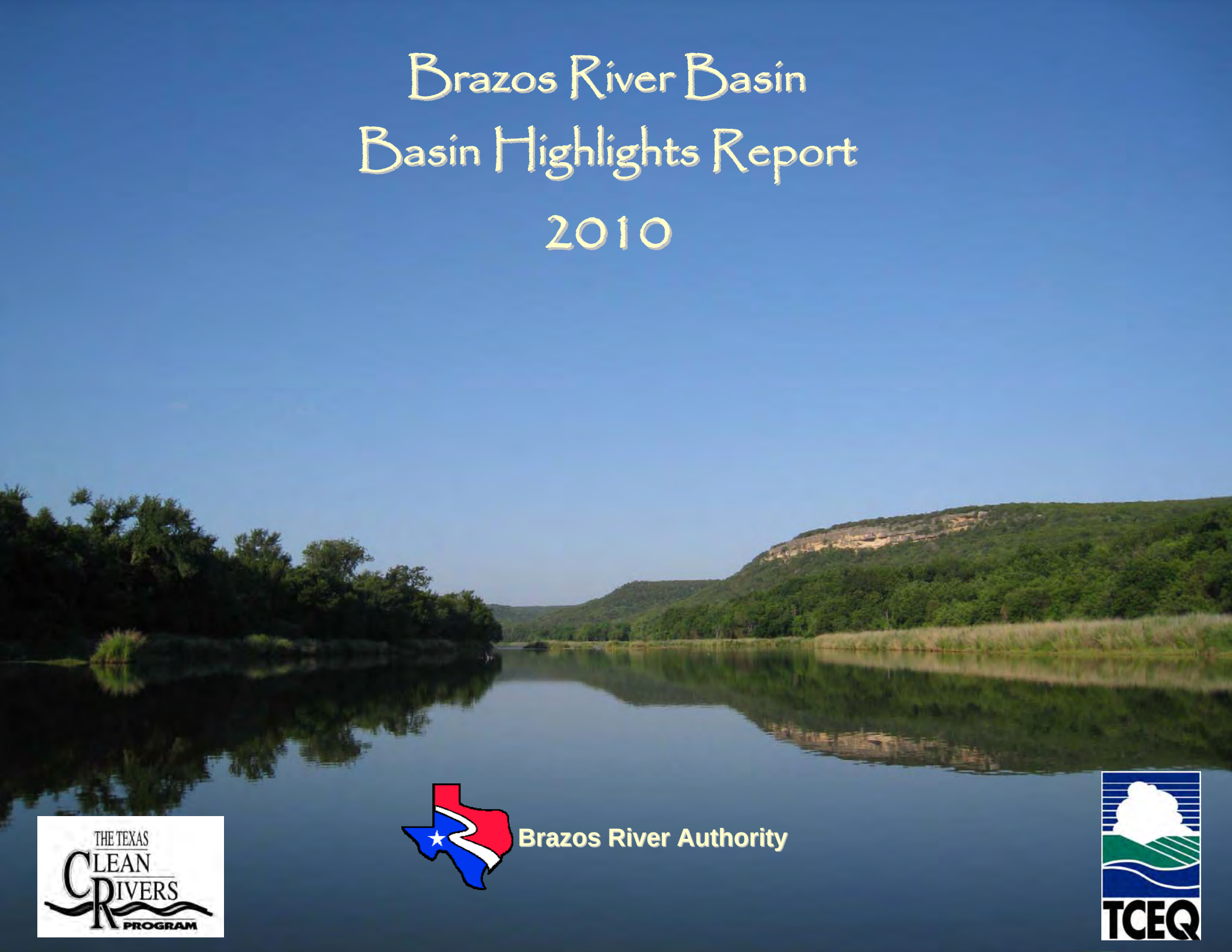
Brazos River Basin
Basin Highlights Report
2010



THE TEXAS CLEAN RIVERS PROGRAM

Brazos River Authority

TCEQ

Brazos River Basin Highlights Report 2010

The Brazos River Authority, as a member of the Texas Clean Rivers Program, works to answer questions about the quality of our local streams, rivers and lakes in the *Brazos River Basin Highlights Report 2010*. This report contains the information needed to answer questions about water quality in the lakes and streams of the Brazos River basin. It also summarizes the results of the ongoing water quality assessment activities in the Brazos River basin under the Texas Clean Rivers Program.

The Authority wishes to thank both the Texas Commission on Environmental Quality's Clean Rivers Program staff and the Surface Water Quality Monitoring Team for their hard work and significant contributions to the water quality in the Brazos River basin. Thanks also go out to the hundreds of individuals and organizations that are not named on these lists who have attended public meetings and other outreach events sponsored by the Authority and the Clean Rivers Program. Their input is the foundation of the watershed management process.

INTRODUCTION

This report highlights the activities that occurred in Fiscal Year 2009 in the Brazos River Basin under the Clean Rivers Program (CRP). The CRP is managed by the Texas Commission on Environmental Quality (TCEQ), and funded entirely by fees assessed to wastewater discharge and water rights permit holders. The Brazos River Authority (BRA) carries out the water quality management efforts in the basin under contract with TCEQ. The activities described in this report include water quality monitoring results, a review of the 2008 Integrated Report (IR) (formerly known as the 305(b) Water Quality Inventory), a review of proposed changes to surface water quality standards, a summary of significant events affecting water quality and a summary of other water quality studies being conducted by the BRA.

THIS YEARS HIGHLIGHTS

Drought

The drought of 2008-09 ranged from severe in the upper basin to extreme and exceptional in south and western parts of the basin. Brazos River flows were at or near record lows near the coast prompting the BRA to release water from its reservoirs to provide water to farmers and ranchers, cities, industry and residents in the most greatly impacted areas of the basin. As bad as the drought was, on a large scale it does not compare to the massive, devastating drought of the 1950s or the Dust Bowl in the 1930s. Those too were intense droughts but they lasted several years, up to a decade, depending on the location. Also, while the 2008-2009 drought primarily affected Texas, the others covered large swaths of the nation.

But according to a study released in August 2009 by the Office of the State Climatologist, if you factor in rainfall shortages, three counties, including Lee in the Brazos basin, are probably seeing the most severe drought on record. And if you add in high temperatures, six more counties likely fall into the record category. Generally, the population growth and increased demands on water supplies in the Brazos River basin since the ‘50s bring about a different drought situation. (Drought Monitor Map)

The decrease in rainfall and subsequent diminishing stream flow did not result in major changes in the water quality of the main stem of the Brazos River in 2009. However, several small to mid-sized, tributary streams became dominated by pools rather than by normal runs and riffles or went completely dry, including: the North Fork of the San Gabriel River, Willis Creek and Berry Creek in the Little River watershed; the South Bosque River and Meridian Creek in the Bosque River watershed; Resley Creek, Armstrong Creek and Copperas Creek in the Leon River watershed; and Campbells Creek, Pin Oak Creek and Spring Creek in the Central Brazos River watershed. Additionally, small receiving streams

(streams that are the final destination of treated wastewater) became more effluent-dominated, as seen at the two monitoring locations on the Nolan River. Ammonia, nitrate-nitrogen, orthophosphate-phosphorus,total phosphorus, chloride and sulfate concentrations all increased significantly over normal conditions at the Nolan River stations. Less base flow from the rivers resulted in longer water residence times in the reservoirs throughout the basin. The longer residence time promoted higher chlorophyll *a*, turbidity, total dissolved solids, chloride and sulfate concentrations in Lake Granger, Lake Georgetown and Lake Proctor, all in the western part of the basin most severely impacted by the drought.

Fortunately, the waters of the Eastern Pacific have warmed, heralding a return in winter of 2009 of the cyclical El Niño weather system. El Niño has brought rain to the southern United States during the winter ending the drought for most of the Brazos River basin.

Heavy Metal and Organic Compound Sampling

In 2009, at the request of stakeholders concerned about the impacts industrial discharges could be having on the basin, the BRA began a five-year special sampling program to test for heavy metals, volatile organic compounds and semi-volatile organic compounds in classified segments with an industrial presence. Segments 1257 (the Brazos River above Possum Kingdom Reservoir), 1208 (Lake Possum Kingdom), 1205 (Lake Granbury) and 1204 (the Brazos River below Lake Granbury) were the first segments sampled during this introductory year. To date, no detections have been measured above the minimum analytical limit of the method.

Biological and Habitat Assessments in 2009

Biological and habitat assessments were conducted on the following streams in 2009: the Brazos River at FM 2114 (Segment 1257), the Little River near Gause (Segment 1213), the South Bosque River at FM 2837 (Segment 1246), California Creek (Segment 1232), Tehuacana Creek (Segment 1242), and Trimmier Creek (Segment 1216).

Added Sampling for 2009

Several new sampling locations were added in 2009. A new site was established on Lake Stillhouse Hollow (Segment 1216) at Pleasant Branch Cove to assess sedimentation impacts from land development activities on Trimmier Creek. A site was added on the South Leon River (Segment 1221) in support of the Leon River Watershed Protection Plan efforts. A historical monitoring site on Berry Creek (Segment 1248) was revitalized to gather background data in response to the high rate of development being observed in western Williamson County. Multiple sites were added in Segment 1242 on the following creeks: Pin Oak, Campbells, Spring, Walnut and Mud. These were added for a comprehensive monitoring

study of the Little Brazos River watershed, through funding by Clean Water Act 319(h) grants administered by the Texas State Soil and Water Conservation Board.

New Projects

Two new projects were developed during 2009 and data collection efforts are scheduled to begin in 2010. The first will characterize Somerville Lake water quality conditions and identify possible contributing sources of pollution. Somerville Lake is on the 2008 303(d) List as being impaired for depressed dissolved oxygen (DO), has a concern for high pH levels at the eastern end of the reservoir near the dam, and has a concern for increased chlorophyll *a* concentrations. The second project addresses several streams in Central Texas that are on the 2008 303(d) List for dissolved oxygen and/or bacteria impairments. To address the streams with bacteria impairments (Tehuacana Creek and Deer Creek in Segment 1242, and Cedar Creek in Segment 1209) a the Authority will gather data collection that will allow TCEQ to determine if existing bacteria criterion applied to these creeks are appropriate and, if not, to develop information necessary to adjust the criterion. To address the streams with DO impairments (Resley Creek in Segment 1221 and Thompsons Creek in Segment 1242) a series of biological and 24-hour DO data collection efforts will be conducted to determine the appropriate aquatic life use and associated dissolved oxygen criteria. Both of these projects are funded with a Clean Water Act 105(b) grant administered by the TCEQ.

The data collected by CRP are not just for use by TCEQ and BRA. The data are being used to develop watershed protection plans for Lake Granbury, Lake Granger and the San Gabriel River and the Leon River. The data are also frequently used by municipalities and local government entities and the BRA's water customers for project planning and development purposes.

National Environmental Laboratory Accreditation Conference

In 2001, HB 2912 required all data used by TCEQ for commission decisions regarding permits or other authorizations, compliance matters, enforcement actions, or corrective actions be from an accredited environmental laboratory and that the state's environmental testing laboratory accreditation program be consistent with National Environmental Laboratory Accreditation Conference (NELAC). The NELAC Standard provides uniform requirements for accreditation of environmental laboratories to ensure that decisions being made are based on data that is scientifically accurate.

TCEQ is the accrediting authority for environmental laboratory accreditation and drinking water certification in Texas. BRA's Environmental Services Laboratory received NELAC accreditation from TCEQ on September 11, 2008 and completed their second audit for continued accreditation in December 2009.

PUBLIC INVOLVEMENT AND OTHER INFORMATION

Brazos River Basin Clean Rivers Program Steering Committee

The size and diversity of issues across the Brazos River basin presents a challenge for the large group of stakeholders in our basin. The Brazos River Clean Rivers Program (CRP) Steering Committee participants represent diverse interests that are represented by government agencies, municipalities, industry, agriculture, organized local stakeholder groups, individuals, and environmental groups.

The BRA holds an annual meeting that provides the Steering Committee with an opportunity to hear results of water quality monitoring and CRP special studies and gives them a forum where they may voice opinions, make recommendations and interact with other stakeholder participants and BRA staff. Steering Committee members also participate by providing input into planning water quality monitoring activities, prioritizing problems within the basin for prospective CRP special studies, identifying problem areas, developing actions to address potential problem areas in the basin and commenting on the current year's draft Basin Highlights Report.

How to get involved with the Brazos Basin CRP?

BRA promotes communication and participation from the general public. If you are interested in serving on the Brazos River Basin CRP Steering Committee, send an email to jbarrett@brazos.org. Please indicate what topics you are interested in and provide an email address so that you can receive electronic notices of meetings and reports. In addition, the information you provide will help us to develop more effective meetings and provide direction to the program. We highly encourage participation in our meetings and input on water quality issues in the basin.

Brazos Basin CRP Website

The BRA maintains both a river authority website (http://www.brazos.org) and a CRP website (http://www.brazos.org/crpHome.asp) as a mechanism to keep the public informed via the internet. These websites provide information on topics of interest in the basin. The websites provide links to a range of information, including:

Water quality data

Water quality data generated by the BRA is available in a searchable format and can be easily downloaded to an Excel file (http://crpdata.brazos.org/). This site is updated quarterly. A link to the TCEQ data website is also provided.

Special Studies Reports

Available for download in .pdf format.

Quality Assurance Information

The Quality Assurance Project Plan for CRP and Data Management Plan are available for download in .pdf format.

Schedule of Monitoring Activities

A link is provided to the coordinated monitoring website, which contains a list of the water quality monitoring locations in the state.

Information on Non-CRP Water Quality Projects

Information is provided on a variety of water quality related projects sponsored by the BRA that are not conducted as part of the CRP.

Recreational Information

Information is provided on boating, fishing and other river and lake activities including canoeing maps below Possum Kingdom Lake and Lake Granbury.

River and Reservoir Levels

An interactive map provides information on USGS Stations in the basin, flood stage at each station and current flow at each station.

Current Drought Status

An updated Palmer Drought Index map is provided along with copies of the BRA's Drought Contingency Plan and Water Conservation Plan.

Water Supply Data

Information is provided on reservoir locations, elevations, and capacities and surface area.

Technical Assistance Program

Information is provided on services offered by the BRA to municipalities and utility districts in the basin, including: Industrial Pretreatment Programs, Regulatory Reviews, and Operations Assistance.

SPECIAL PROJECTS

The Brazos River Authority's public outreach activites include involving our stakeholders in planning water quality and watershed protection activities in the Brazos Basin as well as education and outreach programs.

Watershed Protection Plan for Lake Granbury

In May 2002, a study began to monitor and assess water quality in the canals and coves of Lake Granbury. The canals are backwater areas that have little or no circulation and mix slowly with the main body of the reservoir. The result can mean stagnant conditions where pollution problems have the potential to persist. The on-site sewage facilities located along the many canals and coves of Lake Granbury may be a significant source of bacteria and nutrients to the reservoir and may cause water quality concerns in many of the canals. The BRA and TCEQ are currently developing a Watershed Protection Plan (WPP) to address the concerns that these canals present. The Lake Granbury WPP has a large, active stakeholder group with representatives from government agencies, local, state and federal government, municipalities, and other locally interested parties. In addition, a Technical Advisory Group made up of agency representatives provides technical input to the plan development.

The Lake Granbury Watershed Protection Plan Stakeholders group continued their efforts to develop a Watershed Protection Plan to reduce bacterial impacts in the canals of Lake Granbury. During 2009, the stakeholders group worked to select and analyze Best Management Practices. It is anticipated that the Watershed Protection Plan will be completed fiscal year 2010.

Watershed Protection Plan for Lake Granger and the San Gabriel River

The BRA, in coordination with the Little River-San Gabriel Soil and Water Conservation District (SWCD), has received grant funding from the Texas State Soil and Water Conservation Board to develop a Watershed Protection Plan (WPP) for Lake Granger and the San Gabriel River Watershed. The Little River-San Gabriel SWCD received a funding to provide technical and financial support to farmers and ranchers for the implementation of best management practices on agricultural lands. Utilizing stakeholder input, the BRA has identified stream erosion and sedimentation as the primary concerns in the watershed. In addition, Mankins Branch and Willis Creek both are listed on the State's 303(d) List of Impaired Waterbodies for having *E. coli* bacteria concentrations that exceed the state's contact recreation designation. The BRA will continue to coordinate with stakeholder groups and project partners to develop a WPP that is holistic and includes the most appropriate management strategies to address water quality concerns.

Watershed Protection Plan for the Leon River

The Leon River was placed on the State's 303(d) List in 1997, and the TCEQ began developing a Total Maximum Daily Load (TMDL) on the portion of the river downstream of Lake Proctor and upstream of Hamilton in 2002. Upon completion of the TMDL modeling report, local stakeholders requested the BRA to facilitate the development of a WPP for the Leon River to assist the TCEQ in selection appropriate implementation strategies for the watershed. The BRA received funding for the project through the TSSWCB and began hosting stakeholder meetings in 2007. In the fall of 2008 the TMDL was put on hold, indefinitely, pending proposed changes to water quality standards. Stakeholders, however, continued to work toward the development of a WPP document. A WPP will be available to stakeholders for comment in the spring of 2010.

Clean Texas Marina Program

The Clean Texas Marina Program was established in 2001 in partnership with the marina industry, federal and state agencies and civic organizations. The program is coordinated by the Small Business and Environmental Assistance Division of the Texas Commission on Environmental Quality through a collaborative partnership with the U.S. Environmental Protection Agency, Marina Association of Texas, Texas A&M University Sea Grant Program, Texas Parks and Wildlife Department, General Land Office (Coastal), U.S. Army Corps of Engineers, and other local agencies.

The goal of the Clean Texas Marina Program is to provide technical assistance to implement pollution prevention programs, improve compliance with environmental regulations and enhance water quality. The program also promotes clean boating public education and outreach efforts to promote improved sewage handling and other environmental impacts.

The BRA has administered this program for TCEQ at Possum Kingdom Reservoir and Lake Granbury since 2004. To date, six marinas on Possum Kingdom Lake and three marinas on Lake Granbury have been certified as Clean Marinas. In addition, two Lake Granbury marinas have pledged to join the program and are working towards implementing appropriate pollution prevention practices prior to certification inspection.

