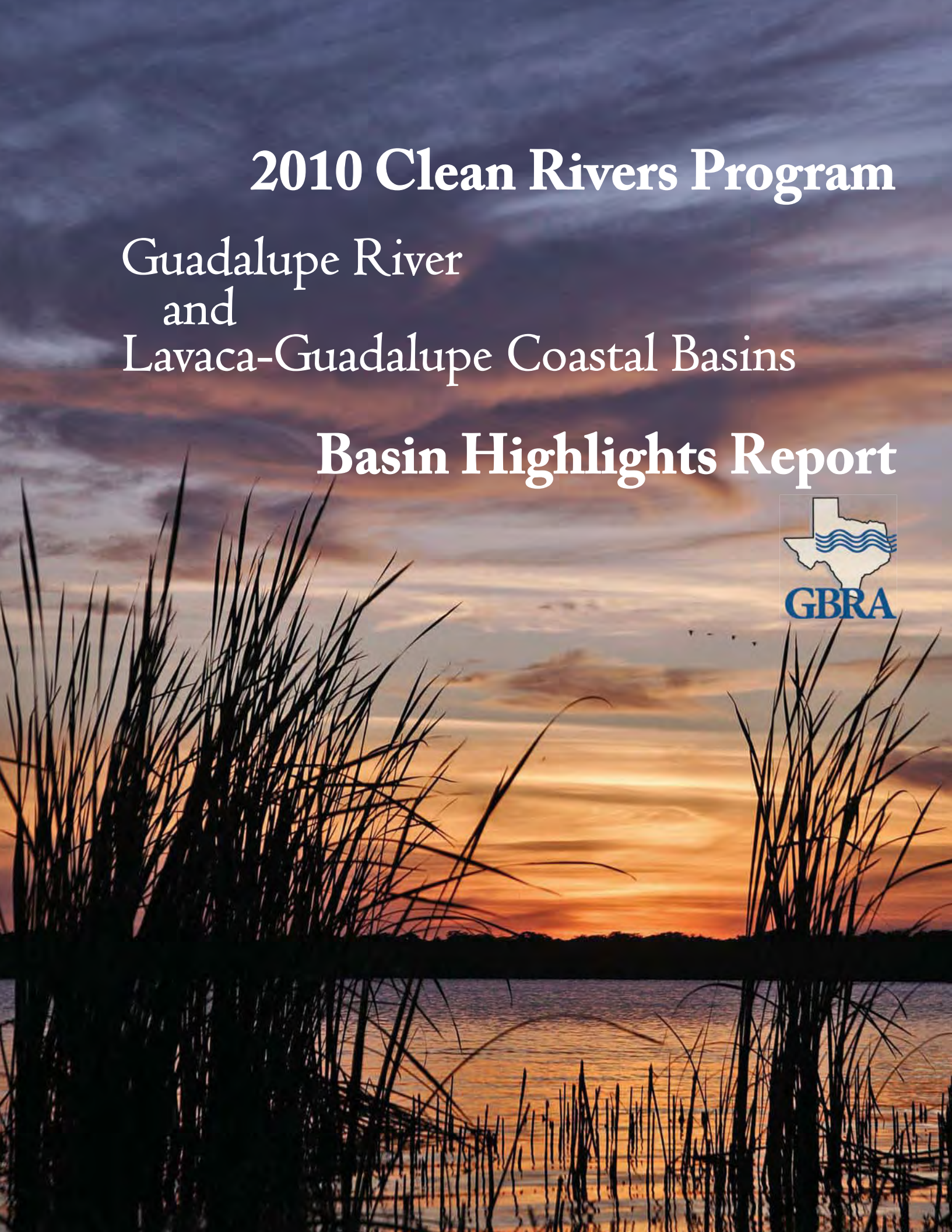


2010 Clean Rivers Program

Guadalupe River and Lavaca-Guadalupe Coastal Basins

Basin Highlights Report

GBRA

Watersheds of the Guadalupe River and Lavaca-Guadalupe Coastal Basins

Cover photograph by Keith Szafranski

Table of Contents

Introduction

This report highlights recent activities of the Guadalupe River Basin and the Lavaca-Guadalupe Coastal Basin under the Clean Rivers Program (CRP). The CRP is managed by the Texas Commission on Environmental Quality (TCEQ). The state-wide program is funded by the fees assessed to water rights and wastewater discharge permit holders. These fees are divided among the CRP partners for the administration of each river basin's program. The Guadalupe-Blanco River Authority (GBRA), together with the Upper Guadalupe River Authority (UGRA), carry out the water quality management efforts in the Guadalupe River Basin under contract with TCEQ. The activities described in this report include water quality monitoring, a review of the draft 2010 Water Quality Inventory, public communication, watershed planning and stewardship activities. The report also includes descriptions of each subwatershed, including segment maps, specific concerns and special notes.

Photo by Lynn McBride

This Year's Highlights

Drought conditions that plagued the Guadalupe River Basin since late 2007 were somewhat relieved in late 2009, but rainfall patterns were not uniform throughout the basin. The lower basin received large amounts of rainfall in the last quarter of the year, and, while the upper watershed received much needed rain, Kerr and Kendall counties did not receive enough to remove a "drought" designation by the National Weather Service. Canyon Reservoir dropped to below 893 mean sea level (msl) (conservation pool is 909 msl), the lowest level since it impounded water in 1968. In August, San Marcos Springs dropped to less than 90 cubic feet per second. As far as intensity of droughts goes, the lack of rainfall from September 2007 through August 2009 was the least amount of rainfall recorded since records were kept.

The year 2009 can be described as the year of watershed planning in the Guadalupe River Basin. The Plum Creek Watershed Partnership's Watershed Protection Plan (WPP) became the first WPP in the State of Texas to be accepted by the U.S. Environmental Protection Agency. In 2004, Plum Creek was listed as impaired for bacteria and having concern for elevated nutrients. The WPP project has moved into the

This Year's Highlights *(cont.')*

implementation phase, with a number of water quality protection projects underway. The cities of Kyle, Lockhart, and Luling are implementing nonpoint source protection projects in their jurisdictions. These projects include stormwater system upgrades, public education and outreach activities, and hazardous waste collection events. Over the last three years, more than $2.5 million has been brought to the Plum Creek watershed because of the development and implementation of the watershed protection plan.

The value of watershed protection planning (WPP) is multi-fold. The planning addresses all sources and causes of impairments and threats to both surface and groundwater within a watershed. WPPs integrate activities and prioritize best management practices that are based on technical merit and load reductions along with their benefit to the community. These types of planning efforts voluntarily address complex water quality problems that cross multiple jurisdictions rather than follow political subdivisions, such as county lines or a city's extraterritorial jurisdictions.

Recognizing these benefits, GBRA has begun the development of a watershed protection plan for Geronimo Creek, and its tributary, Alligator Creek, with funding from the Texas State Soil and Water Conservation Board, and facilitated by the Texas AgriLife Extension Service. This watershed extends from the headwaters of Alligator Creek in a highly urbanized area in Comal County to the confluence of Geronimo Creek and the Guadalupe River near the City of Seguin. Parallel to this effort, Guadalupe County is conducting a flood mitigation study in the same watershed. The study will identify and evaluate storm water controls in the watershed.

Other watersheds in the basin were the focus of watershed planning in 2009. The UGRA continued working with TCEQ to develop an Implementation Plan to address the high bacteria levels identified by the Total Maximum Daily Load Study. UGRA has submitted an application to the TCEQ Nonpoint Source Pollution Division for funding of best management practices that will address the bacteria impairment in the Upper Guadalupe River. The River Systems Institute at Texas State University is developing a decision-making tool (DSS) in conjunction with their watershed planning efforts in the Cypress Creek watershed located in Wimberley. The DSS is a modeling tool that can be used by planners, elected officials and land developers to estimate the impact of proposed urban growth and land activities in the Cypress Creek watershed.

The common thread to all of these community-based activities is the Clean Rivers Program. It is the data that have been collected under the CRP that have identified the segments in the Guadalupe River Basin that are impaired or have concerns. And when the best management practices are implemented in impaired water bodies, it will be the monitoring conducted via the CRP that will help determine the effectiveness of the BMPs. The CRP water quality monitoring program provides quality-assured data that are used to identify impairments or threats to water quality, characterize the watersheds and provide a sound scientific basis for implementation and evaluation of best management practices.

Environmental Flows

by James Murphy, GBRA

The 80th Session of the Texas Legislature passed Senate Bill 3 in May of 2007 after decades of preparation and struggle, thereby formally establishing the Environmental Flows Allocation Process. Environmental flows are the amount of water necessary for a river, estuary, or other freshwater system to maintain its health and productivity.

From the vantage point of 2010 we can take for granted the importance of safeguarding of our rivers and bays; however it wasn't always so. Human population growth and dispersal is closely related to abundant water supply, yet we often take our rivers and bays for granted, or regard them as an inexhaustible, self-regenerating source perpetually available for agricultural or commercial enterprises.

Historically, the effort to protect our rivers and bays has been tangled in a complex web of weather patterns, groundwater-dependent spring flow, population growth and laws governing the use of the waters of the state. For a millennia, inhabitants of South Central Texas lived at the mercy of mother nature, enduring periods of drought punctuated by intermittent floods of often ferocious intensity. In the 16th Century, Spanish friars began the process of taming nature by constructing acequias along the San Antonio River to irrigate the fields that provided crops for their small congregations.

These first modest efforts were succeeded by similar small scale projects as Texas flew the successive flags of the Spanish and Mexican Empires, the Mexican and Texas Republics, the United States, the Confederacy, and once again the United States. Texas continued to grow throughout these political changes, but one

Photo by Keith Szafranski

Continued on Page 5

Environmental Flows *(cont.')*

thing that didn't change was our dependence on mother nature to provide water for human needs.

It wasn't long after Texas rejoined the United States following the tragedy of the Civil War that things began to change. Industrialization brought both population growth and a new approach to the environment, including rivers and bays. South Central Texans discovered the Edwards Aquifer and developed the technology to extract massive quantities of groundwater to fuel agriculture and commercial enterprises.

Texas rivers were transformed over the next one hundred years. From approximately 1870 to 1970 the water bodies of the State served public water supply projects, disposed of our domestic and industrial wastes, were dammed for reservoirs and altered for navigation and hydro-power. By the late 1960's it was not uncommon for public officials to regard water left in a river to flow into the bay or the Gulf of Mexico as "wasted."

Nature can only be altered for so long before problems emerge, and the creation of the Environmental Protection Agency in 1970 signaled both the birth of the environmental movement and a new focus on the effects of 100 years of altering the natural environment.

Photo by Steve Sykes

In 1985 the Legislature adopted the Water Plan that called for interagency studies of the principal bays and estuaries of Texas, while simultaneously revising the way surface water rights were allocated. By December of 1998 Texas Parks and Wildlife Department (TPWD)prepared a preliminary freshwater inflow recommendation for the Guadalupe Estuary of Texas, and by February of 2002 the Executive Director of TPWD was able to testify before the Joint Legislative Committee on Natural Resources that they had developed a statistical model based on "the best possible science" for determining environmental flow regimes for Texas river basins.

The model developed by TPWD proved to be too simple to account for the complex interplay of hydrology, biology, water quality and geomorphology upon which the health and productivity of our rivers and estuaries depend. In addition, the demand for economic growth generated a backlash against the environmental movement prompting Governor Perry in September 2003 to appoint members to a newly enacted State Commission on Water for Environmental Flows.

Continued on Page 6

Environmental Flows *(cont.')*

GBRA, in response to the Governor's call, initiated one month later a project to study environmental flows to San Antonio Bay; a study that continues to this day. In April of 2005 Senator Armbrister of Victoria announced the filing of Senate Bill 3 to provide for a comprehensive water management bill containing provisions to insure better stewardship of the state's environmental flows. This legislation would not finally pass until May, 2007. (For more information see page 35.)

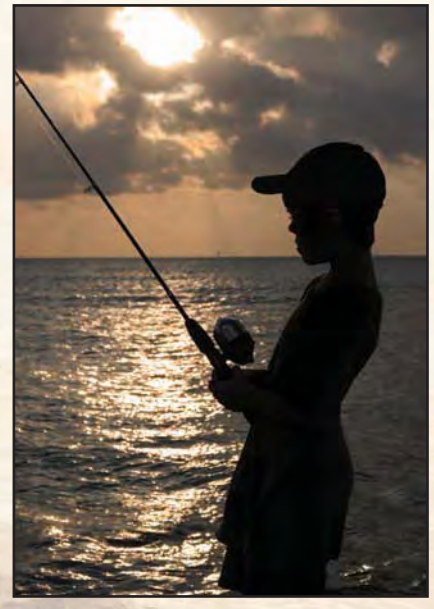
Photo by Steve Sykes

Senate Bill 3 created the Texas Environmental Flows Advisory Group composed of elected and appointed state officials. These officials appointed both the Texas Environmental Flows Science Advisory Committee, to provide science based recommendations to agency staff regarding ongoing studies, and individual Bay/Basin Stakeholder Committees (BBASC) for each of the State's River Basins. The Bay/Basin Stakeholder Committees establish Bay/Basin Expert Science Teams (BBEST) to develop environmental flow recommendations "based solely on best available science."

The stakeholders, who represent a broad spectrum of Texas citizens and interest groups, will add additional scientific and policy considerations to the recommendations of the science teams, and with the support and input of the state's environmental regulatory agencies, present their recommendations to the Texas Commission on Environmental Quality. TCEQ will will adopt rules establishing environmental flow standards for each bay/basin area, including set asides of unappropriated flows for the benefit of rivers and bays.

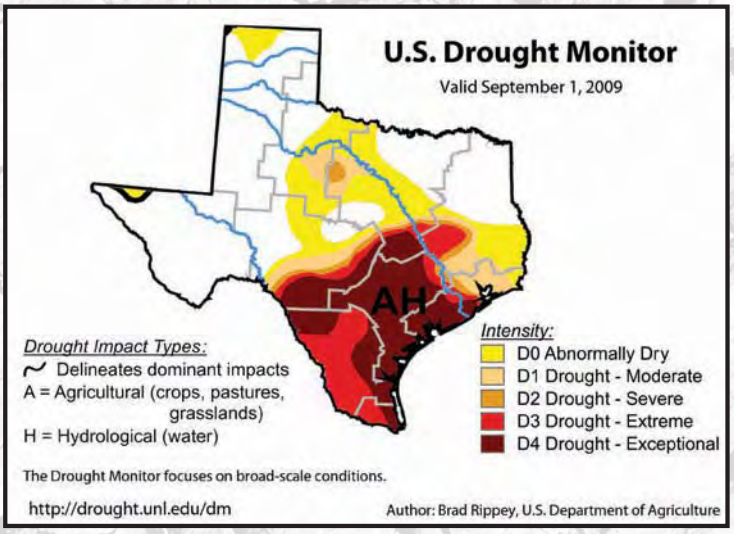
The Guadalupe BBASC and BBEST face controversy and challenges as they begin their work. GBRA is an integral member of the Guadalupe BBASC and will continue to work with other stakeholders to secure a successful outcome to the environmental flows allocation process. Disparate stakeholder interests and a lack of consensus as to what constitutes "best available science" present serious obstacles.

In addition, the work of these groups will impact settled water rights, the role of reuse of treated domestic effluent, water quality issues and water supply strategies developed in the South Central Texas Regional Water Planning Group; all of which suggests that the Environmental Flows Allocation Process will be at the center of attention for at least the next two years.



The Drought of 2008-09

The intense drought which began in 2008 continued through most of 2009. The period between September 2007 and August 2009 recorded only 24.8 inches of rain at the San Antonio National Weather Service Station, becoming the driest 24-month period on record. Previously, 1955-56 held that record, with only 33.12 inches of rain. Canyon Reservoir hit the lowest level ever experienced, elevation 892.68 mean sea level (msl), since the lake was full in 1968. Many groundwater wells in Central Texas hit historic lows. The coastal areas were hit the hardest by the drought. The Mission River ceased to flow for many days. This is the first time zero flows were ever recorded since that gage was installed in 1939.



The U.S. Drought Monitor map (shown below) is issued by the Western Regional Climate Center. The conditions show that the Guadalupe River Basin has experienced "extreme" to "exceptional" drought conditions over the last year. Another statistical tool that meteorologists use to gage the severity of drought is the Palmer Drought Severity Index (PDSI). PDSI is an index that takes into account various meterologic and hydrologic factors such as precipitation, evaporation and soil moisture. South Central Texas and the Edwards Plateau score in the moderate to severe drought range (-5.2). Comparing this PDSI to historical, the period of 1983-85 had a score of -3.1; 1996-98 had a peak score of -4.2 and the drought of record in the 1950s' score exceeded -6.0. According to StormFax.com, in late 2007 through early 2008, the United States was in a La Niña weather pattern. La Niña weather is created when the sea surface temperatures in the tropical Pacific Ocean fall below normal. This phase is characterized by warm winters in the southeastern U.S. Conversely, El Niño, above average sea surface temperatures, creates conditions that are characterized by large scale weakening of the trade winds and warming of the surface layers in the equatorial eastern and central Pacific Ocean. El Niño is synonymous with large scale, climatically-significant warm events, and wet periods in the southern U.S. For additional information and current drought monitor maps visit http://drought.unl.edu/dm/archive.html.

No significant changes in water quality were noted in 2008, nor the need for water use restrictions because early to mid 2007 was a very wet year and contributed a significant volume to recharge. As the drought conditions worsened in 2009, GBRA implemented water restrictions on the hydro lakes. The hydro lakes, referred to as run-of-river impoundments because of the river flows and short residence times, showed characteristics of lakes with long residence times and weak stratification. Landowners whose property are adjacent to the hydro lakes on the Guadalupe River in Comal, Guadalupe and Gonzales Counties were subject to restricted diversions of water usage from those lakes. Users of the water in Canyon Reservoir were placed on voluntary stage 1 restrictions. It wasn't until December 2009 that the reservoir returned to levels that met the criteria for lifting those restrictions.

