BASIN HIGHLIGHTS REPORT

SPRING 2004

GUADALUPE RIVER BASIN

and the

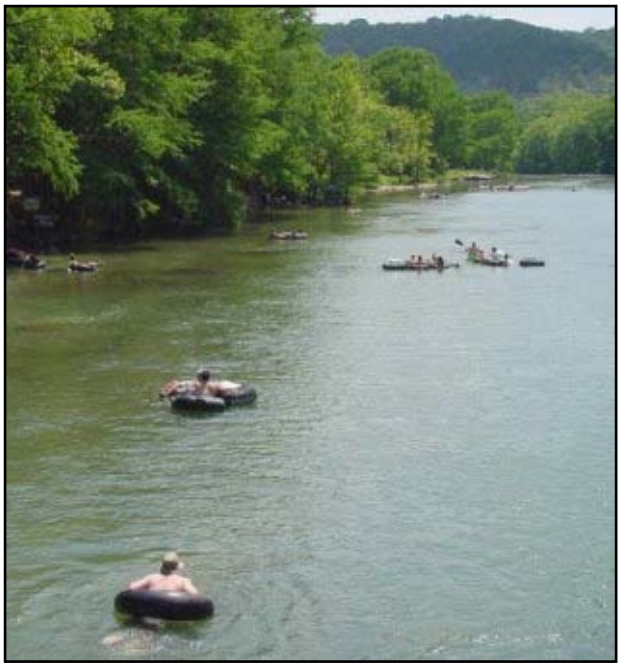
LAVACA-GUADALUPE COASTAL BASIN

INTRODUCTION

This report highlights recent activities in the Guadalupe River Basin and the Lavaca-Guadalupe Coastal Basin under the Clean Rivers Program (CRP). The CRP is managed by the Texas Commission on Environmental Quality (TCEQ), and funded entirely by fees assessed to wastewater discharge and water rights permit holders. The Guadalupe-Blanco River Authority (GBRA) together with the Upper Guadalupe River Authority (UGRA) carry out the water quality management efforts in these basins under contract to the TCEQ. The activities described in this report include water quality monitoring, a review of water quality data, special studies, and public communication efforts.

Major CRP Topics of The Past Year

The weather patterns in 2003 and early 2004 have been relatively normal leading to a typical year for stream flows and lake levels. The GBRA and the UGRA have not noted any significant changes in agricultural operations, reservoir management, or recreational activities that might impact water quality.



In the last year the major focus of the CRP in the basins has been in three main areas: monitoring, special studies, and public involvement and outreach. Of these, the monitoring efforts represent the largest component. These monitoring efforts, described in detail in the next section, provide the raw data and information needed to address a number of significant water quality issues in the basin.

In January of this year the TCEQ completed its draft 2004 Clean Water Act (CWA) Section 305(b) Water Quality Inventory and 303(d) List of water bodies that are not meeting water quality standards. The 2004 inventory provides an update on the status of 182 targeted water bodies. The assessments were conducted for water quality samples collected between March 1, 1998 and February 28, 2003. While water quality in the basins is generally good, a number of locations have been identified with water quality issues:

- Elevated nitrate-N level in the Guadalupe River below the San Antonio River confluence.
- High nitrate-N concentrations in Geronimo Creek.
- Concern of nutrient and chlorophyll *a* levels in Lakes Dunlap and McQueeney.
- Elevated bacteria and depressed dissolved oxygen levels at a number of locations in the basin.
- Nutrient enrichment concerns due to ammonia-N that are apparently a laboratory issue.
- Concerns with concentrated animal feeding operations in upper Peach Creek Watershed.

A more detailed discussion of these issues is provided in the *Water Quality Data Review* section of this report.

In addition, special studies were performed to get a better understanding of complex water quality issues such as nutrient stream standards, impacts of oil field activities on the San Marcos River and Plum Creek, and elevated sulfate concentrations in the Upper Blanco River. Training and equipment were provided to citizen monitoring groups so that the overall level of water quality analysis is enhanced.

Portions of the basin continue to experience rapid urbanization. For example, the Eastern Hays County located in the upper Plum Creek Watershed has seen a population increase of 108% between 1990 and 2000. A water quality issue of urban development is non-point source (NPS) pollution. Urbanization tends to change the characteristics of runoff from the land and also introduces wastewater disposal issues. GBRA has initiated a regional wastewater and water quality planning study for Eastern Hays County. GBRA is also planning an education outreach program to increase public awareness of NPS issues and pollution prevention.

OVERVIEW OF WATER QUALITY MONITORING

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 and entities together to discuss streamlining and coordinating efforts. The table below outlines the types and amounts of water quality monitoring conducted in the Guadalupe River Basin and the Lavaca-Guadalupe Coastal Basin under a TCEQ-approved Quality Assurance Project Plan for September 2003 through August 2004.

The Village of Wimberley (VOW), GBRA, and the Wimberley Valley Watershed Association (WVWA) are jointly conducting the Blanco River-Cypress Creek Water Quality Monitoring Study. The goals of this study include establishing a baseline of the water quality data, identifying potential pollution problems, documenting spatial and temporal changes, determining impacts of point and nonpoint source pollution, and assessing compliance with water quality standards. The study will also provide recommendations for local planning efforts to protect water quality. The GBRA is overseeing the project with technical assistance, providing lab analysis and quality assurance oversight.