Clean Water Sticker Program

The Clean Water Sticker Program is a legislatively-mandated program regulating sewage disposal from boat marine sanitation devices and sewage pump-out facilities. In 2004, the TCEQ delegated administration and regulatory responsibility to the BRA to perform annual inspection and certifications of sewage pump-out facilities at marinas on Possum Kingdom Reservoir and Lake Granbury. As a result, BRA staff have identified compromised pump-out systems

and provided technical assistance to facility operators bringing them into regulatory compliance and eliminating potential discharge of sewage.

In 2007, TCEQ delegated regulatory authority to the BRA for registration and certification of onboard marine sanitation devices. Boats subject to this program include: houseboats, boats longer than 26 feet with permanent sleeping quarters, and any boat with a permanently installed marine sanitation device. After initial inspection and registration, boats with on-board marine sanitation devices must be re-certified every two years.

Fees for registration and certification are set by TCEQ and collected by BRA for program administration.

Little Brazos River Tributaries Bacteria Assessment

The BRA has received funding from the Texas State Soil and Water Conservation Board to further assess water quality in the Little Brazos River Watershed in Robertson County. In 2004, five tributaries to the Little Brazos River were placed on the State's 303(d) List for having bacteria concentrations that exceed state water quality standards for contact recreation. The purpose of this project is to better characterize the bacteria impairment and to determine possible sources. For the project, the BRA has added 8 new water quality monitoring sites throughout the watershed and started monitoring flow and collecting stormwater data in November 2008. The BRA will complete the assessment project in August of 2010.

Two Data Collection Initiatives to Address Several Impaired Water Bodies in the Brazos River Basin

In May of 2009, with funding from the TCEQ, BRA began a 3 year project aimed to address several waterbodies in the basin that are on the 303(d) List for impairments including bacterial, dissolved oxygen and high pH. This is a two pronged project.

Data Collection Effort #1

Tehuacana Creek (1242N), Deer Creek (1242J), Cedar Creek (1209G) and Gibbons Creek (1209I) are all on the 303(d) List for bacteria impairment. Because these unclassified streams are small, ephemeral streams where recreational potential is low to non-existent, the efficacy of applying water quality standards meant for large, recreational river segments has come into question. Typically these streams have low flow to no flow for most of the year and if water is present, it is a result of storm events. Stormwater is known to accumulate high levels of both bacteria and nutrients as it travels over land. These pollutants are then deposited in the small streams where they can accumulate possibly causing impairment.

Thompsons Creek (1242D) and Resley Creek (1221A) are on the 303(d) List for depressed dissolved oxygen (DO). Both waterbodies are small, rural streams characterized by highly intermittent flow and frequent low water levels. These DO impairments are caused in part by the frequent low water levels which hinder the ability of the water to buffer against high ambient air temperatures in the summer and fall reducing the water's capacity to maintain dissolved oxygen levels.

All the waterbodies above are categorized in 5C, which means additional data and information needs to be collected before a Total Maximum Daily Load (TMDL) Study is scheduled. This project will collect the additional data necessary for TCEQ to determine what course of action is most appropriate to address the impairment whether it is a standards amendment, a TMDL, development of at Watershed Protection Plan, etc.

To address the streams with bacteria impairments data will be collected to verify the impairment, a land use assessment for the watershed will be prepared, and intensive watershed surveys will be performed. This data will allow TCEQ to determine if existing bacteria criterion applied to these creeks are appropriate and, if not, to develop information necessary to adjust the criterion.

To address the streams with DO impairments, BRA will conduct a series of biological and 24-hour DO data collections. An Aquatic Life Assessment (ALA) will be conducted on Resley Creek (1221A) to determine the appropriate aquatic life use and associated dissolved oxygen criteria. A Use attainability analysis (UAA) will be conducted on Thompsons Creek (1242D) to determine if existing aquatic life use/dissolved oxygen criterion are appropriate and, if not, to develop information necessary to adjust the aquatic life use/dissolved oxygen criterion.

Data Collection Effort #2

This aspect of the project will characterize Somerville Lake water quality conditions and identify possible contributing sources of pollution. Somerville Lake is on the 2008 303(d) List as being impaired for depressed DO and has a concern for high pH levels at the eastern end of the reservoir near the dam. There is also concern for increased chlorophyll *a*. The extremes in pH are most likely a result of algal activity; the observed high concentrations of chlorophyll *a* may be a potential cause for fluctuations in pH. Photosynthesis and respiration are two major factors that influence dissolved oxygen levels in the lake and the amounts of carbon dioxide in the lake, which in turn affects pH levels.

One tributary to the lake, East Yegua Creek, remains on the 2008 303(d) List as impaired for recreational use due to elevated bacteria levels. Sources of bacteria may include municipal discharges and runoff from agricultural lands and wildlife.

At this time, watershed land use has not been quantified, and the cause of the pH impairment has not been confirmed. Cyanobacteria are believed to be the primary organism leading to the pH and DO fluctuations in the reservoir. However, there is not sufficient data to determine that cyanobacteria are the only organism causing this oscillation in pH and DO. Additionally, historical data collection indicates that nutrient concentrations in Lake Somerville and its major tributary, Yegua Creek, are low. The low nutrient level brings into question the cause of cyanobacteria blooms. The limiting factor leading to algal blooms in the lake is not currently known making regulation of inflows to control blooms virtually impossible.

This project will collect the additional data necessary for TCEQ to determine what course of action is most appropriate to address the impairment; again, whether it is a standards amendment, a TMDL, development of at Watershed Protection Plan, etc. This project is a collaborative effort between the Brazos River Authority (Authority) and the Texas Institute for Applied Environmental Research (TIAER).

EVALUATING WATER QUALITY

The Texas Commission on Environmental Quality (TCEQ) evaluates the condition of the state's water bodies on a periodic basis under the Clean Water Act (CWA) Section 305(b). The results are contained within the Texas Water Quality Inventory and 303(d) List and are comprised of a complete listing of all water quality concerns in the state. This report is referred to as the Integrated Report (IR). As required by the Act, the IR is updated every two years and includes the review of the past seven years' data collected by many organizations statewide, including the BRA. The 2008 Water Quality Inventory and 303(d) List, on which the following information is based, provides an assessment of water quality results using the most recent seven years of data. This inventory is available on the TCEQ Web site at http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305_303.html. In February 2010, the Draft 2010 Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d) was sent out for public comment. As stated the following information is based on the 2008 IR report, however the Draft 2010 IR was taken into consideration and where changes in status of waterbodies are likely, it is noted.

The Texas Water Quality Inventory, 305(b) report, provides an overview of surface water quality throughout the state, including issues relating to public health, fitness for use by aquatic species and other wildlife, specific pollutants and their possible sources. These water quality issues are identified by comparing concentrations in the water to numerical criteria that represent the state's water quality standards or screening levels to determine if the waterbody supports its designated uses, such as suitability for aquatic life, for contact recreation, or for public water supply. The report determines if fish and

aquatic insects have adequate oxygen, if people swimming in the water are exposed to pathogens that may cause illness and if the water is fit to be used as a source for public drinking water. Waterbodies that do not meet established water quality standards are placed on the 303(d) List and are referred to as "impaired," "not supporting," or "NS." Once placed on the list the waterbody is targeted for special study and/or corrective action.

Water quality standards numerical criteria are used by TCEQ as the maximum or minimum instream concentrations that may result from permitted discharges and/or nonpoint sources and still meet designated uses. To resolve the issues of regional and geological diversity of the state, standards are developed for classified segments. Classified segments are defined segments of waterways that are unique from other segments. Appropriate water uses such as contact recreation, public water supply, and aquatic life are then applied to the segments. Site-specific water quality criteria have been developed for water temperature, dissolved oxygen, pH, bacteria, chloride, sulfate and total dissolved solids for classified segments. Many streams that are not classified segments are assessed throughout the state and are considered unclassified segments. These unclassified segments do not have specific water quality standards developed for them. For assessment purposes, unclassified streams are assessed using the numeric criteria developed for the classified segment into which the stream flows.

The TCEQ identifies segments where the data conditions are such that the waterbody is close to violating water quality standards as having a "concern for near non-attainment of standards" or "CN." These CN segments are then targeted for increased monitoring to better understand the conditions in the stream.

Numeric quality standards have not been developed for nutrients and chlorophyll *a*. Instead, the water quality standards for nutrients and chlorophyll *a* are expressed as narrative criteria. In the absence of segment-specific numeric water quality criteria, the state has developed screening levels for these parameters in order to identify areas where elevated concentrations may cause water quality concerns. These screening levels are applied to waterbodies statewide, and are based on the 85th percentile of nutrient values in the statewide water quality database. Waterbodies that exhibit frequent (>25% of the time) elevated concentrations of nutrients or chlorophyll *a* are referred to as having a "concern for screening level violations" or "CS" and are often targeted for continued and increased monitoring to better understand the effects of the elevated concentrations.

Descriptions of Water Quality Parameters

Field parameters are those water quality constituents that can be obtained on-site and generally include: dissolved oxygen, specific conductance, pH, water temperature, stream flow (not in reservoirs) and transparency.

Dissolved oxygen (DO) indicates the amount of oxygen available in the stream or reservoir to support aquatic life. DO concentrations can be reduced by the decomposition of organic matter.

Specific Conductance is a measure of the waterbody's ability to conduct electricity and indicates the approximate levels of dissolved salts, such as chloride, sulfate and sodium in the water. Elevated concentrations of dissolved salts can reduce the waters usability as a drinking water source and as 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 pH. Dissolved constituents can influence pH, such as carbon dioxide and by point and nonpoint source contributions to the stream.

Water Temperature affects the ability of the water to hold dissolved oxygen. Warmer water temperatures decrease the oxygen solubility in water, causing stress in aquatic ecosystems.

Flow is an important parameter affecting water quality. Low flow conditions common in the warm summer months can create critical conditions of aquatic organisms. Under these conditions, streams also have lower assimilative capacities for waste inputs from point and nonpoint sources and are also subject to decreased oxygen availability.

Transparency is a measure of the depth to which light is transmitted through the water column and thus the depth to which aquatic plants can grow.

Conventional Parameters are typical water quality constituents that require laboratory analysis and generally include: chloride, sulfate, total dissolved solids (TDS), nutrients, Chlorophyll *a* (Chl *a*), total suspended solids (TSS), and turbidity.

Chloride is an essential element for maintaining normal physiological functions in all organisms. Elevated chloride concentrations can disrupt osmotic pressure, water balance, and acid/base balances in aquatic organisms which can adversely affect survival, growth and/or reproduction. Elevated chloride content can also impact the usability of water for drinking water.

Sulfate is an essential element for maintaining normal physiological functions in all organisms. Effects of high sulfate levels in the environment have not been fully documented; however, sulfate contamination may be contributing to the declines of native plants by altering chemical conditions in the sediment. Elevated sulfate content can also impact the usability of water for drinking water.

Total Dissolved Solids is a measurement of minerals and other salts that are dissolved in water. High TDS may affect the aesthetic quality of the water, interfering with washing clothes and corroding plumbing fixtures. High TDS in the environment can also affect the permeability of ions in aquatic organisms.

Nutrients in the form of nitrogen and phosphorus compounds, increase plant and algae growth. When plants and algae die, the bacteria that decompose them use oxygen that is no longer available for fish and other organisms. The more dead plants in the water, the more bacteria are produced to decompose the dead leaves.

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, which can influence transparency.

Turbidity is a measure of water clarity or light transmitting capability of water. 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.

Bacteria, specifically *E. coli* and Enterococcus, are used as an indicator of the possible presence of disease-causing organisms.

Biological and Habitat Assessment includes collection of fish community data, benthic macroinvertebrate data and measurement of physical habitat parameters. This information is used to determine whether the stream adequately supports a diverse and desirable biological community.

24-hr Dissolved Oxygen studies perform measurements of DO in frequent intervals in a 24-hr period. This type of monitoring is conducted to measure the diurnal variation of DO and its impacts on the biological community. This monitoring is frequently paired with biological and habitat assessments.

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.

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

Monitoring in the Brazos River Basin

The Brazos River Basin can be divided into 14 major watersheds that fall within the 42,000 square miles and portions of 70 counties that make up the basin (Map). The 14 major watersheds include:

- the Caprock watershed;
- the Double Mountain Fork/Salt Fork of the Brazos watershed;
- the Clear Fork of the Brazos watershed;
- the Upper Brazos River watershed;
- the Lampasas River watershed;
- the Leon River watershed;
- the Bosque River watershed;
- the Aquilla Creek watershed;
- the Little River watershed;
- the Central Brazos River watershed;
- the Navasota River watershed;
- the Yegua Creek watershed;
- the Lower Brazos River watershed; and
- the Oyster Creek watershed.

The Caprock watershed is a non-contributing watershed to the Brazos River Basin due to lack of rainfall and high evaporative rates in northwest Texas. Precipitation in this area is either absorbed by area soils or is contained in the hundreds of playa lakes in this part of the state. Playa lakes are shallow, round depressions that fill after storms then rapidly dry due to evaporation. These temporary lakes provide water for wildlife and flood control for municipalities. However, due to their ephemeral natures, these lakes are not monitored or assessed as part of the CRP.

One of the key roles of the CRP is fostering coordination and cooperation in monitoring efforts. Coordinated monitoring meetings are held once a year to bring all the monitoring agencies together to discuss streamlining and coordinating efforts, and to eliminate duplication of monitoring efforts in the watersheds of the Brazos River Basin.

Table 1 outlines the type, frequency and number of stations in the Brazos Basin monitored by various entities as part of the Brazos Basin CRP for FY 2010 (September 2009 through August 2010).

Table 1. FY 2010 Summary of Known Sampling for the Brazos River Basin (September 2009 through August 2010)

Sampling Entity	Field	Conventional	Bacteria	24-hr DO	Biological and Habitat	Metals in Water	Organics in Water
BRA	85 monthly 73 quarterly 9 semi-annually			10 semi-annually 2 stations 3 events 1 station 1 event	10 semi-annually	7 quarterly	7 quarterly
	10 monthly 4 stations 7 events		5 monthly 10 semi-monthly				
TCEQ	25 semi-annually 45 quarterly			1 semi-annually 1 quarterly 3 stations 5 events	1 semi-annually 1 annually	3 semi-annually 13 quarterly	2 semi-annually
	1 semi-annually						
TIAER	16 semi-monthly						
	8 semi-monthly		8 monthly				
TPWD				3 annually			
Franklin County Water District	1 quarterly				1 semi-annually		

Information compiled from the Clean Rivers Program Coordinated Monitoring website (http://cms.lcra.org/)

Biological and Habitat Assessments

The Authority conducts biological assessments for individual, routine monitoring sites. They are conducted to provide baseline data on environmental conditions or to determine if the designated aquatic life use for the stream is being attained. Data collected as part of a biological assessment are used for the State of Texas Water Quality Inventory or CWA Section 305(b) assessment. The three components evaluated during a biological assessment include: the available habitat, the fish community and the microinvertebrate community. Each component, depending on the nature of a particular waterbody and its biota, is classified as having limited, intermediate, high, or exceptional aquatic life.

BASIN OVERVIEW

The Basin Overview section of this report contains water quality assessment information about each of the classified segments in the Brazos Basin Clean Rivers Program assessment area. This section is presented as a result of Texas Commission on Environmental Quality (TCEQ) and Brazos River Authority (BRA) screening. It is important to remember that the information presented represents a snapshot in time and that water quality conditions are dynamic and can change over time. Furthermore, segments identified as having "no known problems" are not necessarily without problem. Rather, there may have been limited or no data available and all uses may not have been assessed.

Each classified segment has been ranked according to the degree of water quality impairments or concerns and reflects the overall quality of each stream segment (Table 2).

Table 2. Ranking Key

Rank	NS[1]	CS[2]	CN[3]	Description
	0	0	0	No impairments or concerns.
	0	1	0	One concern for screening levels, or
	0	0	1	One concern for near non-attainment of standard
	1	0	0	One impairment, or
	0	>1	0	Multiple concerns for screening levels, or
	0	0	>1	Multiple concerns for near non-attainment of standard, or
	0	1	1	One concern for screening levels and one concern for near non-attainment of standard
	>1	0	0	Multiple parameters impaired
	1	1	0	One impairment and one concern for screening levels, or
	1	0	1	One impairment and one concern for near non-attainment of standard, or
	0	>1	>1	Multiple concerns for screening levels and near non-attainment of standards
	≥1	>1	>1	One or more impairments and multiple concerns for screening levels and near non-attainment of standards

[1]NS indicates a segment is non-supporting or impaired; does not meet applicable water quality standards or is threatened for one or more designated uses by one or more pollutants
[2]CS indicates a segment has a concern for water quality based on screening levels
[3]CN indicates a segment has concern for near-nonattainment of applicable water quality standards

Watershed of the Salt Fork and Double Mountain Fork of the Brazos River (Map)

Salt Fork of the Brazos River (Segment 1238)

This segment has been listed on the TCEQ 303(d) List for elevated chloride since the 2002 assessment. The impairment category in the 2008 assessment is listed as 5b. Data collected since the 2008 assessment show that the segment no longer exceeds the criteria for chloride and the impairment may be removed in the 2010 assessment although trend analysis continues to indicate an increasing trend in chloride and TDS. TCEQ has recommended raising the criteria for chloride and TDS and lowering the criteria for sulfate.

White River (Segment 1239)

This segment was only assessed for drinking water use in 2008 and has no impairments. For the assessment in 2010, TCEQ will no longer assess finished drinking water in the IR. They will only assess surface water bodies as drinking water sources and these screening levels are different.

White River Lake (Segment 1240)

White River Lake is listed as not supporting for chloride, sulfate, and TDS. As with this entire watershed the source of the dissolved solids are natural, due to the geology of the watershed. Trend analysis indicates an increasing trend in chloride and TDS.

Double Mountain Fork of the Brazos River (Segment 1241)

This segment is listed as not supporting for chloride and has a concern for TDS.

