (TEKS) requirements), engineering design challenges for students, and service-learning kits for Texas 4-H Water Ambassadors. This report’s section, “Program Implementation,” contains a summary of how the project’s resources were deployed amongst teachers, students, and the general public through workshops, community events, and attendance at relevant conferences. Following program delivery, follow-up evaluations were performed with attendees of the ACCESS Water Educator Professional Development Workshop. Discussion of these evaluations can be found in this report’s section, “Evaluation of ACCESS Water Teacher Development Workshops”.

Table 1. ACCESS Water Project List of Members and Organizations

Youth STEM Education Team		
First	Last	Organization
Dr. Kelly	Albus	Texas A&M AgriLife Research and Extension Center at Dallas
Dr. David	Berthold	Texas Water Resources Institute
Jennifer	Easterling	Texas A&M Engineering Experiment Station, Spark! PK-12 Engineering Education Outreach
Alexander	Neal	Texas Water Resources Institute
Pam	Simmons-Brooks	Texas A&M Engineering Experiment Station, Spark! PK-12 Engineering Education Outreach
David	Smith	Texas A&M AgriLife Extension Service – Department of Biological and Agricultural Engineering
Shelly	Tornquist	Texas A&M Engineering Experiment Station, Spark! PK-12 Engineering Education Outreach

PROGRAM DEVELOPMENT

To begin developing the project’s educational tools and resources, the project team conducted a Texas Water Education Needs Assessment to review existing education materials, identify what was currently available for teachers and students regarding the protection of watersheds and water quality, and also what materials were needed, and their ideas for water education improvement. Materials reviewed were individually required to align with TEKS requirements. Entities with educational materials regarding watersheds and water quality were identified for review including the Texas 4-H Youth Development, AP College Board and WE Service, Teach Engineering, Texas Parks and Wildlife Department, NASA Jet Propulsion Laboratory, EPA, TQEC, Tarrant Regional Water District, and Texas A&M AgriLife.

Following the review of existing educational materials, the Texas Water Education Needs Assessment was performed and supplemented by the project team engaging in conversation with several professionals associated with watershed-based education and STEM education regarding the needs for watershed-based materials within Texas’ education system. Individuals contacted included employees from The Koan School in Denton, Lewisville Independent School District, TEA Educational Region Center, TCEQ, Texas A&M Natural Resources Institute, Girl Scouts STEM Center, and TEA Region 3 Education Region Center.

Through these developmental stages, it was identified that there were state-wide opportunities to support and expand CCS monitoring with low-cost alternatives, create curricula and educational resources for K-12 teachers, and create a variety of service-learning modules and toolkits for educators and leaders within communities. Specifically, our team identified the following areas to define project goals:

1. A need for more low-cost, accessible and TEKS-aligned materials for middle and high school students;
2. Many educators utilize online water education materials that are not relevant to local water concerns;
3. Contacts reported improved student engagement and learning gains from outdoor, hands-on learning;

4. **Impacts of water education programs on behavior, including adoption of BMPs for potential load reduction of anthropogenic inputs, are more likely when:**
 - a. **Youth participants are able to take immediate action on lessons learned,**
 - b. **Youth action component is supported by the wider community and centered around local concerns.**

Based on these findings, the project team created a comprehensive toolkit of learning modules and resources for middle- and high-school educators centered around active learning through citizen science water quality monitoring. Designed for sustainability, the toolkit is designed in a train-the-trainer format for educators to incorporate relevant modules into existing events and activities and empower youth to participate in local water management (see Appendix A - Texas ACCESS Water Curriculum and Teacher Guide Classroom Toolkit, Appendix B - Optical Brightener Monitoring “Tamplimg” Hub , and Appendix C - ACCESS Water Education Resource Library). Curricular materials were piloted and refined through a series of ACCESS Water Educator Professional Development Trainings held in target regions across Texas in partnership with Regional Education Centers, school districts, outdoor learning areas and County Extension offices (example flyers included – see Appendix G and Appendix H).

ACCESS WATER: COMMUNITY SCIENCE TEACHER WORKSHOPS

Free, hands-on workshops for teachers, built around local environmental issues.

Half-day workshops include:

- TEKS-aligned curriculum (7th, 8th science, high school APES, aquatic science)
- Online community science and water education resources
- Classroom project toolkits with materials included
- CEU/CPD credits
- A team of passionate educators and scientists to support you and have fun!

