

HOW'S THE WATER?

HOUSTON-GALVESTON REGION
CLEAN RIVERS PROGRAM



BASIN HIGHLIGHTS REPORT
2014

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Common Acronyms

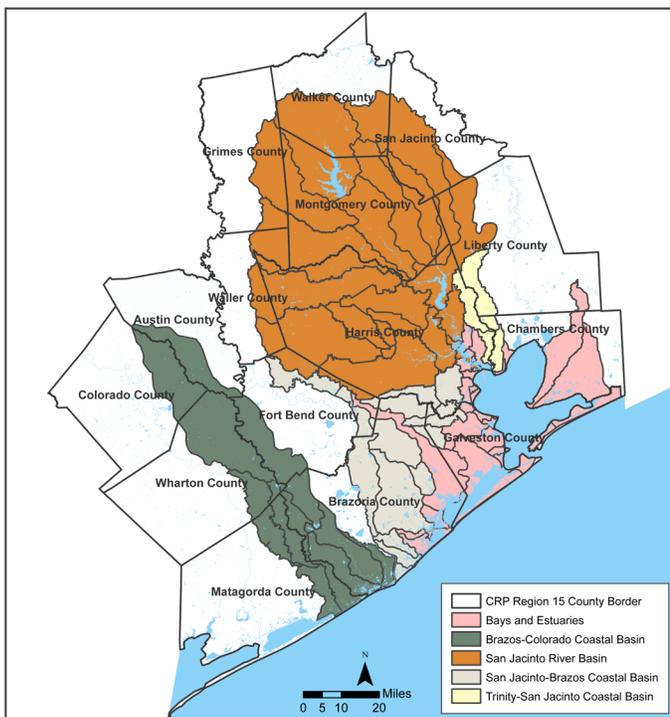
ALU	Aquatic Life Use	I-PLAN	Implementation Plan
AU	Assessment Unit	OSSF	On-Site Sewage Facility
BIG	Bacteria Implementation Group	TCEQ	Texas Commission on Environmental Quality
CRP	Clean Rivers Program	TMDL	Total Maximum Daily Load
DO	Dissolved Oxygen	TSSWCB	Texas State Soil and Water Conservation Board
EPA	Environmental Protection Agency	USGS	U.S. Geological Survey
HARC	Houston Advanced Research Center	WPP	Watershed Protection Plan
H-GAC	Houston-Galveston Area Council	WWTF	Wastewater Treatment Facility

Introduction

Overview

The Houston-Galveston region is home to more than 16,000 miles of waterways and shoreline and has the largest coordinated surface water quality monitoring program in Texas.

The region has a strong economy and rapidly growing population which puts a strain on water resources in terms of both quantity and quality. It is more important than ever that we protect local waters and understand that it is everyone's responsibility to ensure that those resources continue to be viable long into the future. This is why the Houston-Galveston region's Clean Rivers Program (CRP) works closely with local partners and the Texas Commission on Environmental Quality (TCEQ) to monitor and assess water quality, and analyze the various factors and activities that impact local waters. CRP provides information and recommendations on what individuals, industry, and local governments can do to clean up and preserve local waterways, now and in the future.



Houston-Galveston CRP Region

The Houston-Galveston Area Council (H-GAC) is the state-designated lead partner agency for the San Jacinto River Basin, the Trinity-San Jacinto Coastal Basin, the San Jacinto-Brazos Coastal Basin, and the Brazos-Colorado Coastal Basin.

H-GAC oversees all aspects of the CRP in these basins and is responsible for the following tasks:

- Project Administration
- Quality Assurance
- Water Quality Monitoring
- Data Management
- Data Analysis and Reporting
- Stakeholder Participation / Public Outreach

This report provides an overview of CRP activities completed during 2013, as well as highlights new projects made possible using CRP data, and was prepared in cooperation with the TCEQ under the authorization of the Texas Clean Rivers Act.

For more information on the projects and statistical data contained herein, please visit our website at www.h-gac.com/water or email us at waterresources@h-gac.com.

At a Glance

The Regional Water Quality Monitoring Program

The Houston-Galveston region CRP is considered a model program throughout the state, thanks in large part to its coordinated approach to water quality monitoring. CRP covers all or a portion of 15 counties and includes more than 370 coordinated sampling sites and 11 regional partners:

- City of Houston Health and Human Services
- City of Houston Public Works and Engineering
- City of Houston Water Quality Control
- Environmental Institute of Houston
- Harris County Flood Control District
- Harris County Pollution Control
- H-GAC
- San Jacinto River Authority – Lake Conroe Division
- San Jacinto River Authority – Woodlands Division
- TCEQ
- United States Geological Survey



Overview of Common Water Quality Issues for the Houston-Galveston Region

The Houston-Galveston region supports a population of more than six million and includes the fourth largest city and third largest county in the nation. Such a concentration of people can place significant strain on the quality and quantity of water.

Currently, more than 80% of the waterways in the Houston-Galveston region fail to meet one or more state water quality standards. The most common water quality issues are:

BACTERIA

Forty-seven percent of stream miles are impaired by high levels of bacteria. High bacterial concentrations can cause swimmers or others who come into direct contact with the water to become ill or suffer from skin infections.

DISSOLVED OXYGEN

Twenty-four percent of stream miles are impaired by low levels of dissolved oxygen (DO). Oxygen depletion in waterways can create uninhabitable environments for fish and other aquatic life crucial to the region's economy.

PCBs / DIOXIN

Seventy-six percent of tidal waterways in the region are impaired by high levels of PCBs/dioxin in fish tissue. People who eat fish or seafood contaminated by PCBs/dioxin can develop long-term, serious illnesses.

NUTRIENTS

Twenty-nine percent of stream miles exceed the state screening levels for nutrients. In high concentrations, nutrients can cause taste and odor in drinking water, as well unsightly algal blooms.

At a Glance

Initiatives Impacting Water Quality

In 2013, several initiatives began that could impact regional water quality, including:

PROPOSITION 6

In November 2013, Texas voters passed Proposition 6, a state constitutional amendment. Proposition 6 will move money from the Economic Stabilization Fund, also known as the “rainy day fund,” and put it into the State Water Implementation Fund of Texas (SWIFT) and the State Water Implementation Revenue Fund of Texas (SWIRFT).

After the initial investment from the rainy day fund, bill sponsors anticipate that SWIFT and SWIRFT will generate enough revenue to fund \$25 billion worth of water supply projects over the next 50 years, according to State Impact- Texas online.

While the long-term impact of Proposition 6 on water quality isn't yet certain, the conservation efforts associated with SWIFT and SWIRFT have the potential to be beneficial to the health of state and local waterways.

RESTORE ACT

The 2010 Deepwater Horizon oil spill in the Gulf of Mexico had a profound effect on the communities and economies of the Gulf Coast. The federal government responded by passing the RESTORE Act in 2012.

The State of Texas began establishing priorities for funding it will receive as part of the RESTORE Act. Municipal infrastructure projects for coastal communities may be eligible for funding. In 2013, H-GAC worked to identify ways to direct a portion of these funds to coastal communities in the region to improve water quality on the Gulf Coast.

STATEWIDE DEVELOPMENT OF NUTRIENT CRITERIA

Currently, no numeric criteria for water quality standards exist for nutrients, making comparative analysis difficult at the state level.

In 2012, the TCEQ established a Nutrient Criteria Development Advisory Workgroup tasked with “developing nutrient criteria—including strategies for developing criteria, types of criteria, categorization of water bodies, and additional data needs” to ensure that water bodies throughout the state are meeting their designated uses.

Criteria will be fine-tuned to specific regions in lieu of a “one size fits all” option.

The timetable for developing nutrient criteria is being developed. The Nutrient Criteria Development Advisory group holds public meetings and seeks stakeholder and subject-matter expert input.

Did You Know...

Drinking water with high concentrations of nutrients can lead to breathing difficulties in pregnant woman and infants?

Learn more by visiting:

<http://www2.epa.gov/nutrientpollution/problem>.

Learn more at www.tceq.texas.gov/waterquality/standards/stakeholders/nutrient_criteria_group.html.

At a Glance

Summary of Water Quality Impairments and Concerns

Basin	Watershed	SEG_GRP	DO	Bact	Chlor	Nut	PCB	Other*	Frogs
Trinity-San Jacinto Coastal	Cedar Bayou	0901		100	100		100		
	Cedar Bayou Above Tidal	0902							
San Jacinto River	Buffalo Bayou Above Tidal	1014	8.1	79.4		68.4			
	Buffalo Bayou Tidal	1013	30.8	63.3		36.4		27.0	
	Caney Creek	1010	16.1	34.6					
	Cypress Creek	1009	41.0	84.6		84.6		10.4	
	East Fork San Jacinto River	1003		100					
	Greens Bayou Above Tidal	1016	5.4	91.2		80.3			
	Houston Ship Channel	1006	3.5	47.2	4.9	63.8	36.7	36.7	
	Houston Ship Channel Buffalo Bayou Tidal	1007	18.6	74.2		88.8	23.8	23.8	
	Houston Ship Channel/San Jacinto River Tidal	1005				29.3	100		
	Lake Conroe	1012	4.9		16.4				
	Lake Creek	1015	66.3	48.3					
	Lake Houston	1002		6.6	14.1	41.3		0.1	
	Peach Creek	1011			100				
	San Jacinto River Tidal	1001					43.4		
	Spring Creek	1008	37.6	71.7	1.1	22.3		11.7	
	West Fork San Jacinto River	1004			61.5		18.1		
	White Oak Bayou Above Tidal	1017	3.5	84.6		80.8			
San Jacinto-Brazos Coastal	Armand Bayou Tidal	1113	56.5	57.5	17.4	17.7	24.7		
	Bastrop Bayou Tidal	1105	81.3	87.1		6.3			
	Chocolate Bayou Above Tidal	1108	100	100				100	
	Chocolate Bayou Tidal	1107		100			100		
	Clear Creek Above Tidal	1102	66.0	81.8		73.0	44.3	4.4	
	Clear Creek Tidal	1101	37.8	71.0	8.8	19.0	29.4		
	Dickinson Bayou Above Tidal	1104		41.3				41.3	
	Dickinson Bayou Tidal	1103	65.6	84.3	12.2		42.5		
	Old Brazos River Channel Tidal	1111			100				
	Oyster Creek Above Tidal	1110	66.3	42.2	42.2				
	Oyster Creek Tidal	1109			100				
Brazos-Colorado Coastal	San Bernard River Above Tidal	1302	61.8	62.6		9.5			
	San Bernard River Tidal	1301		100	100				
	Caney Creek Above Tidal	1305	59.7	14.4		74.1		14.4	
	Caney Creek Tidal	1304	33.2	100					

At a Glance

Basin	Watershed	SEG_GRP	DO	Bact	Chlor	Nut	PCB	Other*	Frogs
Bays & Estuaries	Barbours Cut	2436				100	100		
	Bastrop Bay / Oyster Lake	2433							
	Bayport Ship Channel	2438			100	100	100		
	Black Duck Bay	2428			100	100	100		
	Burnett Bay	2430			100	100	100		
	Chocolate Bay	2432	35.6	62.6		4.8	38.7		
	Christmas Bay	2434							
	Clear Lake	2425	8.4	18.4	65.1	80.0	92.3		
	Drum Bay	2435							
	East Bay	2423	30.0			100		100	
	Lower Galveston Bay	2439				100		100	
	Moses Lake	2431				19.6	19.6	54.4	
	San Jacinto Bay	2427				100	100	100	
	Scott Bay	2429				100	100	100	
	Tabbs Bay	2426					100	100	
	Texas City Ship Channel	2437				100	100	100	
	Trinity Bay	2422				100	60.6	100	
	Upper Galveston Bay	2421				89.5	95.7	100	
West Bay	2424	9.0	4.3	11.4	1.3	88.5			
Gulf of Mexico		2501						44.0	

Ranking Key

The numbers represent the percent of total segment length that is impaired or of concern for each parameter. Cells without numbers represent stream segments that are currently meeting state standards but may be improving or degrading for each parameter.