The North Fork Double Mountain Fork of the Brazos River (1241A) is listed as not supporting due to bacteria with a concern for ammonia, nitrate, and chlorophyll *a*. The most likely source of nitrogen loading in this segment is from point source municipal discharges.

Lake Alan Henry (1241B) is in full support of all designated uses and possesses no water quality concerns while Buffalo Creek Reservoir (1241C) is listed as having a concern for chlorophyll *a*.

Watershed of the Clear Fork of the Brazos River (Map)

Clear Fork of the Brazos River (Segment 1232)

The Clear Fork is listed as having concerns for nitrate nitrogen, orthophosphate phosphorus, and DO for the portion of the segment downstream from the confluence with Deadman Creek. Nutrient concerns decrease as you move downstream with the sites closest to Deadman Creek inflow having the highest level of nutrients. The DO concern is in the portion of the segment upstream from the Deadman creek inflow. Deadman Creek is an effluent dominated stream and municipal discharges are most likely the greatest contributor to the nutrient loading in the Clear Fork.

California Creek (1232A) is listed as having concerns for nitrate and chlorophyll *a* with contributors to the nutrient enrichment concerns including municipal discharges, agricultural runoff and on-site sewage facilities.

Biological and Habitat Assessments

BRA conducted biological assessments on California Creek (1232A) at FM 142 east of Stamford (Station 11709) in June and August 2009. The creek, an unclassified stream in the watershed of Clear Fork Brazos River Segment 1232, flows into Paint Creek just below Lake Stamford. The purpose was to assess the current condition of aquatic life, in light of possible water quality degradation shown by routine monitoring data, and 305(b) concerns for nitrate and chlorophyll *a*. Physical habitat, benthic macroinvertebrates, and fish did not meet high aquatic life use expectations during either event. Sensitive species were scarce, tolerant species predominated, and Index of Biotic Integrity scores were depressed. Several environmental variables appear to exert negative influences, including less-than-optimal physical habitat; extremely low base flow which may exclude some species due to insufficient water volume; flashy streamflow, with periodic large rise events severely scouring the stream; stressful temperature and conductivity during summertime low flow; and elevated nutrient concentrations which cause excessive primary production and wide diel dissolved oxygen fluctuations. Overall findings reflected relatively harsh instream conditions. Natural factors appear to be primarily responsible, but anthropogenic influences may also be involved to an undetermined extent.

Deadman Creek (1232B) is listed as not supporting due to bacteria and as having concerns for nitrate nitrogen and orthophosphate phosphorus. Special studies on California Creek, Paint Creek, and Deadman Creek identified agricultural nonpoint pollution and municipal discharges as possible sources of nutrient loadings.

Hubbard Creek Reservoir (Segment 1233) 

Hubbard Creek Reservoir is currently listed as having concerns for DO in the Hubbard Creek Arm of the reservoir. Hubbard Creek Reservoir is frequently impacted by drought and low water levels which is most likely the cause of the DO concern.

Big Sandy Creek (1233A) has a concern for bacteria. Potential contributors to the bacteria concerns include: wildlife runoff, agricultural runoff and on-site sewage facilities. Hubbard Creek (1233B) is not listed for any impairment or concerns.

Lake Cisco (Segment 1234) 

Lake Cisco is not listed for any concerns or impairment.

Lake Stamford (Segment 1235) 

Lake Stamford is listed as having concerns for DO Like Hubbard Creek Reservoir, Lake Stamford frequently experiences drought conditions, low inflows, seasonal ambient air temperatures and high evaporative rate all of which contribute to the DO concern.

Fort Phantom Hill Reservoir (Segment 1236) and **Lake Sweetwater (Segment 1237)** 

Both reservoirs were only assessed for drinking water use and did not have any concerns or impairments.

Upper Watershed of the Brazos River (Map)

Lake Graham (Segment 1231) 

The Lake Graham listing has been upgraded from not supporting to having concerns for TDS. The data indicates a statistically significant decreasing trend for TDS, another residual effect of drought relief in 2007.

Brazos River above Possum Kingdom Reservoir (Segment 1208) 

The Brazos River above Possum Kingdom is listed as having a concern for chlorophyll *a* in the portion of the segment upstream of Possum Kingdom to the confluence with Spring Creek. The nutrient sources causing the excessive algal

growth are unknown. The entire segment is listed as not supporting for bacteria. Elevated levels of bacteria are attributed to general nonpoint source pollution. A recreational UAA is tentatively scheduled for this segment to begin in February 2010 and end in November 2010.

Millers Creek Reservoir (1208A) is listed as having concern for DO and concern for near non attainment for bacteria. The DO concern is most likely a result of the shallow depths of the reservoir (ranging from 6 to 8 feet in depth) with insufficient quantity of water to buffer against high ambient air temperatures.

Possum Kingdom Lake (Segment 1207) 

Possum Kingdom is a large reservoir that is an important source of drinking water and recreation. The 2008 assessment did not find any impairment for the reservoir.

Brazos River below Possum Kingdom Reservoir (Segment 1206) 

The Brazos River below Possum Kingdom is listed as not supporting for chloride. The chloride is mostly the result of salt bearing formations in the Salt and Double Mountain Forks of the Brazos River. The 2008 Assessment lists this segment as not supporting for macrobenthic community and having concerns for biological habitat. It is likely that in the 2010 assessment, the macrobenthic community impairment will be removed and become a concern.

Palo Pinto Creek (1206D) supports all of it designated uses with no impairments.

Lake Palo Pinto (Segment 1230) 

Lake Palo Pinto has no impairments or concerns.

Lake Granbury (Segment 1205) 

The 2008 303(d) Lists this reservoir as not supporting due to high chloride. Data collected since the 2008 assessment indicates a decrease in chloride that should remove it after the 2010 assessment. Chloride in the segment fluctuates greatly with the naturally occurring drought/flood cycle and the segment is frequently being listed and de-listed due to this fluctuation.

Brazos River below Lake Granbury (Segment 1204) 

Brazos River below Lake Granbury is not listed as impaired or as having concerns.

Paluxy River (Segment 1229)

The 2008 assessment resulted in the listing of the Paluxy River as not supporting for chloride, sulfate, and total dissolved solids in error. The listing will be removed in the next assessment.

Squaw Creek Reservoir (1229A) possesses concerns for phosphorus. The source of elevated phosphorus in Squaw Creek Reservoir is currently unknown.

Lake Pat Cleburne (Segment 1228)

Lake Pat Cleburne is not listed as impaired or as having concerns.

Nolan River (Segment 1227)

Nolan River is listed as not supporting for chloride, sulfate, and TDS, and having concerns for fecal coliform, nitrate and chlorophyll *a*. More recent bacteria data collected to be included in the 2010 assessment indicate no concern or impairment for bacteria. The ground water in the watershed contains dissolved solids, this water is used by industry and the local municipal waste water treatment can't remove the dissolved solids and thus discharges them to the Nolan River. TCEQ is reevaluating the chloride, sulfate, and TDS criteria for this segment.

Lake Whitney (Segment 1203)

Lake Whitney is listed as having concerns for nitrate in the Nolan River Arm, chlorophyll *a* in the Nolan River Arm and Brazos River Arm, and DO near the dam. Potential non-point sources of nitrate in the watershed include municipal discharges, on-site sewage facilities and municipal and agricultural runoff. The current cause for low DO is unknown.

Brazos River below Lake Whitney (Segment 1257)

The Brazos River below Lake Whitney is not listed for any impairments or concerns in the 2008 Assessment.

Biological and Habitat Assessments

BRA conducted biological assessments on the Brazos River (1257) at FM 2114 southeast of Laguna Park (Station 12044) in March and August 2009. The objectives were to supplement scant biological information for the segment, and to evaluate the condition of the fish assemblage in relation to episodic fish kills that have occurred since 2000 as a result of golden algae blooms. High aquatic life use expectations were met by physical habitat, benthic macroinvertebrates, and

fish during both events. Nighttime dissolved oxygen concentrations were depressed during August, due to an extremely dense growth of aquatic macrophytes, but biological integrity wasn't noticeably affected. The healthy state of the fish assemblage reflected a lack of known adverse effects by golden algae since 2006, and overall findings indicated favorable environmental conditions.

Aquilla Creek Watershed (Map)

Aquilla Reservoir (Segment 1254)

Aquilla Reservoir is a 3,020 acre reservoir is the major drinking water source for Hill County. This segment is listed as having concerns for atrazine in drinking water and nitrate. However, when the data are assessed for the 2010 report, the atrazine in finished drinking water concern will likely be removed as TCEQ will no longer assess finished drinking water in the IR. They will only assess surface water bodies as drinking water sources and these screening levels are different. Sources of the nitrate in the watershed have not been determined but may include permitted discharges, agricultural runoff and other non-point source runoff.

Hackberry Creek (1254A) has a concern for arsenic and nickel in sediment. It is suspected that the arsenic came from the arsenic acid cotton defoliant used for decades in the highly agricultural area around Aquilla Reservoir. The nickel is believed to be a historical remnant from industrial activities in the Hillsboro area.

Brazos River/Lake Brazos (Segment 1256)

The Brazos River/Lake Brazos and the Aquilla Creek sub-segment is listed having concerns for chlorophyll *a* in the Lake Brazos portion of the segment. Elevated chlorophyll *a* levels are most likely a result of municipal discharges and urban runoff, both which can transport high levels of nutrients to waterbodies.

Bosque River Watershed (Map)

Upper North Bosque River (Segment 1255)

The Upper North Bosque River is listed as not supporting due to bacteria and DO, having concerns for nutrients and chlorophyll *a.* Both wastewater treatment plant effluent and the CAFOs located in the watershed are potential contributors to the elevated bacteria and nutrients.

Goose Branch (1255A), North Fork Upper North Bosque River (1255B), and Scarborough Creek (1255C) segments are listed as not supporting due to bacteria and as having concerns for nutrients and chlorophyll *a*.

South Fork North Bosque River (1255D) has a concern for chlorophyll *a*.

Unnamed Tributary to Goose Creek (1255E), Unnamed Tributary to Scarborough Creek (1255F), and Woodhollow Branch (1255G) segments are not supporting due to bacteria.

South Fork Upper North Bosque River Reservoir (1255H) has a concern for DO

Goose Branch Reservoir (1255J) and Scarborough Creek Reservoir (1255K) segments have concern for phosphorus and chlorophyll *a* but were not assessed for bacteria.

The Upper North Bosque River and all of these sub-segment streams are small, prairie streams with no flow to low flow for most of the year, so when water is present in these streams, it is a result of storm events. Stormwater accumulates high levels of bacteria and nutrients as it travels over land. These pollutants are then deposited in the small streams where they can accumulate, causing impairment and contributing to other concerns such as excessive algal growth and low DO levels. In contrast these pollutants would be diluted and distributed throughout the system in a larger stream with constant flow. Because there are many such systems not only in the Brazos River basin, but in other river basins in Texas, the TCEQ has made a focused effort to complete recreational UAAs for these small streams which may result in water quality standards changes for streams such as these. Currently these types of streams have the same water quality standards applied to them as for large river segments.

North Bosque River (Segment 1226)

The portion of the North Bosque River upstream of Hico has concerns for chlorophyll *a*, phosphorus, bacteria, and DO. Wastewater treatment plant effluent, agricultural runoff and the confined animal feeding operations (CAFOs) located in the watershed are potential contributors to the elevated bacteria and nutrients. A TMDL has been completed and implemented for this segment.

Duffau Creek (1226A), Meridian Creek (1226C), Neils Creek (1226D), Spring Creek (1226G), Alarm Creek (1226H), Gilmore Creek (1226I), Honey Creek (1226J), Spring Creek Reservoir (1226P) have no impairments or concerns.

Green Creek (1226B) is not supporting for DO. And has concerns for chlorophyll *a*, and near non attainment for bacteria.

Indian Creek (1226E) and Little Duffau Creek (1226K) segments are not supporting for bacteria and have concern for nutrients.

Indian Creek Reservoir (1226N) has concerns for chlorophyll *a* and nutrients.

Sims Creek (1226F) is not supporting for bacteria.

Sims Creek Reservoir (1226O) has concerns for DO and chlorophyll *a*.

Like the unclassified tributary streams in Segment 1255, many of the impaired or concern sub-segments in 1226 are small, rural streams with little to no flow for most of the year whose water is primarily generated by storm events.

Biological and Habitat Assessments

BRA conducted biological assessments on the North Bosque River (1226) at Coopers Crossing west of China Spring (Station 11951) in May and July 2009. The site integrates effects of most water quality influences in the watershed, due to its location in the lower reach a short distance upstream from Lake Waco. BRA has earmarked the site for long-term aquatic life monitoring, in light of public concern for water quality in the river and lake, a shortage of historical biological data, and past 305(b) concerns for depressed dissolved oxygen, excessive algal growth, elevated orthophosphorus and chlorophyll *a*, and fish community impairment. Further rationale is to monitor instream changes resulting from an ongoing Total Maximum Daily Load project, and to evaluate the effectiveness of best management practices for dairy operations in the watershed. The 2009 events were a follow-up to an initial set of assessments conducted in June and August 2008. During all four events, physical habitat, benthic macroinvertebrates, and fish have met, and generally exceeded, high

aquatic life use expectations, indicating favorable environmental conditions. The only negative implication thus far has been a physical anomaly that occurred in benthic macroinvertebrates during July 2009, when 33% of the specimens were affected by dark-colored tissue necrosis on parts of the body. Although the specific cause is unknown, some type of sediment-associated stressor is suspected. The situation will be closely surveilled during future aquatic life monitoring, the next phase of which is planned for 2011.

Middle Bosque/South Bosque River (Segment 1246) 

The Middle Bosque/South Bosque River segment as well as two sub-segments, Tonk Creek (1246D) and Wasp Creek (1246E), are listed as having concern for nitrate. The area ranges from undeveloped to moderate development with a mix of commercial, industrial, residential, and agricultural uses. Potential sources of nitrates include point source discharges along with both urban and agricultural runoff.

Wasp Creek is on the 2008 303(d) List as impaired for recreational use due to bacteria. Potential sources of bacteria include on-site sewage systems and runoff from rangeland and agricultural lands.

Biological and Habitat Assessments

BRA conducted biological assessments on the South Bosque River (1246) at FM 2837 southwest of Woodway (Station 20308) in May and September 2009. The site is in the lower portion of the segment a short distance upstream from Lake Waco, and conditions there integrate effects of most water quality influences in the watershed. The objectives were to evaluate the current condition of aquatic life in the river, in light of public concern for water quality in the river and lake, a shortage of biological data available for the 305(b) assessment, and past 305(b) concerns for nitrate and fecal coliform bacteria. Physical habitat, benthic macroinvertebrates, and fish met high aquatic life use expectations during both events, indicating favorable environmental conditions. The level of biological integrity during the second event was surprising, given that a two-month period of no flow occurred during the summer. Flow resumed only 18 days prior to the event, following significant rainfall. The results indicate that perennial pools in the reach provide important refuges for aquatic life, with emigration into riffles and runs occurring rapidly once flow resumes.

Waco Lake (Segment 1225) 

Waco Lake is listed as having concerns for nitrate and chlorophyll *a*. The Bosque River watershed fills Waco Lake and is the source of the nutrients needed for algae growth.

Leon River Watershed (Map)

Leon Reservoir (Segment 1224)

The Leon Reservoir has no impairment. There is a concern for manganese in the sediment although data is limited.

Leon River Below Leon Reservoir (Segment 1223)

The Leon River below Leon Reservoir is on the 303(d) List as impaired for recreational use due to elevated bacterial levels and depressed DO. There is a concern for increased chlorophyll *a*. Recent data suggest that in the 2010 assessment, the DO impairment will be downgraded to a concern. This segment frequently experiences low water levels which hinder its ability to buffer against high ambient air temperatures in the summer and fall and are the likely cause for depressed DO levels.

Unclassified segment Armstrong Creek is impaired for bacteria with recent data suggesting that for the 2010 assessment, another unclassified segment, Cowhouse Creek, may have concern for elevated bacteria and chlorophyll *a*. These creeks are plagued by low flow and dominated by stormwater runoff, which is most likely the source of the bacteria.

Proctor Lake (Segment 1222)

Proctor Lake possesses no impairments, however; there is concern for high chlorophyll *a* values with an additional concern for total phosphorous in the upstream portion of the lake. The elevated chlorophyll *a* levels are most likely caused by increased nutrient inputs via tributary streams to the reservoir from runoff from rural lands.

Four tributaries to Lake Proctor possess impairments for bacteria: Duncan Creek, Rush-Copperas Creek, Sabana River and Sweetwater Creek. As in the case of the small tributary streams mentioned in the Bosque River Watershed, the tributary streams of Proctor Lake are also dominated by stormwater runoff. These similarities bring to light the need for discussion on whether applying ambient criteria to these streams is appropriate and whether using the high aquatic life use and contact recreation use as defaults is the best option to assess the waterways when Use Attainability Analyses are not available. With additional data collected for the 2010 assessment, Sowells and Hackberry Creeks will likely be listed as impaired for elevated bacteria with indications that Duncan and Hackberry Creeks will have concerns for low DO.

Leon River Below Proctor Lake (Segment 1221) 

The Leon River below Lake Proctor was first placed on the State's 303(d) List for bacteria levels not supporting contact recreation use in 1998 and is currently listed as impaired for bacterial with concerns for chlorophyll *a* and depressed DO. The bacteria impairment is a result of the contribution of multiple sources, including: confined animal feeding operations, municipal waste water discharge, and stormwater runoff from rural sources. The chlorophyll *a* concern occurs in the upper portion of Segment 1221 and is most likely a result of low flow during summer months that allows for a concentration of algal cells in the water column.

Five of the tributaries to this segment are not supporting their recreational use due to bacteria: Resley Creek (1221A), the South Leon River (1221B), Pecan Creek (1221C), Indian Creek (1221D), and Walnut Creek (1221F). Resley Creek's 303(d) Listing also includes an impairment for depressed DO. Nutrients, chlorophyll *a*, and depressed DO levels are concerns for several of these creeks. With additional data collection to be included in the 2010 assessment, the bacterial impairment for Pecan Creek will likely be removed.

