# HOW'S THE WATER?

## 2002 BASIN HIGHLIGHTS REPORT

SAN JACINTO RIVER BASIN • TRINITY-SAN JACINTO COASTAL BASIN
SAN JACINTO-BRAZOS COASTAL BASIN • BRAZOS-COLORADO COASTAL BASIN

# 2002 Basin Highlights Report


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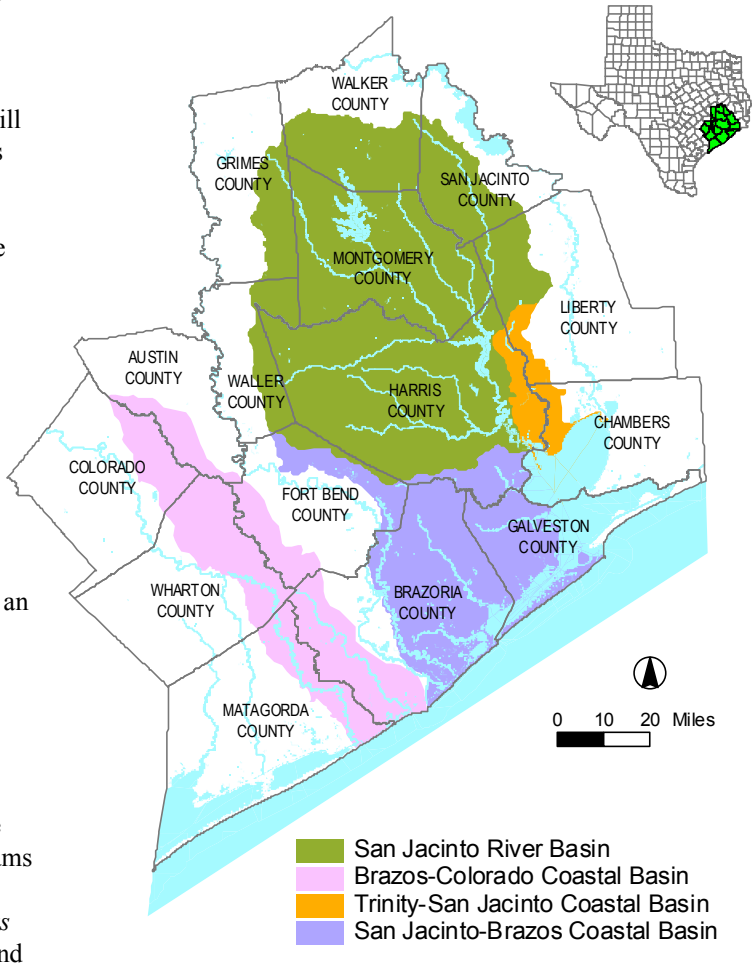
# OUR WATER RESOURCES

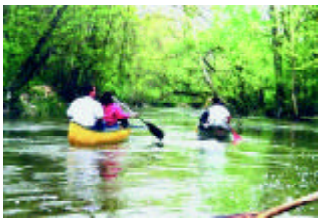
People have always been drawn to water. Almost without exception, the world's great cities are closely identified with their water features -- the Seine in Paris, San Francisco Bay, and the Chicago Lakefront are just a few examples. Historically, cities developed along rivers or coastal areas because of their economic functions as transport mediums or fisheries. While these functions are still important, water resources are increasingly seen as recreational and aesthetic amenities that add to the quality of life of residents and as attractions for visitors. Such amenities have grown in importance as regions compete for the best and the brightest workers.

The Houston-Galveston region is rich in water assets, with an extensive 16,000-mile network of rivers, streams and bayous, feeding into numerous lakes and one of the nation's most important estuarine systems - Galveston Bay. These waterbodies provide a home for a wide variety of freshwater and saltwater fishes and also support a diverse vegetative habitat along their corridors for an incredible array of other wildlife.

Through its Clean Rivers Program (CRP), the Houston-Galveston Area Council (H-GAC) is committed to educating the public about our water resources, and coordinating the efforts of local governments, state and federal agencies to provide high quality data and effective management programs to ensure that these resources can be enjoyed by present and future residents. This *Basin Highlights Report* describes the condition of our waterways and highlights some of the major efforts of the H-GAC's Clean Rivers Program over the last year.

H-GAC's CLEAN RIVERS PROGRAM
ASSESSMENT BASINS






## *So, how's the water?*

Not as bad as you might think, considering the pressures of population growth, urban development, agricultural and industrial activity in the region. This is in large part due to major improvements in wastewater treatment over the past 30 years, as well as more recent programs to reduce "nonpoint source" pollution from stormwater runoff. However, several water quality problems persist.

Almost half of the stream segments in the H-GAC's Clean Rivers Prgram study area show elevated levels of bacteria. While the region's bayous are generally safe for canoeing or boating, they pose significant health risks if large amounts of water are ingested or received in an open wound. High toxicity levels are also present in the Houston Ship Channel and the smaller side bays that it feeds. Additionally, nutrient enrichment, which leads to algal blooms and negative impacts on aquatic flora and fauna, is a concern in several area waterways.

Information about specific waterways is presented later in this report, beginning on page seven.

## *What are we doing to protect and restore our waterways?*

H-GAC's Clean Rivers Program encompasses four major basins: the San Jacinto River Basin, the Trinity-San Jacinto Coastal Basin, the San Jactinto-Brazos Coastal Basin, and the San Bernard River Basin within the Brazos-Colorado Coastal Basin. H-GAC coordinates the water quality monitoring efforts of five local agencies in these river basins under a single "quality assurance" plan. This local monitoring supplements data collected by the Texas Natural Resource Conservation Commission (TNRCC) and provides a much more detailed picture of water quality conditions than has existed in the past. All of the data is made available through an Internet-based Data Clearinghouse.

Additionally, the Clean Rivers Program provides funding for special studies designed to assist water quality management agencies in the search for solutions to specific water quality problems throughout the region. In many cases, these studies represent leading-edge research that will result in more cost-effective regulatory and management programs.

*Keeping our water clean ensures healthy ecosystems and safe recreation opportunities, contributing to the region's quality of life, tourism appeal, and long-term economic stability.*

# WATER QUALITY REVIEW

## *Overview*

The following section contains a brief discussion of potential sources of water pollution and water quality issues within each H-GAC Clean Rivers watershed. Starting on page seven, individual waterbodies are reviewed. More detailed information can be found in H-GAC's 2001 Basin Summary Report at: www.hgac.cog.tx.us/waterdata. A summary table of this information can be found in Appendix A. Descriptions of the assessed waterbodies are listed in Appendix B.

Waterbodies that do not meet standards for their designated uses are listed as "impaired". This designation , known as the "303(d) list" targets the waterbody for special study and possible remedial action. Those waterbodies listed with "concerns" are not placed on the 303(d) list, but enhanced monitoring is conducted for use in a more comprehensive assessment.

## *Watershed management Issues*

Elevated **bacteria** levels continue to be the overwhelming water quality issue throughout H-GAC's basins. Nonpoint sources, those not associated with a wastewater treatment plant, appear to be the biggest contributor to the problem. Some of these sources include failing or improperly maintained septic systems and stormwater runoff containing animal and pet waste. Sewage from failing sewer infrastructure often leaks into storm drains during dry weather, allowing wastewater to make its way to bayous, creeks, and lakes without treatment of any kind. There is also potential for wastewater collection system failure or overflow at the plant. Additionally, discharges from a pipe or wastewater treatment plant, can never be ruled out and must continue to be monitored.

**Toxic substances** found along the Houston Ship Channel have resulted in a Texas Department of Health advisory on fish consumption in the industrialized area, including smaller side bays that receive water from the Ship Channel. The source of dioxin is unclear, but is not thought to come from point sources, since those discharges have not shown any dioxin in water quality samples. While ongoing investigation has not detected dioxin in the water column, fish and crab tissue show high levels of the contaminant. There has also been some detection of dioxin after rain events in tributaries that flow to the Ship Channel. The dioxin found may be in part remnant from sources no longer active or may result from atmospheric deposition and runoff associated with that deposition.

### Area Waterway Impairments Removed from 303(d) List

Some waterways are placed on the list of impaired waterbodies with very little data. As a result of additional and recent monitoring data, TNRCC removed parameters from segments or an entire segment from the 303(d) list. Those segments and associated parameters include the following:

| | |
|---|---|
| Cedar Bayou Tidal (0901) | bacteria |
| Cedar Bayou Above Tidal (0902) | bacteria, Total Dissolved Solids |
| San Jacinto River Tidal (1001) | bacteria |
| Houston Ship Channel (1006) | copper (chronic) in water, water toxicity |
| Cypress Creek (1009) | total dissolved solids |
| Clear Creek Tidal (1101) | carbon disulfide, chlordane, tichloroethane, and dichloroethane in fish and crab tissue |
| Clear Creek Above Tidal (1102) | carbon disulfide, chlordane, tichloroethane, and dichloroethane in fish and crab tissue |
| Chocolate Bayou Above Tidal (1108) | bacteria, Total Dissolved Solids |
| Oyster Creek Tidal (1109) | bacteria |
| Oyster Creek Above Tidal (1110) | bacteria |
| Armand Bayou Tidal (1113) | bacteria |
| West Bay (2424) | copper |
| Lower Galveston Bay (2439) | copper |

One segment, West Fork San Jacinto River (1004), was new to the 303(d) list. The segment contains elevated levels of indicator bacteria.

***REMEMBER: What goes down the storm drain flows directly to our creeks, bayous, lakes, and bays...untreated.***

**Pesticides**, when excessively applied on lawns or agricultural fields, or spilled, are washed down stormdrains or into adjacent streams during heavy rain events and have been found in some waterbodies around the region.

Elevated levels of nitrates and phosphates, or **nutrient enrichment**, are found throughout many of the subwatersheds. These compounds can create excessive algae that eventually deplete that water of dissolved oxygen (DO), causing stressful conditions for aquatic species, and prevent sunlight from reaching aquatic vegetation. These excessive levels also affect the recreational value of the waterbody due to loss of aesthetics, discoloration, and musty odors.

The most prevalent nutrient concern in the region is the excessive levels of **ammonia-nitrogen** found in the water. High concentrations of ammonia can also have a negative impact on the health of aquatic life.

Sources of nitrogen and ammonia include excess fertilizers and animal waste washed off during heavy rain events, sewage, decomposing plant debris, and atmospheric deposition. Phosphorus is primarily transported by attaching to sediment particles. Sources of phosphorus include animal waste runoff, sewage treatment plant discharge, industrial processing discharge, and sediment runoff from agricultural areas and mining activities.

H-GAC is working to expand the monitoring of nutrients throughout the region. With added information, H-GAC will be better able to assess the level of concern for nutrient enrichment.

## Sources of Nonpoint Source Pollution

**Nonpoint source** (NPS) pollutants are those that enter a waterbody through diffuse mechanisms such as rainwater runoff. As stormwater runs off into waterbodies, it has the potential to pick up pollutants such as fertilizers, pesticides, nutrients (such as nitrates and phosphates), toxic chemicals, oil, gasoline, and bacteria.

**The following may generate NPS pollution:**

-- Malfunctioning septic systems
-- Oil spills
-- Littering
-- Dumping of hazardous substances such as antifreeze, oil, gasoline, oil-based paints or other hazardous household wastes
-- Unneccesary or excessive use of fertilizers and pesticides
-- Failure to pick up pet waste
-- Inadequate pollution control measures at construction sites
-- Outdoor equipment cleaning
-- Runoff from streets

The following section contains information on each of H-GAC's Clean Rivers Program subwatersheds. Each subwatershed has been ranked according to the degree of impairment or concern. For information on number of samples collected, number of samples exceeding criterion, and specific impairment zones for each designated use, visit TNRCC's web site at: http://www.tnrcc.state.tx.us/water/quality/02_twqmar/02_305b/index.html

**Ranking Key**

**= poor condition, segment and/or watershed is heavily impaired**

**= marginal condition, the segment and/or watershed contains some impairments**

**= excellent condition, there are no known water quality concerns for the segment and/or watershed**

## Trinity-San Jacinto Coastal Basin

(Watersheds are listed alphabetically, upstream to downstream)

**Cedar Bayou Above Tidal (0902)** 

As a result of the analysis of monitoring data collected since the previous assessment, TNRCC has removed bacteria and total dissolved solids impairments for this waterbody from the 303(d) list. Cedar Bayou Above Tidal is currently listed only for low concentrations of dissolved oxygen (DO), creating an aquatic life use impairment. Low DO concentrations may result from hydrological conditions, where the stream is sluggish, from lack of adequate flow for flushing purposes, or other unknown sources. The watershed is almost completely undeveloped. There are seven domestic outfalls (effluent discharge points) and six industrial outfalls.

**Cedar Bayou Tidal (0901)** 

The tidal portion of Cedar Bayou is currently listed as impaired due to dioxin in catfish and crab tissue. The bacteria impairment has been removed as the result of additional monitoring efforts. Some development can be found in the westernmost portion of the watershed. There are 10 domestic outfalls and 11 industrial outfalls.

## San Jacinto River Basin

(Watersheds are listed alphabetically, upstream to downstream)

**Buffalo Bayou Above Tidal (1014)** 

Buffalo Bayou is divided into many segments, mainly due to the nature of the Houston Ship Channel. Segment 1014 constitutes the above tidal portion of the larger watershed. The watershed is densely developed in the eastern portion, while the tributaries in the headwaters of the watershed currently remain less densely developed or are used as farmland. However, urban development continues to move westward. There are 105 domestic treatment outfalls and 17 industrial outfalls.

The predominant impairment is bacteria, with some concerns for low dissolved oxygen in some of the smaller tributaries. There is currently a special investigation underway to address the bacteria issue and to attempt to determine sources of contamination. Nonpoint source pollution from urban runoff is a major factor. Other sources include untreated effluent from municipal outfalls as well as wastewater collection system failure(s). There may also be a significant influence from wildlife, including waste from birds, raccoons, deer, and other animals, that runs into waterways during storm events.

Nutrients, including ammonia, nitrate+nitrite-nitrogen, orthophosphorus, and total phosphorus, appear in excess throughout the main stem of Buffalo Bayou. Sources of nutrients include municipal point sources such as wastewater treatment plant outfalls, collection system failure(s), as well as urban and rural stormwater runoff.

**Buffalo Bayou Tidal (1013)** 

The Buffalo Bayou Tidal watershed is relatively small and encompasses the downtown Houston area. Over 70% of the watershed is impervious cover, where water flows across the surface instread of infiltrating into the ground. There are no domestic outfalls, but there are six industrial outfalls.

Many of the issues associated with the above tidal portion of the bayou apply to the tidal portion of the bayou. High bacteria levels are a major concern. The current Buffalo Bayou Above Tidal study also addresses the bacteria issues in this watershed. The segment is listed as impaired due to copper (chronic) in water. Nutrients along the main stem are elevated, and low dissolved oxygen levels and high ammonia concentrations can be found in some tributaries.

**Caney Creek (1010)** 

Caney Creek is not listed for any impairments or concerns. The watershed is predominantly undeveloped and contains few known sources of pollution. There are 18 domestic outfalls and no industrial outfalls. A systematic monitoring effort is scheduled for late summer 2002 for this watershed in an effort to gain more background information about the watershed.