Without rain, as the demand on groundwater picked up in the spring of 2009, the flow from springs and seeps diminished, severely affecting the base flow of the Guadalupe, Comal, San Marcos and Blanco Rivers. In August 2009, springflow from the Comal Springs was 174 cubic feet per second. Flow is critical to the endangered species living in the Comal and San Marcos Rivers because as flows drop off, longer residence times promote higher water temperatures. The streams will become more effluent-dominated, until such time as the reuse of wastewater is in greater demand; and then even that flow will not be returned to the stream.

TCEQ Creates New Office of Water

In November 2009, the Texas Commission on Environmental Quality (TCEQ) created the Office of Water. The Office of Water, along with five other offices, including Administrative Services, Legal Services, Compliance and Enforcement, Permitting and Registration (air and waste), and Chief Engineer, make up the structure of TCEQ. The mission of the newly-created Office of Water is to make balanced decisions based on sound science and to proactively work with stakeholders to implement TCEQ programs. The office will continue to develop and train their staff, provide accurate and prompt communication, flexibility and be problem solvers.

There are three divisions within the Office of Water. Water Quality is the division that processes wastewater permits and conducts technical reviews. Water Supply is the division that contains Districts, Utilities, Water Rights Permitting, Instream/Environmental Flows, and Public Drinking Water. The Water Quality Planning Division is the division in which all of the activities to characterize, evaluate and take action on water quality take place, and where the Clean Rivers Program is managed. Previously, these three areas of water quality and water supply management were distributed throughout the agency under three or more different offices. Now they are combined. In addition, the different activities that are included in the Water Quality Planning Division, were previously located in different offices, making it difficult to coordinate activities that are highly dependent upon each other.

The Water Quality Standards (WQS) Group provides the foundation for permitting and water quality assessment. Texas is one of the few states with extensive procedures for site-specific standards for aquatic life, dissolved oxygen, toxic criteria and aquatic recreation. The WQS Group has developed the procedures for use-attainability analyses (UAAs) and initiated 126 recreational UAAs in coordination with the Total Maximum Daily Load (TMDL) Program and the Texas State Soil and Water Conservation Board.

The Surface Water Quality Monitoring Program (SWQM) manages, assesses, shares and reports water quality data to TCEQ programs, management, and a host of other statewide agencies and institutions, local governments and the public. SWQM produces the State of Texas Water Quality Inventory Report every two years. They develop procedures for water quality sampling and have built a network of 66 continuous monitoring stations across Texas.

The Data Management and Analysis Group manages and stores the TCEQ's surface water quality monitoring data. Texas is the only state with a group doing such data validation. Last year the group verified over 2 million separate results from over 20 data providers. They ensure the water quality data in the SWQM information system are of known quality, scientifically valid and legally defensible.

Continued on Page 10

New Water Quality Standards Proposed

Texas has had water quality standards since at least 1967. Much of the present standards were established because of directives handed down to the state from the U.S. Environmental Protection Agency (EPA). Site-specific standards were set for individual water bodies quickly and with limited data. The TCEQ has proposed changes to the waters quality standards based on additional data and evaluations. The proposed revisions would satisfy the federal Clean Water Act requirement that states review and revise surface water quality standards once every three years. These standards are used to protect public health, enhance water quality and to meet the goal of the federal Clean Water Act - to restore and maintain the chemical, physical and biological integrity of the nation's waters. The standards are the scientific basis used for the development of discharge permit authorizations, targets for total maximum daily loads and assessment of water bodies across the state.

Photo by Janet Thome

Specific proposed changes to the water quality standards include expanding categories for recreational uses and criteria. Currently, all stream segments in Texas are assessed by comparing the geometric mean of the *E. coli* bacteria data available over the previous seven years to a standard. The geometric mean must be below 126 colony forming units per 100 milliliters (CFU/100mL). If the mean exceeds the criteria, the stream is listed as impaired for bacteria. The proposed standard would raise the criteria to 206 CFU/100 mL. All waters across the state are considered to have a contact recreation designated use. A proposed change to the water quality standards would expand that designation to categories based on applicability of the segment for recreational uses. Waters of sufficient size and depth would be assigned a primary contact recreation, but small, shallow streams may be assigned to a secondary contact recreation category.

Another proposed change that will impact the waters in the Guadalupe River Basin is the addition of numerical nutrient criteria and screening levels to protect reservoirs from excessive growth of aquatic vegetation related to nutrients. The nutrient criteria for Canyon Reservoir will be 3.66 micrograms per liter, specified in terms of concentration of chlorophyll a in water as a measure of the density of phytoplankton and will be expressed as the median over at least an annual period. The standard will be applied to the GBRA historical monitoring location at the Canyon Park Marina.

The proposed rulemaking would make the temperature criteria for the upper reaches of Comal and San Marcos rivers the same or lower than the existing standards. The U.S. Fish and Wildlife Service recommends lower temperatures in these areas in order to protect endangered aquatic species.

Other changes have been proposed to the water quality standards. Additional information can be obtained by visiting the TCEQ website: www.tceq.state.tx.us.

TCEQ 2010 Draft Water Quality Assessment

The Texas Commission on Environmental Quality has drafted the 2010 Texas Water Quality Inventory and 303d List and has issued the documents for public comment. The TCEQ Surface Water Quality Monitoring Team has assessed the segments in the Guadalupe River Basin, using the data collected between Dec. 1, 2001, through Nov. 30, 2008, and have the option to go back 10 years if necessary. The Inventory lists all segments in the basin that were assessed and assigned a level of support. A healthy stream segment that meets the water quality criteria is designated as fully supporting, meaning that the data show that the stream standards are met; or no concern, meaning that the data show no exceedences of screening values. Those stream segments that do not meet the applicable water quality criteria will receive a designation of nonsupport, screening level concern or use concern, based on the specific criteria being assessed. Each segment that is listed as impaired because of nonsupport or concerns is then assigned an assessment category to provide information about the water quality status or management activities being conducted on that water body. Category 4 contain those stream segments that have had a total maximum daily load or other pollution prevention or control activity associated with the segment and it is reasonable to expect future attainment of the water quality standards. Category 4 also contains those impaired water bodies that are not supporting because of something other than a pollutant. Category 5 contains water bodies that do not meet the applicable water quality standards or is threatened for one or more designated uses by one or more pollutants. This category contains impaired water bodies that have total maximum daily load or watershed protection plan underway or scheduled, or it is recommended that a review of the water quality standards be performed or additional data be collected.

The Segments in the Guadalupe River Basin that are in the draft *2010 Texas Water Quality Inventory and 303d List* are listed on page 11.

TCEQ Creates New Office of Water

Continued from Page 8

Within the Water Quality Planning Division, management measures, such as TMDLs, Watershed Protection Plans (WPPs) and TMDL implementation plans are implemented for addressing water quality impairments. TMDLs and WPPs determine the amount and sources of pollution that cause a water body to not meet the Texas Water Quality Stream Standards. These programs work with stakeholders in the local communities to develop the plans throughout Texas. Frequently developed in collaboration with the Texas State Soil and Water Conservation Board, these plans are designed to improve water quality through harnessing the energy, creativity and common sense of people in the target watershed. An example of how this works is seen in Kerrville as the Upper Guadalupe River Authority addresses bacteria impairment in the Guadalupe River above Canyon Reservoir.

Since the early 1990s, it is the data that has been collected under the CRP that has focused the state's attention on impaired or threatened water bodies.

Still, among the Office of Water, one the most important groups is the Clean Rivers Program. Since the early 1990s, it is the data that has been collected under the CRP that has focused the state's attention on impaired or threatened water bodies. CRP has the mechanisms in place to address local stakeholders concerns. The program is recognized nationally as the premier water quality management program. Most importantly, it is a highly effective conduit between stakeholders and the state's environmental agency, providing the local communities, cities, industries and interest groups a forum to communicate, learn and effect change and protect the state's precious resource, water.

Draft 2010 Texas Water Quality Inventory and 303d List

Segment Number	Water Body	Impairment or Concern	Category (if assigned)	Year first listed
1801	Guadalupe River Tidal	Depressed Dissolved Oxygen; Nitrate-Nitrogen	Note 4	2002
1802	Guadalupe River below San Antonio River	Nitrate-Nitrogen	Note 3	2002
1803A	Elm Creek	Depressed Dissolved Oxygen	5a	1999
1803B	Sandies Creek	Depressed Dissolved Oxygen; Impaired Biological Habitat and Communities; Bacteria	5b and 5c Note 1	1999
1803C	Peach Creek	Depressed Dissolved Oxygen; Bacteria; Aluminum; Chlorophyll *a*	5b and 5c	2002
1803F	Denton Creek (tributary of Peach Creek)	Depressed Dissolved Oxygen; Bacteria	5b	2010
1803G	Sandy Fork (tributary of Peach Creek)	Bacteria	5b	2010
1804A	Geronimo Creek	Bacteria (Note 1); Nitrate-Nitrogen	5c	2006
1805	Canyon Lake	Mercury in Edible Fish Tissue	5c	2006
1806	Guadalupe River above Canyon	Bacteria (Note 1)	4a	1999
1806A	Camp Meeting Creek	Depressed Dissolved Oxygen	5b	2004
1806D	Quinlan Creek	Bacteria	5a	2010
1806E	Town Creek	Bacteria	5a	2010
1810	Plum Creek	Bacteria; Nitrate-Nitrogen; Orthophosphorus; Total Phosphorus; Depressed Dissolved Oxygen	4b	2004
1811A	Dry Comal Creek	Bacteria	Note 2	2010
1813	Upper Blanco River	Depressed Dissolved Oxygen	Note 3	2006
1814	Upper San Marcos River	Total Dissolved Solids	5c	2010
1817	North Fork Guadalupe River	Depressed Dissolved Oxygen	Note 4	2006

[1] Site would not be considered impaired if applying the proposed contact recreation standard.

[2] With new recreational use standards under development, TCEQ is not listing new recreational use impairments where the *E. coli* geometric mean falls between 126 cfu/100 mL and 206 cfu/100 mL.

[3] Listing was carried over from a previous assessment due to inadequate data for this method in this assessment.

[4] No category assigned if listed for a concern rather than a use impairment.

Overview of Water Quality Monitoring

One of the key roles of the Clean Rivers Program is fostering coordination and cooperation in monitoring efforts. Coordinating monitoring meetings are held annually and are attended by the entities collecting water quality data on the Guadalupe River and its tributaries. By coordinating these efforts and discussing the areas in need of additional monitoring, more data will be collected, maximizing the limited resources available to these entities. The table below outlines the types and amounts of water quality monitoring conducted in the Guadalupe River Basin and the Lavaca-Guadalupe Coastal Basin under a TCEQ-approved Quality Assurance Project Plan for September 2009 through August 2010.

In addition to the monitoring programs conducted by the Guadalupe-Blanco River Authority and the Upper Guadalupe River Authority, the Wimberley Valley Watershed Association (WVWA) is conducting the Blanco River- Cypress Creek Water Quality Monitoring Program. The goals of the program include establishing a baseline of water quality data; identifying potential pollution problems; documenting spatial and temporal changes; determining impacts of point and nonpoint source pollution; and assessing compliance with water quality standards. The program will also provide recommendations for local planning efforts to protect water quality. The GBRA is providing technical assistance and oversight of monitoring activities in addition to the laboratory analyses and quality assurance support.

The complete monitoring schedule is available at http://cms.lcra.org. The following sections show, by watershed, the distribution of monitoring sites plus activities that may affect water quality, such as major communities, areas with a concentration of poultry activities, and locations of major oil and gas fields.

Photo by Janet Thome

FY 2010 (September 2009 through August 2010)
Summary of Sampling for the Guadalupe River and Lavaca Coastal Basins

Sampling Entity	Field	Conventional	Bacteria	Biological and Habitat	24 Hr. DO	Metals in Water	Metals in Sediment	Organics in Water	Organics in Sediment
GBRA	19 sites monthly; 7 sites quarterly	19 sites monthly; 7 sites quarterly	19 sites monthly; 7 sites quarterly	4 sites annually	1 site 5 times	2 sites annually; 1 site quarterly	1 site annually; 1 site quarterly	3 sites annually	5 sites annually
UGRA	10 sites quarterly	10 sites quarterly	10 sites quarterly	2 sites annually			1 site annually		
TCEQ	16 sites quarterly	16 sites quarterly	16 sites quarterly			2 sites semi-annually	4 sites semi-annually	1 site semi-annually	1 site semi-annually
WVWA	7 sites 8 times a year	7 sites 8 times a year	7 sites 8 times a year		1 site annually				

Descriptions of Water Quality Parameters

FIELD PARAMETERS are those water quality constituents that can be obtained on-site and generally include: dissolved oxygen (DO), conductivity, pH, temperature, stream flow (not in reservoirs), and secchi disc depth (reservoirs only).

Dissolved Oxygen indicates the amount of oxygen available in the stream to support aquatic life. DO can be reduced by the decomposition of organic matter.

Conductivity is a measure of the water body's ability to conduct electricity and indicates the approximate levels of dissolved salts, such as chloride, sulfate and sodium in the stream. Elevated concentrations of dissolved salts can impact the water as a drinking water source and as a suitable aquatic habitat.

pH is a measure of the hydrogen ion concentration in an aqueous solution. It is a measure of the acidity or basic property of the water. Chemical and biological processes can be affected by the pH. The pH can be influenced by dissolved constituents, such as carbon dioxide and by point and nonpoint source contributions to the stream.

Temperature of the water affects the ability of the water to hold dissolved oxygen. It also has an impact on the biological functions of aquatic organisms.

Stream Flow is an important parameter affecting water quality. Low flow conditions common in the warm summer months create critical conditions for aquatic organisms. Under these conditions, the stream has a lower assimilative capacity for waste inputs from point and nonpoint sources.

Secchi Disc transparency is a measure of the depth to which light is transmitted through the water column, and thus the depth at which aquatic plants can grow.

CONVENTIONAL PARAMETERS are typical water quality constituents that require laboratory analysis and generally include: nutrients, chlorophyll *a*, total suspended solids, turbidity, hardness, chloride, and sulfate.

Nutrients include the various forms of nitrogen and phosphorus. Elevated nutrient concentrations may result in excessive aquatic plant growth and can make a water body unfit for its intended use(s).

Chlorophyll *a* is a plant pigment whose concentration is an indicator of the amount of algal biomass and growth in the water.

Total Suspended Solids indicate the amount of particulate matter suspended in the water column.

Turbidity is a measure of the water clarity or light transmitting properties. Increases in turbidity are caused by suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter, plankton and other microscopic organisms.

Hardness is a composite measure of certain ions in the water, primarily calcium and magnesium. The hardness of the water is critical due to its effect on the toxicity of certain metals. Typically, higher hardness concentrations in the receiving stream can result in reduced toxicity of heavy metals.

Chloride and Sulfate are major inorganic anions in water and wastewater. Numeric stream standards for chloride and sulfate have been set on all of the classified stream segments in the basin. Both of these inorganic constituents can impact the designated uses and can come from point and nonpoint sources, such as wastewater discharges, oil field activities, and abandoned flowing wells from groundwater with elevated concentrations of dissolved solids.

OTHER PARAMETERS

Bacteria, specifically the *E. coli* bacteria, is used as an indicator of the possible presence of disease-causing organisms.

Biological and Habitat assessment includes collection of fish community data, benthic macroinvertebrate (insects) data, and measurement of physical habitat parameters. This information is used to determine whether the stream adequately supports a diverse and desirable biological community. The physical, chemical and biological data are used together to provide an integrated assessment of aquatic life support.