Like the small tributary streams in the Bosque River Watershed, the tributary streams of the Leon Watershed are also dominated by stormwater runoff which brings to light the need for discussion on whether applying ambient criteria to these streams is appropriate and whether using the high aquatic life use as a default is the best option when Use Attainability Analyses are not available.

There is currently a Watershed Protection Plan being developed for the Leon River Watershed.

Belton Lake Segment (Segment 1220) 

Water quality in Belton Lake is fully supporting of all uses assessed; however, an increasing trend in nutrient concentrations near the Leon River arm, specifically nitrate poses a concern.

An unclassified tributary to Belton Lake, Cowhouse Creek is impaired for bacteria. Potential sources of bacteria in this stream include: runoff from agricultural land and range land, on-site sewage facilities and municipal discharges.

Leon River Below Belton Lake (Segment 1219) 

The Leon River below Belton Lake possesses concerns for nitrate and orthophosphorus, but is otherwise fully supporting of all assessed uses. The source of elevated nutrients in this segment is believed to be a result of point source discharges and urban runoff.

Nolan Creek/South Nolan Creek (Segment 1218)

The Nolan Creek/South Nolan Creek segment possesses a bacterial impairment and water quality concerns for nitrate, orthophosphorus, and total phosphorus. Sources of each include municipal discharges, on-site sewage facilities and urban runoff.

Lampasas River Watershed (Map)

Lampasas River Above Stillhouse Hollow Lake (Segment 1217)

The portion of Segment 1217 from the crossing of FM 1690 up to the crossing of CR 117 is listed as impaired for bacteria. This portion of the river is strongly intermittent and only possesses flowing water immediately following a rain event, which is most likely the source of the bacteria. Additional bacteria data will be collected by the TCEQ TMDL team from September 2010 through November 2011 to further investigate this impairment.

The unclassified tributary of North Rocky Creek possesses an impairment for depressed DO. This DO impairment is caused by frequent low water levels which hinder its ability to buffer against high ambient air temperatures in the summer and fall reducing the water's capacity to maintain DO levels. A TMDL project was initiated in 2002 to address the impairment. Biological data collected indicated that North Fork Rocky Creek supports a relatively healthy biological community even with depressed DO levels. The TCEQ's Water Quality Standards program is reviewing data from North Rocky Creek to determine if a site-specific criterion for DO would be appropriate for the creek. The current criterion for the segment is based on a presumed standard. No TMDLs will be developed for the creek unless conditions change.

Stillhouse Hollow Lake (Segment 1216)

Water quality in Lake Stillhouse Hollow currently meets all water quality standard criteria and nutrient screening levels with no impairments or concerns at this time. However, Authority staff is becoming increasingly concerned about Trimmier Creek (1216A), an unclassified tributary to Stillhouse Hollow Lake. The creek flows through an area experiencing rapid development and appears to be carrying a large sediment load caused by urban runoff into Stillhouse Hollow Lake. Because there are no State standards for sediment or suspended solids, assessing this issue is difficult but

visual observations of the confluence of Trimmier Creek and the lake indicate that the lake is being impacted by the sediment load in the creek.

Biological and Habitat Assessments

BRA conducted biological assessments on Trimmier Creek (1216A) at Chaparral Road south of Harker Heights (Station 18754) in April and July 2009. The creek is an unclassified tributary of Stillhouse Hollow Lake Segment 1216. The 2009 events were a follow-up to initial assessments conducted in April 2006 and September 2007. Routine water quality monitoring had revealed excessive sedimentation in the creek beginning in April 2005, resulting from rapid development in the watershed. Aquatic life monitoring was initiated to determine if biological impacts were occurring, and to provide data for future 305(b) assessments. Fish have met high aquatic life use expectations during all four events, but other components have indicated instream degradation. Benthic macroinvertebrates failed to attain a high rating during 2006 and 2007, and physical habitat was impaired during 2007. Differential impacts on benthic macroinvertebrates versus fish indicate that adverse effects are primarily associated with the streambed rather than the water column, in relation to accumulation of large amounts of fine solids on the substrate. An array of evidence suggests that sedimentation peaked around September 2007, then began to decrease. Results of the 2009 assessments reflected temporal improvement, as all components achieved a high aquatic life use rating. Routine water quality monitoring data has also indicated improvement. However, favorable signs are tempered by observations during April 2009, when 20% of the benthic macroinvertebrate specimens were affected by dark-colored tissue necrosis on parts of the body. The specific cause is unknown, but some type of sediment-associated stressor is suspected. That occurrence, plus the fact that the benthic macroinvertebrate assemblage only marginally attained a high rating, indicated that instream conditions remain less-than-optimal, and that recovery from worst-case conditions in September 2007 is incomplete. In light of ongoing threats to biological integrity as development proceeds in the watershed, aquatic life monitoring will be continued to evaluate temporal changes. The next assessment phase is scheduled for 2011.

Lampasas River Below Stillhouse Hollow Lake (Segment 1215)

The Lampasas River below Stillhouse Hollow Lake was removed from the 303(d) List as impaired for bacteria after the 2008 assessment.

Salado Creek (Segment 1243)

Salado Creek possesses a concern for nitrate but no impairments. Likely sources of nitrate include runoff from urban and agricultural areas and on-site sewage facilities.

The Salado Creek Preservation Committee, a group of Salado residents concerned about bacteria levels in Salado Creek have actively participated with both the TCEQ and BRA in water quality monitoring efforts to characterize the concern. After several years of monitoring it appears that the bacteria issues in Salado Creek are localized to the area of the creek between the IH-35 frontage road and the low water dam just north of FM 2268. Both TCEQ and the Bell County Health Department have been informed of both the Authority's and SCPC's data results indicating a very isolated problem. Water samples collected from upstream and downstream of this area do not indicate any concern for bacteria.

Little River Watershed (Map)

North Fork San Gabriel River (Segment 1251) 
and Lake Georgetown (Segment 1249)
Both segments are in full support of all designated uses and possess no water quality concerns.

South Fork San Gabriel River (Segment 1250) 
The 2008 assessment revealed a concern for depressed DO from the Williamson CR 279 crossing to the upper end of the segment. This DO concern is caused by frequent low water levels which hinder the water's ability to buffer against high ambient air temperatures in the summer and fall reducing the capacity to maintain DO levels.

Biological assessments conducted on the South Fork San Gabriel River at the Weir Pit west of Georgetown during 2008 revealed early to middle installation phases of a major sewer line along the streambed did not significantly impact the biota but habitat was affected. Effects included destruction of riparian vegetation, increased turbidity, deposition of large amounts of silt on the streambed, direct physical damage to the stream channel by trenching and heavy machinery traffic, and construction of low water dams used as vehicle crossings. Continued observations revealed progressive deterioration, and severe habitat disruption evident during advanced installation stages, with a high probability for significant aquatic life impacts. Follow-up biological assessments are scheduled for the summer of 2010 to reassess environmental damage.

San Gabriel/North Fork San Gabriel River (Segment 1248) 

The San Gabriel/North Fork San Gabriel River is in full support of all of its designated uses and possesses no concerns in the 2008 assessment. However, further data collected to be included in the 2010 assessment indicate the segment will likely be placed on the 303(d) List for elevated levels of chloride. Authority staff has been concerned about this segment as well as segments 1249, 1250 and 1251 due to the high rate of development and construction activities occurring either in the river channel itself or immediately adjacent to the river. The river at times appears to be carrying a large sediment load caused by these construction activities. Due to a lack of State standards for sediment or suspended solids, assessing these issues are difficult but visual observations indicate that the river is being impacted by the sediment. Additionally, this segment is immediately upstream from Lake Granger which already possesses a concern for increased sedimentation and additional sediment loading from the river will only hasten the rate of sedimentation.

Another issue of note in this developing area the upper portion of the San Gabriel's watershed is the high use of water softeners by residential properties. Most wastewater treatment systems in the state are not equipped to remove the high levels of dissolved solids generated by water softeners, so the when high levels of dissolved solids come to the treatment facility from residential properties they are passed through and discharged into lakes and streams.

Huddleston Branch (1248B), an unclassified stream, possesses concerns for nitrate and bacteria. Mankins Branch (1248C), a tributary which flows into the Huddleston Branch above Lake Granger, is currently identified on the 2008 303(d) List for bacterial impairments. Concerns for elevated nitrate, orthophosphorus and total phosphorus also exist in Mankins Branch. Issues in these subsegments are most likely a combination of municipal discharges and urban runoff.

Granger Lake (Segment 1247) 

Lake Granger is in full support of all of its designated uses but a concern for elevated nitrate levels exists. Willis Creek, a tributary to Lake Granger, is identified on the 2008 303(d) List as possessing bacterial impairments and a concern for elevated nitrate. The watershed in the immediate vicinity of both Lake Granger and Willis Creek is highly utilized for agriculture, and runoff from these fields is the most likely source of both bacteria and nutrients into the lake.

As segment 1248 flows into Lake Granger it deposits its large sediment load into the reservoir. Since there are no State standards for sediment or suspended solids, assessing this issue is difficult but Lake Granger is experiencing a reduction in storage capacity due to this accelerated sedimentation. There is currently a Watershed Protection Plan being developed that includes both segments 1247 and 1248.

Brushy Creek (Segment 1244)

Brushy Creek is on the 2008 303(d) List for bacterial impairment. Concerns for elevated nutrients including nitrate, orthophosphate and total phosphorus exist in Brushy Creek. A recreational UAA is underway and is scheduled for completion in October 2010. Two tributaries to Brushy Creek also possess concerns for nutrients: Brushy Creek above South Brushy Creek (1244A) and South Brushy Creek (1244D). With additional data collected to be included in the 2010 assessment, the concern for nitrate in segment 1244A will likely be removed. Both elevated bacteria levels and nutrient levels in Brushy Creek are attributed to municipal discharges and urban runoff**.**

San Gabriel River (Segment 1214)

The San Gabriel River is listed as impaired for bacteria, chloride, and sulfate with a concern for nitrate. Additional data collected to be included in the 2010 assessment indicate a possible additional concern for orthophosphate. Bacteria and nitrate issues are most likely caused by a combination of agricultural runoff, municipal discharges and on-site sewage facilities. The source of the dissolved solids impairment is currently unknown but may be a result of the high use of water softeners by residential properties in the upper portion of the San Gabriel's watershed. Most wastewater treatment systems in the state are not equipped to remove the high levels of dissolved solids generated by water softeners. When high levels of dissolved solids come to the treatment facility from residential properties they are passed through and discharged into lakes and streams.

Little River (Segment 1213)

The Little River is on the 2008 303(d) List for a bacterial impairment. The Little River also possesses a concern for nitrate and atrazine in finished drinking water. The immediate watershed to segment 1213 is dominated by agricultural activities. Runoff from the agricultural lands is the transport mechanism carrying atrazine to the river. However, when the data are assessed for the 2010 report, the atrazine in finished drinking water concern will likely be removed as the TCEQ will no longer assess finished drinking water in the IR. They will only assess surface water bodies as drinking water sources and these screening levels are different. Nitrogen concerns in this segment are most likely from a combination of localized agricultural runoff and inflow from the San Gabriel River and Brushy Creek which both have nutrient concerns. The elevated bacteria count is likely a result of runoff from agricultural lands, wildlife waste, and municipal discharges.

Biological and Habitat Assessments

BRA conducted biological assessments on the Little River (1213) north of Gause (Station 20526) in April and August 2009. The location in the lower portion of the river integrates effects of most water quality influences in the watershed. The purposes were to supplement Texas Instream Flow Program data, and to evaluate the current condition of aquatic life

in relation to 305(b)/303(d) concerns for bacteria, atrazine, and nitrate. All components of the assessments met high aquatic life use expectations, except for fish during the April event. Evidence suggests that subtle instream stresses related to unidentified water quality factors were responsible for slight fish assemblage impairment. Numerous potential contaminant sources exist in the watershed, including domestic wastewater treatment plant discharges and urban runoff from the Round Rock/Georgetown and Killeen/Belton/Temple areas, plus agricultural runoff. Regardless, the fact that all but one assessment component rated high indicated a prevalence of generally favorable environmental conditions.

Central Watershed (Map)

Brazos River above Navasota (Segment 1242)

There is a concern for the Public Water Supply use on this segment of the Brazos River above Navasota due to the possibility of incurring a higher cost for water treatment due to the need to demineralize the water. However, when the data are assessed for the 2010 report, the concern for demineralization costs will likely be removed as the as TCEQ will no longer assess finished drinking water in the IR. They will only assess surface water bodies as drinking water sources and these screening levels are different. Similar to the upper basin mainstem segments, the chloride concentrations in Segment 1242 are highly dependent on rainfall patterns in the upper basin. The elevated chlorides in this segment are a result of the drought conditions observed from 2005 through early 2007 that resulted in chloride levels becoming even more concentrated than normal due to evaporation, which reduced water levels while leaving chlorides in the remaining water. During this drought period, chloride levels in Possum Kingdom Lake reached high concentrations never previously observed. Water releases from Possum Kingdom then caused abnormally high chloride levels to be observed in the entire main stem. Due to flooding in 2007, recent data indicates that the segment has returned to normal concentrations and it is proposed that the chloride impairment will be removed in the 2010 assessment.

Segment 1242 is also listed as being impaired for bacteria. More recent data indicates that bacteria are no longer a concern for this segment and it is proposed that the impairment will be removed during the 2010 assessment.

Biological and Habitat Assessments

BRA conducted biological assessments on the Little Brazos River (1242E) at SH 21 west of Bryan (Station 11591) in March and July 2009. The stream is an unclassified tributary of Brazos River Segment 1242. The study site integrates effects of most water quality influences in the watershed, due to the location in the extreme lower reach. A number of

tributaries have exhibited elevated *E. coli* levels, which suggests that other undetected water quality impacts may exist. The Little Brazos has not been included in previous 305(b) reports, so the status of water quality and biological conditions is not well known. Aquatic life monitoring was conducted to characterize existing conditions and provide data for future state assessments. High aquatic life use expectations were met by physical habitat, benthic macroinvertebrates, and fish during both events, indicating favorable environmental conditions and lack of discernible impacts. A noteworthy occurrence was the collection of 30 fish species during March, a considerably greater number than is normally seen in middle Brazos River tributaries. This reflected optimal instream conditions, as well as effects of close proximity to the Brazos mainstem. During ample flows typical of springtime, mainstem fishes are able to migrate up the Little Brazos into the study reach, co-mingling with resident species and boosting species richness.

Eleven tributaries to the Brazos above Navasota possess bacterial impairments, including: Cottonwood Branch (1242B), Still Creek (1242C), Thompson Creek (1242D) (also with depressed DO impairment), Campbell's Creek (1242I), Deer Creek (1242J), Mud Creek (1242K), Pin Oak Creek (1242L), Spring Creek (1242M), Tehuacana Creek (1242N), Walnut Creek (1242O) and Big Creek (1242P). Nutrient enrichment is a concern for Cottonwood Branch, Still Creek, Thompson Creek, Pond Creek (1242F) and Deer Creek. Additional impairments for bacteria in Pond Creek and DO for Tehuacana Creek with the removal of the bacteria impairment in Tehuacana Creek are proposed for the 2010 assessment.

Biological and Habitat Assessments

BRA conducted biological assessments on Tehuacana Creek (1242N) at SH 6 southeast of Waco (Station 15771) in June and August 2009. The stream is an unclassified tributary of Brazos River Segment 1242. The study site, due to its location in the lower portion of the creek, integrates effects of most water quality influences in the watershed. The purposes of the assessments were to evaluate the current condition of aquatic life in the creek, in light of potential water quality degradation by wastewater discharges, and to provide biological data for future 305(b) assessments. Study results were mixed, as fish met high aquatic life use expectations but physical habitat and benthic macroinvertebrates didn't. Benthic integrity was depressed due to predominance by tolerant species and scarcity of sensitive species, particularly during August when flow was half that in June and less dilution was available for wastewater effluents. Water quality appeared to be the main factor negatively affecting benthic macroinvertebrates, and was particularly harsh in August. Nutrient and chlorophyll *a* concentrations were extremely high; temperature, conductivity, and pH maxima were elevated; and diel dissolved oxygen fluctuations were very wide, conditions that might be expected to stress sensitive aquatic organisms. Differential impacts on benthic macroinvertebrates versus fish indicated that adverse effects were primarily associated with the streambed rather than the water column, in relation to buildups of fine particulate organic matter on the substrate. Excessive deposition of such material can have an array of detrimental effects on benthic macroinvertebrate assemblages, including physical smothering, dissolved oxygen depletion at the water/sediment

interface, and functional feeding group imbalance. Follow-up assessments are planned for 2012 to evaluate temporal changes.

As in the case of the unclassified tributary streams in the Bosque and Leon Watersheds, many of the impaired or concern sub-segments in 1242 are small, rural streams with little to no flow for most of the year whose water is primarily generated by storm events and the associated runoff. Please see the Special Studies section for more information on two projects to address many of the issues in these unclassified streams. The Little Brazos River Tributaries project is addressing the bacterial impairment in the Campbell's, Mud, Pin Oak, Spring, and Walnut Creeks while the Two Data Collection Initiatives project is addressing issues in Thompson's, Deer and Tehuacana Creeks.

For the Marlin City Lake System, total phosphorus and elevated chlorophyll *a* pose concerns. Data that will be included in the 2010 assessment suggest a concern for orthophosphorus rather than total phosphorus. Currently, the source of phosphorus is unknown; however, the elevated phosphorous levels are likely influencing chlorophyll *a* concentrations.

Navasota River Watershed (Map)

Lake Mexia (Segment 1210)

Lake Mexia is listed as having concerns for low DO, chlorophyll *a*, orthophosphorus and total phosphorus. Additional concerns for ammonia and copper in the water may be added for the 2010 Assessment. Nutrient concerns are attributable to runoff from wildlife and agricultural lands. Low DO levels are most likely attributable to elevated chlorophyll *a* levels and advanced sedimentation which has significantly reduced the reservoirs capacity.

