Technical Study Summaries: Lower San Antonio River
Water Quality Data

San Antonio River Basin Summary Report (2008)
By San Antonio River Authority

The San Antonio River Basin Summary Report provides an overview of monitoring and assessment activities in the San Antonio River Basin. The report was prepared by SARA staff in coordination with the Texas Commission on Environmental Quality (TCEQ) and in accordance with the State's guidelines. The report presents a ten-year history of the levels of bacteria, nutrients, aquatic life use, and other water quality parameters at over 40 sites throughout six watersheds in the basin, covering the period January 1997 through August 2007. Significant findings of the basin summary report are listed below.

- **Bacteria**

  Portions of the San Antonio River, Cibolo Creek, and Salado Creek are not meeting the contact recreation standard due to E. coli bacteria. Generally, there is a relationship between high flows and increased levels of bacteria indicating a non-point source of bacterial pollution.

  The actual source of the pollution whether wildlife, livestock or human origin are more difficult to determine. Several studies are ongoing in the Upper San Antonio River Basin, (please see the Watershed Protection Plan for further details at:

  www.sara-tx.org/site/water_quality/water_qual_mon/Projects_and_Studies.php.
  The Texas Commission on Environmental Quality, San Antonio River Authority, City of San Antonio, and San Antonio Water Systems are working together to abate the bacterial pollution by implementing the Watershed Protection Plan for the urban portion of the Upper San Antonio Watershed. An implementation plan for the entire Upper San Antonio River Watershed (includes Bexar, Wilson and northern Karnes County) and Salado Creek has been started.

- **Nutrients**

  Nutrients are a concern in portions of the San Antonio River, Cibolo Creek, Lower Medina River, Salado Creek and Lower Leon Creek. Currently there are no numerical standards for nutrients, only screening criteria. High nutrients levels may cause algal blooms and consequently low dissolved oxygen levels.

  At this time, no segments are identified as impaired by the TCEQ for low dissolved oxygen levels. The sources of the nutrients are varied and depend on the sampling location. Elevated nutrient levels are typically found below wastewater discharge points, but nutrients can also enter the stream system from storm water runoff, discharge of groundwater polluted with nutrients, through natural and manmade sources, and even through the atmosphere. SARA has launched a nutrient study in the basin to better understand the sources and effects of nutrients in the basin.

- **Toxins**

  As a result of PCBs detected in fish tissue samples by the Texas Department of State Health Services (TDSHS), TDSHS has issued a fish consumption advisory:
  "Persons should not consume any species of fish from Leon Creek starting at the Texas Highway 90 bridge downstream to Military Drive"
  Sampling done by TCEQ from 1998 through 2006 indicates that there is a concern for several metals and PCBs in sediment for Lower Leon Creek. TCEQ is launching a total maximum daily load study for PCBs for the Lower Leon Creek Watershed. The TCEQ has also been involved in limited sampling for toxins throughout the San Antonio River Basin.

  The U.S. Geological Survey, with support from SARA, is currently sampling sediments at various locations throughout Bexar County for metals and organics.

- **Degradation of biological communities and habitat**

  Three stream segments appear on the 303(d) list of impaired water bodies due to impaired fish communities; Lower Leon Creek, Salado Creek, and Upper San Antonio River.
  Salado Creek has one site listed for impaired benthic macroinvertebrate communities. The CRP steering committee has expressed concerns over habitat degradation and the need for promoting native species of plants and animal in and around the streams.

Full report:
http://www.saratx.org/site/water_quality/water_qual_mon/clean_rivers/assessment_report.html

Total Maximum Daily Load Program – How it works

The Total Maximum Daily Load Program works to improve water quality in impaired or threatened water bodies in Texas. The program is authorized by and created to fulfill the requirements of Section 303(d) of the federal Clean Water Act.

The goal of a TMDL is to restore the full use of a water body that has limited quality in relation to one or more of its uses. The TMDL defines an environmental target and, based on that target, the state develops an implementation plan to mitigate anthropogenic (human-caused) sources of pollution within the watershed.