Want to learn more? Visit: <https://ar.cg.is/LVomT>

Sign up here:

or email: kelly.albus@ag.tamu.edu

TEACHER JMG & ACCESS WATER TRAINING

JULY 12, 2023 9AM-4PM

Learn about two great curricula we offer and how to set up your school to succeed with these programs. A complete lesson plan put together by teachers for teachers!

WHAT TO EXPECT

- Overview of both Curricula
- Hands-on activities
- Lunch provided
- Texas A&M AgriLife certification with 875A CPE hours & TEAC recertification

LOCATION: Texas A&M AgriLife Extension Office 5001 Highway 190 South, by County University A&A Conference Center

IF YOU NEED ANY SPECIAL ACCOMMODATIONS, PLEASE CONTACT THE OFFICE AT 281.854.2100 OR EMAIL: 281.854.2100

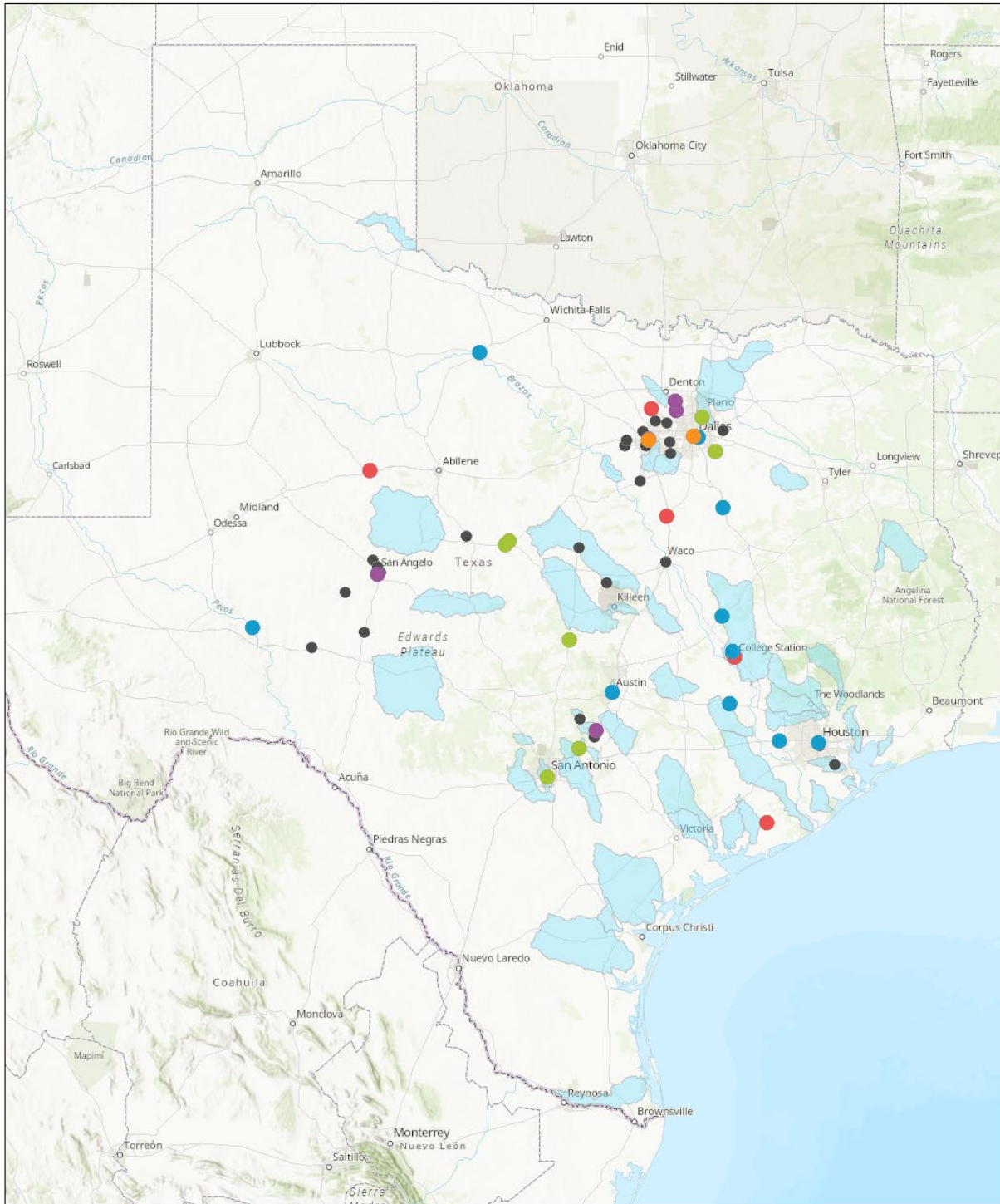
Another leadership entity identified through the needs assessment as one with an opportunity to benefit from the Youth STEM Education project was the Texas 4-H Water Ambassadors program. The Texas 4-H Water Ambassadors, formed in 2017 through the Texas A&M AgriLife Extension Service, are a growing group of Texas high school students who have taken the extra initiative to become educated and well versed on Texas’ water resources. The mission of the organization is to “provide high school youth an opportunity to gain advanced knowledge and develop leadership skills related to the science, technology, engineering and management of water in Texas.” Texas 4-H Water Ambassadors are given numerous opportunities to gain knowledge and better understanding of Texas water issues and are tasked to pass along all information learned from their experiences through the program to their local communities. As of 2023, 188 youth have served as 4-H Water Ambassadors and have made great impacts in their communities. The Youth STEM Education project worked with their program alongside BAEN staff to develop service-learning kits to continue the Ambassadors’ outreach opportunities. The kits developed contain water quality interactive exercises, fact sheets, water education posters, speaker materials, and how-to guides for presenting resources and conducting exercises for local education and outreach events. Texas 4-H Water Ambassadors will use these toolkits to educate peers and youth at 4-H clubs, in schools and at community events.