**Cypress Creek (1009)** 

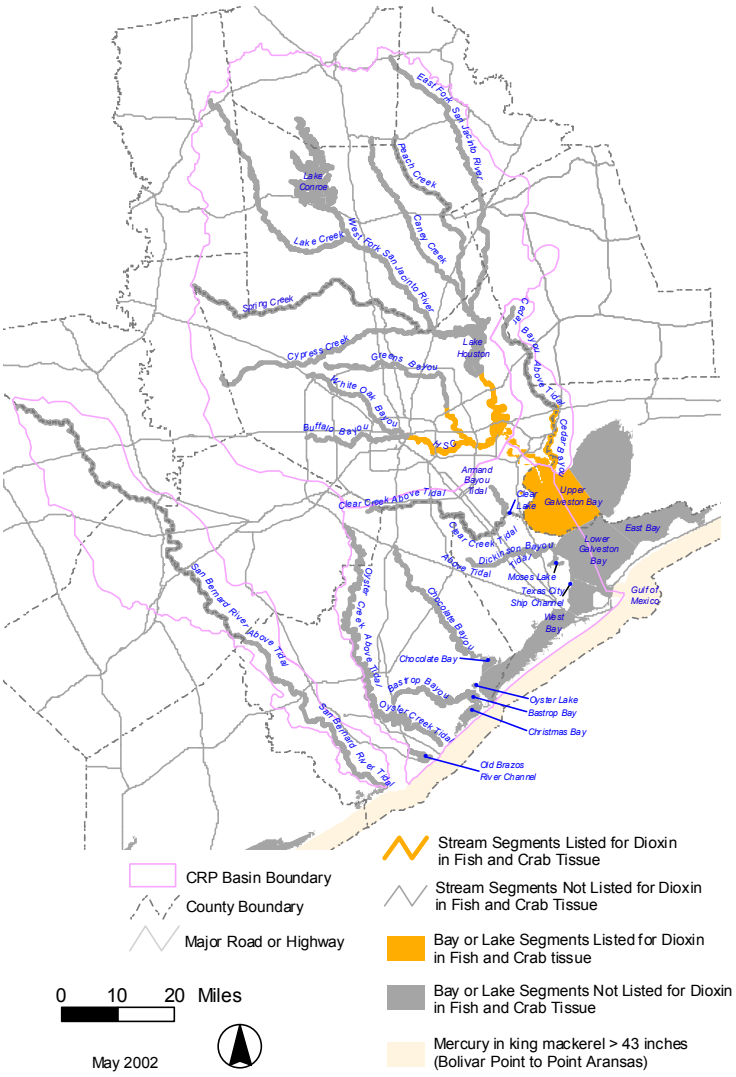
The Cypress Creek watershed is experiencing rapid westward growth. Currently the majority of the high density development is between Hwy 290 and IH 45. There are 102 domestic outfalls and 10 industrial outfalls. While the total

dissolved solids impairment has been removed from the 303(d) list, the segment does not meet its contact recreation use, such as swimming, due to elevated levels of bacteria. This may be a result of problems with sanitary sewer lines, leaking or improperly maintained septic tanks, or permitted land disposal of effluent from wastewater treatment plants onto agricultural fields or golf courses for use as a natural fertilizer. There are also concerns for excessive nutrients as well as low dissolved oxygen levels along the main stem that may result from many of the same sources.

**East Fork San Jacinto River (1003)**
The East Fork of the San Jacinto River is predominantly undeveloped, with the Sam Houston National Forest making up most of the upper portion of the watershed. There are two domestic outfalls and three industrial outfalls. The segment is not on the list of impaired waterbodies, nor are there any known water quality concerns.

**Greens Bayou Above Tidal (1016)**
The above tidal portion of Greens Bayou experiences many of the issues of all urban watersheds. There are 120 domestic outfalls and 23 industrial outfalls. High bacteria levels throughout the watershed continue to be a priority. Due to the characteristics of the watershed, known sources are similar to those in Buffalo Bayou, including municipal point sources, collection system failure, and urban stormwater runoff.

**STREAM SEGMENTS WITH DIOXIN OR MERCURY IMPAIRMENTS**




While nutrient levels are excessive along the main stem of Greens Bayou, ammonia concentration and low dissolved oxygen levels are concerns in some tributaries that feed the bayou. Chromium (chronic) in water is also listed as a concern along the main stem.

**Houston Ship Channel/Buffalo Bayou (1007)**
Water quality standards for the Houston Ship Channel/Buffalo Bayou apply to the Ship Channel as well as the tidal tributaries that flow to the Ship Channel. Hunting Bayou, Vince Bayou, Little Vince Bayou, Brays Bayou, and Sims Bayou, along with their smaller tributaries, are included in this watershed. The watershed is heavily developed, with 48 domestic outfalls and 83 industrial outfalls. Many of the industrial outfalls are along the Houston Ship Channel. The City of Pasadena contains a large number of industrial parks and is just south of the Ship Channel. Upstream of the Ship Channel industrial facilities, the land use is distinctly different. This area is characterized more commonly with mixed high density commercial and residential development.

The main stem along with many of the tidal tributaries is listed as not meeting its fish consumption use due to dioxin, PCBS, and pesticides in fish tissue. Vince Bayou is impaired due to ambient toxicity in sediment. Other impairments along the tributaries in the watershed include elevated bacteria levels and low dissolved oxygen occurrence. Aquatic life assessments are scheduled to determine the appropriate level of use for many of the smaller tributaries. Nutrient

enrichment concerns, particularly ammonia, are found throughout many of the unclassified tributaries as well. Hunting Bayou Tidal exhibits high pH values. The main stem is also listed with concerns for cadmium, copper, and zinc in sediment.

**Brays Bayou Above Tidal (1007B, 1007P)** 

Due to the difference in characteristics between the input to the nontidal portion of Brays Bayou to that of the tidal Houston Ship Channel waters, H-GAC has decided to assess the segment's watershed separately. The watershed is predominantly residential with mixed commercial land uses. Bacteria is again the primary factor impairing the waterbody's ability to support contact recreation. Nutrients, particularly ammonia, are another concern that requires additional monitoring and assessment.

**Sims Bayou Above Tidal (1007D, 1007Q)** 

While this watershed is similar to that of Brays Bayou, the Sims Bayou watershed has more open space and lower density development in the mid-to upper portions. Water quality issues in the watershed are similar as well. Bacteria levels prohibit safe contact recreation, and the portion of the bayou from just south of West Orem Road to South Post Oak exhibits low dissolved oxygen levels. This area of the bayou is much smaller and moves sluggishly across the flat terrain. Low dissolved oxygen values may be a natural factor in the aquatic system. Aquatic life assessments are scheduled to begin in late summer 2002 to determine if dissolved oxygen criteria for this reach is appropriate.

**Houston Ship Channel (1006)** 

This segment includes Halls Bayou, Patrick Bayou, Goodyear Creek, the tidal portion of Greens Bayou, Carpenter's Bayou, Sheldon Reservoir as well as other smaller tributaries to these waterways. Tidal portions of bayous are assessed using the standards for the Houston Ship Channel. Nontidal waterbodies are characterized as unclassified segments and are assessed for aquatic life use and contact recreation. There are 103 domestic outfalls and 68 industrial outfalls. The Halls Bayou corridor is predominantly residential and mixed commercial development as well as some light industry. There are numerous domestic outfalls in this area. The area around Sheldon Reservoir is less developed and has a state natural area around portions of the waterbody. There are several known areas of failing septic systems in upper portions of the watershed including areas around Sheldon Reservoir and an area along Halls Bayou between IH 45 and US 59. The lower portion of the watershed contains the Houston Ship Channel. This area has a large number of industrial outfalls along with heavy industrial activity and barge traffic.

The Ship Channel and its tidal tributaries are listed as impaired due to dioxin, PCBs, and pesticides in fish tissue. The main stem of the Ship Channel is listed with a concern for high levels of nitrate+nitrite nitrogen. Other nontidal segments are listed as impaired for having elevated bacteria levels, and are listed for a nutrient enrichment concern for having high ammonia concentrations. There are toxicity issues concerning Patrick Bayou, the first waterbody ever to be nominated for a Superfund site (uncontrolled or abandoned hazardous waste site). For more details on contaminants in Patrick Bayou, see Appendix A.

**Houston Ship Channel/San Jacinto River (1005)** 

There are six domestic outfalls and 41 industrial outfalls. The watershed is predominantly developed with industrial facilities. Water quality issues include PCBs, and pesticides in fish tissue, downstream I-10 to of Lynchburg Ferry Road, and dioxin. There is currently a study underway to address this issue.

**Lake Conroe (1012)** 

Lake Conroe serves as a drinking water source for the region as well as for contact recreational purposes. The watershed is developed around the lake, while much of the rest of the land is used for grazing. There are 42 domestic outfalls and two industrial outfalls. There are no known water quality problems in the lake; however, there are concerns for low dissolved oxygen values and high pH values.

**Lake Creek (1015)** 

There are no known water quality problems in the watershed. Most of the watershed is currently undeveloped and remains one of the few "wilderness" areas in the region. There are 22 domestic outfalls. There are several major developments, encompassing over 5,000 acres each, currently being constructed in the watershed. A systematic monitoring effort is scheduled to begin in late summer 2002 for this watershed in an effort to gain more information about the waterways as well as to measure developmental impacts.

**Lake Houston (1002)**

Lake Houston is a major drinking water source for the City of Houston. The lake also serves as a recreational facility. The watershed encompasses the lake itself and Luce Bayou. There are 10 domestic outfalls and two industrial outfalls. Over 70% of the watershed is undeveloped or open land. There are no known water quality issues in the watershed; however, elevated nutrients and low dissolved oxygen values in the lake are listed as concerns. Luce Bayou is also noted as having a low dissolved oxygen concern. Eight other watersheds drain to the lake. These include Cypress Creek, Spring Creek, Lake Creek, the West Fork of the San Jacinto River, Lake Conroe, Caney Creek, Peach Creek, and the East Fork of the San Jacinto River. Be aware that the water quality of these watersheds impacts the public water supply. Maintaining the water quality of this area is imperative to having clean drinking water at a reasonable price for the region.

**Peach Creek (1011)**

Peach Creek is another watershed that is predominantly undeveloped (95%) and has no known water quality impairments or concerns. There are six domestic outfalls and no industrial outfalls. A systematic monitoring effort is scheduled for late summer 2002 for this watershed in an effort to gain more information about the creek and its tributaries.

**San Jacinto River Tidal (1001)**

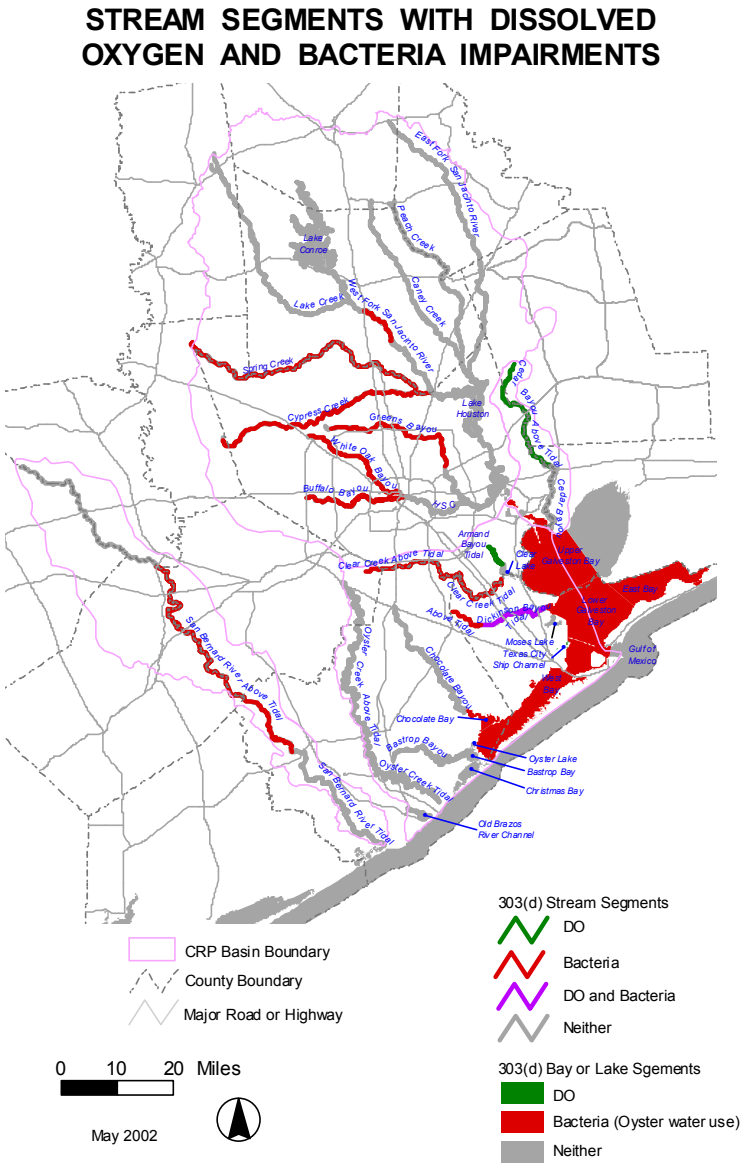
The San Jacinto River Tidal segment includes that portion of the river that flows from the Lake Houston outlet and drains to Galveston Bay. About half of the watershed is undeveloped or open land, while its developed areas are low density. The watershed has 17 domestic outfalls and 13 industrial outfalls. Primary water quality concerns include PCBs and pesticides in fish tissue up to the intersection with Hwy 90 and dioxin up to the Lake Houston Dam. The segment has been taken off of the 303(d) list for bacteria, thus reinstating its designation for contact recreation use.

**Spring Creek (1008)**

While over 80% of the watershed is undeveloped, the area is experiencing rapid growth toward the west. There are 59 domestic outfalls and two industrial outfalls. The segment is listed for not attaining its contact recreation use due to elevated bacteria levels as well as for low dissolved oxygen occurence from SH249 to IH 45. Low dissolved oxygen is also found in the Upper Panther Branch and Lake Woodlands subsegments. Ammonia is a concern along Upper Panther Branch. Excessive levels of other nutrients, including nitrate+nitrite-nitrogen, orthophosphorus, and total phosphorus, are found along the main stem.

**West Fork San Jacinto River (1004)**

The City of Conroe is located in the upper portion of the watershed. However, the rest of the watershed is primarily undeveloped (85%) or less densely developed. The segment is new to the list of impaired waterbodies in the region. Bacteria levels from IH 45 to 10 miles downstream are above the maximum levels set for contact recreation. There are also DO and nutrient,



namely nitrate+nitrite-nitrogen and orthophosphorus, concerns along the main stem.

**White Oak Bayou (1017)** 
There is also a special study for bacteria on White Oak Bayou. Much of the landscape is the same as that in the Buffalo Bayou watersheds: high density mixed residential and commercial land uses. About one quarter of the watershed remains open land. Most of these areas are near the headwaters. There are 64 domestic outfalls and six industrial outfalls. Nutrient levels on the main stem and ammonia levels throughout the watershed are above screening levels for fresh waterbodies, and there are instances of low dissolved oxygen in two unnamed tributaries of the bayou. These low dissolved oxygen values may be a natural occurrence due to the hydrology of the small tributaries.

## San Jacinto-Brazos Coastal Basin

(Watersheds are listed alphabetically, upstream to downstream)

**Armand Bayou (1113)** 
While almost half of the watershed remains undeveloped, the development in place is dense, with large acreages of industrial facilities in the northern portion of the watershed. There is a large amount of undeveloped land in the center of the watershed, and the lower portion is predominantly mixed residential and commercial. Ellington Field is also within the watershed boundary. There are six domestic outfalls and eight industrial outfalls.

The contact recreation impairment on the tidal portion of the bayou has been removed from the 303(d) listing due to additional data collection. The segment is still listed as impaired due to low levels of dissolved oxygen. There are also concerns for excessive algal growth and high pH values. The dissolved oxygen and bacteria impairments remain in the above tidal portion. The low dissolved oxygen levels in the headwaters result from inadequate flushing of water through the bayou.

**Bastrop Bayou (1105)** 
The watershed is predominantly undeveloped and has no known water quality concerns. There are five domestic outfalls. The City of Angleton is the only urban area in the watershed, and there are numerous stock ponds and irrigation ponds. Much of the land is used for grazing.

**Chocolate Bayou Above Tidal (1108)** 
The watershed is predominantly undeveloped and has no known water quality concerns. The bacteria and total dissolved solids impairments have been removed from the 303(d) list for this segment as a result of recent monitoring efforts. There are nine domestic outfalls and one industrial outfall. The upper portion of the watershed contains low density and rural development. Agricultural practices are the main land use.

**Chocolate Bayou Tidal (1107)** 
The watershed is predominantly undeveloped and has no known water quality concerns. Agriculture is the predominant land use. The small community of Liverpool is the only rural development in the watershed. Several industrial facilities are located in the lower portion of the watershed, near Chocolate Bay. There are three domestic outfalls and six industrial outfalls.

**Clear Creek Above Tidal (1102)** 
Prior concerns about carbon disulfide, chlordane, trichlorethane, and dichlorethane have been addressed. (See section on Total Maximum Daily Loads (TMDLs).) However, there remains an impairment for bacteria throughout the watershed. In addition, TDS and chloride levels are elevated along the main stem, causing general use impairments. Other concerns include high ammonia concentrations throughout the watershed, and low dissolved oxygen as well as excessive nutrient levels along the main stem. Mixed high density and low density development is scattered throughout the watershed. Over half of the watershed remains open land. There are two domestic outfalls and seven industrial outfalls.

**Clear Creek Tidal (1101)** 
Prior concerns about carbon disulfide, chlordane, trichlorethane, and dichlorethane have been addressed. (See section on TMDLs in the region.) Elevated bacteria levels do not allow either Clear Creek or its major tributary Chigger Creek to meet the contact recreation use. While there is a concern for high pH values along the main stem, Chigger Creek exhibits high ammonia concentrations. There is dense development throughout the watershed with some large areas of

open space. Also, there are eight domestic outfalls.

**Dickinson Bayou Above Tidal (1104)** 
The above tidal portion of the watershed is listed as impaired for high bacteria levels. Other concerns include low dissolved oxygen and high ammonia concentrations. The watershed is primarily undeveloped below FM 517 and upland from the headwaters. Parts of Friendswood and League City are within the northeastern section of the watershed. There are five domestic outfalls and two industrial outfalls.