Severe, multiple water quality impairments and / or concerns exist in the majority of the water body.



Significant, multiple water quality impairments and / or concerns exist in a majority of the water body.



Impairments or concerns exist in a substantial portion of the water body.



Impairment or concern exists in the water body.



No known water quality impairments or concerns exist in the water body.

IMPROVING

DEGRADING

* Other includes parameters such as metals in water, metals in sediment, impaired habitat, impaired benthic macro invertebrates, impaired fish communities, sediment toxicity, fecal coliform, mercury in fish tissue, and fish contamination.

At a Glance

Water Quality Trends

Even though most of the waterways in the region do not meet state water quality standards, more are stable or showing signs of recovery than further degrading.

21% of stream miles have shown improvement in bacteria levels over the seven year assessment period. Additionally, areas participating in the Bacteria Implementation Group (BIG) I-Plan, which provides recommendations for bacteria reduction in and around the Houston area, have experienced a thirty percent decrease in bacteria levels since 2005.

5% of stream miles have shown improvement in DO levels over the seven year assessment period.

11% of stream miles have shown improvement in nutrient levels over the seven year assessment period.

Overall, improved water quality in the region can be attributed to:

- Increased preservation of natural habitat and installation of water quality features in detention basins
- Improved regulation and maintenance of On-Site Sewage Facilities (OSSFs) and Wastewater Treatment Facilities (WWTFs) and their collection systems
- Heightened public awareness and public participation



Ongoing Efforts

Overview

CRP provides the baseline of information for all water quality studies and projects within the 15-county monitoring area.

The following CRP-enabled special studies and projects serve to assist the TCEQ in providing more accurate assessments of area water bodies and reflect stakeholder-driven priorities.

Ambient Water Quality Monitoring Program & Regional Monitoring Workgroup

H-GAC, local partners, and the regional TCEQ office's coordination of monitoring is accomplished through quarterly meetings of the Regional Monitoring Workgroup.

Each April, the workgroup meets to determine which sites will be monitored the following fiscal year. Changes in the schedule are determined using data analysis, recommendations of field or laboratory personnel, recommendations or requests related to needs of ongoing Total Maximum Daily Loads (TMDL), implementation plans (I-Plans) or watershed protection plans (WPPs), or changes to budgets.

All monitoring is conducted under an approved Regional Quality Assurance Project Plan (QAPP), and local CRP partners aim to monitor the same suite of parameters, using comparable methods. Additionally, all laboratories used by CRP monitors are accredited through the National Environmental Laboratory Accreditation Program (NELAC).

Special Studies & Relevant Activity Overview

24-HOUR DO MONITORING

CRP initiated twenty-four hour Dissolved Oxygen (DO) monitoring to verify or determine the extent of the DO impairment at priority sub-segments within the region, identified by TCEQ and H-GAC.

With recent CRP contracts, H-GAC has chosen six sites from which to collect 24-hour data. Monitoring was conducted four times in 2013, and included the following sites:

1. Cedar Bayou Tidal watershed (segment 0901)
2. Cedar Bayou Above Tidal watershed (segment 0902)
3. West Bernard Creek in the San Bernard watershed (segment 1302B)
4. Brushy Bayou in the Bastrop Bayou Tidal watershed (segment 1105B)
5. Plum Creek (segment 1007I) in the Sims Bayou watershed
6. Pine Gully (segment 1007H) in the Sims Bayou watershed

OUTCOMES

Preliminary results from both Cedar Bayou sites show sufficient DO for aquatic life; half the measurements at West Bernard Creek and Brushy Bayou did not meet the standard, but the remainders were above the standard; and most measurements at Plum Creek and Pine Gully suggest that aquatic life cannot be supported with current DO levels.

Ongoing Efforts

AQUATIC LIFE MONITORING STUDY

In 2013, the Environmental Institute of Houston and H-GAC completed the Aquatic Life Monitoring Study. The objective of this study was to determine whether selected water bodies have experienced any changes in water quality or their biological integrity since previously studied in 1997-98 by the United States Geological Survey (USGS).

Data describing the physical, chemical, and biological characteristics of each water body, including Cedar Bayou, Clear Creek, Dickinson Bayou, Lake Creek, and the West Fork of the San Jacinto River, was collected and compared against the assigned water quality standards for each segment.

The study concluded that all of the water bodies are supporting their respective assigned aquatic life use (ALU) categories and water quality standards. Based on analysis of species composition, fish communities did not appear to have changed much since originally surveyed in 1997. Benthic community ALU assessments of these water bodies confirmed that most sites supported the same ALUs as in 1997 except for Lake Creek.

OUTCOMES

A key recommendation from the study is to conduct a detailed analysis of changes in land use and land cover to evaluate the potential influences of those changes over time. It is intended that the data resulting from the study can also be used in conjunction with the Eco-Logical GIS Application.

ECO-LOGICAL GIS APPLICATION

The Eco-Logical GIS application is an interactive mapping tool used to integrate long-range transportation and environmental planning, and help identify and conserve high value environmental resources in the region.

H-GAC convened an Advisory Committee, comprised of environmental professionals from federal and state resource agencies, as well as additional representatives from other conservation organizations, to guide staff on the development of the Eco-Logical tool and determine ecotype categories.

Identified ecotypes include:

- Tidal Wetlands
- Coastal Prairies
- Bottomland Forests
- Water Bodies
- Upland Forests
- Local Icons
- Riparian Corridors

OUTCOMES

H-GAC and its partner entities currently use Eco-Logical to inform watershed protection planning efforts, providing a more holistic view of how land use can broadly impact area water bodies. As additional types are developed, CRP will continue to encourage our local partner agencies and entities to use this application.

Ongoing Efforts



NUTRIENT AND GEOSPATIAL DATA RELATIONSHIPS IN SELECTED WATERSHEDS

H-GAC completed its evaluation of existing nutrient and geospatial data relationships in 2013. This evaluation sought to identify the potential relationship between land cover, land use, and ambient nutrient concentrations in select streams throughout the region.

H-GAC staff identified fourteen monitoring stations for inclusion in this analysis. Once the watershed was delineated for each station, watershed characterizations were conducted and attributes were identified and assigned to all sub-watersheds.

Attributes include:

- Land cover types
- Number of upstream wastewater treatment plants with average permitted discharge
- Soil types (including hydrological soil groups)
- Drainage density and drainage area
- Basin relief / road density
- Imperviousness

OUTCOMES

Analysis of the data demonstrated the following:

- A weak, but statistically significant, relationship exists between nutrient concentrations and two land cover types: wetlands and forested area.
- Areas with more wetland and forest tended to have lower nutrient concentrations.



Watershed Projects

Overview

Every two years, the TCEQ submits the Texas Integrated Report (IR) to the EPA for approval. The IR combines the 303(d) list of impaired waterways and the 305(b) report which provides an assessment of existing water quality in the state and an overview of past and proposed water pollution abatement efforts. The IR is compiled using CRP monitoring data; in fact, the Houston-Galveston region CRP provides approximately 70 percent of the data used in the IR for the region.

The 303(d) list dictates watershed project priorities for the region and acts as a catalyst for planning and mitigation strategies to address impairments and concerns including bacteria, DO, nutrients, and PCB/dioxin.

After a water body is added to the 303(d) list, there are two paths for resolution available: conducting a Total Maximum Daily Load (TMDL) / Implementation Plan (I-Plan) or a Watershed Protection Plan (WPP).

Total Maximum Daily Load (TMDL) / Implementation Plan(I-PLAN)

TMDL is a regulatory process triggered when a waterway is placed on the 303(d) list of impaired water bodies. The TMDL calculates the maximum amount of a pollutant that a water body can receive and still meet water quality standards.

TMDL / I-Plan Project Summary

WATERSHED / PROJECT NAME	YEAR ADDED TO 303(D)	IMPAIRMENT TYPE
BIG Project	1996 - 2012	Bacteria
Armand Bayou	1998 - 2012 1996 - 1998 2010	Bacteria DO PCB/Dioxin
Watersheds of the East / West Fork San Jacinto River	2002 - 2012	Bacteria
Jarbo Bayou	2002 - 2012	Bacteria
Houston Ship Channel / Upper Galveston Bay	EPA Superfund Site – 2008	PCB/Dioxin
Upper Gulf Coast Oyster Waters	1996 - 2012	Bacteria (Oysters)

Watershed Projects

BACTERIA IMPLEMENTATION GROUP (BIG)

The BIG project area encompasses 72 watersheds and spans multiple counties across the region, including Brazoria, Harris, Fort Bend, Grimes, Liberty, Montgomery, San Jacinto, Walker, and Waller.

Formed in 2008, the BIG is a 35-member stakeholder group charged with developing an I-Plan to improve water quality in the greater Houston region and reduce bacteria levels.

The BIG approved its I-Plan, *Implementation Plan for Seventy-Two Total Maximum Daily Loads for Bacteria in the Houston-Galveston Region* in 2011 and subsequently received approval from the TCEQ in January 2013. To date, the BIG has received 90 resolutions of support for the I-Plan from local governments and organizations representing business, agriculture, professional, and environmental groups and has become a model for regional coordination for other TMDL efforts across the state.

The BIG anticipates implementation activities over the next 25 years, with annual reviews to track success and make necessary course corrections to reduce bacteria.

To track success, the BIG uses Houston-Galveston region CRP data to benchmark environmental progress toward implementation goals as directed in the I-Plan through the production of an Annual Report. All BIG materials are available on the website:

www.h-gac.com/BIG.



BACTERIA IMPLEMENTATION GROUP

CURRENT STATUS

Initial results for BIG implementation activities are good; bacteria levels have reduced by 30 percent since 2005.



ARMAND BAYOU

Armand Bayou is a tributary of Clear Lake, located in the San Jacinto-Brazos Coastal Basin. High concentrations of bacteria, which are found in both human and animal waste, have been detected in the bayou. This watershed currently has 11 monitoring sites.

To mitigate issues associated with high bacteria levels in Armand Bayou and several of its tributaries a 20 member Coordination Committee formed to determine how to implement the TMDL. Ultimately, the Committee decided to join the BIG for cost-savings benefits and quicker implementation in 2013.

CURRENT STATUS

Although the Bayou has decided to join the BIG, the TMDL is ongoing and is expected to be completed in spring 2014.

Watershed Projects

WATERSHEDS OF THE EAST / WEST FORKS OF THE SAN JACINTO RIVER

The watersheds included in this TMDL drain into Lake Houston and are adjacent to the BIG project area. They include the East Fork San Jacinto River, West Fork San Jacinto River, Crystal Creek, and a Western arm of Lake Houston. Currently, there are 15 monitoring stations in the project area.