Implementation of TMDL

An implementation plan usually puts the TMDL into action by outlining the steps necessary to reduce pollutant loads through regulatory and voluntary activities. In some instances, TMDLs are implemented through watershed protection plans.

Implementation could include adjustment of an effluent limitation in a wastewater permit, a schedule for the elimination of a certain pollutant source, identification of any nonpoint source discharge that would be regulated as a point source, a limitation or prohibition for authorizing a point source under a general permit, or a required modification to a storm water management program and pollution prevention plan.

Full report: http://www.tceq.state.tx.us/implementation/water/tmdl/index.html

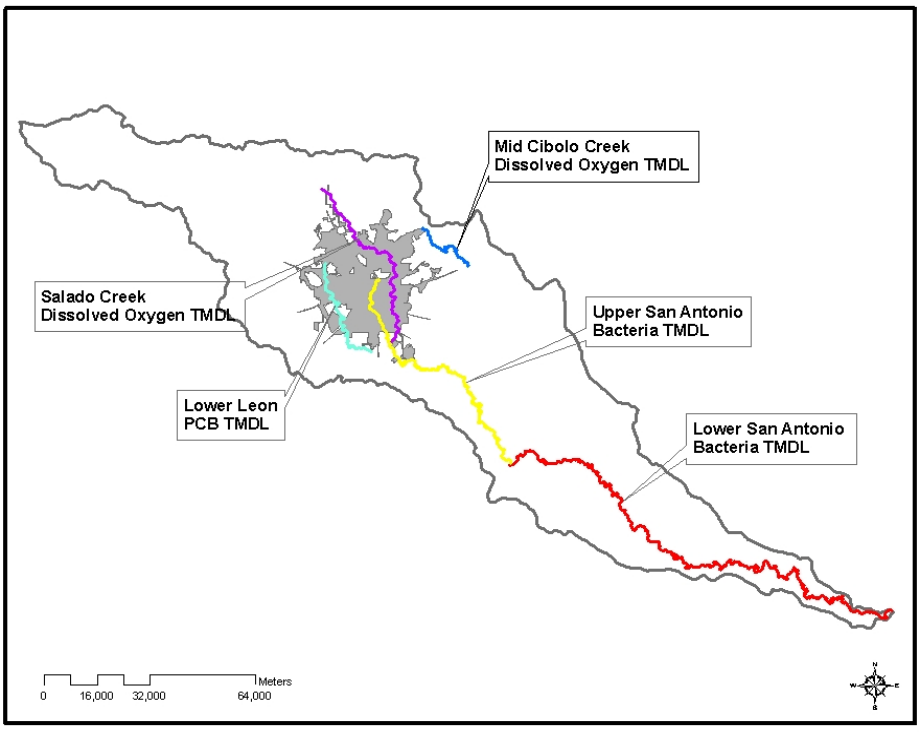

Figure 1. TMDLs in the San Antonio Basin.

Surface Water Quality Monitoring Program

The Surface Water Quality Monitoring Program monitors the quality of surface water to evaluate physical, chemical, and biological characteristics of aquatic systems with reference to human health concerns, ecological condition, and designated uses. Program data provide a basis for effective policies that promote the protection, restoration, and wise use of surface water in Texas.

Uses of Water Quality Data

- identify water quality issues
- set water quality standards for water bodies
- provide baseline data to support TMDL studies & Watershed Protection Plans
- enhance science behind wastewater permitting decisions through the Texas Pollution Discharge Elimination System

http://www.tceq.state.tx.us/permitting/water_quality/wastewater/pretreatment/tpdes_definition.html

How to obtain Water Quality Data

- Phone 512-239-DATA
- Online at http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wdma/dmrg_index.html