PROGRAM IMPLEMENTATION

In-person and virtual programming efforts and opportunities as identified through the developmental process of the ACCESS Water Project began being implemented in October of 2021 and concluded in July of 2023. A total of 45 events were held or attended by members of the project team and five follow-up trainings for attendees of the ACCESS Water Educator Professional Development Workshops were held within three months of the initial workshop. The total number of direct contacts made by the project team through programming was estimated at 9,397 persons. Of the 45 total events, project staff attended six conferences to disseminate project resources amongst educators, students, professionals, and the general public. The types of events implemented through the ACCESS Water Project fall into four categories, described in detail below.

ACCESS Events Map



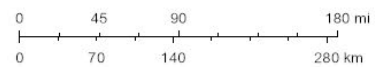
8/25/2023

ACCESS Events Map

- Youth Education Community Event
- Youth Programming Event
- Youth Education Training for Students
- Youth Education Training for Teachers

- Conference
- ACCESS Participant School Locations
- Watershed Protection Plans
- World Hillshade

1:4,622,324



Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS, Esri, USGS, TCEQ NPS Program

1. **Youth Education Training for Teachers:** Working with project partners, the ACCESS Water Project was to develop and implement five, day-long trainings for teachers using workshop materials and resources developed. The trainings were to address topics such as Texas water quality standards, water quality monitoring, and provide interactive activities

for teachers to conduct water quality classroom exercises. Follow-up trainings with participating educators were required for each of the day-long trainings to further train attendees through curriculum development and to create access for the use of workshop materials for future use in the classroom. Follow-up trainings were to occur virtually or in person and occur between one to three months after the initial training. Through the developmental process, the project team created and organized the ACCESS Water Teacher Development Workshop to serve the five, day-long trainings for teachers. Additionally, the ACCESS Water Project directed the team members to attend at least three conferences/trade shows annually such as STEM 4 Innovation, and the Conference for the Advancement of Science Teaching (CAST) to present and advertise training materials to Texas STEM educators.

Youth Education Training for Teachers			
Total Number of Events	6	Overall Numbers Reached	64
Active Community and Citizen Education for Science and Stewardship Water Workshop; Region 15 Education Service Center, San Angelo, TX; October 19, 2022			
Active Community and Citizen Education for Science and Stewardship Water Workshop; Conference for the Advancement of Science Teaching (CAST) 2022; Hilton Anatole, Dallas, TX			
Active Community and Citizen Education for Science and Stewardship Water Workshop; Lake Dallas Middle School; Lake Dallas, TX; December 1, 2022			
Active Community and Citizen Education for Science and Stewardship Water Workshop; The Meadows Center for Water and the Environment; San Marcos, TX; February 4, 2023			
Active Community and Citizen Education for Science and Stewardship Water Workshop; Tarrant County Extension Office; Fort Worth, TX; June 26, 2023			
Active Community and Citizen Education for Science and Stewardship Water Workshop; Tarrant County Extension Office; Fort Worth, TX; July 12, 2023			



2. **Youth Education Training for Students:** Project partners were to deliver at least four trainings to students for service-learning programs on watershed protection, water quality, and other relevant topics. During these events, students were to