To fully understand and mitigate bacteria impairments in the project area, the TCEQ contracted with the Texas Institute for Applied Environmental Research to complete a TMDL study and with H-GAC to assist in conducting public and stakeholder outreach activities.

CURRENT STATUS

The TMDL is still in development and is expected to be completed in late 2014. Concurrent to the development of the TMDL, H-GAC is working with community leaders and stakeholders to develop a diverse Steering Committee. They will determine how to implement the TMDL, once completed, and whether or not the Watersheds of the East / West Forks should join the BIG I-Plan.



JARBO BAYOU

Jarbo Bayou, located in Galveston County, is a tributary of Clear Lake. It is roughly three square miles in size, encompassing all of Clear Lake Shores and portions of Kemah and League City. The Bayou is currently the subject of a bacteria TMDL being developed by the TCEQ and the University of Houston with support from H-GAC.

Concurrent to the development of the TMDL, a representative Steering Committee comprised of local residents and community leaders was formed in early 2014. The committee will meet over a 12-month period to determine next steps: either join the BIG or create a new, stand-alone I-Plan for bacteria reduction in the watershed.

CURRENT STATUS

The TMDL is still in the early stages of development; however, it is expected that the Steering Committee will make a decision with regard to next steps in the spring of 2014.

Watershed Projects

***HOUSTON SHIP CHANNEL / UPPER GALVESTON BAY**

The Houston Ship Channel / Upper Galveston Bay dioxin and PCB TMDLs are located in the southern portion of the San Jacinto River, Houston Ship Channel, and Upper Galveston Bay.

The purpose of the TMDLs are to determine the necessary reductions in PCB/dioxin within these watersheds in order to meet water quality standards. The TCEQ is working with local stakeholders to assist in the development of the TMDLs and subsequent I-Plans.

As a result of stakeholder input, the San Jacinto River Waste Pits were identified as a primary contributor of dioxin to the Galveston Bay Estuary. In 2008, the EPA Region 6, listed the San Jacinto River Waste Pits as a Superfund Site. Subsequent to its being listed, the EPA oversaw the installation of a temporary armored cap to prevent the additional release of dioxin and the placement of warning signage at the site. A feasibility study that includes identification of cleanup alternatives is being completed, to be followed with public comment on the proposed plan for cleanup. In a related effort, the Galveston Bay Foundation placed seafood consumption advisory signage at fishing locations and boat ramps throughout the San Jacinto River, Houston Ship Channel, and Upper Galveston Bay.

CURRENT STATUS

The Dioxin TMDL report is currently under staff review at TCEQ; no date has been set for sending this report out for public comment. The University of Houston is completing additional PCB monitoring activities in Galveston Bay and is modeling the data for inclusion in the PCB TMDL report. Once completed, TCEQ will convene a group of local stakeholders to review monitoring results and further advise the study.

***UPPER GULF COAST OYSTER WATERS**

The Upper Gulf Coast Oyster Waters I-Plan, led by the Galveston Bay Foundation (GBF) with support from H-GAC, addresses 11 TMDLs related to bacterial contamination of oystereries in and around Galveston Bay.

Eighteen stakeholder organizations and concerned citizens developed an I-Plan over the course of several years. The I-Plan identifies likely bacteria sources, technical and financial needs, monitoring and outreach efforts, and a schedule of activities for each of the stakeholder-developed management measures that will be used to reduce bacteria levels.

CURRENT STATUS

A final draft of the I-Plan was completed during 2013 and is currently under TCEQ review.

GBF is currently working with project partners to plan for implementation tasks. Current planning efforts include a Cease the Grease campaign aimed at reducing the impacts of fats, oils, and grease in sanitary sewers, and a boater waste education campaign, and is expected to begin implementation in 2014.

**This effort is not currently being led by H-GAC, but is an important watershed project taking place within the Houston-Galveston region.*

Watershed Projects

Watershed Protection Plans

WPPs are more holistic in scope when compared to a TMDL / I-Plan, but can be triggered when a water body appears on TCEQ's 303(d) list of impaired waterways. A WPP can also be implemented by a concerned group of citizens, even in the water body does not appear on the 303(d) list.

Additionally, implementation activities outlined by WPPs are entirely voluntary and contain no regulatory requirements.

WPP Project Summary

WATERSHED / PROJECT NAME	YEAR ADDED TO 303(D)	IMPAIRMENT TYPE
Bastrop Bayou	2012	Bacteria
Cedar Bayou	1996 - 2012	Bacteria
	2002 - 2012	Dioxin
	2008 - 2012	PCBs
	2006 - 2008	Macroinvertebrates
San Bernard River	2009 - 2012	Bacteria
Dickinson Bayou	1996 - 2012	Bacteria
		Low Levels DO
Double Bayou	2006 - 2012	Bacteria
Highland / Marchand Bayou	2002 -2012	Bacteria
		Low Levels DO

BASTROP BAYOU

The Bastrop Bayou Watershed drains a mix of land uses in eastern Brazoria County, and has high levels of bacteria. Currently, ten sites are monitored in the Bayou.

Potential bacteria sources in the Bayou include failing OSSFs, pet waste, urban runoff, and feral hogs.

In the fall of 2004, the Galveston Bay Estuary Program (GBEP) and H-GAC conducted a watershed risk assessment that led to the development of the Bastrop Bayou Draft WPP. A diverse group of local stakeholders, comprised of local homeowners, cattle ranchers, rice farmers, elected municipal officials, county health district and environmental enforcement representatives, and watershed residents, led the development of this WPP.

CURRENT STATUS

The Draft WPP is currently under TCEQ and EPA review.

Implementation efforts have already begun in the watershed, including installation of educational signage, transition to sanitary sewer service or remediation of failing OSSFs, and creation of a new dog park for the City of Angleton.

Watershed Projects

“The Friends of Cedar Bayou United in Baytown fully support the Cedar Bayou Watershed Protection program. Due to the rapid expansion of industry and residences in the entire Cedar Bayou Watershed, it is very important that we do what we can to educate the general population on how to minimize adverse impact on the watershed.”

*Jerry L. Jones
President - Friends of Cedar Bayou United*

CEDAR BAYOU

Cedar Bayou forms the border between Harris and Chambers counties, as well as the border between Harris and Liberty counties. It contains a mix of urban and rural land covers, spans approximately 173 square miles, and drains into the Galveston Bay system. The Bayou is extensively monitored, with monthly sampling at ten monitoring sites throughout the watershed and four Texas Stream Team volunteers sampling in the Tidal portion of the watershed.

Cedar Bayou has been impaired by elevated levels of bacteria, and dioxin and PCBs in fish tissue in its Tidal segment, and impaired ecological communities in its Above Tidal segment, for many years. The Above Tidal section was subsequently delisted for impaired macrobenthic communities, but the impairments in the Tidal segment are ongoing. Potential contamination sources include:

- Failing OSSFs
- Sanitary sewer overflows
- Wildlife
- Pet waste and urban runoff
- Land development activities
- Farming and ranching activities

As a result of local concern for water quality, the TSSWCB, H-GAC, and local community partners came together to create the Partnership.

CURRENT STATUS

The Partnership is currently developing a WPP to identify potential voluntary measures such as reducing pet waste, improving sanitary sewer maintenance, remediating failing septic systems, and improving riparian corridors that will address the bayou's water quality challenges.

Additionally, local stakeholders independently led an effort for wide-scale removal of abandoned vessels and marine debris in the lower watershed in late 2013.



Watershed Projects

SAN BERNARD RIVER

The San Bernard River Watershed covers approximately 900 square miles in Austin, Colorado, Wharton, Fort Bend and Brazoria counties. This watershed has ambient monitoring at 12 sites, with 15 additional sites for wet weather monitoring, and targeted monitoring at three wastewater treatment facilities.

Contact recreation in the river is impaired by high bacteria levels while excessive nutrients and low DO levels threaten fish and other aquatic life.

To address high bacteria levels and other issues, H-GAC, along with key community stakeholders and the TCEQ, developed the San Bernard WPP, which is expected to receive TCEQ approval in 2014. In this document, stakeholders identified likely bacteria sources and mitigation strategies for OSSF, livestock, pets, wildlife, urban areas, and WWTFs.

CURRENT STATUS

Funding for implementation of mitigation strategies for municipalities, landowners, and individuals will be sought upon TCEQ approval.

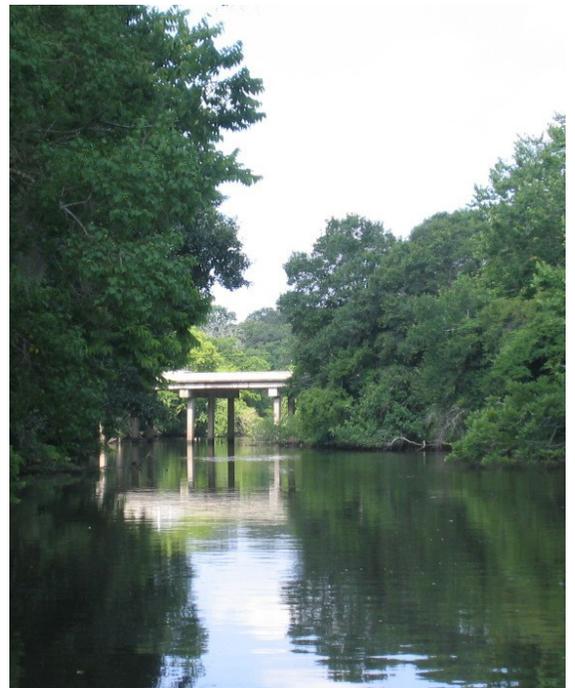
****DICKINSON BAYOU**

The Dickinson Bayou watershed is located within the San Jacinto-Brazos Coastal Basin, to the southeast of Houston and west of Galveston Bay, covering a total of 99.7 square miles.

In response to high levels of bacteria and low levels of DO, TCEQ and local stakeholders formed the Dickinson Bayou Watershed Partnership to address bacteria levels and develop mitigation strategies.

The approved WPP, and subsequent I-Plan in 2014, outlines seven specific implementation measures for Dickinson Bayou:

1. Manage OSSFs
2. Address Wastewater Treatment Facilities & collection systems
3. Address animal waste
4. Restore and repair riparian zones
5. Preserve and restore natural wetlands
6. Construct stormwater treatment wetlands
7. Implement stormwater Best Management Practices (BMP)



CURRENT STATUS

In fulfillment of the goals outlined in the I-Plan, the partnership is currently completing the Dickinson Bayou Marsh Restoration. Additional implementation measures are expected to begin in late 2014.

Watershed Projects



****DOUBLE BAYOU**

The Double Bayou watershed is situated along the eastern shore of Trinity Bay which is part of the Galveston Bay system. Located in southern Liberty County, the headwaters of West Fork Double Bayou flow south before merging with East Fork Double Bayou and then draining to Trinity Bay.

H-GAC partnered with USGS, the Trinity River Authority, and TCEQ in 2006 to collect water quality, stream habitat, and biological data for West Fork Double Bayou, Cotton Bayou, and Hackberry Gully in Chambers County provided important baseline information on this area of the region where little or no data had been collected before. This effort was funded by the CRP, and led to a watershed characterization study in 2009.

This study analyzed gaps in baseline data, implemented initial water quality monitoring, and introduced results to stakeholders.