**Dickinson Bayou Tidal (1103)** 
Development is centered along the bayou within the City of Dickinson. There are some large acreages of open land in the northeastern and southwestern portions of the watershed. There are two domestic outfalls and seven industrial outfalls. The main stem of the bayou is listed as impaired for low dissolved oxygen occurrence. A special study conducted through the Clean Rivers Program revealed that tidal fluctuations allow the surface layer to flush and replenish itself with dissolved oxygen, while deeper water is forced to remain in the same location and slush back and forth. The entire watershed is also listed as impaired for high bacteria levels. Low dissolved oxygen concerns are found on Bordens Gully and Geisler Bayou.

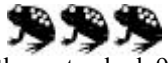
**Old Brazos River Channel (1111)** 
The watershed is densely developed with heavy industrial facilities along the channel. There are two domestic outfalls and seven industrial outfalls. The segment is not listed as impaired. However, there are concerns for barium, copper, and nickel in sediment.

**Oyster Creek Above Tidal (1110)** 
The watershed is 90% undeveloped. There are 14 domestic outfalls and four industrial outfalls. While the bacteria impairment has been removed from the 303(d) list, the creek is still impaired due to low dissolved oxygen occurrence. This situation may be the result of lack of flow to the creek. There is currently an enforcement action involving water rights with a local levee district.

**Oyster Creek Tidal (1109)** 
Over 70% of the watershed is undeveloped. The City of Lake Jackson is in the westernmost portion of the watershed, while the rest of the watershed remains primarily scattered development. The bacteria impairment has been removed due to results of recent monitoring. The watershed is not currently experiencing any known water quality problems.

## San Bernard River

**San Bernard River Above Tidal (1302)** 
Rice and cotton farming can be found throughout the watershed. There are 12 domestic outfalls and six industrial outfalls. The watershed is listed as impaired for high bacteria counts the lower 50 miles and for temperature modifications in the upper 25 miles and 25 miles from below US 90A to above FM3013. The segment is listed with concerns of having an impaired aquatic insect community and an impaired fish community. These biological concerns are thought to be related to natural sources. There is currently a systematic watershed monitoring study being conducted in the watershed.

**San Bernard River Tidal (1301)** 
Several small communities are in the watershed, 90% of which is undeveloped or open land. There are 12 domestic outfalls and six industrial outfalls. Agricultural practices make up most of the land use. There are no known water quality concerns.

## Bays and Estuaries

**Barbours Cut (2436)** 
The segment is in the middle of heavy industrial activity. Dioxin in fish tissue impairs the fish consumption use. Exact sources of dioxin are not known at this time.

**Bastrop Bay/Oyster Lake (2433)** 
There are no known water quality issues in these waters. The bay and lake are in a undeveloped estuarine environment and are part of the larger Christmas Bay system.

**Bayport Channel (2438)**
The segment is in the middle of heavy industrial activity. Dioxin in fish tissue impairs the fish consumption use. Exact sources of dioxin are not known at this time.

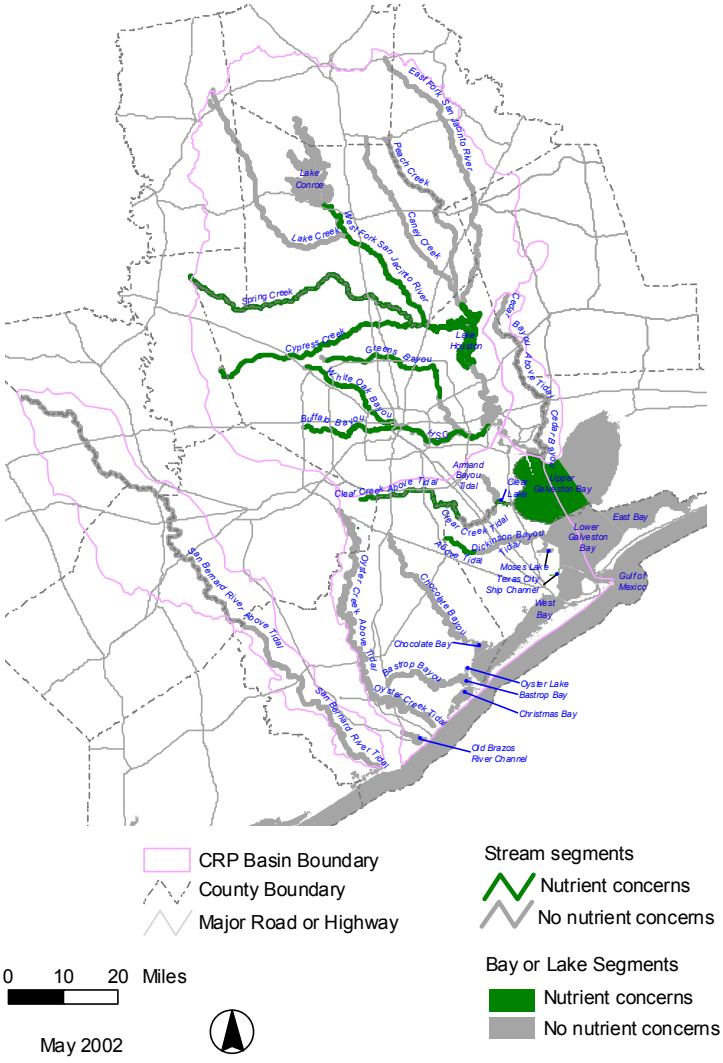
**Black Duck Bay (2428)**
The segment is in the middle of heavy industrial activity, including portions of the City of Baytown. Dioxin in fish tissue impairs the fish consumption use. Exact sources of dioxin are not known at this time.

**Burnett Bay (2430)**
The segment is in the middle of heavy industrial activity. Dioxin in fish tissue impairs the fish consumption use. Exact sources of dioxin are not known at this time.

**Chocolate Bay (2432)**
Bacteria from an unknown source impairs oyster harvesting. The bay receives input from Chocolate Bayou, Halls Bayou, Mustang Bayou, and Persimmon Bayou. There is some industrial activity near the mouth of Chocolate Bayou, but most of the area remains undeveloped marshland.

**Christmas Bay (2434)**
There are no known water quality issues in these waters. The area is surrounded by undeveloped wetland habitat and is part of a larger system of smaller bays and lakes. The Christmas Bay system has been monitored closely over the last several years and is one of the most pristine areas in the H-GAC region.

**STREAM SEGMENTS WITH NUTRIENT CONCERNS**




**Clear Lake (2425)**
The watershed is predominantly densely developed with mixed residential and commercial property. There is also some industrial activity in the watershed near the bay. The tributaries that feed the lake are impaired for contact recreation due to high levels of bacteria. The lake itself is listed with excessive nutrient levels. Robinson Bayou exhibits low dissolved oxygen concerns.

**Drum Bay (2435)**
There are no known water quality issues in these waters. The bay is part of the Christmas Bay system, one of the most pristine estuarine habitats in the region.

**East Bay (2423)**
Bacteria from an unknown source impairs oyster harvesting in an area at the east end of the bay near East Bay Bayou and the Intracoastal Waterway to Marsh Point. Bolivar Peninsula is immediately south of the bay. The community of Crystal Beach is the major development on the Peninsula. The Intracoastal Waterway parallels SH 87 and is used as a major transportation route for barges carrying feed stocks and products associated with Houston's petrochemical industry. The northern part of the Peninsula is abundant in marshland and wetland habitat. The northern shore of the bay is also primarily undeveloped with estuarine environments.

**Lower Galveston Bay (2439)** 

Bacteria from an unknown source impairs the oyster harvesting in a 60.7 square-mile area from Galveston to Texas City to Port Bolivar. The copper impairment has been removed from the 303(d) list. The watershed includes parts of Texas City and Galveston Island. Texas City includes a high density industrial area, while Galveston is mainly residential and commercial (excluding the Galveston Ship Channel). The bay is a major recreational area.

**Moses Lake (2431)** 

There are no known water quality issues in the segment. The southern portion of the watershed contains high density development with some industrial activity. The northern half of the watershed is less densely developed with large areas of open land. There is one domestic outfall and four industrial outfalls.

**San Jacinto Bay (2427)** 

The segment is in the middle of heavy industrial activity, including portions of the City of La Porte. Dioxin in fish tissue impairs the fish consumption use. Exact sources of dioxin are not known at this time.

**Scott Bay (2429)** 

The segment is near heavy industrial activity. Dioxin in fish tissue impairs the fish consumption use. Exact sources of dioxin are not known at this time. There is also a bacteria impairment within the entire segment.

**Tabbs Bay (2426)** 

The segment is downstream of heavy industrial activity. Dioxin in fish tissue impairs the fish consumption use. Exact sources of dioxin are not known at this time. There is also a bacteria impairment within the entire segment.

**Texas City Ship Channel (2437)** 

The watershed contains high intensity industrial activity. There is a great deal of barge and ocean-going ship traffic containing petrochemical feed stocks and products. The channel is impaired due to low dissolved oxygen levels. There is currently a special study going on to address this issue. There are also excessive nutrient concerns.

**Upper Galveston Bay (2421)** 

The upper portion of the watershed encompasses LaPorte and part of Pasadena, both containing a large amount of industrial activity. There is a great deal of barge transport of petrochemical feed stocks and products. The southern portion of the watershed is mixed residential and commercial communities. There is also a large amount of recreation activity in the bay. Dioxin in fish tissue impairs the fish consumption use from Red Bluff to Five Mile Cut to Houston Point to Morgans Point. Exact sources of dioxin are not known at this time. Bacteria impairments prohibit safe oyster harvesting in an area west of a line from Eagle Point to Five Mile Pass to Houston Point. There is also a concern for high levels of total phosphorus.

**West Bay (2424)** 

The West Bay system includes many small bays, lakes, and bayous. The development is primarily in the northeastern portion of the watershed along the major highway corridors. Other cities in the watershed include Alvin, near the center surrounding Mustang Bayou, and part of Missouri City in the headwaters of Mustang Bayou. West of Hitchcock, the watershed remains predominantly undisturbed estuarine habitat. Galveston Island creates the southern boundary of the bay. The copper impairment has been removed from the 303(d) list. The designated use for oyster harvesting is impaired in a 24.4 square-mile area at the east end near Galvestonand Texas City. Portions of Highland Bayou and Marchand Bayou are listed as impaired for high levels of bacteria and low dissolved oxygen. English Bayou and the crash basin are on the concerns list due to high ammonia concentrations. There are also concerns for high ammonia concentrations and low DO levels in Lake Madeline.

**Gulf of Mexico (2501)** 

The only documented issue includes an impairment for mercury in king mackerel 43 inches or deeper along the reach in the H-GAC region. The Galveston County Health District is participating in a Beach Watch Program, which allows for monitoring the levels of bacteria along pubic beaches and advising people of the safest time to swim. For more information on the Beach Watch Program, visit http://www.glo.state.tx.us/coastal/beachwatch/

# Summary

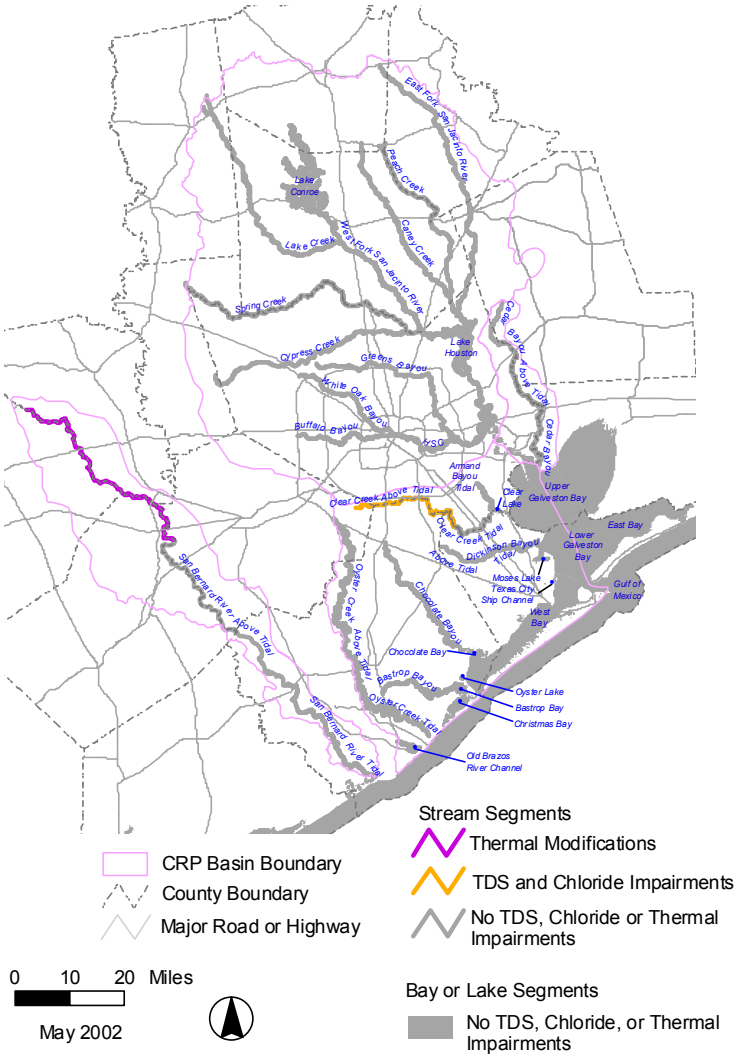
***Impacts and challenges***

The region has many natural areas with unique environmental characteristics. These areas are intermingled and disected by highly urbanized areas, inhabited by over 4.5 million people. What happens when you introduce these factors uncontrolled to the natural environment? Pollution. Yet, with proper prevention and management practices many pollution problems can be reduced or avoided.

The biggest water quality concern common throughout the basins is elevated bacteria levels, which inhibit contact recreation and oyster harvests. Another major issue is toxicity, particularly dioxin. There are also concerns for nutrient enrichment throughout the basins. While there are currently no nutrient criteria, the EPA will be instituting standards for these parameters within the next several years.

There does not appear to be any major concern for dissolved oxygen in the region. Many of the concerns listed may be due to natural causes stemming from sluggish characteristics of tidally influenced waters or from lack of adequate flow. However, there may be other oxygen-demanding substances such as raw sewage or decomposing plant debris, that may have an effect on the dissolved oxygen concentration. Aquatic life assessments are scheduled for select waterways to determine the appropriate degree of aquatic life use.

**STREAM SEGMENTS WITH THERMAL MODIFICATIONS OR TDS AND CHLORIDE IMPAIRMENTS**

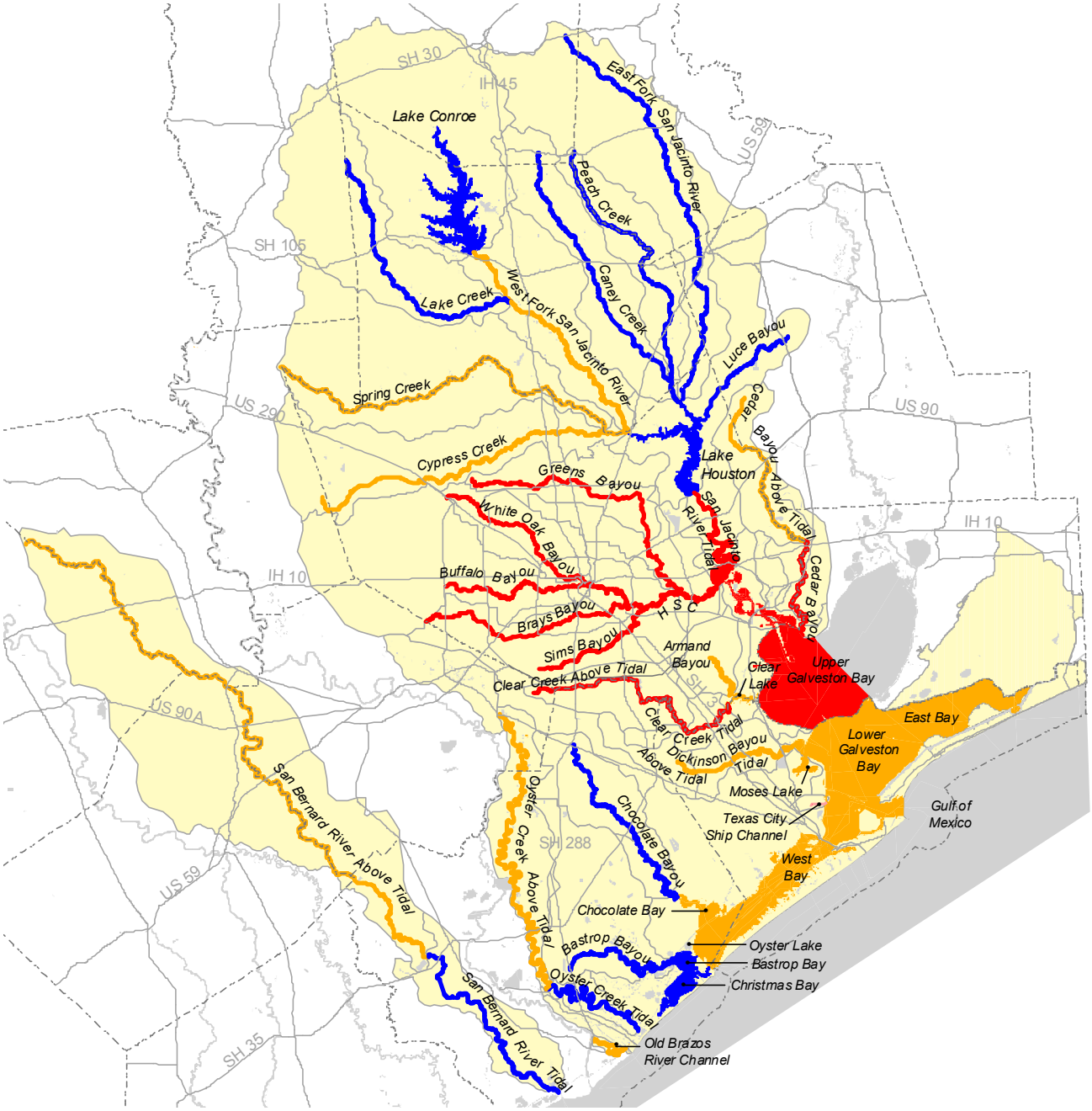



There is a need for monitoring of parameters such as pesticides and herbicides to gain a better idea of baseline levels of these constituents. Systematic monitoring is scheduled for selected watersheds, particularly those that have not been monitored or studied recently. These watersheds are usually undeveloped; therefore, these studies allow for the establishment of a baseline for water quality before development begins.