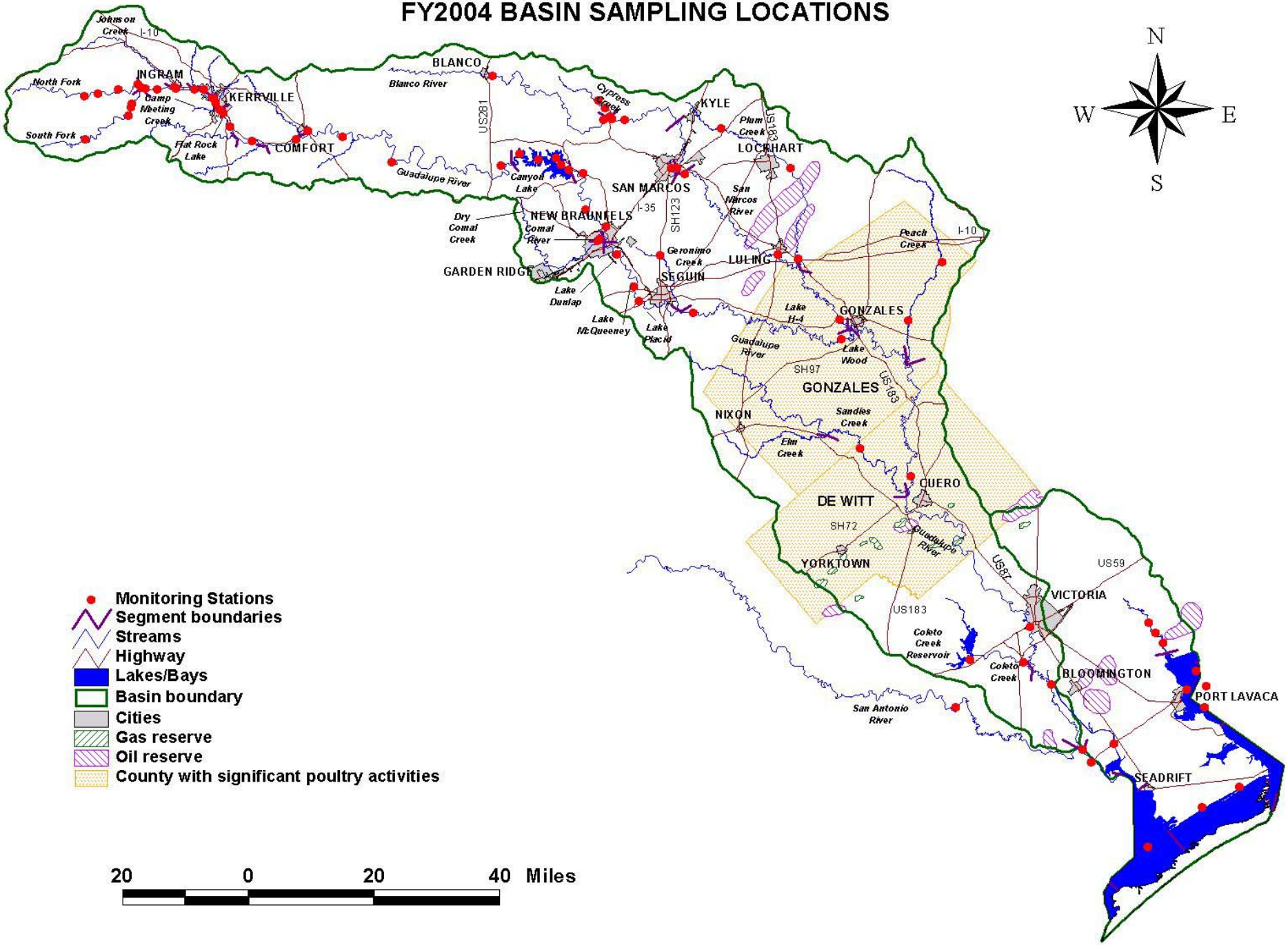
The complete monitoring schedule is updated frequently on the GBRA web page at www.gbra.org. A map is attached showing the distribution of the monitoring sites plus activities that may affect water quality, such as major communities where wastewater discharges are located, areas with a concentration of poultry activity, and the locations of major oil and gas fields. The map is also available on the web page.

FY 2004 (Sept. 2003 through Aug. 2004) Summary of Sampling for the Guadalupe & Lavaca-Guadalupe Basins

Sampling Entity	Field	Conventional	Bacteria	Biological and Habitat	24 Hr DO	Metals in Water	Metals in Sediment	Organics in Water	Organics in Sediment
GBRA	19 sites monthly; 1 site bimonthly; 7 sites quarterly	19 sites monthly; 1 site bimonthly; 7 sites quarterly	19 sites monthly; 1 site bimonthly; 7 sites quarterly	6 sites semi-annually; 1 site annually	1 site (4 times)	6 sites annually			
UGRA (Kerr Co.)	10 sites quarterly	10 sites quarterly; 19 sites weekly (May - Aug)	10 sites quarterly; 19 sites weekly (May - Aug)	2 sites semi-annually		2 sites annually			
TCEQ	21 sites quarterly	21 sites quarterly	21 sites quarterly		2 sites (4 times); 2 sites (1 time)	3 sites semi-annually	4 sites semi-annually	1 site semi-annually	2 sites semi-annually
Village of Wimberley	6 sites monthly	6 sites monthly	6 sites monthly		1 site (12 times)				
TPWD	3 sites bimonthly	3 sites bimonthly		3 sites (habitat once, benthics 3 times, nekton 6 times)	3 sites (6 times)				

Descriptions for sampling types are included on page 5.

FY2004 BASIN SAMPLING LOCATIONS



Description of Water Quality Parameters

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

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

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

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

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

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

Secchi disc transparency is a measure of the depth to which one may see into the water, and thus the depth at which aquatic plants can grow.

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

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

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

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

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

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

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

Bacteria The *E. coli* test is now used as an indicator of the possible presence of disease-causing organisms.

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

Fish Sampling by Electroshocking

24 Hr DO studies perform measurements of DO in frequent intervals (e.g. 30-minute) in a 24-hour period. The average and minimum concentrations in the 24-hour period are compared to corresponding criteria. This type of monitoring takes into account the diurnal variation of DO and avoids the bias in samples taken only at certain times of the day.

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

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

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

Quality Assurance Considerations

All data are collected under a Quality Assurance Project Plan (QAPP) developed and approved in coordination with the TCEQ. This plan exists to provide the level of consistency and scientific validity needed for environmental monitoring and decision making for river basins across the state. The QAPP is a document required by the TCEQ that documents all aspects of sample collection, analysis and data management procedures. The QAPP includes sections on the project organization, background, quality objectives, training requirements, record keeping, methodologies, and equipment maintenance.

Also included are sections outlining data management, validation, and verification. By having the important details specified, it has been possible to consider the monitoring data from all agencies together, enhancing the overall value of the data collected. Although QAPPs for the CRP do not require the approval of the US Environmental Protection Agency (USEPA), the TCEQ requires that data collection under the CRP be comparable to other data collected by the TCEQ and be consistent with the USEPA's requirements.

Sampling at Peach Creek

WATER QUALITY DATA REVIEW

Summary and Explanation of Ongoing Water Quality Issues

While water quality in the two basins (Basin 18, Guadalupe and Basin 17, Lavaca-Guadalupe) is generally good, a number of water bodies have been assessed by the TCEQ to have water quality issues due mainly to nutrient enrichment, elevated bacteria levels, or depressed dissolved oxygen. The TCEQ assesses the state's water bodies on a periodic basis under Clean Water Act Section 305(b). The resulting listing is called the Water Quality Inventory and it is comprised of a listing of water quality issues in the State. As required by the Clean Water Act, the Inventory is updated every 2 years and consists of a review of the past 5 years worth of data. The 2004 Water Quality Inventory provides an update on the status of 182 targeted water bodies. These water bodies were identified as concerns in 2002 because the data set for them was too small to allow for a full assessment, but a number of measurements did not meet the criteria defined in the standards. The update assessment was based on water quality samples collected between March 1, 1998 and February 28, 2003. The draft inventory and the methodology for assessment are available on the TCEQ web page. (www.tnrcc.state.tx.us/water/quality/305_303.html)

Below is a description of the different types of categories used by the TCEQ to describe water quality conditions. These categories are typically based upon whether a certain percentage of measurements do not meet the surface water quality criteria or screening levels set by the TCEQ.