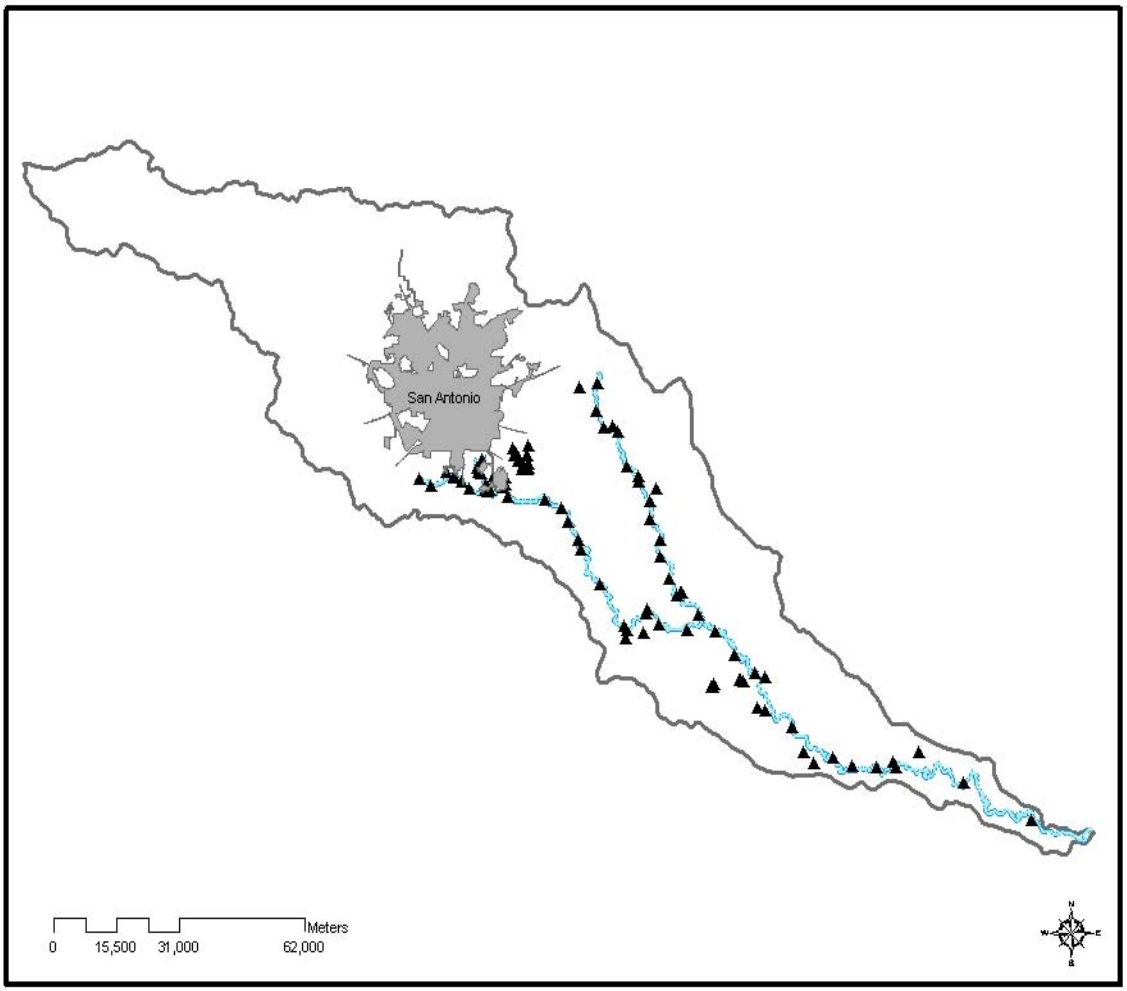

Figure 2. SWQM monitoring stations in the San Antonio Basin

Full report: http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/mtr/swqm.html

