

Continued Coordination of the Leon River Watershed Protection Plan Implementation

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Continued Coordination of the Leon River Watershed Protection Plan Implementation

CLEAN WATER ACT §319(h) NONPOINT SOURCE GRANT PROGRAM

TSSWCB PROJECT 18-11

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TEXAS WATER RESOURCES INSTITUTE TECHNICAL REPORT - 551

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Acronyms

AU	Animal Unit
BMP	Best Management Practice
BRA	Brazos River Authority
BST	Bacteria Source Tracking
EPA	United States Environmental Protection Agency
ERIC-PCR	Enterobacterial Repetitive Intergenic Consensus Sequence
NRCS	Natural Resources Conservation Service
NRI	Texas A&M Natural Resources Institute
OSSF	On-Site Sewage Facility
SWCD	Soil & Water Conservation District
TCEQ	Texas Commission on Environmental Quality
TSSWCB	Texas State Soil & Water Conservation Board
TWON	Texas Well Owner's Network
TWRI	Texas Water Resources Institute
TMDL	Total Maximum Daily Load
WQMP	Water Quality Management Plan
WC	Watershed Coordinator
WPP	Watershed Protection Plan

Executive Summary

A watershed protection plan (WPP) for the Leon River below Proctor Lake and above Belton Lake was developed with funding from the Texas State Soil and Water Conservation Board (TSSWCB) and the United States Environmental Protection Agency (EPA). The WPP received final acceptance from the EPA in 2015. A full-time watershed coordinator position was considered critical in initiating and carrying out the implementation process by the watershed steering committee. This watershed coordinator position was filled by a local individual in a full-time capacity until late 2021. That person moved on and the Texas Water Resources Institute (TWRI) took over the role in a limited capacity. The watershed coordinator provided technical assistance to stakeholders, coordinated outreach and education efforts, assisted in securing funding for bacteria source tracking (BST), and tracked water quality to identify implementation impacts. Education and outreach efforts have included workshops, field days, and presentations by the watershed coordinator and other relevant experts. Implementation efforts have proven successful with several assessment units being delisted from the states list of impaired waterbodies, while several others have been proposed to be delisted by the Texas Commission on Environmental Quality (TCEQ). However, eight of the twelve assessment units in the watershed remain impaired due to elevated bacteria concentrations. Additionally, bacteria concentrations are generally trending higher across the watershed despite implementation efforts to date.

Introduction

Project Background

Segment 1221 of the Leon River (Figure 1) is bound by Proctor Lake upstream and Belton Lake downstream. It is roughly 190 miles long and its watershed covers approximately 1,375 square miles including portions of Comanche, Bell, Erath, Hamilton, Coryell, and Mills Counties. The watershed is in the Brazos River Basin and is a predominantly rural, agricultural watershed dominated by rangeland with some cropland. Forests cover a sizable portion of the watershed and dairy production exists in the northern portion of the watershed.

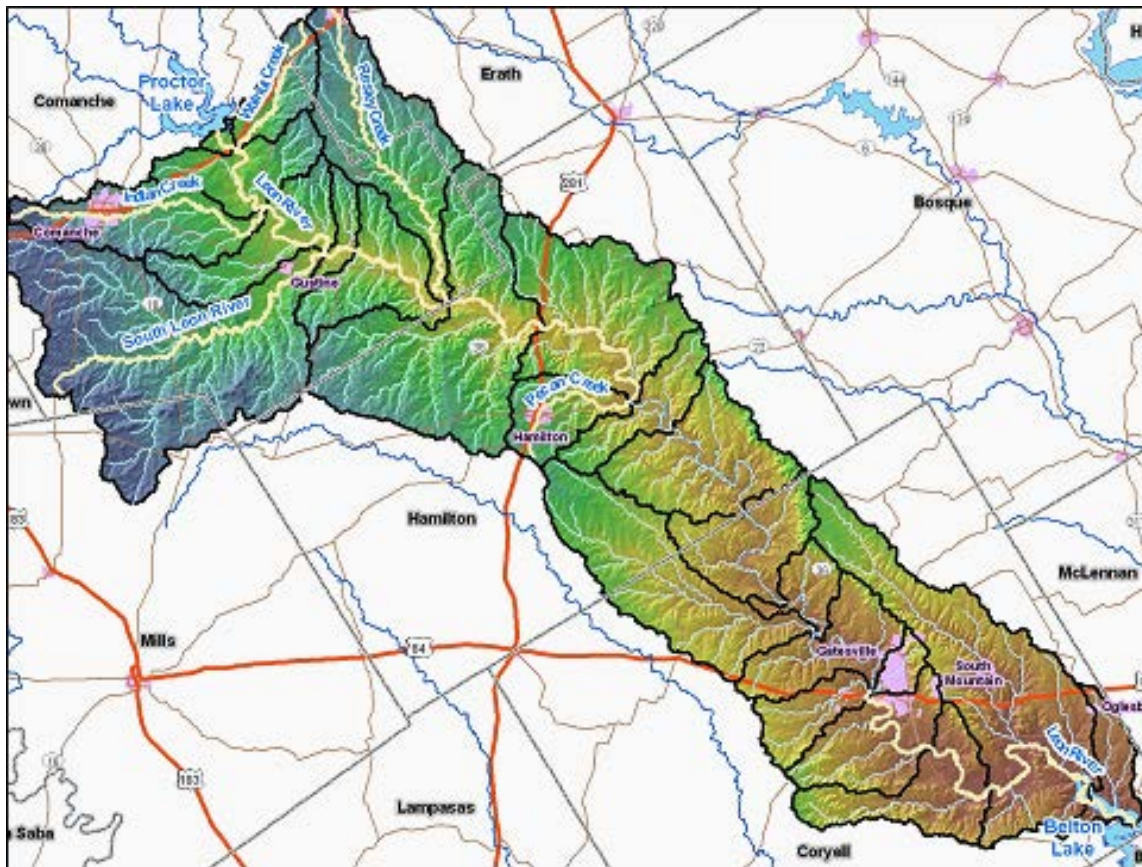


Figure 1. Leon River watershed and subwatershed boundaries

In 1996, Segment 1221 was placed on the *Texas 303(d) List* of impaired waters for bacteria levels “Not Supporting Contact Recreation Use.” The *2008 303(d) List* identified all but two of the segment’s assessment units as impaired or having a concern for near non-attainment resulting from elevated *E. coli* levels. Additionally, five tributaries of the Leon River have been listed as impaired for bacteria (1221A – Resley Creek, 1221B – South Leon River, 1221C – Pecan Creek, 1221D – Indian Creek, and 1221F – Walnut Creek); however, 1221C – Pecan Creek was delisted on the 2010 Integrated Report as it now meets the water quality standard for bacteria. As of the

2022 Texas 303(d) List, only one assessment unit of segment 1221 remains impaired. Resley Creek, Pecan Creek, and Indian Creek remain impaired and Coryell Creek (1221G) was added to the impaired list.

These listings of the Leon River and its tributaries on the §303(d) List caused the TCEQ to initiate development of a total maximum daily load (TMDL). A draft TMDL was published by TCEQ in 2008 that indicated a 21% bacteria load reduction would be needed to restore water quality in the Leon River. During the TMDL development process, stakeholders sought to initiate a voluntary WPP for the Leon River. Through TSSWCB project 06-12, *Leon River Watershed Protection Plan Project*, the WPP for the Leon River below Proctor Lake and Above Belton Lake was completed in fall 2011. Sources of bacteria identified in the Leon River WPP include deer, dead animals, feral hogs, human (wastewater facilities, sanitary sewer overflows, septic systems) storm water runoff from forestland, rangeland, cropland, residential commercial and industrial areas, and dairy waste application fields. The WPP identified needed implementation measures and milestones, estimated financial costs for individual management measures and outreach and education activities, responsible parties, and load reductions expected from full implementation of all management measures.

Measures implemented to reduce bacteria loads from agricultural nonpoint sources include providing: 1) technical assistance to agricultural producers for development and implementation of Water Quality Management Plans (WQMPs) to reduce bacteria loading from livestock operations; 2) financial incentives to agricultural producers for implementing best management practices (BMPs) prescribed in the WQMPs; and 3) allocating Environmental Quality Incentives Program funds by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS). Funding for development and implementation of WQMPs (1 and 2 above) was provided during Fiscal Year (FY) 2009-2013 through the NRCS Agricultural Water Enhancement Program project entitled *Water Quality Improvement Project for the Leon River*.