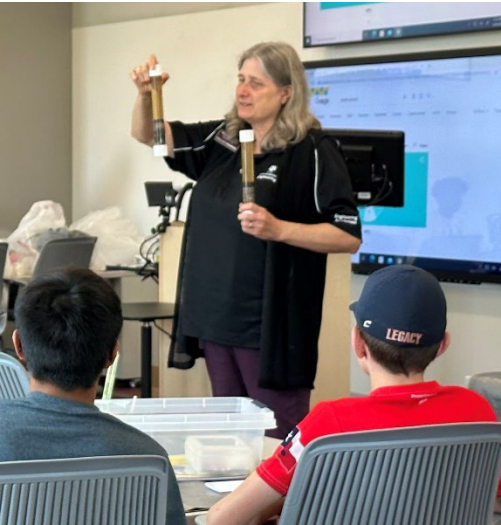
learn how to effectively use service-learning resource kits in their own watersheds. Through the developmental process, the project team created and organized the service-learning kits to be utilized for the 4-H Water Ambassadors.

Youth Education Training for Students			
Total Number of Events	9	Overall Numbers Reached	185
4-H Water Ambassador Retreat; Brownwood, TX; October 30, 2021			
Tier III 4-H2O Leadership Academy; New Braunfels, TX; July 17, 2022			
Tier IV 4-H2O Leadership Academy; San Antonio, TX; July 31, 2022			
4-H Water Ambassadors Fall Retreat; State 4-H Conference Center; Lake Brownwood, Brownwood, TX ; October 21 - 23, 2022			
4-H Water Ambassadors Spring Retreat; Burnet, TX; May 20, 2023			
Wetlands Camp; Seagoville, TX; June 5, 2023			
Tier IV 4-H2O Leadership Academy; Seagoville, TX; June 17, 2023			
Sustainability Summit; Seagoville, TX; June 26, 2023			
Trinity River Crew Internship; Dallas, TX ; June 29, 2023			



3. **Youth Education Community Events:** Project partners were to coordinate and participate in 10 community events to educate youth in targeted communities on water quality, nonpoint source pollution, watershed protection, and other relevant topics. Five of these events were to occur in conjunction with youth education trainings for teachers, while the other five events were to serve as stand-alone events or with already-established community events; all events were to be located in priority watershed areas. Through the developmental process, the project team identified over a dozen priority locations for these events, developed watershed-based design challenges for students to engage with at events, and identified opportunities to share the project’s educational resources and information through engagement with existing community events.

Youth Education Community Events			
Total Number of Events	14	Overall Numbers Reached	4,047
Nuclear Power Institute (NPI) Science on Saturday (SOS); Wharton County Junior College; Bay City, TX; October 23, 2021			
Texas A&M EnVision Conference; Texas A&M University; College Station, TX; October 30, 2021			
Chevron Design Challenge; Texas A&M University; College Station, TX; December 9-10, 2021			
Roscoe ISD Water Festival; Roscoe, TX; November 5, 2021			
Bowen Elementary's Scream for STEAM Night; Bryan ISD; Bryan, TX; October 28, 2022			
Spring Branch ISD HCC Academy Campus Visit; Texas A&M University; College Station, TX; November 3, 2022			
Promotion of: Active Community and Citizen Education for Science and Stewardship Water Workshop; Dallas College Sustainability Summit; Dallas, TX; November 4, 2022			
Texas A&M EnVision Conference; Texas A&M University; College Station, TX; November 13, 2022			
Blinn College Engagement Event for Brenham High School; Blinn College, Brenham, TX; February 3, 2023			
Land, Water and Wildlife; Northwest ISD, North Lake, TX; April 4, 2023			
Hill County Water Days; Hillsboro, TX; April 12 - 13, 2023			
EarthX Expo & Conference 2022; Fair Park, Dallas, TX; April 21 - 23, 2023			
Region 15 STEAM Expo; San Angelo, TX; June 13 - 14, 2023			
Summer Science Caravan; Texas A&M University; College Station, TX; July 20, 2023			



4. **Youth Programming Events:** Working with Texas A&M AgriLife County Extension Agents, project partners were to present at least five already-established youth events within priority watershed areas. Events were to include, but were not limited to, youth agricultural days, Earth Day events, county “Water Days,” 4-H meetings, and other relevant educational opportunities.