In 2013, local stakeholders worked with TSSWCB, USGS, Shead Conservation Solutions, and HARC to establish the Double Bayou Partnership, which seeks to create and implement a WPP for the Bayou to reduce bacteria levels and increase dissolved oxygen.

CURRENT STATUS

Development of the WPP is ongoing and includes ongoing water quality monitoring as well as voluntary stakeholder efforts through regular workgroup meetings.

****MOSES-KARANKAWA BAYOUS**

The Moses-Karankawa Bayous project area is 12.5 miles in length, approximately 120 square miles in size, and includes Highland and Marchand Bayous, Moses Lake and Bayou, the Diversionary canal, and coastal bayous like Basford and Karankawa Bayous, which are all located in Galveston County.

Utilizing CRP funds, H-GAC staff conducted a special study to collect additional water quality, stream habitat, and biological data for the bayous in 2007. Following the special study, communities in Galveston County, coordinated by Texas AgriLife, established the Moses-Karankawa Bayous Alliance to begin addressing high bacteria levels and decreased levels of DO through a Watershed Characterization project and then a WPP.

Watershed Projects

This WPP is designed to provide a coordinated framework for prioritizing protection and restoration strategies guided using environmental data. The University of Houston at Clear Lake collected data that were used to characterize the watershed, develop of the plan and in the future will assist the Alliance in tracking of the plan's implementation to demonstrate improved water quality. Once completed, the plan is expected to address the following concerns:

- Protecting people within the watershed from flooding
- Preserving and protecting natural areas within the watershed
- Providing adequate recreational public access to the bayous
- Maintaining the economic viability of the bayous and the watershed
- Addressing land uses and trends impacting the watershed
- Improving or maintaining the water quality of the bayou

CURRENT STATUS

It is anticipated that the WPP will be completed in 2015.

***This effort is not currently being led by H-GAC, but is an important watershed project taking place within the Houston-Galveston region CRP.*

Other Watershed Projects

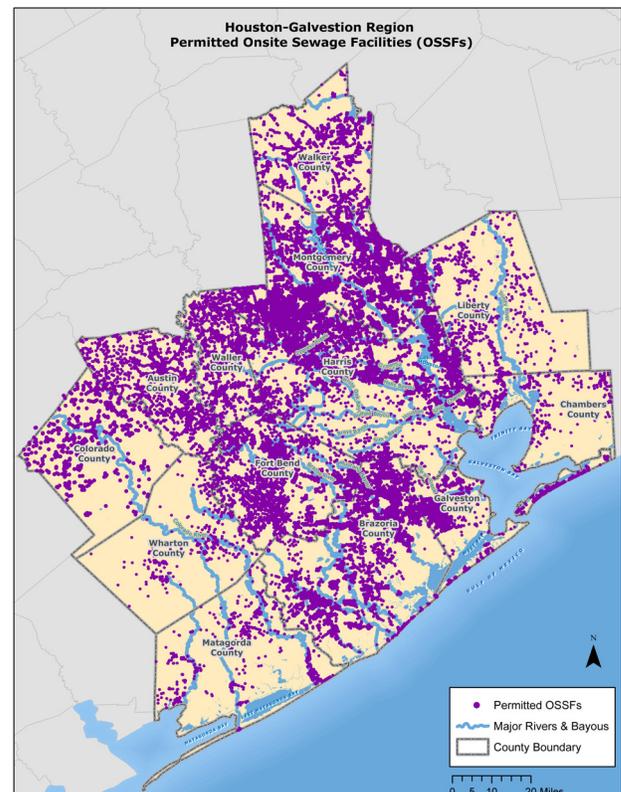
CRP data is used as a baseline for regional projects and programs that seek to support partner agencies and entities and provide a better understanding of regional water quality concerns.

OSSF MANAGEMENT

Currently, there are hundreds of thousands of OSSFs within the CRP basins, many of them failing and outdated. In order to understand the magnitude and scope of OSSF contributions to waterways impaired for elevated bacteria, H-GAC sought to identify the locations for all permitted systems within region and provide this information as a database resource to permitting authorities, or Authorized Agents.

This project provides mapping resources to the Authorized Agents. These mapping resources, which did not exist previously, identify priority areas of concern in proximity to impaired streams for remediation. This information is also useful in the development of TMDL/ I-Plans and WPPs.

The OSSF Information System is a GIS-based online mapping tool that allows for the collected OSSF data to be displayed and used by OSSF professionals as well as the general public.



Watershed Projects

The application allows the user to locate, select, and review specific permits, as well as create workday driving routes to streamline day-to-day operations. User feedback has indicated that this tool has been valuable for OSSF permitting and inspection professionals.

Moving forward, H-GAC will offer a continuing education course, Real Estate Inspections for OSSFs, through the Texas Real Estate Commission (TREC). The course was developed to aide real estate inspectors in identifying failing systems during a point of sale inspection. The focus of this course is to instruct real estate inspectors on how to visually inspect an OSSF as according to TREC rules, and to educate clients on how to maintain an OSSF. The Real Estate Commission approved this course for six continuing education units.

H-GAC staff will offer the course free of charge in areas of concern derived from the unpermitted and potential grandfathered OSSF analysis, and is expected to begin in spring 2014. Visit H-GAC's OSSF website at www.h-gac.com/go/septic to learn more.

STORMWATER PROGRAM EVALUATION



During fiscal year 2013, H-GAC evaluated the state of implementation for the various stormwater management plans (SWMPs) of Phase II Municipal Separate Storm Sewer System (MS4s) stormwater permittees in the region.

H-GAC interviewed 107 of the 142 Phase II MS4s permit holders in the region to evaluate program implementation, successes, challenges, and needs;

evaluated the most recent MS4 Annual Reports from across the region; and interviewed representatives from across the U.S. This data was then compiled into a BMP tracking database housed on the H-GAC website.

Subsequently, H-GAC developed recommendations for better reporting in annual reports and general needs for successful implementation of the Phase II program.

Key recommendations include:

- Increase the public's awareness of stormwater issues through the creation of recognition and certification based branding
- Increase local training opportunities for smaller MS4s
- Require submittal of digital MS4 Annual Reports
- Include quantifiable metrics in Annual Reports
- Incorporate spatial data and monitoring information for BMPs
- Provide funding assistance to implement structural BMPs
- TCEQ promotion at regional MS4 conferences

Moving forward, H-GAC seeks to implement the Stormwater SMART certification and recognition program to honor MS4 permit holders that go above and beyond basic permit requirement using marketable branding elements and annual recognition opportunities.

Watershed Projects

COASTAL COMMUNITIES PROGRAM

From 2012 – 2013, H-GAC surveyed coastal communities within the region to evaluate utility, educational, and financial assistance needs related to nonpoint sources in communities that are too small to have an MS4 permit requirement.

Initially, H-GAC interviewed participating communities to identify needs related to potential nonpoint sources, such as sanitary sewer overflows, drainage issues, and pet waste.



Based on this evaluation, H-GAC derived a set of solutions and services that would seek to simultaneously address the community's needs and reduce nonpoint source pollution, including:

- General information aimed at reducing nonpoint source pollution
- Grant application services for related funding sources, including the RESTORE Act
- Model ordinances and programs that can be modified to fit the needs of individual communities
- Educational materials and resources focused on reducing nonpoint source pollution

In 2013, H-GAC contacted eligible communities to identify potential new participants in the program and new concerns, and publicize the comprehensive program website.

The website provides pertinent information and resources to eligible communities. As a result, H-GAC helped multiple communities identify and apply for various funding sources, including a funding assessment for the Village of Surfside Beach to potentially install pet waste stations.

H-GAC will continue to assist eligible communities through the Coastal Communities Program in 2014.

Learn more at www.coastalcommunitiestx.com.

“The Houston-Galveston region Clean Rivers Program is an invaluable planning tool for the Soil Board. As the data backbone for water quality in our region, CRP helps us prioritize which watersheds and projects within the region to focus on with accurate, current information.”

*Brian Koch
Regional Watershed Coordinator – Wharton Regional Office
Texas State Soil and Water Conservation Board*

Outreach Activities

Overview

Public outreach is a cornerstone of the Houston-Galveston region CRP. In all of its endeavors, H-GAC's water resources group seeks to inform and educate local stakeholders about water quality issues, as well as empower them to take an active role in the health of local waterways when determining needs and setting water quality priorities.

Outreach Priorities

Public outreach and stakeholder participation take several forms in our CRP. The overall priorities of CRP are guided by a local Steering Committee. The Regional Monitoring Workgroup recommends water quality monitoring needs and schedules. Local water quality information is also collected and provided through a network of certified volunteer monitors. CRP also provides many opportunities for education through workshops, booths, and interactive displays at several local events.

All public outreach activities are coordinated with the other water resource programs that occur throughout the region including, WPPs, TMDL / I-Plans, state agencies, and multiple non-profit organizations. This coordination allows CRP to reach a broad number of people, yet tailor information to the needs of a specific geographic or project boundary.

An overview of key public participation and outreach activities from the past year can be found in following sections.



Outreach Projects

CLEAN RIVERS PROGRAM STEERING COMMITTEE

The Clean Rivers Program Steering Committee is a diverse group of stakeholders, comprised of counties, cities, state agencies, environmental groups, citizens, and local industries, which serve as the primary forum for discussion of various water quality issues that have been identified through the assessment process.

In 2013, the Steering Committee met regarding key issues facing CRP, including:

- Establishing a work plan and budget for FY14 – FY15
- Reviewing and finalizing the 2013 Basin Highlights Report
- Discussing proposed Changes to the FY14 Regional Water Quality Monitoring schedule
- Providing updates on WPPs and TMDLs / I-Plans Dependent on CRP data

Learn more at www.h-gac.com/community/water/rivers/crp_committee.aspx.

Outreach Activities

REGIONAL MONITORING WORKGROUP

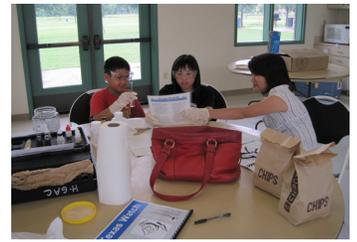
The Regional Monitoring Workgroup, comprised of field and laboratory staff from each of the local CRP partner agencies, met quarterly in 2013 to give updates on individual monitoring programs, discuss quality assurance issues, and offer up solutions to common problems found in the field and/or laboratory.

During the spring of 2013, the workgroup held its coordinated monitoring meeting to discuss data gaps and set the new monitoring schedule for the coming fiscal year.

TEXAS STREAM TEAM

The Houston-Galveston region's Texas Stream Team program, funded locally by CRP, has enabled citizens to become certified volunteer water quality monitors, or citizen scientists, since 1993 and currently boasts 92 monitors sampling at 93 monitoring stations. To become a Texas Stream Team monitor, volunteers must complete three phases of training.

Citizen scientists' data are used to supplement professionally collected data and in some cases provide data in areas where professional monitoring does not take place. This monitoring is extremely valuable to CRP, and is used to inform where new monitoring might be needed and to identify areas with potential problems.



To learn more about upcoming training sessions and current monitoring locations, visit H-GAC's website at www.h-gac.com/community/water/texas_stream_team.



CLEAN WATERS INITIATIVE

The Clean Waters Initiative, a monthly workshop series that serves CRP, ongoing TMDLs / I-Plans, and WPPs, seeks to assist local governments, landowners, and citizens in developing effective strategies to reduce pollution in local waterways. Additionally, this series provides an opportunity for diverse stakeholder groups to connect.