Management measures implemented to reduce bacteria loading across the watershed focused on addressing impacts from various sources. Local funding has supported feral hog removal efforts in Coryell County and the TSSWCB supports a feral hog Extension position that conducts feral hog education programs in priority watersheds including the Leon River watershed. Loading reductions from wastewater include facility improvements by the cities of Comanche and Hamilton and the Upper Leon River Municipal Water District; identification and inspection of onsite sewage facilities (OSSFs) in Coryell and Hamilton counties; and subsequent provision of technical and financial assistance to homeowners for the repair, replacement, or removal of failing OSSFs in Hamilton County. Funding for OSSF inspection and technical and financial assistance provided through a federal Clean Water Act §319(h) Nonpoint Source Grant administered by the TSSWCB and TCEQ from the U.S. EPA.

Brazos River Authority (BRA) personnel served as the watershed coordinator (WC) during WPP development. From June 2013 to October 2021, the Texas A&M Natural Resources Institute (NRI) housed a WC in the watershed with funding from the Central Texas Council of Governments and the TSSWCB. Since October 2021, a WC has not been in the watershed. Instead, TWRI kept implementation going through education and outreach events and information distribution.

The WC serves as the primary conduit for interaction with landowners, citizens, and entities to facilitate WPP implementation. The WC coordinates meetings with the Leon River watershed steering committee and stakeholders, to update them, seek their input and recommendations on needed activities, and continue to support and facilitate WPP implementation. Assistance is also provided to cities, counties, local boards and businesses with acquiring resources to enable WPP implementation. The WC works with state and federal agencies, as needed, to bring technical and financial assistance to the watershed. Other roles and responsibilities include evaluating WPP implementation progress and assessing water quality data in relation to achieving load reductions. Coordinating outreach and education efforts, distribution of newsletters, factsheets, and website content and scheduling programs such as Lone Star Healthy Streams, Riparian Workshops for Landowners, and the Texas Watershed Stewards workshop are all under the WC's purview.

Project Goals

- To foster coordinated assistance activities for the Leon River WPP stakeholders
- To conduct regular stakeholder meetings to encourage citizen participation, provide partners with updates on progress, and seek stakeholder input and recommendations on needed activities
- To support and facilitate the Leon River WPP stakeholders in identifying management measures to improve water quality, developing proposals to acquire funding for implementation of management measures, managing and tracking implementation projects as well as encouraging adoption of BMPs
- Evaluate progress toward achieving milestones established in the WPP
- Coordinate and conduct water resources and related environmental outreach/education efforts across the watershed

Tasks & Accomplishments

Task 1 – Project Administration

The Leon River WC prepared electronic quarterly progress reports and hosted various meetings and conference calls throughout the project. Project meetings discussed project activities, project schedule, communication needs, deliverables, and other issues. Project expenditures have been completed and final billing was completed shortly after the project end date. Less than \$100 dollars in budgeted funds should remain once final billing is complete.

Task 2 – Support and Facilitation of WPP Implementation

The objective of this task is to ensure that stakeholder involvement in WPP implementation continues and results in completion of planned implementation tasks. The Leon River WC worked with local Soil and Water Conservation Districts (SWCDs), NRCS offices, County Commissioners, Extension Agents, Texas Parks and Wildlife Biologists, and others to facilitate Leon River WPP implementation. The WC regularly attended SWCD and Commissioner Court meetings to give updates on the Leon River WPP.

Acquisition of Financial and Technical Resources

The WC worked with various governmental and non-governmental organizations in the Leon River watershed to identify and acquire financial and technical resources for WPP implementation as follows:

- The WC communicated and coordinated with USDA NRCS and Animal and Plant Health Inspection Service to direct the use of feral hog abatement funds in the northern part of the watershed.
- The WC partnered with TWRI to have BST work conducted in the watershed through the statewide BST project funded by TSSWCB.
- The Coryell County OSSF Repair and Replacement project funded by TCEQ to address failing OSSFs was completed during the project period.
- Numerous discussions were held with watershed stakeholders regarding the need to address flooding, and park development; however, no funds were secured for these efforts.

Implementation Tracking

During the project, the WC worked to document progress toward implementing items included in the WPP. Progress was documented in project quarterly reports. Highlights of implementation efforts completed during this project period include:

- 19 OSSFs were repaired or replaced

- Monitoring resumed on several assessment units of the river by Brazos River Authority
- Distribution of information resources through newsletters, events, programs and presentations

Water Quality Monitoring Assessment

Water quality wise, the WC routinely attended and participated in annual Clean Rivers Program meetings at the BRA offices in Waco and semi-annual Watershed Coordinator Roundtable meetings around the state. The WC advocated for additional water quality sampling to be carried out in the watershed. At the beginning of this project, a total of 14 sites were being monitored on the Leon River below Proctor Lake and its tributaries (Coryell, Indian, Pecan, Plum, Resley and Walnut creeks and the South Leon River). In 2019, a monitoring site was added on the Leon River north of Gustine at Comanche County Rd 340. This site continues to be monitored and is on the schedule for monitoring next year as well.

E. coli concentrations over the past 20 years are largely static to trending downward except for Coryell and Resley Creeks (Appendix A). Despite these trends, one portion of the Leon River and Coryell, Pecan, Indian and Resley Creeks remain impaired due to elevated *E. coli* concentrations. No new waterbody delistings occurred in the watershed during this project, but data trends suggest that WPP implementation continues to positively influence water quality across most of the watershed.

Stakeholder Engagement

NRI launched the watershed website (<http://leonriver.tamu.edu>) on June 6, 2013 to serve as a public clearinghouse for project- and watershed-related information. Meeting announcements, agendas, presentations, documents, and results were posted to this website along with press releases, newsletters, and links to social media outlets and YouTube channel, Water News, and education and outreach opportunities throughout the state, are highlighted through social media. Posting on the web page and social media outlets ceased when the full time WC resigned. Watershed stakeholders were also kept informed through direct communications and presentations at local events.

Bacteria Source Tracking Results Comparison

Between February 2011 and January 2012, Texas A&M AgriLife Research collected 116 water samples from flowing water at 15 sampling stations in the Leon River watershed as part of TSSWCB Project 10-51. Samples were analyzed to identify bacteria sources present. The geometric mean of data from all 15 sites was 60.6 cfu/100 mL. Up to five isolates per sample were analyzed with a combined method of enterobacterial repetitive intergenic consensus sequence (ERIC-PCR) and RiboPrinting. A total of 566 isolates from 114 water samples were fingerprinted and identified using the Texas *E. coli* BST Library v. 10-12.

Between September 2020 through August 2021, NRI collected water samples from the Leon River watershed at four different sites from (Figure 2) for BST analysis. These four sites were monitored in the original BST assessment conducted in 2011/2012. Samples were delivered to AgriLife Soil and Crop Science for processing. Up to eight isolates from each of the 12 monthly samples collected for each of the four sites, were tested and confirmed as *E. coli* and archived. Collectively, the geometric mean for the *E. coli* colony counts for all four sites combined was 301 cfu/100mL. All isolates were fingerprinted using ERIC-PCR and RiboPrinting. A total of 406 *E. coli* isolates were fingerprinted and compared against Texas *E. coli* BST Library v. 04-22.

