

Water Quality Monitoring in the Geronimo Creek Watershed and Facilitation of the Geronimo and Alligator Creeks Watershed Partnership

Guadalupe-Blanco River Authority
FY2011 CWA Section 319(h)
Project No. 11-06

Quarterly Report Number 12

Covering work accomplished July 1, 2014 through September 30, 2014

October 15, 2014

I. Abstract

Routine water quality monitoring was continued. Dry weather targeted monitoring for the fall quarter was conducted in September. The sixth newsletter, *The Geronimo Flow*, was distributed to stakeholders. A presentation on the 319(h) grant proposal that will fund nonpoint source educational activities and low impact development demonstrations at the Irma Lewis Seguin Outdoor Learning Center, located in the Geronimo Creek watershed, was made to the GBRA Board of Directors in August. The quarterly partnership meeting was held on September 9, 2014. A two-hour rainwater harvesting class was conducted on August 12, 2014 by Extension. In addition, a 30-minute presentation on rainwater harvesting was given at the quarterly meeting by a Guadalupe County Master Gardener. A presentation on septic systems and private water well protection was given at the Comal County Land and Water Expo by the Watershed Coordinator and the Geronimo and Alligator Creeks Partnership was introduced to the attendees. An audit was performed on the GBRA monitoring program and laboratory.

II. Overall Progress and Results by Task

TASK 1: Project Administration

Subtask 1.1: GBRA will prepare electronic quarterly progress reports (QPRs) for submission to the TSSWCB. QPRs shall document all activities performed within a quarter and shall be submitted by the 15th of January, April, July and October. QPRs shall be distributed to all project partners and posted to the project website.

- GBRA prepared the progress report for April through June 2014 and submitted the report on July 10, 2014.
- GBRA was granted a no-cost project extension through March 31, 2015.

87% complete – On-going

Subtask 1.2: GBRA will perform accounting functions for project funds and will submit appropriate Reimbursement Forms to TSSWCB at least quarterly.

- GBRA submitted the invoice for April through June 2014 on July 30, 2014.

87% complete – On-going

Subtask 1.3: GBRA will host coordination meetings or conference calls, at least quarterly, with Project Partners to discuss project activities, project schedule, communication needs, deliverables, and other requirements. GBRA will develop lists of action items needed following each project coordination meeting and distribute to project personnel.

- Many calls and emails were shared between GBRA, Extension, TSSWCB, and Partnership members, covering:
 - the quarterly meeting,
 - review of newsletter and newspaper articles,
 - ILSOLC grant and other opportunities, and
 - the Rainwater Harvesting Class held in August.

82% complete – On-going

Subtask 1.4: GBRA will continue to host and maintain a website (<http://geronimocreek.org/>) to serve as a public clearinghouse for all project- and watershed-related information. All presentations, documents and results will be posted to this website. The website will serve as a means to disseminate information to stakeholders and the general public. Extension shall contribute content matter for the website as appropriate.

- The Geronimo Creek Partnership webpage was updated with the Partnership meeting notice, workshop notices, and other project-related information and to post the sixth newsletter.
- Extension and GBRA updated the project web page with meeting materials.
- Web hits are monitored monthly. Web hits for July, August, and September were 1970, 2036, and 1125, respectively.
- Data tables updated through July 2014 were posted to the project website.

77% complete – On-going

TASK 2. Quality Assurance

Subtask 2.1: GBRA will develop a QAPP for activities in Task 4 consistent with the most recent versions of EPA Requirements for Quality Assurance Project Plans (QA/R-5) and the TSSWCB Environmental Data Quality Management Plan.

Consistent with Title 30, Chapter 25 of the Texas Administrative Code, Environmental Testing Laboratory Accreditation and Certification, which describes Texas' approach to implementing the National Environmental Laboratory Accreditation Conference (NELAC) Standards, shall be required.

All monitoring procedures and methods prescribed in the QAPP shall be consistent with the guidelines detailed in the TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue

(RG-415) and Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data (RG-416).

- September 29, 2014 - GBRA participated in an audit of the monitoring program by the TSSWCB contractor, Donna Long. The audit included the quality system of the laboratory and the field monitoring protocols. GBRA is awaiting the final audit report and will address any findings.

100% completed – On-going

Subtask 2.2: GBRA will implement the approved QAPP. GBRA will submit revisions and necessary amendments to the QAPP as needed.

- July 21, 2014 - GBRA submitted the annual renewal of the QAPP. Signature pages were circulated and, when completed, were submitted to TSSWCB.
- The QAPP was renewed, effective June 10, 2014. Copies of the renewed QAPP were distributed to the list of entities in Section A3 of the QAPP.

70% completed – On-going

TASK 3. Support and Facilitation of WPP Implementation

Subtask 3.1: Extension will continue to employ a Geronimo Creek Watershed Coordinator to engage and facilitate the Geronimo Creek Watershed Partnership. In coordination with GBRA, the Watershed Coordinator will be responsible for the general oversight and coordination of all project activities, be responsible for reporting requirements and directing educational activities, and serve as the primary conduit for interaction with landowners, citizens, and entities to facilitate the implementation of the WPP. The Watershed Coordinator shall successfully complete (or have already completed) the Texas Watershed Planning Short Course. The Watershed Coordinator shall participate in Texas Watershed Coordinator Roundtables and the TSSWCB Southeast and South Central Texas Regional Watershed Coordination Steering Committee meetings, as necessary.

- Major activities by Extension included:
 - the quarterly partnership meeting held September 9, 2014,
 - beginning coordination of the two On-site Septic System (OSSF) workshops, and
 - upcoming workshops to be held in the Spring 2015.
- Additional tasks completed this quarter include the drafting and production of a newspaper article advertising the Rainwater Harvesting Class conducted by Extension that ran in two local newspapers (included in QPR).
- The sixth quarterly newsletter was developed, reviewed, and distributed to stakeholders. Newsletter included in QPR.
- Two Homeowner Septic System Maintenance classes are planned for November. One will be the basic 2-hour class and one will be the 6-hour class that focuses on aerobic systems.

80% completed – On-going

Subtask 3.2: Extension will facilitate public participation and stakeholder involvement in the watershed planning process, specifically by facilitating meetings of the Partnership Steering Committee (at least quarterly) and Work Groups (as needed) to provide regular updates on the status of monitoring efforts, progress in identifying implementation funding, and movement towards water quality restoration and seek input and recommendations on needed activities. Extension will coordinate meetings, secure meeting locations, prepare and disseminate meeting notices and agendas. Meeting summaries will be prepared and posted to the project website. The WC will provide counties, cities and other partners with updates on progress of implementation of the WPP, if they are unable to regularly attend Partnership Steering Committee meetings.

- Extension produced the sixth newsletter, *The Geronimo Flow*, and distributed it to stakeholders. The newsletter was posted to the project website. Newsletter included in QPR.
- GBRA hosted the quarterly Partnership meeting on September 9, 2014. Extension facilitated the meeting. Extension prepared a press release to advertise the meeting, posted it to the project webpage, posted the meeting to the Seguin-Gazette and New Braunfels Herald-Zeitung community calendars, and emailed the notice and reminders to the Partnership. A representative from the Guadalupe County Master Gardeners presented a 30 minute presentation on how to construct a rain barrel and rainwater harvesting. Ward Ling gave a project update. Copies of the presentations and attendance sheet are attached.

80% completed – On-going

Subtask 3.3: Extension will assist governmental and non-governmental organizations (i.e., responsible parties in the Geronimo Creek WPP) in identification and acquisition of resources (financial and technical) to enable WPP implementation. Extension will actively seek and pursue funding opportunities and work with partners to develop grant proposals. The WC will work with state and federal agencies, as appropriate, to bring technical and financial resources to the watershed.

- GBRA and Extension continued to work through the final stages of approval with TCEQ for the grant proposal for the Irma Lewis Seguin Outdoor Learning Center.

70% completed – On-going

Subtask 3.4: Extension will 1) evaluate and track progress toward achieving milestones established in the WPP; and, 2) work with GBRA to assess water quality data collected through the Clean Rivers Program, this project, and other data collection efforts in relation to achieving load reductions. Extension will develop, publish, print, and distribute to stakeholders, a biennial addendum to the Geronimo Creek WPP that describes modifications/updates to goals and milestones, explains new understandings of sources and cause of water quality issues, documents success in achieving goals and milestones, and success in achieving water quality improvement and load reductions. As the WPP will be published in fall 2012, this draft biennial addendum would most appropriately be published in fall 2014. This draft biennial addendum will function as the Final Report for this project.

- Extension continued development and updating the spreadsheets for the purpose of tracking implementation activities. All implementation activities listed in Tables 8.1 and 8.2 are carefully monitored and updated as implementation proceeds.

70% completed– On-going

Subtask 3.5: Extension will coordinate education and outreach activities as identified in the Geronimo Creek WPP. GBRA will make presentations on the Geronimo Creek Partnership and WPP and general NPS pollution information to local schools and community organizations. Extension will support, promote, and participate in, as appropriate, any field days, demonstrations, site tours, or education events sponsored by AgriLife Extension, USDA-NRCS, and/or SWCDs for the Geronimo Creek watershed.

- Extension submitted meeting materials and other project-related announcements and information to GBRA for posting to the project web page.
- Extension prepared and distributed press releases for the quarterly partnership meeting.
- Extension produced the sixth newsletter, *The Geronimo Flow*, and distributed it to stakeholders. The newsletter was posted to the project website. Newsletter included in QPR.
- Extension is purchasing space in the Seguin and New Braunfels newspapers, for the purpose of publishing articles to raise awareness of the project, educate readers regarding BMPs that can have a direct impact on water quality, and to inform readers about project highlights. An advertisement for the Rainwater Harvesting Class was published twice, in preparation for the event. A copy of the advertisement is included in QPR.
- July 23, 2014 - A presentation on septic systems and private water well protection was given at the Comal County Land and Water Expo by the Watershed Coordinator and the Geronimo and Alligator Creeks Partnership was introduced to the attendees.
- August 14, 2014 – GBRA and Extension held a 2-hour workshop on Rainwater Harvesting. Sign-in sheets are included in the QPR. Copies of the presentations and handouts are available at: <http://www.geronimocreek.org/Meetings.aspx>

80% completed – On-going

Subtask 3.6: GBRA will include information about this project in GBRA newsletters (e.g., *River Run*) and Clean Rivers Program publications regarding progress to implement the Geronimo Creek WPP. GBRA will solicit content matter for these publications from Project Partners as appropriate.

- GBRA participated in the Comal County Land and Water Expo on July 23, 2014, manning a booth that provided information on the Geronimo and Alligator Creeks Watershed Protection Plan.
- Debbie Magin and Mike Urrutia attended the Watershed Coordinator's Roundtable in Waco on July 31, 2014.

- GBRA Public Communication and Education staff prepared nonpoint source pollution activity kits for use with elementary classroom activities in the Geronimo and Alligator Creeks watersheds. Kits support activity described on pages 15-18 in the “Don’t be Clueless about Water Quality” curriculum included in the QPR.
- GBRA Public Communication and Education staff made presentations on nonpoint source pollution to area classes visiting the Irma Lewis Seguin Outdoor Learning Center (ILSOLC) and the Big Red Barn (Guadalupe County Agriculture Heritage Center, educational centers located in the Geronimo Creek watershed.
- GBRA and the ILSOLC received a grant from the TCEQ NPS program for outreach and educational activities, including demonstrations on Low Impact Development. The pertinent pages, including the Scope of Work and budget for the three year program are attached. The presentation on the project given to the GBRA Board in August is also attached.

90% completed– On-going

Subtask 3.7: Extension will develop, publish, and distribute 4 semi-annual newsletters that are designed to keep landowners and entities informed of ongoing WPP implementation activities, including water quality data collection and progress toward achieving milestones in the WPP. The newsletter shall be distributed as most appropriate to individual landowners and entities in the watershed. Extension will solicit content matter for the newsletters from project partners as appropriate.

- Extension compiled the sixth newsletter, “*The Geronimo Flow*”. The newsletter was distributed via email to stakeholders and posted to the project webpage. Copy of newsletter included in QPR.
- GBRA reviewed the newsletter, prior to distribution.

75% completed – On-going

Subtask 3.8: Extension will facilitate communication with stakeholders in order to engage the public and affected entities in WPP implementation. Extension will utilize all appropriate communication mechanisms including direct mail, e-mail, the project website, and mass media (print, radio, television). Extension will develop and disseminate general project informational materials, including, but not limited to, flyers, brochures, letters, factsheets, news releases, and other appropriate promotional publications. Extension will develop and utilize a listserv (e.g., <http://listserv.tamu.edu/>) to facilitate direct discussion between stakeholders. Extension will explore the appropriate use of social media (i.e., Facebook) as a stakeholder communication mechanism for this watershed. Extension will solicit content matter for educational materials from project partners as appropriate.

- Extension emailed the steering committee information about the Partnership meeting, the Rainwater Harvesting classes, and the newsletter. Press releases were released, along with posting the meeting to the community calendars.

70% completed – On-going

Subtask 3.9: Extension will make deliberate efforts to increase awareness of the WPP and secure implementation support thereof from county and municipal governments throughout the watershed.

- Extension continues to maintain communication with the City of Seguin as they move through the process of working with TCEQ on their first grant. Extension met with the representative responsible for administering the grant from TCEQ on June 11. As a result of that meeting, Extension will be assisting Seguin with reporting requirements and calculations due on their grant.
- Extension and GBRA have been in contact with Seguin and New Braunfels informing them of our assistance, if needed, to prepare any new grant proposals.
- GBRA is in the final stages of securing the grant from TCEQ for the education program to be developed at the Irma Lewis Seguin Outdoor Learning Center. Extension will be assisting through advertising, as well as design development for various LID structures to be installed as part of the grant, such as the rainwater harvesting system, grasses swale, rain garden, and pervious pavement. Extension began coordinating the design of these structures within the Extension system.

70% completed– On-going

Subtask 3.10: Extension will maintain a spreadsheet of watershed stakeholders and affected parties for use in engaging the public in the watershed planning process. The spreadsheet will be added to based upon previous efforts of Extension in TSSWCB project 08-06. The spreadsheet will represent a diverse cross section of Geronimo Creek landowners, citizens, local businesses, local and regional governmental entities and elected officials, state and federal agencies, and environmental and special interest groups.

- Extension updated the stakeholder email spreadsheet with participant emails obtained from the September Partnership meeting and from requests from the project page. Many of the participants in the rainwater harvesting classes have requested that they be added to the email list.
- As a result of events this quarter, the email contact list for the project grew to over 350 contacts who now regularly receive project updates and notices.

70% completed – On-going

Subtask 3.11: Extension will attend and participate in other public meetings as appropriate in order to communicate project goals, activities and accomplishments to affected parties. Such meetings may include, but are not limited to, city councils, county commissioners' courts, Clean Rivers Program Basin Steering Committee and Coordinated Monitoring, local soil and water conservation districts (SWCDs), groundwater conservation districts and other appropriate meetings of critical watershed stakeholder groups.

- July 23, 2014 - A presentation on septic systems and private water well protection was given at the Comal County Land and Water Expo by the Watershed Coordinator and the Geronimo and Alligator Creeks Partnership was introduced to the attendees.

70% completed – On-going

TASK 4. Water Quality Data Collection and Analysis

Subtask 4.1: GBRA will conduct routine ambient monitoring at seven sites once per month, collecting field, conventional, flow and bacteria parameter groups. The QAPP developed in Task 2 will precisely identify the sites. The sampling period extends over 21 months. The number of samples planned for collection through this subtask is 147. Currently, routine ambient monitoring is conducted monthly at one station by GBRA (12576) through the Clean Rivers Program. Sampling through this subtask will complement existing routine ambient monitoring regimes such that routine water quality monitoring is conducted monthly at eight sites in the Geronimo Creek watershed. GBRA's Regional Laboratory will conduct sample analyses. Field parameters are pH, temperature, dissolved oxygen and conductance. Conventional parameters are total suspended solids, turbidity, sulfate, chloride, nitrate nitrogen, ammonia nitrogen, total kjeldahl nitrogen, chlorophyll-a, pheophytin, total hardness, and total phosphorus. Flow parameters are flow collected by gage, electric, mechanical or Doppler, including severity. Bacteria parameter is *E. coli* enumerated using USEPA Method 1603.

- July 21, 2014 -
 - Routine monitoring at seven sites - CRP monitoring at one site. One site was dry, Geronimo Creek at Huber Road (20742).
- August 12, 2014 -
 - Routine monitoring at seven sites - CRP monitoring at one site. One site was dry, Geronimo Creek at Huber Road (20742).
- September 10, 2014 -
 - Routine monitoring at seven sites - CRP monitoring at one site. One site was dry, Geronimo Creek at Huber Road (20742).

85% completed – On-going

Subtask 4.2: GBRA will conduct routine ambient monitoring at six sites once per quarter year, collecting field, conventional, flow and bacteria parameter groups; specific parameters are defined in Subtask 4.1. The QAPP developed in Task 2 will precisely identify the sites. The sampling period extends over seven seasons. The number of samples planned for collection through this subtask is 42. Spatial and seasonal variation will be captured in these snapshots of watershed water quality. GBRA's Regional Laboratory will conduct sample analyses.

- July 21, 2014 - Dry weather targeted was conducted for the Summer season.
 - Five targeted sites were dry (site nos. 20744, 20753, 20750, 20749, 20748).
 - One site was wet (Site no. 12575)
- September 10, 2014 – Dry weather targeted was conducted for the Fall season.
 - Six targeted sites were dry (site nos. 20744, 20753, 20750, 20749, 20748, 12575).

70% completed – On-going

Subtask 4.3: GBRA will conduct biased flow monitoring at fourteen sites once per season under wet conditions, collecting field, conventional, flow and bacteria parameter groups; specific parameters are defined in Subtask 4.1. These sites shall be the same as the sites for routine ambient monitoring described in subtasks 4.1-4.2. If a storm event was captured under routine monitoring in subtasks 4.1-4.2, a separate biased flow sample will not be collected under this subtask. The QAPP developed in Task 2 will precisely identify the sites. The sampling period extends over seven seasons. The number of samples planned for collection through this subtask is 98. Spatial, seasonal and meteorological variation will be captured in these snapshots of watershed water quality. GBRA's Regional Laboratory will conduct sample analyses.

- No wet weather events occurred that produced runoff and created wet weather conditions in the Summer quarter.

65% completed – On-going

Subtask 4.4: GBRA will conduct routine groundwater monitoring at up to four sites (e.g., two spring and two wells) once per quarter year, collecting field, conventional, flow and bacteria parameter groups; specific parameters are defined in Subtask 4.1. The QAPP developed in Task 2 will precisely identify the sites. The sampling period extends over seven quarters. The number of samples planned for collection through this subtask is 28. GBRA's Regional Laboratory will conduct sample analyses.

- July 21, 2014 - Routine groundwater monitoring was conducted in this quarter. The Timmermann Springs and two wells were collected (Laubach well and Huber well).

80% completed – On-going

Subtask 4.5: GBRA will transfer monitoring data from activities in subtasks 4.1-4.4 to TSSWCB for inclusion in the TCEQ SWQMIS at least quarterly. Data will be transferred in the correct format using the TCEQ file structure along with a completed Data Summary, as described in the most recent version of the *TCEQ Surface Water Quality Monitoring Data Management Reference Guide*. GBRA will post data from monitoring activities collected in subtasks 4.1-4.4 to the project website in a timely manner. GBRA will submit Station Location Requests to TCEQ, as needed, to obtain TCEQ station numbers for new monitoring sites. Data Correction Request Forms will be submitted to TSSWCB whenever errors are discovered in data already reported. All monitoring data files, data summary reports and data correction request forms will also be provided to Extension. GBRA will input monitoring regime, as detailed in the QAPP, into the TCEQ CMS.

- Water quality data collected in May 2014 was submitted to the TCEQ SWQMIS on June 26, 2014.
- Water quality data collected in June-July 2014 was submitted to the TCEQ SWQMIS on September 11, 2014.
- Water quality data collected in August 2014 was submitted to the TCEQ SWQMIS on October 9, 2014.
- Data tables were updated through July 2014 and posted to the Geronimo Creek

webpage.