Impairments of Water Quality Standards

The term ***Impairment*** is assigned by TCEQ to a portion of a water body when certain water quality constituents reach threshold concentrations (as specified in the Texas Surface Water Quality Standards or screening procedure documents) for a minimum number of times over a period of five years. This designation indicates that TCEQ believes the uses of the water body (drinking water supply, recreation, aquatic life, etc.) may have been *impaired*. In other words, the fish may not be able to get enough oxygen to survive, the water may not be suitable for swimming, or the water may not be fit to be used as a public drinking water supply. Streams that are shown to have an *Impairment* for one or more constituents are placed on the TCEQ's CWA Section 303(d) list.

Once a portion of a stream is placed on the list, a series of actions may be taken by the TCEQ, including but not limited to: denial of increases in wastewater permit effluent limits; a Total Maximum Daily Load (TMDL) study to allocate pollutant loads to certain sources; and instituting a strategy for reducing loads from all sources.

Concerns for Use Attainment

Some water bodies are identified with ***Concerns for Use Attainment (primary concerns)***. These concerns are identified

for indicators such as dissolved oxygen which are directly tied to support of designated uses and criteria adopted in the Texas Surface Water Quality Standards.

• ***Use Concerns-Limited Data*** are identified for indicators where less than 10 samples were available for assessment and some exceedances of the water quality criteria were identified.

• ***Use Concerns*** are identified for indicators that support the designated use as determined by an adequate number of samples, but a few reported exceedances of the water quality criteria indicated a potential water quality problem.

Water Quality or Secondary Concerns

Water Quality or Secondary Concerns are identified for indicators such as nutrients that are not tied to support of a designated use with a quantitative criterion. Screening levels used to identify these concerns have generally not been adopted as standards with the exception of secondary drinking water standards.

Water Bodies with Impairments and/or Concerns

The draft 2004 305(b) Water Quality Inventory identified the following numbers of water bodies with *Impairment* or *Concern*. (Note that a water body may have more than one area listed.)

	Impairment	*Concern*
Nutrient enrichment		**6**
Depressed DO	**4**	**5**
Bacteria	**5**	**2**
Excessive algal growth		**1**

The *impaired* water bodies are listed in the following table.

The reader should be aware that most of the waters so identified are small creeks, many of which are not designated water quality segments and therefore do not have water quality criteria developed for their unique hydrological conditions. They are assessed using the criteria applied to the nearest downstream designated segment. The nearest downstream segment is often the Guadalupe River which is significantly different in physical conditions from a small stream. Moreover, a small stream may be dry most of the time so that monitoring may be dominated by runoff samples. It is unclear how small streams should be assessed, but at the current time, the method used does not appear to reflect actual stream conditions.

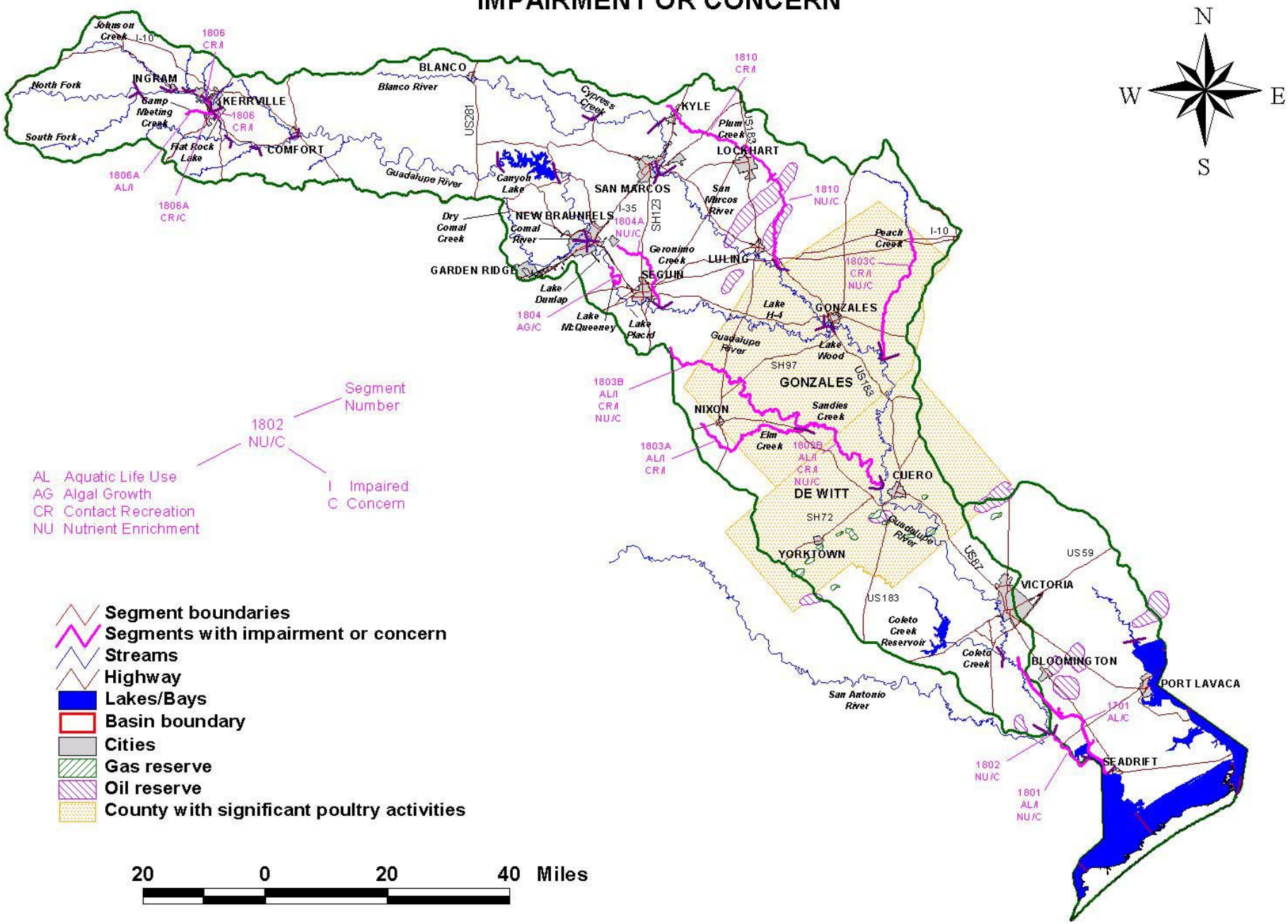
The map on the next page shows the location of all the existing and proposed *Impaired* water bodies as well as those with *Concerns*. A complete listing of such water bodies is provided in Attachment A with information on criteria exceedance.