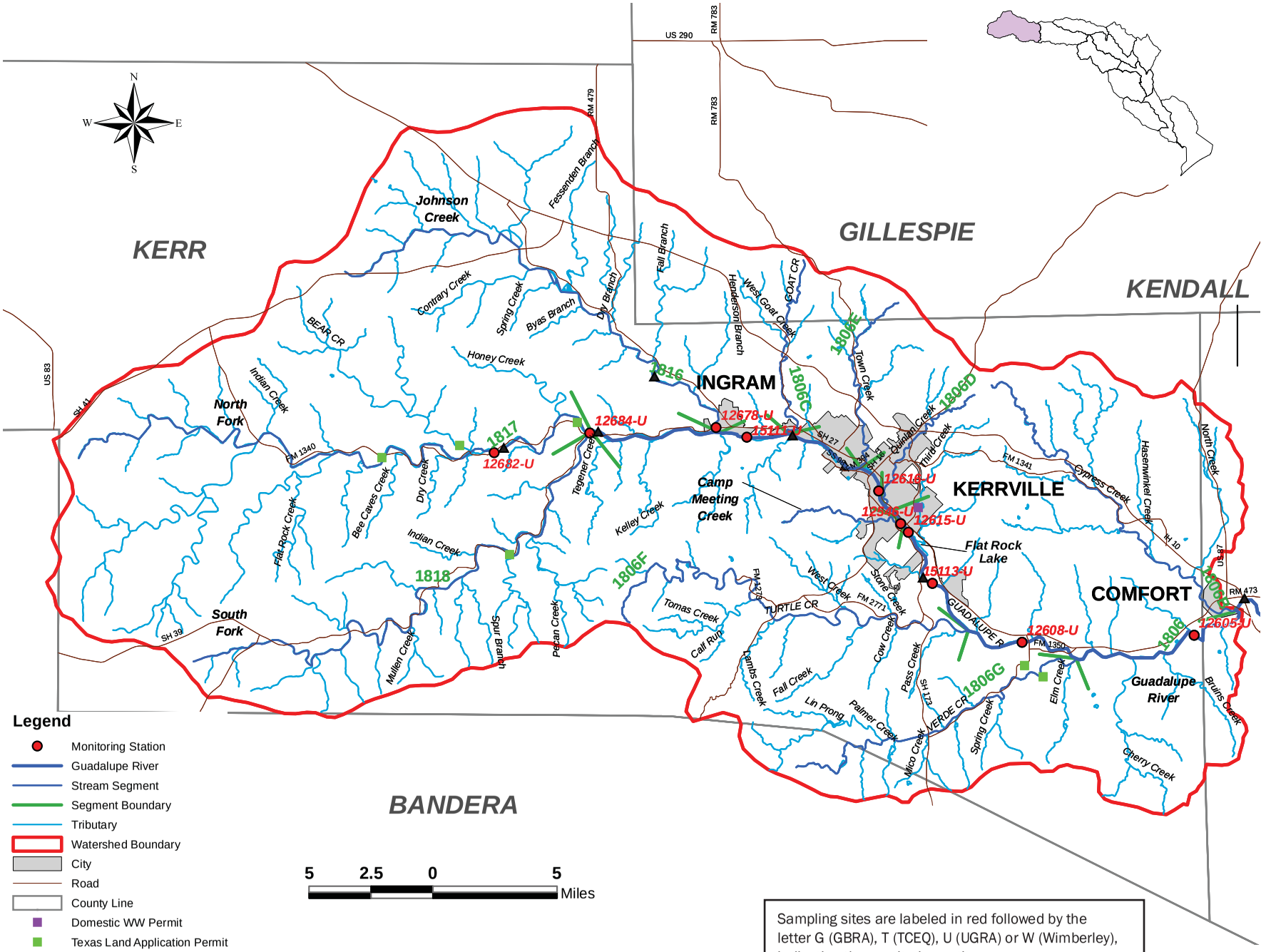
24-Hour DO studies perform measurements of DO in frequent intervals (e.g., one hour) in a 24-hour period. The average and minimum concentrations in the 24-hour period are compared to corresponding criteria. This type of monitoring takes into account the diurnal variation of DO and avoids the bias in samples taken only at certain times of the day.

Metals in Water, such as mercury or lead, typically exist in low concentrations, but can be toxic to aquatic life or human health when certain levels are exceeded. To obtain accurate data at low concentrations, the GBRA uses special clean methods that minimize the chance for sample contamination and provide high quality data.

Organics and Metals in Sediment could be a source of toxicants for the overlying water, though currently there are no numeric sediment standards.

Organics in Water, such as pesticides or fuels, can be toxic to aquatic life or human health when certain levels are exceeded.

Upper Guadalupe River Above Comfort



Legend

- Monitoring Station
- Guadalupe River
- Stream Segment
- Segment Boundary
- Tributary
- Watershed Boundary
- City
- Road
- County Line
- Domestic WW Permit
- Texas Land Application Permit
- USGS Gage

Sampling sites are labeled in red followed by the letter G (GBRA), T (TCEQ), U (UGRA) or W (Wimberley), indicating the monitoring entity.

Upper Guadalupe River Above Comfort Watershed

River Segments, Descriptions and Concerns

Segment 1816 (Johnson Creek): This spring-fed 21 mile segment consisting of Johnson Creek to its confluence with the Guadalupe River in Kerr County has good water quality. Intermittent in stages, the stream crosses an area characterized by steep slopes. The generally shallow, stony soils support grasses and open stands of live oak and Ashe Juniper.

Segment Concerns: None

Segment 1817 (North Fork Guadalupe River): The spring-fed 29 mile North Fork of the Guadalupe River is a perennial stream with exceptional aquatic life designation. River flow is swift but shallow. Typical vegetation are baldcypress, live oak and Ashe Juniper trees.

Segment Concerns: The draft 2006 water quality assessment for the North Fork Guadalupe River found a concern for dissolved oxygen grab samples at the screening level. However, the mean dissolved oxygen value is only slightly below the criteria.

Segment 1818 (South Fork Guadalupe River): The spring-fed 27 mile South Fork of the headwaters of the Guadalupe River is clear, with moderately flowing water and has excellent water quality. It is a narrow and shallow scenic river with baldcypress-lined banks.

Segment Concerns: None

Segment 1806 (Guadalupe River above Canyon Lake): The Guadalupe River from the city of Comfort in Kendall County to the confluence with the North and South forks of the Guadalupe River in Kerr County is scenic with crystal clear water between baldcypress-lined banks. The shallow riffle areas, punctuated with deep pools create an exceptional aquatic life ecosystem.

Segment Concerns: According to prior assessments performed by TCEQ, a portion of segment 1806 is not supporting due to *E. coli* bacteria concentrations that exceeded the geometric mean criteria. A TMDL has been completed and UGRA staff are working with TCEQ to develop a TMDL Implementation Plan.

Tributary Concerns: Three tributaries to segment 1806 have also been identified as not supporting when assessed by TCEQ. Segment 1806A, Camp Meeting Creek, has been listed as not supporting when screened against the dissolved oxygen 24-hour average. According to the draft 2010 Assessment, segment 1806D, Quinlan Creek, and segment 1806E, Town Creek, are listed as not supporting due to *E. coli* bacteria concentrations that exceed both the geometric mean and the single grab screening level.

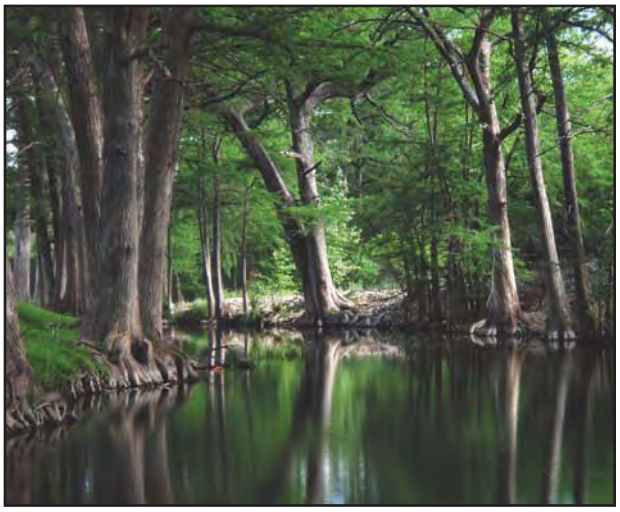


Photo provided by UGRA

Drainage Area: 850 square miles

Streams and Rivers: North Fork and South Fork of the Guadalupe River, Johnson Creek, Quinlan Creek, Camp Meeting Creek, Town Creek, Cypress Creek, Goat Creek, Turtle Creek, Verde Creek, Bear Creek

Aquifer: Trinity

River Segments: 1816, 1817, 1818, 1806A-G

Cities: Center Point, Ingram, Kerrville, Comfort, Hunt

Counties: Kerr, Gillespie, Bandera, Kendall

EcoRegion: Edwards Plateau

Vegetation Cover:
Evergreen Forest - 46.9%; Grass/Herbaceous - 14.4%
Shrublands - 28.8%

Climate:
Average annual rainfall: 30 inches
Average annual temperature: January 32˚, July 94˚

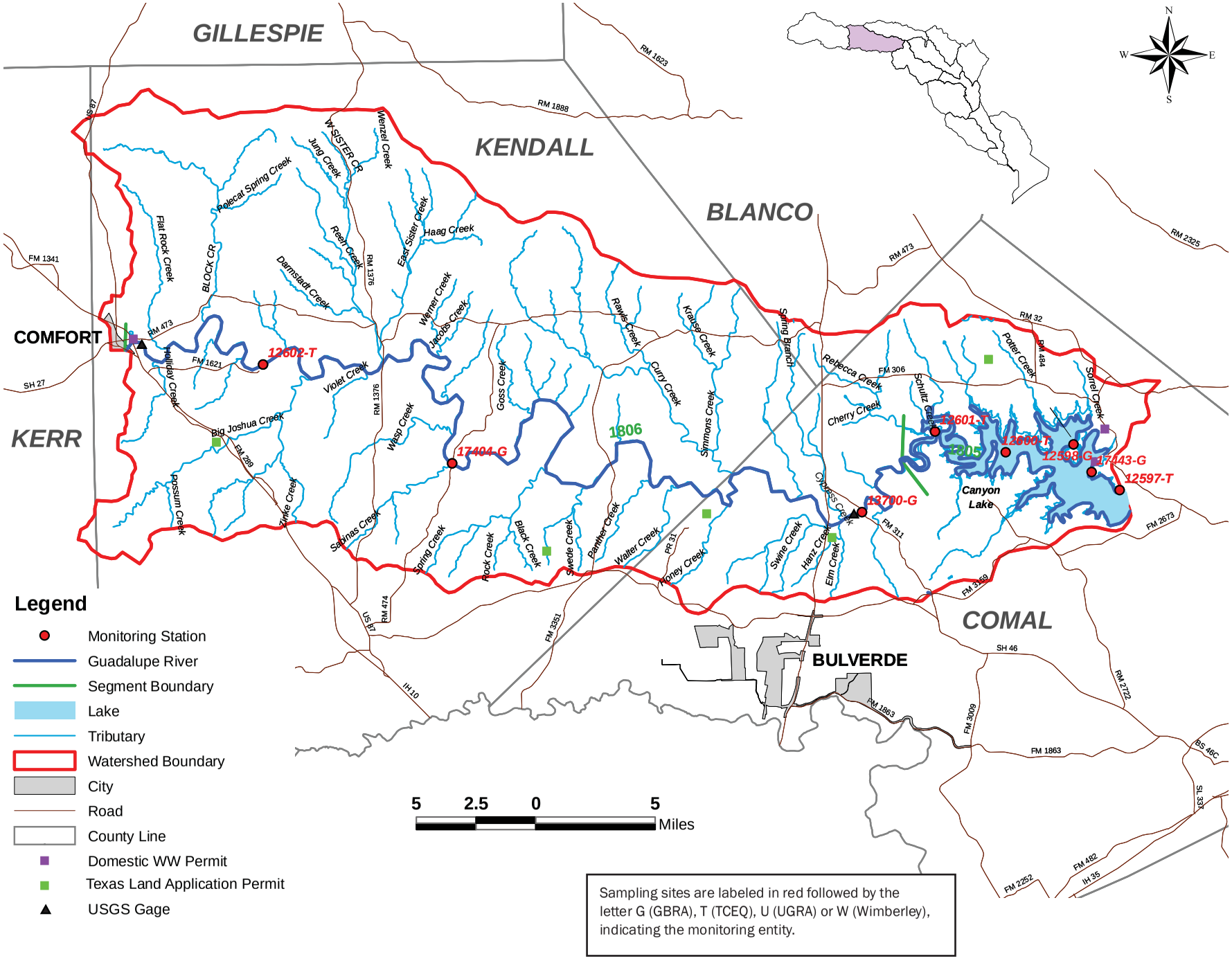
Land Uses: ranching, farming, tourism, light manufacturing

Water Body Uses: aquatic life, contact recreation, general use, fish consumption and public water supply

Soils: Dark and loamy over limestone; to the south and east soils are variable with light colored brown to red soils in some areas and dark loamy or loamy soils over clay subsoils elsewhere

Permitted Wastewater Treatment Facilities:
Domestic: 1 Land Application: 6 Industrial: 0

Guadalupe River Above Canyon Lake



Upper Guadalupe River Below Comfort Watershed

River Segments, Descriptions and Concerns

Segment 1806 (Guadalupe River above Canyon Lake): From a point (1.7 miles) downstream of Rebecca Creek Road in Comal County to the city of Comfort in Kendall County.

Segment Concerns: Urban and suburban growth (large lot housing developments) along the Hwy. 281 corridor between San Antonio and Blanco is a growing concern, especially in the regions near the city of Bulverde and the city of Spring Branch.

Segment 1805 (Canyon Lake): From Canyon Dam in Comal County to a point (1.7 miles) downstream of Rebecca Creek Road in Comal County, including Canyon Reservoir. Canyon Reservoir is a flood control and water supply reservoir, impounding the Guadalupe River with a conservation pool elevation of 909 feet mean sea level (msl).

Segment Concerns: Explosive suburban growth in the Canyon Reservoir region.

Special Notes: Canyon Reservoir is listed on the 303d list of impaired water bodies because of the fish consumption advisory for longnose gar and striped bass that has been issued by the Texas Department of State Health Services (DSHS, formerly Texas Department of Health). Because the concentration of methylmercury in fish tissue of these species exceeds the criteria to protect human health, the DSHS advises that adults should limit consumption of longnose gar and striped bass to no more than two eight-ounce meals per month and children under twelve years old should limit consumption to no more than two four-ounce meals per month. Potential sources of mercury include emissions from coal-fired power plants, cement plants, volcanoes, industrial discharges, and batteries. Samples of water from Canyon Reservoir have shown no detectable concentrations of mercury. The DSHS has not speculated as to the source of the mercury.

Photo provided by UGRA

TCEQ is establishing numerical nutrient criteria and screening levels to protect reservoirs from excessive growth of aquatic vegetation related to nutrients. The nutrient criteria for Canyon Reservoir will be 3.66 micrograms per liter, specified in terms of concentration of chlorophyll a in water as a measure of the density of phytoplankton and will be expressed as the median over at least an annual period. The standard will be applied to the GBRA historical monitoring location at the Canyon Park Marina.

In September 2009, Canyon Reservoir hit its all time lowest elevation of 892.71 mean sea level (msl) since it impounded water in the 1960s. The reservoir conservation pool is 909 msl. Prior to the February 2010, the last time that the reservoir was at the conservation pool was April 2008. The U.S. Army Corps of Engineers is responsible for managing releases of water from the reservoir when the elevation is above 909 msl. When the reservoir is at or below conservation pool, GBRA manages the stored water portion and reservoir releases. Canyon fulfilled its role of a storage reservoir and released adequate amounts of water providing beneficial uses to cities, industry and individuals. Releases are determined based upon several factors including natural inflows, licensed flows for the project, senior water rights, contract releases from the conservation pool for cities, industries and other downstream users, and bays and estuary flow requirements.

Drainage Area: 596 square miles

Streams and Rivers: Guadalupe River from Comfort to Canyon Lake, Joshua Creek, Flat Rock Creek, Rebecca Creek, Block Creek, West Sister Creek

Lake: Canyon Lake

Aquifer: Trinity

River Segments: 1805, 1806

Cities: Comfort, Kendalia, Bergheim, Bulverde, Canyon City, Spring Branch, Startzville

Counties: Kerr, Comal, Kendall, Blanco

EcoRegion: Edwards Plateau

Vegetation Cover:
Evergreen Forest - 43.6%; Shrublands - 11.0%
Grass/Herbaceous - 31.3%

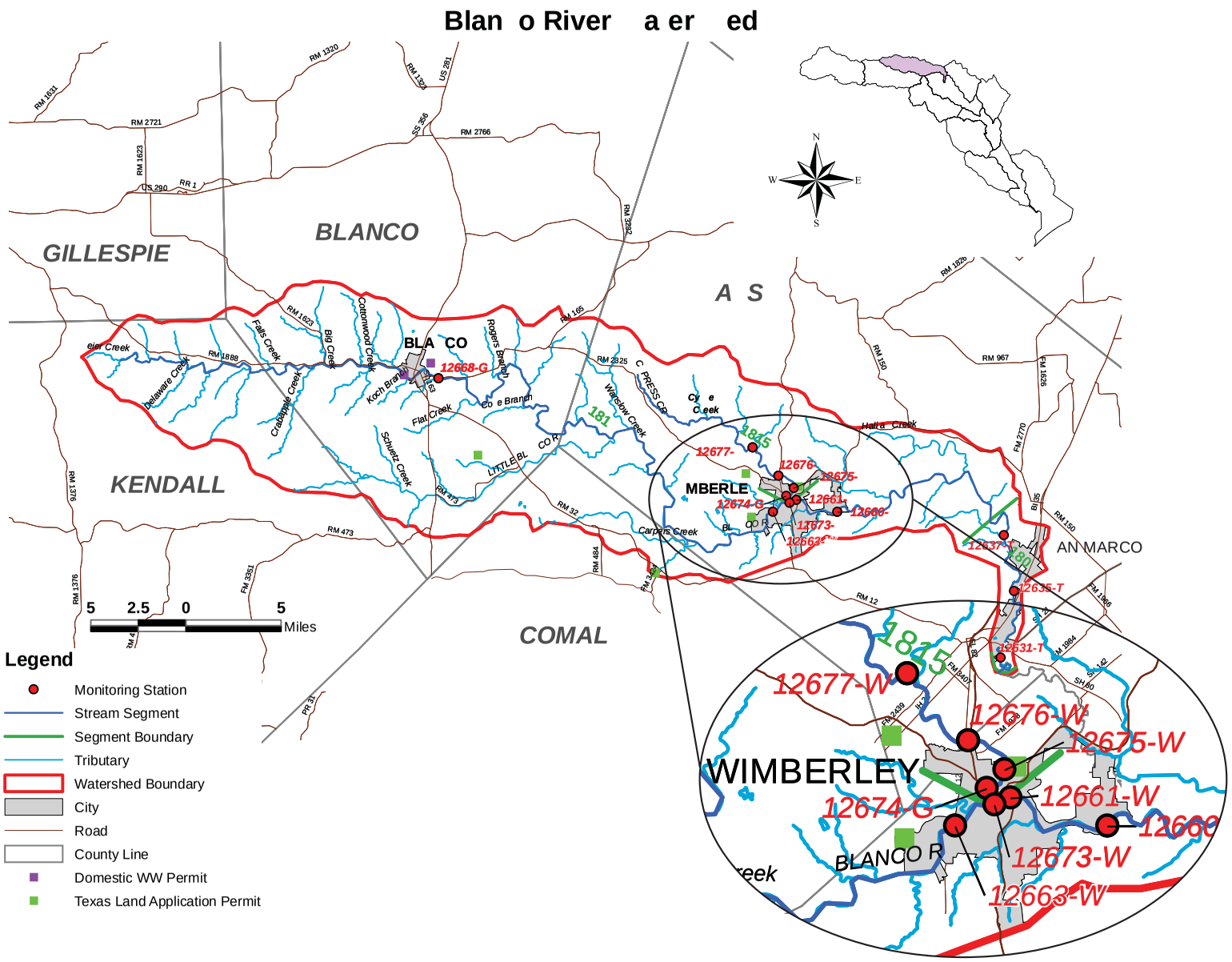
Climate:
Average annual rainfall: 32 inches
Average annual temperature: January 38°, July 95°

Land Uses: urban, unincorporated suburban sprawl, cattle, goat and sheep production, light and heavy industry, and recreational

Water Body Uses: aquatic life, contact recreation, general use, fish consumption, and public water supply

Soils: Dark and loamy over limestone to loam with clay subsoils

Permitted Wastewater Treatment Facilities:
Domestic: 3 Land Application: 5 Industrial: 0



Sampling sites are labeled in red followed by the letter G (GBRA), T (TCEQ), U (UGRA) or W (Wimberley), indicating the monitoring entity.