85% completed – On-going

Subtask 4.6: GBRA will develop a final Assessment Data Report summarizing water quality data collected through Task 4. The Report shall, at a minimum, provide an assessment of water quality with respect to effectiveness of BMPs implemented and a discussion of interim short-term progress in achieving the Geronimo Creek WPP water quality goals. GBRA will summarize the results from Task 4 in the GBRA's Clean Rivers Program Basin Highlights Report and Basin Summary Report. GBRA will provide updates on the results and activities of Task 4 to the Steering Committee.

- No work was performed under this task in this quarter.

0% completed– On-going

III. Related Issues/Current Problems and Favorable or Unusual Developments

- A workshop on rainwater harvesting was conducted in Seguin.
- The quarterly partnership meeting was held and included a presentation on rainwater harvesting.
- GBRA and ILSOLC received a grant for nonpoint education and LID demonstrations in the Geronimo Creek watershed. Extension and GBRA participated in the Comal County Land and Water Expo in July.

IV. Projected Work for Next Quarter

The following will be accomplished during the coming quarter:

- a. Extension will continue publishing newspaper articles and production and distribution of the quarterly newsletter, *The Geronimo Flow*.
- b. Extension will continue to update the web page by coordinating with GBRA.
- c. Extension will continue to assist the Comal-Guadalupe SWCD and the new district technician provide assistance to watershed agricultural producers.
- d. Extension and GBRA will coordinate the scheduling of the next round of Homeowner Septic System Maintenance classes for November.
- e. GBRA will continue water quality monitoring.
- f. Extension and GBRA will bring the Texas Well Owner Network workshop to the watershed on January 28, 2014.
- g. Extension and GBRA will continue to coordinate the implementation of the ILSOLC grant, namely the design and installation of the rainwater harvesting system in the near term.
- h. Extension and GBRA will coordinate the scheduling and development of the next Smart Growth Workshop in the watershed.



**FREE
1 HOUR
RAINWATER
HARVESTING
CLASS**

Come learn about

Rainwater Harvesting



Rainwater harvesting is an innovative alternative water supply practice that anyone can do. It can provide additional water that is collected and stored for a variety of uses such as landscape watering, wildlife and livestock watering, in-home use, fire protection, and stormwater control. You can start out with something as simple and low-cost as a bucket or barrel, or scale up to multiple barrels or a large storage tank system.

A free 1 hour Rainwater Harvesting Class is being offered by the Geronimo and Alligator Creeks Partnership on Tuesday, September 9, at 6pm at the GBRA River Annex, 905 Nolan Street, Seguin. The instructor is a Guadalupe County Master Gardener Water Harvesting Specialist, and a 55 gallon rain barrel will be raffled off as a door prize. Just prior to the class, an overview of the Geronimo and Alligator Creeks Partnership will be presented.

Please RSVP to Ward Ling at wling@ag.tamu.edu or 979-845-6980
or go to www.GeronimoCreek.org for more information.

The Geronimo Flow

August 2014



Your Newsletter

The Geronimo and Alligator Creeks Watershed Partnership was formed in 2010 to restore and protect water quality in the Geronimo and Alligator Creeks Watershed due to elevated levels of bacteria and nitrate-nitrogen. The Partnership completed a Watershed Protection Plan in 2012 and is now working toward full

implementation. The purpose of this newsletter is to inform and engage local stakeholders in helping to improve and protect the quality of water in Geronimo and Alligator Creeks. For more information about the project visit our website:

www.geronimocreek.org

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Rainwater Harvesting Captures a Great Audience

With signs of the impact of the ongoing drought all around us, interest in conserving and protecting our valuable water resources is at an all-time high. The Partnership recently conducted a Rainwater Harvesting Class for Homeowners to a packed room on August 12 at the GBRA River Annex. Rainwater harvesting captures, diverts, and stores rainwater for later use.

Implementing rainwater harvesting (RWH) is beneficial because it reduces demand on existing water supplies and reduces run-off, erosion, and contamination of surface water.

Rainwater can be used for nearly any purpose that requires water. These include landscape use,

stormwater control, wildlife and livestock watering, in-home use, and fire protection. A rainwater harvesting system can range in size and complexity. All systems have basic components which include: a catchment surface, conveyance system, storage, distribution, and treatment.

The catchment area is the first point of contact for rainfall. For the vast majority of tank-based rainwater harvesting systems, the catchment area is a roof surface. Important factors to consider in planning a RWH system are: roof material, slope, and sizing of the catchment area.

Roof material is not as important as contaminants that may be on the



The winners of the rain barrel raffle at the August 12 Rainwater Harvesting class were all smiles.



Rainwater harvesting can be utilized to provide additional water to livestock and wildlife.

roof. For landscape purposes, the common asphalt shingle will work fine. If starting on a new system, the recommendation is for a metal roof because they easily shed contaminants.

The slope of the roof affects how quickly water will runoff during a rain event. A steep roof will shed runoff quickly and more easily clean the roof of contamination.

The size of the catchment area or roof will determine how much rainwater you can harvest. The area is based on the “footprint” of the roof, which can be calculated by finding the area of the building and adding the roof’s overhang.

Approximately 550 gallons can be collected for every 1,000 square feet of collection surface per inch of rainfall.

In this part of the state, based on the average rainfall, a RWH system with just 1,000 square feet of catchment area could collect just over 18,500 gallons each year!

Come out the next Partnership meeting September 9 at 6 pm at the GBRA River Annex to hear about how you can start rainwater harvesting. We will have Dave Elders of the Guadalupe County Master Gardeners conducting a one hour class on RWH, so come out and learn how you can get started.

To All the Farmers and Ranchers

Joseph McIntosh is a District Technician for the Comal-Guadalupe Soil and Water Conservation District (SWCD). The SWCD was awarded a grant from the Texas State Soil and Water Conservation Board to hire a technician who can assist farmers and ranchers in developing Water Quality Management Plans (WQMP) for their individual operations. The grant also provides financial incentives to help producers implement approved practices.

Nutrient and bacteria loading from agricultural operations are identified in the Geronimo and Alligator Creeks WPP as potential sources of pollution in area creeks. A site specific WQMP is developed by working with a land owner to identify, design, and implement practices that will protect water resources. The plan includes appropriate land treatment practices, production practices, management

measures and technologies. Examples of key practices include prescribed grazing, fencing, watering facilities, pipelines, wells, grassed waterways, pasture/hayland/rangeland planting, riparian buffers, filter strips, and others.

“There is no cost to the landowner for development of the WQMP,” says McIntosh. However, there may be costs for implementing certain practices, but financial assistance is available in most cases.

September starts our fiscal year 2015 off and with that being said, a new average cost list for the approved best management practices will be approved and used. Landowners within the watershed should keep an eye out for the updated information at the upcoming Geronimo and Alligator Creeks Partnership Meeting September 9.

If you need assistance or are interested in learning more, you can contact Mr. McIntosh at (830) 379-0930 x107, or stop by the office at 3251 N. Hwy 123 Bypass in Seguin.

Come to the Partnership meeting September 9th and meet Joseph. He will be on hand at the meeting and will be happy to visit with you and answer any questions you may have.

Feral Hog Workshop

The first Feral Hog Workshop to ever be offered in the watershed was held Friday, May 23, 2014 from 8:30 a.m. – 3:00 p.m. at the Texas Agricultural Education and Heritage Center to an audience of over 50 attendees.

Speakers included representatives of AgriLife Extension, Texas Animal Health Commission, Texas Parks and Wildlife Department, Texas Wildlife Services and the Texas Department of Agriculture. Topics included basic ecology and biology, feral hog effects on the Geronimo Creek watershed, regulations for transporting, disease concerns, population dynamics and control techniques, including traps, as well as hunting regulations. There was also a discussion of feral hog resources available to the landowner.

“Each year feral hogs do millions of dollars of damage to property, crops

and watersheds, as well as serving as potential vectors for disease,” said Jeff Hanselka, AgriLife Extension agent for agriculture and natural resources, Guadalupe County. “This program gave participants some useful information about feral hogs, especially their behavior and ways to control them.”

Five Texas Department of Agriculture continuing education units — two general, two integrated pest management, and one in laws and regulations — for commercial, non-commercial and private applicators were given to each attendee.

Our goal is to make this workshop an annual event, in order to better equip landowners with the knowledge they need to help control feral hogs on their property.

Lone Star Healthy Streams Workshop

A Lone Star Healthy Streams workshop was conducted June 5 at the Texas Agricultural Education and Heritage Center to an audience of 33 attendees. A catered lunch was provided.

“The Lone Star Healthy Streams program aims to educate Texas livestock producers and land managers on how to best protect Texas waterways from bacterial contributions associated with livestock production and feral hogs,” said Jennifer Peterson, Texas A&M

AgriLife Extension Service program specialist in College Station.

The workshop was sponsored by the Texas Agricultural Education and Heritage Center and the Texas State Soil and Water Conservation Board and is free to all participants. Three Texas Department of Agriculture general continuing education credits were provided for certified pesticide applicators.

Currently, about 300 Texas water bodies do not comply with state water quality standards established

Do you have something you would like to contribute to the newsletter? Or, would you like to see us provide information on a particular topic? Suggestions can be sent to Ward Ling at wling@ag.tamu.edu or call 979-845-6980.

for *E. coli* bacteria. By participating in this workshop, livestock producers and landowners learned about specific conservation practices that help improve and protect the quality of Texas' water bodies.

Workshop presentations focused on specific best management

practices to help minimize bacterial contamination originating from beef cattle, horses and feral hogs.

The Lone Star Healthy Streams program is funded through a Clean Water Act nonpoint source grant from the Texas State Soil and Water Conservation Board and the U.S. Environmental Protection Agency.

Protect Your Groundwater Day September 9

Extended drought in California and Texas have put the spotlight on a critical resource of importance to every person—groundwater. The Geronimo and Alligator Creeks Watershed Partnership is urging the public to pitch in on Protect Your Groundwater Day September 9.

Groundwater makes up 99 percent of all available fresh water in the world and is connected from beneath to most surface water bodies.

Groundwater is out of sight and out of mind for most people. Yet groundwater is the source water supply for 13 million households on private water wells in America. It also supplies much of the water to our country's more than 40,000 community water systems. Not only that, it supplies 53.5 billion gallons of water a day for agriculture and supports the environment.

Started by the National Ground Water Association, Protect Your Groundwater Day is the perfect time for every household to act to protect this resource. The Protect Your Groundwater web page, www.NGWA.org/PYGWD, provides ways citizens can protect groundwater from overuse or contamination. Here are a few suggestions :

Everyone

When it comes to hazardous household substances:

- Store them properly in a secure place
- Use them according to the manufacturer's recommendations
- Dispose of them safely (if in doubt as to how, contact your local waste authority)

When it comes to water conservation:

- Modify your water use (click to see more water-saving tips)
- Install a water-saving device (i.e. a water-efficient appliance or faucet and showerhead flow restrictors)

If you own a water well

- Move possible contamination sources a safe distance from the wellhead
- Know what's in your water: Test your water regularly for bacteria, nitrate, and anything of local concern
- Get your annual water well system inspection
- Properly decommission any abandoned wells using a qualified professional

To learn more about groundwater protection in Texas, visit

Upcoming Events

Partnership Meeting

Tuesday September 9
6p – 7:30p
GBRA River Annex
905 Nolan Street
Seguin

Homeowner Septic System Maintenance Class

Monday, November 10
6:00 – 8:00p
GBRA River Annex
905 Nolan Street
Seguin

Homeowner Septic System Maintenance Class Emphasis on Aerobic Systems

Tuesday, November 11
8:30a – 3:30p
NBU Service Center
355 FM 306
New Braunfels

This publication was developed with funding support from the U.S. Environmental Protection Agency through a Clean Water Act §319(h) Nonpoint Source grant administered by the Texas State Soil and Water Conservation Board

<http://twon.tamu.edu/>

and access publications on groundwater protection, using water wisely, and decommissioning abandoned wells.

NGWA, a nonprofit organization composed of U.S. and international

groundwater professionals. It is dedicated to advancing groundwater knowledge. NGWA's vision is to be the leading groundwater association that advocates the responsible development, management, and use of water.

Homeowner Septic System Maintenance Classes

A 2-hour Homeowner Septic System Workshop is scheduled for November 10th from 6-8 p.m. at the GBRA River Annex, 905 Nolan Street, Seguin.

The course will provide a basic overview of the operational and maintenance activities of conventional and aerobic septic systems. Topics covered will include treatment processes, health and safety considerations, an overview of how to inspect and maintain the system, and instruction on how activities in the home can impact the system.

Homeowners wanting a more in depth focus on aerobic systems may attend a 6 hour class scheduled for November 11th from 8:30 a.m. until 3:30 p.m. at the NBU Service Center at 355 FM 306 in New Braunfels. The 6 hour

course covers the same material as the 2 hour course, but goes into more depth on aerobic systems and their operation and maintenance. It has **not yet** been determined if attendees will receive certification to maintain their systems, but that notice will be sent out as soon as it can be confirmed.

The 2-hour class is free, but an RSVP is requested in order to adequately provide materials and classroom space. The 6-hr class will likely have a nominal cost to cover course materials, and an RSVP is required, as well. As soon as the course cost is determined, the information will be made available.

To register for either class, contact Ward Ling (wling@ag.tamu.edu or 979-845-6980).

Next Partnership Meeting

The Geronimo and Alligator Creeks Watershed Partnership will meet Tuesday, September 9th at 6:00 p.m. at the GBRA River Annex, 905 Nolan Street, Seguin.

Ward Ling will open the meeting with a recap of past and upcoming workshops. Immediately following will be a Rainwater Harvesting Class provided by Dave Elder of the Guadalupe County Master Naturalists. The class will introduce the basics of

rainwater harvesting and explore how to build your own system. Highlights will include an in-class demonstration of how to construct your own rain barrel, and a rain barrel will be raffled off at the end of the class as a door prize!

Come find out how you can get involved. We hope to see you there! For more information contact Ward Ling at 979-845-6980 or wling@ag.tamu.edu

The Geronimo and Alligator Creeks Watershed Protection Plan

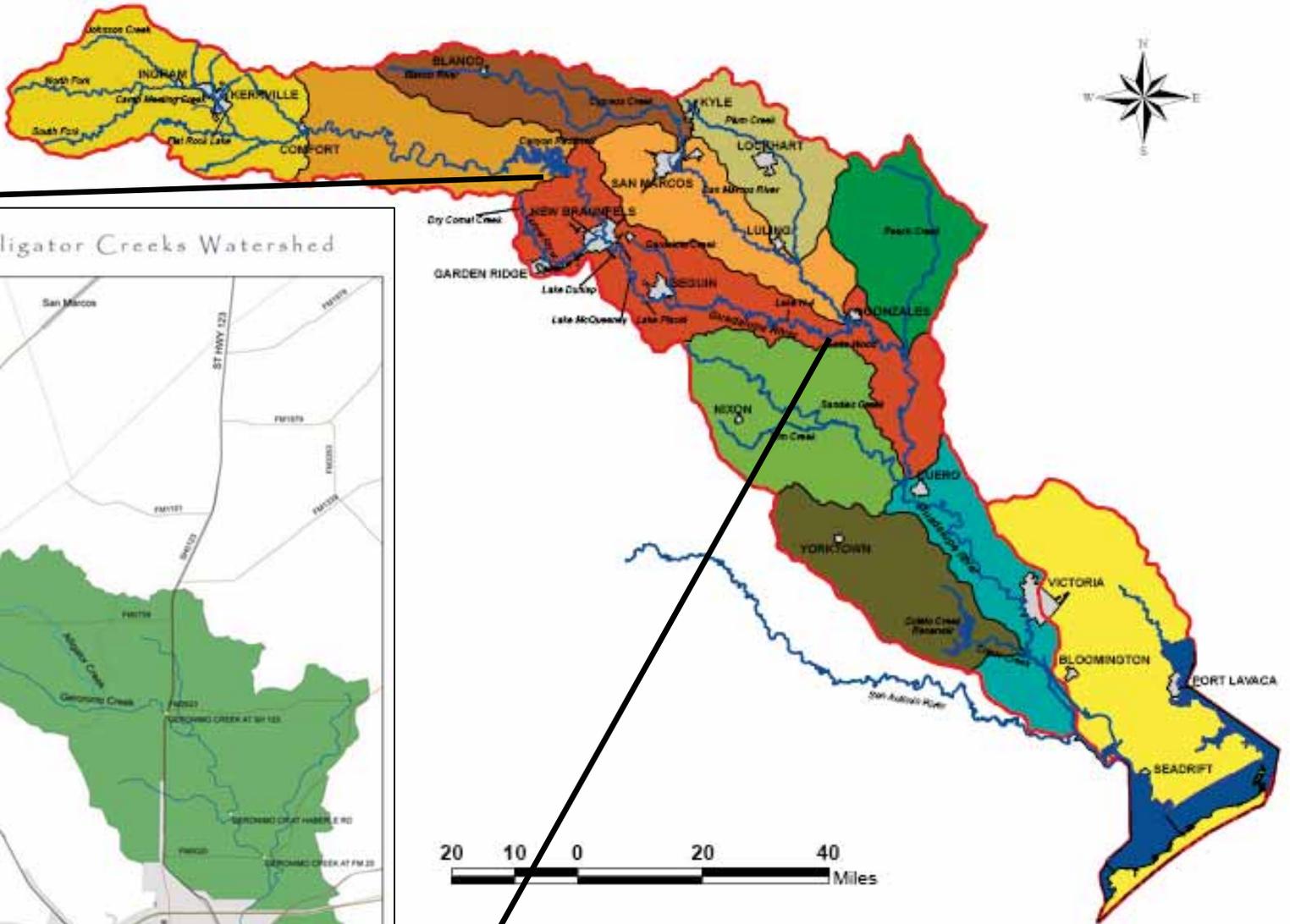


Ward Ling

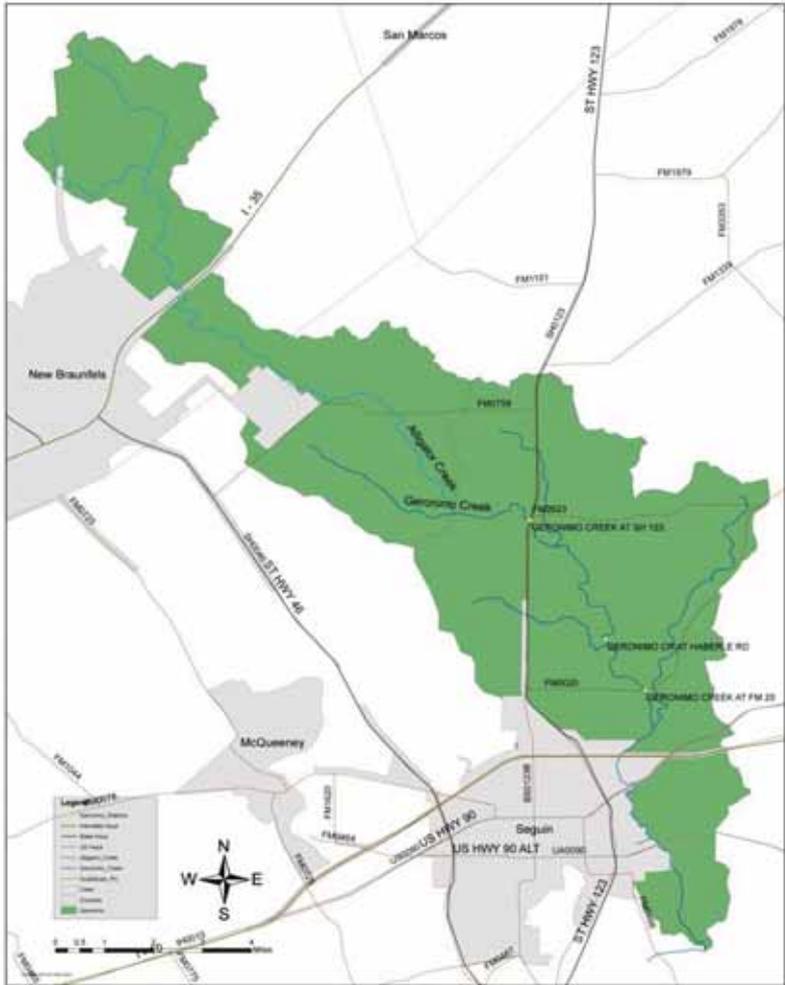
Texas A&M AgriLife Extension



GUADALUPE RIVER BASIN WATERSHEDS



Geronimo and Alligator Creeks Watershed



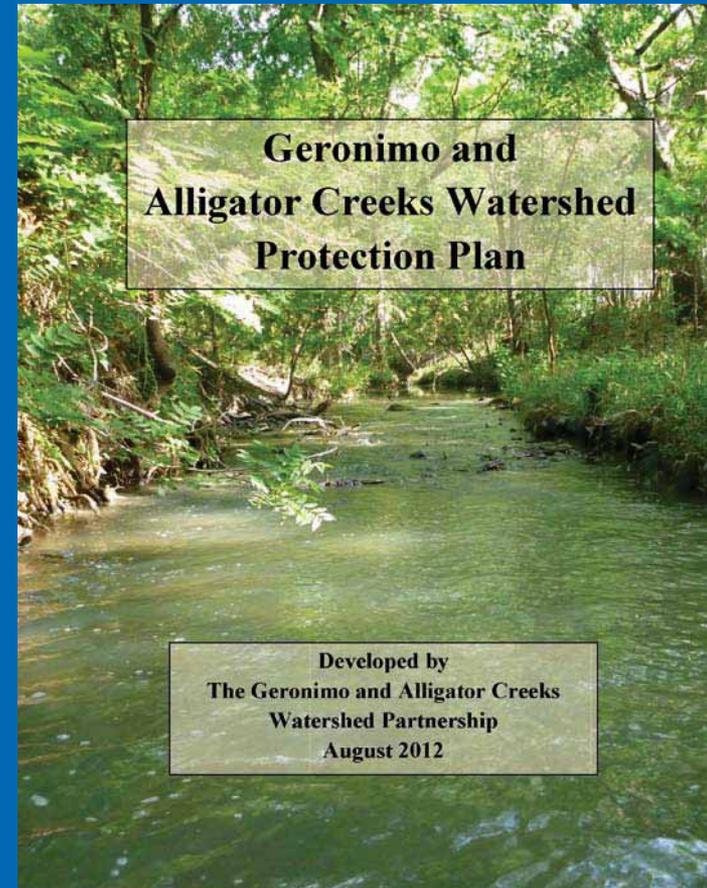
Water Quality

- Geronimo Creek was listed on the 2006 303(d) list for not supporting its contact recreation use
- Geronimo Creek was first listed in 2000 for concern for nutrient enrichment



What is the Geronimo and Alligator Creeks Watershed Protection Plan?