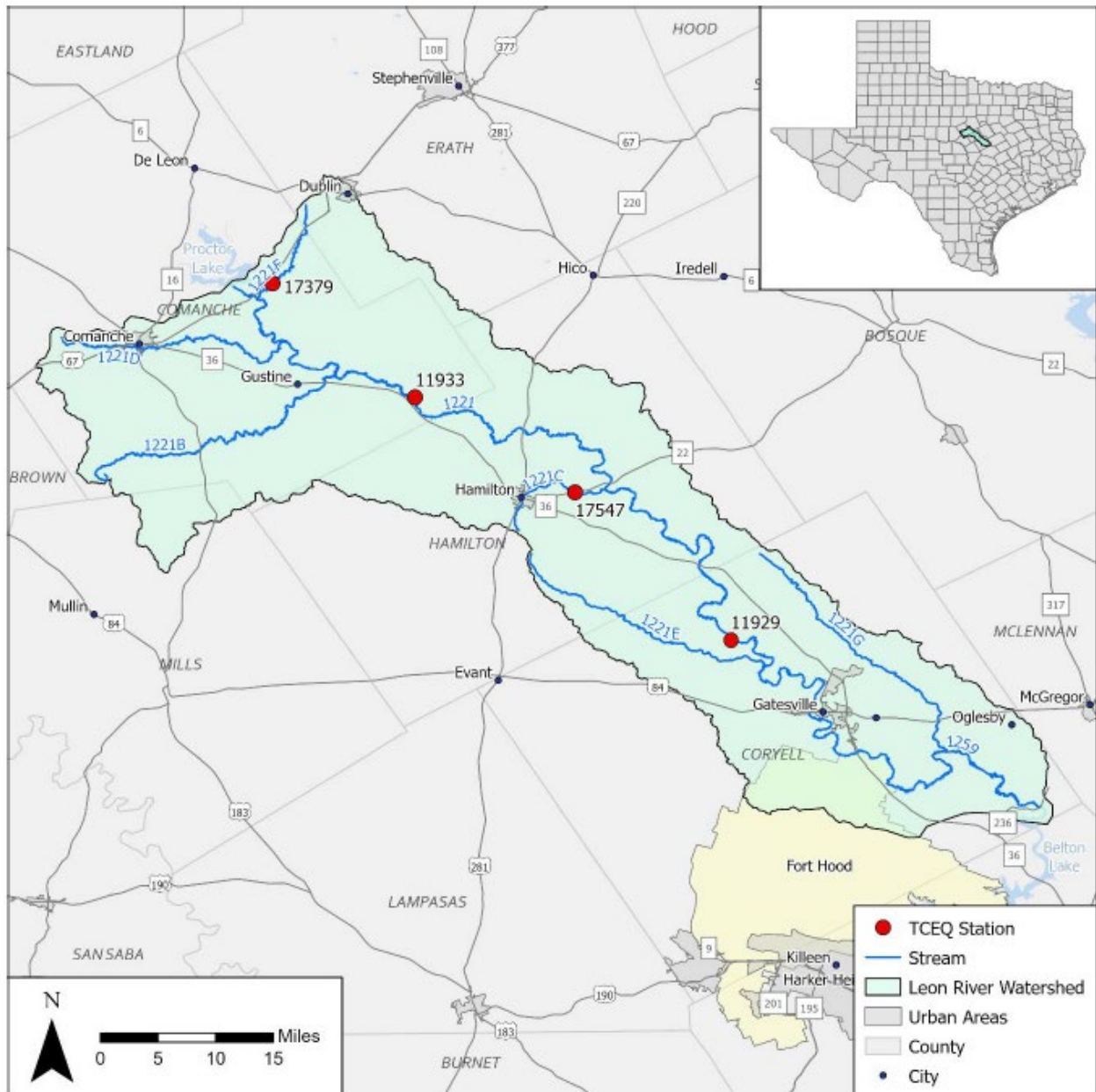


Figure 2. Leon River watershed sampling locations for BST assessment

Data from the two BST assessments were compared to identify what differences if any in bacteria source contribution occurred because of WPP implementation. Source categories including humans, pets, cattle, other livestock – avian, other livestock – non avian, wildlife – avian, wildlife – non avian, and unidentified were evaluated.

Wildlife was the major *E. coli* contamination contributor in the Leon River watershed during both assessments; however, a slight percentage decrease of 44% to 38% (non-avian) and 16% to 13% (avian) in 2020–2021 occurred. Human-derived *E. coli* isolates decreased slightly from 8% to 4% in 2020–2021 and other avian livestock decreased from 2% to 1% in 2020–2021. All other source classes, including unidentified, slightly increased in 2020–2021 (Figure 3).

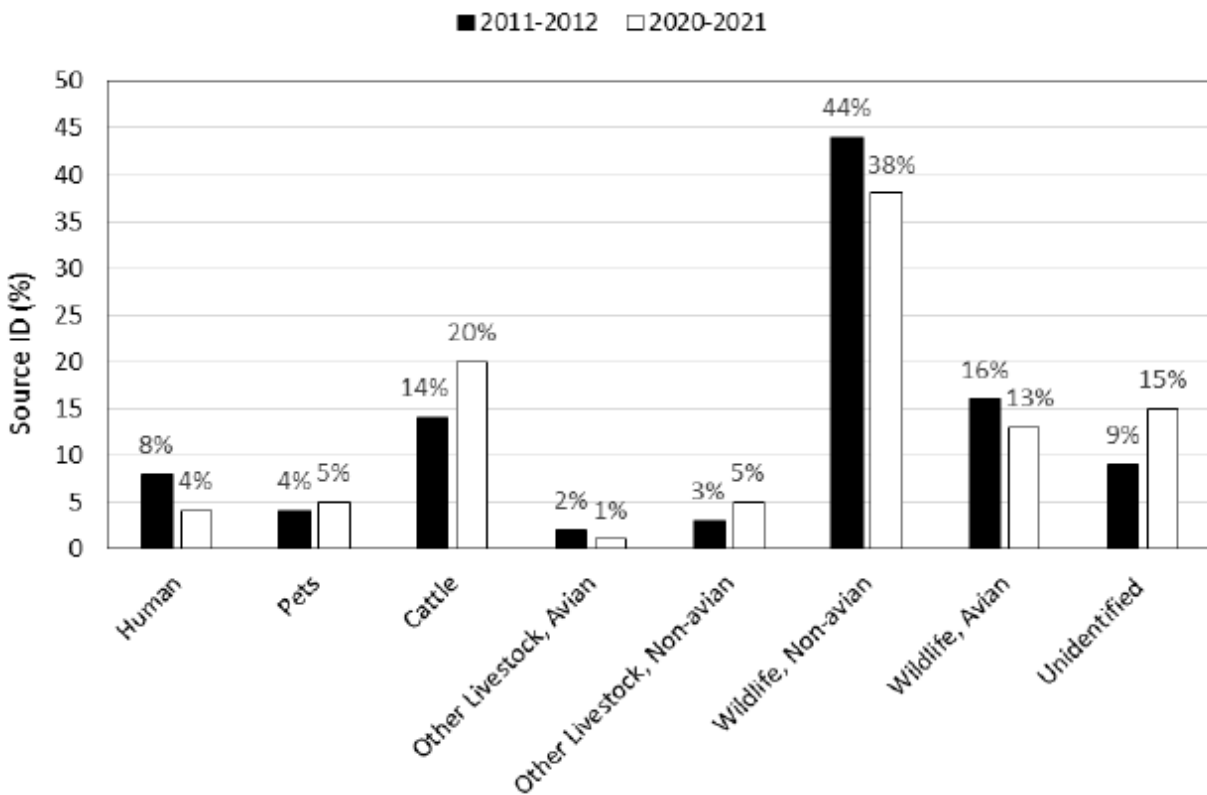


Figure 3. Comparison of *E. coli* source class identifications between 2011/2012 vs 2020/2021

Following initial BST work in 2011/2012 in the Leon River watershed, several rounds of implementation funding were dedicated to repairing and replacing failing OSSFs. These efforts were focused in Hamilton and Coryell counties. Centralized wastewater treatment facilities in the cities of Comanche and Hamilton and another system operated by the Upper Leon River Municipal Water District were all upgraded to improve their treatment processes. These actions all have direct impacts on instream water quality and BST results suggest that they reduced human derived *E. coli* contributions into the Leon River watershed.

Of note is the fact that the 2011-2012 Leon River project documented water quality and quantity conditions observed under exceptional drought conditions characterized as the worst 1-year drought documented in Texas since record keeping began in 1895. Normal average annual rainfall for the area is approximately 30 inches. However, precipitation during the sampling period totaled only 11.67 inches. These extreme drought conditions may account for drastically lower *E. coli* geometric means observed compared to the 2020 –2021 campaign.

Task 3 – Outreach, Education, and Community Support

During the project, the WC worked with local county Extension agents and program leaders to schedule and host available statewide education programs on relevant topics. In total, four events were hosted at various locations across the watershed. News releases and flyers for events are presented in Appendix B.

Texas Watershed Steward Program

A Texas Watershed Steward Program was held in Jonesboro, Texas on December 11, 2018. This program provided science-based, watershed education to help citizens identify and take action to address local water quality impairments. Texas Watershed Steward program participants learn about the nature and function of watersheds, potential impairments, and strategies for watershed protection. In total, 37 watershed stakeholders attended this event that is funded through a Clean Water Act §319(h) nonpoint source grant from the TSSWCB and the U.S. EPA.

Texas Well Owner Network Program

The Texas Well Owner Network program focuses on delivering training on how well owners can protect ground water quality and aquifer integrity by emphasizing best management practice implementation. The free training for residents allows participants to become familiar with groundwater resources, septic system maintenance, proper well design, well maintenance, water quality and water treatment options. As a result, participants have a better understanding of the relationships between practices in or near wells and the quality of water available for drinking and irrigation. The program also includes voluntary private water well screening events that provide information to the well owner about their actual water quality. In total, 10 watershed stakeholders attended this event that is funded through a Clean Water Act §319(h) nonpoint source grant from the TSSWCB and the U.S. EPA.