Blanco River Watershed

River Segments, Descriptions and Concerns

Segment 1813 (Upper Blanco River): Flowing 71 miles from northern Kendall County until Limekiln Road in Hays County, the upper Blanco is a spring-fed stream. Cypress Creek joins the river in the village of Wimberley. The steep-sloped, intermittent, meandering stream is lined with baldcypress, oak and Ashe Juniper.

Segment Concerns: Suburban growth (large lot housing developments) along the Hwy 281 corridor between San Antonio and the city of Blanco is a growing concern because of the potential for nonpoint source pollution.

Photo by Lynn McBride

Segment 1815 (Cypress Creek): The spring-fed creek flows 14 miles into the village of Wimberley where it merges with the Blanco River in Hays County. A picturesque creek, lined with baldcypress trees, with good water quality.

Segment Concerns: The segment is experiencing tremendous residential and commercial suburban growth. Occasional high levels of *E. coli* bacteria are likely due to faulty septic tanks. The River Systems Institute at Texas State University is developing a decision-making tool (DSS) in conjunction with their watershed planning efforts in the Cypress Creek watershed located in Wimberley. The DSS is a modeling tool that can be used by planners, elected officials and land developers to estimate the impact of proposed urban growth and land activities in the Cypress Creek watershed. Phase one of the watershed planning project that includes storm water monitoring, stakeholder recruitment, and education and outreach, will be completed by August 2010.

Segment 1809 (Lower Blanco River): This 15-mile lower stretch of the Blanco River from Limekiln Road until the confluence with the San Marcos River varies from a rapid moving stream as it crosses the Balcones Fault Zone to a shallow, slow moving stream, lined with scrub oaks as it enters the Blackland Prairies.

Segment Concerns: Located in the middle of the IH-35 corridor from the northern boundary of the city of San Marcos and the southern boundary of the city of Kyle. Concerns include cumulative impacts on watersheds caused by construction and multiple subdivision development. Impervious cover (rooftops and buildings, roads, parking lots) associated with the growth increases the quantity of storm water that scours stream beds, creating additional sediment loading and pollutants to the small tributaries of the watershed. Adequate construction oversight is needed to assure that storm water controls are appropriate and in place.

Drainage Area: 440 square miles

Streams and Rivers: Guadalupe River, Lower Blanco River, Upper Blanco River, Cypress Creek, Meier Creek, and Sycamore Creek

Aquifers: Edwards-Trinity, Trinity

River Segments: 1813, 1815, 1809

Cities: Blanco, Fisher, Wimberley, Kyle, San Marcos

Counties: Kendall, Comal, Blanco and Hays

EcoRegion: Edwards Plateau

Vegetation Cover:
Evergreen Forest - 42.9%; Shrublands - 11.0%
Grass/Herbaceous - 32.2%; Deciduous Forest - 7.7%

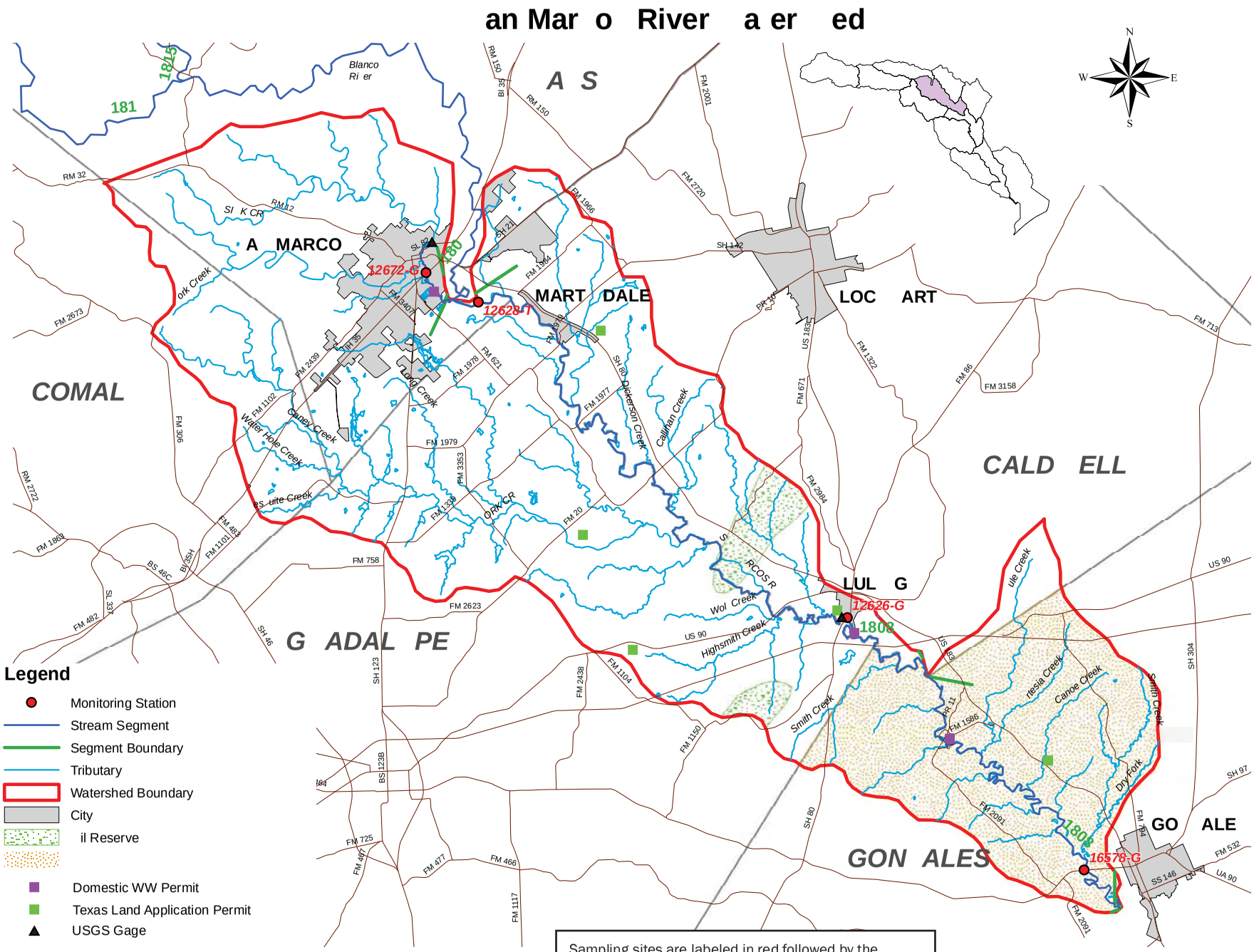
Climate:
Average annual rainfall: 31 inches
Average annual temperature: January 34°, July 94°

Land Uses: urban, agricultural crops (wheat, hay, oats, peaches and pecans), sheep, cattle, goats and turkey productions; light manufacturing and recreation

Water Body Uses: aquatic life, contact recreation, general use, fish consumption use, and public water supply use

Soils: Varies from thin limestone to black, waxy, chocolate, and grey loam, calcareous, stony, and clay loams

Permitted Wastewater Treatment Facilities:
Domestic: 2 Land Application: 3 Industrial: 0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US 183
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Legend
Monitoring Station
Stream Segment
Segment Boundary
Tributary
Watershed Boundary
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Texas Land Application Permit
USGS Gage
Sampling sites are labeled in red followed by the letter G (GBRA), T (TCEQ), U (UGRA) or W (Wimberley), indicating the monitoring entity.

San Marcos River Watershed

River Segments, Descriptions and Concerns

Segment 1814 (Upper San Marcos River): Beginning at the San Marcos Springs that are fed by the Edwards Aquifer in Hays County, the five mile stretch of river continues through to the confluence with the Blanco River east of San Marcos. The headwaters of the San Marcos River are clear flowing and a constant temperature year long.

Segment Concerns: The spring-fed stream, sometimes referred to as an island ecosystem, is home to a number of endangered species that are dependent upon the constancy of clean springflow for their survival. Springflow is a concern during times of drought. Population growth is also a concern in this stream, which is located in the IH-35 growth corridor. Recreation use of the river is high during summer months. Texas State University is conducting a study on the impacts of nonpoint pollution on Spring Lake from the Sink Creek watershed, the tributary to the lake. The study will monitor stormwater in the Sink Creek watershed to determine nutrient contributions. Additionally, the study will deploy continuous water quality monitoring stations in Spring Lake. One of the goals of the project is to develop a nutrient management plan for Spring Lake and the upper San Marcos River. TCEQ has proposed rulemaking that would set the temperature criteria for the upper reaches of Comal and San Marcos Rivers at 78°F. The U.S. Fish and Wildlife Service recommends lower temperatures in these areas in order to protect endangered aquatic species.

Segment 1808 (Lower San Marcos River): From the confluence of the San Marcos River with the Blanco River continuing about 75 miles until the point of confluence with the Guadalupe River outside the city of Gonzales. Includes the confluence with Plum Creek. The lower San Marcos River is a lazy, smooth flowing river during normal flow.

Segment Concerns: Protecting spring flow is a concern during times of drought. Recreational use of the river is increasing. Activities related to the production and transportation of petroleum are potential threats to the watershed.

Special Note: The Edwards Aquifer Authority is in the third year of a Recovery Implementation Program (RIP). A RIP is a multi-stakeholder initiative that seeks to balance water use and development with the recovery of federally listed endangered or threatened species. RIPs use a long-term interdisciplinary approach of policy formation, scientific research, habitat restoration, and education. Stakeholders develop a comprehensive document that outlines goals, activities, timelines, measurements of success, and roles of the participants, and then sign a cooperative agreement to implement the activities. The Edwards Aquifer RIP's 26-member steering committee includes representatives of state and regional water agencies, municipalities, industries, agriculture, environmental organizations and the public. The procedural tasks have been completed and the Expert Science Committee is tackling the difficult questions, including the necessity to maintain minimum spring flows. The EAA, state agencies and the U.S. Fish and Wildlife Service are required to approve and execute a RIP agreement by the fall of 2012.

Photo by LaMarriol Smith

Drainage Area: 522 square miles

Streams and Rivers: Lower San Marcos River, Upper San Marcos River, Sink Creek, York Creek

Aquifers: Edwards-Balcones Fault Zone, Carrizo-Wilcox

River Segments: 1814, 1808

Cities: San Marcos, Maxwell, Martindale, Fentress, Prairie Lea, Luling, Ottine, Gonzales

Counties: Hays, Guadalupe, Caldwell, Gonzales

EcoRegion: Edwards Plateau, Post Oak Savannah, Texas Blackland Prairies

Vegetation Cover:
Pasture/Hay- 27.0%; Evergreen Forest - 12.8%
Grass/Herbaceous - 16.3%; Shrublands - 12.2%
Deciduous Forest - 19.0%; Row Crops - 8.6%

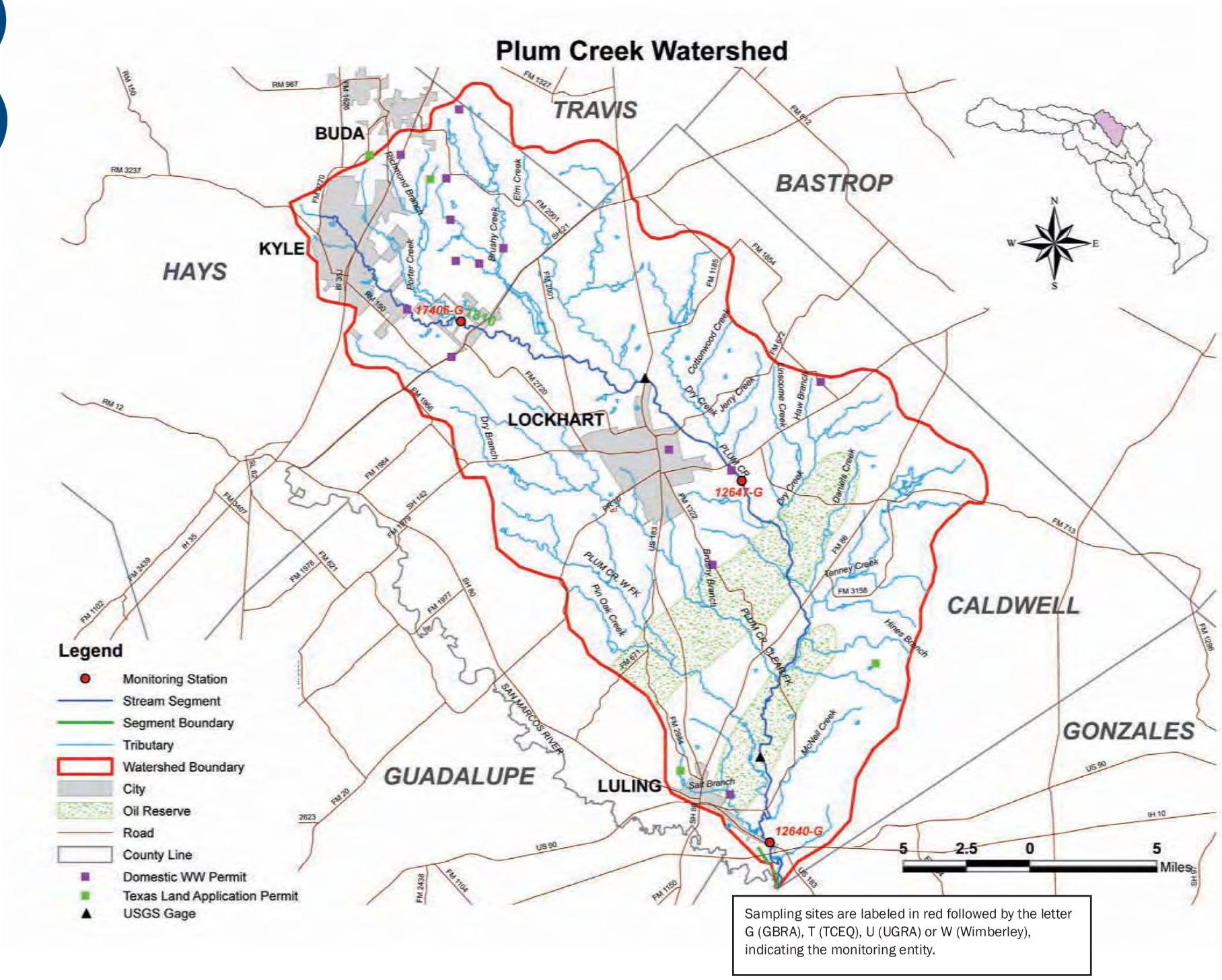
Climate:
Average annual rainfall: 33 inches
Average annual temperature: January 40°, July 96°

Land Uses: urban, industry, agricultural crops (corn, sorghum, hay, cotton, wheat, pecans), cattle and hog production, poultry production, oil production, and recreation

Water Body Uses: aquatic life, contact recreation, general use, fish consumption, and public water supply

Soils: Varies from thin limestone to black, waxy, chocolate, and grey loam

Permitted Wastewater Treatment Facilities:
Domestic: 3 Land Application: 5 Industrial: 0



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Plum Creek Watershed

River Segments, Descriptions and Concerns

Segment 1810 (Plum Creek): Plum Creek begins in northeastern Hays County at about FM 2770 and continues 52 miles to the confluence with the San Marcos River south of Luling in Caldwell County. Plum Creek is typically a shallow, slow moving stream flowing through gently rolling hills lined with agricultural fields and scrub oak trees.

Segment Concerns: The Plum Creek Watershed Partnership (PCWP) has completed the Watershed Protection Plan (WPP) for Plum Creek and its tributaries in Hays and Caldwell Counties. The Plum Creek WPP is the first watershed protection plan in the state to receive confirmation from EPA that it meets all nine elements of a WPP. In 2004, Plum Creek was identified as impaired for *E. coli* bacteria, with concerns for nutrients. Load duration curve analysis indicated that both point and nonpoint sources contribute to the impairment. Based on stakeholder input and land use analysis, sources of the pollutants include urban sources, such as urban runoff and pet waste, as well as agricultural activities and wildlife sources (deer and feral hogs). Associated with the PCWP WPP planning process, an education and outreach grant from the Texas Commission on Environmental Quality and the U.S. EPA funded several water quality projects. Over seven tons of illegally dumped waste was removed from the stream; training was provided for municipal officials, on-site septic systems maintenance providers and homeowners; and on-line educational computer modules were developed covering topics such as wastewater treatment, on-site septic systems and disposal for household hazardous wastes. The project has moved into the implementation phase of the WPP. Grant funding received in this phase is covering urban nonpoint source pollution management strategies for the cities of Kyle, Luling and Lockhart, feral hog management education in the rural portions of the counties, and nonpoint source pollution outreach and education. The Texas AgriLife Extension will continue to work in the watershed for three more years (http://pcwp.tamu.edu/).