Eight workshops were held in 2013, focusing on coastal communities; on-site sewage facilities; education, outreach and public participation; low impact development; stormwater and watersheds; and minimum control measures for municipal separate storm systems.

To learn more about upcoming CWI workshops or get information on past workshops, visit H-GAC's website at www.h-gac.com/community/water/cwi/default.aspx.

Outreach Activities

OUR GREAT REGION 2040 – PUBLIC OUTREACH SUPPORT

In support of the *Our Great Region 2040* plan, CRP staff provided input on and assistance with the development of several major goals and strategies. The plan is a high-level plan that focuses on economic development, the environment, healthy communities, housing, transportation and resiliency in the Houston-Galveston region.

One of the key ideas in the plan is to secure a clean and ample water supply. With this idea in mind, staff and other interested stakeholders recommended strategies for inclusion in the plan that are in line with best management practices frequently recommended for protecting and preserving water quality.

Visit www.ourregion.org to learn more about this plan.



ENVIRONMENTAL AWARENESS ROUNDTABLE

H-GAC conducted two Environmental Awareness Roundtable events in 2013, designed to facilitate idea-sharing between city staff, county staff, and community organizations to create more effective environmental awareness campaigns. Environmental Awareness Roundtable events reinforce CRP's mission to educate and empower the public on water quality issues.

The first event, *Social Media 101: Raising Stakeholder Awareness in an Information Age*, presented by Texas A&M AgriLife Extension, took place in the spring. In the fall, H-GAC staff presented *Measuring the Success of Your Outreach*. To learn more about upcoming EAR workshops, visit H-GAC's website at: www.h-gac.com/community/publicawareness/ear.aspx.

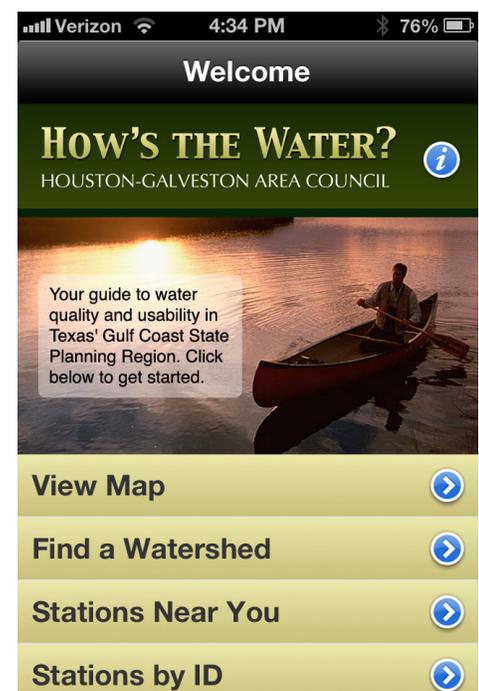
WRIM & HOW'S THE WATER? IPHONE APPLICATION

The Water Resources Information Map (WRIM) is a state-of-the-art interactive mapping tool which displays all CRP water quality monitoring sites in the region, along with photos and data associated with each site. This tool is available to anyone, from water quality project managers to residents interested in current and historic water quality data in the region.

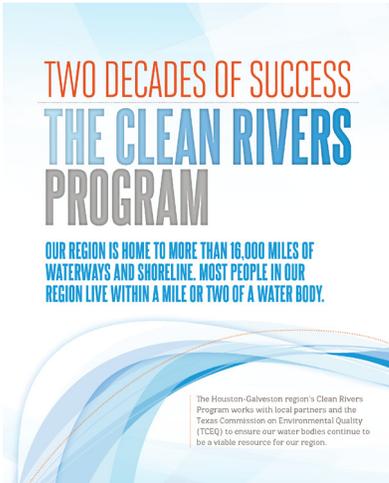
Using the information housed in the WRIM, H-GAC developed the "How's the Water?" iPhone app to provide a snapshot of WRIM data for users on the go.

Moving forward, H-GAC will continue to expand the WRIM to better meet the needs of its users. Additionally, the "How's the Water?" iPhone app will be replaced with a more user-friendly and interactive application in 2014. The replacement application will pull directly from the WRIM and will be accessible to all mobile devices.

To access the WRIM, visit <http://arcgis02.h-gac.com/wrim> or download the app through iTunes.



Outreach Activities



TWO DECADES OF SUCCESS: THE CLEAN RIVERS PROGRAM

CRP has provided consistent, current water quality data to its partners and stakeholders for more than 20-years, resulting in increased collaboration and more targeted public outreach activities. In recognition of this milestone, H-GAC staff developed *Two Decades of Success: The Clean Rivers Program*, an informative tri-fold brochure sent to fee payers, elected officials, local partners, and supporters of CRP in late 2013.

The brochure provides an overview of regional water quality concerns, along with a breakdown of benefits to partners, cost savings measures that have been implemented and general information on CRP.

Visit www.h-gac.com/community/publications.aspx to download a copy.

ANNUAL RIVER, LAKES, BAYS 'N BAYOUS TRASH BASH®

The annual Rivers, Lakes, Bays 'N Bayous Trash Bash® originally established by CRP in 1993, is the largest single-day waterway cleanup event in the State of Texas.

This event promotes environmental stewardship of the Galveston Bay Watershed through public education by utilizing hands-on educational tools and developing partnerships between environmental, governmental, and private organizations.

In 2013, more than 5,000 volunteers cleaned an unprecedented 167 miles of shoreline. More than 50 percent of participants in 2013 were under 18-years of age, further contributing to Trash Bash®'s desire to educate and empower the next generation in caring for the Galveston Bay Watershed.

Want to get involved? Visit www.trashbash.org for more information on upcoming events.



Outreach Activities

Other Activities

CRP sponsored several events in 2013, and intends to return to these events in 2014 and 2015, that focused on education and encouraging positive water behaviors outside of the “typical sphere” of water quality stakeholders, such as other public entities and environmental groups.

At each of the events outlined below, staff answered questions about the relationship between pet waste and water quality, provided activities and games for young attendees that focused on watershed education, and encouraged responsible pet practices by handing out pet waste bags and dispensers.



Sam Houston Area Council Boy Scout Fair

H-GAC staff hosted a booth at the Sam Houston Area Council Boy Scout Fair, a two-day event open to area scouts and their families with roughly 35,000 individuals in attendance.

Reliant Park World Series of Dog Shows

For the past two years, H-GAC and the City of Houston have jointly hosted a booth at the Reliant Park World Series of Dog Shows, an event that attracts more than 40,000 spectators, participants, and vendors annually.

Caring for Creation

H-GAC staff participated in Caring for Creation, an event intended to bridge the gap between the existing stewardship conducted by local churches / institutions of faith and environmental stewardship in Montgomery County.

Get Involved

Interested in getting involved with H-GAC’s water quality activities? Email staff at WaterResources@h-gac.com, visit the H-GAC Facebook page at www.facebook.com/HGACregion, or check out Twitter [@HGACWater](https://twitter.com/HGACWater) for the latest events, public meetings, and more.

“We have been Texas Stream Team volunteers for the San Bernard River since September 2008 and have seen the entire lifecycle of the river, through droughts and the dredging of the river mouth. For us, doing water quality testing is like having our fingers on the pulse of the river.”

*Jan and Roy Edwards
Texas Stream Team Volunteers*

Local Water Quality

Overview

This section gives a brief review and summary of ambient water quality conditions for each designated stream segment in the four basins in which H-GAC monitors and completes assessments.

The terms “list” or “listed” are used throughout this section and refer to the list of impaired waters, also known as the 303(d) list, which is a part of the 2012 Texas Integrated Report (IR) previously referenced in this document. Streams are included on the 303(d) list if they do not fully support the water quality standard for a certain parameter. Streams can be on the list for one or more parameters at any given time.

Trinity-San Jacinto Coastal Basin

(Segments are listed alphabetically, upstream to downstream.)



Cedar Bayou Above Tidal (0902)

Major tributaries: Adlong Ditch, Buck Gully

The majority of this segment is used for agricultural purposes with small ranchettes scattered throughout. Residential and industrial development is concentrated in the extreme southern portion of the watershed. Cedar Bayou Above Tidal is fully supporting all its uses and designations according to the 2012 IR, including its designated use as a public water supply. There are no existing concerns for this segment.

A WPP for the entire Cedar Bayou watershed (Tidal and Above Tidal) was initiated in December 2010. Past concerns regarding bacteria, DO, and macrobenthic communities will be addressed during the project. Four biological assessment events over two years, along with monthly ambient water quality and 24-hour DO monitoring, will be conducted to determine current status of all the watershed uses. See the Cedar Bayou WPP project discussion found earlier in this report for more details. Part of the WPP effort will be aimed at preventing future degradation of water quality in this segment.

Local Water Quality



Cedar Bayou Tidal (0901) 🌿

Major tributaries: Cary Bayou, McGee Gully

Cultivated crops, such as grass farms, are prevalent in the northwest and east-northeast areas of this segment, and large industrial facilities are located along the eastern shoreline of the Bayou and in City of Mont Belvieu. Residential development is concentrated in the west central portions and along SH 146 in the City of Baytown.

The tidal portion of Cedar Bayou is currently listed as not meeting its fish consumption use due to elevated levels of dioxin and PCBs in edible tissue of catfish and crabs.

This segment was first listed for dioxin in edible tissue in 2002 and for PCBs in 2008. The segment is also listed as impaired due to elevated levels of bacteria and there is a concern for higher than acceptable concentrations of chlorophyll-*a* in this water body.

In response to seafood advisories issued for the greater Galveston Bay area by the Texas Department of State Health Services (TDSHS), two TMDL projects were initiated. The dioxin TMDL and PCB TMDL projects are held concurrently and public outreach efforts regarding the TMDLs continue.

To address the water quality issues in Cedar Bayou, H-GAC and TSSWCB launched a WPP project in December 2010. Additional water quality data is being collected in the form of monthly water quality monitoring and 24-hour DO monitoring. Stakeholders continue to meet to address issues and work on the plan.

San Jacinto River Basin

(Segments are listed alphabetically, upstream to downstream.)



Buffalo Bayou Above Tidal (1014) 🌿 🌿 🌿

Major tributaries: Bear, Langham, Mason, Rummel, South Mayde, Spring Branch and Turkey Creeks; Neimans Bayou

Buffalo Bayou Above Tidal extends from the heavily developed areas of Houston's urban core west and north to the primarily rural and agricultural areas of western Harris County and southeastern Austin County. Addicks and Barker Reservoirs, which are flood water retention basins, sit in the middle of the segment. Two major parks, Bear Creek Park and George Bush Park, occupy portions of the reservoirs creating multi-use areas.

Local Water Quality

The entire Buffalo Bayou Above Tidal segment and eleven of its twelve sub-segments are listed on TCEQ's list of impaired water bodies due to elevated levels of bacteria. There is also a bacteria concern for the twelfth sub-segment. Elevated bacteria levels may stem from the usual sources such as overflows of municipal wastewater collection systems, failing septic systems, including OSSFs, pet waste, naturally occurring wildlife, and avian populations. Three sub-segments have concerns for DO grab screening level while Newman Branch (Neimans Bayou) is listed as not supporting its aquatic life use due to low DO grab minimums, 24-hour averages, and 24-hour minimums. Lastly, nutrient concerns are found throughout the main stem and are identified in eight of the twelve sub-segments.