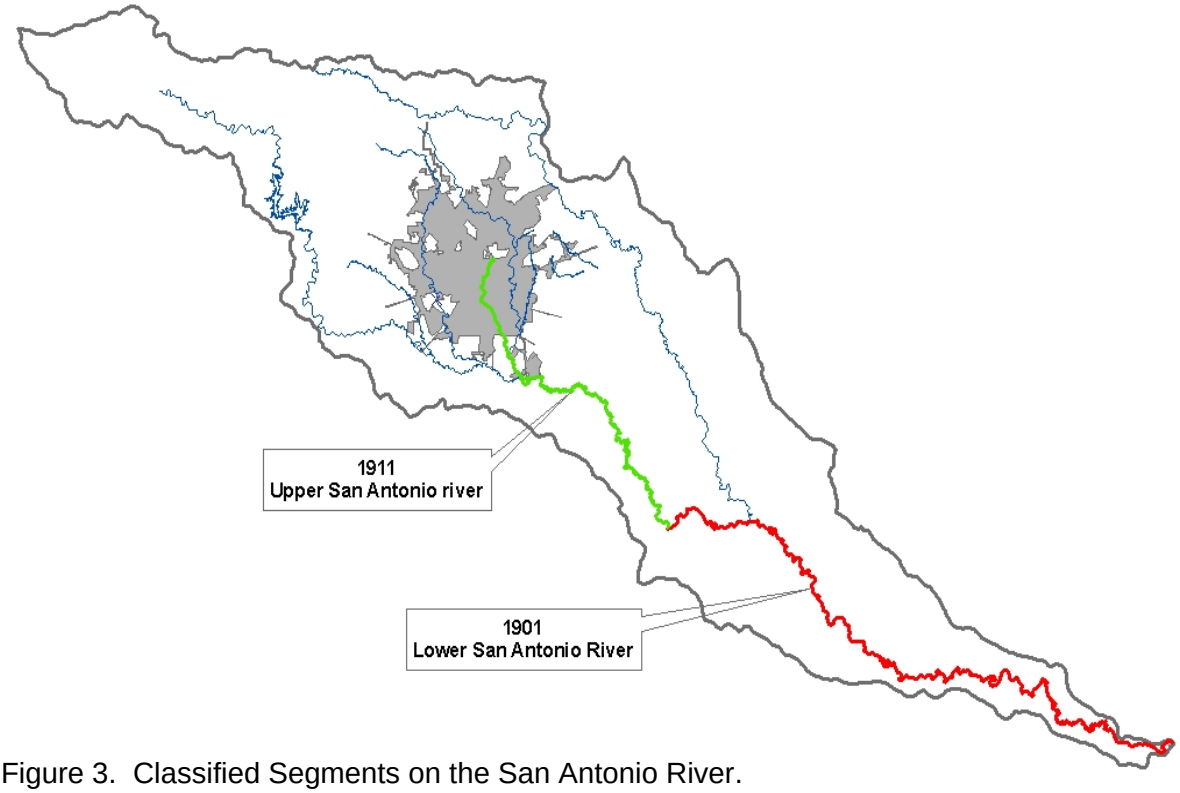

Figure 3. Classified Segments on the San Antonio River.

WQ Standards: http://www.tceq.state.tx.us/nav/eq/eq_swqs.html

Criteria: http://www.epa.gov/waterscience/standards/wqslibrary/tx/tx-wqs.pdf

		Uses		Criteria						
Seg-ment No.	Segment Name	Recreation	Aquatic Life Use	Cl^{-1} (mg/L)	SO_4^{2-} (mg/L)	TDS (mg/L)	DO (mg/L)	pH	Indicator bacteria* (#/100ml)	Te-mp ^0F
1901	Lower San Antonio River	Contact Recreation	High	180	140	750	5.0	6.5-9.0	126/200	90
1911	Upper San Antonio River	Contact Recreation	High	150	150	750	5.0	6.5-9.0	126/200	90

High Aquatic Life Use

Aq Life Subcategory	Dissolved Oxygen	Aquatic Life Attributes					
	Freshwater mean/min	Habitat	Species Assemblage	Sensitive Species	Diversity	Species Rich	Trophic Structure
High	5.0/3.0	Highly diverse	usual association of regionally expected species	Present	High	High	Balanced - slightly imbalanced