Plum Creek at Plum Creek Road

CWA Section 303(d) List of *Impaired* Water Bodies for the Guadalupe River Basin

Water Body ID	Area	Parameter of *Impairment*	Draft 2002 List	Draft 2004 List
1801	Guadalupe River Tidal (entire segment)	DO	X	X
1803A	Elm Creek (entire water body)	DO, Bacteria	X	X
1803B	Sandies Creek (from the confluence with Elm Creek to upper end of water body)	DO		X
1803B	Sandies Creek (from the confluence with Elm Creek to upper end of water body)	Bacteria	X	X
1803B	Sandies Creek (from the confluence with the Guadalupe River to the confluence with Elm Ck)	DO	X	X
1803B	Sandies Creek (from the confluence with the Guadalupe River to the confluence with Elm Ck)	Bacteria	X	X
1803C	Peach Creek (lower 25 miles)	Bacteria	X	X
1806	Guadalupe River Above Canyon Lake (from 1 mile upstream of Flat Rock Dam to confluence with Camp Meeting Creek, and from RR 394 1 mile downstream)	Bacteria	X	X
1806A	Camp Meeting Creek	DO	X (entire water body)	X (upper 9 miles)
1810	Plum Creek (from approx. 1 mile downstream of Caldwell CR202 to upper end of segment)	Bacteria		X
1815	Cypress Creek (lower and upper 7 miles of segment)	DO	X	

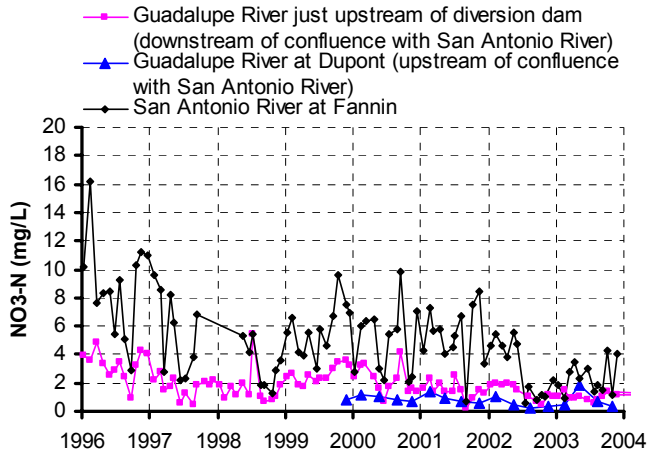
SEGMENTS WITH WATER QUALITY IMPAIRMENT OR CONCERN



Comments on the TCEQ Listed *Impairments* and *Concerns*

Nutrients

Both Segments 1801 (Guadalupe River Tidal) and 1802 (Guadalupe River below San Antonio River) are identified with nutrient enrichment concerns with elevated NO_3+NO_2-N levels. The figure below shows the Nitrate-N level of the Guadalupe River at several locations. Concentrations in the Guadalupe River above the confluence with the San Antonio River are low, while the San Antonio River levels are higher. A short distance downstream of the confluence with the San Antonio River the concentration is intermediate and tracks fairly well with the Nitrate-N level of the San Antonio River at Fannin. The Nitrate-N levels appear to be lower in the most recent years.



Monitoring has documented very high concentrations of Nitrate-N in Geronimo Creek (Segment 1804A) at SH 123, often above 10 mg/L. Land use in the watershed upstream of the sampling location is primarily row-crop agriculture. The source appears to be groundwater seepage, but the reason for the high groundwater nitrate-N concentration is not known at this time. Investigation is being planned to understand this situation.

Geronimo Creek at SH 123

Historically there has been concern with infestations of aquatic vegetation in Lakes Dunlap and McQueeney. In the past TCEQ has identified a chlorophyll *a* concern on Lake McQueeney, but recent data are lower. This is a complex situation with many sources of nutrients. Those sources include background concentrations of nutrients in spring flows, reservoir releases, nutrient-rich sediments and wastewater discharges. Because these are small run-of-river impoundments, the impacts of these sources can be intensified under low flow conditions. The Clean Rivers Program has studied these issues in the past. A new nutrient study of Lakes Dunlap and McQueeney has been initiated in early 2004. The study will collect data from the two impoundments to characterize lake conditions, identify sources of nutrients and better define relationships between flow and chlorophyll *a*.

A number of the nutrient enrichment *Concerns* are due to elevated levels of ammonia nitrogen (NH_3-N). However, recent data show NH_3-N at much lower levels. The difference was found to be due to a change in laboratory procedure. Prior to 2001, NH_3-N had been analyzed with a distillation step that is required for wastewater samples. This distillation step is not required by the TCEQ for ambient water analyses that typically have much lower NH_3-N concentrations. In the interest of providing data that are comparable statewide, GBRA dropped the distillation step for ambient water samples in early 2001. Additionally, it was felt that false positives were a possibility during the distillation step due to absorption of ammonia from the lab atmosphere where wastewater influent and sample digestions are an everyday occurrence.

The remaining cases of nutrient enrichment *Concerns* appear to be a transitional issue. Currently assessment is based on statewide screening criteria with no consideration of site-specific conditions. The EPA is promoting numeric nutrient criteria development for all US waters. When site-specific numeric nutrient criteria are developed, these listings will need to be re-evaluated.

Bacteria and Dissolved Oxygen in Small Streams

A number of the segments listed for elevated bacteria levels and depressed dissolved oxygen are unclassified water bodies. These are small streams that are markedly different from the waters for which the criteria and screening levels were developed, and have little anthropogenic influence. A solution would be to develop site specific criteria for smaller waters.

Study contractors are collecting additional data for Elm Creek, Sandies Creek and Peach Creek to gain more information on the contact recreation use impairments. Sampling will be concluded this summer.

Dissolved Oxygen Issues Throughout the Basin

Cypress Creek (Segment 1815) was on the draft 2002 303(d) list. It was delisted in the 2004 assessment since enough 24-hour dissolved oxygen data were collected demonstrating support of a high aquatic life use.

There are four water bodies listed for DO on the draft 2004 303(d) list. These are Camp Meeting Creek (segment 1806A), Elm Creek (segment 1803A), Sandies Creek (segment 1803B), and Guadalupe River Tidal (segment 1801).

For Camp Meeting Creek, Sandies Creek and Elm Creek, the TCEQ Standards Team is currently reviewing the physical, chemical and biological data collected to make a determination on whether the water bodies will undergo a criteria change. Whether TMDL studies are necessary for these creeks will depend on the outcome of this review.

For Segment 1801, intensive 24-hour DO monitoring has been conducted 8 times in 2002 and 2003 at Station 12577, Guadalupe River Tidal Bridge at SH 35 NE of Tivoli. Only one 24-hr average result is below the segment criterion of 5 mg/L. Further monitoring has been scheduled in FY04.