Photos by Janet Thome

Drainage Area: 397 square miles

Streams and Rivers: San Marcos River, Plum Creek, Clear Fork Creek

Aquifers: Edwards-Balcones Fault Zone, Carrizo Wilcox

River Segments: 1810

Cities: Kyle, Buda, Uhland, Luling, Lockhart

Counties: Hays, Travis, Caldwell

EcoRegion: Texas Blackland Prairies, Post Oak Savannah

Vegetation Cover:
Deciduous Forest - 23.6%, Row Crops - 14.4%, Pasture/Hay- 22.9%, Shrublands - 11.4%, Grass/Herbaceous - 22.4%

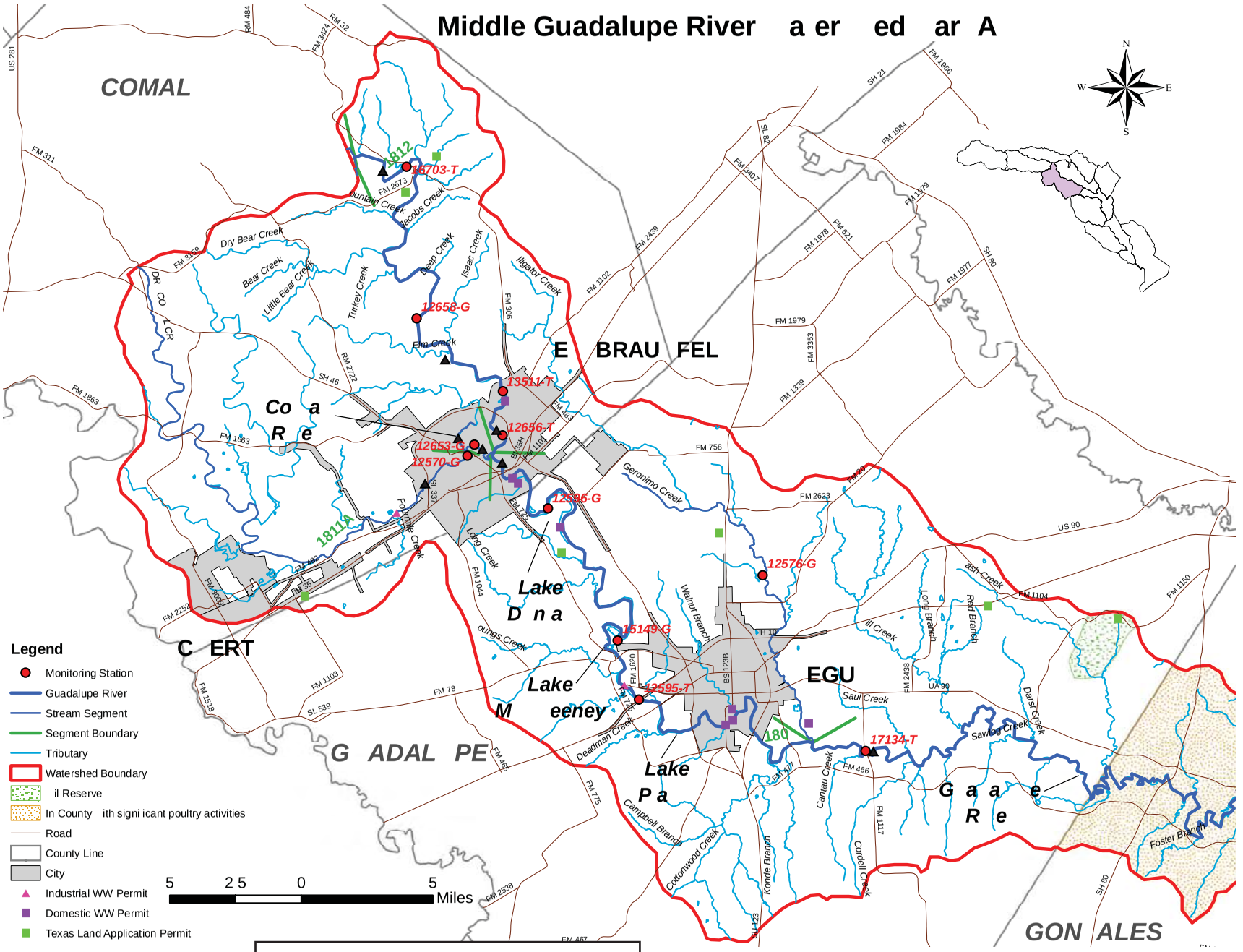
Climate:
Average annual rainfall: 33 inches
Average annual temperature: January 40°, July 95°

Land Uses: industry, urban, oil and gas production, cattle, hog and poultry productions, agriculture, crops (sorghum, hay, cotton, wheat and corn)

Water Body Uses: aquatic life, contact recreation, general use and fish consumption

Soils: Black, waxy soil to sandy soil, limestone to black waxy chocolate and grey loam

Permitted Wastewater Treatment Facilities:
Domestic: 14 Land Application: 4 Industrial: 0



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Middle Guadalupe Watershed (Part A and B)

River Segments, Descriptions and Concerns

Segment 1812 (Guadalupe River below Canyon Dam): As the Guadalupe River flows from Canyon Dam to the confluence with the Comal River, the river is considered to be one of the finest white-water stretches in the state. The rapids are attributed to the change in elevation as the river cuts through the Balcones Fault Zone. The river is scenic, with limestone bluffs, bald cypress, pecan and elm trees. Trout Unlimited and Texas Parks and Wildlife Department take advantage of the cold-water releases from the bottom of Canyon Dam and sponsor the stocking of rainbow trout in the tailrace.

Segment Concerns: Water quality is good. No water quality concerns have been identified by the assessment performed in 2010. Releases from Canyon Reservoir can be anoxic in late summer and early fall but the stilling basin and weirs aerate the water to above the stream standard for aquatic life use. Stakeholders raised concerns about the impacts from heavy recreational use. The impacts mentioned are nonpoint source pollution loading (bacteria and trash) associated with the number of recreationists using the area during the low flow, summer months. The City of New Braunfels has secured a litter removal contract on the portion of the Guadalupe River that flows through the city.

Segment 1811 (Comal River): The 2½-mile-long Comal River, spring-fed from the Edwards Aquifer, has no water quality concerns, but has developed large stands of aquatic macrophytes. The clean, clear, fast moving water is a constant temperature all year, and supports a number of endangered species as well as intensive recreational uses. Dry Comal Creek is also included in this segment.

Segment Concerns: No water quality concerns were noted in the draft 2010 assessment but population growth and recreational pressure are of concern to stakeholders. The impacts mentioned are nonpoint source pollution loading (bacteria and trash) associated with the number of recreationists using the area during the low flow, summer months. The City of New Braunfels has implemented an innovative SCUBA litter collection contract for the Comal River. The city pays for this once-a-week trash removal. Also of concern to stakeholders in the area are the introduction of non-native invasive species such as hygrophila (aquatic plant), the ram's horn snail and loriicarids, a tropical fish used in aquariums for algae control. Non-native species have very few predators in the watershed and can disturb the balance of species in the aquatic ecosystem. Bacteria concentrations in the Dry Comal are on the rise and are impacting the water quality of the Comal River. The City of New Braunfels is investigating the source of the bacteria, one of which may be livestock that is using the creek as a water source.

Drainage Area: 939 square miles

Lakes, Streams and Rivers: Lake Dunlap, Lake McQueeney, Lake Placid, Guadalupe River below Canyon Dam, Dry Comal Creek, Comal River, Geronimo Creek

Aquifers: Edwards Trinity, Edwards Balcones Fault Zone, Carrizo Wilcox

River Segments: 1804, 1804A, 1811, 1811A, 1812

Cities: Sattler, New Braunfels, Schertz, Seguin, Geronimo, Kingsbury

Counties: Comal, Guadalupe, Gonzales

EcoRegions: Texas Blackland Prairies, Post Oak Savannah

Vegetation Cover:
Pasture/Hay- 25.5%; Grass/Herbaceous - 15.1%
Evergreen Forest - 18.0%; Shrublands - 12.0%;
Deciduous Forest - 15.5%; Row Crops - 8.1%

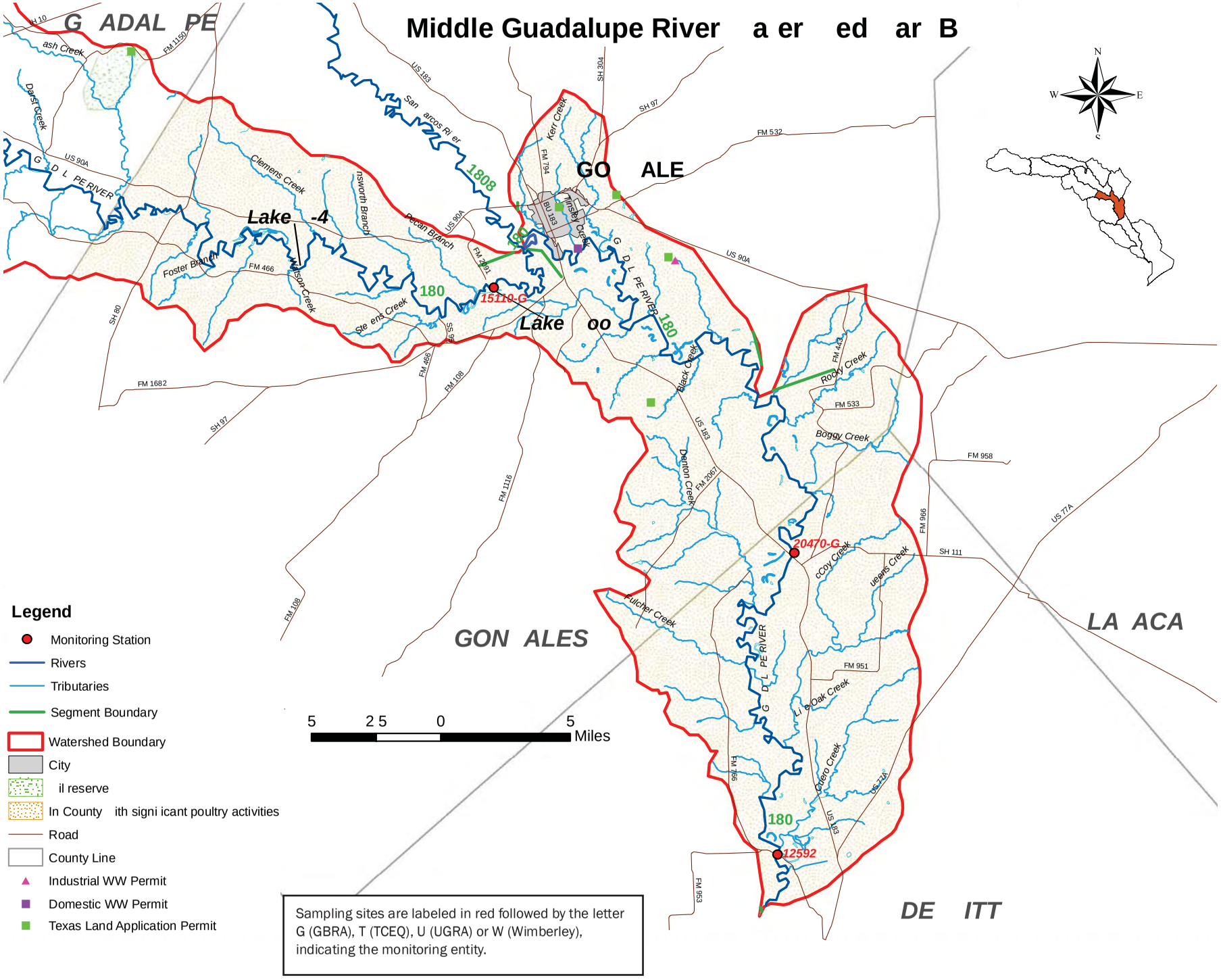
Climate:
Average annual rainfall: 29 inches
Average annual temperature: January 35°, July 95°

Land Uses: urban, light manufacturing, heavy manufacturing, farming, cattle ranching, poultry, petroleum production and gravel mining

Water Body Uses: aquatic life, contact recreation, fish consumption, general, public water supply, hydroelectricity, agricultural crops and industrial

Soils: Dark, calcareous clay, sandy loam, loam with clay subsoils; dark red sandstone, light tan and gray sandstone

Permitted Wastewater Treatment Facilities:
Domestic: 8 Land Application: 7 Industrial: 2



Legend

- Monitoring Station
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- Segment Boundary
- Watershed Boundary
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- Road
- County Line
- Industrial WW Permit
- Domestic WW Permit
- Texas Land Application Permit

Sampling sites are labeled in red followed by the letter G (GBRA), T (TCEQ), U (UGRA) or W (Wimberley), indicating the monitoring entity.

Middle Guadalupe Watershed (cont.)

River Segments, Descriptions and Concerns

Segment 1804 (Guadalupe River below Comal River): This stretch of the Guadalupe River between the confluence with the Comal River in New Braunfels to the confluence of the San Marcos River in Gonzales is a beautiful flowing river. Seven GBRA hydroelectric facilities utilize the elevation changes, creating small lakes that are widely used for recreation in Guadalupe County. Lake elevations are managed by GBRA. From New Braunfels to below Seguin, the banks of the hydroelectric lakes are lined with private residences, primarily on septic tanks.

Segment Concerns: Geronimo Creek and its tributary, Alligator Creek, are located in Guadalupe and Comal Counties. The 2006 Texas Water Quality Inventory listed Geronimo Creek as impaired for *E. coli* bacteria, with a concern due to elevated nitrate-nitrogen. The Texas State Soil and Water Conservation Board and the EPA have funded the development of a watershed protection plan for the creeks. A 23-member stakeholder group has been formed; three topical work groups will begin meeting to help identify activities associated with urban and agricultural nonpoint source pollution and with wastewater and septic tanks in the watershed that could be sources of the impairments. The water quality monitoring portion of the project has been extended through two additional seasons because of the impact of the drought on the first two seasons of the project in 2009.

Photo by Drew Engelke

Segment Concerns: Hydroelectric lakes have a history of problems created by non-native invasive aquatic macrophytes, such as hydrilla and water hyacinth.

Segment 1803 (Guadalupe River below San Marcos River): From the point of confluence of the San Marcos River, the Guadalupe becomes a much larger, slower moving stream as it flows toward the coast. Elevation changes are minimal.

Segment Concerns: A number of large poultry farms and cattle ranches are located in this area. To date, there have been no problems in the main segment associated with these land uses, although subwatersheds have been listed as impaired (1803B Sandies Creek and 1803C Peach Creek). See website for links to information on TMDL studies on these streams.

Drainage Area: 939 square miles

Lakes, Streams and Rivers: Lake Gonzales (H-4), Lake Wood, Guadalupe
River below Canyon Dam, Guadalupe River from confluence with the San Marcos River

Aquifers: Carrizo Wilcox

River Segments: 1803, 1804

Cities: Gonzales

Counties: Guadalupe, Gonzales, Lavaca, DeWitt

EcoRegions: Texas Blackland Prairies, Post Oak Savannah

Vegetation Cover:
Pasture/Hay- 25.5%; Grass/Herbaceous - 15.1%
Evergreen Forest - 18.0%; Shrublands - 12.0%
Deciduous Forest - 15.5%; Row Crops - 8.1%

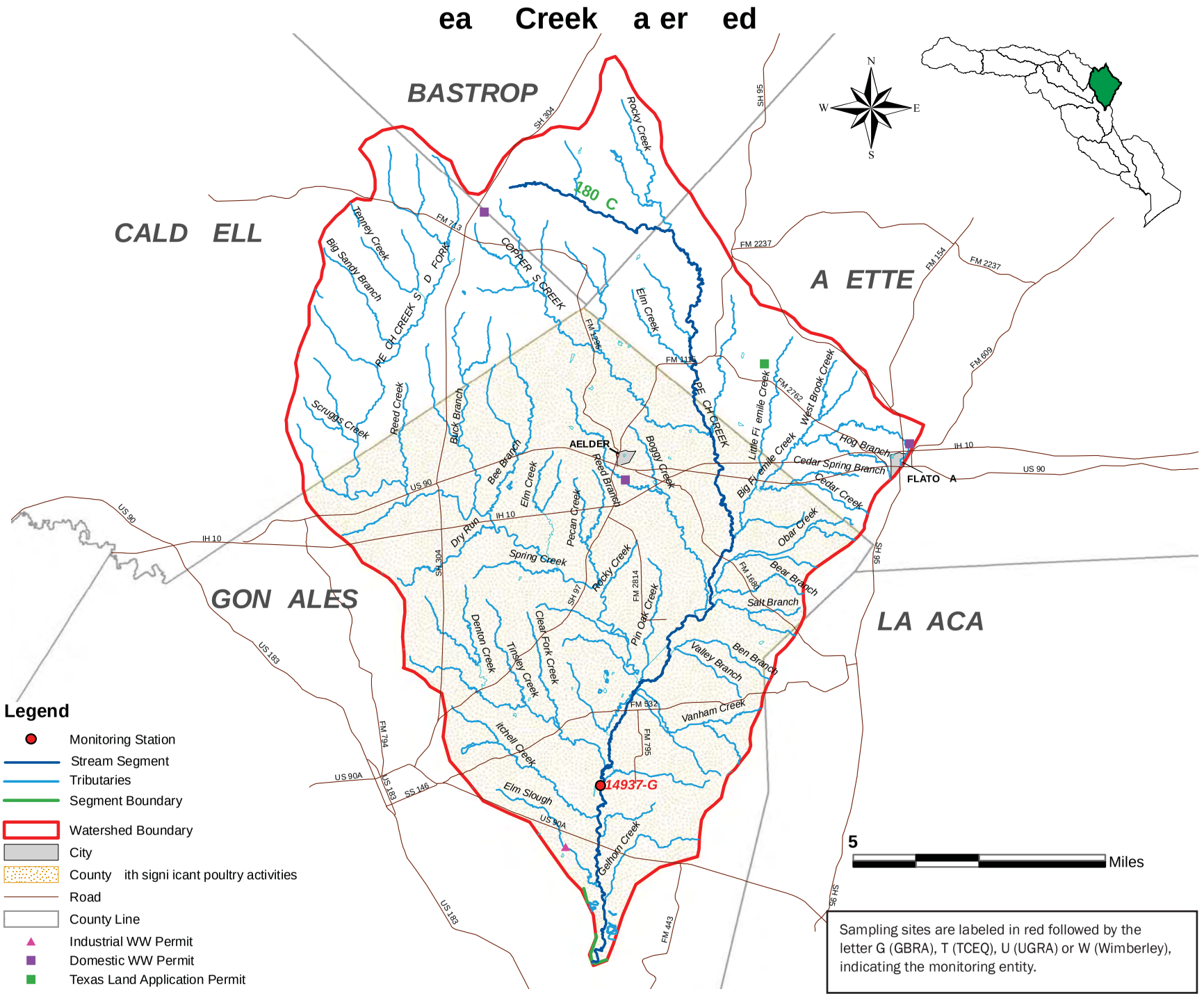
Climate:
Average annual rainfall: 29 inches
Average annual temperature: January 35°, July 95°

Land Uses: urban, light manufacturing, heavy manufacturing, farming, cattle ranching, poultry, petroleum production, and gravel mining

Water Body Uses: aquatic life, contact recreation, fish consumption, general, public water supply, hydroelectricity, agricultural and industrial

Soils: Dark, calcareous clay, sandy loam, loam with clay subsoils; dark red sandstone, light tan and gray sandstone

Permitted Wastewater Treatment Facilities:
Domestic: 1 Land Application: 5 Industrial: 1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Tributaries
Segment Boundary
Watershed Boundary
City
County ith signi icant poultry activities
Road
County Line
Industrial WW Permit
Domestic WW Permit
Texas Land Application Permit
Sampling sites are labeled in red followed by the letter G (GBRA), T (TCEQ), U (UGRA) or W (Wimberley), indicating the monitoring entity.