There is also a need for continued and expanded public education about water quality issues as well as of sources of pollution and explanation of what individuals can do to prevent pollution or help restore impaired waterways.

Watershed management is the key to successfully maintaining and restoring our waterways. The combination of data collection, analysis, education, stakeholder involvement, and reasonable implementation strategies are key factors in gaining a better understanding of water quality issues and the health of ecological systems. Our bayous, creeks, lakes, and bays are valuable resources and provide critical habitat for hundreds of species of flora and fauna. Serving as transport mechanisms and fishery sources, our waterways serve an important economic function. In addition, our waterbodies provide an array of recreational opportunities and aesthetic properties that contribute to tourism benefites and a higher quality of life for the region's residents.

# REGIONAL WATERBODY CONDITIONS




Ranking

- Not assessed by H-GAC
- Poor, segment is heavily impaired
- Marginal, segment contains some impairments
- Excellent, no known water quality concerns

- Major Highway
- County Boundary
- Watershed

0 5 10 Miles

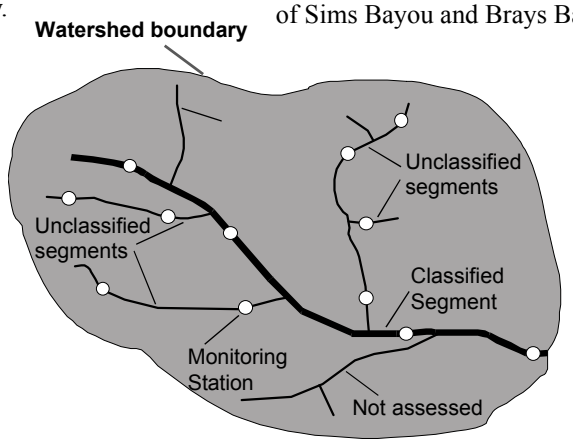
Houston-Galveston Area Council May 2002
www.hgac.cog.tx.us/waterdata

# HOW DO WE ASSESS THE WATER?

Every two years, the Texas Natural Resource Conservation Commission (TNRCC) compiles an inventory of water quality, the 305(b) report (a requirement of the Federal Clean Water Act), based on the preceding five years of data. Parameter values are compared against state standards or screening levels to determine if the waterbody supports its designated use(s), such as level of aquatic life, contact recreation, public water supply, or oyster harvesting. The inventory is conducted as a requirement of the Clean Water Act to determine if the fish have enough oxygen to survive, if people swimming in the water are exposed to pathogens that may cause illness, and if water is fit to be used as a source for public drinking water. Standards for the region's waterbodies can be found at www.hgac.cog.tx.us/resources/wq/crp/standards.html.

As a result of local monitoring programs' incorporation into H-GAC's regional Quality Assurance Project Plan (QAPP), the TNRCC has more data to use in its assessment of regional water quality.

Waterbodies across the state are designated as either classified or unclassified segments (note graphic to the right). A classified segment is one that is defined in the Texas Surface Water Quality Standards and has specific uses such as contact recreation associated with them. Watersheds are defined for these segments. Unclassified segments are commonly monitored tributaries to the main stem of a classified waterbody.




While classified segments are assessed for contact or noncontact recreation uses, as well as aquatic life and public water supply, the uses assessed for unclassified tributaries are limited to aquatic life and contact recreation. If a waterbody does not meet its designated use(s), it is placed on the 303(d) list. At this point, TNRCC may take a series of actions including, but not limited to, denying increases in wastewater permit effluent limits, sponsoring a project to allocate pollutant loads to certain sources, and implementing of a strategy for reducing loads from all sources

Other constituents, most notably nutrients, not tied to a Texas Surface Water Quality Standard, are listed as concerns, which requires additional monitoring and study. Concerns are not included in the 303(d) listing.

For those unclassified reaches that have a completed Receiving Water Assessment -- a comprehensive study of a portion of a waterbody, a site-specific aquatic life use and corresponding dissolved oxygen criteria have been defined.

For other unclassified waterbodies, the aquatic life use and associated dissolved oxygen criteria are assumed based on available flow information. The contact recreation use in unclassified waterbodies is assessed with the same criteria as classified segments.

*Assessing the Houston Ship Channel Watershed*

*While compiling the 2001 Basin Summary Report,* H-GAC defined areas that potentially needed a different standard or classification, most notably Houston Ship Channel (HSC) segments 1006 and 1007. While the standards are in place for the HSC, H-GAC recommends that other major tributaries, such as the above tidal portions of Sims Bayou and Brays Bayou, should be looked at independently due to the unique characteristics of those areas of the watershed. In addition, tidal portions of tributaries flowing into the HSC are assessed as part of the Ship Channel segment, with standards applicable to the Ship Channel. Because several of these steams flow through neighborhoods, where people can be seen wading or playing in the water, other uses, such as contact recreation, may apply.

As shown in the 2002 305(b) report, the TNRCC is moving in the direction of assessing regional watersheds more comprehensively while being able to focus on smaller areas/tributaries at the same time. H-GAC will pursue determining appropriate criteria for tributaries and some tidal portions of tributaries that flow into the Houston Ship Channel. This information will be based on data gathered from local agencies as well as from Receiving Water Assessments, Aquatic Life Assessments (a comprehensive study on an entire stream), and other studies as appropriate.

# REGIONAL MONITORING

Water quality data that is used in any data analysis under H-GAC's Clean Rivers Program is collected by outside agencies and contractors. All data is collected under an approved Quality Assurance Project Plan and undergoes quality assurance and quality control checks at several levels.

***Ambient Monitoring***

Routine monitoring of existing conditions in waterways is coordinated through H-GAC's Regional Monitoring Workgroup. A coordinated monitoring schedule for the local monitoring agencies is implemented in September each year. Changes in the schedule are made in response to findings in audits, data analysis, assessments, or recommendations of field or laboratory personnel. Changes in the monitoring schedule may include the addition or deletion of monitoring sites or parameters monitored at the sites, or a change in the methodology used in monitoring certain parameters.

Currently there are over 400 ambient water quality stations in the four basins monitored by H-GAC. Monitoring locations are shown on the map on page 20. Monitoring entities and parameters sampled include the following:

| | |
|---|---|
| City of Houston Health and Human Services | pH, DO, Conductivity, Temperature, Flow severity, TSS, TDS, Sulfate, Chloride, E. coli, Ammonia-Nitrogen |
| City of Houston Water Quality Control | pH, DO, Conductivity, Salinity, Chlorine Residual, Temperature, Secchi Depth, Days Since Rainfall, Flow Severity, TSS, TDS, Sulfate, Chloride, E. coli, Enterococcus, Fecal Coliform, Ammonia, Fluoride, Total Hardness, Nitrate-Nitrogen, Nitrate+nitrite-Nitrogen, Orthophosphorus, Total phosphorus |
| Galveston County Health District | pH, DO, Conductivity, Salinity, Temperature, Secchi Depth, Days Since Rainfall, Wind Direction, Wind Intensity, Tide Stage, Color, Turbidity, Flow Severity, TSS, Sulfate, Chloride, E.coli, Enterococcus, Fecal Coliform, Total Hardness, Nitrate+Nitrite-Nitrogen, Orthophosphorus, Total phosphorus |
| Harrris County Pollution Control | pH, DO, Conductivity, Salinity, Temperature, Secchi Depth, Days Since Rainfall, TSS, TDS, E. coli, Enterococcus, Fecal Coliform, Ammonia, Fluoride, Total Hardness, Orthophosphorus, BOD5, TOC |
| San Jacinto River Authority | pH, DO, Conductivity, Salinity, Chlorine Residual, Temperature, Secchi Depth, Days Since Rainfall, Flow Severity, TSS, TDS, Sulfate, Chloride, E.coli, Enterococcus, Fecal Coliform, Ammonia, Fluoride, Total Hardness, Nitrate-Nitrogen, Nitrate+Nitrite-Nitrogen, Orthophosphorus, Total phosphorus |

***Expanding Ambient Monitoring***

Regional agencies, in cooperation with the H-GAC Clean Rivers Program, have expanded their monitoring efforts to include areas outside of historical data collection sites. Many of these sites are within or near areas of new development. Some groups have adjusted their monitoring efforts to include additional parameters, primarily nutrients, in an effort to create a dataset that allows for more comprehensive data assessment. Field staff will also be making notes of site characteristics such as water clarity, aquatic activity, or unusual occurences.

For a complete list of monitoring sites, please visit our web site at: www.hgac.cog.tx.us/waterdata

***Additional Monitoring***

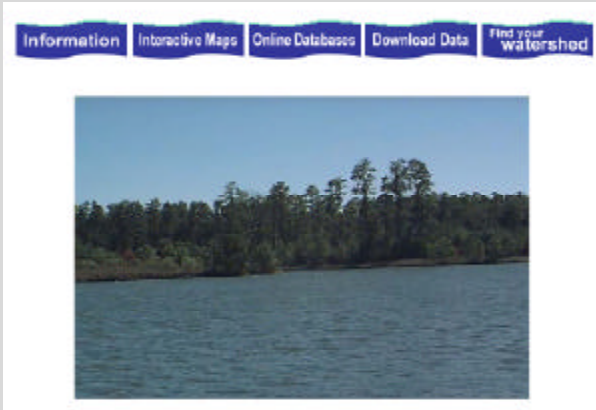
In addition to ambient water quality monitoring activities, H-GAC has conducted a large number of studies that include systematic watershed monitoring, targeted monitoring, receiving water assessments and use attainability analyses. Each of these studies was selected to address major water quality issues within each basin.

Systematic watershed monitoring is conducted in areas that have received little or no monitoring in recent years. Another purpose of this type of monitoring includes investigating areas of known concern and detecting areas of potential concern.

Targeted monitoring is used to collect water quality or quantity information needed for permitting purposes. The results of these efforts help water quality managers make permit decisions based on sound science.

Receiving Water Assessments (RWAs) are intensive studies of water bodies into which treated wastewater will be discharged. These are generally done on unclassified streams where no flow measurements or water quality baseline has been established. RWAs are required before permits for those facilities can be written.

Use Attainability Analyses (UAAs) are most often conducted on previously unclassified waterbodies that are becoming designated stream segments needing standards. Sometimes UAAs are done on classified waterbodies not meeting their designated criteria in order to determine if criteria are still applicable or if a standard should be modified.

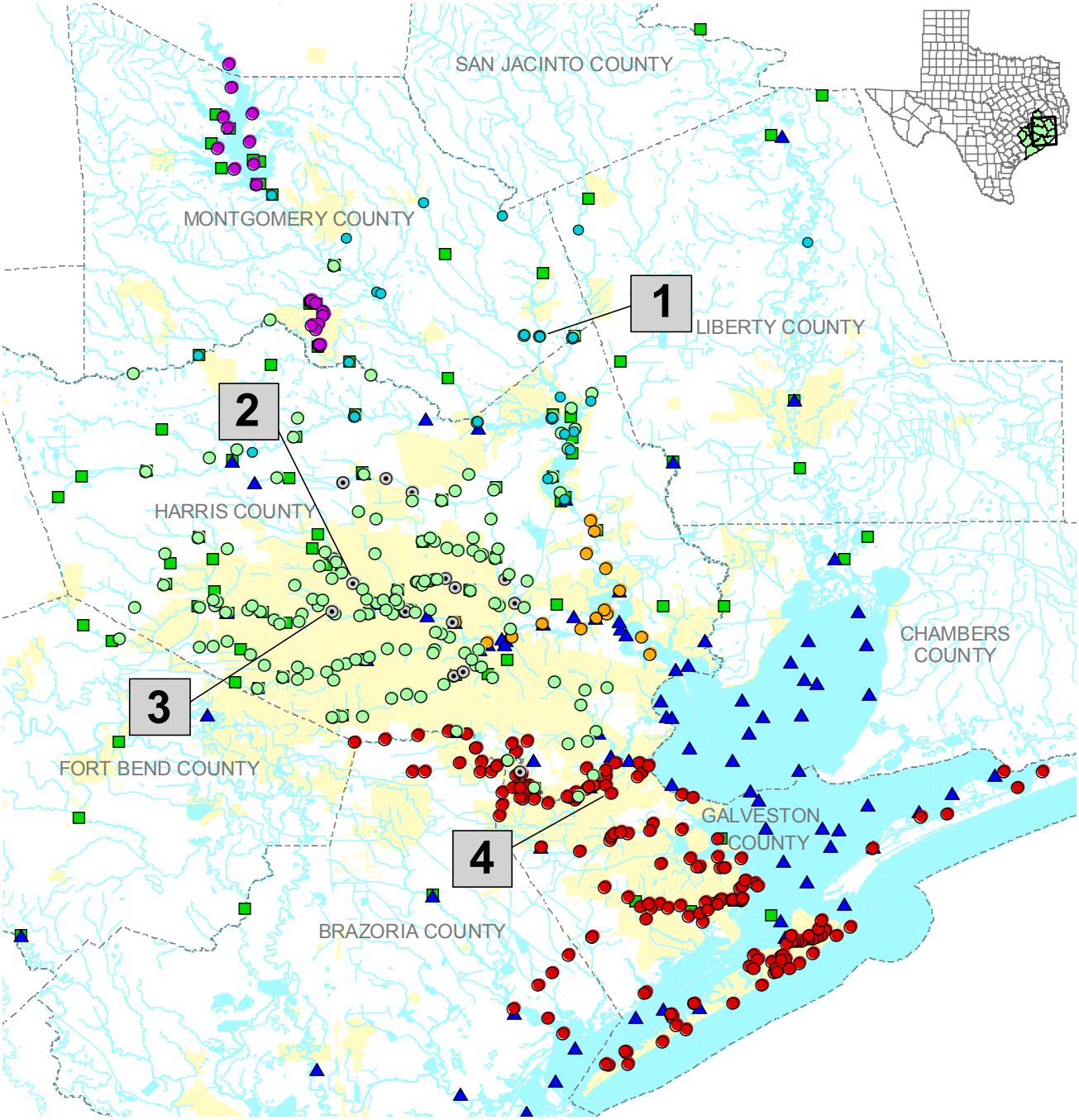



***Data Clearinghouse Functions***

H-GAC has developed a data clearinghouse (www.hgac.cog.tx.us/waterdata) for water quality management professionals and the general public. Local monitoring agencies submit their ambient water quality monitoring data to H-GAC on a monthly basis. H-GAC staff perform quality assurance checks on those data and in turn submit those files to TNRCC for approval. Then the data is uploaded into the online database for use by the public. This process ensures that all data on the web site is valid.

Data are available through a query tool and can be directly downloaded from the database over the Internet. Data can also be received by making a telephone or email request to H-GAC. Entire data sets can be sent via email or delivered via floppy disk or CD.