A use concern has been identified for Segment 1701 due to depressed dissolved oxygen. This segment has a limited amount of data at the time of the assessment and the concern was based on one incident of low DO. Data since 2001 are all well above the segment criterion of 4 mg/L.

Kerrville Area Bacteria Issues

For many years, there has been an issue with elevated bacteria levels at a few stations in the Kerrville area. UGRA has been monitoring the bacteria levels in the Upper Guadalupe River from May through August in approximately weekly intervals for a number of years. The few stations with consistently high bacteria levels are all located in parks in Kerrville. All the investigations to date have indicated the cause is high bird populations under the bridges. UGRA staff are working with TxDOT personnel to install netting to limit the bird populations.

Birds in Louise Hays Park – Potential Source of Bacteria

Monitoring to Address Specific Needs

The 2002 Basin Highlights Report reported that a number of monitoring sites were added to address specific needs. The data have been reviewed and findings are summarized here.

The Comal County Judge requested a monitoring site in Canyon Reservoir in the vicinity of the Canyon Park Estates wastewater treatment plant. Canyon Lake at Jacobs Creek Park (Station 17443) has been monitored since October 2001. Results thus far indicate there has been no water quality concern at this location.

A site (Station 17405) was added downstream of a landowner under executive order to remove lead shot from Joshua Creek. Monitoring of metals has been conducted twice during the summer of 2002. All metals concentrations were below criteria. This site was discontinued in July 2003.

Joshua Creek at Waring Road in Kendall County

A site was added on Plum Creek at Plum Creek Road (Station 17406) to monitor the effects of growth in Hays County. Results show elevated nutrient levels in recent months. This site will continue to be monitored.

At the request of the Jackson County Judge, a site (Station 13295) was added to monitor Arenoso Creek in advance of the operation of a biosolids land application site in Victoria County. Monitoring has been conducted for over two and a half years and enough data are now available for establishing a baseline condition. The monitoring site was discontinued in September 2003. It will be determined in the coordinated monitoring meetings what future monitoring will be required to detect changes that may occur due to the activities at the proposed land application site.

In April 2003, a discharge from a hog farm into a tributary of Peach Creek was reported to have caused a fish kill. Both TCEQ and TPWD have investigated the situation. According to TCEQ, the owner has taken measures to prevent runoff from getting into the tributary and TCEQ has not received further complaint. However, a TPWD representative indicated that legal proceedings were underway. To help better understand the situation, a new site on Peach Creek, Station 17934, is being monitored.

SPECIAL STUDIES

Special Studies are an integral component of the Clean Rivers Program. Through coordinated monitoring meetings and active public communication, the GBRA determined specific needs for targeted assessment. Three studies have been completed since the last Basin Highlights Report:

- Nutrient Criteria Study for the Guadalupe River Basin
- Investigation of Impacts of Oil Field Activities on the San Marcos River and Plum Creek in Caldwell County
- Investigation of Elevated Sulfate Concentrations in the Upper Blanco River

Key findings of these studies are discussed below. Reports are available on the GBRA web page www.gbra.org.

Nutrient Criteria Study for the Guadalupe River Basin

The US Environmental Protection Agency (EPA) has set a national goal of establishing numerical nutrient standards in the waters of the US. The target date to have criteria in place is now 2004, and Texas has committed to address criteria for lakes and reservoirs by the same time.

Nutrients, primarily nitrogen and phosphorus, are a water quality concern because in excess supply they can stimulate high concentrations of aquatic plants and degrade the quality of waters for particular uses. At the same time, a certain amount of nutrients are necessary to support the base of the aquatic life food web. There are many unique conditions that can affect the levels that actually result in degraded water quality. The challenge of setting numerical criteria is to define amounts that protect the designated uses such as aquatic life support and public water supply, without making unreasonable demands on sources of nutrients.

EPA has published Guidance Manuals for developing nutrient numerical criteria. The methodology proposed in the EPA Guidance Manuals is essentially empirical in that it recommends establishing criteria based on a percentile of existing data for systems that share some type of geographic similarity. The common factor in their method is being in one of 14 Ecoregions defined for the continental US. The Guidance Manuals suggest two ways to establish criteria. The first is to identify reference water bodies in the Ecoregion that are relatively undisturbed. The 75th percentile of the frequency distribution of these relatively pristine reference water bodies could be used to develop the criteria. When pristine reference water bodies are not identified, the 25th percentile of the frequency distribution of the entire population of water bodies is used. The 25th percentile method was used in this evaluation.

The GBRA, UGRA and the TCEQ recognize that the issue of numerical nutrient criteria is very complex and variable. This study was designed and supported by the Clean Rivers Program (CRP) to evaluate the techniques proposed by EPA to establish numeric nutrient criteria and to assess other approaches that may have greater utility for waters in the Guadalupe River basin.

In addition to the national recommendations from EPA, the US Geological Survey (USGS), with EPA support has applied the percentile methodology to a more detailed set of Ecoregions in Texas. In this study the same method was also applied to the waters of the Guadalupe Basin. The results of this work, together with the EPA recommendations and USGS findings were reviewed and discussed. The basic finding is that the percentile methodology yields results that differ substantially depending on the study area being considered. This variability does not inspire confidence in the result.

Another major limitation of the method noted and discussed is that there is no technical tie between the percentile values and the uses that have been established for the waters. Water quality standards consist of two elements: designated uses (the goal of the standard) and criteria that can be measured to determine if the use is being achieved. The National Research Council's report to EPA on the TMDL program (NRC, 2001) argues that to avoid confusion the use statement should be as specific as possible. They note that statements like "aquatic life use support" are too vague for proper quantification and suggest language like support for a specific type of fishery and the biological communities necessary to support that fishery. The NRC report also notes that it is desirable for the criteria to be as closely related to the use being protected as possible. The lack of any technical relation between designated use and the criteria used to judge attainment of the use was considered to be a serious problem.

Another problem is that when the national and state-based percentile criteria are compared with actual data from the Guadalupe Basin, most of the lakes/reservoirs would not attain the criteria. In theory, this would mean that they are not supporting their designated aquatic life support uses and a TMDL study would have to determine the needed reductions in nutrient loads. While this may be the case at some locations, it is hard to imagine this is true for most basin waters.

The main study recommendation is that effort is needed to work with the TCEQ and EPA in developing site-specific standards for the key waterways in the basin. Following on the NRC recommendations, these standards should include a more specific definition of the uses for each reservoir, and numerical criteria that have a quantitative tie to attainment of these uses. The GBRA and associated water quality programs would be well suited to supervise this effort.

Investigation of Impacts of Oil Field Activities on the San Marcos River and Plum Creek in Caldwell County

A special study was conducted to investigate the impact of oil field activities on the water quality of the San Marcos River and Plum Creek in Caldwell County. Active oil wells and storage tanks are heavily concentrated in Caldwell County. According to the Railroad Commission of Texas, there are 4450 wells in Caldwell County that in 2001 produced 956,305 barrels of crude oil. In the study area, there are 996 permitted wells. Additionally, the county is dissected by a network of pipelines that support the oil industry and carry the crude and gas to production facilities outside of the county.