The Navasota River above Lake Mexia (1210A), which is highly intermittent, is listed as impaired due to bacteria. Potential sources of bacteria include: on-site sewage facilities, wildlife wastes, and runoff from residential areas and agricultural lands. A recreational UAA is tentatively scheduled for this segment to begin in February 2010 and end in November 2010.

Navasota River Below Lake Mexia (Segment 1253)

There are concerns for chlorophyll *a* and depressed DO on the Navasota River from the headwaters of Springfield Lake to the Lake Mexia Dam. This DO impairment is caused by frequent low water levels which hinder its ability to buffer against

high ambient air temperatures in the summer and fall reducing the water's capacity to maintain DO levels. The cause of elevated chlorophyll *a* levels is currently unknown, but may be a result of nutrient rich runoff entering the river and lake.

The unclassified Springfield Lake (1253A) is in full support of all of its uses, but there is a concern for elevated levels of chlorophyll *a* and depressed DO. With the inclusion of additional data to be used in the 2010 assessment, the depressed DO concern may be upgraded to not supporting its aquatic life use and there may be a concern for orthophosphorus and total phosphorus. The cause of depressed DO is likely the elevated chlorophyll *a* levels due to nutrient rich runoff entering the river and lake.

Lake Limestone (Segment 1252) 

This lake possesses concerns for depressed DO and chlorophyll *a*. The cause of the depressed DO is currently unknown but may be due to high chlorophyll *a* concentrations which are most likely a result of elevated nitrate concentrations in the reservoir. However, the concern for nitrate was removed during the 2008 assessment.

Navasota River Below Lake Limestone (Segment 1209) 

The Navasota River below Lake Limestone is listed on the 2008 303(d) List as impaired for contact recreation due to elevated bacteria levels. Sources of bacteria may include stormwater inflow from tributary streams, runoff from agricultural lands, municipal discharges, wildlife runoff and on-site sewage facilities. Concerns also exist for nitrate and orthophosphorus, which are likely caused by runoff from agricultural lands and municipal discharges.

There are nine tributaries that likely contribute to this segment's impairments.
Carter's Creek (1209C), Country Club Branch (1209D), Wickson (1209E), Cedar (1209G), Duck (1209H), Gibbons (1209I), Shepherd (1209J), Steele (1209K), and Burton (1209L) Creeks all have impairments for their recreation use designation due to elevated bacteria levels. Carter's Creek and Burton Creek both have concerns for nutrients, while Cedar, Duck and Shepherd Creeks have concerns for depressed DO. Carter's Creek and Burton Creek are both strongly influenced by municipal discharges that are most likely the source of both elevated bacteria and nutrients. A TMDL was initiated for Carter's and Burton Creek in August 2007 with a proposed completion date of November 2010.

Country Club Branch, Wickson, Cedar, Duck, Gibbons, Shepherd, and Steele Creeks are small, prairie streams with no flow to low flow for most of the year, so when water is present in these streams it is a result of storm events. Stormwater is known to accumulate high levels of both bacteria and nutrients as it travels over land and these are deposited in small streams where they can cause elevated bacteria levels, excessive algal growth and low DO levels. Since the streams

have little to no consistent flow (e.g. flow contributed by springs), the stormwater and its associated pollutants tend to stay in the stream and accumulate, where in a larger stream with constant flow the pollutants would be diluted and distributed throughout the stream system. At this time, these streams are held to the same standards as all surface water streams in Texas. It may be appropriate to change the standards that these streams must meet. To assess standard appropriateness, recreational UAAs have been initiated for all of these creeks to help determine what standards should be applied to these streams. Proposed completion of the UAAs is October 2010.

Country Club (1209A) and Fin Feather Lake (1209B) both have impairments for their aquatic use designation due to toxic sediments. These impairments are mostly a remnant from historically poor industrial practices. Country Club Lake also possesses concerns for phosphates while Fin Feather Lake possesses an additional concern for ammonia. A TMDL was completed on theses segments in 2003.

Yegua Creek Watershed (Map)

Somerville Lake (Segment 1212)

Somerville Lake is on the 2008 303(d) List as being impaired for depressed DO and has a concern for high pH levels at the eastern end of the reservoir near the dam. There is also concern for increased chlorophyll *a* concentrations. The extremes in pH are most likely a result of algal activity; the observed high concentrations of chlorophyll *a* may be a potential cause for fluctuations in pH. Photosynthesis and respiration are two major factors that influence the amounts of carbon dioxide in the lake, which in turn affects pH levels and DO levels. With a grant from the TCEQ, BRA is collecting additional data through the Two Data Collection Initiatives project, to gain a better understanding of the possible causes of the elevated pH levels and depressed DO in Lake Somerville. The study will run from December 2009 through September 2012.

One tributary to the lake, East Yegua Creek (1212B), is on the 2008 303(d) List as impaired for recreational use due to elevated bacteria levels. Sources of bacteria may include municipal discharges and runoff from agricultural lands and wildlife. A recreational UAA is tentatively scheduled for this segment to begin in February 2010 and end in November 2010.

Yegua Creek (Segment 1211) 

Yegua Creek is in full support of all of its designated uses and exhibits no concerns. The unclassified tributary to Yegua Creek, Davidson Creek (1211A), is impaired due to elevated bacteria levels and with additional data to be included in the 2010 assessment; there may be an impairment for depressed DO. Reminiscent of the unclassified tributary streams in the Central Brazos and Navasota Watersheds, Davidson Creek is a small, rural stream with little to no flow for most of the year whose water is primarily generated by storm events and the associated runoff.

Lower Watershed (Map)

Brazos River Below Navasota River (Segment 1202) 

The Brazos River below Navasota River is in full support of all of its designated uses but may have a concern for chlorophyll *a* when data is assessed for the 2010 report.

Allen's Creek (1202H) possesses a concern for depressed DO and orthophosphate while the upper portion of Big Creek (1202J) has concerns for phosphate and chlorophyll *a*. Both of these segments are not supporting for contact recreation use due to bacteria on the 2008 303(d) List, however Big Creek will likely be removed from the list in 2010 because there is adequate data to assess with *E. coli* values rather than the superseded Fecal coliform values and recorded *E. coli* values will meet the designated used standard.

Bacteria issues and nutrient concerns in Big Creek are most likely a result of agricultural and wildlife runoff. Big Creek also is impaired for the fish community and has concern for habitat in the upper portion of the creek. The poor diversity in the fish community is a result of the poor habitat available. Like Allen's Creek, his section of the creek is shallow, with muddy bottoms and low sloping banks. There is little habitat variety in this portion of the creek which leads to low diversity in the fish community. In the 2010 assessment, the fish community impairment will likely become a concern with an added concern for nitrate.

Mill Creek (1202K) currently has a concern for an impaired fish community. Like Big Creek, Mill Creek has poor available habitat to support a large and diverse fish population. And with collection of additional data to be included in the 2010 assessment, it is likely that Mill Creek will be not supporting for contact recreation use due to bacteria and have additional concerns for DO, nutrients and chlorophyll *a*.

Brazos River Tidal (Segment 1201)

The Brazos River tidal segment differs from the rest of the Brazos River in that the Gulf of Mexico can have an effect on the water quality of that portion of the river. This segment does not have any water quality impairments, but there is a concern for nitrate. Potential sources of nitrates may include: industrial and municipal discharges, and stormwater runoff from urban and residential lands. There may be an added concern for chlorophyll *a* in the 2010 assessment. The elevated chlorophyll *a* may be the result of the increased nitrate.

Upper Oyster Creek Watershed (Map)

Upper Oyster Creek (Segment 1245)

Upper Oyster Creek is on the 2008 303(d) List for DO impairments. Previously listed bacteria problems led to a TMDL being initiated. The TMDL for bacteria was approved by the U.S. Environmental Protection Agency in September 2007 and recommended a 73 percent reduction in bacteria loading in each section to meet the contact recreation use. Currently the TCEQ and its stakeholders are developing an implementation plan that will outline the management strategies needed to restore water quality to Upper Oyster Creek. The Draft TMDL for DO was completed and the public comment period was closed on November 18, 2009. The TCEQ's response to comments and a revised report will be posted on TCEQ's website before the commission considers adopting the TMDL.

Additional concerns that have been identified in Upper Oyster Creek include nutrients and chlorophyll *a*. The elevated nutrient levels are most likely stimulating algal growth and the elevated chlorophyll *a* concentrations. Potential sources of nitrates in the watershed include municipal and industrial discharges, wildlife contributions and urban runoff.

Bullhead Bayou (1245C) and an associated unnamed tributary (1245D) are also impaired due to elevated bacteria levels with Brown's Bayou (1245B) having a concern for bacteria.

Additional data collected that will be used in the 2010 assessment has identified several other segments in this watershed that may be listed as being impaired for their designated uses or have concerns. These segments include Red Gully (1245A) - concern for bacteria and nutrients, Flewellen (1245E) and Stafford Run (1245J) - bacteria impairment, Alcorn Bayou (1245F) and Steep Bank Creek (1245I) - bacteria impairment and concern for nutrients.

CONCLUSIONS

Now that El Niño has brought an end to the drought for most of the Brazos River basin, water quality throughout the basin is beginning to return to normal conditions. Eighteen of the fifty-seven classified segments and fifty-six unclassified segments in the Brazos River basin do not meet State water quality standards. Of those seventy-four water quality impairments, 62 of them are bacteria-related. The one commonality to be found between most of the bacteria-impaired waterbodies in the Brazos River basin is that they are small, prairie streams with no flow to low flow for most of the year, so when water is present in these streams, it is a result of storm events. Stormwater is known to accumulate high levels of both bacteria and nutrients as it travels over land. These pollutants are then deposited in the small streams where they can cause impairment and also contribute to other concerns such as excessive algal growth and low DO levels. As a result of little to no consistent flow (e.g. flow contributed by springs or other streams), the stormwater and its associated pollutants tend to stay and accumulate in the stream. In contrast these pollutants would be diluted and distributed throughout the system in a larger stream with constant flow.

There has been a long-standing concern about the appropriateness of monitoring such streams in Texas and the efficacy of applying water quality standards meant for large river segments to small, ephemeral streams. The bacteria standards are designed to protect the safety of contact recreation in state waters; however, this standard has been applied to all waterbodies in the state regardless of whether they are classified or unclassified or even hold the potential to support contact recreational activities.

Fortunately, there may be relief on the horizon from applying contact recreation standards to all waterbodies regardless of size or function. The Texas statewide surface water quality standards were last amended in July 2000 and were recently (November 2009) approved by the EPA. Over the last two years the TCEQ has undertaken the arduous task of revising the water quality standards for the State of Texas. These revised standards will be submitted to the EPA for their consideration in spring of 2010. The commission is proposing changes to the general criteria that are intended to improve statewide qualitative and quantitative criteria and to ensure that the general criteria are compatible with other proposed revisions. Other revisions address the water quality uses and/or criteria that are applicable to individual water bodies. Numerous revisions of toxic criteria are proposed to incorporate new data on toxicity effects, and changes are proposed to provide clarity to the basic requirements for toxicity effluent testing. Additionally, the TCEQ is recommending changes to provide additional categories of recreational uses and provide more definition on assigning recreational uses. Also, new criteria are proposed to protect numerous reservoirs from excessive growth of aquatic vegetation related to nutrients.

The two largest changes that will have the largest impact on the Brazos River basin are the revisions to bacteria standards and the creation of four categories of recreational use and the addition of nutrient standards for reservoirs.

Below we will briefly discuss these proposed changes. If you would like more detail on the other proposed changes please visit: http://www.tceq.state.tx.us/permitting/water_quality/stakeholders/2010standards.html .

Revisions to Contact Recreation Standards

The contact recreation portion would be revised to include four categories of recreational use: primary contact recreation (PCR), secondary contact recreation 1 (SCR1), secondary contact recreation 2 (SCR2), and non-contact recreation (NCR) waters. The proposed *E. coli* standards for each category can be found in Table 3. The revisions to the bacteria standards also propose that classified segments are designated for primary contact recreation, unless site-specific information, such as a Use Attainability Analysis, demonstrates that different recreational uses and/or criteria may be justified. PCR will remain the presumed use for all waterbodies; however, SCR1 may be the presumed use for certain types of unclassified waters if primary contact recreation does not occur and if certain depth characteristics are met. Proposed changes also include descriptions for SCR2 and NCR and that no waterbodies are presumed to have these two uses. To have a waterbody classified as SCR2 will require the completion of a Recreational Use Attainability Analysis study. There are no waterbodies in the Brazos River basin that would qualify for the NCR designation.

Table 3. Proposed *E. coli* standards for freshwater for each category of recreational use

Use Category	**Geometric Mean (colonies/100mL)**
Primary Contact Recreation (PCR)	206
Secondary Contact Recreation 1 (SCR1)	630
Secondary Contact Recreation 2 (SCR2)	1,030
Non-contact Recreation (NCR)	2,060

Based on new calculations using updated information and to be more consistent with national standards, the TCEQ is recommending that the PCR standard be raised from a concentration of 126 colonies/100mL to 206 colonies/100mL. If this proposed change is accepted by EPA, it would eliminate 14 of the Brazos River basin's 62 bacteria impairments. Most of the unclassified waterbodies impaired for bacteria would be eligible for a SCR1 categorization, which would eliminate most of those impairments. Studies are under way across the basin to gather the data necessary for TCEQ to make category determination for the impaired, unclassified.

Nutrient Standards for Reservoirs

New criteria are proposed to protect numerous reservoirs from excessive growth of aquatic vegetation related to nutrients. The proposed standards contain chlorophyll *a* criteria and supplemental screening values for total phosphorus and transparency that are used to confirm if a water body is attaining the nutrient criteria.

Standards attainment will be based on the median of chlorophyll *a* measurements collected over at least two years. The median concentration will be compared to the chlorophyll *a* criteria, if the chlorophyll *a* criterion is exceeded, then the median of measurements for total phosphorus and the median of measurements of transparency are compared to the respective screening levels for these two parameters. If the median of measurements for total phosphorus exceeds the screening level for total phosphorus, or the median of measurements for transparency are less than the screening level for transparency, then nonattainment of the water quality standards is indicated.

There is some concern for some Brazos Basin reservoirs whose median chlorophyll *a* concentrations are very near to the proposed chlorophyll *a* criteria. Table 4 summarizes the proposed nutrient standards for the basin's reservoirs and their current status. The reservoirs highlighted in green are expected to be impaired when the standards become effective.

Table 4. Proposed Nutrient Standards and Current Status

Reservoir	Proposed Chlorophyll a Criteria (µg/L)	Current Chlorophyll a Median Concentration (µg/L)	Proposed TP Screening Level (mg/L)	Current TP Median Concentration (mg/L)	Proposed Transparency Screening Level (M)	Current Transparency Concentration (mg/L)
Lake Possum Kingdom	9.57	6.99	0.05	0.03	2.22	2.43
Lake Granbury	20.15	18.21	0.07	0.03	0.99	1.08
Lake Whitney	16.18	9.07	0.03	0.06	1.32	1.39
Lake Aquilla	12.48	12.60	0.04	0.03	0.58	0.71
Lake Proctor	25.22	29.90	0.10	0.08	0.52	0.60
Lake Belton	5.70	3.30	0.03	0.06	1.81	2.03
Stillhouse Hollow Lake	1.96	1.5	0.03	0.06	2.84	3.28
Lake Georgetown	3.49	3.50	0.04	0.03	1.86	2.07
Granger Lake	10.43	9.40	0.06	0.06	0.41	0.38
Lake Limestone	17.40	14.07	0.08	0.07	0.70	0.83
Lake Somerville	47.64	32.70	0.09	0.08	0.63	0.73

It is not known how the EPA will receive TCEQ's proposed changes to the water quality standards or when these proposed rules will become effective. Increasing the contact recreation categories for bacteria impairments will eliminate

many frivolous impairments and allow the state to focus its limited water quality resources on waterbodies with legitimate impairments. While the proposed nutrient standards will cause some Brazos Basin lakes to be impaired as soon as the new standards are effective, these proposed nutrient standards will provide TCEQ the tools they need to protect Texas reservoirs from excessive eutrophication and will give the TCEQ to ability to limit nutrient loading from wastewater discharges in to the reservoirs of Texas.