Riparian and Stream Ecosystems Workshop

A free Texas Riparian and Stream Ecosystems Workshop was held in Gatesville, Texas on September 7, 2021. The training focused on the nature and function of stream and riparian zones and the benefits and direct impacts from healthy riparian zones. The riparian education program covered an introduction to riparian principles, watershed processes, basic hydrology, erosion/deposition principles, and riparian vegetation, as well as potential causes of degradation and possible resulting impairment(s), and available local resources including technical assistance and tools that can be employed to prevent and/or resolve degradation. A total of 15 stakeholders

attended the workshop. This program was funded by a Clean Water Act grant provided by the Texas State Soil and Water Conservation Board and U.S. EPA.

Lone Star Healthy Streams Program

The Lone Star Healthy Streams program was delivered April 19, 2023, in Gatesville to educate Texas livestock producers and landowners on how to best protect Texas waterways from bacterial contributions associated with livestock production and feral hogs. Workshop presentations focus on watershed health and will discuss basic watershed function, water quality, and specific best management practices that can be implemented to help minimize bacterial contamination originating from beef cattle, horses, and feral hogs. A total of 25 watershed stakeholders attended this event. This program was funded by a Clean Water Act grant provided by the Texas State Soil and Water Conservation Board and U.S. EPA.

Other Workshops and Educational Opportunities

Other workshops and educational programs were supported by the WC including:

- Coryell County Ag Day – Gatesville, Texas. September 20, 2018. Presentation and handouts promoting ranch stewardship.
- Riparian Watershed Management Workshop – San Antonio, Texas. November 6, 2018. The Effects of Feral Hogs on Riparian Areas.

Mail Based Education & Outreach in the Lampasas River Watershed

An educational 6”x11” postcard (“mailer”) with information about cattle stocking rates, indicators of overstocking, and conservation actions to correct stocking rate issues was developed by TWRI and approved by NRCS and TSSWCB personnel and sent to agricultural producers in the Lampasas River watershed. Pictures were included on the mailer to provide visuals of overstocked pastures contrasted with correctly stocked pastures. The mailer also contained an explanation of financial and technical assistance available and contact information for the appropriate local NRCS/SWCD offices for Burnet and Lampasas counties.

TWRI acquired an original mailing list of 616 addresses from NRCS, containing known producers with five or more acres within the watershed. The original mail list was checked by Advertising Mail Corp., Inc. (“Admail”, College Station, TX) and 580 deliverable addresses were verified. Mailer #1 was distributed on April 4, 2022. Mailers #2-4 were sent quarterly thereafter, on July 25, 2022, October 3, 2022, and January 4, 2023, respectively. After each mailing, non-deliverable addresses were removed from the next mailer’s contact list. Table 1 provides information about the distribution of mailing contacts throughout the project, including contacts with local (addresses within Burnet and Lampasas counties) and non-local (outside Burnet and Lampasas counties) producers.

Table 1. Number of educational mailers delivered.

	Mailer #1	Mailer #2	Mailer #3	Mailer #4	Total
Local	557	538	526	524	2,145
Non-local	23	22	22	20	87
Total	580	560	548	544	2,232

Impact on NRCS Planning Efforts

The NRCS planning numbers varied throughout the project with several possible explanations. Implementation numbers steadily increased over time with the number of applied practices. A noticeable spike occurred in 2021, which is evident in NRCS implementation numbers for other counties throughout Texas. This spike is likely a result of the increase in land management activities and program interest during the COVID-19 pandemic in 2020, which was noted by offices around the state as an influx of new landowners entered the producer population.

While 2021 presents a valid measure of applied practices, it should be compared to other annual data with caution, as it was an exceptionally above-average year for conservation planning throughout the state as seen in range management conservation practices applied in the watershed before and during the project period (Table 2). Of note, prescribed grazing plan numbers steadily increased, with 2022 remaining above average despite the potential shift introduced by the exceptional 2021 year. More notably, Prescribed Grazing (Conservation Practice 528) constituted a greater proportion of total conservation practices implemented in 2022 than in 2019 and 2020. This suggests that a greater proportion of conservation activity in the watershed is being focused on prescribed grazing, including developing and implementing a written prescribed grazing plan with NRCS assistance.

Table 2. Range management conservation practices applied within the project watershed.

Practice	2019	2020	2021	2022
Prescribed Grazing (ac.)	3,424	3,830	8,892	5,935
# of Prescribed Grazing Practices	10	18	25	21
% of Total Applied Practices	19.6	24.3	30.0	27.5
Fence (ft.)	22,156	26,283	13,817	19,493
Livestock Pipeline (ft.)	7,316	1,504	6,682	7,931
Watering Facility (no.)	5	6	5	4
HUAP (sq. ft.)	944	613	708	236
Brush Management (ac.)	1,210	4,287	2,447	1,645
Range Planting (ac.)	236	254	278	408
Pond (no.)	-	1	-	1
Total number of applied practices	51	74	79	70

Post-mailer Evaluation Results

Approximately six weeks after distribution of the fourth mailer, a prenotice postcard was sent to the 544 remaining addresses that received the full complement of mailings. The postcard was designed to raise awareness of the upcoming evaluation and detailed its purpose and scope. One week later, the evaluation packet was sent out. The packet contained a four-page evaluation, information sheet, cover letter with instructions, and business reply envelope. The following week, a reminder postcard was sent to all addresses to prompt action and thank individuals who had already responded. All materials and procedures, including the mailer, postcards, evaluation questionnaire, study information sheet, and cover letter were approved by the Texas A&M Institutional Review Board prior to distribution.

Of the 544 survey packets sent out, 16 were returned as non-deliverable, reducing the evaluation population to 528. In total, 105 responses were received (19.9% response rate). Of the 105 responses, 73 were not eligible to contribute to the survey. The primary reasons provided for ineligibility were that the respondent did not work the land (e.g., had a wildlife exemption), worked the land but did not own cattle, or no longer owned or leased land within the applicable counties. The final count for completed usable responses was 32.

Respondents mostly had cattle operations Lampasas County ($n = 25$, 78.1%). Additionally, six respondents operated in Burnet County (18.8%) and one respondent operated in Bell County (3.1%). Operation types were primarily cow/calf ($n = 30$, 93.8%), one operation was described as genetic/breeder (3.1%), and one listed as a hobby operation (3.1%). Three cow/calf operations listed secondary operation types, which included feedlot ($n = 2$) and stocker ($n = 1$). The median acreage per producer was 159 acres, with a range between 7 and 4,411 acres.

Of all 32 respondents, 15 (46.9%) recalled that they received the mailer. Of those recipients, self-assessed knowledge about information categories presented on the mailer generally improved (Table 3). A few respondents also stated they acted or intend to act on mailer information by making a grazing plan ($n = 3$, 20%), changing their stocking rate ($n = 3$), installing new practices ($n = 3$), or contacting NRCS or SWCD offices for assistance ($n = 2$, 13.3%).

Table 3. Self-assessed changes in knowledge due to mailer.

Category of Knowledge	Before Mailer	After Mailer	Difference
Where to get conservation assistance	2.67	2.93	0.26
Warning signs of overstocking	2.73	2.93	0.20
Issues caused by overstocking	2.93	3.20	0.27
Benefits of balanced stocking rates	2.80	3.20	0.40
How to adjust stocking rates	2.67	3.00	0.33

Knowledge scale: 1 = Poor, 2 = Fair, 3 = Good, 4 = Excellent

To further understand educational needs, respondents were asked what their current information sources and preferred education formats were. Number of grazable acres available to the producer ($n = 14$) was a commonly used information source to make decisions about stocking rate. No respondents reported using NRCS or SWCD local office guidance to make stocking rate decisions. Physical print materials ($n = 15$) were the most preferred education resource format followed closely by in-person courses or seminars ($n = 12$), online videos or demos ($n = 11$), and online written materials ($n = 10$). The least preferred method was an online course or seminar ($n = 7$).

When asked about activities related to livestock management and stocking rates, respondents had mixed experiences. Many respondents have never measured grass height before or after grazing ($n = 21$; $n = 25$), worked with the local NRCS or SWCD offices ($n=22$), or installed shade structures ($n = 18$). Most producers had previously installed or planned to install cross fencing and water structures. Most producers actively use rotational grazing ($n=17$).

This evaluation offered a unique opportunity to ask producers about their experience with severe drought that occurred in 2022 and their perspectives on future droughts. Nearly two-thirds of the respondents ($n = 22$, 71%) reduced herd size in 2022 to adapt to severe drought that impacted the watershed. Only seven respondents felt they were fully prepared for the drought. Most respondents ($n = 21$) expected to change their preparedness for future droughts based on their experience with the drought of 2022. Finally, most producers ($n = 25$, 78.1%) stated they expected another severe drought to occur within the next 10 years.