Youth Programming Events			
Total Number of Events	10	Overall Numbers Reached	1,397
Seymour ISD Water Day; Seymour, TX; March 23, 2022			
Harris County Water Day; Houston YMCA; Houston, TX; July 11, 2022			
Brazos County Fair; Bryan, TX; October 21 - 23, 2022			
Franklin ISD STEAM Night; Franklin, TX ; November 14, 2022			
EarthX Expo & Conference 2023; Fair Park, Dallas, TX; April 21 - 23, 2023			
Land, Water and Wildlife; Brenham, TX; April 27 - 28, 2023			
Easton Park's Earth Day Market 2023; Bryant Park, Austin, TX; April 29, 2023			
Navarro County Water Day; Corsicana, TX; May 10, 2023			
Pecos County Water Day; Iraan, TX; May 12, 2023			
Harris County Water Day; Katy, TX; June 6, 2023			



5. Professional Conferences (listed below)

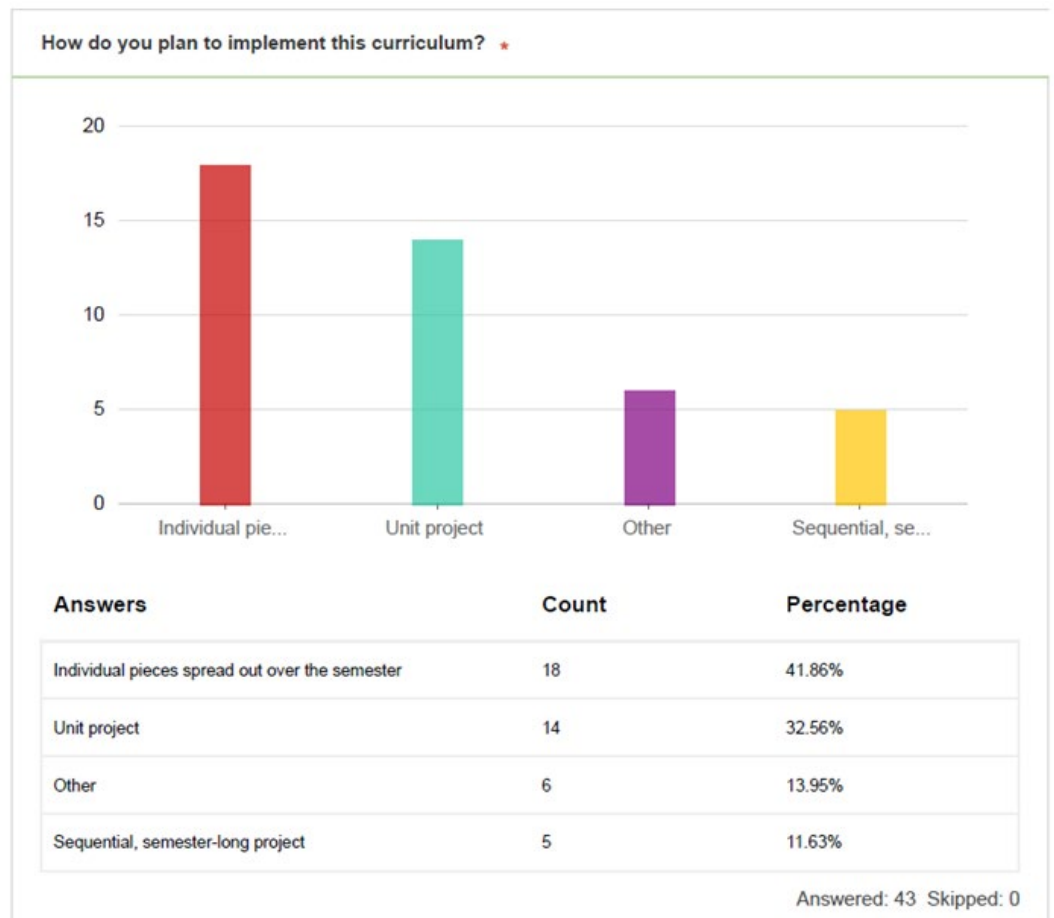
- **Conference for the Advancement of Science Teaching (CAST) 2021 and 2022:** Hosted by the Science Teachers Association of Texas, the annual 3-day CAST conference brings together science educators and advocates from across Texas and the southwestern US to inspire and transform science instruction. Project staff from AgriLife Dallas and Spark! attended to promote the ACCESS Water Project and host a one-day ACCESS Water Educator Professional Development Workshop for attendees of the conference.
- **STEM 4 Innovation Virtual Conference for K-12 Education 2021 and 2022:** This virtual conference is hosted annually by TEES and Spark! at Texas A&M University to provide Texas K-12 formal and informal educators, administrators and counselors ideas, strategies and resources to encourage more of their students to pursue careers in STEM. Project staff from AgriLife Dallas attended to promote the ACCESS Water Project.
- **National Water Quality Monitoring Conference 2023:** This annual, multi-day conference brings together professionals from a variety of backgrounds including federal, state, tribal, nonprofit, academic, consulting, industry and volunteer organizations and is hosted by the National Water Quality Monitoring Council. Presentations and discussions focused on the conference theme of Working Together for Clean Water. Project staff from AgriLife Dallas attended to co-present on the ACCESS Water Project, water education and CCS with partnering staff from the Texas Stream Team, The Meadows Center for Water and the Environment at Texas State University.
- **Citizen Science Association Conference 2023:** Convening across several disciplines, roles, and perspectives, traditional and innovative practices in Citizen Science are shared to lead powerful partnerships for discovery, learning, and action. The Citizen Science Association hosts this multi-day conference annually and invites interdisciplinary abstracts to be submitted for cross-cutting symposia, interactive workshops, engaging talks, and dynamic posters. Project staff from AgriLife Dallas attended to co-lead a session on water education and CCS, including information from the ACCESS program.