Peach Creek Watershed

River Segments, Descriptions and Concerns

Segment 1803C (Peach Creek, unclassified water body): A small system, Peach Creek flows east and south through gently rolling hills for 64 miles from Bastrop and Fayette counties northeast of Waelder into the Guadalupe River in eastern Gonzales County.

Segment Concerns: Contact recreation use is a concern due to bacteria. Peach Creek was included in a TMDL project conducted by the TCEQ. See the GBRA website for links to information on the TMDL study on this watershed.

Special Notes: TCEQ has completed the TMDL on Peach Creek. The segment was listed due to elevated bacterial indicators for contact recreation. A TMDL is an allocation of point and nonpoint source pollution loadings that will enable the waterbody to meet water quality standards. As a result of the water quality monitoring conducted with the TMDL, two additional creeks in the Peach Creek watershed have been listed on the 2010 303d list, Sandy Fork and Denton Creek.

Upper Peach Creek (at FM 1680 in Gonzales County) is being sampled by the U.S. Geological Survey for TCEQ as a 5c water body (where preliminary data show a need to confirm or not aquatic life use attainment). This work includes ten 24-hour DO profiles (done with a multiprobe that also records temperature, conductivity, and pH). Also two biological and habitat assessments are being conducted per Surface Water Quality Monitoring procedures. Chemical constituents analyzed from water samples collected at the time of the biological assessments are total alkalinity, ammonia as N, Chloride, Nitrate+Nitrite as N, Orthophosphate as P, Total Phosphorus, Sulfate, Total Dissolved Solids, Total Kjehdahl Nitrogen, Total Organic Carbon, Total Suspended Solids, and Volatile Suspended Solids. However, the sample collected on 8/25/08 was not analyzed for total phosphorus, nitrate-nitrite, and TKN due to power outages caused by the extreme weather conditions.

Photo by Janet Thome

Drainage Area: 480 square miles

Streams and Rivers: Guadalupe River, Peach Creek, Copperas Creek

Aquifers: Carrizo-Wilcox

River Segments: 1803C

Cities: Waelder, Flatonia

Counties: Caldwell, Bastrop, Fayette, Gonzales

EcoRegion: Texas Blackland Prairies, Post Oak Savannah

Vegetation Cover:
Pasture/Hay- 21.1%; Shrublands - 13.9%
Grass/Herbaceous - 23.4%; Deciduous Forest - 34.1%

Climate:
Average annual rainfall: 31 inches
Average annual temperature: January 39°, July 94°

Land Uses: recreation, extensive cattle and poultry productions, light industry and agricultural crops

Water Body Uses: aquatic life, contact recreation, and fish consumption

Soils: Dark red sandstone and tan and grey sandstone

Permitted Wastewater Treatment Facilities:
Domestic: 3 Land Application: 1 Industrial: 1

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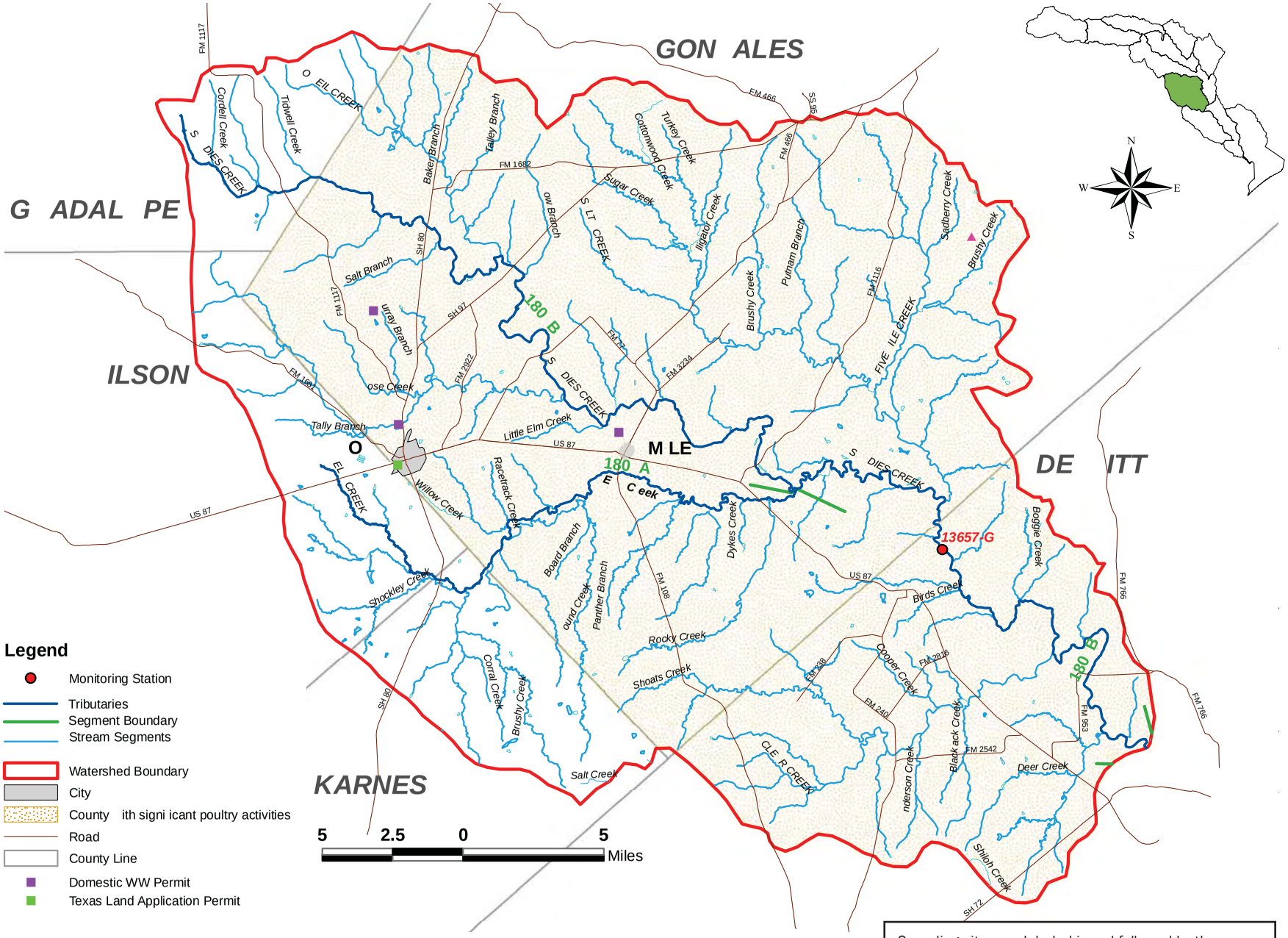

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Sandies Creek Watershed

River Segments, Descriptions and Concerns

Segment 1803A (Elm Creek, unclassified water body): Elm Creek flows 24.3 miles before it confluences with Sandies Creek, east of Smiley in Gonzales County.

Segment Concerns: In past stream assessments and again in 2010, Elm Creek is listed as impaired for aquatic life use due to depressed dissolved oxygen. Elm Creek was included in the TMDL study, along with Sandies Creek.

Segment 1803B (Sandies Creek, unclassified water body): Sandies Creek is a 65 mile long stream originating in Guadalupe County northwest of Nixon to the confluence of the Guadalupe River west of Cuero in DeWitt County.

Segment Concerns: Sandies Creek is impaired for aquatic life use due to depressed dissolved oxygen, impaired for contact recreation uses due to elevated bacteria and impaired for macrobenthic and fish communities.

Special Note: Elm Creek (Segment 1803A) and Sandies Creek (Segment 1803B) are two predominantly rural streams located in the Guadalupe River Basin in South Central Texas. The waterbodies were placed on the 303(d) List for elevated levels of bacteria and low concentrations of dissolved oxygen. The development of the bacteria TMDLs were discontinued in January of 2009. Review of the 2008 Water Quality Inventory indicated that both Elm and Sandies creeks would meet the proposed water quality standard for primary contact recreation. The development of the dissolved oxygen TMDLs were discontinued January 2009, pending future studies of the system by the Water Quality Standards Group of TCEQ. The implementation strategy for Elm and Sandies creeks is to proactively address agricultural sources of pollutants through voluntary implementation of best management practices by private landowners to bring water bodies back into compliance with water quality standards. Conservation partnerships have been developed in the watershed including SWCDs, TSSWCB and NRCS. Technical assistance for cattlemen and poultry growers is available to help develop and implement WQMPs (Water Quality Management Plans). Financial assistance is available through TSSWCB's EQIP. Education programs are being developed by AgriLife Extension. (TCEQ 2010).

Photo by Janet Thome

Drainage Area: 711 square miles

Streams and Rivers: Guadalupe River, Elm Creek, and Sandies Creek, Five Mile Creek, Salty Creek, Clear Creek, O'Neil Creek

Aquifers: Carrizo-Wilcox, Gulf Coast

River Segments: 1803A, 1803B

Cities: Smiley, Nixon

Counties: Guadalupe, Karnes, Wilson, Gonzales, DeWitt

EcoRegion: Texas Blackland Prairies, Post Oak Savannah

Vegetation Cover:
Pasture/Hay- 24.9%; Deciduous Forest - 19.6%
Grass/Herbaceous - 24.3%; Evergreen Forest - 5.3%
Shrublands - 21.1%; Row Crops - 3.4%

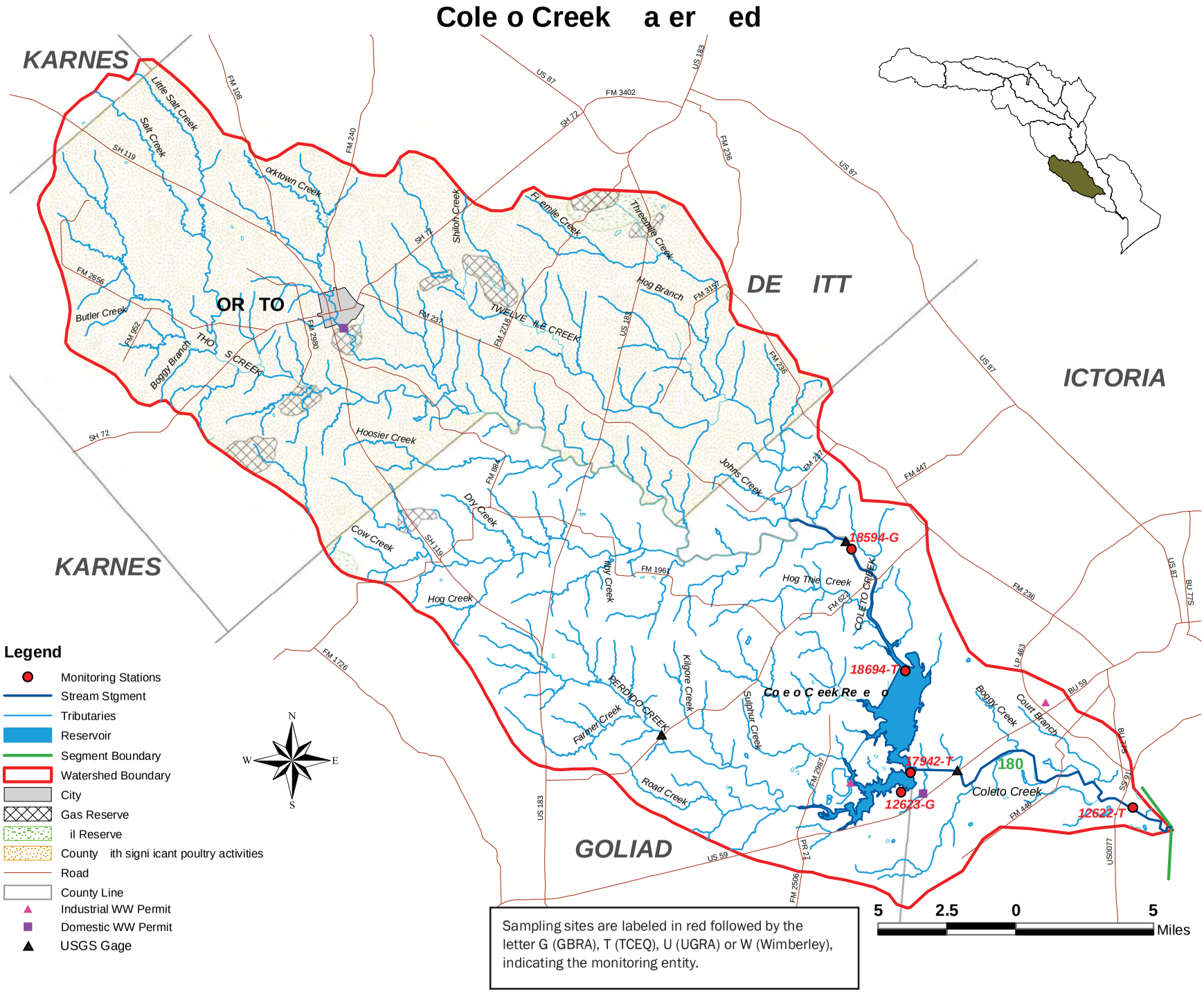
Climate:
Average annual rainfall: 31 inches
Average annual temperature: January 39°, July 94°

Land Uses: light manufacturing, extensive cattle production and poultry production; agricultural crops (hay, sorghum, etc.)

Water Body Uses: aquatic life, contact recreation and fish consumption

Soils: Dark red sandstone, light tan and gray sandstone

Permitted Wastewater Treatment Facilities
Domestic: 3 Land Application: 1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Farmer Creek
PERDIDO CREEK
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Sampling sites are labeled in red followed by the letter G (GBRA), T (TCEQ), U (UGRA) or W (Wimberley), indicating the monitoring entity.

Coleto Creek Watershed

River Segments, Descriptions and Concerns

Segment 1807 (Coleto Creek): Coleto Creek extends 27 miles beginning in DeWitt County, through Goliad and Victoria Counties, including the 3,100-acre Coleto Creek Reservoir to the confluence with the Guadalupe River in Victoria County. Because of the size of Coleto's drainage basin, this normally slow moving creek can become a fast, flowing river during a typical South Texas rainstorm. Much of the creek bottom is made up of sand with typical vegetation ranging from mesquite and huisache to large live oaks and anaque trees. Because of its rural sitting and limited development you can still find a wide range of Texas wildlife along its shores ranging from turkey and deer, to red fox and bobcats. With the completion of the Coleto Creek Reservoir, it now supports over 100 different species of birds with the most noted being the Southern Bald Eagle, Osprey, and Roseate Spoonbills.

Segment Concerns: Coleto Creek Reservoir is used for cooling water by the Coleto Creek, WLE, LP coal-fired power plant. This use may impact aquatic life (temperature, dissolved oxygen, excessive aquatic macrophyte growth). Other activities in the watershed that may impact water quality include oil field activities, increasing numbers of subdivision developments, land clearing on existing ranches along the creek, and introduction of non-native aquatic plant species into the Coleto Creek system.