Oil Field Activities

These oil tanks and wells are often unmanned and leaks may go for extended periods of time without detection. Rainfall events can carry contaminated soil and oil deposits to the tributaries that feed the San Marcos River and Plum Creek. The City of Luling is at the greatest risk. The city uses the San Marcos River as the raw water source for their surface water treatment plant located in Luling.

GBRA has two routine monitoring sites, one on the San Marcos River and one on the Plum Creek. Total petroleum hydrocarbons (TPH), BTEX and polynuclear aromatic hydrocarbons (PAH) were added quarterly to the list of routine chemical analysis at these sites. TPH is a term used to describe a large group of chemical compounds that originate from crude oil. Because there are so many different chemicals in crude oil, it is not practical to measure each one separately. The BTEX chemicals are Benzene, Toluene, Ethylbenzene, and Xylenes. These compounds are volatile, monoaromatic hydrocarbons that are commonly found together in crude petroleum. They are considered one of the major indicators of environmental pollution from crude oil facilities resulting from widespread occurrences of leakage from underground petroleum storage tanks and spills at petroleum production wells, refineries, pipelines, and distribution terminals. PAHs are a group of organic compounds that are formed during the incomplete burning of coal, oil, gas and wood and are also found in crude oil.

In addition, samples were collected for the organic compounds after three rainfall events that occurred during the study period. Sites were monitored upstream of the existing sites to establish background concentrations of the organic compounds.

The analyses resulted in no detection of BTEX or TPHs, thus no PAH analyses were performed. Whereas, it was good to learn that there were no organic compounds detected in the San Marcos River or Plum Creek, it is apparent by the number and concentration of oil wells in the area that the potential for contamination from oil field activities still exists. Because this was a very limited study of only seven sampling events, additional monitoring may be warranted. It is recommended that the work plan for 2005, and all subsequent work plans, include monitoring for the organic compounds on an annual basis.

Investigation of Elevated Sulfate Concentrations in the Upper Blanco River

A special study on the sub-watersheds of the upper Blanco River was conducted to investigate the occurrence of elevated sulfate concentrations observed during routine monitoring at the site located on the Blanco River at FM 165 in Blanco County in stream segment 1813. Between September 1999 and November 2000, eight of the thirteen possible sampling events conducted at the GBRA routine monitoring site had sulfate concentrations that were greater than the stream standard of 50 milligrams per liter (mg/L) and all thirteen were greater than the previous standard of 25 mg/L. Whereas, TCEQ would not be concerned about one site within the segment that exhibited impairment if it did not impact the segment as a whole, GBRA was concerned, based on the historical data, about the future impact the site could have on the categorization of the segment. GBRA felt that if a source of elevated sulfate could be identified prior to the listing of the segment as impaired, any subsequent intensive study or TMDL could be eliminated or minimized.

Blanco River at FM 165

The study was divided into two phases. The first phase consisted of monthly monitoring at 12 locations for one year, mixed between main stem and tributaries, in addition to the current monitoring location on the Blanco River at FM 165. These sites were included to identify possible sources of sulfate or the watershed contributing elevated sulfate concentrations, while investigating the relationship between flow and sulfate in the Blanco River. Data was collected for flow, sulfate, temperature and conductivity. The sub-watersheds that were included are: Falls Creek, Crabapple Creek, Big Creek, McKinney Creek, Cottonwood Creek, and Koch Creek. The effluent from the Blanco wastewater treatment facility was monitored for sulfate and discharge volume.

A sub-watershed, Big Creek, was identified as a potential source of sulfate concentrations in Phase 1 of the study. Phase 2 was conducted in the second year of the biennium and was developed to focus monitoring efforts in that sub-watershed. The Phase 2 sites included the original site on Big Creek, an unnamed tributary to Big Creek, the East Prong of Big Creek and the West Prong of Big Creek.

During Phase 1, samples were collected from January 2002 through December 2002. During the monitoring conducted in this phase, one tributary, Big Creek, had a range of sulfate concentrations from 21.2 and 129 mg/L, with a mean sulfate concentration of 54.4 mg/L, 2.2 times greater than the mean sulfate concentration observed at the Blanco River at FM 165 site during the study period. The City of Blanco disposes of treated effluent by irrigating coastal bermuda. Only during times of the cutting of the hay does the city discharge its effluent to the Blanco River. There was no discharge of effluent to the Blanco River on the days that the river was being sampled.

It was observed at the main stem sites that there is an inverse relationship between flow and sulfate concentrations. As flow increases the sulfate concentration is diluted in the stream. The reduction of flow has less of an impact in five of the six tributaries; as the flow fluctuates the concentration of sulfate stays relatively stable. The one exception to this trend is in the Big Creek data. During low flow conditions, there was a marked increase in sulfate concentration.

One possible explanation for the elevated sulfate could be a contribution of groundwater to Big Creek. Groundwater in the area of the Big Creek watershed is very high in sulfate concentration. Because of the apparent link between the sulfate concentrations and low flow or drought conditions, further research into land practices and water usage should be done on the Big Creek watershed to determine if there are any discharges of groundwater into the stream during these dry periods.

Confluence of Blanco River and Big Creek – a monitoring site of the sulfate study

PUBLIC INVOLVEMENT AND OUTREACH ACTIVITIES

The CRP in the Guadalupe Basin strives to maintain active communication with the public to pursue the goals of public involvement and education in water quality issues. The GBRA and UGRA maintain a number of communication mechanisms to support this CRP effort. GBRA develops opportunities for direct public participation to ensure that community concerns are addressed. These include quarterly Water Resource Reports, issuing press releases regarding various water topics, and making public presentations to schools and other interested groups. The UGRA has a similar level of public outreach on water quality issues.

The Guadalupe River Basin Steering Committee

A major communication vehicle for the CRP is the Basin Steering Committee. This group, composed of community leaders and interested citizens from throughout the basin meets annually to review activities and advise the program on priorities for monitoring and special studies. The Steering Committee membership includes: representation from municipalities, counties, industries, homeowner organizations, Texas Soil and Water Conservation Board, Texas Parks and Wildlife Department, Texas Department of Agriculture, Texas Railroad Commission, League of Women Voters and chambers of commerce, local and regional environmental organizations.

Steering Committee meetings are OPEN TO THE PUBLIC with the primary purpose of reviewing and approving achievable basin water quality objectives and priorities, considering available technology and economic impacts, and guiding work plans and the allocation of available resources. Notice of meetings of the Steering Committee is made available by way of mailed notices, as well as on the meeting page of the GBRA website (www.gbra.org).