- A community-driven, voluntary management plan developed to solve complex water quality problems
- The purpose is to restore and protect the creeks
- It relies heavily on stakeholder involvement at the local level



Where is it coming from?

- The impairment is the result of loading from nonpoint sources:
 - Urban: dog waste, urban runoff
 - Agricultural: livestock, feral hogs, wildlife
 - Wastewater: septic systems



Recent Events

- Smart Growth Workshop
- Homeowner Septic System Maintenance Classes
- Second Annual Creek Clean Up Event
- Feral Hog Workshop
- Lone Star Healthy Streams Workshop



Smart Growth Workshop

- Low Impact Development techniques – better than conventional structures and management of stormwater which has an improved impact on surface water, both quality and quantity



Homeowner Septic System Maintenance Classes

- Classes conducted Nov 2013 and April 2014
- Two types of classes conducted
 - 2 hr basic overview class (materials on project website)
 - 6 hr in-depth class on aerobic systems
- Comal and Guadalupe County homeowners with aerobic systems are required to have a maintenance contract for first 2 years
 - After that time, Guadalupe County homeowners can be certified or must have a maintenance contract

Fall Classes

- Monday, November 10
6:00p to 8:00p, GBRA River Annex
- Tuesday, November 11
9:30a to 3:30p, NBU Service Center
- Potentially those taking the 6 hr class will receive certification to maintain their own aerobic systems (Guadalupe County requirement)



Creek Clean Up Event

- Prior to the event, volunteers used the online sign up form
- Day of the event, all necessary equipment was provided
- Water bottles, breakfast tacos, and T-shirts were distributed
- Guadalupe County Master Naturalists presented educational presentations to many of the clean up crews – took “an educational fair to the crews”



Sponsors

- 
- Cities of New Braunfels and Seguin
 - Alamo Group
 - Continental Corporation
 - Geronimo Creek Retreat
 - Geronimo Lions Club
 - Guadalupe County Commissioner Seidenberger
 - Guadalupe-Blanco River Authority
 - HEB
 - Liz Sedlacek
 - New Braunfels Herald-Zeitung
 - Robin and Bill Walker
 - Seguin Daily News KWED
 - Seguin Gazette
 - Spirit of Joy Lutheran Church
 - Texas A&M AgriLife Extension
 - Thrivent Financial for Lutherans



Coverage

- 22 locations covering 17 miles of roadways and creek banks
- Over 230 volunteers participated
- Volunteers met at one of three locations











Results

- Volunteers collected over 7,000 pounds of trash
- Cities of New Braunfels and Seguin donated disposal and recycling of all materials collected
- Residents have a greater awareness of area creeks
- Great response from area businesses and groups



Feral Hog Workshop

- Extension conducted the first Feral Hog Workshop in the watershed with over 50 attending
- Feral hog biology, populations, laws and regulations, safety and disease concerns, control measures, and trap demonstrations
- 4 TDA CEUs for commercial, non-commercial & private applicators
- This will become an annual event



Lone Star Healthy Streams Workshop

- June 5 at The Texas Agricultural Education and Heritage Center
- Over 30 attendees heard about how to protect Texas' surface water from bacterial contamination from livestock, horses, and feral hogs
- 3 TDA CEUs for pesticide applicators

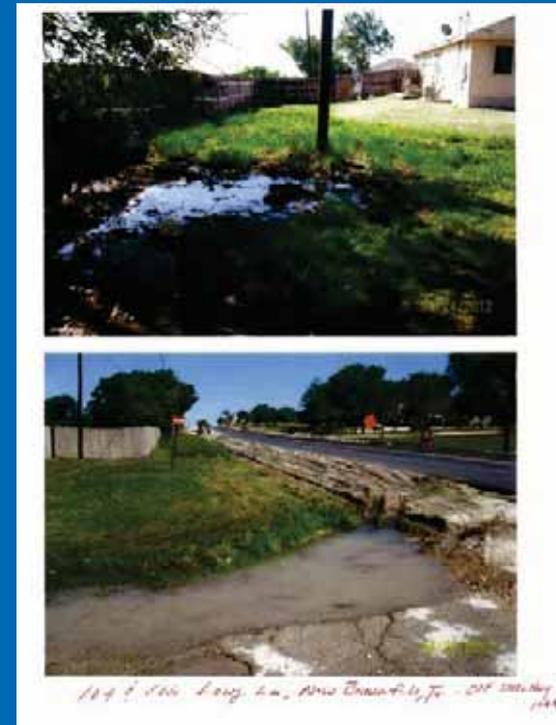


Ongoing Projects

- Septic System Decommissioning Project
- Irma Lewis Seguin Outdoor Learning Center Project
- Isotope Study
- Comal-Guadalupe SWCD District Technician

Decommissioning Project

- Fund decommissioning costs that the homeowners would be responsible for
- Estimated average cost of \$1,500 to decommission a septic system
 - Pump contents of septic tank
 - Remove the tank cover
 - Fill tank with sand/gravel
- Decommissioning is a state requirement



City of Seguin

- Seguin has a website:
http://www.seguintexas.gov/public_works/detail/capital_projects/
- City of Seguin produces a newsletter every 2 weeks
- FAQ page and online form for submitting questions and construction maps of the project

**Geronimo Creek Sewer Project
Phase V
Oak Village North Subdivision**

PROJECT UPDATE

SATURDAY, MAY 21st
WEEK SCHEDULED
Crews will be grading the drainage areas behind the back of curb and building the concrete foundation of the sanitary manholes.

WEEK OF JUNE 2nd - JUNE 6th
Grade and spread trench behind the curb to prepare for soil placement.
Make multiple trips to give concrete slabs.
Grade the entrance at Marlinville Road and concrete cleanup of the staging roads.

REMINDERS
For the safety of the neighborhood and workers, please drive with caution and adhere to all driveway and lane markings.
To ensure regularly scheduled garbage and so on curbside pick up, customers should be placed on the right before or prior to 6:00 a.m. the morning of collection. Programs has adjusted their trash schedule due to the construction and there will only curbside on Thurs. If your trash or recycling is missed, please call 281-654-2776 or 281-654-2767, an answer provided. In addition, every order or return for a second pickup requests on or 24 hours in advance.

**TO DISCUSS
SPRINKLER SYSTEM
and/or
BLOCK MAILBOX
REPAIRS**

**CONTACT NATE GARZA at
ngarza@seguintexas.gov**

**To file a claim contact
Capital Projects (817) 461-2776**

REMINDERS
If you receive this newsletter by regular mail and would prefer to receive via email, please provide your email to planning@seguintexas.gov

All emails will remain confidential

Irma Lewis Seguin Outdoor Learning Center Project

- Collaboration between GBRA, Texas A&M AgriLife, and the Irma Lewis Seguin Outdoor Learning Center
- Combines technology with on-the-ground demonstrations and outdoor education on LID techniques



Isotope Study

- GBRA and USGS will attempt to identify the source of nitrates in the groundwater and surface water in the Geronimo and Alligator Creeks Watershed and Plum Creek Watershed
- Possible sources:
 - Fertilizers
 - Septic systems
 - Animal waste
 - Nitrifying plants
 - Atmospheric deposition



District Technician

- Comal-Guadalupe SWCD District Technician assists agricultural producers with development and implementation of Water Quality Management Plans



Upcoming Opportunities

- Homeowner Septic System Maintenance Workshops
- Spring 2015 soil and water testing campaign
- Turf grass management workshop Spring 2015
- Quarterly newsletter
- Quarterly Partnership meetings
- Annual Clean Up Event



Barrels

CL [san marcos](#) > [all for sale / wanted](#) > [farm & garden - by dealer](#) [[account](#)]

[reply](#) [prohibited](#) Posted: 21 days ago [prev](#) [next](#)

★ Many Barrels and Totes (seguin)



© craigslist - Map data © OpenStreetMap (google.map) (yahoo.map)

I have different sizes of metal and plastic barrels. Also have 275 gallon plastic totes. These are all food safe. Call 830-660-887four. Thanks for looking!
No emails please. [share](#)

- do NOT contact me with unsolicited services [offers](#)

post id: 4607248857 posted: 21 days ago updated: 5 hours ago [email to friend](#) [best of](#)

[Avoid scams .deal locally.](#) Beware wiring (e.g. Western Union), cashier checks, money orders, shipping

reply prohibited [icon] Posted: 8 hours ago +prev ▲ next ▶

★ Rain Barrels w/ Spigot & Screen - S40 (East Austin)



© craigslist - Map data © OpenStreetMap

FM 969

(google.map) (yahoo.map)

condition **good**

size / dimensions: **55 Gallons**

Natural rainwater is better for plants than processed, chlorinated water which can have other chemicals and unknown additives. Now you can harvest FREE rainwater from your own roof. Rain barrels are IDEAL for watering your plants, trees, shrubs, etc.

You probably didn't know that if you have a 1400 square-foot house and collected water from just 25% of your total roof, it would take only 1/4" of rain to give you 55 gallons of water! With this in mind, you may want 2, 3 or more rain barrels to take full advantage of each rain opportunity when it comes.

Features of these rain barrels:

- (1) Made from food-grade containers.
- (2) Interior has been rinsed out, exterior has been washed off.
- (3) 4" inlet on top for rain water entry; covered with screen to keep out leaves, mosquitoes, and other insects.

Thank You!

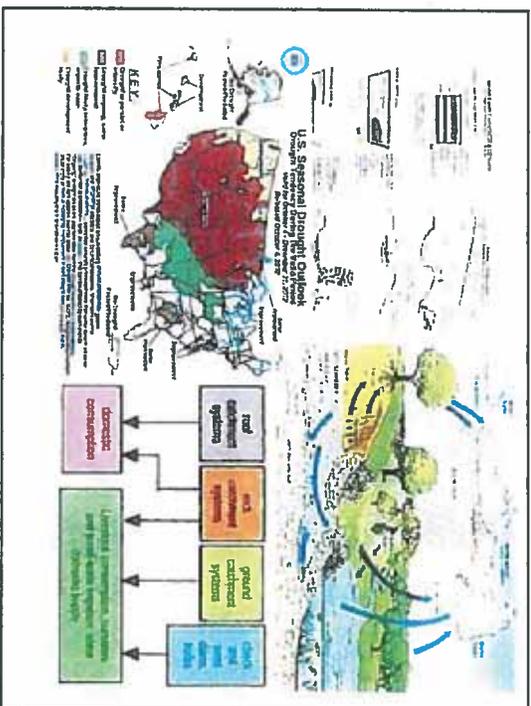
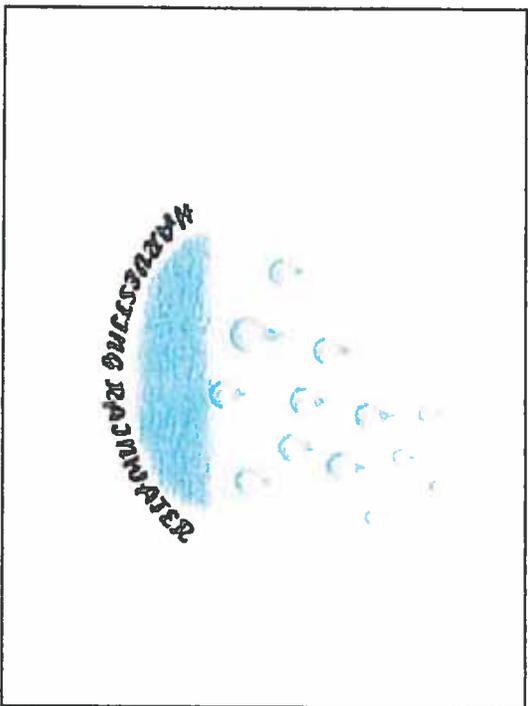
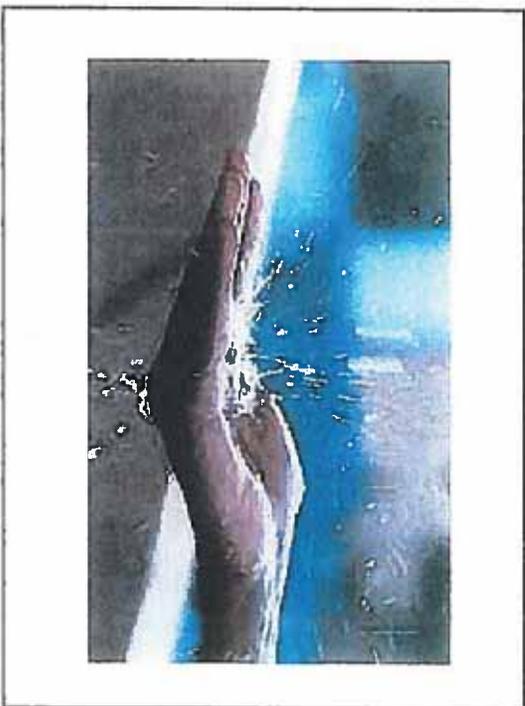
Questions and comments

Ward Ling
Geronimo and Alligator Creeks Watershed Coordinator
Phone: 979-845-6980
wling@ag.tamu.edu



TEXAS A&M
AGRI LIFE
 EXTENSION

Dave Elder
 Master Gardener
 Guadalupe County
 Water Harvesting Specialist
 Seguin, TX



What is Important NOW?

1. Where are we now?

What is Important NOW?

1. Where are we now?

The eight-county region that includes Bexar, Atascosa, Bandera, Comal, Guadalupe, Kendall, Medina and Wilson counties grew to 2.1 million people from 2000 to 2010.

Guadalupe County grew 40% during that time period.

What is Important NOW?

1. Where are we now?
2. Resources Available!

What is Important NOW?

1. Where are we now?

2. Resources Available!

Can We make electricity to meet our needs?

What is Important NOW?

1. Where are we now?

2. Resources Available!

Can We make electricity to meet our needs?

Can we build an infrastructure to meet our needs?

What is Important NOW?

1. Where are we now?

2. Resources Available!

Can We make electricity to meet our needs?

Can we build an infrastructure to meet our needs?

Can we make more water?

What is Important NOW?

1. Where are we now?

2. Resources Available!

3. What can we do now?

What is Important NOW?

1. Where are we now?

2. Resources Available!

3. What can we do now?

Plan on how to use the water we are getting free .

Create a berm in the slope of your yard.



Why do I want to collect rain water?

For every one inch of a rain event you can collect **.6 gallons** of water for each 1 square foot of surface.

On one side of my house, the roof size is 30 feet by 40 feet or 1200 square feet.

With a 1 inch rain event, I collect **720 gallons** of water which I divert to a water garden. This helps water 4 trees in my landscape near my home.

Create a water garden in the low areas of your yard



Use low water usage plants for your landscape



Be creative in capturing free water



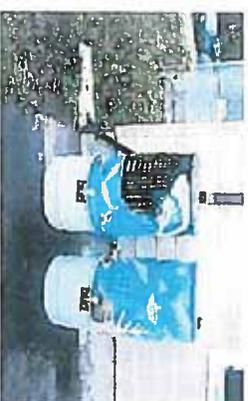
Used for large scale water collection



Smaller home scale water collection



Cheapest way to start in collecting rain water



Any Questions?



Thank You



Dave Elder
Master Gardener
Guadalupe County
Water Harvesting Specialist
Seguin, TX

Water Barrel Parts List
Guadalupe County Master Gardeners

Tools Needed

Hack Saw	
plyers	
hex drivers	
pvc pipe cutter	
power drill & 1/4 inch spade bit	
flat blade screw driver	
large quick change arbor	15.97
2 3/8 inch bi-metal hole saw	12.97
3 inch bi-metal hole saw	14.97
	43.91

Parts Needed

Oatey Handy Pack primer and cement	\$ 9.00
2 foot by 2 1/2 inch pvc pipe	\$ 1.23
2 foot by 2 1/2 inch pvc pipe	\$ 4.30
two 90 degree elbows	\$ 0.60
one 1/2 inch male adaptor	\$ 0.80
one 2 inch elbow	\$ 1.25
one 2 inch male adaptor	\$ 2.00
one 3 inch to 2 inch pipe increase	\$ 3.75
one pipe seal tape	\$ 1.30
one electric tape	\$ 4.00
one 1/2 inch nokink hosebibe	\$ 7.00
one 1/2 inch female adaptor	\$ 2.25
two 4 inch worm drive metal clamps	\$ 7.00
screen material	\$ 7.00
	\$ 51.48

Optional

white primer spay paint	\$ 9.00
-------------------------	---------

Blue Barrel
\$30 TO \$50.00

5/16/2014



**Don't Be Clueless
About Water Quality**

**NonPoint Source Pollution
Watershed Education
Curriculum Supplement
Grades 4-8**



Guadalupe-Blanco River Authority

933 East Court St.

Seguin, TX 78155

830-379-5822

800-413-5822

Introduction

Welcome to *Don't Be Clueless About Water Quality* – an innovative supplement on watersheds, water quality and NonPoint Source Pollution for teachers and students (grades 4-8) in the Guadalupe River Basin.

Don't Be Clueless About Water Quality is divided into three lessons. Each of these lessons is presented through the 5-E Model for Science Instruction.

Lesson 1 is designed as an introduction to watersheds.

Lesson 2 introduces the term NonPoint Source Pollution.