Special Note: An examination of the hydrology and ground-water recharge/discharge in the upper Coleto Creek is being conducted by the U.S. Geologic Survey. Surface water from the Coleto and Perdido Creeks and groundwater data from the Chicot and Envangeline aquifers are being collected. The watershed is mostly rural, but is undergoing land use changes, including a renewed interest in uranium mining. The study will provide basin information that can be used to develop appropriate natural-resource management strategies. The Uranium Energy Corporation is proposing to lease property in Goliad County to mine uranium by in-situ leaching. In-situ mining is the stripping of uranium from underground formations by the injection of acid and water. The subsequent solution containing dissolved uranium is pumped to the surface and piped to a production facility. The Uranium Information at Goliad (UIAG), a citizen group, has formed to gather and disseminate information about the process and possible impacts to surface and ground water. The stakeholders have asked CRP to collect background samples from Coleto Creek for radiological compounds. Those samples are being collected through fiscal year 2010.

Drainage Area: 558 square miles

Streams and Rivers: Guadalupe River, Coleto Creek, Perdido Creek, Twelve Mile Creek, Thomas Creek

Aquifer: Gulf Coast

River Segments: 1807

Cities: Yorktown

Counties: DeWitt, Goliad, Victoria

EcoRegion: Texas Blackland Prairies, Gulf Coastal Plains

Vegetation Cover:
Pasture/Hay- 15.3%; Shrublands - 9.7%
Grass/Herbaceous - 33.2%; Deciduous Forest - 18.7%
Row Crops - 5.0%

Climate:
Average annual rainfall: 30 inches
Average annual temperature: January 41˚, July 95˚

Land Uses: agricultural crops (sorghum, rice, cotton and corn), beef, hogs and poultry productions and oil and gas production

Water Body Uses: aquatic life, contact recreation, fish consumption, public water supply and power plant cooling

Soils: Sandy, sandy loam and clay loam

Permitted Wastewater Treatment Facilities:
Domestic: 2 Industrial: 2

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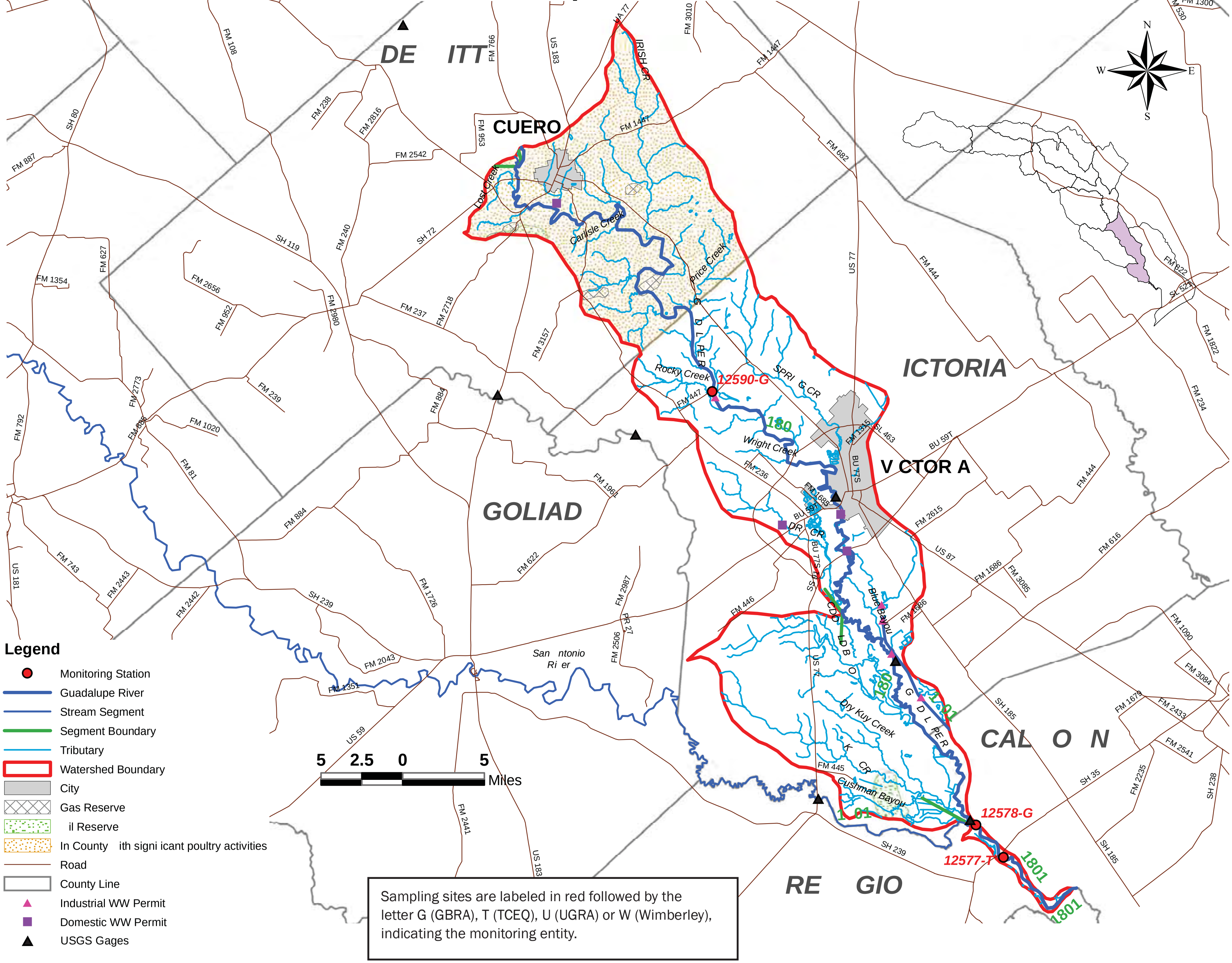

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Lower Guadalupe River Watershed

River Segments, Descriptions and Concerns

Segment 1803 (Guadalupe River below San Marcos River): From the point where the San Marcos River confluences with the Guadalupe River in Gonzales, Segment 1803 becomes a twisting, slow-moving coastal river, lined with pecan bottoms, with no rapids of any consequence. This portion of Segment 1803 begins to the west of the city of Cuero, flowing south to the west of the city of Victoria, to immediately upstream of the confluence with the San Antonio River.

Segment Concerns: In early assessments, in addition to the concern for nutrient enrichment, this segment was thought to have a concern for depressed dissolved oxygen. With additional data collection and assessment against the correct standard, the segment has been removed from the list of concerns for aquatic life use in the Guadalupe River Basin.

Segment 1802 (Guadalupe River below San Antonio River): This 0.4 mile long stretch between the confluence of the San Antonio and Guadalupe rivers to the GBRA Salt Water Barrier is a typical slow moving coastal river.

Segment Concerns: In early assessments, this segment was found to have a concern for nutrient enrichment from the San Antonio River. With additional data collection, the stream segment has been removed from the list of concerns in the Guadalupe River Basin.

Segment 1801 (Guadalupe River tidal): From the confluence with Guadalupe Bay in Calhoun and Refugio counties to the GBRA Salt Water Barrier (0.4 miles) downstream of the confluence of the San Antonio River in Calhoun and Refugio counties.

Drainage Area: 488 square miles

Streams and Rivers: Guadalupe River Tidal, Guadalupe River below San Antonio River, Guadalupe River Below San Marcos River, Sandies Creek, Elm Creek, Coleto Creek, Spring Creek, McDonald Bayou

Aquifers: Carrizo-Wilcox, Gulf Coast

River Segments: part of 1803, 1802, 1801, 1701

Cities: Cuero, Victoria, Tivoli

Counties: Calhoun, Refugio, Victoria, DeWitt

EcoRegion: Gulf Coastal Plains,East Central Texas Plains

Vegetation Cover:
Pasture/Hay- 14.8%; Shrublands - 21.1%
Grass/Herbaceous - 22.6%; Evergreen Forest - 5.7%
Row Crops - 4.2%; Wetlands - 10.2%
Deciduous Forest 14.8%

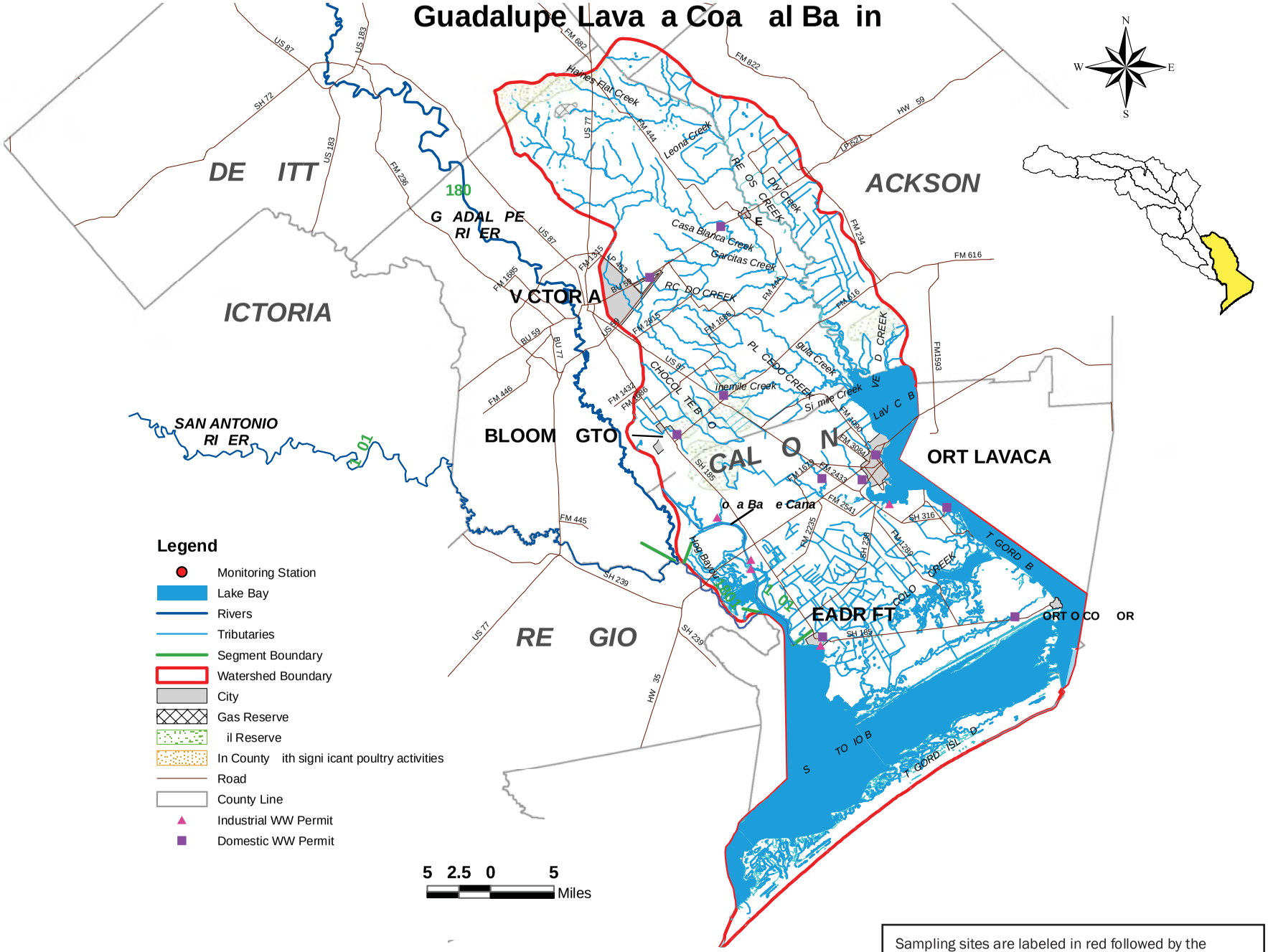
Climate:
Average annual rainfall: 37.4 inches
Average annual temperature: January 53˚, July 84˚

Land Uses: urban, agricultural crops (cotton, corn, wheat, rice, hay, grain sorghum), cattle and hog productions, industrial (plastics, chemicals, petrochemicals)

Water Body Uses: aquatic life, contact recreation, general, fish consumption, heavy industrial and public water supply

Soils: Cracking clay subsoil, sandy, sandy and clay loam

Permitted Wastewater Treatment Facilities:
Domestic: 4 Industrial: 5



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Guadalupe-Lavaca Coastal Basin

River Segments, Descriptions and Concerns

Segment 1701 (Victoria Barge Canal): From the Victoria Turning Basin in Victoria County to the confluence with San Antonio Bay in Calhoun County.

Segment Concerns: The concern for aquatic life use has been removed from this segment after additional 24-hour dissolved oxygen data was collected.

Drainage Area: 998 square miles

Streams and Rivers: Guadalupe River, Garcitas Creek, Victoria Barge Canal, Marcado Creek, Arenosa Creek

Aquifer: Gulf Coast

River Segments: 1701

Cities: Victoria, Seadrift, Bloomington, Inez, Port O'Connor, Port Lavaca

Counties: Calhoun, Victoria, Jackson

EcoRegion: Gulf Coastal Plains

Vegetation Cover:
Pasture/Hay- 15.1%; Shrublands - 16.9%
Grass/Herbaceous - 13.7%; Deciduous Forest - 8.4%
Row Crops - 21.4%; Wetlands - 17.2%

Climate:
Average annual rainfall: 42 inches
Average annual temperature: January 44°, July 93°

Land Uses: agriculture row crops (cotton, corn, rice and grain sorghum), urban, recreation, oil and gas production, cattle, hog and poultry production and industry (plastics, chemicals, petrochemicals)

Water Body Uses: aquatic life, non-contact recreation, fish consumption and industrial cooling

Soils: Clay subsoils, deep black soil, sandy clay, dark clay loam, clay

Permitted Wastewater Treatment Facilities:
Domestic: 10 Industrial: 5

San Antonio Guadalupe Estuarine System (SAGES) Study

From 2002 through 2009, Texas A&M University conducted field, laboratory, and modeling studies to investigate the diet, behavior, and habitat of the whooping crane at Aransas National Wildlife Refuge (ANWR). The overall goal of the San Antonio Guadalupe Estuarine System (SAGES) project was to use empirically-generated and existing data to evaluate the relationship between freshwater inflows feeding San Antonio Bay and the health of the endangered whooping crane population at ANWR. Field research included studies of wetland processes, plant ecology, and the abundance and distribution of blue crabs in the salt marshes of ANWR. Investigations focused on behavioral responses of whooping cranes to changes in abundance and distribution of blue crabs, wolfberry fruit, abiotic factors, and human-induced disturbances.

The first area of study was the ecology of key crane foods, namely blue crab and wolfberries. The primary study objective was to determine how environmental parameters influenced the abundance and distribution of these foods. The second area looked at the behavioral ecology of the cranes. The main objectives of this portion of the study were to document the food habits and time activity budgets of the cranes, as well as investigate the effects of abiotic conditions, food abundance and human disturbance on the crane's energy balance. The studies show a clear effect of river inflows on water quality patterns across the greater bay ecosystem. However, during periods of low flows, the impacts of factors such as wind and tides became more noticeable.

Photo by Jim Payne

The study found that the diet of the whooping crane is varied and included blue crabs, wolfberry fruit, clams, snails, and insects. The dominant food resources (blue crabs and wolfberries) are affected by several factors: freshwater inflow, bay salinity, tides, and temperature. Wolfberries were most productive in early spring and late summer, with fruit abundance coinciding with crane arrival in October each year. Based on the study observations, salinity immediately prior to and leading up to the late summer leafing period may be an important factor in fruit production. Blue crabs were significantly influenced by abiotic factors: water temperature, precipitation, water level , wind speed and direction. For the entire report, go to: http://www.gbra.org/Documents/Reports/Sages_Final.pdf. (Slack, et. al. 2009)

January - December 2009 Inventory of Events

Clean Rivers Program Guadalupe River and Lavaca-Guadalupe Coastal Basins

2009	**Wastewater permits in basin begin the renewal process**	**All Segments**

In an effort to make renewal of wastewater permits more efficient, TCEQ has placed basins in groups. The Guadalupe River Basin is in TCEQ's E group. Permits in each group will be on a five year renewal cycle. Status of wastewater permits can be viewed at: http://www.tceq.state.tx.us/nav/data/permit_data.html.

2009	**City of New Braunfels secured litter contracts on both the Comal and Guadalupe rivers**	**Segment 1811 and 1812**

The City of New Braunfels has secured litter contracts on both the Comal and Guadalupe rivers. More importantly the City of New Braunfels has implemented a one-of-a-kind, innovative SCUBA litter collection contract for the Comal River. The city pays for once a week SCUBA trash removal from the Comal River.

Summer 2009	**TPWD and Friends of Lake McQueeney find hydrilla in river channel below Lake Dunlap Dam**	**Segment 1804**

Friends of Lake McQueeney and the GBRA removed 0.1 acres of hydrilla from the old river channel below the Lake Dunlap Dam. The area was treated with Aquathal K, followed by mechanical removal (by hand) of any remaining plants.

2009	**Drought plagues river basin**	**All Segments**

Drought conditions across the river basin continued through three quarters of 2009. A break came in the fall of the year as rains began in earnest, especially heavy in the lower basin. The upper portion of the watershed did not see significant rains in 2009. Canyon Reservoir reached its lowest elevation since it impounded water in 1968.

March 2009	**New Braunfels Utilities relocating lift station in floodway**	**Segment 1804**

New Braunfels Utilities issued $10.2 million in bonds to make improvements to the city's water and wastewater system. Most of the bond money will be used to relocate a lift station from the floodway on the opposite side of the Guadalupe River from the Kuehler plants.

March 2009	**Toxic Release Inventory includes Guadalupe River Basin industries**	**Segment 1803**

Ineos Nitriles in Calhoun County and Invista's Victoria facility made the state's top ten list for chemical release to the environment.

July 2009	**Plum Creek Watershed Protection Plan first plan in state accepted by EPA**	**Segment 1810**

EPA reviewed and found that the Plum Creek Watershed Protection Plan met requirements outlined in the 2004 National Nonpoint Source Program Guidelines. The partnership continues to meet quarterly. The WPP has brought over $2 million to the watershed in the form of nonpoint source infrastructure improvement grants and education and outreach resources.

