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. As required by the Act, the inventory 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.

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, and 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. Specific water quality criteria has been developed for water temperature, dissolved oxygen, pH, bacteria, chloride, sulfate and total dissolved solids have been developed 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 "concern for near nonattainment 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 and chlorophyll *a* are referred to as 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 (DO), specific conductance, pH, water temperature, stream flow (not in reservoirs) and transparency.

Dissolved oxygen 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**, 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 3 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 2008 (September 2007 through August 2008).

Table 3. FY 2008 Summary of Sampling for the Brazos River Basin (September 2007 through August 2008)

Sampling Entity	Field	Conventional	Bacteria	24-hr D.O.	Biological and Habitat	Metals in Water	Organics in Water
BRA	76 monthly 72 quarterly 9 semi-annually			8 semi-annually	8 semi-annually		
TCEQ	65 quarterly			4 semi-annually	2 semi-annually	15 quarterly 3 semi-annually	2 semi-annually
		1 quarterly					
	1 quarterly		1 quarterly				
	6 semi-annually						
TIAER	20 semi-monthly						
	7 semi-monthly		7 monthly				
	1 bi-monthly						
TPWD				3 annually			
Abilene	1 semi-annually						

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

Biological 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.