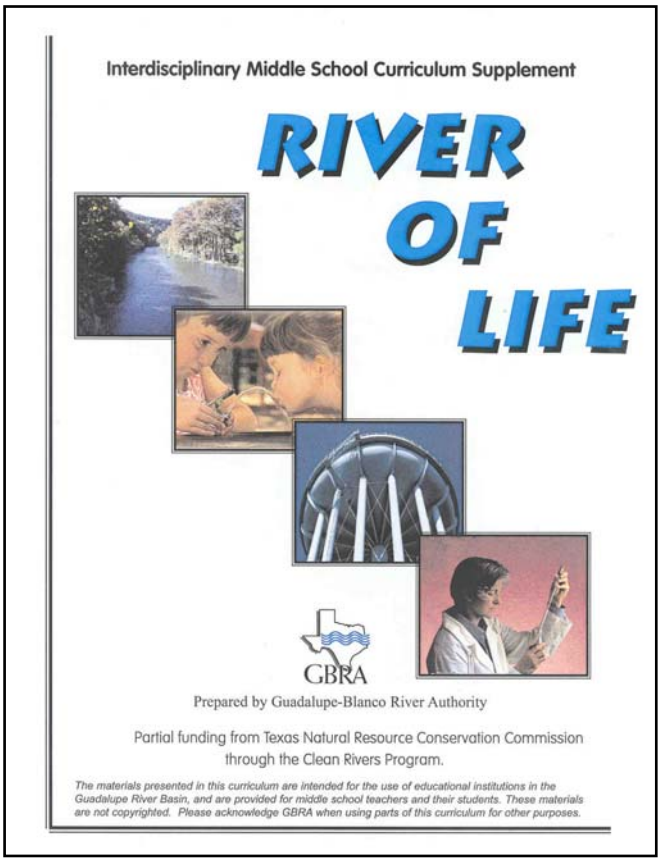
HOW CAN YOU GET INVOLVED? Send an email addressed to dmagin@gbra.org or write a letter to Ms. Debbie Magin, 933 East Court Street, Seguin, Texas 78155. Indicate what topics you are interested in and provide enough information so that you can receive mailed notices of meetings and reports. In addition, the information you provide will help us develop sub-watershed groups that have specific interests and may become involved in designing and providing input on special studies. We highly encourage all participation in our meetings and input on water quality issues in the basin.

Special Sub-committees for Local Water Quality Issues

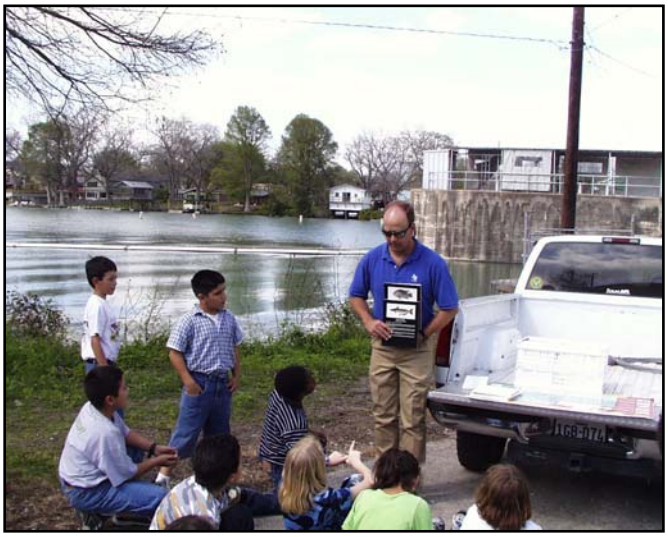
In addition to the Basin Steering Committee for the CRP, the GBRA has established the Hydroelectric Lake Citizens Advisory Committee and the Coleto Creek Reservoir Public Advisory Committee. The committees represent the user groups impacted by aquatic vegetation and by control measures that may be implemented by GBRA. They are given the opportunity to hear, question and give input on activities to control nuisance, non-native aquatic vegetation each year. The committees have representatives from homeowners associations, potable water systems, bass clubs, boating sales companies, and industries, as well as the Texas Parks and Wildlife Department and Texas Department of Agriculture. These committees receive invitations to the CRP steering committee meetings as well.

Public Education and Volunteer Monitoring Activities

One of the outreach activities by GBRA is the development of a middle school curriculum that includes discussion on the Clean Rivers Program, water quality, and water and wastewater treatment. The curriculum was distributed to all of the middle schools in the basin.



Other outreach activities include presentations to groups and classes, contributions to the Seguin Outdoor Learning Center to support water quality laboratory equipment, and the training of volunteer monitoring groups.



Mike McCall of GBRA giving a presentation on fishery to students

Texas Watch

Texas Watch is a cooperative program of environmental monitoring and communication about the environment. It includes volunteers, the TCEQ and Texas Watch partners. GBRA and UGRA are partners in the Texas Watch program in the basin. The goals of the Texas Watch program are to collect environmental information needed to make environmentally-sound decisions, and to improve communications about environmental issues. The program encourages everyone to ask:

- What questions do we want to answer about the environment?
- What part of the environment are we most concerned with?
- What can I do to help preserve and protect the environment?

GBRA and UGRA support Texas Watch in the Guadalupe River Basin by:

- Providing informational sessions to promote and help establish monitoring groups.
- Providing training to monitors.
- Providing quality control sessions.
- Providing technical expertise to support, expand and maintain monitoring groups.

For information or scheduling contact:
Mike McCall (GBRA) mmcall@gbra.org
Charles Kneuper (UGRA) ugraclk@ugra.org
Link to Texas Watch website:
www.texaswatch.geo.swt.edu

WEB SITES

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

The GBRA web page provides links to a range of information on river flows and quality conditions, including:

- Water quality data
  - Data of water quality samples collected by the two river authorities over the years along with data collected by the TCEQ and the USGS.
  - These files can be easily downloaded in pdf format.
- Special Studies Reports
  - Available for download in pdf format.
- Schedule of Monitoring Activities
  - A list of all the monitoring sites under a TCEQ-approved QAPP.
- Interactive Map of the Monitoring Sites
  - Click on each site and find out which information is being collected for that location.
- Quality Assurance Information
  - Detailed information on the type of constituents (pollutants) collected by the river authorities.
- Events Inventory
  - A listing of events related to water quality in the Guadalupe and Lavaca-Guadalupe Basins.