# CRP REGIONAL MONITORING STATIONS FOR 2002-03




Regional Monitoring Station by Agency

- Galveston County Health District
- Harris County Pollution Control
- Houston Health and Human Services
- Houston Public Health and Engineering (historical)
- Houston Water Quality Control
- San Jacinto River Authority
- Texas Natural Resource Conservation Commission
- United States Geological Survey

- City, Town or Place
- County Boundary
- Bayou, Creek or River
- Open Water

0 5 10 Miles

Houston-Galveston Area Council May 2002
www.hgac.cog.tx.us/waterdata

# HABITAT DATA COLLECTION

1

2

3

4

*Each number corresponds to a map location on the facing page.*

H-GAC's Clean Rivers Program hosted a "Habitat and Water Quality" workshop at its offices on October 11, 2001. Topics included the following:

-- Hydrologic and physical characteristics of streams and open water

-- Aquatic and terrestrial vegetation

-- Regional biotic indices

The workshop was the kickoff of a data-gathering project. Photographs and information on such items as riparian vegetation, instream habitat, and local land use at each of over 400 monitoring stations has been gathered. The data collected will be combined with water quality data to create more comprehensive environmental assessments and will help further the understanding of the region's watersheds. In addition, definition of characteristics at each location may help to draw some conclusions about the nature of the water quality and sources of pollution.

Information gathered included the following:

-- Physical characteristics (bank stability, substrate)

-- Vegetative characteristics (riparian vegetation characteristics, buffer zone characteristics)

-- Aquatic life activity (fish and insect populations)

-- Anthropogenic influences (stormwater outfalls, treatment plant outfalls)

The information will also be used as a public outreach tool to make residents aware of what each water quality monitoring station looks like and to illustrate how water quality is impacted by various types of habitat and land use.

A copy of the datasheet is available on the H-GAC web site at www.hgac.cog.tx.us/waterdata

# GOODYEAR CREEK SUCCESS STORY

With such a broad array of bacteria problems in the region, trying to identify specific sources can be challenging. Looking at small tributaries that feed into larger bayous in the area is a good start to preventing excessive bacteria from entering in the water.


*Image courtesy of Dr. Ron Hurlbert*

## Sources of Bacteria

Where does the bacteria come from? There are numerous sources from which bacteria can enter the water column. Here are a few.

-- Leaking sewer lines that cross waterways

-- Leaking sewer mains that run to area stormdrains and then to a waterway

-- Sewage treatment overflows

-- Improperly maintained septic systems

-- Runoff from feedlots, barnyards, pastures, or rangeland after heavy rain events

-- Stormwater runoff from urban and rural areas where there is pet waste and wildlife waste

-- Bacteria from parking lots and other impervious surfaces

Goodyear Creek is a small tributary of Greens Bayou. The creek flows into Greens Bayou just before its confluence with the Houston Ship Channel. Historically, TNRCC has evaluated tidal portions of the Houston Ship Channel (HSC) tributaries as part of the HSC segment.

The HSC is not classified for either contact or noncontact recreation, and because the tidally influenced tributaries assume the same classification as the HSC, they are not assessed for a contact recreation use. However, some of the tidally influenced tributaries flow through neighborhoods, where contact recreation uses may apply. When analyzed with contact recreation standards, indicator bacteria counts in Goodyear Creek exceeded the state standard (fecal coliform) of 200 colonies/100mL of water (5-day average). The size of the tributary (1.6 miles long) allowed TNRCC staff to easily investigate the situation. Staff encountered three illegal bypass lines running from manholes to the area collection system and every manhole along the creek had sewage debris around it. Residents indicated that this has been a long-term problem. Raw sewage was flowing from one of the bypass lines while the TNRCC investigator was on the site. While a fecal coliform sample collected upstream showed 90 colonies/100 ml of water, an outfall 160 feet downstream exhibited 300,000 + colonies/100 ml of water.

The illegal lines have now been removed and the City is expanding the force mains and two lift stations to address any overflows. The collection system in the area will be reevaluated.

TNRCC staff will be evaluating data from other tributaries listed as having bacteria problems and initiate similar investigations for sources. As these problems are corrected, bacteria loads to the main stem will decrease.

The small tributary approach is an excellent step toward addressing bacteria issues with a minimal amount of data collection.

# SUMMARY OF LOCAL TOTAL MAXIMUM DAILY LOADS

***What is a Total Maximum Daily Load?***

Section 303(d) of the Clean Water Act and Environmental Protection Agency's (EPA) regulation (40 CFR 130.7) require that all states identify waterbodies that do not meet, or are not expected to meet, applicable water quality standards for their designated uses. These waterbodies are placed on a list referred to as the "303(d) list". The state prioritizes waterbodies on the list in order to schedule development of a Total Maximum Daily Load (TMDL), a technical analysis that:

-- Determines maximum loadings of a pollutant of concern that a water body can receive and still meet water quality standards and;

-- Allocates this allowable loading to different pollutant sources in the watershed, both point and non-point.

Once a TMDL has been developed for the pollutant of concern, an implementation plan is developed that determines the control measures and management actions that must be conducted to improve water quality. H-GAC, in partnership with the Environmental Institute of Houston, assists the TNRCC with public participation activities to ensure that local perspectives are considered during TMDL development.

H-GAC participates in public participation by creating watershed stakeholder groups and by providing stakeholders with information to enhance decision-making. Each stakeholder group contains representatives from the regulated community, regulators, natural resource agencies, environmental groups, local governments, interested citizens residing in the watersheds, and individuals with specific expertise on the subject of the TMDL project.

## Project Updates

*Regional Dioxin Issues*

The "Dioxin TMDL Project" addresses elevated concentrations of dioxin in catfish and blue crab tissue in: Cedar Bayou Tidal, San Jacinto River Tidal , the Houston Ship Channel, Upper Galveston Bay, Tabbs Bay, San Jacinto Bay, Black Duck Bay, Scott Bay, Burnett Bay, Barbours Cut and Bayport Channel.

While there has been dioxin found in the water after rain events in the smaller tributaries that feed the HSC, samples from the Channel itself do not reveal any dioxin in the water. However, dioxin is found in fish and crab tissue there. Samples from point sources have not shown any dioxin; therefore, other methods of introduction are being investigated. Some of these include atmospheric deposition and runoff associated with that deposition.

*Buffalo Bayou, White Oak Bayou - Bacteria*

Targeted monitoring to investigate point and non-point sources and to study the fate and transport of bacteria in the bayous continued through April 2002.

The results of the targeted monitoring are currently being analyzed and validated. Modeling to determine the load allocation has begun.

*Dickinson Bayou - Dissolved Oxygen*

Data collection for this project is complete. To determine support of existing aquatic life uses at the sampling locations, data collected included stratified samples to account for the presence of oxygen demanding substances, measurements of flow magnitude and direction at each depth, and biological data.

*Patrick Bayou*

Twelve months of water quality sampling along with a report was completed in September 2001. Analyses of data collected through April 2001 indicate that water toxicity and dissolved copper levels no longer exceed water quality standards.

Biological sampling occurred from August 2000 through Spring 2002.

Development of a model to assess thermal conditions and discharge effects is underway. Laboratory analyses and testing to identify the specific cause(s) of sediment toxicity continue.

## More Information

H-GAC's web site contains several pages dedicated to TMDL activities and can be found at: www.hgac.cog.tx.us/intro/introtmdl.html. The content includes meeting dates, agendas, meeting summaries, copies of the technical reports, the stakeholder roster, links to related programs and agencies or staff contact information. H-GAC revises this information as it becomes available.

# Other Regional Projects

The following are studies being conducted through TNRCC with other resources besides the Clean Rivers Program. The summaries are provided for information purposes only. For the complete report, please visit the TNRCC's web site at: www.tnrcc.state.tx.us/water/quality/tmdl/index.html.

*Armand Bayou – Dissolved Oxygen*

An intensive data set representing hot weather conditions at various points in the Armand Bayou system has been delivered to the TNRCC. The data was collected during May through September of 1999. Initial analyses of the data set revealed that dissolved oxygen concentrations are often relatively low during hot weather, but also found no indication of aquatic life impairment or limitation related to the dissolved oxygen regime. The data set has several unconventional aspects that are related to unique hydraulic characteristics of the Armand Bayou system. A TMDL allocation related to dissolved oxygen is not deemed appropriate at this time, since available data does not indicate impairment of the aquatic life community, nor identify a pollutant that needs to be controlled. Additional data is needed to provide satisfactory understanding of the causes and effects of the Armand Bayou dissolved oxygen regime.

*Clear Creek – Chlordane*

Chlordane is a legacy pollutant, a term used to describe substances whose use has been banned or severely restricted by the EPA. Within the context of these TMDLs, legacy pollutants are considered background sources that reflect the site-specific application history and loss rates of the subject area. All continuing sources of pollutant loadings occur from nonpoint source runoff leaching or erosion. Continuing natural attenuation of these pollutants is expected via degradation and metabolism of the contaminants and scouring and redistribution of sediments in rivers and bayous. Natural attenuation is generally a preferred option for the elimination of legacy pollutants.

*Clear Creek - Volatile Organic Compounds*

Water samples from portions of Clear Creek have shown levels of the volatile organic chemicals 1,2-dichloroethane and 1,1,2-trichloroethane.

The Brio Refining, Inc. waste site is an abandoned refinery located on approximately fifty-eight acres along Mud Gully, a tributary to Clear Creek in Friendswood, Harris County. The facility was operated from the late 1950s until 1982. Chemical spills at this facility have entered Mud Gully and contaminated soils and groundwater. Groundwater from the Brio site is pumped, treated, and discharged to Mud Gully under a U.S. EPA Record of Decision amended in 1997 (EPA/541/R-97/122). This discharge and direct migration of contaminated groundwater to Mud Gully are believed to be the only significant continuing sources of 1,2-dichloroethane and 1,1,2-trichloroethane to Clear Creek. Concentrations of 1,2-dichloroethane and 1,1,2-trichloroethane are now below the water quality targets for protection of the fish consumption use. As a result, the Texas Department of Health has rescinded the health advisory. Continued periodic monitoring will be required to confirm that concentrations of volatile organic compounds in Mud Gully and Clear Creek water do not exceed the water quality targets. Additional monitoring of 1,2-dichloroethane and 1,1,2-trichloroethane concentrations in fish tissue will be required to verify that fish continue to be safe for consumption.

*Houston Ship Channel System – Nickel*

Data collected during the late 1980's and early 1990's caused some concern about dissolved nickel concentrations in the Houston Ship Channel System. That concern, in conjunction with the large number of discharges to the system and the absence of dependable data, instigated further investigation of water column concentrations of nickel.

Numerous data collected using modern clean methods for sampling and analysis have verified that the pre-1993 data are unsuitable for determining attainment of water quality standards for nickel. The modern data indicate that the Houston Ship Channel System meets water quality standards for dissolved nickel. The project resulted in a model that assessed cumulative nickel to the Ship Channel (based on very minimal discharge contributions) and an implementation process that will assure nickel will not exceed criteria in the future.

# RECENT SPECIAL STUDIES

H-GAC conducts special studies on waterbodies that have had specific problems identified or that have not received any ambient monitoring for several years. For detailed project summaries, please go to: www.hgac.cog.tx.us/waterdata

## Completed Studies

### Urban Bayou Bacteria DNA Study

Study using DNA hybridization to help determine sources of E. coli bacteria in Buffalo and White Oak Bayous.
Dates of Study: March 2000 – August 2001
Parameters Monitored: E. coli, Fecal Coliform, Total Suspended Solids (TSS), Volatile Suspended Solids (VSS), Ammonia-nitrogen, Conductivity, pH, BOD, Sulfate, Chloride, Total Dissolved Solids
Budget: $80,000
Data Available: Hard copy or CD
Project Contacts: Todd Running, H-GAC; Dr. Paul Jensen, PBS&J

### Dickinson Bayou Study

Pre-TMDL Study to help determine the cause(s) of dissolved oxygen depletion in Dickinson Bayou.
Dates of Study: October 1999 – August 2001
Parameters Monitored: Cond., DO, 24 Hour DO, Flow, pH, Salinity, Temp., Secchi Depth, Nekton, Benthic Invertebrates, Habitat Assessment, Alkalinity, Ammonia-nitrogen, BOD, Chloride, E. coli, Enterococcus, Fecal Coliform, Nitrate+Nitrite, Phosphorus, Orthophosphorus, Sulfate, TSS, VSS, Total Kjeldal Nitrogen (TKN), Chlorophyll -a, Pheophytin
Budget: $95,000
Data Available: Hard copy or CD
Project Contacts: Todd Running, H-GAC; Jean Wright, Galveston County Health District; Jeff East, USGS

### Dioxin Study

Study to verify elevated dioxin levels in fish tissue and sediment in the Houston Ship Channel and Upper Galveston Bay.
Dates of Study: January 2001 – August 2001
Parameters Monitored: Dioxin in tissue of Catfish, Blue Crabs, and Oysters, Dioxin in sediment
Budget: $80,000
Data Available: Hard copy or CD
Project Contacts: Todd Running, H-GAC; Dr. Yu Chun Su, PBS&J

### Christmas Bay

Study to help determine circulation and overall health of Christmas Bay.
Dates of Study: October 1999 – August 2001
Parameters Monitored: DO, pH, Temp, Cond., Turbidity, Nutrients, Major Ions, Total Organic Carbon, Soluble Pesticides, Trace Metals, Chlorophyll-a, Phytoplankton, Bed Sediment Organochlorine Pesticides
Budget: $45,000
Data Available: Hard copy or CD
Project Contacts: Todd Running, H-GAC; Jeff East, USGS

### Spring Creek Biological

Phase III study designed to document biological community of Spring Creek and compare IBI with reference stations in region and DO concentrations.
Dates of Study: October 1999 – August 2001
Parameters Monitored: DO, 24 hour DO, Stream Velocity, pH, Salinity, Temp. Nekton, Benthic Macroinvertebrates, Habitat Assessment
Budget: $120,000
Data Available: Hard copy or CD
Project Contacts: Todd Running, H-GAC; Dr. Bruce Moring, USGS

## Continuing Studies

### Illicit Connections Study

Study designed to find and eliminate illicit connections to storm sewers throughout the Clear Creek Watershed. Study includes the development of a manual to guide municipalities and other local entities through the process of finding and eliminating illicit connections.
Dates of Study: October 1999 – present
Parameters Monitored: E. coli, Enterococcus, Fecal Coliform
Budget: $150,000
Data Available: Hard copy or CD
Project Contacts: Todd Running, H-GAC; Jean Wright, Galveston County Health District

# Recent Special Studies *continued*

## Continuing Studies

### San Bernard River Study
Systematic Monitoring Study to collect data on the San Bernard River and selected tributaries.
Dates of Study: October 1999 – present
Parameters Monitored: DO, Cond., Temp., Ammonia-nitrogen, Orthophosphorus, Nitrate+Nitrite, TKN, BOD-5, Total phosphorus, E. coli, Fecal Coliform, Enterococci, Chlorophyll-a, Pesticides and Herbicides
Budget: $250,000
Data Available: Hard copy or CD
Project Contacts: Todd Running, H-GAC; Chris Ryon, Parsons ES; Jeff East, USGS

### Texas City Ship Channel
Pre-TMDL study to verify low dissolved oxygen levels within the Texas City Ship Channel
Dates of Study: June 2000 - present
Parameters Monitored: DO, 24 Hour DO, Flow severity, pH, Salinity, Temp., Secchi Depth, Total Alkalinity, Ammonia-nitrogen, BOD, Chloride, Total Hardness, Nitrate+ Nitrite, Total Phosphorus, Orthophosphorus, TSS, VSS, Sulfate, Dissolved: Aluminum, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Molybdenum, Nickel, Silver, Total Selenium, Zinc
Budget: $165,000
Data Available: Hard copy or CD
Project Contacts: Todd Running, H-GAC; Jean Wright, Galveston County Health District

## New Studies

### Lake Creek, Peach Creek and Caney Creek
Systematic Monitoring study to collect data on Lake Creek, Peach Creek and Caney Creek
Dates of Study: April 2002 – August 2003
Parameters Monitored: DO, pH, Temp., Conductivity, Turbidity, Fecal Coliform, E. coli, Organochlorine Pesticides, Nekton, Benthics, Habitat assessment
Budget: $320,000
Data Available: In August 2003
Project Contacts: Todd Running, H-GAC; Jeff East, USGS

### Aquatic Life Use Studies
Studies to determine if select tributaries of the Houston Ship Channel should be designated for High Quality Aquatic Life Use.
Dates of Study: June 2002 – August 2003
Parameters Monitored: Stream Characterization, Habitat Assessment
Budget: $128,800
Data Available: In August 2003
Project Contacts: Todd Running, H-GAC – Consultant has not been selected

### Houston Ship Channel Waste Load Evaluation
Data collection effort to help determine appropriate loadings for the Houston Ship Channel
Dates of Study: June 2002- August 2003
Parameters Monitored: DO, Conductivity, Temp., CBOD5 and CBOD, NH3-N, NO3-N, TOC, TSS, Chlorophyll A
Budget: $50,000
Data Available: In August 2003
Project Contacts: Todd Running, H-GAC; Dr. Paul Jensen, PBS&J; Teresa Battenfield, City of Houston

### Small Scale Watershed Analysis
Studies to determine sources of bacteria and ammonia in four small watersheds, Brickhouse Gully, Garner's Bayou, Turkey Creek, and Mason Creek
Dates of Study: June 2002 – August 2003
Parameters Monitored: DO, Conductivity, Temp., pH, E. Coli , Fecal Coliform, Ammonia-nitrogen, TSS, TDS, Turbidity
Budget: $85,000
Data Available: In August 2003
Project Contacts: Todd Running, H-GAC – Consultant has not been selected

# PUBLIC OUTREACH

## *Focus on Outreach*

H-GAC's Clean Rivers Program public outreach activities include involvement of stakeholders and committees in planning and analysis of watershed management as well as watershed and water quality education for the public.