This segment is a part of a large TMDL project addressing bacteria impairments in the region's waterways. In 2008, H-GAC formed the BIG, a committee of stakeholders with 14 additional workgroups, to create a plan to address the many sources of bacteria. The I-Plan was approved by TCEQ in January 2013. The BIG continues to update the I-Plan and seeks voluntary participation from all agencies/entities within the affected area. For more information, see the discussion about TMDLs and the BIG found earlier in this report.



Buffalo Bayou Tidal (1013) 🐸 🐸 🐸

Major tributaries: Tidal portion of White Oak Bayou, Little White Oak Bayou

Buffalo Bayou Tidal is completely urbanized, encompassing downtown Houston, the theater and entertainment districts, residential developments with high-volume, mixed-commercial development, and light industry. Several parks and natural areas are located along the banks of the Bayou. A major portion of the Houston metropolitan area drains to or through this segment.

Additionally, a large number of municipal and industrial wastewater discharges flow into or through this segment. The entire segment and two sub-segments, 1013A and 1013C, are listed on TCEQ's list of impaired water bodies due to elevated levels of bacteria. There are also concerns for high nutrient concentrations in the main segment and sub-segment 1013C, depressed DO in sub-segments 1013A and 1013C, and an impaired macrobenthic community in sub-segment 1013A.

This segment is a part of a large TMDL project addressing bacteria impairments in the region's waterways. In 2008, H-GAC formed the BIG, a committee of stakeholders with 14 additional workgroups, to create a plan to address the many sources of bacteria in the area. The I-Plan was approved by TCEQ in January 2013. The BIG continues to update the I-Plan and seeks voluntary participation from all agencies/entities within the affected area. For more information, see the discussion about TMDLs and the BIG found earlier in this report.

Local Water Quality



Caney Creek (1010)

Major tributaries: Camp, White Oak, Little Caney, McRae and Dry Creeks; Spring and West Fork Spring Branches

This watershed is primarily forested but small ranches, ranchettes, and hobby farms are common throughout. A few tracts of the Sam Houston National Forest lie in the very northern portions of the segment. Cleared lands for cattle grazing and hay production make up most of the agricultural activities. Timber harvesting is also found in the middle and upper portions of the segment.

With exception of a few communities, most of the urbanized area is found in the lower portion of the watershed around U.S. Route 59. Caney Creek flows into the northern east fork of Lake Houston, a major drinking water supply for the City of Houston and surrounding communities.

Per the 2012 IR, Caney Creek fully supports its general use and public water supply use criteria with dissolved solids, fluoride and nitrates being within acceptable concentrations. Two of Caney Creek's four AUs have high bacteria geomeans and do not support contact recreation use. Spring Branch, a tributary, also has concerns for high bacteria and depressed DO.

This segment is a part of a large TMDL project addressing bacteria impairments in the region's waterways. In 2008, H-GAC formed the BIG, a committee of stakeholders with 14 additional workgroups, to create a plan to address the many sources of bacteria. The I-Plan was approved by TCEQ in January 2013. The BIG continues to update the I-Plan and seeks voluntary participation from all agencies/entities within the affected area. For more information, see the discussion about TMDLs and the BIG found earlier in this report.



Cypress Creek (1009)

Major tributaries: Dry, Little Cypress, Live Oak, Mound, Pilot and Seals Creeks; Dry, Faulkey, Lemm and Spring Gullies

The eastern portion of the watershed is dominated by dense residential development within forested lands, but the western portion is still dominated by crop lands and grasslands used for cattle grazing. The middle of the watershed has experienced rapid urbanization. Grasslands and cultivated fields were once the primary land cover/land use; however, subdivisions and commercial buildings now dominate the landscape.

Local Water Quality

Segments and sub-segments of Cypress Creek are listed as not supporting contact recreation use due to high bacteria levels that exceed state standards. There is also a concern regarding high concentrations of nutrients. In the upstream AU of Cypress Creek, there is a concern for depressed DO while in the middle AU there is a concern about habitat and macrobenthic community impairments. In Little Cypress Creek (1009E) there is also a concern for depressed DO.

This segment is a part of a large TMDL project addressing bacteria impairments in the region's waterways. In 2008, H-GAC formed the BIG, a committee of stakeholders with 14 additional workgroups, to create a plan to address the many sources of bacteria. The I-Plan was approved by TCEQ in January 2013. The BIG continues to update the I-Plan and seeks voluntary participation from all agencies/entities within the affected area. For more information, see the discussion about TMDLs and the BIG found earlier in this report.



East Fork San Jacinto River (1003)

Major tributaries: Orange Branch, Miller Creek, Whiskey Branch, Winters Bayou

This watershed is primarily undeveloped forested land with scattered ranchettes or small homesteads except for the lower portion which is populated by the small cities of Plum Grove and Cleveland. Part of the City of Huntsville is located in the far northern portion along with a large part of the Sam Houston National Forest. Timber harvesting is a major industry in the upper watershed. Land has also been cleared for grazing and hay production.

The three AUs of the East Fork San Jacinto River appear in the 2012 IR as not supporting contact recreation use due to bacteria levels which exceed the state standard. All other uses such as aquatic life and public water supply are fully supported.

This segment is currently a part of a TMDL project addressing bacteria impairments in the East and West Forks of the San Jacinto River, Crystal Creek – a tributary of the West Fork, and a portion of Lake Houston. TCEQ contracted with Texas Institute for Applied Environmental Research (TIAER) to develop a Technical Support Document and draft TMDL report. The draft Technical Support Document was submitted to TCEQ in July 2013 and draft TMDL in August 2013. H-GAC has been contracted to coordinate the public participation meetings for this project and hosted three meetings along with TCEQ in July 2013 to kick off this project with stakeholders. For more information, see the discussion about TMDLs found earlier in this report.

Local Water Quality



Greens Bayou Above Tidal (1016) 🌿 🌿 🌿

Major tributaries: Garners Bayou, Williams Gully

Greens Bayou Above Tidal experiences similar issues associated with all urban watersheds. Beltway 8 runs through the middle of the watershed with large, high intensity residential, commercial, and industrial developments found adjacent to and at intersections with major highways: I-45, U.S. Route 59 and SH 249. Bush Intercontinental Airport is located in the north-central portion of the watershed.

The entire segment, as well as five of its unclassified segments, is listed as not supporting contact recreation use due to elevated levels of bacteria. This segment plus four of its tributary segments have a concern for nutrient concentrations greater than the screening levels. There is also a listing for depressed DO for sub-segment 1016D, an unnamed tributary to Greens Bayou. There is a concern for the grab DO screening criteria and the DO minimum. The excessive nutrients may be the cause of the low DO levels.

This segment is a part of a large TMDL project addressing bacteria impairments in the region's waterways. In 2008, H-GAC formed the BIG, a committee of stakeholders with 14 additional workgroups, to create a plan to address the many sources of bacteria. The I-Plan was approved by TCEQ in January 2013. The BIG continues to update the I-Plan and seeks voluntary participation from all agencies/entities within the affected area. For more information, see the discussion about TMDLs and the BIG found earlier in this report.



Houston Ship Channel/Buffalo Bayou (1007) 🌿 🌿

Major tributaries: Berry, Brays, Country Club, Hunting, Keegans, Little Vice and Vince Bayous; Plum and Berry Creeks, Pine Gully

This very urbanized watershed includes the Houston Ship Channel (HSC) and more than 70 miles of tidal and non-tidal tributary streams. The HSC watershed includes the cities of Bellaire, Houston, Pasadena, Galena Park, and South Houston as well as large petrochemical complexes located along the shores of the ship channel. Numerous permitted wastewater and stormwater discharges are located throughout the watershed.

All eight AUs of this tidal segment are listed as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of chlordane, dieldrin, dioxin, heptachlor epoxide, and PCBs in edible fish and/or crab tissues.

Local Water Quality

These AUs include HSC, Sims Bayou tidal, Hunting Bayou tidal, Brays Bayou tidal, Vince Bayou tidal, Berry Bayou, Little Vince Bayou, and Buffalo Bayou. The same eight AUs also have nutrient concentrations which exceed the screening criteria for this segment. Plus, Little Vince Bayou (1007_05) is non-supportive of the aquatic life use due to acute sediment toxicity and Line of Evidence toxicity in sediment. This impairment is shown through sediment sampling which is tested and evaluated for chemical analysis, toxicity, and abundance of benthic infauna.

All twenty-five unclassified segments with segment 1007 are not supporting their contact recreation use due to high bacteria concentrations. A geometric mean of 332 MPN was the lowest exceedence of the criteria of 126 MPN while 6,079 MPN was the highest geometric mean exceedence. Twenty of the same twenty-five AUs exceeded the screening criteria for one or more nutrient parameter as well. Fifteen of the nutrient screening criteria concerns were related to ammonia which is generally thought to be associated with wastewater discharges. Depressed DO is also a concern in eleven of the twenty-five AUs. Six of the eleven AUs were not supporting the aquatic life use designation because the grab DO minimum was too low too often or the 24-hour DO minimum or average were below the state criteria.

The above tidal portions of this segment are a part of a large TMDL project addressing bacteria impairments in the region's waterways. In 2008, H-GAC formed the BIG, a committee of stakeholders with 14 additional workgroups, to create a plan to address the many sources of bacteria. I-Plan was approved by TCEQ in January 2013. The BIG continues to update the I-Plan and seeks voluntary participation from all agencies/entities within the affected area. For more information, see the discussion about TMDLs and the BIG found earlier in this report.



Houston Ship Channel (1006) 🌿 🌿 🌿

Major tributaries: Boggy, Carpenters and Patrick Bayous, Goodyear and Halls Creek, Tidal portion of Greens Bayou

The whole watershed is highly urbanized and receives effluent discharges from many permitted wastewater and storm water outfalls. The lower portion of the watershed includes the heavy industrial complexes that line both sides of the Channel including the cities of Deer Park, Channelview, Houston, Pasadena, and parts of unincorporated Harris County.

All seven AUs of this tidal segment are listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of chlordane, dieldrin, dioxin, heptachlor epoxide, and PCBs in edible fish and/or crab tissues. The seven AUs with the fish consumption advisory include the HSC, Greens Bayou tidal, Patrick Bayou tidal, Goodyear Creek (tidal), Tucker Bayou tidal, and Carpenters Bayou. Six of the same seven AUs also have one or more nutrient parameter with concentrations that exceeded the screening criteria for this segment.

Local Water Quality

Plus, Greens Bayou tidal (1006_03) has a concern for the aquatic life use due to concentrations of dichlorodiphenyltrichloroethane (DDT) and dichlorodiphenyldichloroethane (DDD) in sediment. Patrick Bayou tidal (1006_04) also has aquatic life use impairment due to toxicity of the sediment in the bayou and concerns for concentrations of mercury, pyrene, and hexachlorobutadiene (HCBD) in the sediment. Patrick Bayou is also not supporting its aquatic life use due to unacceptable concentrations of mercury found in water samples.

All six unclassified above tidal AUs associated with segment 1006 have contact recreation use impairments due to elevated bacteria geometric mean concentrations. These water bodies include Halls Bayou (2 AUs), Big Gulch, Spring Gully, and two unnamed tributaries to Halls Bayou. Three of the AUs have concerns for elevated nutrients but only one AU (1006J) has a concern for depressed DO.