ATTACHMENT A
SUMMARY OF DRAFT 2004 305(b) ASSESSMENT OF GUADALUPE RIVER BASIN AND LAVACA-GUADALUPE COASTAL BASIN

Water Body ID	Water Body Name	Impairment/Concern Location	Use/Water Quality Concern	Impairment/ Concern	Parameter of Impairment/Concern	Criterion exceedance
1701	Victoria Barge Canal	Entire segment	Aquatic Life Use	Use Concern-Limited Data	depressed dissolved oxygen	1 of 8 exceed criterion.
1801	Guadalupe River Tidal	Entire segment	Aquatic Life Use	Impaired	depressed dissolved oxygen	Listed on 2000 303(d). Insufficient number of 24-hr DO values to determine if criterion supported.
1801	Guadalupe River Tidal	Entire segment	Nutrient Enrichment Concern	Concern	nitrate+nitrite nitrogen	11 of 20 exceed criterion.
1801	Guadalupe River Tidal	Entire segment	Aquatic Life Use	Use Concern-Limited Data	depressed dissolved oxygen	1 of 4 exceed criterion (24-hr avg).
1802	Guadalupe River Below San Antonio River	Entire segment	Nutrient Enrichment Concern	Concern	nitrate+nitrite nitrogen	17 of 64 exceed criterion.
1803A	Elm Creek (unclassified water body)	Entire water body	Aquatic Life Use	Impaired	depressed dissolved oxygen	Listed on 2000 303(d). Insufficient number of 24-hr DO values to determine if criterion supported.
1803A	Elm Creek (unclassified water body)	Entire water body	Contact Recreation Use	Impaired	bacteria	Listed on 2000 303(d). Insufficient data to evaluate changes in water
1803A	Elm Creek (unclassified water body)	Entire water body	Narrative Criteria Concern	Concern	depressed dissolved oxygen	
1803B	Sandies Creek (unclassified water body)	From the confluence with Elm Creek to upper end of water body	Aquatic Life Use	Impaired	depressed dissolved oxygen	5 of 7 exceed criterion (24-hr avg), 4 of 7 exceed criterion (24-hr min).
1803B	Sandies Creek (unclassified water body)	From the confluence with Elm Creek to upper end of water body	Contact Recreation Use	Impaired	bacteria	GM: EC=131, FC = 336. 10 of 25 single FC samples exceed criterion.
1803B	Sandies Creek (unclassified water body)	From the confluence with Elm Creek to upper end of water body	Aquatic Life Use	Use Concern	depressed dissolved oxygen	10 of 26 exceed criterion. Stream is perennial. High ALU.
1803B	Sandies Creek (unclassified water body)	From the confluence with Elm Creek to upper end of water body	Nutrient Enrichment Concern	Concern	ammonia	12 of 19 exceed criterion.
1803B	Sandies Creek (unclassified water body)	From the confluence with the Guadalupe River to the confluence with Elm Creek	Aquatic Life Use	Impaired	depressed dissolved oxygen	Listed on 2000 303(d). Insufficient number of 24-hr DO values to determine if criterion supported.
1803B	Sandies Creek (unclassified water body)	From the confluence with the Guadalupe River to the confluence with Elm Creek	Contact Recreation Use	Impaired	bacteria	GM: EC=174, FC = 311.
1803B	Sandies Creek (unclassified water body)	From the confluence with the Guadalupe River to the confluence with Elm Creek	Contact Recreation Use	Use Concern	bacteria	7 of 25 single FC samples exceed criterion.
1803B	Sandies Creek (unclassified water body)	From the confluence with the Guadalupe River to the confluence with Elm Creek	Aquatic Life Use	Use Concern	depressed dissolved oxygen	16 of 46 exceed criterion. Stream is perennial. High ALU.
1803B	Sandies Creek (unclassified water body)	From the confluence with the Guadalupe River to the confluence with Elm Creek	Nutrient Enrichment Concern	Concern	ammonia	5 of 13 exceed criterion.

Notes: GM = Geometric Mean, FC = Fecal Coliform, EC = E. Coli.

ATTACHMENT A (CONTINUED)
SUMMARY OF DRAFT 2004 305(b) ASSESSMENT OF GUADALUPE RIVER BASIN AND LAVACA-GUADALUPE COASTAL BASIN

Water Body ID	Water Body Name	Impairment/Concern Location	Use/Water Quality Concern	Impairment/ Concern	Parameter of Impairment/Concern	Criterion exceedance
1803C	Peach Creek (unclassified water body)	Lower 25 miles of water body	Contact Recreation Use	Impaired	bacteria	GM: EC=135, FC = 266. 17 of 54 single FC samples exceed criterion.
1803C	Peach Creek (unclassified water body)	Lower 25 miles of water body	Nutrient Enrichment Concern	Concern	ammonia	15 of 29 exceed criterion.
1804	Guadalupe River Below Comal River	From McQueeney Dam upstream approximately 7 miles	Algal Growth Concern	Concern	excessive algal growth	12 of 41 exceed criterion.
1804A	Geronimo Creek (unclassified water body)	Entire water body	Nutrient Enrichment Concern	Concern	nitrate+nitrite nitrogen	54 of 54 exceed criterion.
1806	Guadalupe River Above Canyon Lake	From 1 mile upstream Flat Rock Dam to confluence with Camp Meeting Creek	Contact Recreation Use	Impaired	bacteria	GM: EC=238, FC = 423.
1806	Guadalupe River Above Canyon Lake	From RR 394 1 mile downstream	Contact Recreation Use	Impaired	bacteria	GM: EC=283, FC = 491. 5 of 8 single FC samples exceed criterion.
1806A	Camp Meeting Creek (unclassified water body)	Upper 9 miles	Aquatic Life Use	Impaired	depressed dissolved oxygen	3 of 8 exceed criterion (24-hr avg).
1806A	Camp Meeting Creek (unclassified water body)	Upper 9 miles	Aquatic Life Use	Use Concern-Limited Data	depressed dissolved oxygen	2 of 8 exceed criterion (24-hr min).
1806A	Camp Meeting Creek (unclassified water body)	Lower 9 miles	Contact Recreation Use	Use Concern	bacteria	6 of 20 exceed criterion (EC single sample).
1810	Plum Creek	From approx. 1 mi downstream of Caldwell CR 202 to upper end of segment	Contact Recreation Use	Impaired	bacteria	GM: EC = 183.
1810	Plum Creek	Confluence with San Marcos River to confluence with Clear Fork Plum Creek	Nutrient Enrichment Concern	Concern	ammonia	6 of 22 exceed criterion.
1810	Plum Creek	Confluence with San Marcos River to confluence with Clear Fork Plum Creek	Nutrient Enrichment Concern	Concern	nitrate+nitrite nitrogen	12 of 40 exceed criterion.
1810	Plum Creek	From confluence Clear Fork Plum Creek to approx. 1 mi downstream of Caldwell CR 202	Nutrient Enrichment Concern	Concern	nitrate+nitrite nitrogen	11 of 16 exceed criterion.
1810	Plum Creek	From confluence Clear Fork Plum Creek to approx. 1 mi downstream of Caldwell CR 202	Nutrient Enrichment Concern	Concern	total phosphorus	8 of 16 exceed criterion.

Notes: GM = Geometric Mean, FC = Fecal Coliform, EC = E. Coli.