There are three main groups that help set priorities and direct water quality assessment activities for the program. They include a Steering Committee, a Technical Advisory Group, and a Regional Monitoring Workgroup. For more information on the roles of these committees, please visit:
www.hgac.cog.tx.us./intro/introcmte.html

H-GAC has instituted several new approaches to educating the public about watersheds and water quality throughout the region. While continuing to participate in environmental festivals and outdoor events, H-GAC has also devised ways to reach others who may not attend or have access to those types of events.

One approach has been through direct mailouts. A brochure that summarizes the Greens Bayou watershed was mailed out randomly to approximately 3,000 residents in that watershed. Enclosed in the mailing was a postcard response survey that asked the recipient

1) How familiar they were with the concept of a watershed?

2) Before receiving this document, did they know they lived in the Greens Bayou watershed? and

3) Had they learned anything new about the health of the aquatic environment from the information provided?

Many of the cards received indicated that the recipient had never heard of the watershed concept, did not know they lived in the Greens Bayou watershed, and did learn something about the health of the aquatic environment. In addition, almost half of the recipients who returned their survey cards requested more information.

H-GAC plans to use a similar outreach strategy for the upcoming Sims Bayou watershed brochure. In addition, a brochure summarizing the region's bacteria problem and how people can help reduce their contribution will be produced. Targeted mailings of that brochure to watersheds impaired by bacteria are in the planning stages.

H-GAC's environmental literature has been well received. Of particular interest has been the "What Watershed Do You Live In?" maps. People can look on the map and then determine what watershed they reside or work in and also see how the watersheds of the region are linked. H-GAC will be making presentations and visiting with local homeowners associations to distribute these materials.

H-GAC also makes a great deal of information available on its website. H-GAC's CRP site is the number one match on several search engines for Houston water quality. Currently, H-GAC staff are working to make the site more interactive and more easily navigated.

*Watershed Signs*

As part of its public outreach efforts, H-GAC's Clean Rivers Program has initiated the installation of watershed signs throughout the region. Many similar projects have been implemented nationwide. The goal of the project is to make a wide audience aware that they are always in a watershed and that their everyday activites influence the character and the water quality of the watershed. The signs are placed at the intersection of major roads and watershed boundaries. They read "Entering Dickinson Bayou Watershed", for example, and provide a toll free number, 1-866-77WATER, to call for more information. In addition, the project includes the production and distribution of magnets that replicate the sign and read, "What Watershed Do You Live In?" with the toll free number.


H-GAC is providing coordination and location analysis for watershed signs. Funding will be provided through the regional Texas Clean Rivers Program as well as through Total Maximum Daily Load public outreach funds, the Bayou Preservation Association, and the Galveston Bay Foundation. H-GAC also plans to actively seek corporate sponsorship for sign production and installation in order to ensure that all watersheds within the region are outfitted with signs.

Due to special studies associated with a TMDL, the first signs installed were for the Dickinson Bayou watershed. Eleven signs were installed along the perimeter of the watershed in Galveston County and Brazoria County. More than 20 signs have also been installed around Buffalo Bayou, White Oak Bayou, and Greens Bayou. The next watersheds slated for sign installation are the Armand Bayou and Lake Creek watersheds.

# TEXAS WATCH UPDATE

Texas Watch is a part of CLEAN TEXAS, a statewide environmental partnership program designed to reduce the pollution generated in Texas and to provide citizens, industry, and public agencies with the information they need to improve and preserve Texas' natural resources. Texas Watch has over 4,000 monitors conducting water quality monitoring statewide.

As the local Texas Watch partner, H-GAC coordinates initial water quality monitoring training and annual Quality Assurance checks. In addition, H-GAC provides monitoring kits and reagent replacements to volunteers, as needed. The data obtained from the monitors is sent to H-GAC and provides valuable insight into probable water quality issues, especially in areas where official data is unavailable. Quality assured data is used to support professional data and provides information vital to the health of our streams.

Local businesses and industries benefit greatly from their involvement in Texas Watch by getting employees involved in water quality monitoring and encouraging pollution prevention. Through their partnership with Texas Watch, industries and businesses demonstrate a local commitment to environmental protection and in turn fulfill part of the requirement for TNRCC's Clean Leaders initiative. H-GAC helps match volunteer groups with local businesses and industry as well as assisting in the coordination of special studies by volunteers.

H-GAC held training sessions on January 26, 2002, and February 9, 2002. Ten volunteers are currently scheduled to become new certified monitors. In addition, there was a Phase I and II training on May 18, 2002 and a quality assurance session held on March 30, 2002.

## *Texas Watch Training Schedule for the remainder of 2002*

| **Phase I and Phase II** | **Quality Assurance** |
|---|---|
| August 17 | July 13 |
| November 16 | October 19 |

Additional sessions are held on an as needed basis.

As part of the Earth Day (April 22nd) festivities, Texas Watch coordinated a statewide monitoring day on April 18, 2002, *A Day in the Life of Texas Waters*.

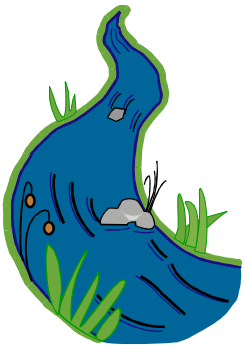
### National Water Monitoring Event October 18, 2002

In honor of the 30th anniversary of the Clean Water Act, the American Clean Water Foundation will lead a National Water Quality Monitoring event. On October 18, 2002 citizen volunteer monitors, established water quality monitoring organizations and professional water quality monitoring agencies will conduct monitoring events on wterbodies across the nation. Data resulting from these monitoring efforts will be entered in a standard reporting format into a national database on a real-time basis by the participating monitoring organizations and agencies. This information was obtained from www.yearofcleanwater.org. Please visit the web site for more information.

Please show your commitment to the environment and participate in the water quality monitoring event on October 18, 2002!

If you are interested in becoming a certified water quality monitor or need further information, please contact Ingrid Fairchild at 832-681-2516 or ifairchild@hgac.cog.tx.us. For more information visit www.hgac.cog.tx.us/intro/introtxwat.html

# VISIT US ONLINE!



The H-GAC Clean Rivers Program Data Clearinghouse, www.hgac.cog.tx.us/waterdata, is full of information on watersheds, water quality and includes other data resources

The main features of the clearinghouse are:
- interactive mapping
- customized water quality data query

*Water quality data is updated on the website when it is approved by TNRCC.*

Other information available includes:
- Data quality objectives of each monitoring agency under the regional QAPP
- State water quality standards
- Pollution complaint contact information
- Links to other complementary data
    - Topography
    - Flow
    - Soils
    - Weather and Climate
    - Wetlands
- Other Digital Geographic Data

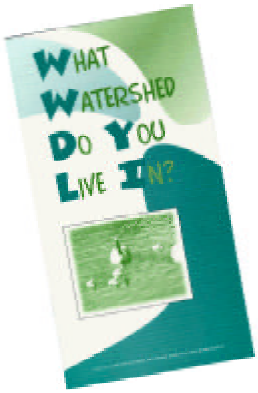
The complete 2001 Basin Summary Report, including data appendices, is available online at www.hgac.cog.tx.us/resources/crp/watersheds.html

View:
- Detailed information about each TNRCC-defined segment watershed.
- information about conditions within each basin
- Maps
- Graphs

Special study summaries and reports are highlighted on the main Clean Rivers Program page, www.hgac.cog.tx.us/intro/introwater.html.

HOUSTON-GALVESTON AREA COUNCIL
H-GAC
THE TEXAS CLEAN RIVERS PROGRAM

# HOW DO I GET INVOLVED?




- Learn more about how to prevent nonpoint source pollution, request a FREE copy of our "What Watershed Do You Live In?" brochure
- Be aware of local laws and ordinances that aim to protect our waterways
- Report spills, fish kills, or illegal dumping to TNRCC's Pollution Hotline at 1-800-3OURBAY or to Texas Parks and Wildlife at 281-842-8100
- Volunteer to monitor a nearby bayou, creek, or lake. Join the H-GAC Texas Watch team, please visit: www.hgac.cog.tx.us/intro/txw.html
- Volunteer for other activities such as the annual Trash Bash, which aims to remove thousands of pounds of trash from area waterways, visit www.trashbash.org
- Check out H-GAC's Data Clearinghouse for information, interactive maps, online databases, and more at: www.hgac.cog.tx.us/waterdata

# Contact Information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# Appendices

Appendix A - List of Impairments and Concerns

Appendix B - List of Regional Segments and Subsegments

| Watershed | Segment | 2000 303(d) List Parameter | 2002 305(b) impairments | 2002 305(b) concerns |
|---|---|---|---|---|
| Cedar Bayou Above Tidal | 0902 | pathogens, TDS | DO | DO |
| Cedar Bayou Tidal | 0901 | pathogens | dioxin | - |
| Buffalo Bayou Above Tidal | 1014 | pathogens | **1014**- bacteria **1014H**-bacteria **1014K**-bacteria **1014M**- DO, bacteria **1014N**-bacteria **1014O**- bacteria | **1014**- bacteria, ammonia, nitrate+nitrite nitrogen, orthophosphorus, total phosphorus **1014M**- DO, ammonia **1014N**- DO, ammonia **1014O**- DO |
| Buffalo Bayou Tidal | 1013 | pathogens, copper | **1013**- bacteria, copper (chronic) in water **1013A**- DO, bacteria **1013C**-bacteria | **1013**- nitrate+nitrite nitrogen, orthophosphorus, total phosphorus **1013A**- DO, ammonia **1013C**- DO, ammonia |
| Caney Creek | 1010 | - | - | - |
| Cypress Creek | 1009 | pathogens, TDS | bacteria | ammonia, nitrate+nitrite, orthophosphorus, total phosphorus, DO |
| East Fork SJR | 1003 | - | - | - |
| Greens Bayou Above Tidal | 1016 | pathogens | **1016**- bacteria **1016A**- bacteria **1016B**- bacteria **1016C**- bacteria **1016D**- DO, bacteria | **1016**- ammonia, chromium (chronic) in water, nitrate+nitrite nitrogen, orthophosphorus, total phosphorus **1016A**- ammonia **1016B**- DO **1016C**-DO, ammonia **1016D**- DO, ammonia |
| HSC | 1006 | dioxin, copper, toxicity in sediment, toxicity in water, thermal modifications | **1006 (Houston Ship Channel, Goodyear Creek Tidal, Greens Bayou Tidal)**- dioxin, PCBs, pesticides **1006 (Patrick Bayou)**-chronic toxicity in sediment, metals in sediment, organics in sediment, thermal modifications, PCBs, dioxin, pesticides **1006D**- bacteria **1006E**-bacteria **1006F**- bacteria **1006H**-bacteria **1006I**- bacteria **1006J**-bacteria | **1006**- nitrate+nitrite nitrogen, **1006 (Goodyear Creek Tidal)**- bacteria, ammonia, **1006 (Patrick Bayou)**- 1,3-dichlorobenzene, acenapthene, acenapthylene, anthracene, barium, benzo(a)anthracene, benzo(a)pyrene, benzo(a)fluoranthene, bis(2-ethyhexyl) phthalate, chromium, chrysene, copper, fluoranthene, fluorene, hexachlorobenzene, hexachlorbutadiene, mercury, napthalene, nickel, phenanthrene, pyrene, zinc in sediment, mercury in water **1006D**-ammonia **1006E**-ammonia **1006F**- DO, ammonia **1006H**- ammonia **1006I**-DO, ammonia **1006J**-DO, ammonia |
| HSC/Buffalo Bayou | 1007 | dioxin, toxicity in sediment | **1007 (HSC/Buffalo Bayou Tidal, Berry Bayou Tidal, Brays Bayou Tidal, Hunting Bayou Tidal, Sims Bayou Tidal)**-dioxin, PCBs, pesticides **1007 (Vince Bayou Tidal)-** ambient toxicity in sediment, dioxin, PCBs, pesticides **1007B**- bacteria **1007C**-bacteria **1007D**-bacteria **1007E**-bacteria **1007F**- bacteria **1007G**-bacteria **1007H**- DO, bacteria **1007I**-DO, bacteria **1007K**-DO, bacteria **1007L**- bacteria **1007M**- bacteria **1007N**- bacteria **1007O**- DO, bacteria **1007P**- bacteria **1007Q**- bacteria, DO **1007R**- DO, bacteria | **1007**- ammonia, nitrate+nitrite nitrogen, orthophosphorus, total phosphorus, CD,CU, and ZN in sediment, **1007 (Berry Bayou Tidal)**- bacteria, **1007 (Brays Bayou Tidal)**- ammonia, **1007 (Sims Bayou Tidal)**- ammonia, nitrate+nitrite nitorgen, orthophosphorus, total phosphorus, **1007 (Vince Bayou Tidal)**- ammonia, orthophosphorus, total phosphorus **1007 (Hunting Bayou Tidal)**- high pH **1007B**- ammonia, nitrate+nitrite nitrogen, orthophosphorus, total phosphorus **1007C**- ammonia **1007D** - ammonia **1007F**- ammonia **1007G**- ammonia **1007H**- DO, ammonia **1007I**- DO, ammonia **1007K**-DO, ammonia **1007N**- DO, ammonia **1007O**- DO, ammonia **1007P**-DO, ammonia **1007Q**-ammonia, nitrate+nitrite nitrogen, orthophosphorus, total phosphorus, DO **1007R**- DO, ammonia |
| HSC/SJR | 1005 | dioxin | PCBs, pesticides (downstream I-10 to Lynchburg Ferry Road), dioxin | - |
| Lake Conroe | 1012 | - | - | DO, high pH |
| Lake Creek | 1015 | - | - | - |
| Lake Houston | 1002 | - | - | **1002**-orthophosphorus, total phosphorus, DO, nitrate+nitrite nitrogen **1002B**-DO |
| Peach Creek | 1011 | - | - | - |
| San Jacinto River Tidal | 1001 | dioxin, pathogens | dioxin (up to Lake Houston Dam), PCBs, pesticides (up to Hwy 90) | - |
| Spring Creek | 1008 | DO, pathogens | **1008**- bacteria, DO | **1008**- DO, nitrate+nitrite nitrogen, orthophosphorus, total phosphorus **1008B**- DO, ammonia, total phosphorus **1008F**- DO **1008G**- DO, ammonia |
| West Fork SJR | 1004 | - | bacteria | DO, nitrate+nitrite nitrogen, orthophosphorus |
| White Oak Bayou | 1017 | pathogens | **1017**- bacteria **1017A**- bacteria **1017B**- bacteria **1017D**- DO, bacteria **1017E**- bacteria | **1017**- bacteria, ammonia, nitrate+nitrite nitrogen, orthophosphorus, total phosphorus **1017A**- ammonia **1017B**- ammonia **1017D**- DO, ammonia **1017E**- DO |