Finally, producers were asked about their acreage available and stocking rates. The median grazed acreage was 159 acres, with a range of 7 to 4,411 acres. Producers were also asked to report the number of each animal unit classification from the National Range and Pasture Handbook present in their herd in an average year, including cow (dry), cow (with calf), cattle (1 year old), cattle (2 years old), and bull (mature). The median herd size was 18 head per respondent, with a range of 2 to 418 head. Using the animal unit (AU) conversions in the National Range and Pasture Handbook, each type of animal was converted into the standard animal units prescribed for calculating stocking rate: cow (dry) as 0.92 AU, cow (with calf) as 1.0 (AU), cattle (1 year old) as 0.6 AU, cattle (2 years old) as 0.8 AU, and bull (mature) as 1.35 AU (Pate et al., 2022). Using this conversion, the median AU per herd for each respondent was 15.7 AU, with a range of 1.6 AU to 364.3 AU. Given the available data on grazing area and herd size, the median acres per AU for respondents was calculated at 11.3 ac./AU, with a range of 2.3 ac./AU to 31.5 ac./AU.

According to the respective County Appraisal District 1-D-1 guidelines, Lampasas County recommended stocking rate is 20 acres per AU and Burnet County recommended stocking rate is 15 to 30 acres per AU (Burnet CAD, 2019; Lampasas CAD, 2021). No specific stocking rate was

provided by the Bell County Appraisal District. Using the associated stocking rate recommendations, 77.4% of respondents were considered overstocked.

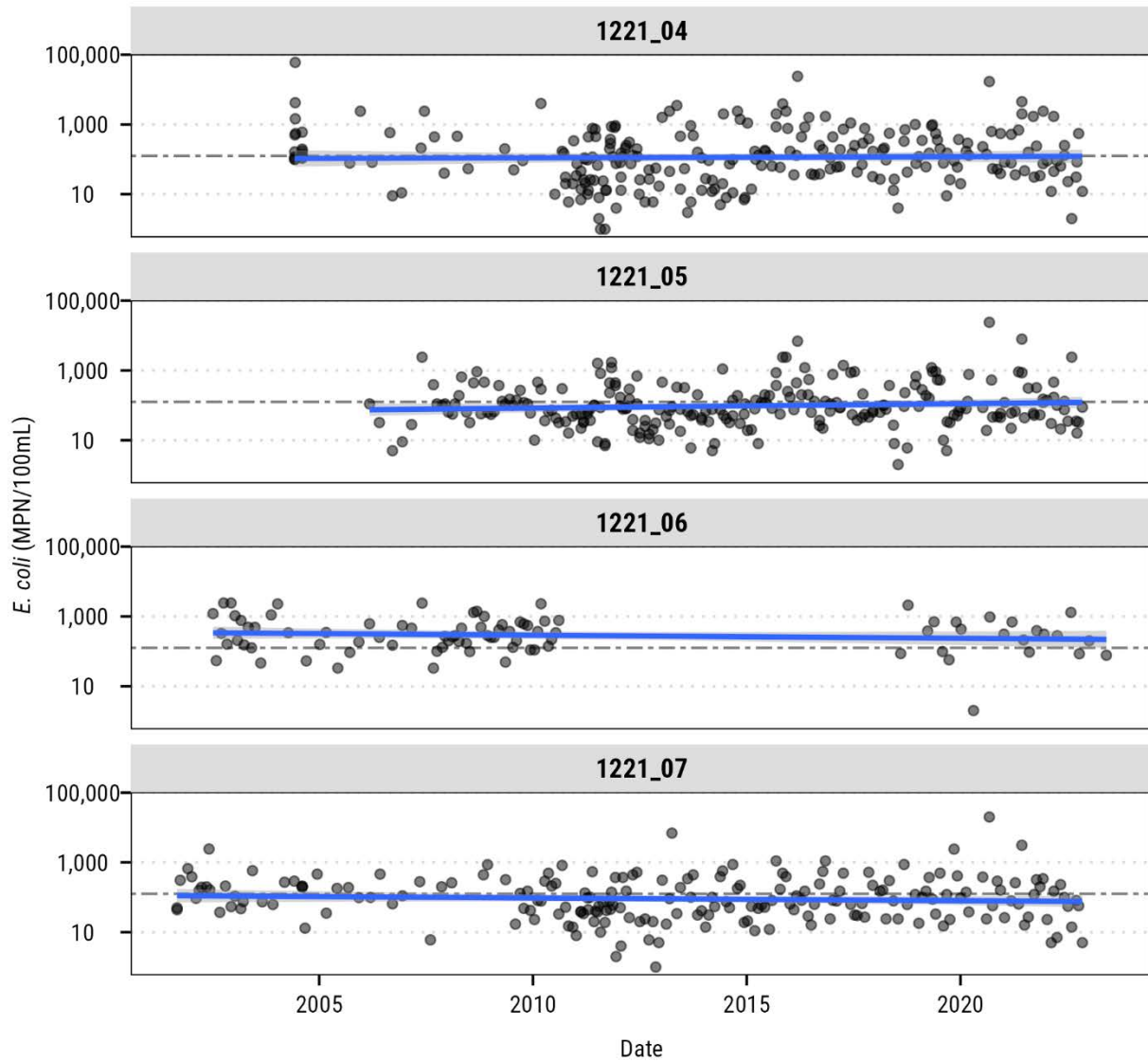
Conclusions

Educational mailers were responsible for over 2,000 contacts with more than 500 landowners during the project period. While the study's scale limits conclusions that can be drawn, there is evidence that mailers improved recipients' knowledge regarding conservation assistance sources, overstocking warning signs and issues, balanced stocking rates benefits, and how to adjust stocking rates. Additionally, mailers prompted some recipients to act by making a grazing plan, changing stocking rate, installing practices, or contacting NRCS or SWCD offices for assistance.

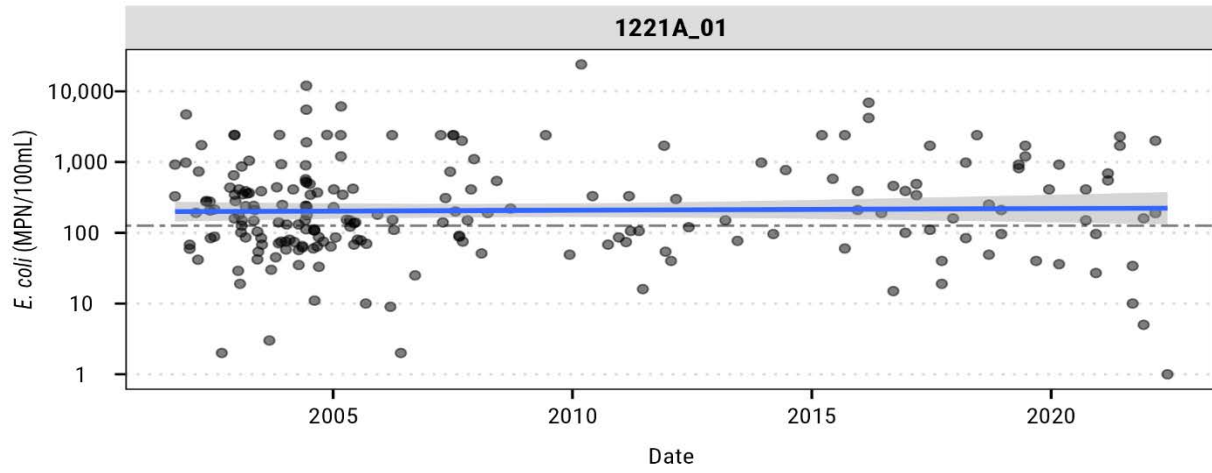
The advantage of this mailing program is that it provides education and outreach to stakeholders who may not traditionally attend in person programming. Many respondents indicated that they would be receptive of educational resources other than in-person courses. Conservation professionals should take advantage of alternative methods when possible to maximize their reach in water resource stewardship topics and advancing adoption of proper land management practices. Direct mailing is one alternative method available to reach producers consistently at a relatively low cost with minimal time and effort. This method is also adaptable to various topics that relate to water issues throughout Texas, which allows outreach and education professionals to adapt quickly to changing needs for target audiences.