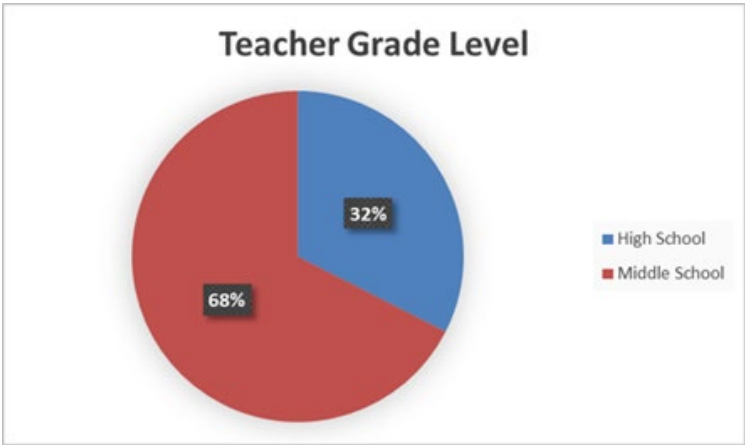
EVALUATION OF ACCESS WATER WORKSHOPS

Based on program feedback from participating educators, the ACCESS Water Educator Professional Development Workshops and educational materials are an overwhelming success. Out of 64 educators that participated in a training workshop, 43 completed an evaluation survey (67% response). A summary of participant responses is included below.

Survey Description: ACCESS Water participants completed this survey after participating in one of six ACCESS Water Professional Development Workshops. Combined responses from all workshops included below (for locations of participant schools see ACCESS Events Map on page 9).

Survey Responses:





3. What additional resources could help you implement the ACCESS Water Materials in your classroom?

Unknown	12	30%
None	9	20%
Water Testing supplies: Tampling (4), WQ testing (2), Macro (1)	7	16%
Presentation slides and links	3	7%
Time/Practice	3	7%
Reminders/Follow-up communications	2	4%
Other	7	16%
TOTAL	43	100%

**Each response only coded once for most prominent theme*

4. What was your favorite part of this workshop?

Tampling	12
Resources, supplies, information provided	11
Instructors/Presenters, energy, enthusiasm	8
Citizen science	6
All of it	6
Real world, difference, impact to the classroom, community	5
Hands on	3
Local	2
Easy and low-cost	2

Digital microscope	1
Insects	1
Practical ways to sample and report data	1
Going outside to participate in observations	1
Nature walk	1
5E alignment	1
Application to classroom	1
Collaboration	1
Encouraging	1
Eye-opener	1

**Responses coded multiple times for each theme present*

Select Quotes from Participants:

- “The wealth of information.”
- “The resources to help my students be community scientists on Monday!!”
- “My favorite part was learning about the tampling and the real world experience we were able to have.”
- “The instructors and resources.”
- “The energy, hands on, so much information! Loved it but need time to digest.”
- “Speakers were absolutely a delight to listen to and engage with. There was not a slow or boring part the whole morning! Water talks can be so discouraging, this was uplifting and encouraging!”
- “I am totally hooked! This has been my favorite time of the entire conference!”
- “Seeing how the tampling is already making a difference”
- “My favorite part was learning about the tampling and the real world experience we were able to have.”
- “Literally. All of it!!!”
- “Learning about all of the hands on applications to administer and can bring to the classroom”
- “All of it! Easy to use and cheap materials that can be easily used for impactful science.”
- “I enjoyed the entirety of the workshop. Everything was new to me.”