The above tidal portions of this segment are a part of a large TMDL project addressing bacteria impairments in the region's waterways. In 2008, H-GAC formed the BIG, a committee of stakeholders with 14 additional workgroups, to create a plan to address the many sources of bacteria. The I-Plan was approved by TCEQ in January 2013. The BIG continues to update the I-Plan and seeks voluntary participation from all agencies/entities within the affected area. For more information, see the discussion about TMDLs and the BIG found earlier in this report.



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

Major tributaries: Black Duck, Burnet, San Jacinto, Scott and Tabbs Bays, Goose Creek, Old River, Barbour's Cut

This watershed includes the cities of Baytown and Highlands located on the eastern shore of the HSC and the San Jacinto River with the heavily industrialized cities of Channelview, Deer Park, and La Porte situated along the western shoreline.

All seven AUs of this tidal segment are listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish and/or crab tissues.

Local Water Quality



Lake Conroe (1012) 🌿🌿🌿🌿🌿

Major tributaries: Caney, East Sandy, Lewis, Little Lake, McDonald, McGary and West Sandy Creeks; West Fork San Jacinto River

Lake Conroe covers most of the lower one-third of the watershed and has significant residential and commercial development around its shores. Sam Houston National Forest covers the middle of the watershed with small ranchettes and hobby farms scattered throughout. The upper watershed is a mixture of cultivated lands, pastures, pristine forests, and cleared land from timber harvesting.

The city of Huntsville is the major urban development location in the northeastern section of the watershed.

While Lake Conroe provides a broad scope of recreational activities, its primary purpose is a public drinking water source for the region. As such, the lake is fully supporting of that use designation as well as the contact recreation use designation. There are no concerns for bacteria at this time; however, from H-GAC's trends analysis of available data, bacteria concentrations appear to be on the rise. The Lake Conroe segment has eleven AUs which were evaluated in the 2012 IR. Of those AUs, three have concerns for chlorophyll-*a* concentrations exceeding the nutrient screening level and one shows a concern for the DO grab screening level.



Lake Creek (1015) 🌿🌿🌿

Major tributaries: Caney Creek, Fish Creek, Garretts Creek, Landrum Creek, Little Caney Creek, Mound Creek

This watershed is primarily rural in nature and is dominated by forest and grasslands with the major land cover/land use being pastureland or hay production. Row crop cultivation is scattered throughout the upper portion but is definitely in the minority. Mixed residential and commercial development in the form of subdivisions, strip centers, and ranchettes or hobby farms is occurring in the lower watershed increasing the possibility of negative impacts on water quality.

The 2012 IR shows four AUs were evaluated. Lake Creek (2 AUs) is fully supporting its public water supply use designation but there is a concern for its aquatic life use due to depressed DO grab samples in both AUs. The downstream AU (1015_01_) also has a concern for bacteria because concentrations have been increasing over time. One tributary, Mound Creek (1015A), also has a concern for its recreation use due to high bacteria concentrations. More data is needed to confirm whether this concern will become an impairment or not.

Local Water Quality



Lake Houston (1002)

Major tributaries: East Fork San Jacinto River, Luce Bayou, March Branch, Tarkington Bayou, West Fork San Jacinto River

Lake Houston is a large reservoir located in northeast Harris County. It is the primary source of drinking water for the city of Houston and several surrounding communities. The lake receives in-flow from the East Fork and West Fork San Jacinto River as well as their tributaries of Cypress Creek, Spring Creek, Lake Creek, Lake Conroe, Caney Creek, and Peach Creek. Luce Bayou, which receives flow from Tarkington Bayou, is the third major tributary of the lake.

The quality of water from these watersheds has a tremendous impact on this public water supply. Additionally, major urbanization has occurred around the lake on both the west and north shores. Suburban sprawl also affects the eastern and northeastern shores where septic systems are the primary method of sewage disposal.

The 2012 IR shows Lake Houston has seven AUs, plus three AUs associated with Luce Bayou, Tarkington Bayou, and Lake Isabell, a small lake located northeast of the confluence of East Fork San Jacinto River, and Caney Creek. The lake fully supports its public water supply designation and six of the seven AUs fully support its contact recreation designation. Where the West Fork San Jacinto River flows into the upper west fork of the lake, the geometric mean for bacteria exceeds the state standard for contact recreation. This is not surprising since the West Fork San Jacinto River is also impaired by high concentrations of bacteria. Six of the seven AUs in the lake have concerns due to high levels of one or more nutrient parameters. Only AU 1002_07 where the East Fork San Jacinto River flows into the lake is there no concerns with water quality. Tarkington Bayou also has a concern for nutrients but the downstream water body, Luce Bayou, does not at this time. Lake Isabell, which does not flow directly into Lake Houston, has a restricted consumption advisory issued by the TDSHS due to high levels of mercury found in edible fish tissue.

This segment is currently a part of a TMDL project addressing bacteria impairments in the East and West Forks of the San Jacinto River, Crystal Creek (a tributary of the West Fork), and a portion of Lake Houston. TCEQ contracted with Texas Institute for Applied Environmental Research (TIAER) to develop a Technical Support Document and draft TMDL report. The draft Technical Support Document was submitted to TCEQ in July 2013 and draft contractor TMDL in August 2013. H-GAC has been contracted to coordinate the public participation meetings for this project and hosted three meetings along with TCEQ in July 2013 to kick off this project with stakeholders. For more information, see the discussion about TMDLs found earlier in this report.

Local Water Quality



Peach Creek (1011)

Major tributaries: Boggy, Duck, Jayhawker, Lawrence and Mare Creeks; Gully, Gum, Waterhole and Bee Branches

This watershed is dominated by forested land with the Sam Houston National Forest located in the upper reach. Grass and pasture lands are scattered throughout the watershed along with cattle ranches and ranchettes or hobby farms. Several communities including Splendora and Woodbranch are located in the lower reaches of the watershed.

Peach Creek is divided into two AUs for the 2012 IR and neither are meeting the contact recreation use because the bacteria concentration geometric mean is greater than the state standard. Besides contact recreation, this water body fully supports its aquatic life use and its public water supply use designations.

This segment is a part of a large TMDL project addressing bacteria impairments in the region's waterways. In 2008, H-GAC formed the BIG, a committee of stakeholders with 14 additional workgroups, to create a plan to address the many sources of bacteria. The I-Plan was approved by TCEQ in January 2013. The BIG continues to update the I-Plan and seeks voluntary participation from all agencies/entities within the affected area. For more information, see the discussion about TMDLs and the BIG found earlier in this report.



San Jacinto River Tidal (1001)

Major tributaries: Gum Gully Creek

The lower portion of the watershed is heavily developed, with industrial activity along the HSC as its major land use. The middle of the watershed is primarily forested wetlands and the upper and eastern areas are primarily cultivated land and grasslands. Four rural communities lay within the watershed: Highlands, Barrett, and Crosby on the east side of the river and Sheldon on the western side.

The San Jacinto Waste Pits EPA superfund site is in the southern portion of the watershed. For many years, the site was used to dispose of waste from the Champion Paper Mill. Over time the area was affected by both river erosion and subsidence releasing unknown quantities of pollutants into the environment. EPA, TCEQ, and all parties involved are still trying to work out a long term remediation solution for the site. Both AUs of this tidal segment are listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and/or PCBs in edible fish and/or crab tissues.

Local Water Quality



Spring Creek (1008) 🌿 🌿 🌿

Major tributaries: Three Mile, Walnut, Willow, Birch, Brushy, Dry and Mill Creeks; Bear, Mill, Mink, Panther and Sulfur Branches, Lake Woodlands

The Spring Creek watershed continues to experience rapid urban growth especially around the cities of Tomball and The Woodlands, as well as the I-45 and SH 249 corridors. The western portion of the watershed is dominated by cultivated fields, grasslands, shrub lands, and forests.

Three of the four downstream AUs on Spring Creek are not meeting contact recreation use due to bacteria impairment. In AU 1008_02, which is located between Field Store Rd and SH 249, there is a concern for low DO grab samples and the 24-hour DO average is not supporting its aquatic life use criteria. This also leads to a concern for a threatened fish community; however, more data is needed to confirm an impairment. AU 1008_04, located between I-45 and the confluence with Lake Houston, has a concern for nutrients with average concentrations exceeding the screening levels for nitrate, orthophosphorus, and total phosphorus.

Of the fourteen AUs assessed for the 2012 IR, all but one has a concern or impairment with one or more of the parameters monitored on those water bodies. Upper Panther Branch (2 AUs), Lower Panther Branch (2 AUs), Bear Branch (1 AU), and Willow Creek (1 AU) have contact recreation impairments due to elevated bacteria concentrations while Walnut Creek (1 AU) and Brushy Creek (1 AU) have bacteria concerns at this time. Three AUs (Mill Creek, Lower Panther Branch, and Brushy Creek) have concerns for DO because of frequent grab samples being below the minimum screening criteria. So far there is no reason to believe the 24-hour DO average is impaired. Eight of the fourteen tributary AUs have concerns for nutrient concentrations. Lake Woodlands in particular has results above the screening criteria for nitrate, total phosphorus, orthophosphorus, and chlorophyll a. Ammonia is above the screening levels in the upper and middle portion of the lake but not the lower portion near the dam.

This segment is a part of a large TMDL project addressing bacteria impairments in the region's waterways. In 2008, H-GAC formed the BIG, a committee of stakeholders with 14 additional workgroups, to create a plan to address the many sources of bacteria. The I-Plan was approved by TCEQ in January 2013. The BIG continues to update the I-Plan and seeks voluntary participation from all agencies/entities within the affected area. For more information, see the discussion about TMDLs and the BIG found earlier in this report.

Local Water Quality



West Fork San Jacinto River (1004)

Major tributaries: Camp, Crystal, East Fork Crystal, Caney, Egypt, Lake, Little Caney, Stewarts, West Fork Crystal, and White Oak Creeks; Woodsons Gully; Harpers, Horsepen, Rice, and Sand Branches

This watershed is primarily forested with residential and commercial development scattered throughout. The city of Conroe is located at the upper end of the watershed with several small communities located in the lower area. All have the potential to affect water quality. Bacteria concentrations are elevated throughout the segment causing the river and two of its tributaries to be impaired for bacteria.

Elevated bacteria levels most likely stem from sources such as intermittent municipal collection system overflows, failing septic systems, including OSSFs, pet waste, and naturally occurring wildlife and avian populations. Nutrients are also a concern in the lower assessment unit of the river but the public water supply use and aquatic life use are both fully supported.

A tributary of the West Fork San Jacinto River, Stewarts Creek, is a part of a large TMDL project addressing bacteria impairments in the region's waterways. In 2008, H-GAC formed the BIG, a committee of stakeholders with 14 additional workgroups, to create a plan to address the many sources of bacteria. The I-Plan was approved by TCEQ in January 2013. The BIG continues to update the I-Plan and seeks voluntary participation from all agencies/entities within the affected area. For more information, see the discussion about TMDLs and the BIG found earlier in this report.

The West Fork of the San Jacinto River and a tributary of this segment, Crystal Creek, is currently part of a TMDL project addressing bacteria impairments in the East and West Forks of the San Jacinto River, Crystal Creek, and a portion of Lake Houston. TCEQ contracted with TIAER to develop a Technical Support Document and draft TMDL report. The draft Technical Support Document was submitted to TCEQ in July 2013 and draft contractor TMDLs in August 2013. H-GAC has been contracted to coordinate the public participation meetings for this project and hosted three meetings along with TCEQ in July 2013 to kick off this project with stakeholders. For more information, see the discussion about TMDLs found earlier in this report.