| Watershed | Segment | 2000 303(d) List Parameter | 2002 305(b) impairments | 2002 305(b) concerns |
|---|---|---|---|---|
| Armand Bayou | 1113 | DO, pathogens | **1113**- DO **1113A**- DO, bacteria | **1113**- excessive algal growth, pH |
| Bastrop Bayo Tidal | 1105 | - | - | - |
| Chocolate Bayou Above Tidal | 1108 | pathogens, TDS | - | - |
| Chocolate Bayou Tidal | 1107 | - | - | - |
| Clear Creek Above Tidal | 1102 | carbon disulfide, chlordane, trichloroethane, dichloroethane, pathogens | **1102**- TDS, bacteria, chloride **1102A**- bacteria **1102B**- bacteria | **1102**- DO, ammonia, nitrate+nitrite nitrogen, orthophosphorus, total phosphorus **1102A**- ammonia **1102B**- ammonia |
| Clear Creek Tidal | 1101 | carbon disulfide, chlordane, trichloroethane, dichloroethane, pathogens | **1101**- bacteria **1101B**- bacteria | **1101**- high pH **1101B**- ammonia |
| Dickinson Bayou Above Tidal | 1104 | pathogens | **1104**- bacteria | **1104**- DO, ammonia |
| Dickinson Bayou Tidal | 1103 | DO, pathogens | **1103**- DO, bacteria **1103A**- bacteria **1103B**- bacteria **1103C**- bacteria **1103D**- bacteria | **1103**- DO, bacteria **1103A**- bacteria **1103B**- DO **1103C**- DO |
| Old Brazos River Channel Tidal | 1111 | - | - | **1111**- barium, copper, nickel in sediment |
| Oyster Creek Above Tidal | 1110 | DO, pathogens | **1110**- DO | **1110**-DO |
| Oyster Creek Tidal | 1109 | pathogens | - | - |
| San Bernard River Above Tidal | 1302 | thermal modifications | **1302**- bacteria, thermal modifications | **1302**- impaired macrobenthos community, impaired fish community |
| San Bernard River Tidal | 1301 | - | - | - |
| Barbours Cut | 2436 | dioxin | dioxin | - |
| Bastrop Bay/ Oyster Lake | 2433 | - | - | - |
| Bayport Channel | 2438 | dioxin | dioxin | - |
| Black Duck Bay | 2428 | dioxin | dioxin | - |
| Burnett Bay | 2430 | dioxin | dioxin | - |
| Chocolate Bay | 2432 | pathogens | bacteria (oyster water use) | - |
| Christmas Bay | 2434 | - | - | - |
| Clear Lake | 2425 | - | **2425B**- bacteria **2425C**- bacteria | **2425**- ammonia, orthophosphorus, total phosphorus, excessive algal growth **2425C**- DO |
| Drum Bay | 2435 | - | - | - |
| East Bay | 2423 | pathogens | **2423**- bacteria (oyster water use) | - |
| Lower Galveston Bay | 2439 | copper (chronic), pathogens | **2439**- bacteria (oyster water use) | **2439-** bacteria (oyster water use) **2439A**- ammonia |
| Moses Lake | 2431 | - | - | - |
| San Jacinto Bay | 2427 | dioxin | dioxin | - |
| Scott Bay | 2429 | dioxin, pathogens | dioxin, bacteria | - |
| Tabbs Bay | 2426 | dioxin, pathogens | dioxin, bacteria | - |
| TX City Ship Channel | 2437 | DO | DO | ammonia, orthophosphorus, total phosphorus |
| Upper Galveston Bay | 2421 | dioxin, pathogens | **2421**- dioxin, bacteria (oyster water use) | **2421**- bacteria (oyster water use), total phosphorus |
| West Bay | 2424 | copper (chronic), pathogens | **2424-** bacteria (oyster water use) **2424A**- bacteria, DO **2424C**- DO, bacteria | **2424A**- DO **2424B**- DO, ammonia **2424C**- DO, bacteria **2424E**- ammonia **2424F**- ammonia |
| Gulf of Mexico | 2501 | - | **2501**- mercury in king mackerel >43 inches | - |

**NOTE: Some of these listings are for portions of waterbodies. Please visit TNRCC's listing of individual water body assessments and sample information at http://www.tnrcc.state.tx.us/water/quality/02_twqmar/02_305b/index.html for more details**

**Dioxin is found in catfish and crab samples; PCBs and pesticides are found in fish tissue**

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| Segment/ Subsegment | Name | Description | Type | Length/Area |
|---|---|---|---|---|
| 0901 | Cedar Bayou | From the confluence with Galveston Bay 1.0 km (0.6 miles) downstream of Tri-City Beach Road in Chambers County to a point 2.2 km (1.4 miles) upstream of IH 10 in Chambers/Harris County | Tidal | 19 miles |
| 0902 | Cedar Bayou Above Tidal | From a point 2.2 km (1.4 miles) upstream of IH 10 in Chambers/Harris County to a point 7.4 km (4.6 miles) upstream of Fm 1960 in Liberty County | Freshwater | 25 miles |
| 1001 | San Jacinto River | From a point 100 meters (110 yards) downstream of IH 10 in Harris County to Lake Houston Dam in Harris County | Tidal | 17 miles |
| 1001A | Jackson Bayou | Perennial stream from a point immediately upstream of the tidal portion of Jackson Bayou upstream to the confluence with Gum Gully | Freshwater | 2.2 miles |
| 1001B | Rickett Creek | Intermittent stream with perennial pools from San Jacinto River Tidal to US 90 | Tidal | 2.0 miles |
| 1001C | Gum Gully | Perennial stream from the confluence with Jackson Bayou upstream to the confluence with an unnamed tributary approximately 0.4 km downstream of Huffman-Crosby Road | Freshwater | 4.6 miles |
| 1001D | Bear Lake | Encompasses the entire portion of the bay (tributary bay of San Jacinto River Tidal | Tidal | 0.06 sq. mile |
| 1002 | Lake Houston | From Lake Houston Dam in Harris County to the confluence of Spring Creek on the West Fork San Jacinto Arm in Harris/Montgomery County and to the confluence of Caney Creek on the East Fork Arm in Harris County, up to normal pool elevation of 44 | Reservoir | 12,240 acres |
| 1002A | Tarkington Bayou | Perennial stream from the confluence with Luce Bayou upstream to the confluence with Little Tarkington Bayou near the City of Cleveland | Freshwater | 15.2 miles |
| 1002B | Luce Bayou | From confluence with Lake Houston to FM 1008 | Freshwater | 22.3 miles |
| 1003 | East Fork San Jacinto River | From the confluence of Caney Creek in Harris County to US 190 in Walker County | Freshwater | 75 miles |
| 1004 | West Fork San Jacinto River | From the confluence of Spring Creek in Harris/Montgomery County to Conroe Dam in Montgomery County | Freshwater | 40 miles |
| 1004A | East Fork White Oak Creek | Perennial stream from the confluence with White Oak Creek upstream to the confluence of an unnamed tributary approximately 0.4 km upstream of League Line Road in the City of Panorama Village | Freshwater | 1.9 miles |
| 1004B | West Fork White Oak Creek | Perennial stream from the confluence with White Oak Creek and West Fork San Jacinto River upstream to an on-channel impoundment on West Fork White Oak Creek 1.2 km upstream of League Line Road | Freshwater | 2.7 miles |
| 1004C | Unnamed Tributary of West Fork San Jacinto River | Perrenial stream from the confluence of the West Fork San Jacinto River upstream to the Missouri-Pacific Railroad bridge crossing located east of IH 45 and north of Needham Road approximately 10 km south of the City of Conroe | Freshwater | 2.0 miles |
| 1005 | Houston Ship Channel/San Jacinto River | From the confluence with Galveston Bay at Morgan's Point in Harris/Chambers County to a point 100 meters (110 yards) downstream of IH 10 in Harris County | Tidal | 12 miles |
| 1006 | Houston Ship Channel Tidal | From the confluence with the San Jacinto River in Harris County to a point immediately upstream of Greens Bayou in Harris County, including tidal portions of tributaries | Tidal | 25.6 miles |
| 1006A | *Patrick Bayou Tidal* | *Part of the Houston Ship Channel. 1006A no longer in use as a subsegment* | *NA* | *NA* |
| 1006B | Carpenters Bayou | Perennial stream from 9.0 km upstream of Houston Ship Channel up to 0.8 km upstream of Wallisville Road | Freshwater | 4.4 miles |
| 1006C | Carpenters Bayou | Perennial stream from 0.8 km upstream of Wallisville Road up to Sheldon Reservoir | Freshwater | 5.2 miles |

| Segment/ Subsegment | Name | Description | Type | Length/Area |
|---|---|---|---|---|
| 1006D | Halls Bayou below US 59 | Perennial stream from the confluence with Greens Bayou up to US 59 | Freshwater | 8.3 miles |
| 1006E | Halls Bayou above US 59 | Perennial stream from US 59 upstream to Frick Road | Freshwater | 11.1 miles |
| 1006F | Big Gulch | From the confluence with Greens Bayou Tidal to Wallisville Road | Freshwater | 1.2 miles |
| 1006G | Goodyear Creek Tidal | From confluence with Greens Bayou Tidal to Granada Street | Tidal | 0.6 mile |
| 1006H | Spring Gully | From confluence with Greens Bayou to US 90 | Freshwater | 0.5 mile |
| 1006I | Unnamed Tributary of Halls Bayou | From the confluence with Halls Bayou to a point 0.13 miles upstream of Richland Drive | Freshwater | 0.72 mile |
| 1006J | Unnamed Tributary of Halls Bayou | From the confluence of Halls Bayou (east of US 59 and south of Langley Road) to Mount Houston Road | Freshwater | 2 miles |
| 1007 | Houston Ship Channel/Buffalo Bayou | From a point immediately upstream of Greens Bayou in Harris County to a point 100 meters (110 yards) upstream of US 59 in Harris County, including tidal portions of triburtaries | Tidal | 34.5 miles |
| 1007A | *Vince Bayou Tidal* | *Part of the Houston Ship Channel. 1007A no longer in use as a subsegment* | *NA* | *NA* |
| 1007B | Brays Bayou Above Tidal | Perennial stream from 11.5 km upstream of confluence with Houston Ship Channel up to SH6 | Freshwater | 19.7 miles |
| 1007C | Keegans Bayou | Perennial stream from confluence with Brays Bayou upstream to Harris County line | Freshwater | 12.4 miles |
| 1007D | Sims Bayou Above Tidal | Perennial stream from 11.0 km upstream of confluence with Houston Ship Channel upstream to Hiram Clark drive | Freshwater | 12.7 miles |
| 1007E | Willow Waterhole Bayou | Perennial stream from confluence with Brays Bayou upstream to South Garden (in Missouri City) | Freshwater | 6.5 miles |
| 1007F | Berry Bayou Above Tidal | Perennial stream from 2.4 km upstream from the confluence with Sims Bayou to the southern city limits of South Houston | Freshwater | 2 miles |
| 1007G | Kuhlman Gully | From confluence with Brays Bayou to Atchison, Topeka and Santa Fe Railroad tracks | Freshwater | 1.2 miles |
| 1007H | Pine Gully | From the confluence with Sims Bayou to Broadway | Freshwater | 1 mile |
| 1007I | Plum Creek | From the confluence with Sims Bayou to Telephone Road | Freshwater | 3.8 miles |
| 1007J | Berry Bayou Tidal | From the confluence of Sims Bayou to a point 2.4 km (1.5 miles) upstream | Tidal | 1.5 miles |
| 1007K | Country Club Bayou | From the confluence with Brays Bayou to approximately 0.5 miles upstream of North Wayside Drive | Freshwater | 1 mile |
| 1007L | Unnamed Tributary of Brays Bayou | From the confluence with Brays Bayou near Fondren Road to a point 0.60 miles upstream | Freshwater | 0.6 mile |
| 1007M | Unnamed Tributary of Hunting Bayou | From the confluence with Hunting Bayou to Mercury Road | Freshwater | 1.1 miles |
| 1007N | Unnamed Tributary of Sims Bayou | From the confluence with Sims Bayou, south of Airport Road, to Reed Road, east of SH 288 | Freshwater | 1.4 miles |
| 1007O | Unnamed Tributary of Buffalo Bayou | From the confluence with Buffalo Bayou to IH-10 between Hirsch Road and Lockwood | Freshwater | 1 mile |
| 1007P | Brays Bayou Above Tidal | From Alief Clodine Road to SH6 | Freshwater | 3 miles |
| 1007Q | Sims Bayou Above Tidal | From Hiram Clark Drive to south of West Orem Road | Freshwater | 2.2 miles |
| 1007R | Hunting Bayou Above Tidal | From the confluence with Hunting Bayou Tidal at IH-10 to Maury Street on the north fork and Bain Street on the south fork | Freshwater | 11 miles |
| 1008 | Spring Creek | From the confluence with the West Fork San Jacinto River in Harris/Montgomery County to the most upstream crossing of M 1736 in Waller County | Freshwater | 69 miles |
| 1008A | Mill Creek | Perennial stream from the normal pool elevation of Neidigk Lake upstream to the confluence of Hurricaine Creek and Kickapoo Creek | Freshwater | 13.4 miles |

| Segment/ Subsegment | Name | Description | Type | Length/Area |
|---|---|---|---|---|
| 1008B | Upper Panther Branch | Intermittent stream with perennial pools from the normal pool elevation of 125 feet of Lake Woodlands upstream to the confluence with Bear Branch | Freshwater | 1.9 miles |
| 1008C | Lower Panther Branch | Perennial stream from the confluence with Spring Creek upstream to the dam impounding Lake Woodlands | Freshwater | 5.2 miles |
| 1008D | Metzler Creek | Intermittent stream with perennial pools from the confluence of Cannon Gully up to 0.2 km below Kuykendahl Road | Freshwater | 1.4 miles |
| 1008E | Bear Branch | From the confluence with Upper Panther Branch to south of FM 1488 | Freshwater | 8.7 miles |
| 1008F | Lake Woodlands | From Lake Woodlands Dam to confluence with Upper Panther Branch Creek | Reservoir | 284 acres |
| 1008G | Upper Panther Branch Above Bear Branch | From the confluence with Bear Branch to Old Conroe Road | Freshwater | 4.8 miles |
| 1009 | Cypress Creek | From the confluence with Spring Creek in Harris County to the confluence of Snake Creek and Mound Creek in Waller County | Freshwater | 53 miles |
| 1009A | Dry Creek | Perennial stream from the confluence with Cypress Creek upstream to the beginning of channelization at Jarvis Road, 0.6 km upstream from the confluence with Cypress Creek north of Hwy 290 | Freshwater | 0.37 miles |
| 1009B | Dry Creek | Perennial stream from the point where channelization begins ar Jarvis Road, which is 0.6 km upstream of the confluence with Cypress Creek, upstream to Spring Cypress Road, 1.2 km upstream of Jarvis Road north of Hwy 290 | Freshwater | 0.77 miles |
| 1009C | Dry Gully | Perennial stream from its confluence with Cypress Creek upstream 3.2 km, which is approximately 1 km upstream of Louetta Road | Freshwater | 1.9 miles |
| 1009D | Dry Gully | Perennial stream from a point 1 km upstream of Louetta Road upstream to Spring Cypress Road | Freshwater | 1.3 miles |
| 1010 | Caney Creek | From the confluence with the East Fork San Jacinto River in Harris County to SH 150 in Walker County | Freshwater | 57 miles |
| 1011 | Peach Creek | From the confluence with Caney Creek in Montgomery County to Sh 150 Walker County | Freshwater | 67 miles |
| 1012 | Lake Conroe | From Conroe Dam in Montgomery County up to the normal pool elevation of 201 feet (impounds West Fork San Jacinto River) | Reservoir | 19, 320 acres |
| 1012A | Town Creek | Perennial stream from the confluence with Atkins Creek upstream to the confluence with Carwile Creek | Freshwater | 3.0 miles |
| 1012B | Robinson Creek | Perennial stream from the confluence with the West Fork San Jacinto River upstream to the confluence with an unnamed second order tributary approximately 0.1 km upstream of Bethel Road | Freshwater | 5.1 miles |
| 1013 | Buffalo Bayou Tidal | From a point 100 meters (110 yards) upstream of US 59 in Harris County to a point 400 meters (440 yards) upstream of Shepherd Drive in Harris County | Tidal | 4 miles |
| 1013A | Little White Oak Bayou | Perennial stream from the confluence with White Oak Bayou up to RR tracks north of IH 610 | Freshwater | 4.3 miles |
| 1013C | Unnamed Tributary of Buffalo Bayou Tidal | Located approximately 1.8 miles upstream of the Buffalo Bayou/White Oak Bayou confluence between IH-10 and Memorial Drive west of IH-45 | Freshwater | 0.6 mile |
| 1014 | Buffalo Bayou Above Tidal | From a point 400 meters (440 yards) upstream of Shepherd Drive in Harris County to SH 6 in Harris County | Freshwater | 24 miles |
| 1014A | Bear Creek | Perennial stream from the confluence with South Mayde Creek upstream to the confluence with an unnamed tributary 1.24 km north of Longenbaugh Road | Freshwater | 16.8 miles |