Lesson 3 applies watershed and NonPoint Source concepts to the local and regional level.

5-E Model for Science Instruction

A model of science instruction relevant to teaching science as inquiry

Engagement

- Activities that initiate learning and stimulate curiosity
- Students connect to relevant past learning
- May include asking questions, posing a problem or acting out a solution

Exploration

- Students have a concrete physical experience
- Students observe properties, establish relationships, note patterns and ask questions
- Teacher guides, coaches and facilitates

Explanation

- Students describe what they see and offer explanations of why
- Teacher helps students make sense of observations and questions that arise
- Teacher introduces scientific explanation for the event through direct and formal instruction
- Students and teacher identify common terms for experiences and explanations

Elaboration

- Teacher facilitates students in developing understandings of concepts and ideas that are broader and more in depth
- Students engage in cooperative group work on new activities that relate to the original learning task
- Students present and defend their understandings in cooperative and whole class groups

Evaluation

- Assessment of what has been learned
- May be teacher, group or self-assessment

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Lesson 1: Watersheds and Water Quality

Engagement: *What's a Watershed/Strain Your Brain*

This activity takes a humorous look at the definition of watershed. It also provides opportunities for discussion about nearby creeks and rivers, and the health of these water bodies.

Exploration: *Watershed Model*

This activity provides instructions for groups to build a simple watershed model. It also provides an opportunity for students to visualize pollution, discuss problems associated with poor water quality.

Explanation: *Why Watersheds?*

A PowerPoint is provided for teachers to use in a presentation for discussion. Students will be introduced to terms *watershed*, *impervious cover*, *water quality*, *nonpoint source pollution*.

Elaboration: *Read All About It*

Students are provided a template that can be used to create a tri-fold brochure that will illustrate facts about watersheds and the importance of water quality.

Evaluation: *Watershed Jeopardy*

Students will exhibit their understanding of topics presented in the lesson by playing a Jeopardy Game.

Strain Your Brain....

Teacher led brainstorm and discussion of watersheds and water quality

Teacher Background Information: Definition of watershed

A watershed is simply an area of land that drains the rainwater into one location such as a stream, river, lake, or wetland. This means that the runoff from streets, fields, and lawns will eventually drain into those streams, rivers, lakes, or wetlands.

Each watershed contains a set of streams and rivers that all drain to a single larger body of water, such as a larger river, a lake, a reservoir or an ocean. In Texas, rivers flow in a general southeastern direction, emptying into the Gulf of Mexico.

Watersheds can vary in size and shape from a couple of square miles to hundreds of thousands of miles. We all live, work, and play in watersheds, and what we do outside on the lands can affect everything and everyone else in the watershed, as well as in watersheds downstream.

Directions for Student Activity and Discussion:

1. Lead a discussion about the term *Watershed* - Project the illustration on p.3 (*What Is A Watershed?*) to brainstorm with students for the definition of the word *watershed*. Instruct students to cup their hands as if drinking water from a faucet. The thumbs and forefingers are like the ridges of a watershed and the palms are like the water body that catches the rainwater.
2. *Discuss nearby creeks and rivers:* Ask students to identify nearby creeks and rivers. List them on the board. Instruct students to make a chart that will compare good and bad qualities of each water body.

Example:

Water body	Good Things About the Water body	Bad Things about the Water body
Smith Creek	Water is Clear	Algae in the summer
Jones River	Fishing is good	Water is murky

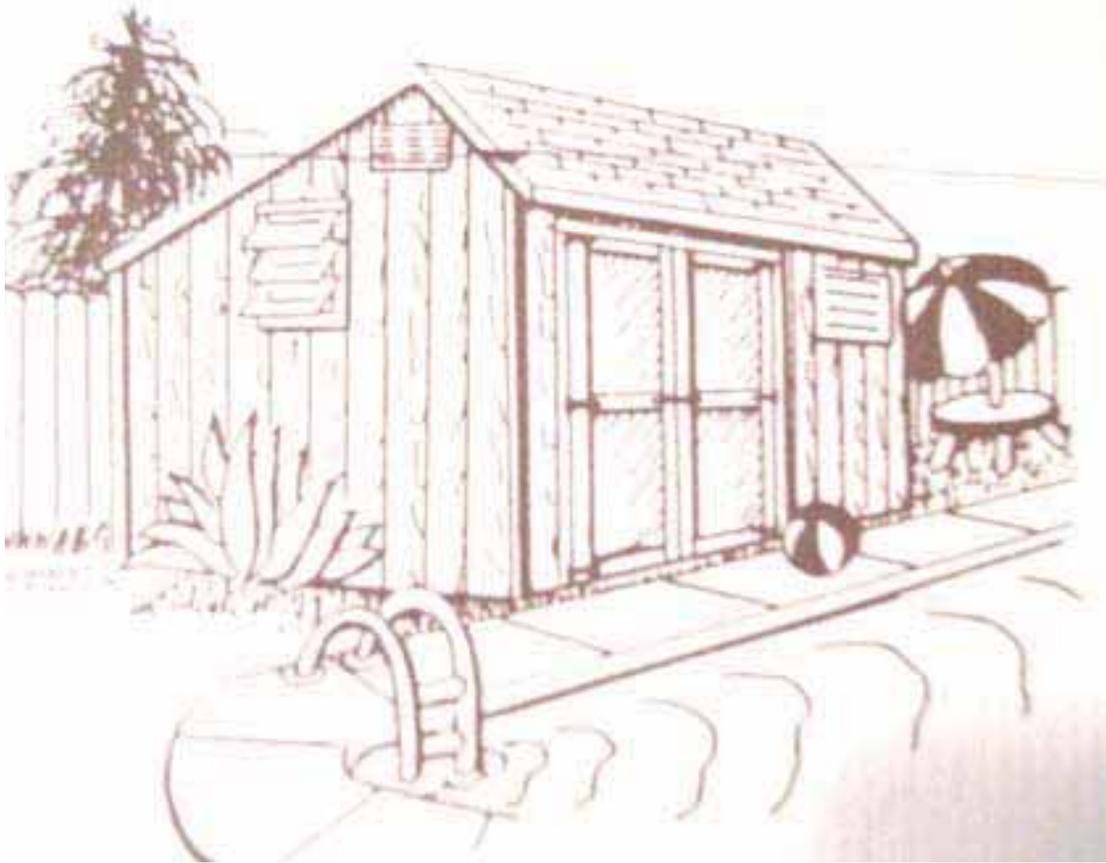
3. *Lead a discussion about water quality, using the concepts below.*

A watershed includes more than just the water. Watersheds are complex systems with many smaller parts. All the surface water and groundwater, soils, plants, animals, and human activities are part of a watershed. Everything that happens in a watershed has an impact on the health of the whole system. Farmers, homeowners, businesses, urban land use, industry, and recreational sties can all add pollutants to our waterways by how they use the land, and what is applied to the land. Chemicals and toxins, bacteria and pathogens can all make their way into our water bodies when caught up in runoff after a big rainfall.

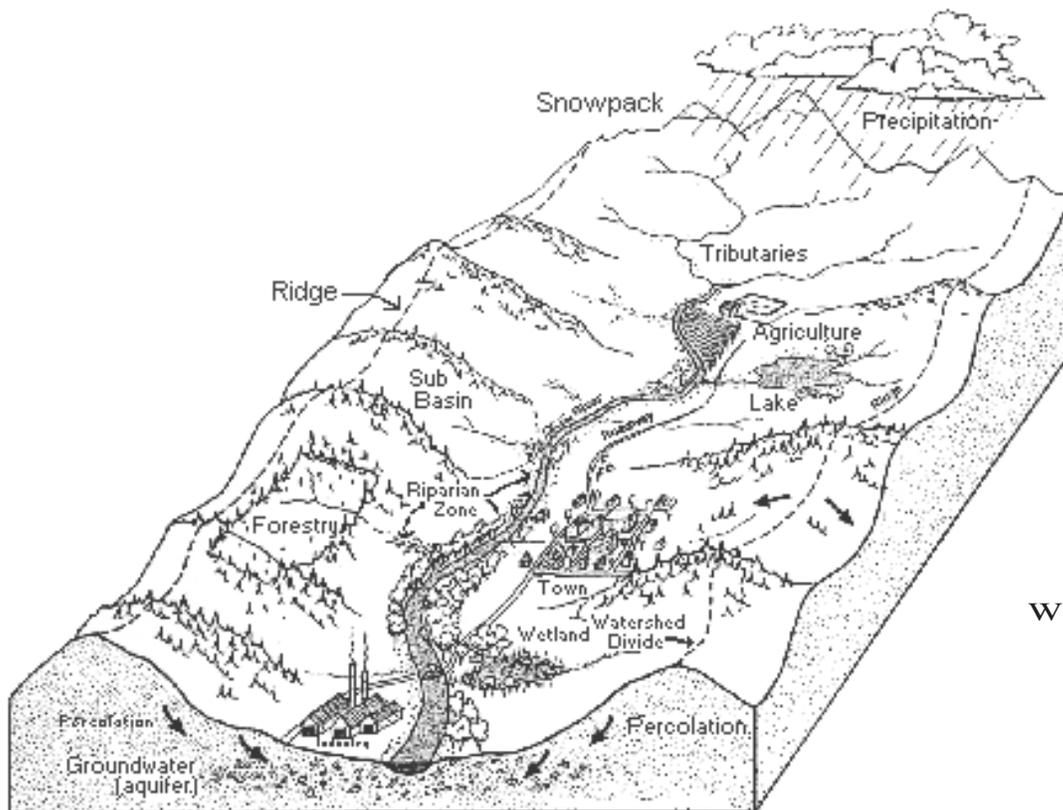
Many of the rivers in Texas are source waters for municipal and rural water supply companies. In the long run, it is a good idea for the citizens of Texas to preserve a high level of water quality in their watersheds. If the water quality is poor, additional treatment processes may be needed, which will be more costly. As the population in Texas grows, demand on available water supplies in Texas also grows. We all need to think about, and learn about, how to protect our water resources. And lastly, poor water quality will likely impact the plants and animals that live in or rely on the rivers for survival.

WHAT IS A WATERSHED?

True or False: You live in a watershed similar to one of these.



Watershed



Watershed

Watershed Model

Directions for Student Activity and Discussion:

Divide the class into small groups of 3-4 students. Give each group a large cake pan, several sheets of newspaper, a large sheet of plastic (wax paper is great), a small amount of soil, a small amount of colored drink mix, and a cup of water.

1. Instruct students to crumple several sheets of newspaper into tight bundles, and stack them loosely in the large pan. Cover the newspaper with the plastic sheet.

Students have created a rugged landscape. Ask student to identify and/or predict the following:

- Where is the ridge with the highest elevation?
- Where will the water go when it rains on the mountaintops?
- Where will small streams form?
- Where will streams join together?
- Where will larger rivers be located? Identify the headwaters and mouth.
- Where will ponds, lakes, or bays form?

Challenge students to find smaller watersheds within the larger watershed.

2. Instruct each group to make it “rain” on their watershed by lightly sprinkling water on the model. Have students check their predictions with what actually happens.

3. Instruct students to lightly dust the model with the colored drink mix, and again make it “rain” on the watershed. Inform them that the colored drink mix represents things that humans have applied to the land that can get caught up in runoff and go into waterbodies when it rains.

Questions for discussion:

- What types of activities could leave things on the ground that could pollute our watersheds? (*Use of fertilizers, pesticides, dumping of chemicals, car washing, animal waste on the ground, etc.*)
- If the water gets polluted, would you want to swim or go fishing in the waterbody? (*not likely*)
- If our water gets polluted, will it be harder to clean for people to use for drinking water? (*Yes*)
- Can we prevent our water from becoming polluted? (*Yes, through education and awareness of how our actions can affect water quality.*)

Why Watersheds?

To further student understanding of the importance of watersheds, the role of impervious cover and the importance of good water quality, use a computer and projector to display and discuss the ***Why Watersheds?*** presentation found on the web at:

<http://www.gbra.org/education/whywatersheds>

This is also included on the accompanying CD: *Don't Be Clueless About Water Quality*.

Elaboration

Read All About It!

Using the given template (pp. 6-7), students will make a tri-fold brochure illustrating learned facts about watersheds and the importance of water quality. Students can also design their own brochure.

All brochures should include the following information:

- Drawing of a watershed
- Definition of watershed
- Chart comparing the characteristics of good water quality and bad water quality
- Discussion of why clean watersheds are important
- Listing of actions people do that contribute to water pollution
- Listing of things people can do that will address these actions
- Listing of clues that will help to identify if water quality in a stream is good or bad
- Authors and Logo (if they choose to design a logo)

Clues to Help You Identify Water Quality
in Your Nearby Creeks and Rivers.

LOGO?

Authors of brochure

Title

Drawing of a watershed

Definition of a watershed

Clues for Identifying a Clean Watershed

Clues for Identifying a Watershed With Poor Water Quality

Human actions that effect water quality

Things we can do differently

Discussion of Why We Need Clean Watersheds:

Watershed Jeopardy

To evaluate student understanding of the importance of watersheds and the importance of good water quality, use a computer and projector to show the presentation found at:

www.gbra.org/education/watershedjeopardy

Teachers need to put the presentation on slide show mode, and then use the arrow icon at the bottom of the answer screen to forward to the question screen. To return to the “Home” (main screen), click on the house icon at the bottom of the question screen.

The presentation can also be found on the accompanying CD: *Don't Be Clueless About Water Quality*.

Lesson 2: NonPoint Source Pollution

Engagement: *Attack of the NPS!*

Students will be introduced to the concept of Nonpoint Source Pollution through a role-playing activity wherein water molecules are attacked by nonpoint source pollutants.

Exploration: *Who's to Blame Game*

Students will play a matching game using drawings (from role playing activity), identifying links to land use.

Explanation: *Where Does It All Begin*

Students will be given the reading *Sources of Pollution* and work as a group to study and discuss an illustration of a landscape/ land uses, and will identify places that could be associated with water quality problems.

Elaboration: *NonPoint Source Watershed Game or Pollution Isn't Always As Clear As It Seems*

Students will play computer game(*Watershed Game*) to further their understanding of NPS. If a computer lab isn't available--complete worksheet (*Pollution Isn't Always As Clear As It Seems*) for review.

Evaluation: *Water Quality and NPS Classification*

Students will complete a classification chart, exhibiting their understanding of NPS.

Attack of the NPS!

Teacher Background Information:

Nonpoint source pollution (NPS) is used to describe contaminants that enter streams from dispersed and uncontrolled sources (such as surface runoff) rather than through pipes. Since NPS occurs when pollution is released from many locations, it is difficult to identify and control. For instance, storm water runoff and irrigation can carry pollutants like garden fertilizers, construction debris and pesticides into nearby waters.

Preparation:

Make four Water Molecules signs, with strings to hang around their neck (template included, p. 11). Make copies of the NPS Pollutant Cards (template included, p. 12.) For a class of 22, make four copies of the cards*, cut apart and laminate. Then shuffle the cards so when the cards are handed out they are random. *Call or email GBRA Education Program to request color copies of the cards.

Directions for Student Activity and Discussion:

1. Pick three or four students to play the role of Water Molecules. Give them a sign to wear around their necks (it is helpful if you can make the strap for the sign out of Velcro). Give 4-5 NPS Pollutant Cards to the rest of the class at random. (Attach tape or the other half of the Velcro to the cards.)
2. Tell the Water Molecules to slowly wander through the classroom while the rest of the students attach the cards on their signs. The objective is for the water molecules to pick up random pollutants as they 'runoff' during a rain. To help make the role playing more fun, you could simulate the sound of a thunderstorm in the background (**see below).
3. After the Water Molecules have been 'attacked', have students sit down and sort out the contaminants. Make a bar graph on the front board. Discuss what each of the terms on the card means:

Pesticides – Excessive use of household and business use of pesticides can add these toxins to our water bodies.

Fertilizers – Excessive use of fertilizers on lawns, gardens and flowerbeds by homeowners and business can overload our water bodies with nutrients.

Petroleum Products – Poorly maintained automobiles or individuals tossing their used motor oil or using gasoline outdoors can add these very toxic chemicals to our water bodies.

Industrial Toxins – Occasionally some industrial sites may have improperly stored hazardous chemicals, and the residuals of the chemicals can get caught up in the runoff.

Leaking Septic Tank – Older and poorly maintained septic tanks can leak raw sewage, adding bacteria into our water bodies.

Pet Poop – Pet owners who don't pick up their pet poop are inadvertently adding to bacterial problems in our water bodies.

Ranch Animals – Waste from ranch animals that are close to a water bodies can add to bacterial problems in our water bodies.

Household Waste – Trash and improper storage of household hazardous waste can add toxins to our water bodies.

**Simulation of a rainstorm (led by Teacher):

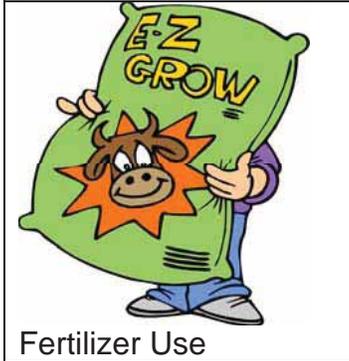
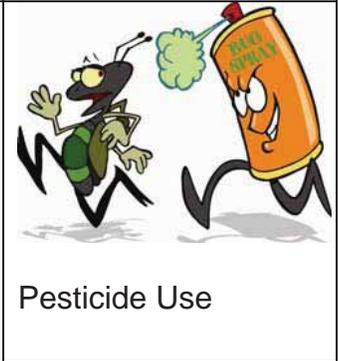
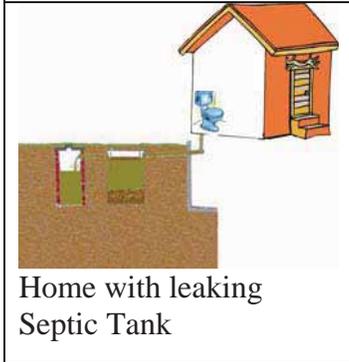
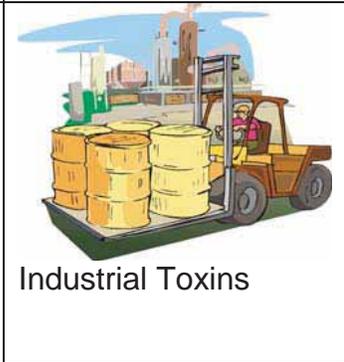
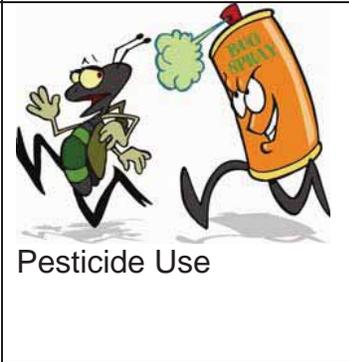
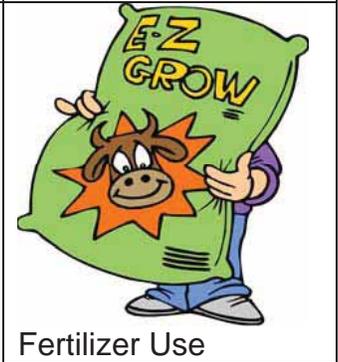
- 1) rub hands together slowly, then speed up (soft rain)
- 2) snap fingers, slowly then speed up (raining a bit harder)
- 3) gently drum fingers on desk slowly, then speed up (rain is picking up)
- 4) bang hands on desk slowly, then speed up (heavy rain)
- 5) stamp feet on floor (Heavy rain and thunder)
- 6) Reverse

Water

Molecule

Water

Molecule

			
<p>Farm and Ranch Waste</p>	<p>Pesticide Use</p>	<p>Industrial Toxins</p>	<p>Fertilizer Use</p>
			
<p>Fertilizer Use</p>	<p>Household Waste</p>	<p>Pet Poop</p>	<p>Pesticide Use</p>
			
<p>Pesticide Use</p>	<p>Fertilizer Use</p>	<p>Petroleum Products</p>	<p>Household Waste</p>
			
<p>Home with leaking Septic Tank</p>	<p>Industrial Toxins</p>	<p>Pesticide Use</p>	<p>Fertilizer Use</p>
<p>Pesticide Use</p>	<p>Pet Poop</p>	<p>Fertilizer Use</p>	<p>Petroleum Products</p>

Who's to Blame? Game

Preparation:

If possible, use card stock to make copies of the board game for groups (4-5). Also make copies of tokens for board game, cut out and place in baggies.