Maps

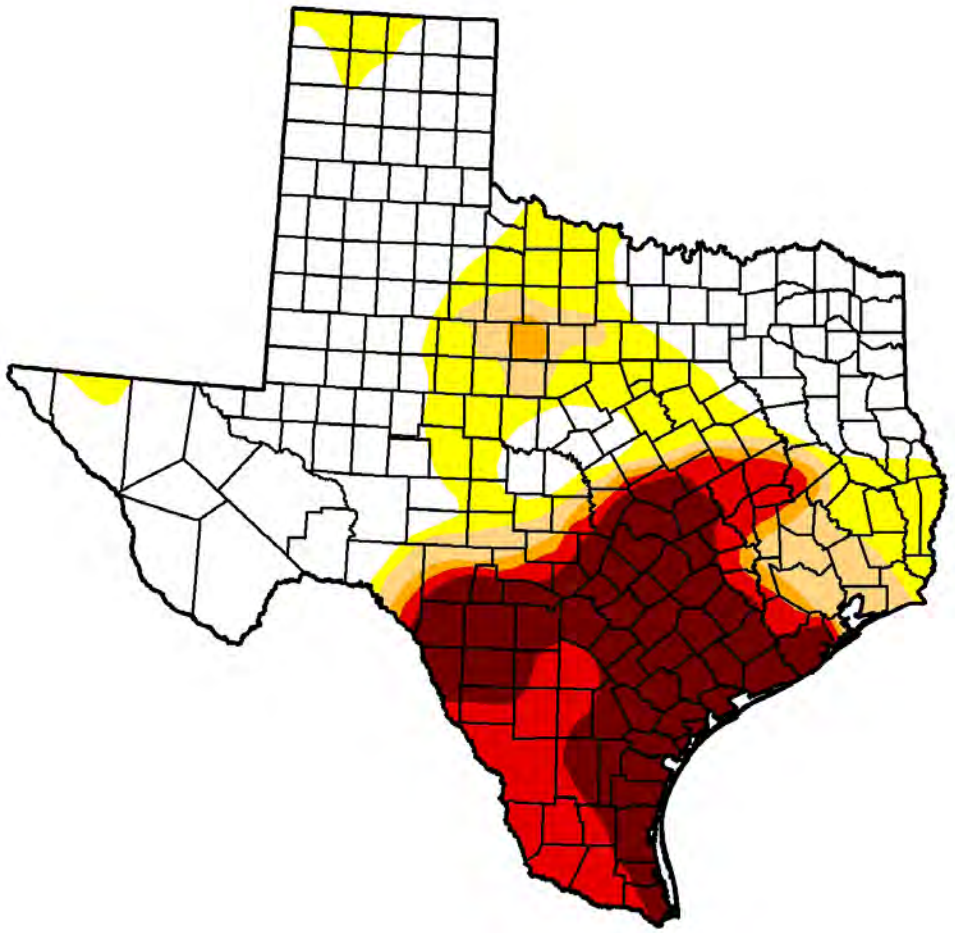
U.S. Drought Monitor

September 1, 2009
Valid 7 a.m. EST

Texas

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	48.3	51.7	35.3	28.8	26.5	17.3
Last Week (08/25/2009 map)	47.6	52.4	35.7	28.8	26.5	18.8
3 Months Ago (06/09/2009 map)	29.0	71.0	46.2	28.9	17.5	7.6
Start of Calendar Year (01/06/2009 map)	41.7	58.3	24.5	15.0	9.1	4.2
Start of Water Year (10/07/2008 map)	67.2	32.8	20.5	11.0	3.6	0.0
One Year Ago (09/02/2008 map)	43.2	56.8	26.5	10.3	3.1	0.0



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

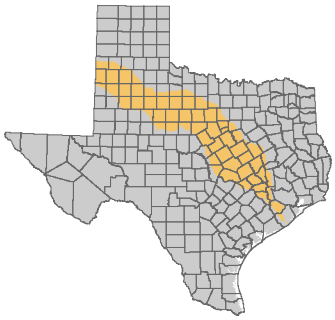
USDA National Drought Mitigation Center

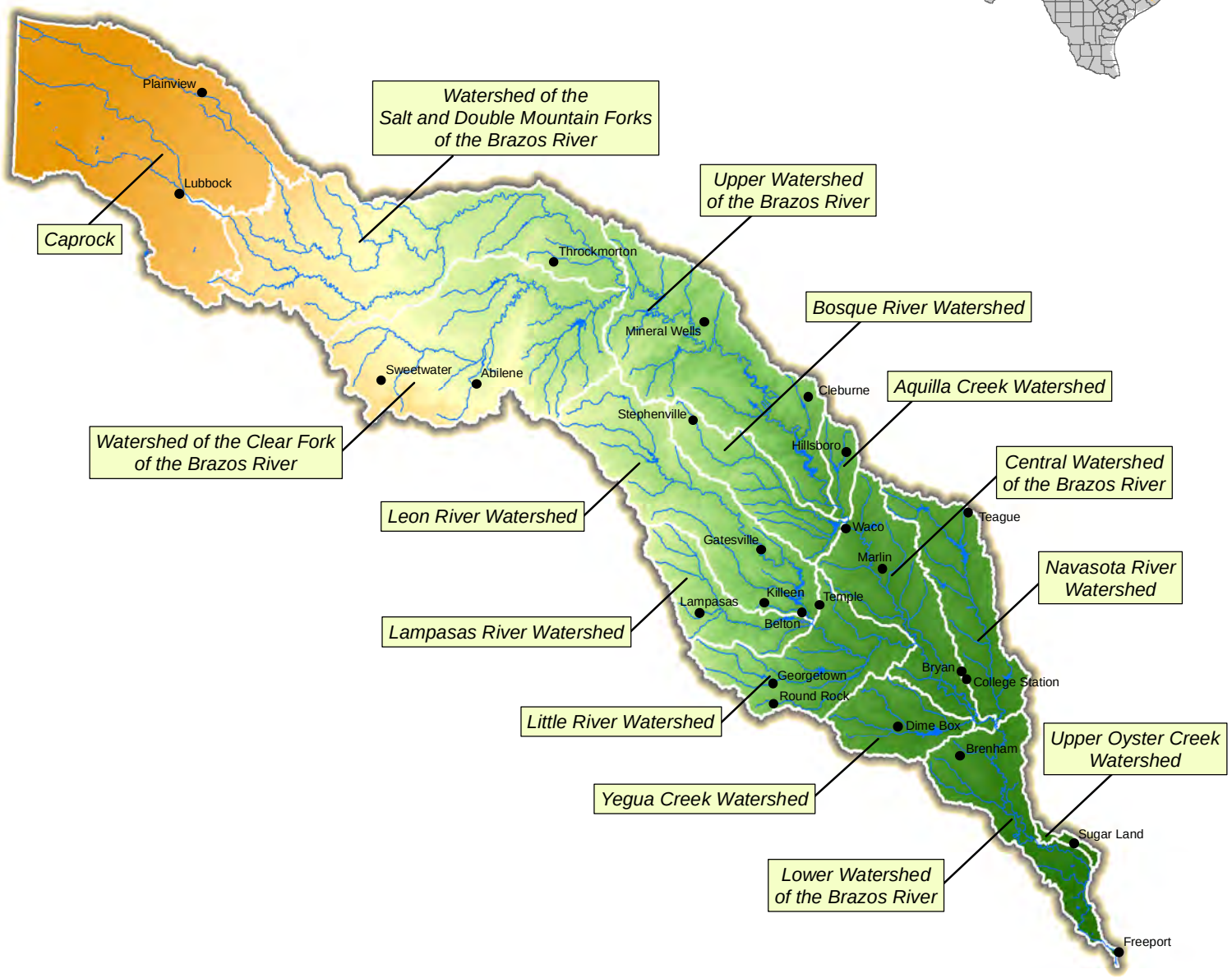
Released Thursday, September 3, 2009

Author: Brad Rippey, U.S. Department of Agriculture

http://drought.unl.edu/dm

Watersheds of the Brazos River Basin



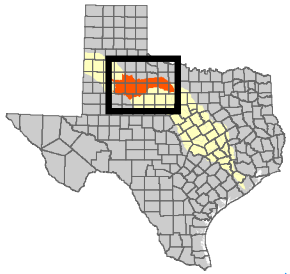


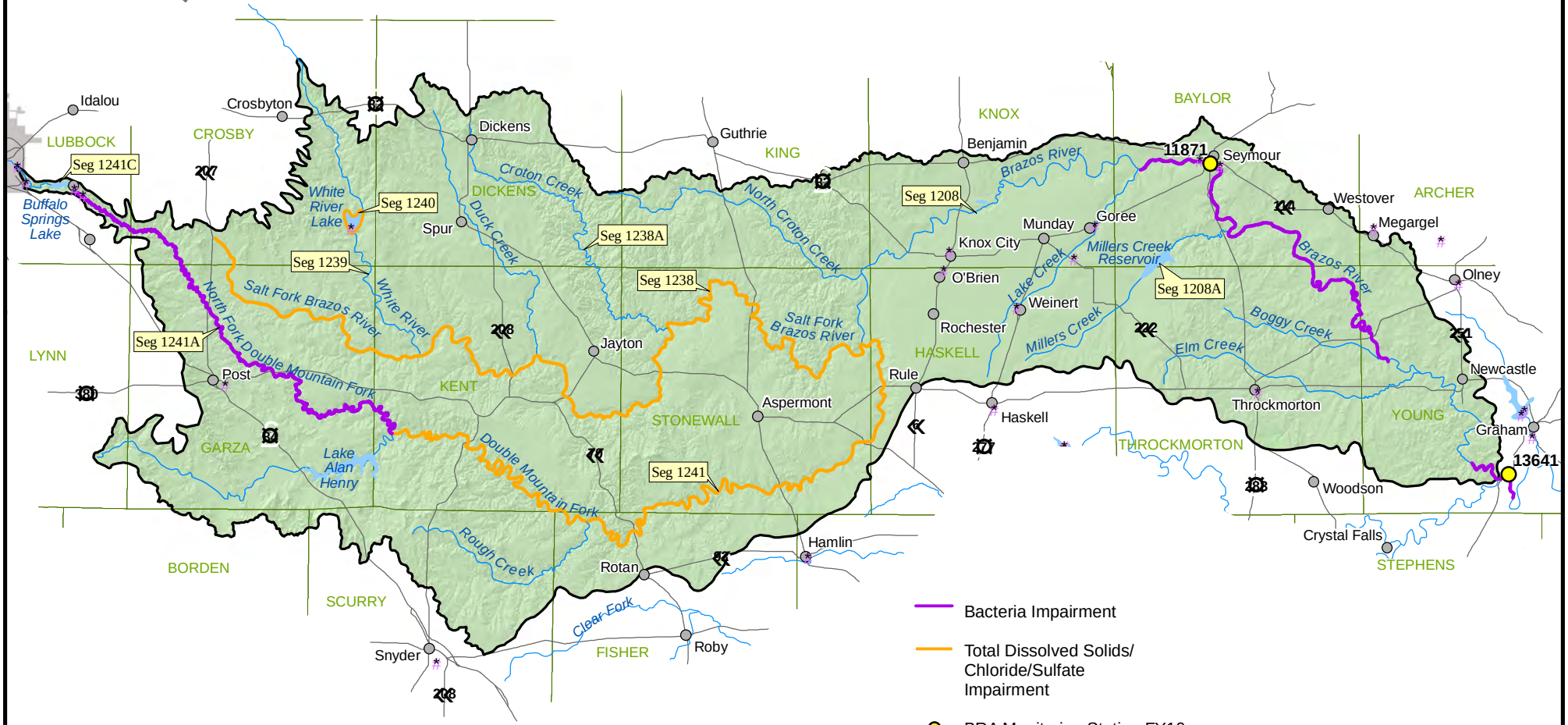
Brazos River Authority

0 50 100

Miles

Watershed of the Salt and Double Mountain Forks of the Brazos River
FY10 Water Quality Monitoring





Bacteria Impairment

Total Dissolved Solids/ Chloride/Sulfate Impairment

BRA Monitoring Station FY10

Wastewater Outfall

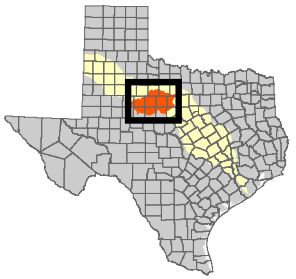
Watershed Boundary

0 15 30

Miles

Brazos River Authority

Watershed of the Clear Fork of the Brazos River
FY10 Water Quality Monitoring



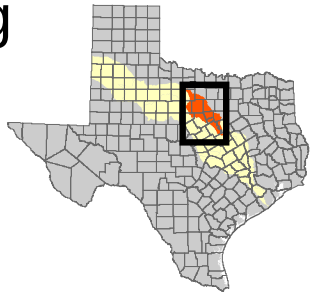
Bacteria Impairment
BRA Monitoring Station FY10
Biological Assessment FY09
Wastewater Outfall
Watershed Boundary

Rochester
Weinert
HASKELL
Rule
Haskell
Throckmorton
THROCKMORTON
Graham
YOUNG
Sagerton
Seg 1235
Lake Stamford
STONEWALL
Paint Creek
Woodson
13641
Seg 1232
California Creek
Clear Fork Brazos River
Stamford
11709
Fort Griffin
Crystal Falls
Seg 1232A
Hamlin
Seg 1232
Rotan
Foyle Creek
Hubbard Creek Reservoir
Lueders
SCURRY
Anson
Breckenridge
Roby
SHACKELFORD
Albany
Caddo
FISHER
JONES
Seg 1232
Seg 1233
Cottonwood Creek
Clear Fork Brazos River
Seg 1232B
Gonzales Creek
Salt Prong Hubbard Creek
Seg 1236
Hawley
Battle Creek
Big Sandy Creek
Bitter Creek
Lake Fort Phantom Hill
STEPHENS
Mulberry Creek
Hubbard Creek
Moran
Seg 1233A
Impact
Deadman Creek
Deep Creek
Sweetwater
Trent
Seg 1233B
Ranger
MITCHELL
Merkel
Tye
Abilene
Lake Cisco
Seg 1234
Lake Sweetwater
Roscoe
Clyde
Baird
Eastland
Seg 1237
Loraine
Putnam
Cisco
CALLAHAN
EASTLAND
NOLAN
TAYLOR
Elm Creek
Cedar Creek
Seg 1236A
Buffalo Gap
Tuscola
Lawn
Cross Plains

Brazos River Authority

0 10 20
Miles

Upper Watershed of the Brazos River
FY10 Water Quality Monitoring



Bacteria Impairment

Total Dissolved Solids/ Chloride/Sulfate Impairment

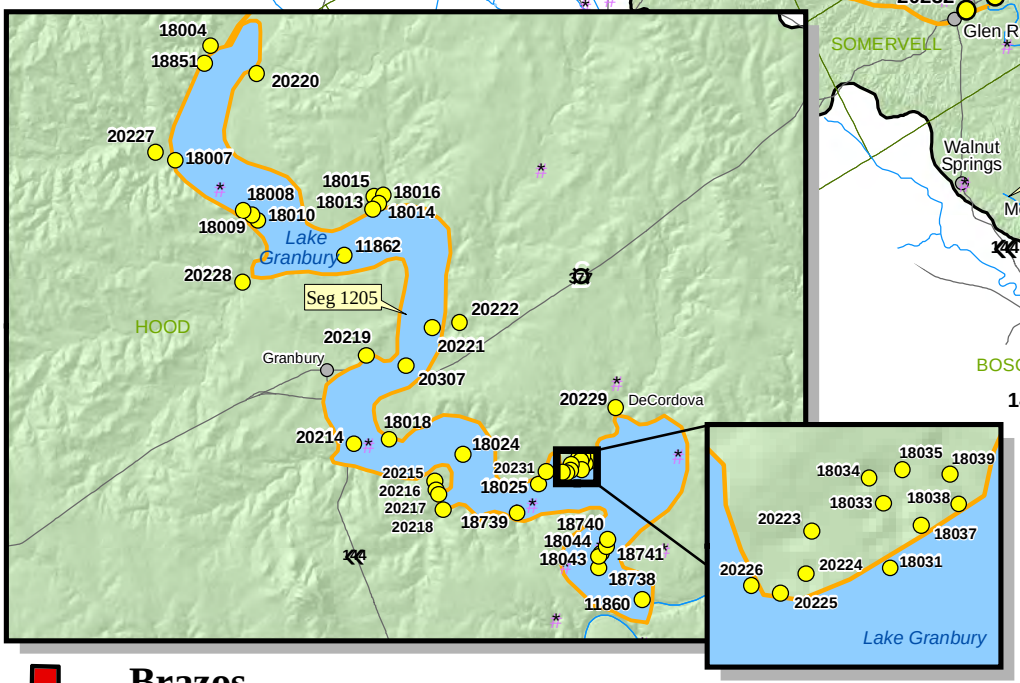
BRA Monitoring Station FY10

Biological Assessment FY09

Wastewater Outfall

Watershed Boundary

ARCHER
Olney
YOUNG
Newcastle
Salt Creek
Brazos River
Seg 1231
Lake Graham
Graham
JACK
Jacksboro
Bryson
Rock Creek
West Fork Keechi Creek
13641
Seg 1208
11868
Graford
Possum Kingdom Lake
11867
11865
11866
18748
Seg 1207
Brazos River
11864
Mineral Wells
Rock Creek
PARKER
Cool
Weatherford
Hudson Oaks
Millsap
Annetta North
Annetta
Annetta South
Breckenridge
STEPHENS
Cedar Creek
Caddo
PALO PINTO
Palo Pinto
Seg 1206
Seg 1230
Brazos
11074
11863
18743
13543
16408
18745
Lake Palo Pinto
Caddo Creek
North Fork Palo Pinto Creek
Strawn
Gordon
Mingus
Lipan
20230
Seg 1206D
Ranger
Barton Creek
South Fork Palo Pinto Creek
ERATH
Paluxy River
HOOD
Tolar
See Inset Map
Burleson
Cross Timber
Briaroaks
Joshua
Godley
Keene
Nolan River
Cleburne
JOHNSON
Lake Pat Cleburne
Seg 1228
Grandview
Lake Leon
EASTLAND
Squaw Creek Reservoir
Seg 1204
Seg 1229A
Seg 1229
20232
20213
Glen Rose
SOMERVELL
Camp Creek
11971
Rio Vista
Covington
Brazos River
11967
Blum
Seg 1227
Walnut Springs
Seg 1203A
Morgan
Steele Creek
HILL
Whitney
Lake Aquilla
Seg 1203
Meridian
Lake Whitney
Aquilla
BOSQUE
14908
11956
12044
Seg 1257
Clifton
Childress Creek
Gholson
11954
11951
11593
Valley Mills
China Springs
MCLENNAN
Waco
Lake Waco



Brazos River Authority

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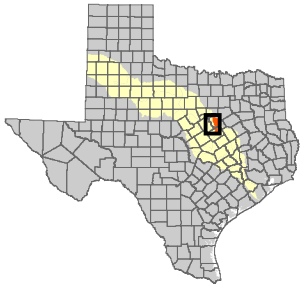
Miles