| Segment/ Subsegment | Name | Description | Type | Length/Area |
|---|---|---|---|---|
| 1014B | Buffalo Bayou | Perennial stream from SH6 in Harris County upstream to the confluence with Willow Fork Buffalo Bayou in Fort Bend County | Freshwater | 18.6 miles |
| 1014C | Horsepen Creek | Perennial stream from 0.62 km north of FM 529 upstream to a point 2.4 km upstream of SH 6 | Freshwater | 2.5 miles |
| 1014D | Horsepen Creek | Perennial stream from the confluence with Langham Creek upstream to where channelization begins, which is .62 km norht of FM 529 | Freshwater | 2.7 miles |
| 1014E | Langham Creek | Perennial stream from the confluence with Dinner Creek upstream to FM 529 | Freshwater | 2.5 miles |
| 1014F | Langham Creek | Perennial stream from the confleunce with Bear Creek upstream to the confluence with Dinner Creek | Freshwater | 8.8 miles |
| 1014G | South Mayde Creek | Perennial stream from an unnamed tributary 0.62 km east of Barker-Cypress Road upstream to an unnamed tributary 1.05 km south of Clay Road | Freshwater | 4.5 miles |
| 1014H | South Mayde Creek | Perennial stream in the Addicks Reservoir flood pool area, from the confluence with Buffalo Bayou upstream to the confluence with an unnamed tributary 0.62 km wast of Barker-Cypress Road | Freshwater | 5.9 miles |
| 1014K | Turkey Creek | Perennial stream from the confluence with South Mayde Creek upstream to the headwaters south of Clay Road | Freshwater | 5.5 miles |
| 1014L | Mason Creek | Perennial stream from the confluence with Buffalo Bayou upstream to channelization, 1.55 km south of Franz Road | Freshwater | 5.1 miles |
| 1014M | Neimans Bayou | From the confluence with Buffalo Bayou Above Tidal to upstream of IH 10 | Freshwater | 1 mile |
| 1014N | Rummel Creek | From the confluence with Buffalo Bayou Above Tidal to upstream of IH 10/ Beltway 8 | Freshwater | 2.1 miles |
| 1014O | Spring Branch | From confluence with Buffalo Bayou to Blalock Road | Freshwater | 4 miles |
| 1015 | Lake Creek | From the confluence with the West Fork San Jacinto River in Montgomery County to a point 4.0 km (2.5 miles) upstream of SH 30 in Grimes County | Freshwater | 48 miles |
| 1016 | Greens Bayou Above Tidal | From a point 0.7 km (0.4 miles) above the confluence of Halls Bayou in Harris County to a point 100 meters (110 yards) above FM 1960 in Harris County | Freshwater | 24 miles |
| 1016A | Garners Bayou | Perennial stream from the confluence with Williams Gully upstream to 1.5 km north of Atoscocita Road | Freshwater | 7.2 miles |
| 1016B | Unnamed Tributary of Greens Bayou | From confluence with Greens Bayou to Hirsch Road | Freshwater | 5.1 miles |
| 1016C | Unnamed Tributary of Greens Bayou | From confluence with Greens Bayou, east of Aldine Westfield Road, to the Hardy Toll Road | Freshwater | 2.2 miles |
| 1016D | Unnamed Tributary of Greens Bayou | From confluence with Greens Bayou, west of El Dorado Country Club to Lee Road, west of US Hwy 59 | Freshwater | 2.75 miles |
| 1017 | White Oak Bayou | From a point immediately upstream of the confluence of Little White Oak Bayou in Harris County to a point 0.3 km (1.9 miles) upstream of FM 1960 in Harris County | Freshwater | 23 miles |
| 1017A | Brickhouse Gully/Bayou | Perennial stream from the confluence with White Oak Bayou to Gessner Road | Freshwater | 6 miles |
| 1017B | Cole Creek | Perennial stream from the confluence with White Oak Bayou up to south of Beltway 8 | Freshwater | 6.8 miles |
| 1017C | Vogel Creek | Perennial stream from the confluence with White Oak Bayou to a point 3.2 km upstream of the confluence with White Oak Bayou | Freshwater | 2.1 miles |
| 1017D | Unnamed Tributary of White Oak Bayou | From confluence with White Oak Bayou downstream to TC Jester, to Hempstead Hwy, norht of US Hwy 290 | Freshwater | 1.4 miles |
| 1017E | Unnamed Tributary of White Oak Bayou | From the confluence with White Oak Bayou, near W 11th Street, to just upstream of W 26th Street, south of Loop 610 W | Freshwater | 1.6 miles |

| Segment/ Subsegment | Name | Description | Type | Length/Area |
|---|---|---|---|---|
| 1101 | Clear Creek Tidal | From the confluence with Clear Lake at a point 3.2 km (2.0 miles) downstream of El Camino Real in Galveston/Harris County to a point 100 m (110 yards) upstream of Fm 528 in Galveston County | Tidal | 12 miles |
| 1101A | Magnolia Creek | Intermittent stream with perennial pools from the confluence with Clear Creek upstream to 0.8 km upstream of the confluence with the second unnamed tributary | Freshwater | 2.4 miles |
| 1101B | Chigger Creek | From the confluence with Clear Creek Tidal to the Brazos River Authority Canal near CR 143 | Freshwater | 9.8 miles |
| 1102 | Clear Creek Above Tidal | From a point 100 meters (110 yards) upstream of FM 528 in Galveston/Harris County to Rouen Road in Fort Bend County | Freshwater | 30 miles |
| 1102A | Cowart Creek | Intermittent stream with perennial pools from the confluence with Clear Creek to SH 35 | Freshwater | 8.1 miles |
| 1102B | Mary's Creek/ North Fork of Mary's Creek | Perennial stream from the confluence with Clear Creek upstream to the confluence with North Fork Mary's Creek near FM 1128, approximately 5 km southwest of Pearland. Includes perennial portions of North Fork Mary's Creek from the confluence to Mary's Cre | Freshwater | 10.9 miles |
| 1103 | Dickinson Bayou Tidal | From the confluence with Dickinson Bay 2.1 km (1.3 miles) downstream of SH 146 in Galveston County to a point 4.0 km (2.5 miles) downstream of FM 517 in Galveston County | Tidal | 15 miles |
| 1103A | Bensons Bayou | From the confluence with Dickinson Bayou Tidal to 0.37 miles upstream of FM 646 | Tidal | 2.3 miles |
| 1103B | Bordens Gully | From the confluence with Dickinson Bayou Tidal to upstream of Calder Road | Tidal | 2.5 miles |
| 1103C | Geisler Bayou | From confluence with Dickinson Bayou tidal to IH 45 | Tidal | 1.8 miles |
| 1103D | Gum Bayou | From confluence with Dickinson Bayou tidal to FM 3436 | Tidal | 3.1 miles |
| 1104 | Dickinson Bayou Above Tidal | From a point 4.0 km (2.5 miles) downstream of FM 517 in Galveston County to FM 528 in Galveston County | Freshwater | 7 miles |
| 1105 | Bastrop Bayou Tidal | From the confluence with Bastrop Bay 1.1 km (0.7 miles) downstream of the Intracoastal Waterway in Brazoria County to Old Clute Road at Lake Jackson in Brazoria County | Tidal | 25 miles |
| 1105A | Flores Bayou | Perennial stream from a point 2.6 km downstream of CR 171 upstream to SH 35 | Freshwater | 7.1 miles |
| 1107 | Chocolate Bayou Tidal | From the confluence with Chocolate Bay 1.4 km (0.9 miles) downstream of FM 2004 in Brazoria County to a point 4.2 km (2.6 miles) downstream of Sh 35 in Brazoria County | Tidal | 14 miles |
| 1108 | Chocolate Bayou Above Tidal | From a point 4.2 km (2.6 miles) downstream of SH 35 in Brazoria County to SH 6 in Brazoria County | Freshwater | 22 miles |
| 1109 | Oyster Creek Tidal | From the confluence with the Intracoastal Waterway in Brazoria County to a point 100 meters (110 yards) upstream of Fm 2004 in Brazoria County | Tidal | 25 miles |
| 1110 | Oyster Creek Above Tidal | From a point 100 meters (110 yards) upstream of FM 2004 in Brazoria County to the Brazos River Authority diversion dam 1.8 km (1.1 miles) upstream of SH 6 in Fort Bend County | Freshwater | 77 miles |
| 1111 | Old Brazos River Channel | From the confluence with the Intracoastal Waterway in Brazoria County to SH 288 in Brazoria County | Estuary | 0.9 sq. miles |
| 1113 | Armand Bayou Tidal | From the confluence with Clear Lake (at NASA Road 1 bridge) in Harris County to a point 0.8 km (0.5 miles) downstream of Genoa-Redbluff road in Pasadena in Harris County (includes Mud Lake) | Tidal | 8 miles |
| 1113A | Armand Bayou Above Tidal | From a point 0.8 km (0.5 mile) downstream of Genoa-Red Bluff Road | Freshwater | 5.9 miles |
| 1113B | Horsepen Bayou | From confluence with Armand Bayou Tidal to SH 3 | Freshwater | 7.8 miles |

| Segment/ Subsegment | Name | Description | Type | Length/Area |
|---|---|---|---|---|
| 1301 | San Bernard River Tidal | From the confluence with the Intracoastal Waterway in Brazoria County to a point 3.2 km (2.0 miles) upstream of SH 35 in Brazoria County | Tidal | 33 miles |
| 1302 | San Bernard River Above Tidal | From a point 3.2 km (2.0 miles) upstream of SH 35 in Brazoria County to the county road southeast of New Ulm in Austin County | Freshwater | 107 miles |
| 2421 | Upper Galveston Bay | A 280.2-square-kilometer (108.2-square-mile) portion of Galveston Bay entirely within Chambers County extending southward from the vicinity of Morgan's Point to an imaginary east-west line in the area of Redfish Island extending due west from Smith's Point to the western shore of Galveston Bay near Dickinson, and eastward toward imaginary north-south line extending southward from the Beach City area to Smith Point. | Estuary | 108.2 sq. miles |
| 2421A | Clear Lake Channel | From confluence with lower Galveston Bay to Sh 146 | Tidal | 0.33 mile |
| 2423 | East Bay | A 134.9 sq. km (52.1 sq. mile) side bay within the Galveston Bay system, located north of Bolivar Penisula and south of Trinity Bay | Estuary | 52.1 sq. miles |
| 2423A | Oyster Bayou | From confluence with East Bay to 1.4 miles upstream from SH 65 | Tidal | 21 miles |
| 2424 | West Bay | A 179.5-square-kilometer (69.3-square-mile) side bay within the Galveston Bay system, located on the landward side of Galveston Island from the Galveston Causeway (IH 45) to San Luis Pass (in the jurisdiction of Galveston County, except for a northwestern portion in Brazoria county). | Estuary | 69.3 sq. miles |
| 2424A | Highland Bayou | From confluence with Jones Bay to Avenue Q 1/2 north of Sh 6 between Arcadia and Alta Loma | Tidal | 13.2 miles |
| 2424B | Lake Madeline | Located between Jones Street, Stewart Street, and Pine Street, north of the seawall on Galveston Island | Estuary | 0.1 sq. miles |
| 2424C | Marchand Bayou | From confluence with Highland Bayou to 0.45 mile north of IH 45 | Tidal | 1.8 miles |
| 2424D | Offatts Bayou | Located on the east end of Galveston Island, running parallel with the southern terminus of IH 45, and joins West Bay near Teichman Point | Estuary | 1.34 sq. miles |
| 2424E | English Bayou | Between IH 45, Bayou Shore Drive, South Shore Rear and SH 342 on Galveston Island | Estuary | 0.1 sq. miles |
| 2424F | Crash Basin | Located off West Bay near the outlet of Offatts Bayou and adjacent to Teichman Point | Estuary | 0.04 sq. miles |
| 2425 | Clear Lake | A 5.2-square-kilometer (2.0-square-mile) brackish, tidally-influenced water body on the western shore of Upper Galveston Bay that receives inflows from Clear Creek and Armand Bayou and also serves as the Galveston/Harris County boundary in the area. | Estuary | 1,280 acres |
| 2425A | Taylor Lake | Encompasses the entire portion of the bay (tributary bay of Clear Lake) | Estuary | 0.28 sq. miles |
| 2425B | Jarbo Bayou | From confluence with Clear Lake to 0.6 mile upstream of FM 518 | Tidal | 2.7 miles |
| 2425C | Robinson Bayou | From confluence with Clear Lake to 0.33 miles upstream of Webster Street | Tidal | 1.4 miles |
| 2426A | Goose Creek | Baker Street to near Highland Reservoir | Freshwater | 4.3 miles |
| 2426B | Goose Creek | East Goose Creek to Baker Street | Freshwater | 2.2 miles |
| 2426 | Tabbs Bay | A 9.3 sq. km (3.6 sq. mile) side bay immediately north of Upper Galveston Bay and just south of Black Duck Bay in the vicinity of Morgan's Point in Harris County | Estuary | 3.6 sq. miles |
| 2427 | San Jacinto Bay | A 5.4 sq. km (2.1 sq. mile) side bay west of Black Duck Bay in the vicinity of Baytown in Harris County | Estuary | 2.1 sq. miles |
| 2428 | Black Duck Bay | A 2.1 sq. km (0.6 sq. mile) side bay immediately north of Tabbs Bay and east of San Jacinto Bay in the vicinity of Baytown in Harris County | Estuary | 0.6 sq. miles |

| Segment/ Subsegment | Name | Description | Type | Length/Area |
|---|---|---|---|---|
| 2429 | Scott Bay | A 4.4 sq. km (1.7 sq. mile) side bay north of Black Duck Bay and south of Burnett Bay in the vicinity of Baytown in Harris County | Estuary | 1.7 sq. miles |
| 2430 | Burnett Bay | A 7.0 sq. km (2.7 sq. mile) side bay north of Scott Bay and south of the confluence with the San Jacinto River and the Houston Ship Channel in Harris County | Estuary | 2.7 sq. miles |
| 2431 | Moses Lake | An 8.5-square-kilometer (3.3-square-mile) water body on the western shore of Lower Galveston Bay immediately south of and adjacent to Dickinson Bay in Galveston County. | Estuary | 3.3 sq. miles |
| 2431A | Moses Bayou | From confluence with Moses Lake to 1.4 miles upstream to SH 3 | Tidal | 5.7 miles |
| 2432 | Chocolate Bay | A 19.7 sq. km (7.6 sq. mile) side bay within the Galveston Bay system emptying into West Bay and receiving inflow from Chocolate Bayou, Mustang Bayou, and Halls Bayou in southeastern Brazoria County | Estuary | 7.6 sq. miles |
| 2432A | Mustang Bayou | Perennial stream from County Road 166 upstream to the confluence with an unnamed tributary 0.3 kilometers upstream of SH 35 | Freshwater | 2.9 miles |
| 2433 | Bastrop Bay/Oyster Lake | A 10.1 sq. km (3.9 sq. mile) side bay within the Galveston Bay system that includes the adjacent Oyster Lake and empties into Christmas Bay after receiving inflow from Bastrop Bayou in southeastern Brazoria County | Estuary | 3.9 sq. miles |
| 2434 | Christmas Bay | A 23.1 sq. km (8.9 sq. mile) side bay within the Galveston Bay system that is immediately west of and adjacent to West Bay near San Luis Pass and receives inflow from Bastrop Bayou and Bay in southeastern Brazoria County | Estuary | 8.9 sq. miles |
| 2435 | Drum Bay | A 4.4 sq. km (1.7 sq. mile) side bay within the Galveston Bay system that is immediately west of and adjacent to Christmas Bay in southeastern Brazoria County | Estuary | 1.7 sq. miles |
| 2435A | Nicks Cut | Cut from Nicks Lake to Gulf Intercoastal Waterway to Drum Bay | Estuary | 0.5 mile |
| 2436 | Barbours Cut | A 0.5 sq. km (0.2 sq. mile) inlet in the vicinity of Morgan's Point in Harris County at the northernmost point of Upper Galveston Bay | Estuary | 0.2 sq. miles |
| 2437 | Texas City Ship Channel | A 1.6-square-kilometer (0.6-square-mile) navigation channel immediately south of the Texas City Dike on the western shore of Lower Galveston Bay in Galveston County. | Estuary | 0.6 sq. miles |
| 2438 | Bayport Channel | A 2.3 square kilometer (0.9 square miles) navigation channel on the western shore of Upper Galveston Bay in the vicintiy of La Porte in Harris County. | Estuary | 0.9 sq. miles |
| 2439 | Lower Galveston Bay | A 361.6-square-kilometer (139.6-square-mile) portion of Galveston Bay entirely within Galveston County extending eastward from the Galveston Causeway (IH -45) past Bolivar Roads (the pass between Galveston Island and Bolivar Peninsula) to an imaginary line from the landward side of Bolivar Peninsula northwest toward Smith's Point and northward to an imaginary east-west line in the area of Redfish Island extending due west from Smith's Point to the western shore of Galveston Bay near Dickinson. | Estuary | 139.6 sq. miles |
| 2439A | Seawall Lagoon | Located approximately 1.2 miles south of Dollar Point adjacent to Bay Street N | Estuary | 0.004 sq. mile |
| 2501 | Gulf of Mexico | Stretch of coastline from the Old Brazos River Channel to the easternmost edge of the Galveston County line | Ocean | Approximately 73 miles |

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