Texas Water Quality Inventory and 303(d) List

These reports describe the status of Texas waters based on historical data on surface-water and groundwater quality (the Inventory) and identify water bodies that are not meeting standards set for their use (the List). The reports satisfy the requirements of the federal Clean Water Act for both Section 305(b) water-quality reports and Section 303(d) lists. The Inventory and List are produced every two years in even-numbered years, as required by law. A List must be approved by the EPA before it is considered final.

Segments on the San Antonio River currently listed on the 303(d) list

1901 Lower San Antonio River
bacteria year 2000

1911 Upper San Antonio River
Impaired fish community 2006

Full report: http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305_303.html

Clean Rivers Program

The Texas Clean Rivers Program is a state fee–funded program for water quality monitoring, assessment, and public outreach. The program is a collaboration of 15 partner agencies (ex. SARA, BRA, etc.) and the TCEQ. The program provides the opportunity to approach water quality issues within a watershed or river basin locally and regionally through coordinated efforts among diverse organizations.

More information: http://www.tceq.state.tx.us/compliance/monitoring/crp/

Indicators: Lower San Antonio River

Water Quality

Water Quality Objectives

- Maintain flow in order to sustain water quality to support:
    - Biodiversity,
    - Economic uses, and
    - Recreational uses

Water Quality Indicators

Water quality data are used to describe the condition of a water body, to help understand why that condition exists, and to provide some clues as to how it may be improved. Water quality indicators include chemical measurements as well as certain physical and biological measurements. Some of the most common are listed here, with an explanation of why they are important to the health of a water body.

Category	Indicator	Explanation
Nutrients	Nitrogen Organic Nitrate plus nitrite Ammonia Total Phosphorus Filterable reactive Total	The nutrients nitrogen and phosphorus are essential for plant growth. High concentrations indicate potential for excessive weed and algal growth. Total nutrients are made up of a dissolved component (e.g. nitrate plus nitrite, ammonia and filterable reactive phosphorus) and an organic component, which is bound to carbon (e.g. organic nitrogen). Nutrients in the dissolved state can be readily used by plants.
Oxygen	Dissolved oxygen	Oxygen is essential for both plants and animals. There is often a relationship between discharge and dissolved oxygen concentrations. Decreased dissolved oxygen can be harmful to fish and other aquatic organisms. Nonpoint-source pollution as well as the decomposition of leaf litter, grass clippings, sewage, and runoff from feedlots can decrease the amount of dissolved oxygen in water. Dissolved oxygen is measured in milligrams per liter (mg/L). Expected levels: 4.0 to 12.0 mg/L.
Temperature	Temperature	Aquatic organisms are dependent on certain temperature ranges for optimal health. Temperature affects many water parameters, including the amount of dissolved oxygen available, the types of plants and animals present, and the susceptibility of organisms to parasites, pollution, and disease. Causes of water temperature changes include weather conditions, shade, and discharges into the water from urban sources or groundwater inflows. Temperature is measured in degrees Celsius (°C). Seasonal trends: May to October: 22 to 35°C, November to April: 2 to 27°C. Low flow conditions can also have an influence on temperature.
pH	pH	A measure of the acidity or alkalinity of the water. Changes to pH can be caused by a range of potential water quality problems (e.g. low values due to acid sulfate runoff). Extremes of pH (less than 6.5 or greater than 9) can be toxic to aquatic organisms.
Water clarity	Suspended solids	Small particles (soil, plankton, organic debris) suspended in water. High concentrations of suspended solids limit light penetration through water, and cause silting of the benthic (bottom) environment.
Water clarity	Turbidity	A measure of light scattering by suspended particles in the water column, provides an indirect indication of light penetration.