Aquilla Creek Watershed
FY10 Water Quality Monitoring



JOHNSON

Covington

Itasca

Hackberry Creek

Carl's Corner

Seg 1254B

Aquilla Creek

HILL

Seg 1254A

Hillsboro

Whitney

Seg 1254

Lake Aquilla

Abbott

Aquilla

12044

West

Seg 1256A

Brazos River

MCLENNAN

Aquilla Creek

Ross

Gholson

11593

Elm Mott

Seg 1257

Seg 1256

Brazos River

Lacy-Lakeview

North Bosque River

Bellmead

Seg 1225

Lake Waco

Waco

BRA Monitoring Station FY10

Wastewater Outfall

Watershed Boundary

Brazos River Authority

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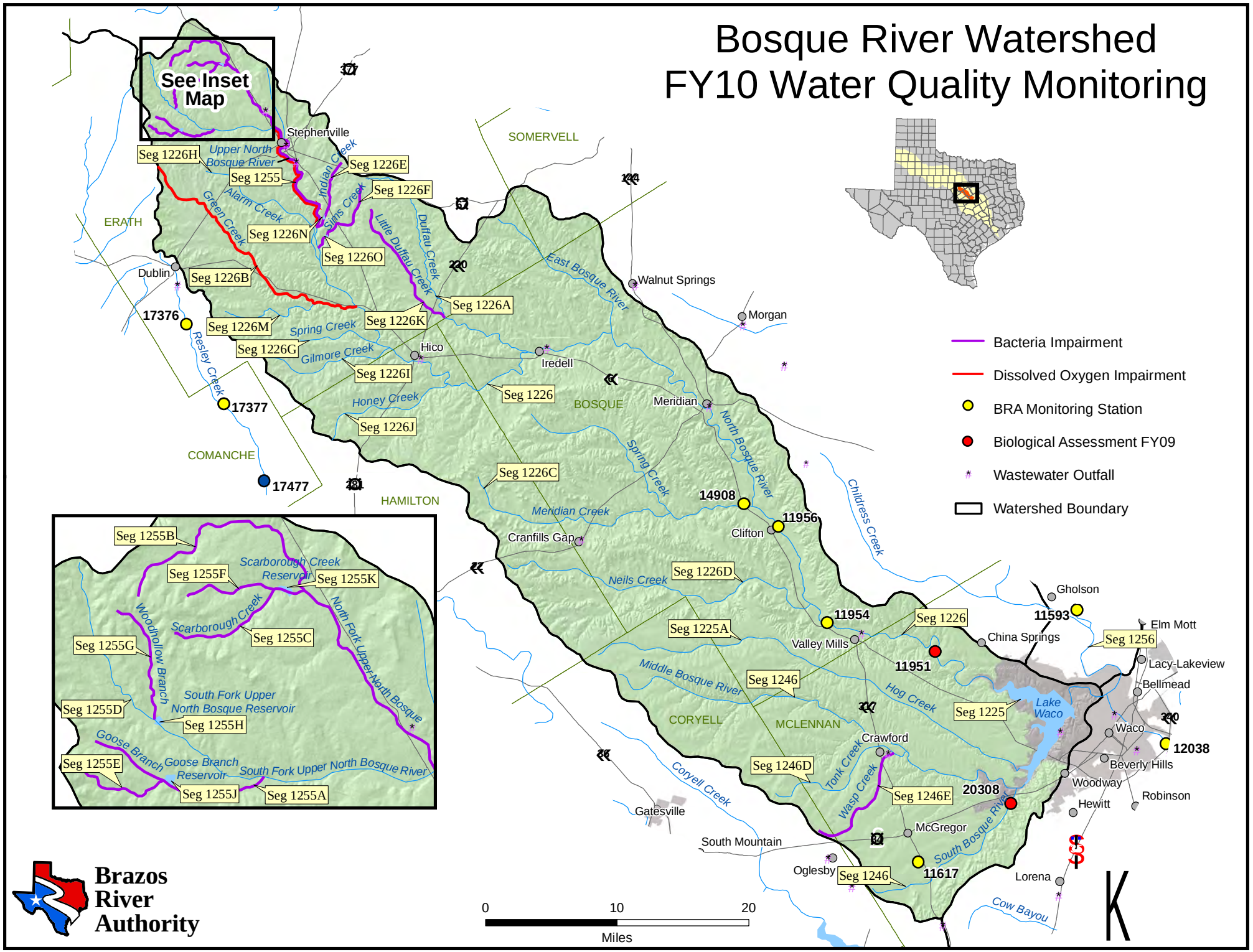
Miles


Bosque River Watershed
FY10 Water Quality Monitoring
See Inset Map
Stephenville
Upper North Bosque River
Seg 1226H
Seg 1255
Seg 1226E
Seg 1226F
Indian Creek
Sims Creek
Alarm Creek
Green Creek
Seg 1226N
Seg 1226O
Little Duffau Creek
Duffau Creek
ERATH
Dublin
Seg 1226B
17376
Seg 1226M
Spring Creek
Seg 1226K
Seg 1226A
Seg 1226G
Gilmore Creek
Hico
Iredell
Seg 1226I
Resley Creek
17377
Honey Creek
Seg 1226J
Seg 1226
BOSQUE
COMANCHE
17477
HAMILTON
Seg 1226C
Meridian
Spring Creek
North Bosque River
14908
Meridian Creek
Cranfills Gap
11956
Clifton
Childress Creek
Neils Creek
Seg 1226D
Gholson
11593
Elm Mott
11954
Seg 1225A
Valley Mills
China Springs
Seg 1226
Seg 1256
Lacy-Lakeview
11951
Middle Bosque River
Seg 1246
Bellmead
Hog Creek
Lake Waco
Seg 1225
CORYELL
MCLENNAN
Waco
12038
Crawford
Beverly Hills
Coryell Creek
Seg 1246D
Tonk Creek
Wasp Creek
Woodway
Seg 1246E
20308
Robinson
Hewitt
Gatesville
McGregor
South Bosque River
South Mountain
Oglesby
Seg 1246
11617
Lorena
Cow Bayou
Seg 1255B
Scarborough Creek Reservoir
Seg 1255F
Seg 1255K
Woodhollow Branch
Scarborough Creek
Seg 1255C
North Fork Upper North Bosque
Seg 1255G
South Fork Upper North Bosque Reservoir
Seg 1255D
Seg 1255H
Goose Branch
Goose Branch Reservoir
South Fork Upper North Bosque River
Seg 1255E
Seg 1255J
Seg 1255A
Bacteria Impairment
Dissolved Oxygen Impairment
BRA Monitoring Station
Biological Assessment FY09
Wastewater Outfall
Watershed Boundary
0
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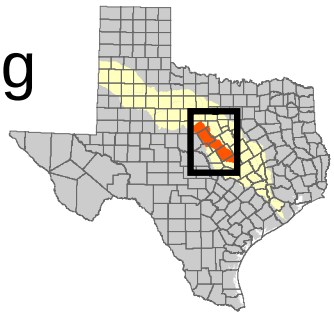
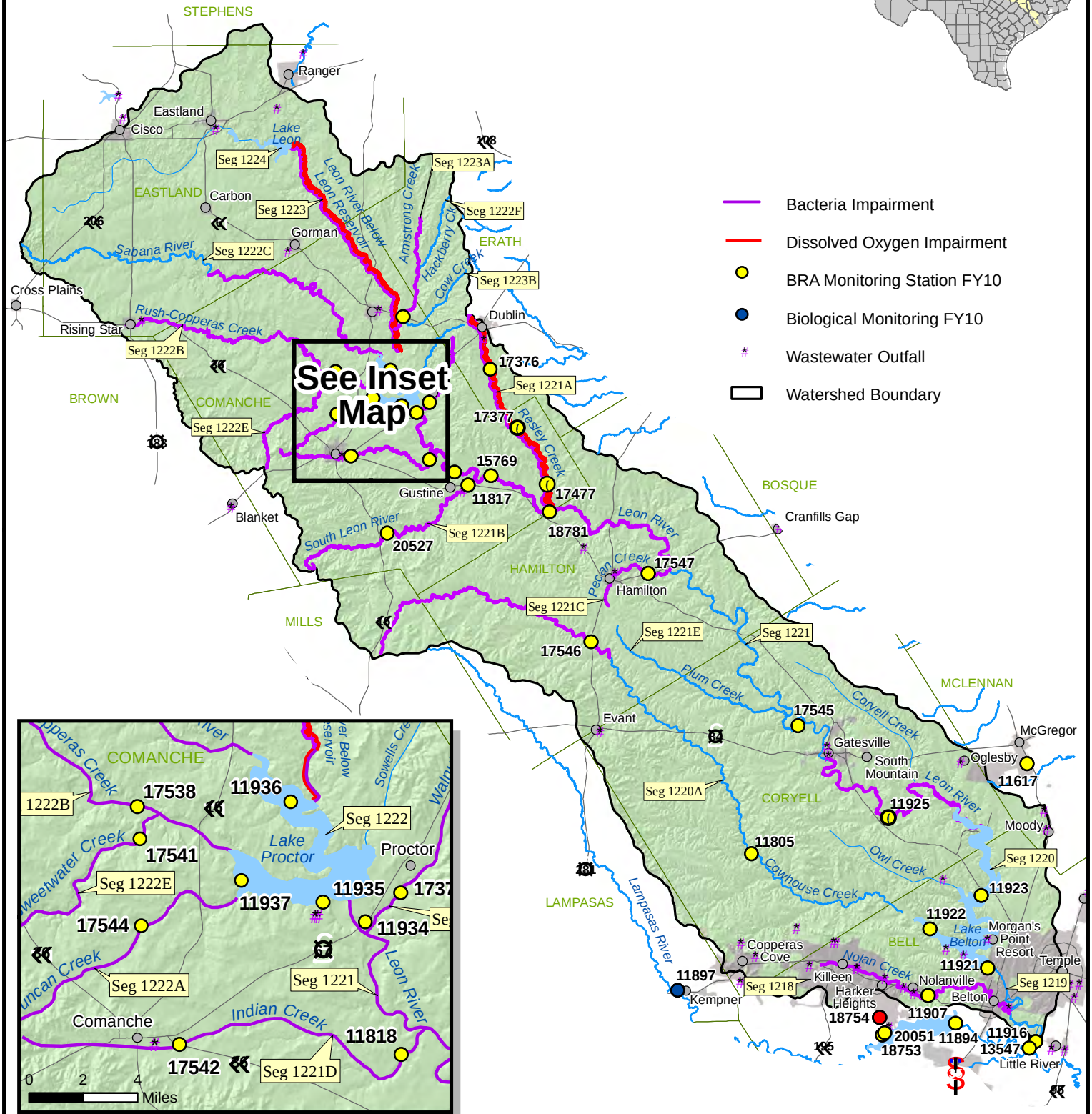
Miles
Brazos River Authority

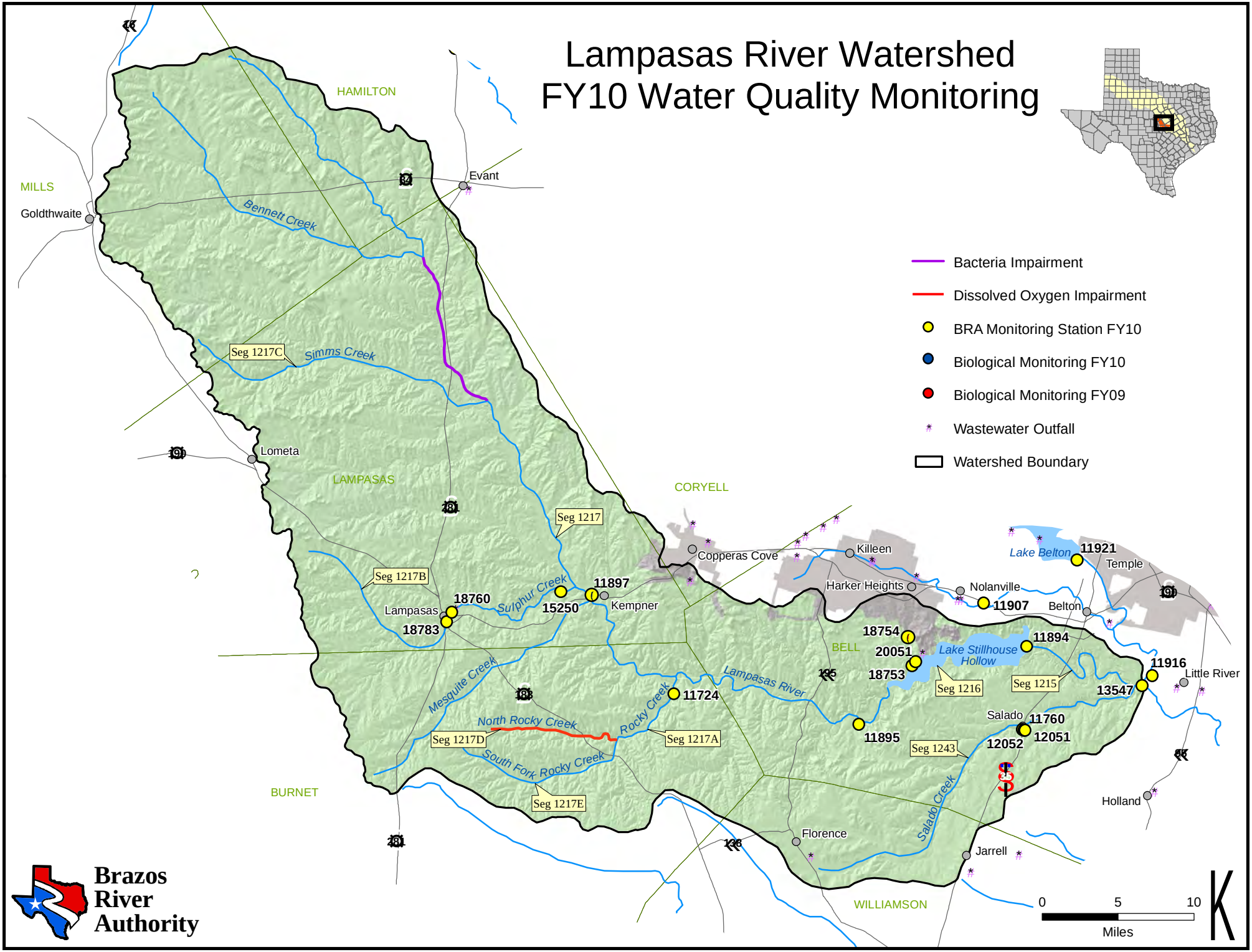
Leon River Watershed
FY10 Water Quality Monitoring



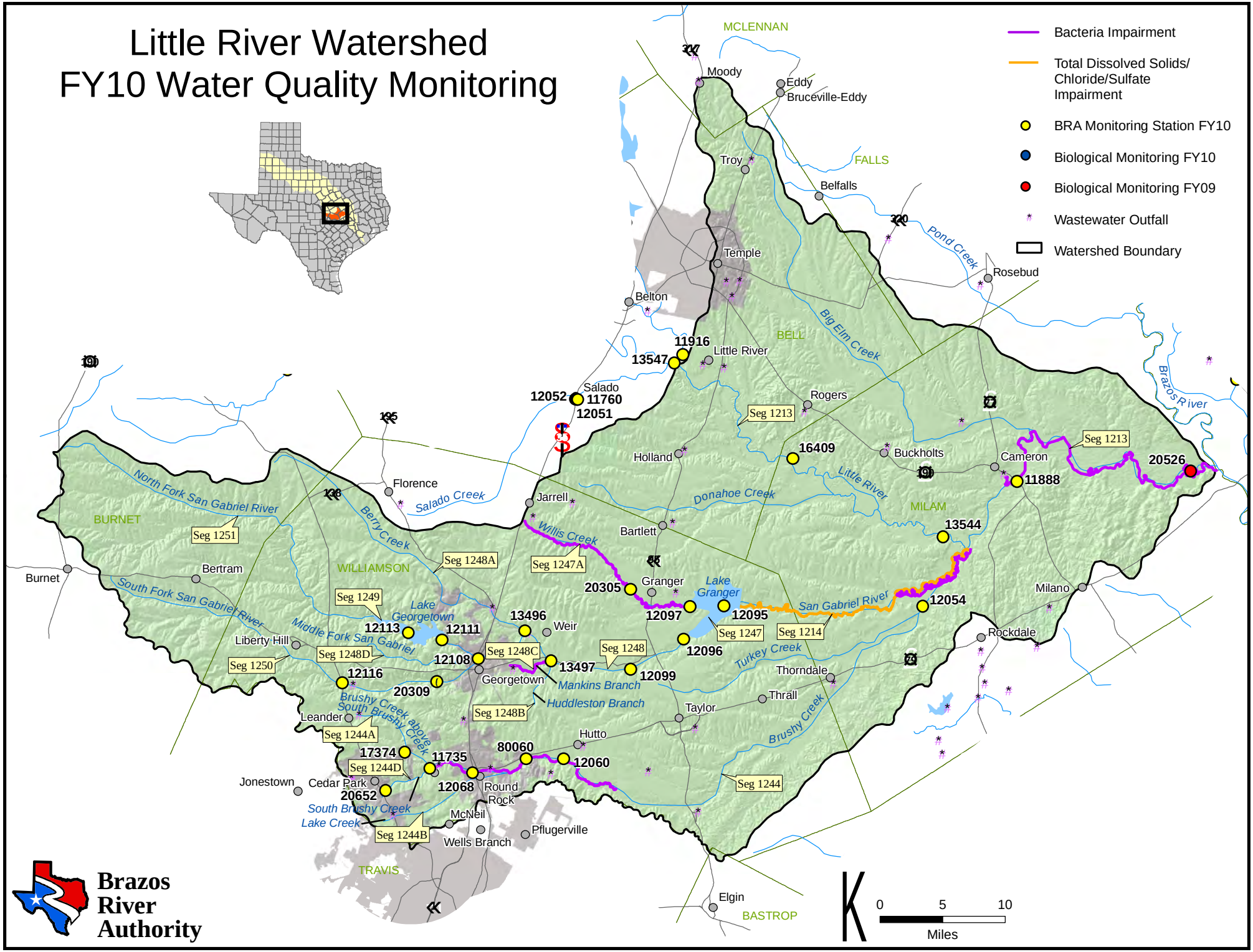


Brazos River Authority

Lampasas River Watershed
FY10 Water Quality Monitoring



Brazos River Authority


Little River Watershed
FY10 Water Quality Monitoring
Bacteria Impairment
Total Dissolved Solids/ Chloride/Sulfate Impairment
BRA Monitoring Station FY10
Biological Monitoring FY10
Biological Monitoring FY09
Wastewater Outfall
Watershed Boundary
MCLENNAN
FALLS
BELL
WILLIAMSON
BURNET
MILAM
TRAVIS
BASTROP
Moody
Eddy
Bruceville-Eddy
Troy
Belfalls
Temple
Rosebud
Belton
Little River
Salado
Rogers
Holland
Florence
Jarrell
Bartlett
Granger
Buckholts
Cameron
Milano
Rockdale
Thorndale
Thrall
Taylor
Hutto
Elgin
Burnet
Bertram
Liberty Hill
Leander
Georgetown
Jonestown
Cedar Park
Round Rock
McNeil
Wells Branch
Pflugerville
Weir
Lake Granger
Lake Georgetown
Pond Creek
Big Elm Creek
Brazos River
Little River
Donahoe Creek
Salado Creek
Willis Creek
Berry Creek
North Fork San Gabriel River
South Fork San Gabriel River
Middle Fork San Gabriel
San Gabriel River
Turkey Creek
Mankins Branch
Huddleston Branch
Brushy Creek above South Brushy Creek
Brushy Creek
South Brushy Creek
Lake Creek
Seg 1213
Seg 1214
Seg 1247
Seg 1247A
Seg 1248
Seg 1248A
Seg 1248B
Seg 1248C
Seg 1248D
Seg 1249
Seg 1250
Seg 1251
Seg 1244
Seg 1244A
Seg 1244B
Seg 1244D
11916
13547
12052
11760
12051
16409
11888
20526
13544
20305
12097
12095
12054
13496
12111
12113
12108
12116
20309
13497
12099
12096
80060
12060
11735
17374
12068
20652
Brazos River Authority
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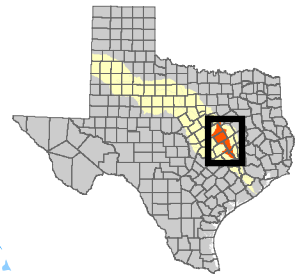
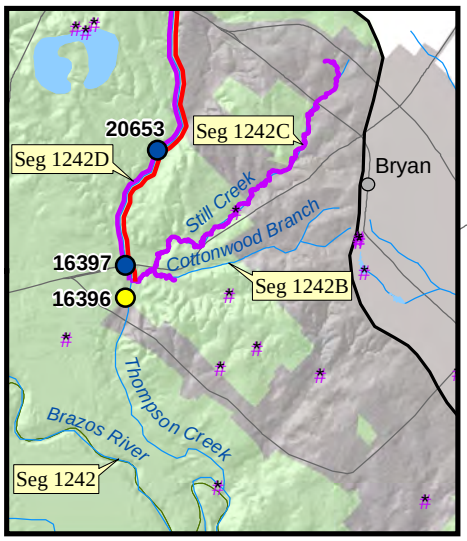
Miles