Directions for Student Activity and Discussion:

1. Provide students with the definitions of Point Source and NonPoint Source Pollution. Discuss.

Point Source Pollution – Several decades ago, factories and poorly operated sewage treatment plants were the major source of pollutants in our waters. It was easy to identify exactly where the pollution was coming from – we could ‘point’ to the source of the pollution. However, we see little point source pollution these days, due to the passage of a couple of federal laws (Clean Water Act, Drinking Water Act), which make it illegal for these sites to pollute our creeks and rivers.

Nonpoint Source Pollution – Instead, most of our water quality problems come from polluted runoff draining into rivers, lakes, and bays after a rain storm. Rain washing over the landscape can carry dirt, oil, fertilizer, pesticides, and animal waste and many other substances off streets and farms straight into our waterways. This form of pollution is called *nonpoint source pollution* because it comes from many different places, rather than a single ‘point’ source.

As we pave over natural areas to make parking lots, driveways and roads (previously taught concept: impervious surfaces) the rainwater doesn’t slowly soak into the ground like it would naturally. Instead it is channeled into gutters, culverts and storm drains. Unfortunately, these tend to be easy places for people to illegally dump used motor oil, trash, and yard waste.

These pollutants then are channeled directly into streams, creeks, rivers, lakes, wetlands and bays.

Additionally, humans have modified (straightened and physically altered) streams to flow in a certain path. Some streams have even been lined with concrete. Lining streams with concrete makes water rush faster after a rainstorm (increasing erosion), and makes it difficult or impossible for plants and aquatic creatures to live and thrive.

2) Divide students into groups. Each group will be provided a game board and a set of tokens. As they work, students will discuss different land-use activities that could contribute to nonpoint source pollution, and identify the water quality problems that are associated with the land-use activities. Vocabulary terms should be provided.

Vocabulary:

Sediments – Loose dirt (soil) that can get caught up in runoff.

Fertilizers – Chemical or natural fertilizers are used to help make plants grow faster and bigger, and can overload water bodies with nutrients.

Pesticides – Toxic chemicals that are used to kill pests such as insects, weeds, ants, etc.

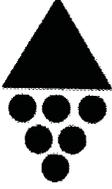
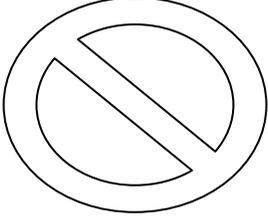
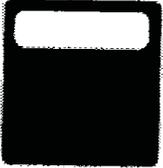
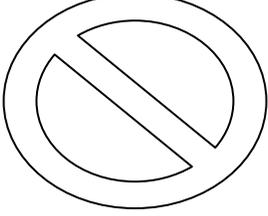
E-Coli Bacteria – Bacteria that comes from the intestines of warm-blooded animals, typically found in waste products.

Petroleum products such as gasoline and motor oil, anti-freeze are extremely toxic chemical compounds that can get captured in runoff during big rain events.

Organic debris – Sticks, leaves and other natural litter that can get caught up in runoff.

Pathogens – Disease-causing organisms (bacteria, viruses, etc.)

W H O ' S T O B L A M E ?

Land Use Activity	Type of Pollutants that could come from this land use activity.	Type of Pollutants that could come from this land use activity.	Type of Pollutants that could come from this land use activity.
Eroding Stream Banks 			
Farming 			
Gardens and Lawns 			
Ranching and Pets 			
Recreation / Parks 			
Septic Tanks 			
Roads and Streets 			

E-coli
Bacteria

E-coli
Bacteria

Pathogens

Pathogens

Sediments

Sediments

Sediments

Sediments

Pesticides
(Toxins)

Pesticides
(Toxins)

Pesticides
(Toxins)

Sediments

Fertilizers
(Nutrients)

Fertilizers
(Nutrients)

Fertilizers
(Nutrients)

Motor Oil
(Toxin)

Anti-freeze
(Toxin)

Gasoline
(Toxin)

Organic
Debris

Where Does It All Begin?

Preparation:

1. Make student copies of reading: *Sources of Pollution* (p. 16).
2. Make an overhead transparency of the illustration *Where Does It All Begin?* (p. 17).

Directions for Student Activity and Discussion:

1. Distribute copies of the reading: *Sources of Pollution*. (p. 16).
2. Lead a discussion with students about how different land uses can affect water quality. Review definition of non-point source pollution and vocabulary terms. Brainstorm with them about what types of pollutants can come from different land uses.
3. Place the *Where Does It All Begin* illustration on the overhead for discussion. Ask students to identify the land uses on the illustration, and to independently list possible activities/pollutants that could originate from each site. Review answers as a class, recording on the overhead transparency.

Sources of Pollution

When most of us think of water pollution, we think of a pipe with toxic chemicals spilling out of it onto the land or into a body of water (creek, river or lake). This is called point source pollution -- we can easily identify the point of the original source, and remedy the problem. Point source pollution is a concern in the Guadalupe River Basin. For example, pipelines and underground storage tanks with hazardous chemicals are located in the basin region. With point source pollution, the source of the pollution can be identified and controlled, although cleanup may take a long period of time.

Nonpoint source pollution is much more difficult to identify.

In fact, it is almost impossible to trace the source of nonpoint source pollution. Nonpoint source pollution is an inevitable result of our modern society's everyday land use activities.

To help us better understand nonpoint source pollution we should examine the natural movement of rain across the surface of the ground. Runoff from rainfall will usually pick up excess from overuse of fertilizers and pesticides on residential lawns and commercial landscapes. These chemicals, as well as oil, grease and other pollutants from parking lots and roadways, are a big part of nonpoint source pollution.

Impervious cover is one of the biggest culprits involved in nonpoint source pollution. Covering up the natural environment with hard cover that does not allow any percolation into the ground is directly related to the cleanliness of water. Good examples of impervious cover are paved streets, sidewalks, parking lots and buildings. Impervious cover forces water to runoff more quickly, picking up pollutants along the way. This eliminates the ability of natural soils and vegetation to filter some pollution from runoff water before it enters the river. Impervious cover is become a big problem in the areas where the population is growing the fastest: Kendall County, Comal County, Hays County, Caldwell County, Guadalupe County and Victoria County.

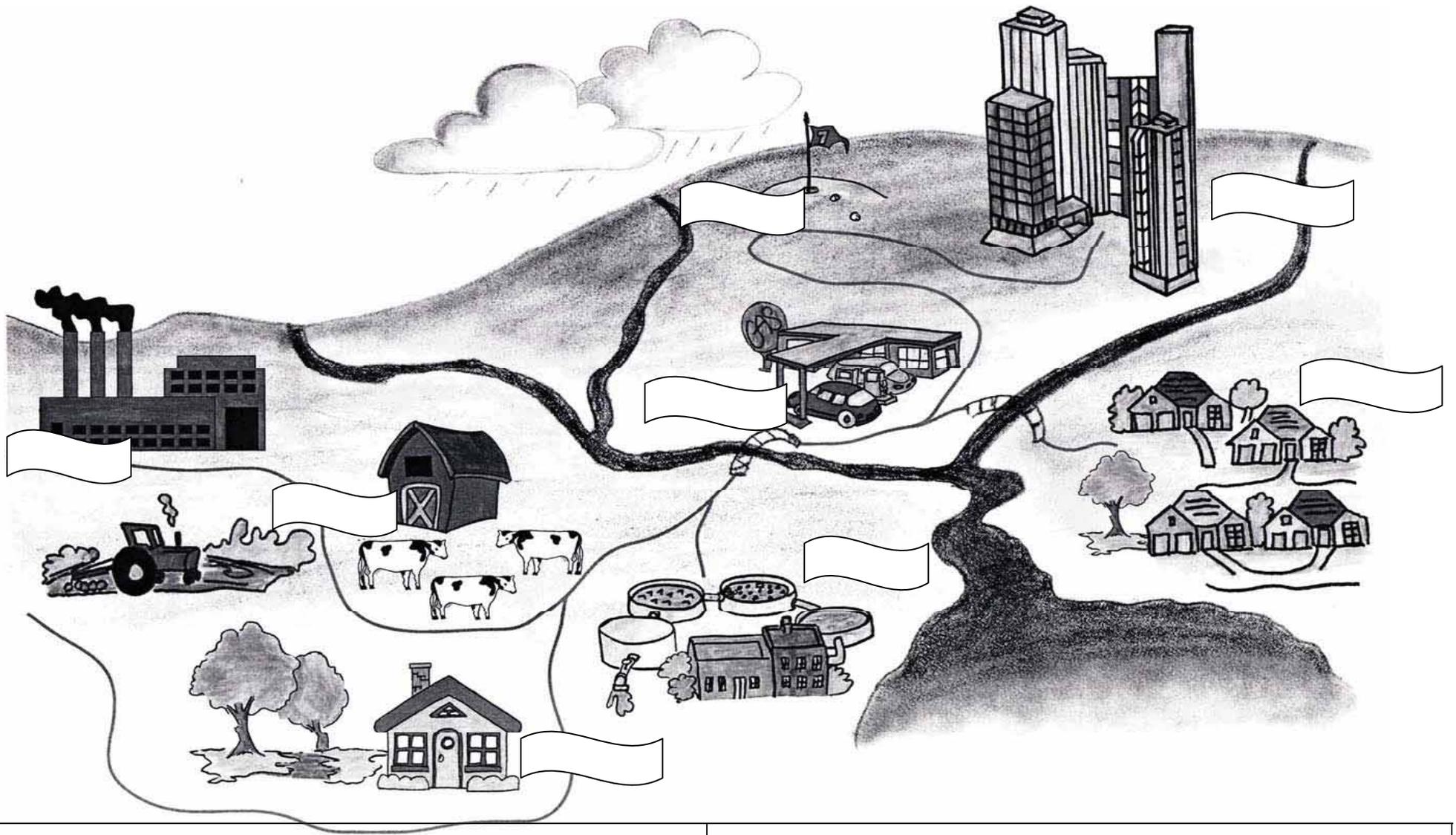
What are the possible effects of nonpoint source pollution?

In the Guadalupe River Basin, nonpoint source pollutants runoff into the watersheds, and can easily enter the river. For example:

- 1) Agricultural fertilizers can runoff crop fields and inadvertently fertilize the stream or add microorganisms in rivers and lakes, causing an adverse effect on water quality and aquatic life;
- 2) The irresponsible disposal of household chemicals, including pesticides and fertilizers can be harmful because these chemicals travel through the watershed, poisoning life and damaging natural ecosystems;
- 3) The same is true of improper disposal of industrial chemicals.

Nonpoint source pollution could result in a chronic problem that will slowly degrade the quality of water in the river over a long period of time. Many communities use rivers and streams as their source of drinking water. Water treatment prepares this water for human consumption, but if the water is laden with chemicals and microorganisms, it can be difficult to treat effectively.

Evidence shows that nonpoint source pollution has already had a slight negative effect on the quality of water in the Guadalupe River Basin. This trend will most probably increase as development continues in the sensitive watersheds, especially in the northern part of the river basin.



Industry -	Golf Course -

Option 1: NonPoint Source Watershed Game

Directions for Student Activity:

Preferably in a computer lab setting where students can work independently, use the following website for further exploration about watersheds and nonpoint source pollution:

<http://www.bellmuseum.org/distancelearning/watershed/watershed2.html>

Students type in their name, and then play the Novice level of the game. This will lead them through 11 multiple choice questions about watersheds, land use and nonpoint source pollution. If they answer a question correctly or incorrectly, the game cues them and gives them additional information to support the answer. After they have finished the novice level, there are additional questions that target different land activities: agriculture, neighborhoods, cities (and National Parks, which has not been a part of the class discussion but is still interesting....). Encourage students to work through each of the sections (each one has five questions). These questions in these sections promote higher level thinking. Students will receive a score and an explanation of each answer at the end of the five questions.

Option 2: Pollution Isn't Always as Clear as It Seems

Directions for Student Activity:

1. Make copies of the worksheet (p. 20) ahead of time. Divide students into pairs to decode the reading.
2. Give students 10 minutes to decode the reading. While students are working, list the six situations below on the chalkboard or overhead (minus the answers in italics).
3. When students are finished with the activity, read aloud and discuss the reading. To reinforce the reading, read aloud one item at a time from the list on the chalkboard, and have students discuss to determine whether these are examples of point source or nonpoint source pollutants.
 - Factory with discharge pipe into a river (*Point Source*)
 - Corn, cotton and bean fields within the river's watershed (*NonPoint Source*)
 - Parking lot at mall within 2 miles of river (*NonPoint Source*)
 - Subdivision on river's edge (*NonPoint Source*)
 - Old leaking septic tanks located on the river's edge (*NonPoint Source*)
 - Leaking gasoline storage tank (*Point Source*)

Pollution Isn't Always as Clear as it Seems

Directions: Use the drawings at the bottom of the page to decode the reading. After you find the drawing, write the word in the blank. You will use some of the words more than once. After you fill in the blank, read the sentence aloud to make sure it makes sense.

No one wants pollution in the Guadalupe River Basin. But, understanding pollution isn't as clear as it may seem. What we think is pollution may not be harmful, and what looks okay can sometimes be bad. To make it easy, let's discuss two types of pollution: point source pollution, and nonpoint source pollution.

A  that pours toxic  on the ground or in the water would be uncontrolled point source , because we can easily "point" to or  the source and _____ the problem. Point source pollution is regulated by the Texas Commission on Environmental Quality and monitored by the Guadalupe Blanco River Authority. Because costly  are charged to people and companies that violate their permits by polluting, it doesn't happen very often. When it does, we can find the  source and  it quickly. Point source pollution is not a big problem in the Guadalupe River Basin because the river is very well-managed. Cities, factories and wastewater treatment plants are examples of permit holders that must clean the water they use before piping it back into the river. Many times, the water they discharge is cleaner than the water they originally used!

Nonpoint source pollution gets its name because it is almost impossible to  the "point" where it begins. It is a result of our everyday activities. For example, if we  the runoff from  as it moves across the ground, we find that it often picks up leftover fertilizers and pesticides on peoples' lawns. These _____, as well as oil, grease and other pollutants from  and parking lots are a big part of nonpoint source pollution. Covering up natural land with paved , sidewalks, parking lots and  can make runoff water dirty with . These paved areas also remove the natural soil and plants that normally filter some of the  from runoff water before it enters the river.

() pollution

() identify

() pipe

() fines

() examine

() chemicals

() buildings

() streets

() rainfall () fix

Water Quality and NPS Classification

Student will complete a classification chart to evaluate their understanding of:

- the term NonPoint Source Pollution
- what land use activities can contribute to NPS

Directions for Student Activity:

- 1) Make student copies of the worksheet *Water Quality and NPS Classification* (p. 22).
- 2) Instruct students to match the picture with the pollution description by putting the number in the box. Second, classify pollutants as point source or nonpoint source by placing a check in the appropriate column. Last, classify each type of pollutant as either bacterial, toxic or nutrient.

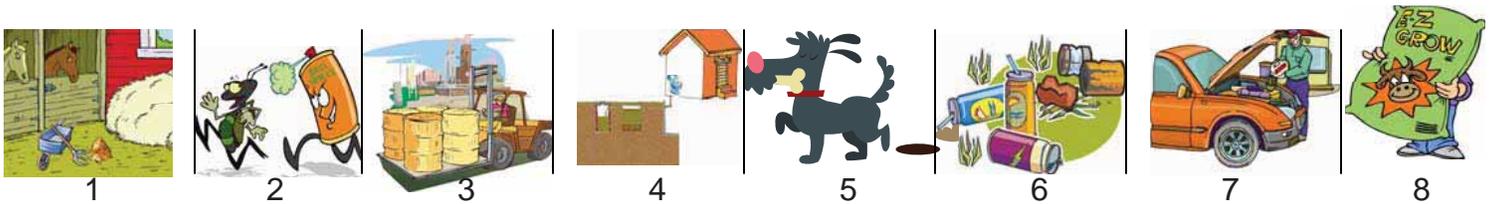
Water Quality and NPS Classification

Bacterial Pollution comes from human and animal wastes. Occasionally, lakes are closed to swimmers because of high counts of fecal coliform bacteria from raw sewage (human waste) and feedlot runoff that makes its way into rivers and streams that empty into lakes. Coliform bacteria itself is not harmful, but it usually indicates that pathogens (disease-causing organisms) are present.

Toxic Pollution is the presence of poisonous chemicals in water. Toxic pollution usually comes from point sources, such as industrial discharges or accidents in transportation (such as oil spills, train derailments or truck wrecks on highways). It can also come from nonpoint sources such as runoff from urban areas, as well as fallout from the atmosphere (acid rain).

Nutrient Pollution is derived from fertilizers. Although plants need nutrients for growth, if there is too much nitrogen and phosphorous in water then algae and other aquatic plants grow too rapidly. This uncontrolled rapid growth in water means that more plants die and decay, using up the oxygen dissolved in the water. A common result of this is fish and other aquatic life dying.

Directions: First, match the picture to the pollution description by putting the number in the box. Second, classify pollutants as point source or nonpoint source. Then use information above to classify as bacterial, toxic or nutrient.



Picture number?	Pollution Description	Point Source	Nonpoint Source	Bacterial	Toxic	Nutrient
	Animal Waste (Ranches)					
	Human Waste (Leaking Septic Tanks)					
	Animal Waste (Pet Poop)					
	Fertilizers (Lawns and Farms)					
	Pesticides (Lawns and Farms)					
	Petroleum Byproducts (Automobiles Leaking)					
	Trash (Improper Disposal by People)					
	Chemical Waste (Factories)					

Lesson 3: Water on the Move – Your Watershed (And Beyond!)

Engagement: *Puzzling Watersheds*

Students will be introduced to the watersheds in the Guadalupe River Basin through putting together an electronic jigsaw puzzle.

Exploration: *Focus on Your Watershed*

Students will examine the watershed where their school homes are located, and brainstorm to identify land uses throughout the watershed.

Explanation: *Wat-er Your Problems?*

Students will be introduced to problems in the watershed where their home and schools are located. Discuss concerns.

Elaboration: *It All Flows Downstream*

This activity will assist students in their understanding of how the land uses in their watershed can impact the water quality in watersheds downstream.

Evaluation: *Watershed Model(s)*

Students will use a watershed model to demonstrate Nonpoint Source Pollution in a watershed or in the Guadalupe River Basin.

Puzzling Watersheds

Students will assemble a computerized jigsaw puzzle of the Guadalupe River Basin. There are two ways to gain access to the puzzle:

- 1) a copy of the puzzle is on the *Don't Be Clueless About Water* CD
OR
- 2) a copy of the puzzle can be found on the GBRA website at:
<http://www.gbra.org/Education/WatershedsPuzzle.swf>

Directions for Student Activity:

1. The teacher can download the puzzle on all the computers in the lab, or simply pull it up on the classroom computer w/ the projector.
2. Directions are included in the first 3 screens of the puzzle. Students will need to read the first three introduction pages before they begin the puzzle. To assemble the puzzle, they will choose each puzzle piece with the mouse and rotate it by hitting any key on the keyboard. Then they can drag it and drop it into place on the map.
3. After students have completed the puzzle, it will morph into a map of the four main watersheds of the Guadalupe River Basin. Challenge students to figure which of the four main watersheds they live in, and identify the creeks, rivers and cities that are in the watershed.

Focus on Your Watershed

Preparation:

1. Make group copies of the watershed map for your area. (See **Map Supplement**)
2. Make an overhead transparency of the watershed map.