Appendix A: *E. coli* Concentration Trends

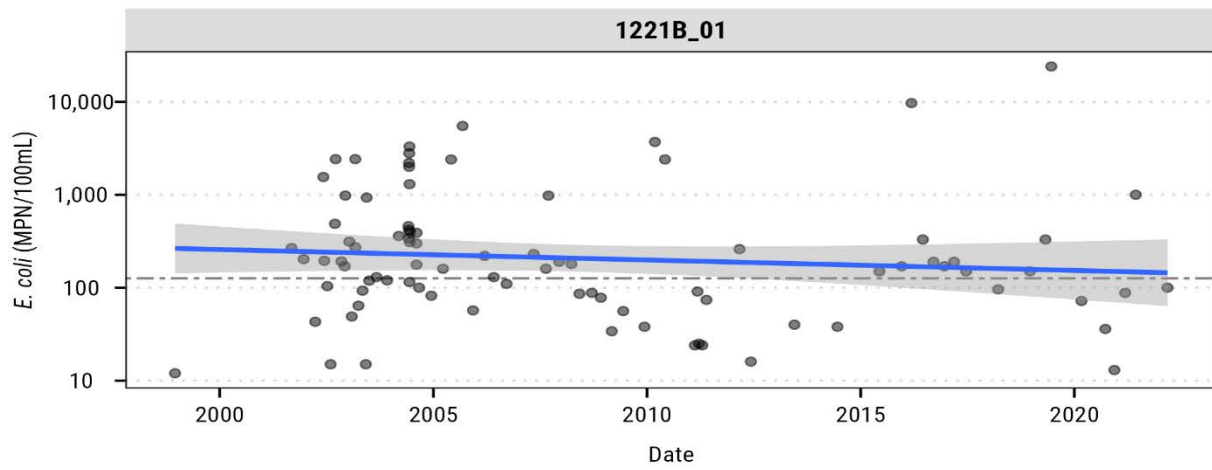
Leon River assessment units from the river's confluence with Plum Creek up to Proctor Lake.