5. What can we do to improve?

Nothing, N/A, Unknown, or Positive Feedback only (34) (79%)

- · Nothing. You were great.
- · Great stuff
- · Everything flowed really well and was very informative.
- · N/A
- · Nothing
- · N/A
- · N/a
- · Good
- · ???
- · Nothing, it was wonderful!
- · It was great!
- · Nothing it was great!
- · Nothing as of yet!!
- · This training was awesome and the activities are simple yet impactful. I cannot think of a way to improve right now.

- · Nothing
- · Keep doing what your doing!!!
- · Nothing that I can think of.
- · Y'all were great!
- · Not one thing :)
- · N/A
- · Can't think of anything to improve!
- · Nada
- · Nothing!
- · All good for now!
- · Nothing
- · You all did great!
- · Can't think of anything else
- · I'm not sure. I'll have to reflect.
- · Not sure
- · None
- · Nothing
- · N/a thank you for everything
- · Nothing at this time
- · At this time I can not think of anything to improve.

Pacing of activities (3) (7%)

- Add in spaced activities through out the day.
- Integrate some hands on in the morning as well. I just feel like it would help prevent information overload, because there is a lot of information.
- Practice using and doing some of the activities

More time, longer workshop (3) (7%)

- I just wish it was longer. Everything was great!
- I wish it was a three-day thing, but there was a lot of information provided/printed, so thank you!
- More time:-)

Other (3) (7%)

- There were a lot of websites and links, which is good but they seemed a bit difficult to find/, overwhelming. Too much focus on north texas-- would have preferred things to be catered to my area! We spent a little too much time at the beginning on the why--I was already sold on that signing up. Would have preferred more time with the actual resources.
- Share the information from teachers on how they are implementing this in their class
- **Bring coffee**

*Each response coded once for most prominent theme

6. Overall impressions, feedback, comments, etc. (select quotes from participants):

Very interesting for adults and students
Would love to attend any PD from this group!!!
Great place to start for getting students active for outside activities.
I thought the content was very engaging and I like that I have specific things to take back to my classroom. There was a lot of information, but I don't feel like it was so much that I don't know where to start.
I love the idea of giving my students purpose!
I loved it and am so excited to move forward. Thank you so much!
This is very inspirational.
I am so excited to take this information straight to my students!!
So much awesomeness in this session. You ladies are beyond knowledgeable about this subject.
Thank you. I'm very excited about doing this project and others with my students.
Love all the resources and links to things we can dig into more
Easy, hands-on toolkit to have students participate in their local water quality education! I also loved the enthusiasm of the presenters and teachers :)

7. "After attending this workshop, I'm hopeful..."

I can implement this and become part of the Texas Stream Team
That my students have greater awareness of water quality issues.
That teachers will implement sampling with their students
That my students will be as excited as I am to do some of these activities and projects!
That I can bring things to the classroom and get good engagement in these things.
to spark some interest in my students who may have not been introduced to this type of fun and exciting way to be part of science!
My kids will be contributing to scientific data!
That we can make change and grow citizen scientists.
That I can help my students realize that they can be part of the solution
To help my students feel motivated to make an impact

To help impact our local water source positively
My students will have meaningful learning from the content.
Students will get involved and realize their information can be helpful.
I can encourage students to get in involved in their local resources and also globally (yay citizen science!)
To bring more real world to my kiddos
I have the resources to implement real world applications of their sci skills and knowledge
to engage my students in real world problems and solutions, and in citizen science
That we can inspire and change the future

Evaluation of ACCESS Water Workshops - Summary:

Overall, the vast majority of participants reported enjoying the workshop, and nearly all intend to use all or part of the workshop materials (ACCESS Water Classroom Toolkit) in their classroom in the upcoming school year. Follow-up interviews with several educators revealed that field trips are increasingly challenging, and they are hopeful that the CCS materials especially will allow them to include the outdoor components as independent study projects for students. Our team has also received multiple requests from educators for additional workshops, and longer workshops with more in-depth content, which indicates a need and ability for ACCESS Water Materials to expand to new audiences in future.