Category	Indicator	Explanation
Water clarity	Secchi depth	The depth to which the black and white markings on a Secchi disc can be clearly seen from the surface of the water provides an indication of light penetration.
Salinity	Conductivity	A measure of the amount of dissolved salts in the water, and therefore an indicator of salinity. In fresh water, low conductivity indicates suitability for agricultural use. In salt waters low conductivity indicates of freshwater inflows such as stormwater runoff.
Microalgal growth	Chlorophyll-a	An indicator of algal biomass in the water. An increase in chlorophyll-a indicates potential eutrophication of the system. Consistently high or variable chlorophyll-a concentrations indicate the occurrence of algal blooms, which can be harmful to other aquatic organisms.
Recreational health	Bacteria	*E. coli* and Enterococci bacteria are measured to determine the relative risk of swimming (contact recreation), depending on whether the water body is fresh or marine. These bacteria originate from the wastes of warm-blooded animals. The presence of these bacteria indicates that associated pathogens from these wastes may be reaching a body of water. Sources may include inadequately treated sewage, improperly managed animal waste from livestock, pets in urban areas, aquatic birds and mammals, or failing septic systems.
Metals	Concentration of Metals in Water	High concentrations of metals such as cadmium, mercury, and lead pose a threat to drinking water supplies and human health. Eating fish contaminated with metals can cause these toxic substances to accumulate in human tissue, posing a significant health threat. Metals also pose a threat to livestock and aquatic life. Potentially dangerous levels of metals and other toxic substances are identified through chemical analysis of water, sediment, and fish tissue.
Organics	Concentration of Organics in Water	Toxic substances from pesticides and industrial chemicals, called organics, pose the same concerns as metals. Polychlorinated biphenyls (PCBs), for example, are industrial chemicals that are toxic and probably carcinogenic. Although banned in the United States in 1977, PCBs remain in the environment, and accumulate in fish and human tissues when consumed.
Biological	Benthic Invertebrates	Macroinvertebrates are aquatic insects and other aquatic invertebrates associated with the substrates of waterbodies (including, but not limited to, streams and rivers). Macroinvertebrates can be useful indicators of water quality because these communities respond to integrated stresses over time which reflect fluctuating environmental conditions. Community responses to various pollutants (e.g. organic, toxic, and sediment) may be assessed through interpretation of diversity, known organism tolerances, and in some cases, relative abundances and feeding types. Examples of Pollution Intolerant Bugs: Mayfly, Caddisfly, Water Penny, Planarian, Dobson Fly, Stonefly Examples of Pollution tolerant bugs: Crayfish, Dragonfly, Damselfly, Clam, Leech, Midge, Aquatic Worm, Black Fly

Category	Indicator	Explanation
Biological	Fish	Fish diversity, species richness, species pollutant tolerance, disease prevalence, and other metrics are used to evaluate the aquatic health of water bodies as compared to a regional reference condition. Using fish as a water quality indicator is widely regarded as one of the more reliable methods for assessing human caused ecological impacts. For lists of tolerance groups of species in Texas, see Texas Parks and Wildlife Department River Studies Report No. 14. *Classification of Texas Freshwater Fishes Into Trophic and Tolerance Groups* (which can be found as Appendix J in River Studies Report No. 17 located at: http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_rp_t3200_1086.pdf
Fish consumption advisories and closures	Fish Tissue Analysis	The Texas Department of State Health Services conducts chemical testing of fish tissue to determine whether there is a risk to human health from consuming fish or shellfish caught in Texas streams, lakes, and bays. Fish seldom contain levels of contaminants high enough to cause an imminent threat to human health, even to someone who eats fish regularly. However, risk increases for people who regularly consume larger fish and predatory fish from the same area of contaminated water over a long period of time. To reduce health risks in areas of contamination, people should eat smaller fish from a variety of water bodies. When a fish consumption advisory is issued, a person may legally take fish or shellfish from the water body under advisory, but it is not recommended. When a fish consumption closure is issued for a water body, the taking of fish or shellfish is legally prohibited.