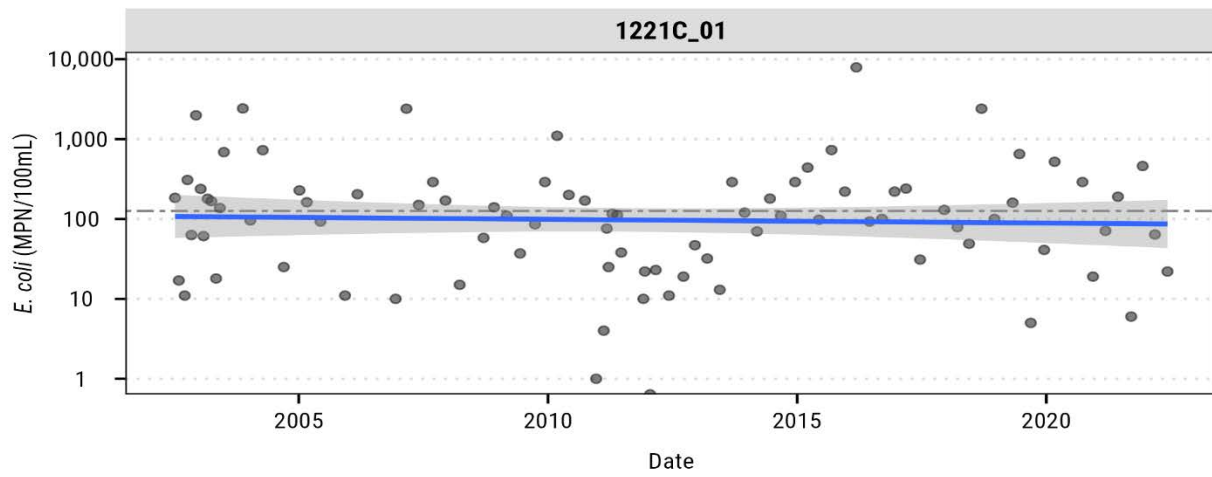
Resley Creek



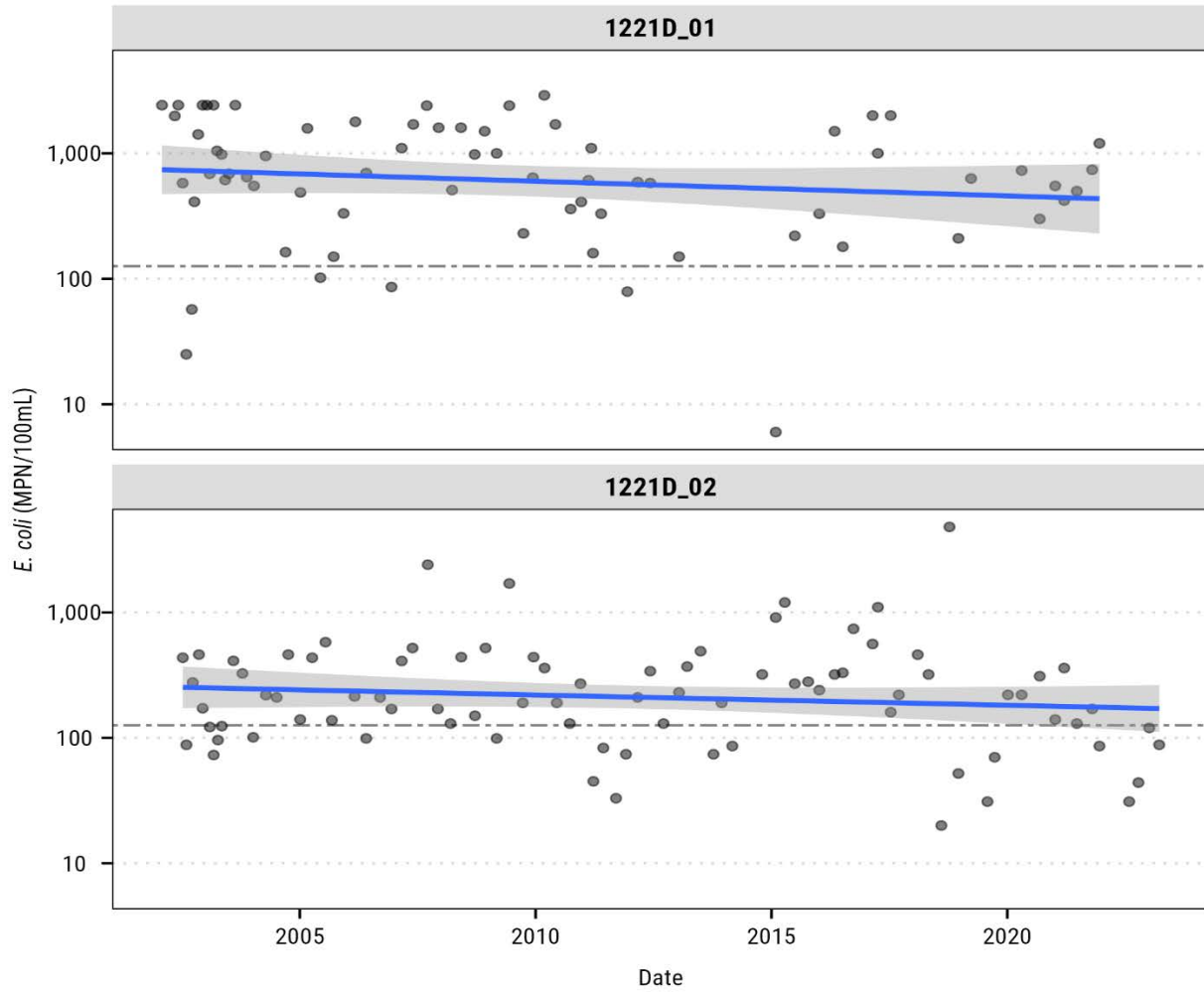
South Leon River



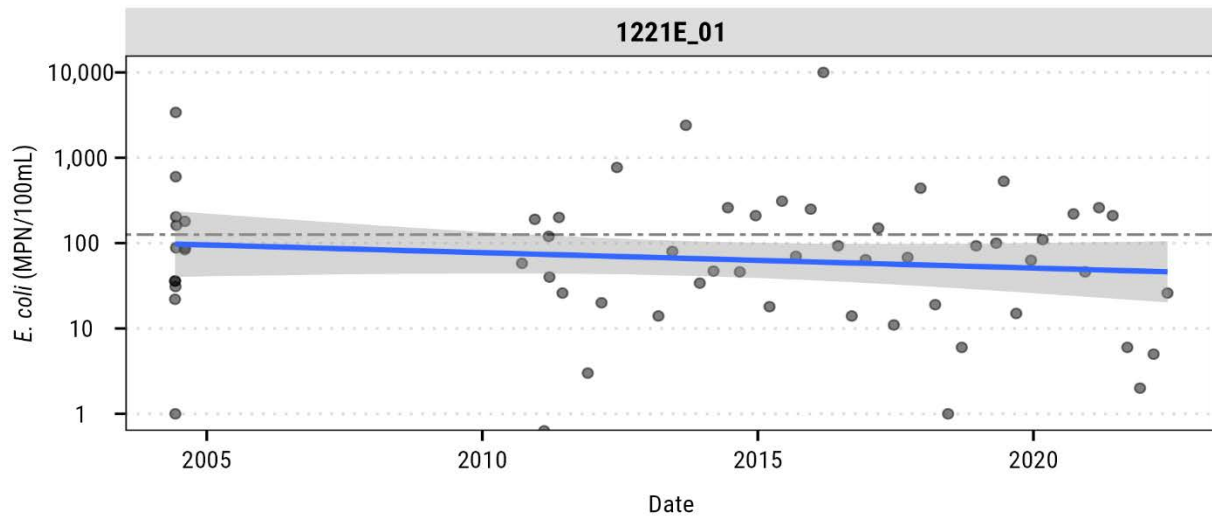
Pecan Creek



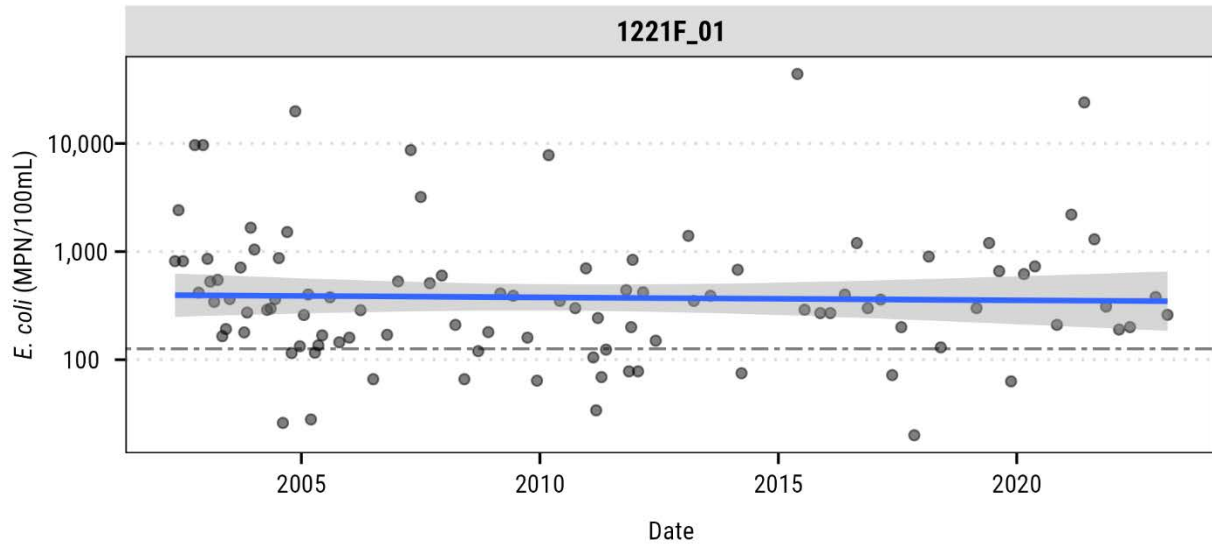
Indian Creek



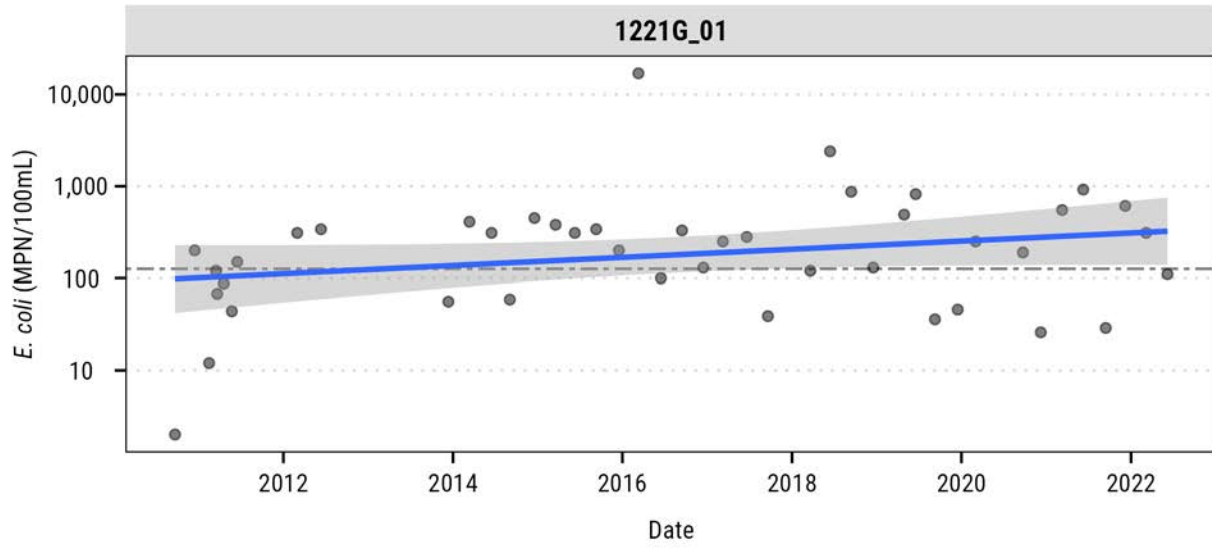
Plum Creek



Walnut Creek



Coryell Creek



ENVIRONMENT

Water quality training Dec. 11 in Jonesboro to focus on Leon River

NOVEMBER 9, 2018



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Michael Kuitu, 979-862-4457, mkuitu@tamu.edu
JONESBORO – A Texas Watershed Steward workshop on water quality related to the Leon River will be held from 1-5 p.m. Dec.11 at the Jonesboro Community Center, 11625 Texas Highway 36 in Jonesboro.



It is free and open to anyone interested in improving water quality in the region.



A Texas Watershed Steward workshop related to water quality in the Leon River will be held Dec. 11 in Jonesboro. (Texas Watershed Steward program photo)

The workshop is presented by the Texas A&M AgriLife Extension Service and the Texas State Soil and Water Conservation Board in cooperation with the Texas A&M Natural Resources Institute.

“This workshop is designed to assist watershed residents improve and protect their water resources by becoming involved in watershed protection and management activities for the Leon River,” said Michael Kuitu, AgriLife Extension program specialist and coordinator for the Texas Watershed Steward program, College Station.

He said participants are encouraged to preregister at the Texas Watershed Steward website at <https://tw.s.tamu.edu>.

The workshop will include a discussion of watershed systems, types and sources of water pollution as well as ways to improve and protect water quality. There also will be a group discussion on community-driven watershed protection and management.

“The workshop will include an overview of water quality and watershed management in Texas, but will primarily focus on area water quality, including current efforts to help improve and protect the Leon River,” said Bruce Boyd, AgriLife Extension agent for Hamilton County. “It will address issues related to local water resources but will be applicable to all waters in the region.”

Surface water in the Leon River is a critical source of water in the area, said Andy James, project coordinator with the Texas A&M Natural Resources Institute who is based in Gatesville.

“Our goal is to protect and improve water quality in the Leon by providing technical assistance and high-quality education to citizens, landowners, and agricultural producers about water quality management practices,” James said.

Attendees of the workshop will receive a copy of the Texas Watershed Steward Handbook and a certificate of completion. The Texas Watershed Steward program offers four continuing education units in soil and water management for certified crop advisors, four units for professional engineers and certified planners, four credits for certified teachers, and two credits for nutrient management specialists. A total of four professional development hours are available for professional geoscientists.

In addition, three general continuing education units are offered for Texas Department of Agriculture pesticide license holders, and four for certified landscape architects. Four continuing education credits are provided to certified floodplain managers. Four continuing education credits are also offered for each of the following Texas Commission on Environmental Quality occupational licensees: wastewater system operators, public water system operators, on-site sewage facility installers, and landscape irrigators.

“Participating in the Texas Watershed Steward program is a great opportunity to get involved and make a difference in your watershed,” said Robert Ferguson, AgriLife Extension agent for Coryell County.

Funding for this effort is provided through a federal Clean Water Act §319(h) nonpoint source grant administered by the Texas State Soil and Water Conservation Board from the U.S. Environmental Protection Agency.

For more information on the Texas Watershed Steward program and to preregister, go to the website or contact Kuitu at 979-862-4457, mkuitu@tamu.edu; Boyd at 254-386-3919, bruce.boyd@ag.tamu.edu; or Ferguson at 254-865-2414, robert.ferguson@ag.tamu.edu.

For information on watershed protection efforts for the Leon River watershed, contact James at 254-223-3056, andy.james@tamu.edu.

ENVIRONMENT

Water well owner training set for Nov. 7 in Gatesville

OCTOBER 10, 2019



The Texas Well Owner Network will present a Well Educated training and water well screening Nov. 7 in Gatesville. (Texas Well Owner Network photo)

A Texas Well Owner Network, or TWON, training has been scheduled for 8 a.m.-12 p.m. Nov. 7 at the Gatesville Civic Center, 301 Veteran's Memorial Drive in Gatesville.

The "Well Educated" training is free and open to the public.