Directions for Student Activity and Discussion:

1. Hand out map of the watershed for your school. Eleven are included in this packet:
 - Upper Guadalupe River Above Comfort Watershed* (p. 1)
 - Guadalupe River Above Canyon Lake* (p. 2)
 - Blanco River Watershed* (p. 3)
 - Plum Creek Watershed* (p. 34)
 - San Marcos River Watershed* (p. 5)
 - Middle Guadalupe Watershed –Part A Watershed* (p. 6)
 - Middle Guadalupe Watershed –Part B Watershed* (p. 7)
 - Peach Creek Watershed* (p. 8)
 - Sandies Creek Watershed* (p. 9)
 - Coletto Creek Watershed* (p. 10)
 - Lower Guadalupe River Watershed* (p. 11)
2. Divide students into groups. Instruct students to examine the map and identify the approximate location of their school, homes (if rural), etc. Instruct them to write down all the names of the creeks and rivers in the watershed.
3. Use a transparency of the watershed map and brainstorm with students about how land is used. Use different colored vis-à-vis pens to shade in: urban areas, agricultural areas and large subdivisions. Use a simple symbol such as a triangle or square to identify approximate locations of recreational area such as: golf courses/ parks, tubing/canoeing/kayaking enterprises. Use another color and symbol to indicate the location of industries. Students should use map colors to make the same colorings and symbols on their maps.

Water Your Problems?

Preparation:

1. Teacher should refer to GBRA's *Basin Highlights Report** to research and identify problems areas within their watershed.
2. Make a transparency of the watershed upstream, if applicable.

Directions for Student Activity and Discussion:

1. Using the transparency of the map for the watershed that the school is located in, identify the approximate site of the problem area and circle it. Discuss whether the water quality problem could be related to land uses in the watershed above the location. Trace the streams that lead to the watershed upstream. Using that map, explore and discuss the possibility of land uses in that watershed impacting water quality downstream (in your watershed). Use the GBRA *Basin Highlights Report* to investigate land uses and problems in the upstream watershed.
2. Discuss how water quality in their watershed will affect water quality of the areas downstream – that their actions can impact people who live further down the river or creek.
3. As a class, write a short story about a water drop or fish or dragonfly as it makes its way from the northernmost part to the southernmost part of the watershed. Start the story with one sentence, and have each student add a sentence until completed.

* GBRA *Basin Highlights Report* can be provided, or teachers can find it on the GBRA website: <http://www.gbra.org/CRP/Default.aspx>

It All Flows Downstream

Preparation:

1. Make copies of *Guadalupe River Basin Watersheds* map/worksheet for students. (p. 29)
2. Hand out maps/worksheets for students to work on independently, or with a partner.
3. After students have finished with their work, use the following questions to lead a discussion about how the areas at the lower part of the river basin are recipients of all of the pollutants that result from the land use activities to the north.

Questions for discussion:

1. How many downstream watersheds does the water from your watershed flow through?
2. How many upstream watersheds flow into your watersheds?
3. What creeks and rivers flow into your watershed from upstream? What kind of land uses do you think are in those upstream watersheds? Could these activities affect the water that flows through your watershed? (Hints for answers to this below.)

Upper Guadalupe Above Comfort	Ranching, light urban, recreation (camping, canoeing, kayaking,),
Guadalupe Above Canyon Lake	Light urban, recreation (camping, canoeing, kayaking, golf), ranching
Blanco	Light urban, recreation (camping, canoeing, kayaking, golf), ranching, farming
Plum Creek	Heavy urban, ranching, farming, petroleum industry
San Marcos	Heavy urban, recreations (tubing, canoeing, kayaking, golf), farming, ranching
Middle Guadalupe	Heavy urban, recreation (tubing, canoeing, kayaking, motor boats, fishing, golf), light industry farming, ranching
Peach Creek	Ranching, farming
Sandies Creek	Ranching, farming
Coleto Creek	Ranching, farming, recreation (camping, boating, fishing)
Lower Guadalupe	Heavy urban, heavy industry, farming, ranching

4. Engage students to pretend that they live at the coast on San Antonio Bay, and to use the map to find the Guadalupe River and follow it upstream, noting all of the different creeks and streams that eventually merge into the Guadalupe River. Instruct them to use their purple map color to highlight each and every stream in the northern part of all of the watersheds, and follow all the way to the coast--- As if they were individual drops of rain that fell on each watershed.
5. When finished, the students should have a pretty thick purple line when it gets to the end. This is representative of all of the pollution that makes its way to the southern part of the river basin.
6. Discuss challenges that the downstream part of the river basin has because of the pollutants in the river.
 - a. Water quality is poor, so the water companies that pull water from the river for drinking water have a challenge getting the water clean enough to send out to homes, businesses, etc.
 - b. Water quality if poor, so contact recreation like swimming and fishing is not encouraged.

An extension of this activity would be to take a poster-sized copy of the map* (laminated) and add stickers into each of the watersheds, representing different types of land uses. For example, in watersheds with farming, put red circle stickers along the creek or river, and continue to add these stickers every few inches all the way to the coast. For those with urban areas, use yellow, for industry use orange, for recreation use blue. These dots should start in the watershed(s) where the particular land uses are taking place, and then continued all the way down to San Antonio Bay. It may be best to assign one watershed to a group of 3 students, instruct the groups to come up one at a time to add stickers. At the end of the activity, the stickers should be thick at the lower part of the river basin, and will illustrate how pollutants travel from north to south, and become more concentrated as more and more watersheds merge into the river.

**You can request a poster-sized copy of this map from GBRA. Give at least 2 weeks notice.*

Watershed Model(s)

Use a watershed model in the classroom - invite students to orally participate and determine what kinds of land uses may contribute to water quality problems, and what types of pollutants can result from these land uses. Invite them to speculate on what activities could be modified in an attempt to help improve water quality.

Option 1:

GBRA has two tabletop watershed models that can be used for this activity. Both are small (3' X 3') models that can easily be set up in the classroom. These models have props (houses, cows, cars, etc.), and are a great hands-on tool for students.

1. represents the upper Guadalupe Basin, with hills, golf course, industry, agriculture, roads, residential areas, construction areas, and a creek/lake
2. represents the lower (coastal) Guadalupe Basin, with residential areas, marinas, wetlands, industry, construction areas, streams and bay

Teachers can borrow a model from GBRA or they can request the GBRA Education Coordinator to visit with a model.

The model should be set up in advance of the arrival of students. Teacher (or speaker) can lead a discussion about the different types of land uses, and have students speculate on what types of problems we could possibly see as a result of these land uses. Add kool-aid to the areas where there are pesticide and fertilizers. Various pollutants can be addressed with the use of cocoa – sediment, oil and gas (liquid mixture), manure, etc. After the model is set up and the pollutants added to the landscape, students can spray water on the model and then see how the pollutants make their way as run-off into the water bodies.

After the rain event has taken place, encourage students to brainstorm about what land-use activities were detrimental, and how some of these habits and activities can be changed. For example, a berm to prevent soil erosion from the farm, use of natural fertilizers instead of chemical, use of beneficial nematodes or organic pesticides, etc.

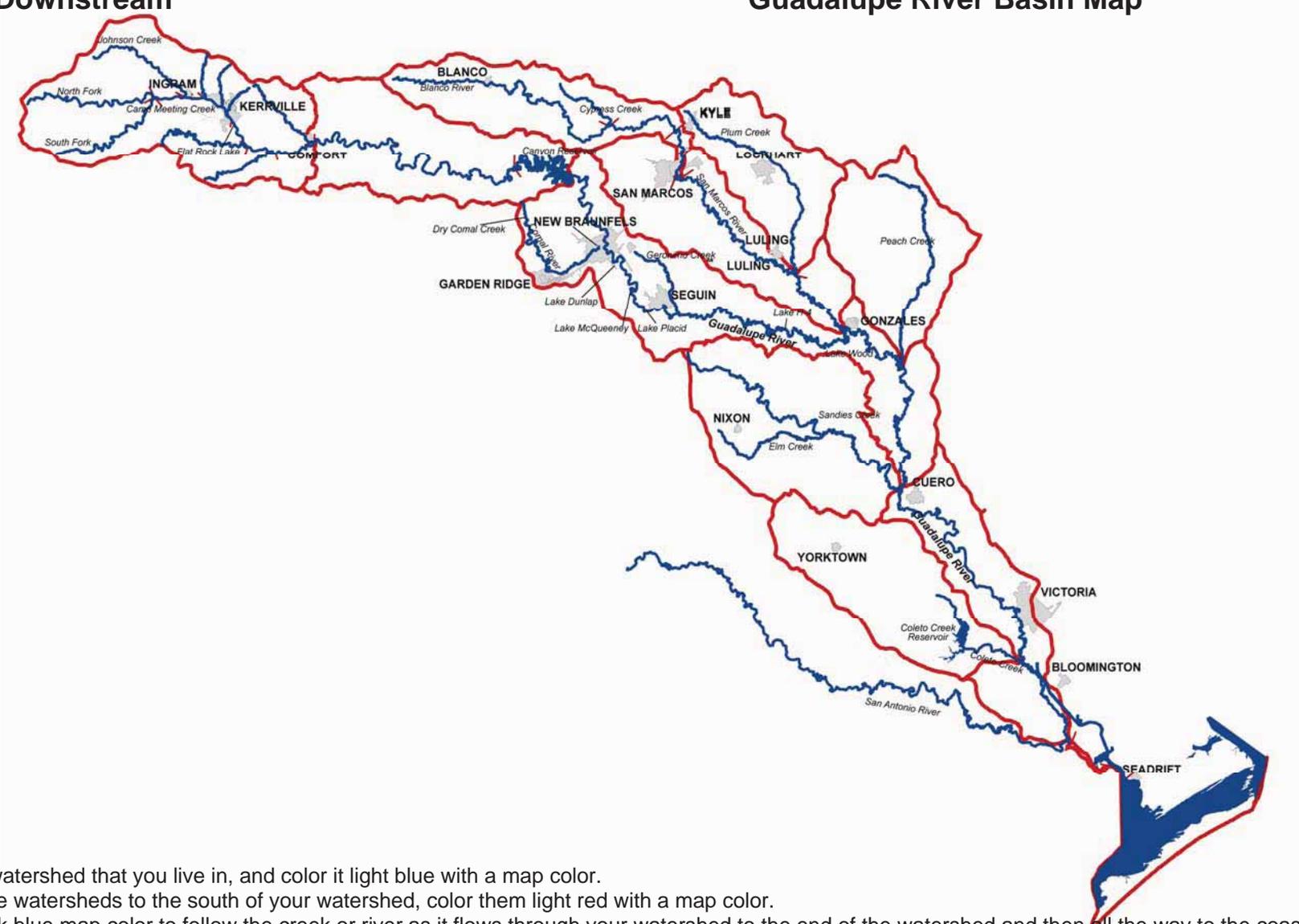
Option 2:

GBRA also has a large river basin model (7' X 3') that is available for use. This is a true model of the river basin, elevations included. Each of the 10 watersheds is painted on the model. This enables students to see how elevation plays a role in stream/river flow. Water can be sprayed on this model as well, so the fake 'pollutants' can also be sprinkled on this model, and students will be treated to a very eye-opening viewing of how pollutants become more concentrated as the different watersheds merge together.

The large model is not available for loan –the GBRA Education Coordinator must be scheduled in advance to bring the model. . Before arrangements will be finalized to bring the model to the school, GBRA requests that at least 50 students will be able to work with the model.

It All Flows Downstream

Guadalupe River Basin Map



Directions:

- 1) Find the watershed that you live in, and color it light blue with a map color.
- 2) If there are watersheds to the south of your watershed, color them light red with a map color.
- 3) Use a dark blue map color to follow the creek or river as it flows through your watershed to the end of the watershed and then all the way to the coast.
- 4) If there is a river or stream that flows through your watershed from the north of your watershed, color these 'upstream' watersheds light green.
 - a. Exceptions are: Upper Guadalupe Above Comfort, Blanco, Plum, Peach, Sandies, Coleta – these are independent of any upstream flow.
- 5) Use a purple map color to color all of the streams and rivers that are upstream of your watershed. Continue coloring the river through your watershed and all the way to the coast, coloring along the blue line that you have already drawn.

Texas Essential Knowledge and Skills

Science TEKS

- (4.3), (5.3), (6.3), (7.3), (8.3) – The student uses critical thinking and scientific problem solving to make informed decisions.
- (4.4), (5.4), (6.4), (7.4), (8.4) – The student knows how to use a variety of tools and methods to conduct science inquiry.
- (4.11), (5.11) – The student knows that the natural world includes earth materials and objects in the sky.
- (6.14) – The student knows the structures and functions of Earth Systems.
- (7.14), (8.14) – The student knows that natural events and human activity can alter Earth's systems.

Social Studies TEKS

- (4.6), (5.6) – The student uses geographic tools to collect, analyze, and interpret data.
- (4.7), (5.7) – The student understands the concept of regions.
- (4.8), (5.8) - The student understands the location and patterns of settlement and the geographic factors that influence where people live.
- (4.22), (5.25), (6.21), (7.21), (8.30) – The student applies critical-thinking skills to organize and use information acquired from a variety of sources including electronic technology.
- (4.23), (5.26), (6.22), (7.22), (8.31) – The student communicates in written, oral and visual forms.
- (4.24), (5.27), (6.23), (7.23), (8.32) – The student uses problem-solving and decision making skills, working independently and with others, in a variety of settings.
- (5.9) – The student understands how people adapt to and modify their environment.
- (6.3) - The student uses maps, globes, graphs, charts, models and databases to answer geographic questions.
- (7.6) – The student understands the impact of physical process on patterns in the environment.
- (7.10) – The students understands the effects of the interaction between humans and the environment in Texas during the 19th and 20th centuries.
- (6.7) – The students understands the impact of interactions between people and the physical environment on the development of places and regions.
- (7.8) – The student uses geographic tolls to collect, analyze, and interpret data.
- (7.9) – The student understands the location and characteristics of places and regions of Texas.
- (8.10) – The student uses geographic tools to collect, analyze, and interpret data.

Texas Commission on Environmental Quality (TCEQ)

Cooperative Reimbursement Contract for State Agencies and Local Governments

CONTRACT SIGNATURE PAGE

Contract Name: Geronimo and Alligator Creeks Watershed Protection Plan (WPP) Implementation – Education and Outreach

Contract Number: 582-14-43818

Performing Party: Guadalupe-Blanco River Authority (GBRA)

Performing Party Identification Number: 14760017795

Maximum Authorized Reimbursement: \$184,000.00

Effective Date: Date of last signature

Expiration Date: 8/31/2017

If checked, this Contract requires matching funds. Match Requirement: \$122,667.00

If checked, this Contract is funded with federal funds.

CFDA Number: 66.460

Federal Grant Number: TBD

This Contract is entered under: Gov't Code ch. 771 Gov't Code ch. 791 Water Code § 5.124

TCEQ, an agency of the State of Texas, and the named Performing Party, a state agency or local government of the State of Texas, enter this agreement (Contract) to cooperatively conduct authorized governmental functions and activities under the laws of the State of Texas.

The Parties agree as follows: (a) to be effective, the Contract must be signed by an authorized official of the TCEQ and the Performing Party; (b) this Contract consists of all documents specified in the list of Contract Documents following this page; and (c) as authorized by TCEQ, the Performing Party will conduct Contract Activities as part of its own authorized governmental functions and TCEQ will reimburse Allowable Costs subject to the Texas Uniform Grant Management Standards (UGMS) and this Contract.

TCEQ

By: _____

Authorized Signature

L'Oreal W. Stepney P.E.

Printed Name

Deputy Director, Office of Water

Title

Date

Authorized Signature

Lilia VanderWal, CTPM, CTCM

Printed Name

Procurements & Contracts Representative

Title

Date

GBRA

By: _____

Authorized Signature

William E. West Jr

Printed Name

General Manager

Title

Date

SCOPE OF WORK

“Geronimo and Alligator Creeks WPP Implementation – Education and Outreach,” is a collaborative effort between the GBRA and the Irma Lewis Seguin Outdoor Learning Center (ILSOLC), an environmental and recreational learning center located in the heart of the Geronimo and Alligator Creeks watersheds. The ILSOLC offers hands-on science and nature activities for explorers and naturalists of all ages. This proposed project will expand these activities to include opportunities to learn about nonpoint source (NPS) pollution.

Geronimo Creek flows through the ILSOLC facility and is used as part of an outdoor “classroom” for learning about nature and the environment. School children of all ages from the Seguin, New Braunfels and Comal ISDs visit the facility annually. This project will add a station that focuses on the environmental health of the creek and its riparian habitat.

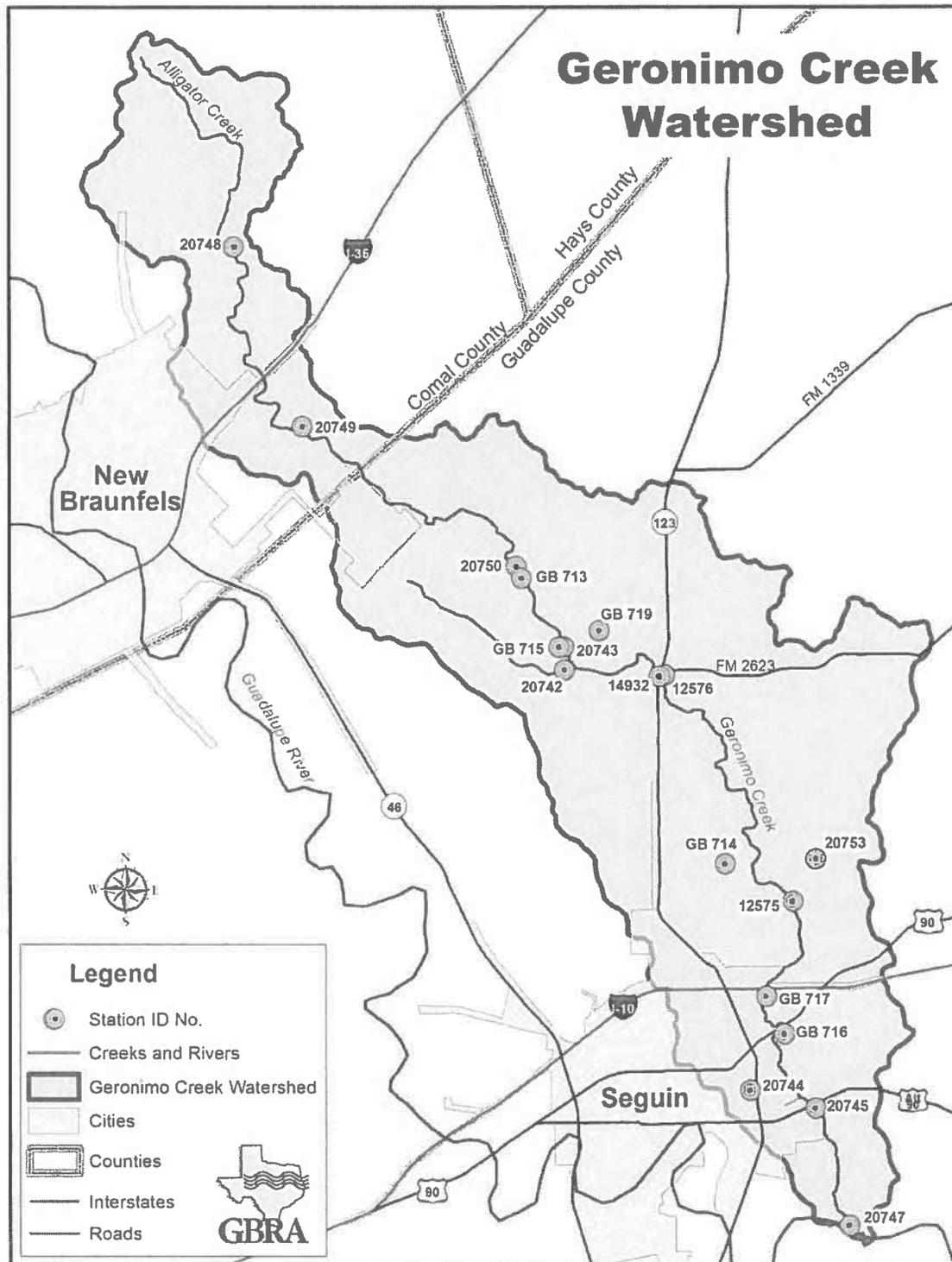
The project combines technology with on-the-ground demonstrations and outdoor education covering NPS pollution best management practices (BMPs) and associated load reductions to promote activities which positively impact water quality in stakeholders living and working in the Geronimo and Alligator Creeks watersheds. The Geronimo and Alligator Creeks WPP was accepted by EPA on September 13, 2012. The WPP states “An aggressive outreach and education program will be vital to successful engagement of watershed stakeholders.” Several of the project’s deliverables will highlight the Geronimo and Alligator Creeks watershed, but will also be appropriate for use throughout the Guadalupe River Basin, as well as, across the state.