Central Watershed of the Brazos River
FY10 Water Quality Monitoring



Bacteria Impairment
Dissolved Oxygen Impairment
BRA Monitoring Station FY10
Biological Monitoring FY10
Biological Monitoring FY09
Wastewater Outfall
Watershed Boundary

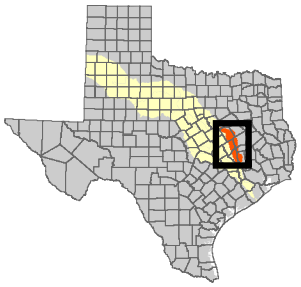
Bynum
Malone
Abbott
Penelope
Hubbard
Seg 1242N
West
Mount Calm
Leroy
Ross
Gholson
11593
Elm Mott
Tehuacana Creek
Axtell
Lacy-Lakeview
Seg 1256
Bellmead
Tradinghouse Creek Reservoir
LIMESTONE
Lake Waco
Seg 1225
Waco
12038
15771
Hallsburg
Mart
Groesbeck
MCLENNAN
Beverly Hills
11609
Woodway
Riesel
20308
Hewitt
Robinson
Big Creek
Big Sandy Creek
McGregor
Seg 1242
Thornton
11617
Golinda
Lorena
Seg 1242A
Satin
Marlin City Lake
Little Brazos River
11717
Kosse
Moody
Eddy
Cow Bayou
Marlin
Chilton
11723
12033
Seg 1242P
Bruceville-Eddy
16407
Twin Oak Reservoir
Deer Creek
Seg 1242J
Lott
Seg 1242E
Troy
Bremond
Belfalls
FALLS
12032
Walnut Creek
Temple
Seg 1242
20565
Seg 1242F
Rosebud
Seg 1242O
ROBERTSON
Pond Creek
Franklin
16403
Calvert
Mud Creek
20562
16402
Seg 1242K
Seg 1242L
Brazos River
Pin Oak Creek
20563
20529
Hearne
Seg 1242M
Spring Creek
20526
16401
20564
MILAM
Seg 1242I
Campbells Creek
16394
20561
Wixon Valley
16395
Milano
BRAZOS
Bryan
Cedar Creek
11591
See Inset Map
College Station
11785
BURLESON
Caldwell
Wellborn
Old River
Snook
Millican
Seg 1242
Yegua Creek
11873
Navasota
11880
12030
Somerville
GRIMES
WASHINGTON



0 10 20 Miles

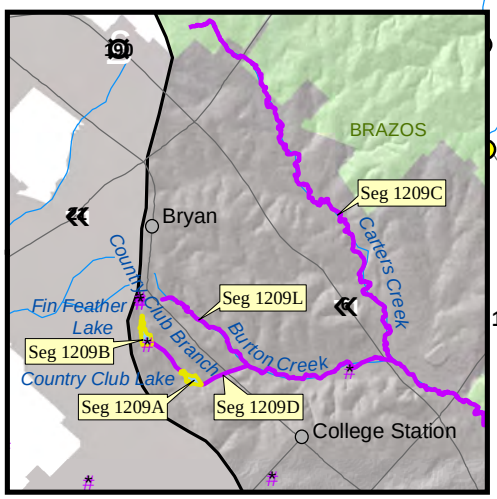
Brazos River Authority

Navasota River Watershed
FY10 Water Quality Monitoring



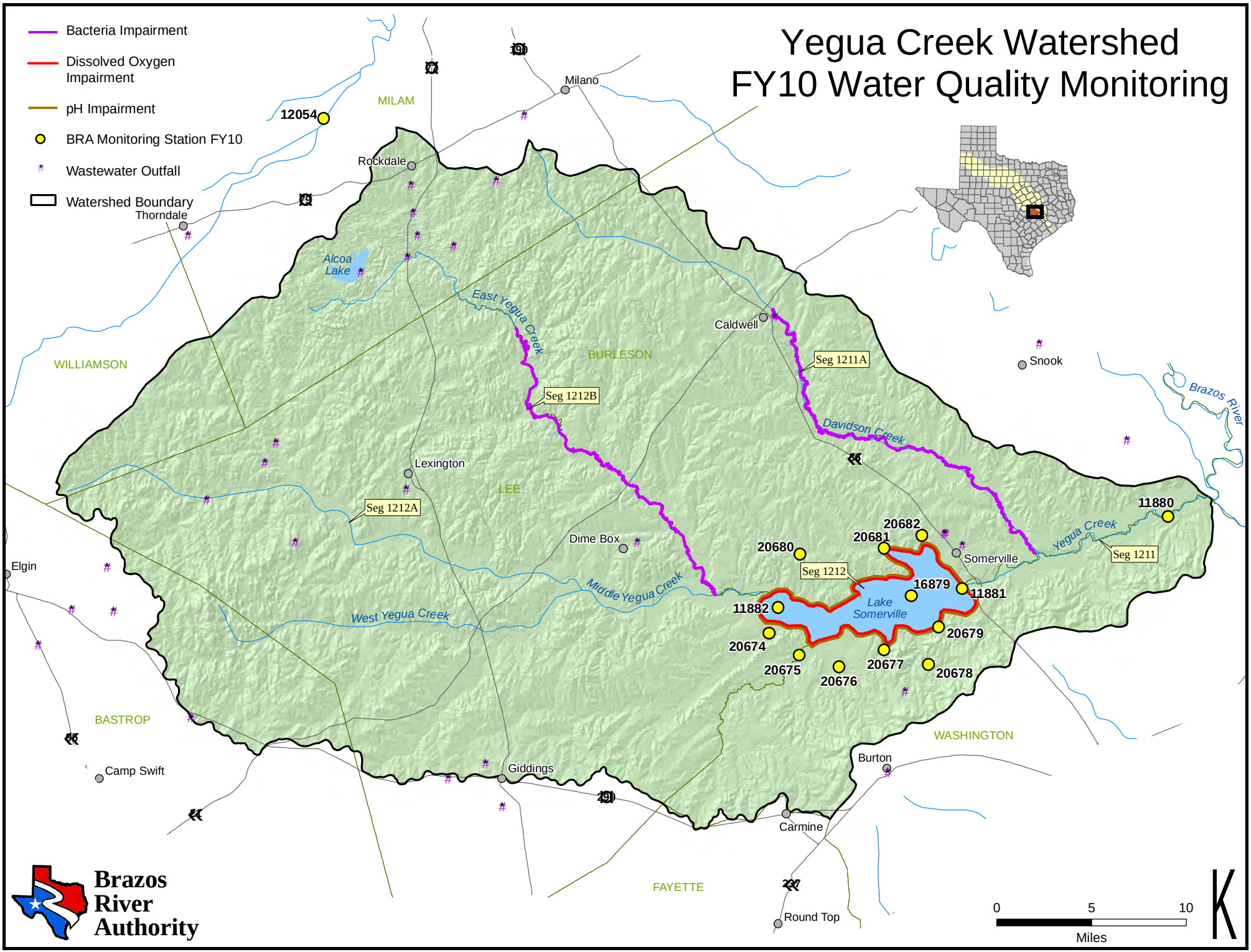
Penelope
Hubbard
HILL
NAVARRO
Wortham
Kirvin
Coolidge
Tehuacana
Mount Calm
Axtell
Navasota River
Seg 1210A
Seg 1210
Mexia
FREESTONE
Lake Mexia
Springfield Lake
Christmas Creek
Seg 1253A
Teague
Holman Creek
MCLENNAN
Mart
Seg 1253
Groesbeck
12126
LIMESTONE
13970
Seg 1252
12125
Thornton
12124
Jewett
Lake Limestone
Seg 1209K
12123
Steele Creek
Kosse
LEON
Seg 1209
FALLS
Marquez
Twin Oaks Reservoir
Duck Creek
11877
Seg 1209H
16389
Seg 1209
Franklin
ROBERTSON
Normangee
Navasota River
MADISON
20562
Cedar Creek
Shepard Creek
North Zulch
Cottonwood
Seg 1209G
20529
Seg 1209J
20564
BRAZOS
11787
20561
Seg 1209E
Wixon Valley
16395
Wickson Creek
Navasota River
Bryan
20653
See Inset Map
16397
16396
Gibbons Creek Reservoir
Carters Creek
11875
Seg 1209I
College Station
11785
18800
Seg 1209C
20719
Gibbons Creek
GRIMES
Wellborn
20528
11756
Anderson
BURLESON
Millican
Seg 1209
11873
11880
Navasota
12030

Bacteria Impairment
Toxicity in Sediment Impairment
BRA Monitoring Station FY10
Biological Monitoring FY10
Wastewater Outfall
Watershed Boundary

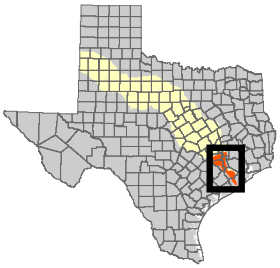


Brazos River Authority

0 10 20
Miles


Yegua Creek Watershed
FY10 Water Quality Monitoring
Bacteria Impairment
Dissolved Oxygen Impairment
pH Impairment
BRA Monitoring Station FY10
Wastewater Outfall
Watershed Boundary
12054
Milano
MILAM
Rockdale
Thorndale
Alcoa Lake
East Yegua Creek
Caldwell
BURLESON
Seg 1211A
Snook
Brazos River
WILLIAMSON
Seg 1212B
Davidson Creek
Lexington
LEE
Seg 1212A
11880
20682
20681
20680
Dime Box
Somerville
Yegua Creek
Seg 1211
Elgin
Seg 1212
16879
11881
Middle Yegua Creek
West Yegua Creek
11882
Lake Somerville
20679
20674
20677
20675
20678
20676
BASTROP
WASHINGTON
Camp Swift
Giddings
Burton
Carmine
FAYETTE
Round Top
Brazos River Authority
0
5
10
Miles

Lower Watershed of the Brazos River FY10 Water Quality Monitoring



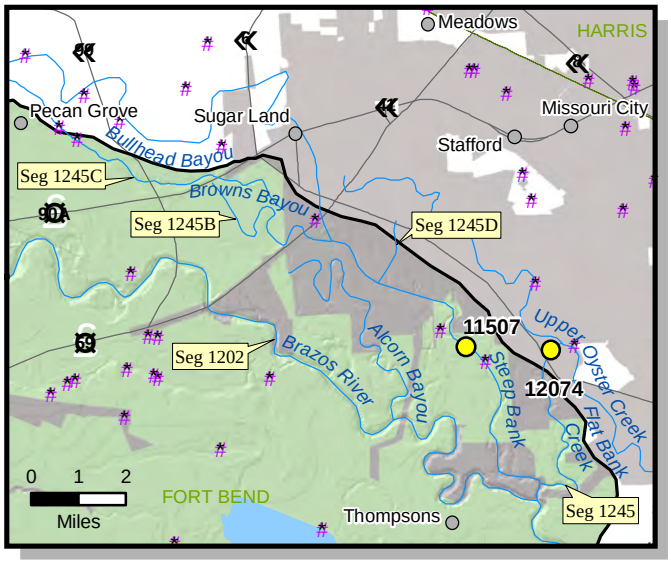
Bacteria Impairment

BRA Monitoring Station FY10

Wastewater Outfall

Watershed Boundary

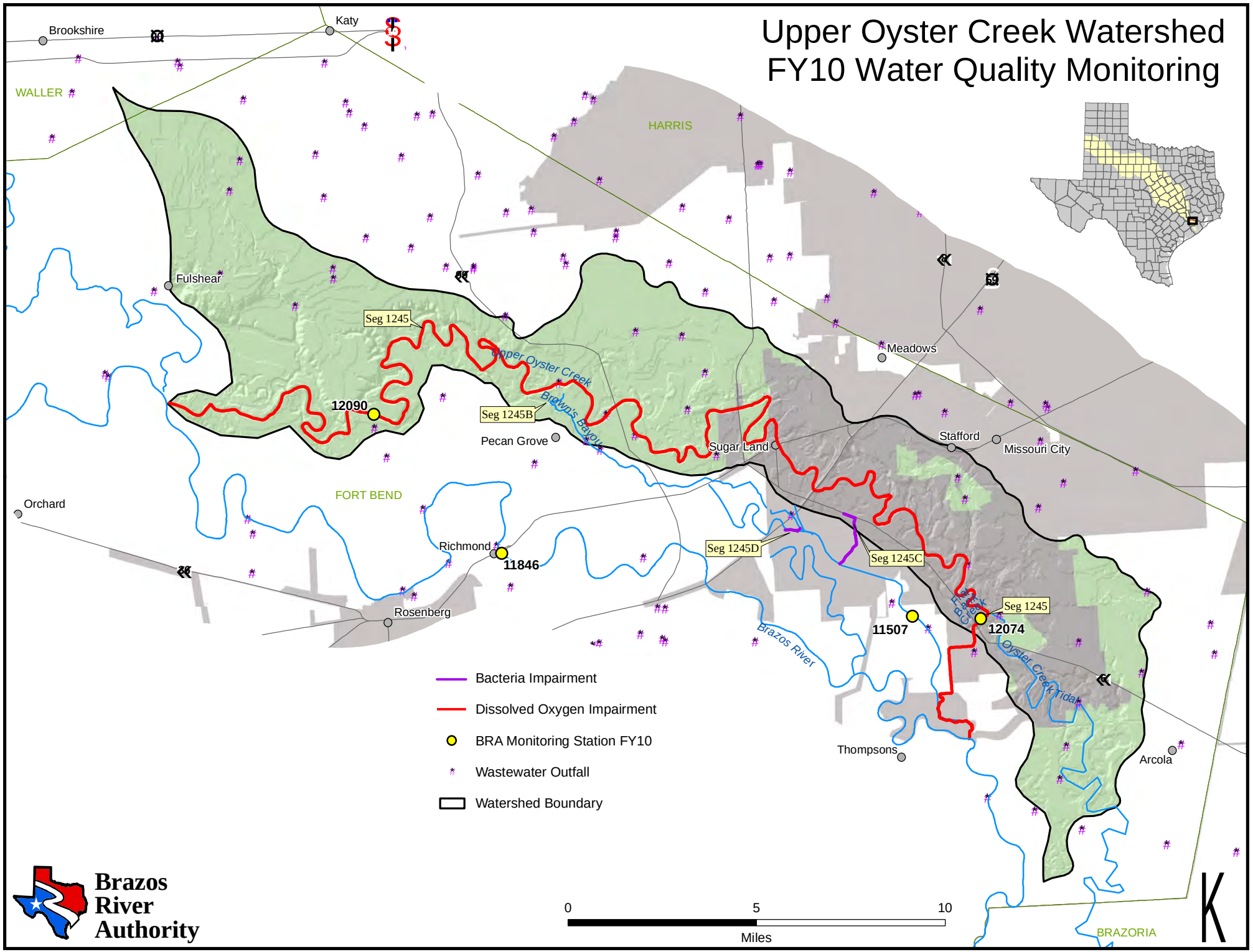
See Inset Map



Brazos River Authority

0 10 20

Miles


Upper Oyster Creek Watershed
FY10 Water Quality Monitoring
Brookshire
Katy
WALLER
HARRIS
FORT BEND
BRAZORIA
Fulshear
Meadows
Stafford
Missouri City
Sugar Land
Pecan Grove
Orchard
Richmond
Rosenberg
Thompsons
Arcola
Seg 1245
Seg 1245B
Seg 1245C
Seg 1245D
Seg 1245
12090
11846
11507
12074
Upper Oyster Creek
Brown's Bayou
Brazos River
Oyster Creek Tidal
Bacteria Impairment
Dissolved Oxygen Impairment
BRA Monitoring Station FY10
Wastewater Outfall
Watershed Boundary
0
5
10
Miles
Brazos River Authority