Joel Pigg, [Texas A&M AgriLife Extension Service](#) program specialist and TWON coordinator, College Station, said the TWON program is for Texas residents who depend on household wells for their water needs.

"The program was established to help well owners become familiar with Texas groundwater resources, septic system maintenance, well maintenance and construction, and water quality and treatment," Pigg said. "It allows them to learn more about how to improve and protect their community water resources."

He said participants may bring well-water samples to the training for screening at a cost of \$10 per sample, due when samples are turned in. Samples will be screened for nitrates, total dissolved solids and bacteria.

Well owners who would like to have their well water sampled can pick up two sample containers from the AgriLife Extension office in [Coryell County](#), 303 Veteran's Memorial Drive in Gatesville or the AgriLife Extension office in [Hamilton County](#), 101 E. Henry St. in Hamilton.

Pigg said bringing water samples to the training is not required, but those wanting to have water samples analyzed must attend.

Attendees can register for the screenings at the [Texas Well Owner Network](#) website or by calling 979-845-1461.

"The training is one of several being conducted statewide through the Texas Well Owner Network project," Pigg said. "The core content of this program is the same as other trainings, but the information is tailored to local water quality issues and aquifers."

More than a million private water wells in Texas provide water to citizens in rural areas and increasingly to those living on small acreages at the growing rural-urban interface.

Private well owners are independently responsible for monitoring the quality of their wells.

“They are responsible for all aspects of ensuring their drinking water system is safe — testing, inspecting, maintaining it,” Pigg said. “This training will help private well owners understand and care for their wells.”

Funding for the Texas Well Owner Network is through a Clean Water Act nonpoint source grant provided by the Texas State Soil and Water Conservation Board and the U.S. Environmental Protection Agency. The project is managed by [TWRI](#), part of [Texas A&M AgriLife Research](#), [AgriLife Extension](#) and the [College of Agriculture and Life Sciences](#) at Texas A&M University.

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Leon River watershed workshop set for Sept. 7

Participants must sign up by Sept. 1 for the free event

AUGUST 12, 2021



The Texas Water Resources Institute, TWRI, will host a free [Texas Riparian and Stream Ecosystem Education Program](#) from 8 a.m.-4:30 p.m. Sept. 7 in Gatesville for area residents interested in land and water stewardship in the Leon River watershed.

The morning session will be at the M.J. Hanna Ranch, 500 Hanna Ranch Road, Gatesville. The afternoon session will include a walk and presentations along the river.

All attendees must [RSVP online](#) or by email to Clare.Entwistle@ag.tamu.edu by Sept. 1. The program will include a lunchtime presentation. A catered lunch is being offered for \$15 or participants may select to bring their own lunch.



The Leon River of Central Texas. (AgriLife Extension/Natural Resources Institute photo by Andy James)

The workshop is co-hosted locally by the [Natural Resources Institute](#), the [Texas A&M AgriLife Extension Service in Coryell County](#), [Texas Riparian Association](#) and TWRI.

The Leon River watershed

The Leon River, a 190-mile stream in north Central Texas, is the focus of watershed planning efforts by stakeholders.

“Stakeholders recognize successful implementation of a watershed protection plan requires implementing a variety of management strategies,” said Andy James, AgriLife Extension program coordinator and Leon River watershed coordinator. “The riparian and stream workshop is an educational event supporting this effort.”

Clare Escamilla, TWRI research associate, San Antonio, said the workshop will focus on the nature and function of stream and riparian zones as well as the benefits and economic impacts from proper functioning riparian systems.

“Riparian areas — the green vegetated land area adjacent to the bank of a stream, creek, bayou, river or lake — are unique and important ecosystems that provide many benefits including habitat and forage,” Escamilla said. “The goal of the workshop is for participants to better understand riparian and watershed processes, the benefits of healthy riparian areas and what resources are available to prevent degradation while improving water quality.”

Workshop presentations will be given by representatives of TWRI, [U.S. Department of Agriculture’s Natural Resources Conservation Service](#), [AgriLife Extension](#), [Texas Parks and Wildlife Department](#), the [Texas A&M Forest Service](#) and the Texas Riparian Association.

Escamilla said they are able to offer the workshop without cost thanks to program funding provided through a Clean Water Act nonpoint source grant from the [Texas State Soil and Water Conservation Board](#) and the [U.S. Environmental Protection Agency](#).

Continuing education opportunities

Robert Ferguson, AgriLife Extension agent for Coryell County, said participants will receive a certificate of completion and appropriate continuing education unit certificates at the conclusion of the training.

The workshop offers many types of continuing education units, including three units — two general and one integrated pest management — for [Texas Department of Agriculture](#) pesticide license holders. Foresters and professional loggers can receive six hours from the [Texas Forestry Association](#) and six hours from the [Society of American Foresters](#). It offers one unit from TWRI, seven credits from [Texas Floodplain Management Association](#), seven hours for [Certified Crop Advisors](#), and six hours for Texas Nutrient Management Planning specialists. The program may also be used for continuing education units for professional engineers.

The riparian education program is managed by the [Texas Water Resources Institute](#), part of [Texas A&M AgriLife Research](#), AgriLife Extension and the [College of Agriculture and Life Sciences](#) at Texas A&M University.

For more information, contact Escamilla, visit <http://texasriparian.org> or go to Facebook at <https://www.facebook.com/TexasRiparianAssociation>.

ENVIRONMENTAL HEALTH

Lone Star Healthy Streams program set April 19 in Gatesville

Focus on minimizing feral hog, livestock contamination of Leon River Watershed

APRIL 5, 2023



A [Lone Star Healthy Streams](#) workshop will be held on April 19 at the Gatesville Civic Center, 301 Veterans Memorial Loop, Gatesville.



The workshop is offered as a joint effort by the [Texas A&M AgriLife Extension Service](#), [Texas State Soil and Water Conservation Board](#), the [Natural Resources Institute](#) and [Texas Water Resources Institute](#), TWRI.



The free workshop will run from 8 a.m. to noon. RSVP by April 17 to the AgriLife Extension office in Coryell County at 254-865-2414.



The Leon River watershed event will be April 19 in Gatesville. (Photo by Andy James)

Two [Texas Department of Agriculture](#) continuing education credits in integrated pest management for pesticide applicators are available.

The program will focus on the [Leon River Watershed](#) and discuss basic watershed function, water quality and specific best-management practices that can be implemented to help minimize bacterial contamination originating from livestock and feral hogs.

“The goal of the Lone Star Healthy Streams program is to protect Texas waterways from bacterial contamination originating from livestock, wildlife and invasive species that may pose a serious health risk to Texans,” said Leanne Wiley, AgriLife Extension program specialist and Lone Star Healthy Streams coordinator, Bryan-College Station. “The aim is to increase awareness, provide education materials to Texas producers and landowners, and encourage implementation.”

Protecting the Leon River Watershed

The Leon River watershed encompasses approximately 2,600 square miles in Bell, Hamilton, Coryell, Comanche and Erath counties. The river, located below Lake Proctor, was listed as “impaired” for having bacteria concentrations that exceed state water quality standards.

“Stakeholders recognize successful implementation of a watershed protection plan requires implementing a variety of management strategies,” said Lucas Gregory, TWRI associate director and Leon River watershed coordinator. More information on the project will be presented at the workshop.

Funding for this effort is provided through a Clean Water Act Section 319 nonpoint source grant administered by the Texas State Soil and Water Conservation Board from the [U.S. Environmental Protection Agency](#).

For more information on the workshop, contact Wiley at 979-240-8407 or leanne.wiley@ag.tamu.edu; or Robert Ferguson, AgriLife Extension agriculture and natural resources agent, Coryell County, at 254-865-2414 or robert.ferguson@ag.tamu.edu.

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TEXAS A&M AGRILIFE EXTENSION
&
LONE STAR HEALTHY STREAMS
PRESENTS:

LEON RIVER WATERSHED WORKSHOP

APRIL 19TH, 2023
8:00AM-12:00PM

GATESVILLE CIVIC CENTER
301 VETERANS MEMORIAL LOOP
GATESVILLE, TX 76528

- * Grazing Cattle BMPs
- * Weed Management
- * Feral Hog Management

2 IPM CEUs available



Workshop is FREE and open to all residents.
Focus is on Leon River Watershed, watershed function, and water quality. Includes voluntary conservation practices along with sources for technical and financial assistance designed to reduce pollutants such as fecal bacteria in our waterways.



Please RSVP to:
Coryell County AgriLife at 254-865-2414
For additional inquiries, call
Lone Star Healthy Streams at 979-240-8407

Funding for this project is provided through a Clean Water Act Section 319 Nonpoint Source Grant from the Texas State Soil and Water Conservation Board and the U.S Environmental Protection Agency.