September 2009	**Broken oil field brine line discovered during sampling event on Salt Branch in the Plum Creek watershed**	**Segment 1810**

GBRA discovered a broken 2-inch water line spraying oily water into the Salt Branch, a tributary of Plum Creek, near Luling. The water coming from the pipe was high in chlorides and the stream banks at least 10 meters downstream were covered in black oily tar. The Railroad Commission was notified and they oversaw the repairs to the line by the owner, Lutex Oil Limited. By the next month the area was completely cleaned and all residue was removed. No water quality impacts were observed.

January - December 2009 Inventory of Events

Clean Rivers Program Guadalupe River and Lavaca-Guadalupe Coastal Basins

Fall 2009	**New Braunfels Utilities offers to voluntarily remove Total P from Kuehler discharges**	**Segment 1804**

NBU is in negotiations with TCEQ and the homeowner associations to voluntarily remove Total Phosphorus from the wastewater effluent discharged from the Kuehler plants. NBU is proposing to implement chemical removal of Total Phosphorus but is requesting that it not be a limit written into the permits.

Fall 2009	**GBRA, Texas AgriLife Extension and Texas State Soil and Water Conservtion Board meet with public to begin development of Geronimo and Alligator Creeks Watershed Partnership**	**Segment 1804**

A watershed protection plan is being developed on Geronimo and Alligator creeks in Comal and Guadalupe counties with the goal of removing Geronimo Creek from the 303d list of impaired water bodies. The creek was listed in 2004 for bacteria impairments. The partnership steering committee or topical workgroups (Urban NPS, Agricultural NPS and Wastewater/OSSF) will meet monthly in order to draft the WPP.

Fall 2009	**Guadalupe County begins Flood Mitigation Study in Geronimo Creek Watershed**	**Segment 1804**

Parallel to the WPP efforts, Guadalupe County has received a grant from the Texas Water Development Board to conduct a flood mitigation study for the Geronimo Creek Watershed. The study will identify up to five sites for possible construction of flood control structures.

Fall 2009	**City of New Braunfels and GBRA investigate source of elevated *E. coli* concentrations in Dry Comal**	**Segment 1811**

City of New Braunfels and GBRA field staff did a windshield survey of land use activities in the portion of the watershed of the Dry Comal Creek that lies within the city's jurisdiction. Bacteria samples were collected at a number of locations. Cattle using the creek as a water source are suspected to be a source of the contamination. The city is talking to the land owner about other options for his cattle.

December 2009	**Lakes Wood and Gonzales lowered during hard freeze to help control waterhyacinths**	**Segment 1804**

In order to utilize the hard freeze as a method of controlling waterhyacinths in the lower two hydro impoundments, GBRA lowered the lakes 18 inches to expose approximately 50 acres of the nuisance plant to four days of subfreezing temperatures.

Texas Watershed Stewards

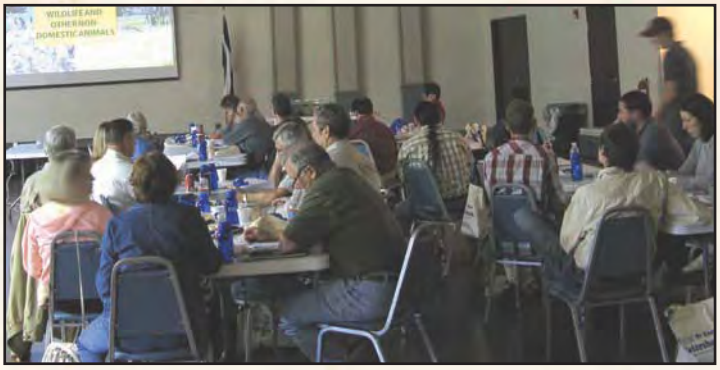
by Jennifer L. Peterson, Texas AgriLife Extension Service

Texas Watershed Stewards (TWS) is a highly successful educational program designed to support the development and implementation of Watershed Protection Plans (WPP) and Total Maximum Daily Loads (TMDL) by promoting a sustainable proactive approach to managing water quality at the local level by empowering individuals to take leadership roles in the management of water resources.

The program curriculum is comprised of five different units including a program introduction, an overview of watershed systems, an overview of watershed impairments, watershed management and regulation, and community-driven watershed protection strategies. The curriculum is compiled into a full-color handbook that also includes a comprehensive glossary of terms, and three appendices providing detailed information on federal, state, and local water quality agencies and organizations, important websites pertaining to water quality projects, management, and regulation, and a list of important activities for communities to engage in to help protect their local water resources. In addition, interactive modules were developed for each of the five curriculum units to serve as the foundation for the training program.

To date, 19 workshops have been conducted across the state in project watersheds undergoing TMDL or WPP development and/or implementation. Included in this list are the Plum Creek and the Geronimo and Alligator Creek watersheds located in the Guadalupe River Basin.

In total, over 1,050 citizens have become trained Texas Watershed Stewards representing small business owners, landowners, cities, agricultural producers, schools, state environmental agencies, universities, and other watershed residents.



Preliminary results from pre and post-test evaluations indicate that knowledge regarding pollutant sources/BMPs and watershed function has increased by 58% and 35%, respectively. Preliminary results from 6-month delayed post-test evaluations indicate that 80% of workshop attendees have more closely monitored individual actions that could impair water quality, 80% have adopted and/or maintained water quality BMPs on their property, and 65% have encouraged others in their community to attend a TWS workshop.

Seven additional TWS training events are planned across the state for 2010. Future training locations are currently being prioritized in collaboration with the TSSWCB and other project partners. For more information on the TWS program, please visit http://tws.tamu.edu.

How Can You Get Involved?

GBRA promotes communication and participation from the general public. Anyone who is interested in volunteering, or has a specific concern, may send an email addressed to dmagin@gbra.org or write a letter to Debbie Magin, 933 East Court Street, Seguin, TX 78155. Indicate topics of interest and provide enough information to receive mailed notices of meetings and reports. In addition, such information will help GBRA develop sub-watershed groups that have specific interests and may become involved in designing and providing input on special studies. Participation in these meetings and activities and input on water quality issues in the basin are highly encouraged.

Public Involvement and Outreach

GBRA strives to maintain active communication with the public to pursue the goals of public involvement and education in water quality issues. GBRA provides opportunities for direct public participation to ensure that community concerns are addressed. Such communications include the award-winning *River Run* magazine, website updates, and press releases regarding topical water quality issues. GBRA staff also participates in numerous events promoting water quality and environmental protection.

Luling River Pals - Luling Independent School District

The Guadalupe River Basin Steering Committee

A major communication tool for the CRP is the Basin Steering Committee (BSC). Composed of community leaders and interested citizens from throughout the basin, the BSC meets annually to review activities and advise the program on priorities for monitoring and special studies. The BSC membership includes: basin monitoring agencies and other state agencies, representation from municipalities, counties, industries, homeowner organizations, League of Women Voters and local/regional environmental organizations. Steering Committee meetings are OPEN TO THE PUBLIC with the primary purpose of reviewing and approving achievable basin water quality objectives and priorities, considering available technology and economic impacts, and guiding work plans and the allocation of available resources. To learn more about the program and how to get involved, please visit http://www.gbra/CRP.

Regional Lab

The GBRA Regional Laboratory holds accreditation through the TCEQ's National Environmental Laboratory Accreditation Conference or "NELAC." The lab, located at the General Offices of GBRA in Seguin, provides technical assistance and support to GBRA's operations, as well as municipalities, water districts, industries, engineering firms and other organizations as they comply with federal, state and local regulatory requirements that protect water quality. The Regional Laboratory is equipped to perform physical, chemical and biological analyses of water from natural streams, potable water and wastewater treatment plants, groundwater wells and treatment residuals, utilizing current technology and equipment. The Regional Laboratory serves as a contract laboratory for the CRP and maintains strong working relationships with federal, state and local government agencies responsible for water quality, as well as corporations and individuals capable of affecting water quality.

Public Involvement and Outreach *(cont.')*

Public Education Efforts

GBRA's award-winning programs *Journey Through the Guadalupe River Basin* (4th grade), and *River of Life* (middle school) maintain a strong presence in schools throughout the river basin. Both programs are TEKS-correlated interdisciplinary curriculum supplements that place an emphasis on watersheds and water quality, specifically in the Guadalupe River Basin. In addition, the curriculum touches on the water cycle, water uses in the basin, population growth, and water conservation. GBRA continues to offer teacher trainings for these two programs.

Photo by Janet Thome

Education staff makes frequent use of table-top watershed models in schools and at public events to demonstrate how a watershed works, and the impact of nonpoint source pollution to the watershed. Use of these models provides an opportunity to discuss best management practices (BMPs) within a watershed. GBRA staff also utilizes a model of the Guadalupe Basin. This 7-foot long tool models elevation, watershed boundaries, and river/stream flow. Additional information on the model includes cities, roads, county boundaries, and underlying aquifers. It is also used to demonstrate nonpoint source pollution and promote discussion about land uses and BMPs.

Education efforts include presentations at various outdoor education and nature centers: Aquarena Center, Seguin Outdoor Learning Center, Texas Agricultural Education and Heritage Center, Cibolo Nature Center, Coleto Creek Park, and Lockhart State Park. Education efforts also include tours for students to the GBRA Regional Lab and to GBRA-operated drinking water and wastewater facilities.

For the last three years, GBRA has been a lead sponsor with area universities in providing week-long teachers workshops in both the upper and lower basins. *Wonders of Water* provides background information for teachers as well as field trips. Teachers are also provided curricula activities and tools for use in their classrooms. These workshops also provide partnership opportunities with Texas Stream Team in training volunteer water quality monitors.

Funds from TCEQ provided opportunities for GBRA to develop electronic modules targeting water quality topics of interest to the general public. All are found at www.gbra.org/PlumCreek. Frequently mentioned during discussions targeting bacteria topics are Wastewater Treatment Plants (WWTP). One module leads the user on an informative tour of how these systems operate. Problems associated with malfunctioning WWTP often are attributed to fats, oils and greases (FOGs). The FOG module leads the user in an investigation of where FOGs originate in a home or business, as well as how to avoid problems with FOG. On-site sewage facilities are frequently suspected to be a source of bacteria in streams. The online flash animation modules *How a Septic System Works* and *How An Aerobic System Works* explain to users the workings of these systems and problems associated with malfunctions.

Public Involvement and Outreach

UGRA As the lead water resource planning agency for the Upper Guadalupe River Basin, UGRA partners with municipal and county governments, communities, civic groups, and citizens to preserve and protect water quality in all Kerr County streams and water bodies.

Extensive Water Quality Monitoring Programs

Photo provided by UGRA

As an active participant in the Texas Clean Rivers Program, UGRA performs routine, quarterly sampling at ten sites in Kerr County. In 2008, UGRA launched the County Wide Goal Based Monitoring Program to increase the number of sites that are monitored routinely in the Upper Guadalupe River so that water quality concerns can be addressed proactively. The program concentrates on the main tributaries to the Guadalupe River and monitors the same parameters as the Clean Rivers Program.

UGRA's Summer Swimability Program provides information on current water quality conditions for local citizens. Samples for *E. coli* bacteria analysis are taken at 21 sites on a weekly basis from Memorial Day to Labor Day. The results are compared to state guidelines for contact recreation and are posted on the UGRA website.

A portion of the Upper Guadalupe River is included in the Texas list of impaired water bodies (also called the 303(d) list). This area exceeded the state standard for *E. coli* bacteria and a Total Maximum Daily Load study (TMDL) was completed. An implementation plan (I-Plan) is currently underway to put the TMDL into action by outlining the steps necessary to reduce the bacteria load. UGRA is working with TCEQ to develop the TMDL I-Plan. Routine monitoring will provide better identification of *E. coli* sources as well as evaluation of control measures.

UGRA provides opportunities for citizen stewardship and community involvement in protecting the Upper Guadalupe River water resources of Kerr County. A popular activity is the UGRA Volunteer Summer Study. This program is supported by interested members of the community who collect samples for *E. coli* bacteria analysis each summer. The information collected by the volunteers provides important data and helps identify areas in need of further investigation while including the community in water quality monitoring.

Central to these varied water monitoring programs is the nationally accredited UGRA Environmental Laboratory, a full service laboratory serving the entire Hill Country. The Laboratory's analytical services include bacteriological, chemical, and biological testing of water, wastewater, soils, and sludge. The Laboratory is certified by the National Environmental Laboratory Accreditation Program and is one of the largest microbiological laboratories in the region.

Preservation and Conservation Efforts

UGRA is committed to the elimination of trash from the river and actively solicits and promotes community involvement in its Trash Free Initiative. UGRA arranges for and funds routine clean ups at fifteen low water crossings across the county. More than 13,000 pounds of trash was removed from these low water crossings in 2009.

Another cornerstone of the Trash-Free Initiative is UGRA's Annual River Clean Up, a county wide event to promote awareness of the importance of the Guadalupe River to the community and its proper stewardship. In 2009, more than 3,000 pounds of garbage was collected by over 150 participants, working along the river from above Hunt all the way to Center Point.

UGRA partners with other local entities for hazardous material spill containment and clean up. Absorbent hazmat socks and pillows are provided to area fire departments and the environmental health department to aid them in their efforts to contain and clean up oil and gas spills in and near the Guadalupe River.

Public Education to Raise Awareness of the Importance of the Guadalupe River

Part of UGRA's mission is to actively facilitate the understanding of water issues and engage the community in maintaining and promoting the health and enjoyment of the Upper Guadalupe River Basin.

UGRA has an active education program designed to give Kerr County residents a better understanding of the Upper Guadalupe River and its watershed. UGRA staff prepares presentations for area schools, clubs, organizations and summer camps to teach about water quality, conservation, the water cycle, and the importance of the Guadalupe River to the community. UGRA published a monthly column in the local newspapers about water quality and the aquatic environment and has an active public awareness campaign to keep the community informed of water issues. The *Major Rivers* water education program is distributed to 4th and 5th grade teachers in Kerr County to aid their lessons on the water cycle, conservation and Texas water resources.

Above all, UGRA is a resource for the community on water quality, surface water, and the Guadalupe River. Please contact UGRA with comments, questions, or concerns at (830) 896-5445 or visit www.ugra.org.

Reclamation: Restoring the Guadalupe River Watershed

The Guadalupe Bass Restoration Initiative is a five-year plan developed by the Texas Parks and Wildlife Department in cooperation with UGRA and the Hill Country Fly Fishers. The goal is to stock pure strain Guadalupe bass in areas that have been contaminated by smallmouth bass-Guadalupe bass hybrids. Overtime, the pure strain Guadalupe bass will reduce or replace hybrid populations in the Guadalupe River in Kerr County. In addition to being the state fish of Texas, the Guadalupe bass is an excellent indicator of water quality; thriving populations suggest that the water is clean and the watershed is healthy.

UGRA promotes landowner practices that have the potential to enhance groundwater and surface water resources. Numerous studies have indicated that brush control, primarily Ashe Juniper removal, can help increase Edwards-Trinity Aquifer recharge, enhance spring flow, and improve range and pasture land productivity. Financial assistance is available for eligible landowners to aid their brush management efforts; contact UGRA for more information.

Texas Stream Team

by Jason Pinchback, Texas River Systems Institute

The Texas Stream Team program operates statewide and focuses its efforts on training citizens to collect water quality information, conducting watershed outreach, and stakeholder engagement. This program is a joint partnership with Texas Commission on Environmental Quality, U.S. EPA Region VI, and the River Systems Institute at Texas State University in San Marcos.

Texas Stream Team (TST) trains 400 new monitors annually and has approximately 1400 active monitors throughout Texas. Certified monitors collect data that addresses aquatic life use and contact recreation conditions by analyzing samples for dissolved oxygen, pH, specific conductivity, temperature, Secchi depth transparency, flow severity, field observations, and *E. coli*. Data uses outlined in the quality assurance project plan include problem identification, research, education, local decision-making, and other uses deemed appropriate by the data user.

The Guadalupe River basin continues to show increased citizen monitoring activities from various groups including: San Marcos River Rangers (San Marcos River Foundation), Lindheimer Master Naturalists, Hays Master Naturalists, Luling River Pals, Hays County, various Texas State University student groups, Plum Creek Partnership, Water Advisory Group in Wimberley, Wimberley Outdoor Educators, Guadalupe River State Park, and many individual Texas Stream Team monitors.

TST delivers additional resources to the Plum Creek Partnership, the TMDL on the upper Guadalupe River upstream Canyon Lake, and the Cypress Creek Watershed Protection Plan in Wimberley. Enhanced resources available in these areas include: NPS pollution watershed outreach presentation; an assortment of curricula and related written and electronic materials for use in classrooms and creek side lessons; watershed tours; watershed surveys; intensive bacteria snapshot; biological monitoring demonstrations; GIS and map-based visual aides; water quality communications; partnership development; grant and project development facilitation; participation in partner scoping meetings; participation in WPP and TMDL Stakeholder meetings; river and lake clean up projects; storm drain stenciling; land use surveys; and watershed protection workshops.

TST is developing an on-line dataviewer tool for data querying, graph building, on-line data entry, and program development. This will be available by fall 2010. In the meantime anyone can view data summary reports and the last five years of raw data by visiting http://txstreamteam.rivers.txstate.edu/Data.html. The general TST program website is located at http://txstreamteam.rivers.txstate.edu/.

Websites

Another mechanism used to keep the public informed is the Internet. Both river authorities have Internet web pages: www.gbra.org and www.ugra.org These websites provide information to the public on topics of interest in the basin.

The GBRA web page provides links to a range of information on river flows and quality conditions, including: water quality data, special studies reports, schedule of monitoring activities, interactive map of the monitoring sites, quality assurance information and an events inventory.

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Guadalupe-Blanco River Authority

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