CONCLUSION

In conclusion, the continued statewide delivery of TWON & water resources education and outreach for students and teachers met stated program goals by creating a comprehensive toolkit of water education materials designed to provide more impactful youth water education programming for students and educators in the state of Texas. There is an anticipated long-term impact via the reach of deliverables as several of the educational resources and programs are intended to be utilized by students and educators after the conclusion of this project. These deliverables with high potential to continue their educational engagement include the future career paths of hundreds of students whom engaged with the project’s engineering water design activities, 6,000 - 12,000 middle and high school students annually via the 64 participating educators in the ACCESS Water Project who are planning to utilize the ACCESS Water Materials and Program in their classrooms, and dozens of 4-H Water Ambassadors who are expected to continue utilizing service-learning toolkits to teach peers and other youth about water quality testing and watershed pollution at future 4-H club meetings, in schools, and at community events.

The trainings, events and educational materials developed through the course of this project specifically met project goals by filling the following Texas Water Education Needs Assessment areas:

- 1. Additional low-cost, accessible and TEKS-aligned materials for middle and high school students in the form of the ACCESS Water Curriculum and Teacher Guide Classroom Toolkit, with 5 learning modules aligned to the current and incoming standards for Texas 7th-12th grade students, as well as expansion engineering, research, technology and Gifted & Talented (GT) activities to meet youth career development needs.**
- 2. Provided online water education materials that are relevant to local water concerns by connecting learning with ongoing CCS and watershed water monitoring research through an ArcGIS Online community engagement platform.**
- 3. ACCESS Water learning modules include student-led outdoor CCS data collection activities, which have shown to be successful for increased student engagement and improved learning gains with outdoor, hands-on learning.**

4. **The ACCESS Water program, through these materials, online interface and training framework, has the potential to improve impacts of youth water education programs on behavior, including adoption of BMPs for potential load reduction of anthropogenic inputs.**

Research and pilot feedback from this program confirm that the ACCESS Water Education framework, designed for (a) youth participants to take immediate action on lessons learned by CCS activities and water quality monitoring on local waterbodies, and (b) the youth action component is supported by the wider community and centered around local concerns through an online geographic hub, can increase educational impacts; and are already leading to subsequent impacts in water quality

(refer to:

- Presentation for National Water Quality Monitoring Conference 2023: *Volunteer Monitoring of Optical Brighteners in Texas Waterways: Education and Research Opportunities* (Appendix D),**
- ArcGIS StoryMap for National Water Quality Monitoring Conference 2023: *A Tamplimg Story: Citizen Science Monitoring of Wastewater Leaks using Tampons* (Appendix E), and**
- Poster for Citizen Science Association Conference 2023: *“Tamplimg” for ACCESS* (Appendix F)**

These innovative tools, supported by extensive training and community engagement across the state, provide an unparalleled opportunity for youth and their educators, families and wider communities, to become water quality education ambassadors for Texas.

REFERENCES

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APPENDIX

Appendix A - Texas ACCESS Water Curriculum and Teacher Guide Classroom Toolkit (see “Texas ACCESS Water Curriculum.PDF” as an attachment to this report)

Appendix B – Optical Brightener Monitoring “Tamplimg” Hub [Available at <https://ob-tamplimg-citizen-science-hub-pmaps-tx.hub.arcgis.com/>]

Appendix C – ACCESS Water Education Resource Library [Available at <https://ob-tamplimg-citizen-science-hub-pmaps-tx.hub.arcgis.com/pages/Citizen%20Science%20and%20Tamplimg%20Resources>]

Appendix D – Presentation for National Water Quality Monitoring Conference 2023: *Volunteer Monitoring of Optical Brighteners in Texas Waterways: Education and Research Opportunities* [Available at https://youtu.be/2rZl5ij7PIk?si=LeV-3IMETsSj_Tmy]

Appendix E – Map for National Water Quality Monitoring Conference 2023: *A Tamplimg Story: Citizen Science Monitoring of Wastewater Leaks using Tampons* [Available at <https://storymaps.arcgis.com/stories/459b6b098a4949fd80046700dc64c0fb>]

Appendix F - Poster for Citizen Science Association Conference 2023: “*Tamplimg*” for ACCESS (see “Tamplimg for ACCESS.PDF” as an attachment to this report)

Appendix G – ACCESS Water: Community Science Teacher Workshops flyer (see “ACCESS Water Workshops flyer.PDF” as an attachment to this report)

Appendix H – Teacher JMG & ACCESS Water Training flyer (see “JMG and ACCESS flyer.PDF” as an attachment to this report)

Appendix I – ACCESS Water: Professional Development Workshop Presentation (see “ACCESS Water Workshop Presentation.PDF” as an attachment to this report)