In year one of the project, the GBRA will develop video and audio public service announcements (PSAs) focusing on two key nonpoint pollution sources identified in the WPP, dog waste and stormwater quality. In years two and three, those PSAs will be played on local media and on rolling ad monitors in businesses within the watershed.

The GBRA will develop educational resources that include an interactive, flash computer module appropriate for all ages. The interactive computer module will provide information about the riparian processes and features at “the touch of a finger” to a computer screen. The module will be installed onto the educational kiosk that was developed and made available to students in the Geronimo Creek watershed through the TCEQ CWA Section 319(h) grant, *Guadalupe River Basin Monitoring Network – Continuous Monitoring on Threatened or Impaired Water Bodies*, completed in 2012. Additionally, the module will be available on computers in the ILSOLC environmental science building for use during environmental classes. The GBRA, in coordination with project partners, will develop a “riparian walk” along Geronimo Creek that takes what was introduced in the workshops and flash module, outdoors. The nature walk will include an interpretive kiosk and signage appropriate for all ages. Also, the GBRA will develop a geocaching “treasure hunt” that takes high school students on a search for riparian plants and features, located along the creek.

The GBRA, with assistance from project partners, will oversee the development and design of Low Impact Development (LID) demonstration structures. In years one and two, the demonstration projects will be constructed. The demonstration projects include a vegetated swale, rain garden, and pervious pavement. A rainwater harvesting system and a garden that exhibits native plants and grasses will also be constructed. The GBRA and its partners will support demonstration projects by hosting two NPS education workshops in years two and three. The GBRA and its partners will assist with these workshops, and will provide professional educators with experience in LID and Green Infrastructure (GI) techniques. The workshops will be open to municipal officials, municipal staff, developers, and landowners and will focus on components of LID. The demonstration projects will also be available and open to other adult educational opportunities offered at ILSOLC, such as classes for Master Naturalists and Master Gardeners.

1. Project Map:



Map of the Geronimo and Alligator Creeks watershed

Task 1: Project Administration

Objective: To effectively administer, coordinate, and monitor all work performed under this project including technical and financial supervision and preparation of status reports.

Subtask 1.1: Project Oversight – The GBRA will provide technical and fiscal oversight of the staff and/or subgrantee(s)/ subcontractor(s) to ensure Tasks and Deliverables are acceptable and completed as scheduled and within budget. With the TCEQ Project Manager’s authorization, the GBRA may secure the services of subgrantee(s)/ subcontractor(s). Project oversight status will be provided to TCEQ with the Quarterly Progress Reports (QPRs).

Subtask 1.2: QPRs – The GBRA will submit QPRs to the TCEQ Project Manager by the 15th of the month following each state fiscal quarter for review by the TCEQ Project Manager and incorporation into EPA’s Grant Reporting and Tracking System (GRTS). A template for the QPR will be provided to the GBRA by the TCEQ Project Manager.

Subtask 1.3: Reimbursement Forms – The GBRA will submit Reimbursement Forms as identified in the Special Terms and Terms Conditions.

Subtask 1.4: Contract Communication – The GBRA will participate in a post-award orientation meeting with TCEQ within 30 days of Contract execution.

The GBRA will maintain regular telephone and/or e-mail communication with the TCEQ Project Manager regarding the status and progress of the project. This will include a call or meeting each state fiscal quarter following the submittal of the quarter’s QPR. Project task status, financial status, and any other matters that require attention will be discussed during the call or meeting. The TCEQ Project Manager may request additional information from the Performing Party prior to the call or meeting.

The GBRA will provide a Contract Closeout Strategy within the first quarter of the last year of the Contract. The template for the Contract Closeout Strategy will be provided by the TCEQ Project Manager. Matters that must be communicated to the TCEQ Project Manager include, but are not limited to:

- Notification a minimum of 14 days before the GBRA has scheduled public meetings or events, initiation of construction, or other major Task activities.
- Notification within 48 hours regarding events or circumstances that may require changes to the budget, Scope of Work, or Schedule of Deliverables.

Subtask 1.5: Coordination Meeting with EPA – The GBRA will attend a project update and coordination meeting with EPA upon request by TCEQ and EPA to share progress on goals, measures of success, challenges, and opportunities.

Subtask 1.6: Annual Report Article – The GBRA will provide an article for the NPS Annual Report upon request by TCEQ. The article will include a brief summary of the project and describe the activities of the past fiscal year.

Deliverables:

- QPRs
- Reimbursement Forms
- Contract Communication Meeting Notes
- Contract Closeout Strategy
- Annual Report Article

Task 2: Riparian Education

Objective: To illustrate how the riparian system works and its importance to the health of the ecosystem.

Subtask 2.1: Interactive Flash Module – The GBRA will develop an interactive flash module to support outreach and education in the watershed and riparian educational workshops statewide and the install flash module on the computer kiosk and laptop computers located at the ILSOLC.

Subtask 2.2: Computer Technology – The GBRA will purchase and install computers, projector, projector screen, router and microscope to support the use of the interactive module as part of workshops held at the ILSOLC, including riparian education, elementary school tours, landowners and Master Naturalists workshops.

Subtask 2.3: Geocaching Exercise – The GBRA will develop a geocaching exercise for high school students that visit ILSOLC, taking students on a tour of the riparian network on the ILSOLC property to identify riparian vegetation and functions. Educational assessments and evaluations will be administered at the beginning and end of the exercise to gauge the knowledge gained and how effective the exercise was for each participant.

Subtask 2.4: “Riparian Walk” – The GBRA will develop a “riparian walk,” along Geronimo Creek, including an informative kiosk and signage that includes Quick Response (QR) codes for smart devices.

Deliverables:

- Flash interactive module
- Installation of module on the computer kiosk and laptop computers at the ILSOLC
- Installation of computers (10) projector (1), projector screen(1), router(1) and microscope (1) at the ILSOLC (quantities are approximate, and may change with TCEQ PM approval)
- Geocaching exercise, including summary of educational assessment and evaluation results from participants
- “Riparian Walk” kiosk (up to three total kiosks) and signage

Task 3: NPS Education

Objective: Develop NPS resources to educate individuals about their watershed, the impacts of individual actions, and how they can reduce their impacts on the Geronimo Creek watershed. All subtask materials will be submitted to the TCEQ Project Manager for review and comment before dissemination.

Subtask 3.1: Pet Waste PSA – The GBRA will develop a 30-second video on the importance of picking up after pets; post the video as a PSA on local media and on rolling ad monitors in businesses in the Geronimo Creek watershed; and develop an audio version for use as PSAs on local radio stations.

Subtask 3.2: Stormwater PSA – The GBRA will develop a 1-minute video on the fate and transport of pollutants in stormwater; post the video as a PSA on local media and on rolling ad monitors in businesses in the Geronimo Creek watershed; and develop an audio version for use as PSAs on radio stations in the watershed.

Subtask 3.3: LID Workshops – The GBRA will organize and conduct two workshops on LID practices, including stormwater controls, aimed at municipal officials and employees, landowners, and developers. Educational assessments and evaluations will be administered at the beginning and end of the workshops to gauge the knowledge gained and how effective the workshops were for each participant.

Deliverables:

- Two NPS videos on local media and associated audio versions to local radio stations
- Two workshops (years two and three) on LID practices including summary of educational assessment and evaluation results from participants

Task 4: Demonstration of LID Practices

Objective: To demonstrate function, size and applicability of LID practices for urban NPS pollution load reductions.

Subtask 4.1: Rainwater Harvesting System – The GBRA will design and construct a rainwater harvesting system to collect rainwater off of the pavilion (3,344 sq. ft.) located at the ILSOLC; the system will provide storage

for up to 12,300 gallons of rainwater for use in landscape watering and maintenance of the LID demonstrations on the site. The GBRA will develop signage and printed literature describing the rainwater harvesting system for use at workshops and other outreach events held at the ILSOLC.

Subtask 4.2: Other LID Structures – The GBRA will design and construct LID demonstration structures: pervious pavement (up to 6 parking slots), vegetated swale(s) (up to 600 linear feet), and a rain garden (up to 800 square feet). The GBRA will develop signage and printed literature for use at workshops and outreach events held at the ILSOLC.

Subtask 4.3: Green Landscaping – The GBRA will design and construct a demonstration plot containing urban landscaping with native plants and grasses, promoting water conservation, proper fertilizer use and drought tolerance (up to 1,000 square feet). The GBRA will develop signage and printed literature for use at workshops and other outreach events held at the ILSOLC.

Deliverables:

- Installation of rainwater harvesting system
- Installation of pervious pavement (up to six parking slots)
- Installation of vegetated swale (up to 600 linear feet)
- Installation of rain garden (up to 800 square feet)
- Installation of demonstration plot of native grasses and plants (up to 1,000 square feet)
- Printed information and signage

Task 5: Program Outreach

Objective: To develop outreach strategies and materials that advertise and promote the riparian education, LID practices and NPS education activities as described in Tasks 2-4. All subtask materials will be submitted to the TCEQ Project Manager for review and comment before dissemination.

Subtask 5.1: Task 2 – Deliverables and accomplishments associated with Task 2 will be promoted to stakeholders in the watershed through a press release, partnership meeting presentations, posting to the Geronimo Creek Watershed Partnership project web page <http://www.geronimocreek.org/>, and in the Geronimo Creek Watershed Partnership newsletter.

Subtask 5.2: Task 3 – Deliverables and accomplishments associated with Task 3 will be promoted to stakeholders in the watershed through a press release, partnership meeting presentations, posting to the Geronimo Creek Watershed Partnership project web page <http://www.geronimocreek.org/>, and in the Geronimo Creek Watershed Partnership newsletter.

Subtask 5.3: Task 4 – Deliverables and accomplishments associated with Task 4 will be promoted to stakeholders in the watershed through a press release, partnership meeting presentations, posting to the Geronimo Creek Watershed Partnership project web page <http://www.geronimocreek.org/>, and in the Geronimo Creek Watershed Partnership newsletter.

Deliverables:

- Deliverables and accomplishments communicated per subtask 5.1
- Deliverables and accomplishments communicated per subtask 5.2
- Deliverables and accomplishments communicated per subtask 5.3

Task 6: Final Report

Objective: The Performing Party will produce a Final Report that summarizes all activities completed and conclusions reached during the project. The report will describe project activities, identify and discuss the extent to which project goals and purposes have been achieved, and the amount of funds actually spent on the project. The report will emphasize successes, failures, lessons learned, and will include specific water quality data demonstrating water quality improvements if applicable. The Final Report will summarize all the Task Reports in either the text or as appendices.

Subtask 6.1: Draft Final Report – The Performing Party will provide a draft report summarizing all project activities, findings, and the contents of all previous deliverables, referencing and/or attaching them as web links or appendices. This comprehensive, technical report will provide analysis of all activities and deliverables under this Scope of Work. The report should be structured per the following outline:

- Title;
- Table of Contents;
- Executive Summary;
- Introduction;
- Project Significance and Background;
- Methods;
- Results and Observations;
- Discussion;
- Summary;
- References; and
- Appendices.

Subtask 6.2: Final Report – The Performing Party will revise the draft report to address comments provided by the TCEQ Project Manager and EPA. The Performing Party will submit the final report to the TCEQ Project Manager, who will subsequently submit it to EPA.

Deliverables:

- Draft Final Report
- Address TCEQ/EPA comments pursuant to TCEQ/EPA approval
- Final Report

SCHEDULE OF DELIVERABLES

Task No.	Deliverable	Due Date
1. Project Administration		
1.2	QPR's	The 15 th of the month following each state fiscal quarter
1.3	Reimbursement Forms	Within 30 days following each state fiscal quarter. For the last reporting period of the project, reimbursement forms are required to be on a monthly basis
1.4	Post-Award Orientation Meeting	Within 30 days of contract execution
1.4	Quarterly call or meeting, and notes	Quarterly, following QPR submittal
1.4	Contract Closeout Strategy	The first quarter of the last year of the project
1.5	EPA Coordination Meeting	TBD
1.6	Annual Report Article	Upon Request
2. Riparian Education		
2.1	Interactive flash module	Quarter 4
2.1	Installation of module on computer kiosk and ILSOLC computers	Quarter 5
2.2	Installation of computers, projector, screen, router, and microscope	Quarter 3
2.3	Geocaching exercise development complete	Quarter 3
2.3	Student tours educational assessment and evaluation results	Quarters 5 – 12
2.4	"Riparian Walk" kiosk and signage	Quarter 4
3. NPS Education		
3.1	Pet waste PSAs (audio and video)	Quarter 4
3.2	Stormwater PSAs (audio and video)	Quarter 4
3.3	Two LID Workshops	1 in each Quarters 7 and 11
3.3	LID Workshop educational assessment and evaluation results	Quarters 7 and 11
4. Demonstration of LID Practices		
4.1	Installation of rainwater harvesting system and supporting educational materials	Quarter 6
4.2	Installation of pervious pavement and supporting educational materials	Quarter 6

Task No.	Deliverable	Due Date
4.2	Installation of vegetated swale and supporting educational materials	Quarter 6
4.2	Installation of rain garden and supporting educational materials	Quarter 6
4.3	Installation of demonstration plot of native grasses and plants and supporting educational materials	Quarter 6
5. Program Outreach		
5.1	Promotion of Task 2 (Riparian Education)	Documented in Quarters 4 and 8 QPRs and the Final Report
5.2	Promotion of Task 3 (NPS Education)	Documented in Quarters 4 and 8 QPRs and the Final Report
5.3	Promotion of Task 4 (Demonstration of LID Practices)	Documented in Quarters 4 and 8 QPRs and the Final Report
6. Final Report		
6.1	Draft Final Report	July 1, 2017
6.2	Final Report	August 1, 2017

COST BUDGET

16. Budget. Authorized budgeted expenditures for work performed are as follows:

Budget Category	Cost for Work to be Performed
Salary/Wages	\$93,662.00
Fringe Benefits	\$37,660.00
Travel	\$380.00
Supplies	\$16,800.00
Equipment	\$0
Contractual	\$31,000.00
Construction	\$54,500.00
Other	\$44,910.00
Total Direct Costs	\$278,912.00
Indirect Cost	\$23,588.00
Other In-Kind Contributions	\$4,167.00
Total Costs	\$306,667.00
Recipient Cost Share (40%)	\$122,667.00
Total Reimbursable Costs (60%)	\$184,000.00

16.1 **Indirect Cost Reimbursable Rate.** The reimbursable rate for this Contract is 25.22% of:

salary and fringe benefits modified total direct costs other direct costs base

If other direct cost base, identify: Salary/Wages

This rate is less than or equal to (check one):

approved predetermined rate experienced-based predetermined rate default rate

16.2 **Other.** If Budget Category "Other" is greater than \$25,000 or more than 10% of budget total, identify the main constituents: Video ad time, workshops and printing of supporting materials.

16.3 **Budget Categories.** The Budget Categories above have the definitions, requirements and limitations stated in UGMS. Construction costs are not reimbursable without prior, specific written authorization from TCEQ.

16.4 **Budget Control.** Actual costs to be reimbursed for each line item above must not exceed ten percent (10%) over the budgeted amount for that line item. Total costs to be reimbursed must be at or less than the total specified. All invoices must be submitted in a format that clearly shows how this requirement is being met. At a minimum, invoices must show expenses for the invoice period, year-to-date expenses, projected totals for the year (or applicable Contract period), percent of budget spent to date, and percentage of budget projected to be spent.

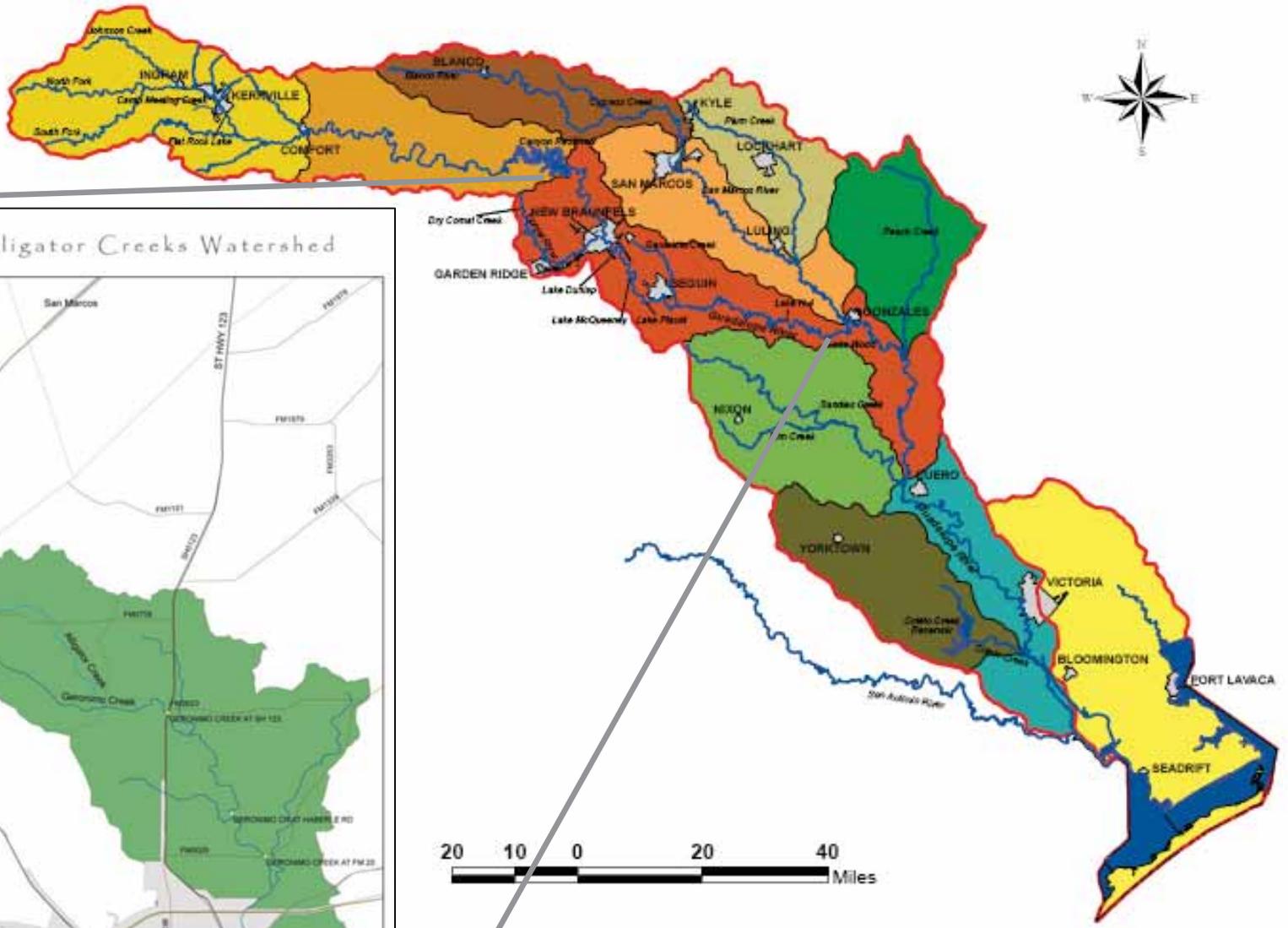
16.5 **Invoice Submittal.** Unless otherwise stipulated in the Contract, invoices must be submitted to the individual named in TCEQ Project Representatives and Records Location at monthly intervals. Final invoices will be submitted within two calendar months after completing the Scope of Work activities. TCEQ may extend this deadline by unilateral contract agreement.

