Briefing Paper on Trinity River and Eastern Bayous and Bays Watersheds:
Old River to High Island and Trinity and East Bays

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Description of the Watershed

This subwatershed begins on the east at High Island and the East Bay Bayou. It extends west to Old River and along Trinity Bay to Houston Point. The Trinity River watershed below the dam on Lake Livingston is part of the watershed, but our focus will be on the portion of the river in Liberty and Chambers Counties. This land area surrounds Trinity Bay and adjoins East Bay. There are no municipalities with populations over 10,000 in this area. There are a few industrial facilities on the western edge near Baytown.

Land Use and Habitat in the Watershed

Large tracts of land in this area are undeveloped. There is very limited commercial and residential land use with industrial land use restricted to a few facilities on the western edge of the area. Generally, land use in this subwatershed is agricultural with the most extensive efforts being rice farming and cattle grazing. There are forested areas along the edges of the Trinity River and some bayous. This area is the only one around Galveston Bay that still contains large areas of cypress swamp. The delta of the Trinity River has large areas of freshwater wetlands with forested and grassy wetland plant communities.

The Trinity River supplies more than half of the annual inflow of freshwater to Galveston Bay. It is responsible for the low salinity regime in Trinity Bay and the maintenance of brackish and fresh marshes in the delta and along the edge of Trinity Bay. There are old distributary channels near the delta that remain major water features today including Old River and Lost River. Moving upstream toward Lake Livingston, there are many oxbow lakes and swamps left from the river meandering over the landscape. In undeveloped areas, the river and associated water features are bounded by a bottomland hardwood forest. The Trinity River is habitat for a diverse freshwater fauna including large predators, such as large blue and flathead catfish.

The land between Trinity and East Bays is a mosaic of grassland and marsh. Little forest is left because so much has been converted to agricultural use. There are extensive canal systems for distributing the Trinity River water to rice farmers. The rice fields are unsuitable habitat for many of the prairie species, but they are heavily used by wading birds and over wintering waterfowl. This area holds populations of small mammals, which have been impacted by the epidemic abundance of the introduced Nutria.

Water Quality Issues

There are no heavily developed locations adjacent to the water in this area. So there are few instances of discharge of polluted water. However, the Trinity River does receive effluent from the Dallas-Fort Worth metropolitan area and other municipalities along its route to the bay. Some of these contaminants can be metabolized, but there is still residual pollution when the river empties into the Bay. This appears to be the largest source of pollution inputs in this area. It is possible that pollution deposited from the air makes a significant contribution, but there is insufficient information to make that judgment.

In this subwatershed, there are agricultural sources of nutrient and fecal coliform contaminants that can produce local degradation of water quality. The screening levels for nutrients used by TCEQ for classifying the quality of estuarine waters are often exceeded by the levels in samples taken from Trinity Bay. The indicator developed by the Galveston Bay Indicator Project rates Trinity Bay as only moderate for nutrients in surface water. (See Tables 1 and 2.)

Table 1. Indicator rating system developed for the nutrients in surface waters indicator. Table created by the Galveston Bay Indicators Project, Houston Advanced Research Center.

Rating	Percent of samples exceeding TCEQ screening levels
Very Good	0-5%
Good	6-15%
Moderate	16-30%
Poor	>30%

As seen in the Table below, Trinity Bay appears to have experienced an improvement in nutrient concentrations since the 1980's, but it still has higher nutrient conditions than East Bay.

Table 2. Indicator describing the state of nutrients (ammonia, nitrate-nitrite, total phosphorus) and chlorophyll-a/pheophytin concentrations in surface waters as an average proportion of TCEQ screening levels by decade from the 1970s through 2000s. Please refer to Table 1 for a description of the color system. Table created by the Galveston Bay Indicators Project, Houston Advanced Research Center. Data source: Texas Commission on Environmental Quality and the National Coastal Assessment, Texas Parks and Wildlife Department.

Subbays and Tributaries	1970s	1980s	1990s	2000s
Trinity River				
Trinity Bay				
East Bay				

Contaminants in Seafood

Pollutants are often difficult to detect in water samples because they degrade or leave the water column. Evidence of pollutants having been in the water can be collected by sampling the sediment, into which some pollutants are deposited, or the living organisms, which take up contaminants through feeding or across the skin and membranes. In this subwatershed, there is evidence of some contamination by industrial chemicals in the tissues of living organisms.

The Galveston Bay Indicator Project used data obtained by DSHS for an assessment of seafood safety to create an indicator using contamination of tissue to judge pollution of water. Only a few representative contaminants are used to create the indicator. The selected compounds and metals are known or suspected to cause acute or chronic diseases of the nervous, circulatory, endocrine and other systems of the body. The compounds have the potential to be more damaging in combination than alone, but very little research has been done on synergistic effects of pollutants. The risk ratios are scored for the indicator according to the following system.