Taking Charge of Water Quality in the Geronimo and Alligator Creeks Watersheds through Outreach and Education

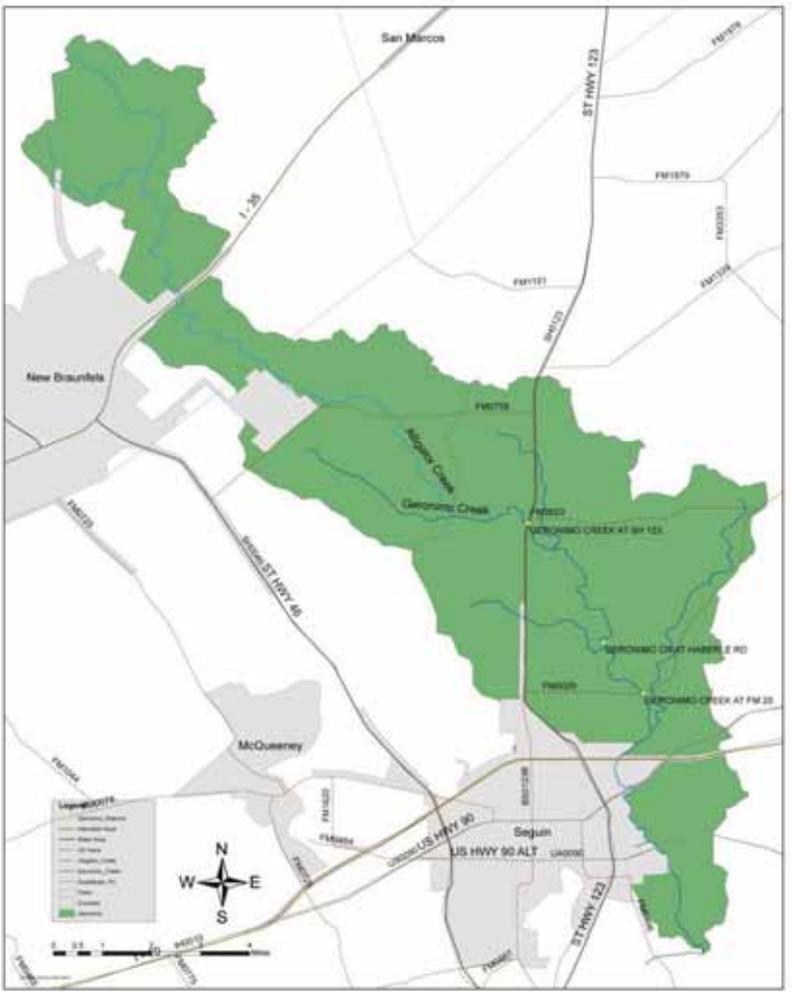
Debbie Magin

August 20, 2014

GUADALUPE RIVER BASIN WATERSHEDS



Geronimo and Alligator Creeks Watershed



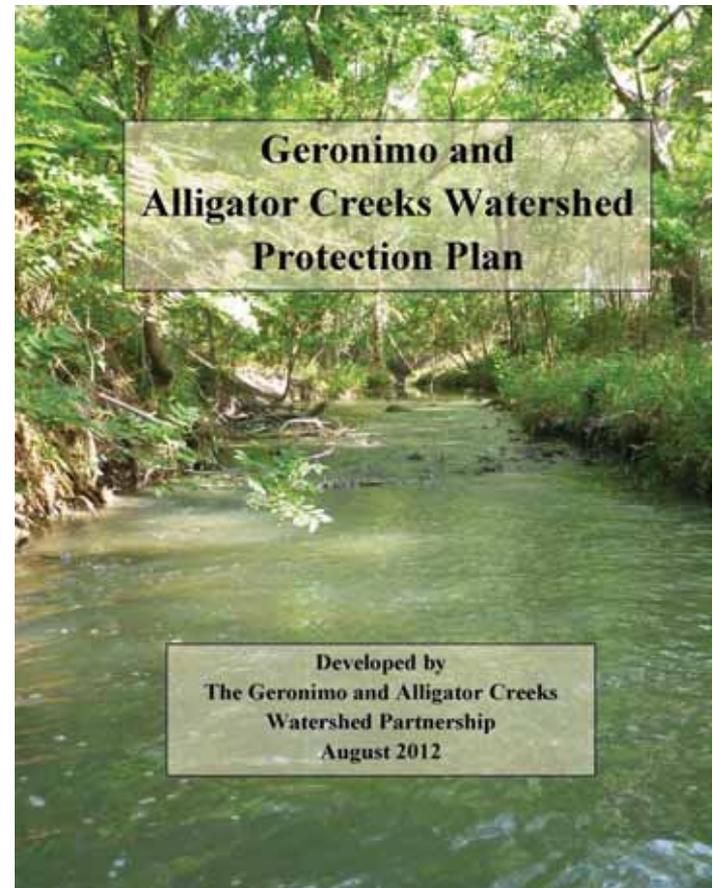
Water Quality

- Geronimo Creek was listed on the 2006 303(d) list for not supporting its contact recreation use
- Geronimo Creek was first listed in 2000 for concern for nutrient enrichment



What is the Geronimo and Alligator Creeks Watershed Protection Plan?

- A community-driven, voluntary management plan developed to solve complex water quality problems
- The purpose is to restore and protect the creeks
- It relies heavily on stakeholder involvement at the local level



Nonpoint Source Pollution

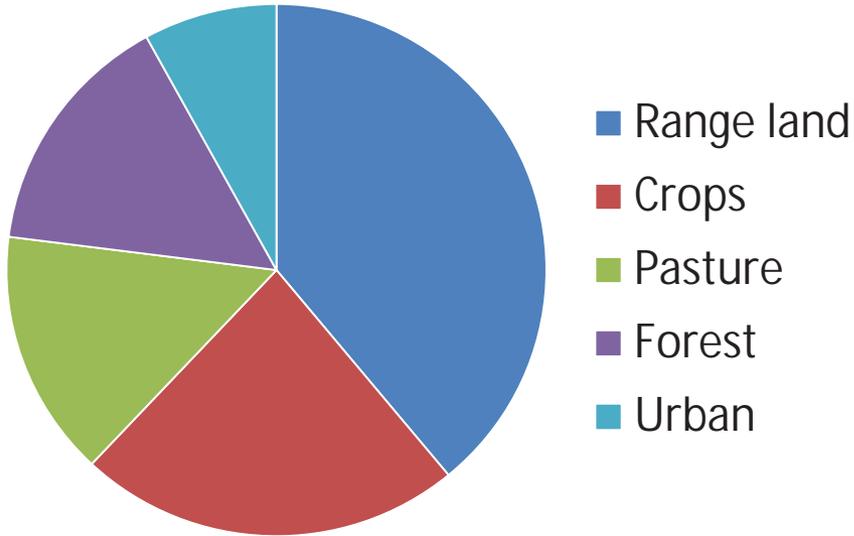
- Pollution not coming from a pipe
 - Urban Storm water
 - Septic systems
 - Agriculture Operations
 - Wildlife



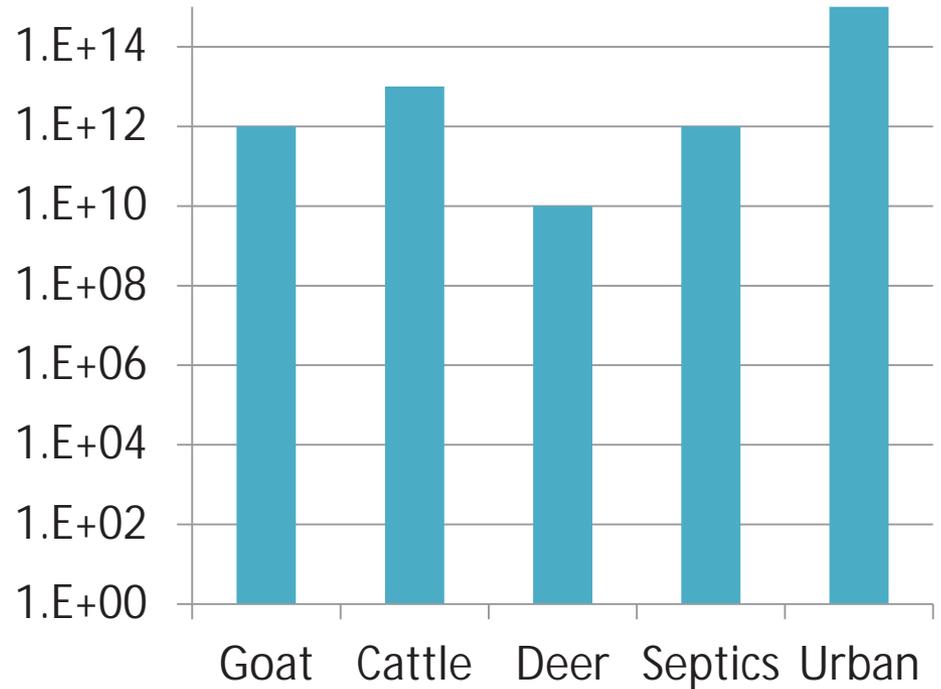
1995. 12th. Hwy. Co., New Brunswick, NJ - 07033



Land Use



E. coli Loading



- In terms of loading, urban runoff was higher than all the other sources.

Taking Charge of Water Quality in the Geronimo and Alligator Creeks Watershed through Outreach and Education

Project Participants:

EPA

GBRA

ILSOLC

Texas AgriLife Extension

Texas Water Resources Institute

Texas AgriLife Extension and Texas Water Resource Institute (TAMU)

- Assist in development of outreach and education materials
- Provide instructors for classes on green infrastructure
- Design of green infrastructure demonstrations and rainwater harvesting
- Assist in development of resources that support riparian education

Project Goals

Design and implement the educational components of the WPP that will serve as tools that can be utilized with elementary school students through high school, with teachers, with civic leaders, with riparian landowners, and with the general public in order to enhance understanding of the health of the riparian and creek ecosystem in the Geronimo and Alligator Creeks Watersheds.

Project Budget –

Federal – \$184,000

Non-Federal Match - \$122,667

Total - \$ 306,667

Project Timeline – 3 years

September 2014 – August 2017

Non-Federal Match

GBRA - project administration, development of educational materials, construction management, final report

\$52,862 personnel

\$21,340 fringe

\$13,388 indirect

ILSOLC – construction management, coordination of workshops and school tours, development of educational resources, volunteer hours (tours, installation of demonstration projects)

\$30,910

\$4,167 (use of land for demonstration projects)

Project Tasks

Task 1 - Project Administration

Task 2 - Riparian Education

Task 3 - Nonpoint Source Education

Task 4 - Demonstration of Green
Infrastructure

Task 5 - Marketing

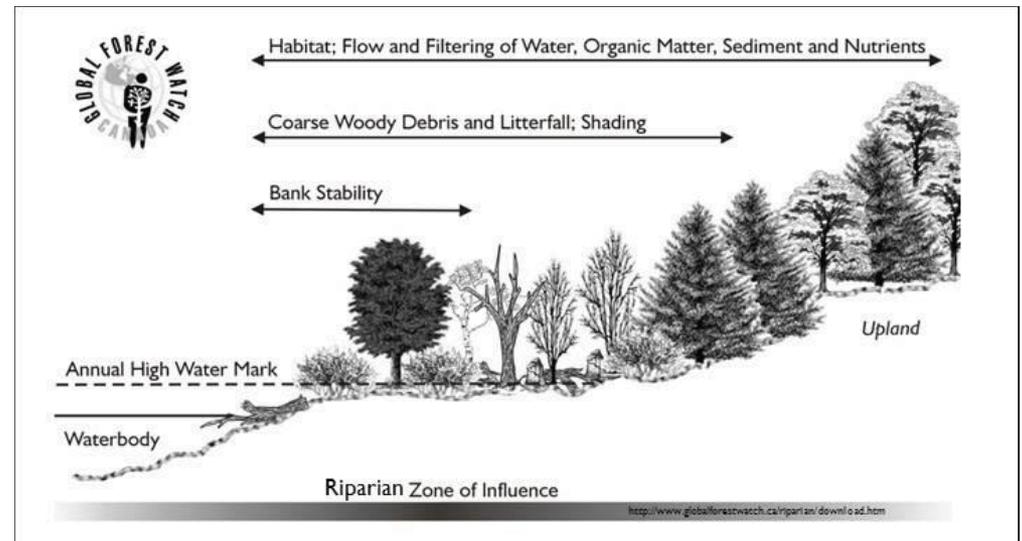
Task 6 - Final Report

Project Administration

- Project oversight
- Quarterly Progress Reports
- Quarterly Reimbursement Requests
- Contract Communications
- Coordination with EPA and TCEQ
- Annual Report Article

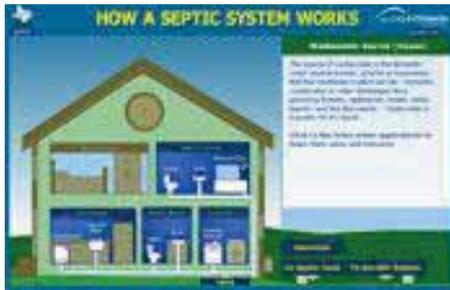
Riparian Education

To illustrate how the riparian system works and its importance to the health of the ecosystem



Riparian Education

-Interactive Flash Module – installed on ILSOLC computers, kiosks, used at workshops



Riparian Education

-Purchase and install computer technology (10 computers, microscope, router, screen, projector) for the ILSOLC to support the module as part of the workshops, school tours, Master Naturalist workshops, landowner education



Riparian Education

-Develop "Riparian Walk" in the riparian area along Geronimo Creek, including kiosks and signage

Includes QR codes for smart phones



Riparian Education

-Develop geocaching exercise for high school students to use on riparian walk along Geronimo Creek



Nonpoint Source Education

To educate individuals about their watershed, the impacts of individual actions and how they can reduce their impacts



Nonpoint Source Education

- Develop 30 second video on importance of picking up after your pets
- Post video as a public service announcement on local media and rolling ad monitors
- Develop audio version



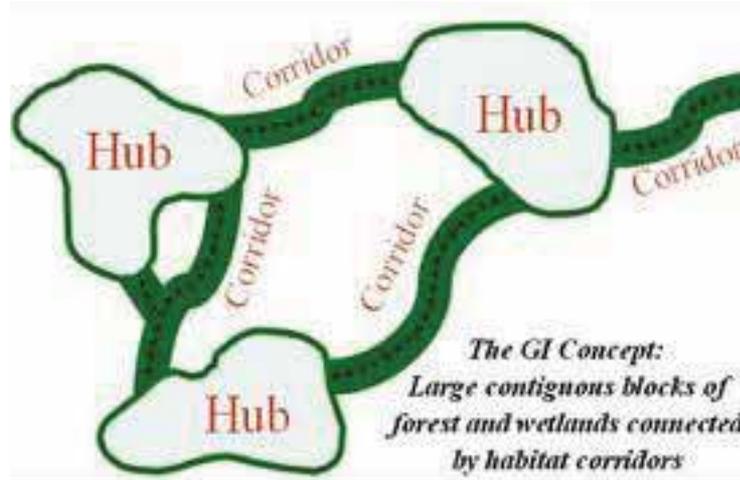
Nonpoint Source Education

- Develop 1-minute video on fate and transport of storm water
- Post video as a public service announcement on local media and rolling ad monitors
- Develop audio version



Nonpoint Source Education

-Conduct two workshops on green infrastructure, aimed at municipal officials, employees, landowners, developers



Demonstration of Green Infrastructure

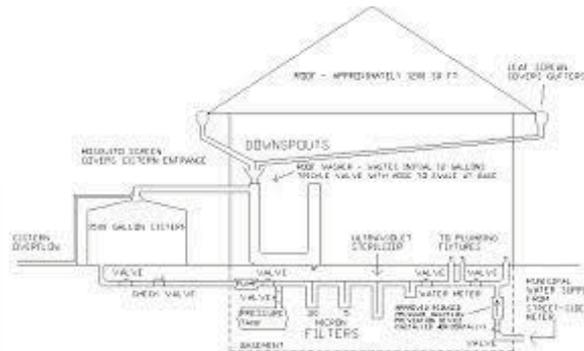
Demonstrate function, size and applicability of green infrastructure for urban nonpoint source pollution load reductions



Demonstration of Green Infrastructure

Construction of rainwater harvesting system on pavilion

- storage of over 12,000 gallons for use as landscape watering and maintenance of green infrastructure
- includes signage and printed literature



Demonstration of Green Infrastructure

Demonstration of pervious pavement (up to six parking spots) in front natural history building

Includes signage and printed literature



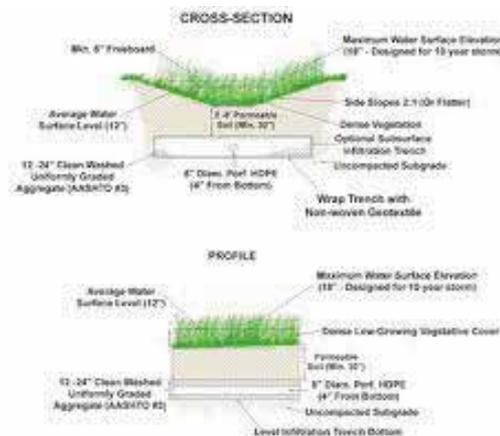
Demonstration of Green Infrastructure

Demonstration of urban landscaping with native plants and grasses, promoting water conservation, proper fertilizer use, drought tolerance



Demonstration of Green Infrastructure

Demonstration of vegetative swales



Marketing

Develop strategies and materials that advertise and promote riparian education, use of green infrastructure and nonpoint source education

- press releases
- presentations
- posting to webpages
- newsletter articles

Final Report

GBRA will develop final report that summarizes all activities completed and conclusions reached, goals met, successes, failures, lessons learned, and water quality improvements if any.

July 16, 2014

Rainwater harvesting program in Seguin should 'capture' attendee interest

Contact: Ward Ling, 979-945-6980, wling@ag.tamu.edu

SEGUIN – The “Rainwater Harvesting for Homeowners” program will be held from 10 a.m.-noon Aug. 12 at the Guadalupe-Blanco River Authority’s River Annex, 905 Nolan St, in Seguin, said program coordinators.

Coordinators said the training is free and open to the public, and light refreshments will be served.

The program is a joint effort of the Geronimo and Alligator Creeks Partnership, Texas A&M AgriLife Extension, Guadalupe-Blanco River Authority and the Texas State Soil and Water Conservation Board, said Ward Ling, watershed coordinator for the Geronimo and Alligator Creeks Watershed.

“Rainwater harvesting is a great way to capture and utilize water that is normally lost to runoff,” Ling said. “This process collects rainwater, stores it and allows it to be used when needed, which lessens the demand on existing water supplies, which is especially critical in these times of drought.”

Participants in the class will learn about the benefits of rainwater harvesting and other conservation methods, as well as how to build an effective system, said John Smith, AgriLife Extension Water Resources Specialist, College Station, who will serve as one of the program instructors for the class.

“Not only does rainwater harvesting provide an additional source of water, it also reduces contamination of surface water due to storm-water runoff by allowing the rainwater to be filtered more than it typically would be if it just drained directly into the creek,” Smith said.

Attendees are asked to RSVP to Ling at wling@ag.tamu.edu or 979-845-6980 in order to ensure adequate materials.

In 2008, Geronimo Creek was identified for watershed protection plan development due to concerns about elevated levels of bacteria and nitrate-nitrogen, Ling said. The Geronimo and Alligator Creeks Watershed includes parts of Comal and Guadalupe counties, as well as portions of the cities of New Braunfels and Seguin.

More information about the Geronimo and Alligator Creeks Watershed Partnership and this program can be found at <http://www.geronimocreek.org/>.

The facilitation of the Geronimo and Alligator Creeks Watershed Partnership is funded by the Texas State Soil and Water Conservation Board through a Clean Water Act grant from the U.S. Environmental Protection Agency.