Table 3. Tissue contaminant risk ratios calculated by the Galveston Bay Indicator Project by dividing the average observed concentration by the screening level employed as a health assessment comparison criterion. Table created by the Galveston Bay Indicators Project, Houston Advanced Research Center.

Rating	Risk Ratio
Very Good	All compound ratios < 0.1
Good	All compound ratios < 0.5; 1 or more > 0.1
Moderate	All compound ratios < 1.0, 1 or more > 0.5
Poor	1 compound ratio > 1.0

Analyzed metals included cadmium, mercury, and zinc. Pesticides selected for inclusion in the indicator were chlordane, DDE, dieldrin, heptachlor epoxide and hexachlorobenzene. These compounds are the most commonly detected pesticide contaminants in the DSHS data. Aroclor 1260 was the only PCB detected in any of the samples collected from Galveston Bay.

A risk ratio equal to one for PCBs would mean that the average concentration of this contaminant was equal to the value at which DSHS considers issuing a seafood consumption advisory. The indicator suggests that risk increases as the number of contaminants detected in the seafood increases. However, the relationship to safety of seafood consumption is not simple and should not be attached to this indicator. This indicator is principally a measure of biological uptake of past water and sediment contamination.

Table 4. Indicator describing the state of contaminants in biota as a proportion of Health Assessment Comparison (HAC) values published by the DSHS. Refer to Table 3 for a description of the color system. Table created by the Galveston Bay Indicators Project, Houston Advanced Research Center. Data source: Texas Department of State Health Services.

Subbays	Metals	PCB	Pesticides
Upper Galveston Bay		*	
Trinity Bay			
East Bay			

*Does not include 2004 data from DSHS

Public Health Issues

Risk of illness from contact recreation is directly related to the concentration of human pathogens in the water. Water quality monitoring has historically used a measure of fecal coliforms as an indicator of the likely concentration of human pathogens. Fecal coliform concentrations are low in water samples from Trinity Bay, East Bay and the Trinity River. There is low risk for swimming, wade fishing or boating in these waters.

Human health can be impacted by pathogens or toxins contaminating seafood. The Texas DSHS conducts monitoring programs to assess the risk of illness from consumption of Galveston Bay seafood and to regulate oyster harvesting for protection of public health. DSHS has assayed the tissue of fish and crabs from Trinity and East Bays for a variety of toxic and carcinogenic compounds. A summary of the results are presented in Tables 1 to 4 above. None of the contamination detected in 1999 samples occurred at concentrations that would warrant a seafood consumption advisory and no advisory has been issued. However, additional sampling is planned subsequent to the new seafood advisory based on the contamination with PCBs of spotted seatrout collected in Upper Galveston Bay.

Historical bacterial contamination of shellfish waters has resulted in restriction of oyster harvest from water close to the Trinity Bay shoreline from Houston Point, below Baytown, to several miles south of Anahuac on the eastern shore of Trinity Bay. There is also an area restricted for shellfish harvest on the eastern end of East Bay where it receives effluent from the Intracoastal Waterway.

Other Issues

This subwatershed has the highest potential to be impacted by drastically reduced freshwater inflow. The majority of inflow to Galveston Bay comes from the Trinity River. Upstream of the bay, the river feeds reservoirs that are major components of the water supplies to Dallas-Fort Worth and Houston, the largest metroplexes in the state. Large reductions in flow down the Trinity River would particularly alter the salinity regime in Trinity Bay.

Lower Trinity Bay and the western portion of East Bay are areas of high importance to the oyster industry. The commercial leases that sustain the oyster industry during periods of high temperature and low water quality are located in this area. Also, Trinity and East Bay are major sources of shrimp and blue crabs for commercial fishermen. Changes in the salinity pattern could negatively impact the populations of commercial species. Increasing salinity due to decreasing freshwater inflow is a serious concern for commercial fishing operations that depend on the east side of the Galveston Bay system.

Conclusion

The land in the subwatershed is largely converted to agricultural use, but still provides important habitat to migratory birds and resident water birds. Very little of the land has been converted to industrial, commercial or residential uses. Agricultural land generates some types of pollution, but agricultural use in the Galveston Bay watershed does not yield the same impact on water quality by acre as the developed residential, commercial or industrial land. The relatively undeveloped nature of the land results in low levels of contamination to the water and sediment. There are some concerns about high levels of nutrients and fecal coliform bacteria, but not to the degree that is found in water bodies on the more developed western side of the Galveston Bay system. Contamination of seafood may be an emerging problem, but there is insufficient data at this time to advise caution in consuming seafood from this area. The greatest potential problem is the possibility of reduced freshwater inflow from the Trinity River.