Local Water Quality



White Oak Bayou (1017)

Major tributaries: Brickhouse Gully, Cole Creek, Little White Oak Bayou, Vogel Creek

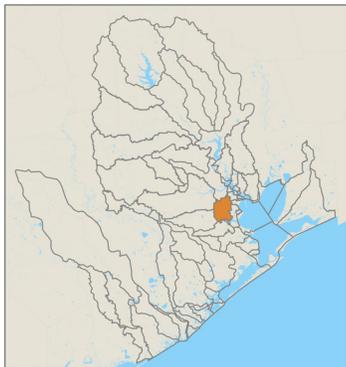
This watershed is almost entirely developed with pockets of parklands and wooded acreages scattered throughout. The densest population is found in the lower reaches inside IH-610. Heavy commercial development occurs along the US-290 corridor with residential and mixed developments adjacent to the corridor.

All of White Oak Bayou and its tributaries are listed for not supporting contact recreation use due to elevated bacteria levels. All four AUs within White Oak Bayou proper have concerns for elevated nutrient concentrations. Likewise, four of the six sub-segment AUs evaluated in the 2012 IR have concerns for elevated nutrient concentrations. Only the sub-segment 1017D, an unnamed tributary of White Oak Bayou - also called channel E-110 by the Harris County Flood Control District (HCFCD), does not support its aquatic life use designation. Its 24-hour average and 24-hour minimum for DO concentrations are below the state standards.

This segment is a part of a large TMDL project addressing bacteria impairments in the region's waterways. In 2008, H-GAC formed the BIG, a committee of stakeholders with 14 additional workgroups, to create a plan to address the many sources of bacteria. The I-Plan was approved by TCEQ in January 2013. The BIG continues to update the I-Plan and seeks voluntary participation from all agencies/entities within the affected area. For more information, see the discussion about TMDLs and the BIG found earlier in this report.

San Jacinto-Brazos Coastal Basin

(Segments are listed alphabetically, upstream to downstream.)



Armand Bayou (1113)

Major tributaries: Big Island Slough, Horsepen Bayou, Middle Bayou, Mud Lake, Spring Gully, Willow Spring Bayou

A majority of the watershed is densely developed with the city of Houston (Clear Lake Water Authority) in the south, the city of Taylor Lake Village to the south east, the city of La Porte in the east, and parts of the cities of Deer Park and Pasadena in the north. High and low intensity of residential and mixed commercial developments are the dominant land uses, but large industrial facilities are scattered throughout the northern portion of the watershed.

Local Water Quality

Through the middle of the watershed from west to east is Ellington Field then a large area of grasslands, shrub lands, and wetlands, moving more towards forested wetland on the east site. The Armand Bayou Nature Center is also located in the south east portion of the watershed.

The TDSHS issued a restricted fish consumption advisory due to elevated concentrations of dioxin and PCBs found in edible fish tissue collected from the tidal portion of Armand Bayou. The tidal segment also has a concern for chlorophyll a because concentrations exceeded the nutrient screening levels in that water body. Of the two AUs in the Armand Bayou tidal segment, only the downstream AU (1113_01) is supporting its contact recreation use with acceptable bacteria levels. Conversely, the upstream AU (1113_02) is not supporting its aquatic life use because the 24-hour DO minimum concentration is below the state standard.

Five unclassified segments associated with Armand Bayou were evaluated in the 2012 IR. All five are not supporting their contact recreation use designations because of high bacteria concentrations. Additionally, one unclassified water body, Armand Bayou Above Tidal, has a DO impairment and is not meeting its aquatic life use designation. Likewise, two other unclassified water bodies – Horsepen Bayou Tidal and Big Island Slough – have concerns for depressed DO. Sub-segment 1113B (Horsepen Bayou Tidal) is the only tributary AU with a nutrient concern due to concentrations exceeding the screening levels for several parameters.

H-GAC began a project to develop an Armand Bayou TMDL I-Plan in January 2013. The I-Plan is being completed concurrently with the TMDL by the University of Houston. The TMDL is expected to be completed in the spring of 2014 and then Armand Bayou stakeholders will join the BIG I-Plan. For more information, see the discussion about TMDLs and the BIG found earlier in this report.



Bastrop Bayou (1105) 🌿 🌿 🌿

Major tributaries: Austin Bayou, Brushy Bayou, Flores Bayou

The main stem of Bastrop Bayou originates near SH 288 south of Angleton and flows due east through forested wetlands, cultivated land, and then through coastal prairies and wetlands. The watershed is mostly rural, with urban development primarily limited to the cities of Angleton and Danbury. The primary land use is agriculture which includes rice production and cattle grazing. Bastrop Bayou includes part of the Brazoria National Wildlife Refuge.

In the 2012 IR, Bastrop Bayou Tidal (1105), Flores Bayou (1105a), and Brushy Bayou (1105E) do not support their contact recreation use designation due to elevated concentrations of bacteria. In Austin Bayou Above Tidal, an unclassified segment, there is a concern for bacteria levels but the water body is not currently impaired. Four of the five unclassified water bodies have concerns or impairments for DO. Brushy Bayou has a confirmed impairment with its aquatic life use due to DO grab samples being below the minimum state standard. There is also a concern for nutrients because ammonia concentrations frequently exceeded the screening levels.

Local Water Quality

H-GAC worked to develop a WPP for the Bastrop Bayou Watershed in partnership with the TCEQ, Galveston Bay Estuary Program, TSSWCB, Brazoria County, and concerned citizens. The WPP is a result of complaints from local residents of the watershed regarding elevated levels of bacteria found in Bastrop Bayou and the impairments and concerns in the IR. The draft WPP is currently in review by TCEQ and EPA. H-GAC is currently working with TCEQ on a series of implementation efforts in the watershed, including remediation of failing OSSFs, installation of pet waste stations, facilitation of partner efforts, and education and outreach activities. For more detailed information on the WPP, please look in the “Watershed Projects” section of this report.



Chocolate Bayou Above Tidal (1108) 🐸 🐸 🐸

Major tributaries: Hayes Creek, West Fork Chocolate Bayou

This watershed is largely undeveloped with the exception of small urban centers dispersed across its northern and eastern reaches. Towns within the watershed include Manvel, Arcola, Iowa Colony, and the western portion of Alvin. Agriculture is a major land use in the watershed and many large farms are found throughout.

A system of canals distributes surface water for irrigation purposes. Forested wetlands cut through farms and prairie grassland as the bayou meanders from near SH-6 downstream towards Liverpool.

In the 2012 IR, Chocolate Bayou Above Tidal has three concerns:(1) The grab screening level for DO is depressed and further testing is needed to confirm the extent and frequency of the low DO occurrences; (2) There is a concern for impaired habitat, and; (3) A concern for bacteria concentrations exceeding the state standard. These are new concerns for the watershed not previously identified on the IR.



Chocolate Bayou Tidal (1107) 🐸

Major tributaries: Corner Bayou, Cottonwood Bayou, Pleasant Bayou

The majority of the watershed is rural with the community of Liverpool as the only urban area in the watershed. Agriculture is the major land use and a large system of irrigation canals crisscross the watershed. Forested wetlands meander along the Bayou as it cuts through tracts of prairie grasslands changing to herbaceous wetlands in the lower reaches of the segment.

Local Water Quality

A large industrial complex comprised of several major petrochemical plants is located in the southeast sector of watershed and the Bayou is used for barge traffic hauling raw materials and finished products to and from the complex. Duck Lake and Monsanto Reservoir are used as water impoundments by these industries.

In the 2012 IR, Chocolate Bayou Tidal does not support its contact recreation use, nor its fish consumption use designations. Bacteria concentrations exceed the state standard and the TDSHS has issued a fish consumption advisory due to elevated concentrations of PCBs and dioxin in edible fish tissue collected from this water body.



Clear Creek Above Tidal (1102) 🌿 🌿

Major tributaries: Cowart Creek, Hickory Slough, Mary's Creek, Turkey Creek, Mud Gully

This watershed continues to experience rapid residential and commercial development especially around the Hwy 288 corridor and north of FM 518 throughout Pearland and on the south side of FM 518 in eastern Friendswood. Agricultural land is being converted to residential development throughout but areas are still in production near the headwaters of Cowart Creek and in the far upper reaches. Medium and small farms occupy the non-residential areas.

Clear Creek Above Tidal is divided into five AUs. All five have a restricted and no fish advisory issued for them by the TDSHS due to high levels of PCBs in edible tissue taken from fish caught within this water body. Three of the five AUs in Clear Creek are impaired with bacteria and do not support a contact recreation use designation. The AUs located furthest upstream and furthest downstream support the contact recreation use. There are also concerns for depressed DO and nutrients are also concerns in all but the furthest upstream AU (Rouen Road to SH 288).

Tributaries to Clear Creek Above Tidal do not fare much better. Both AUs in Cowart Creek (1102A), Mary's Creek/North Fork Mary's Creek (1102B), Hickory Slough (1102C), Turkey Creek (1102D), and an unnamed tributary to Mary's Creek (1102G) do not support their contact recreation use designation due to bacteria concentration geometric means greater than the state standard. Hickory Slough (1102C), Turkey Creek (1102D), Mud Gully (1102E), Mary's Creek Bypass (1102F), and an unnamed tributary to Mary's Creek (1102G) have concerns for low DO due to grab samples being measured below the screening level for those water bodies. Lastly, five unclassified water bodies have concerns for nutrients because one or more parameters exceed the screening levels on a frequent basis.: nitrate, orthophosphorus and total phosphorus in Mary's Creek/North Fork Mary's Creek (1102B); nitrate, ammonia, orthophosphorus and total phosphorus in Turkey Creek (1102D); nitrate in Mud Gully (1102E); orthophosphorus and total phosphorus in Mary's Creek Bypass (1102F), and orthophosphorus in an unnamed tributary to Mary's Creek (1102G).

Local Water Quality

This segment is a part of a large TMDL project addressing bacteria impairments in the region's waterways. In 2008, H-GAC formed the BIG, a committee of stakeholders with 14 additional workgroups, to create a plan to address the many sources of bacteria. The I-Plan was approved by TCEQ in January 2013. The BIG continues to update the I-Plan and seeks voluntary participation from all agencies/entities within the affected area. For more information, see the discussion about TMDLs and the BIG found earlier in this report.



Clear Creek Tidal (1101)

Major tributaries: Chigger Creek, Magnolia Creek

This watershed continues to experience rapid growth with mixed residential and commercial development throughout; however, large tracts of grassland and shrub lands still exist in the western and south central portion of the watershed. Most of the high intensity development is located near I-45 and the Johnson Space Center and Baybrook Mall complexes located in the northeastern section.

In the 2012 IR, the main segment of Clear Creek has four AUs all of which are listed as having a restricted and no fish consumption advisory due to elevated concentrations of PCBs and dioxin in edible tissue. The three downstream AUs are also listed in the 2012 IR as not supporting its contact recreation use due to elevated bacteria concentrations. The creek also has concerns with nutrients since several parameters exceed the screening levels frequently. Between the confluence with Chigger Creek near Friendswood and I-45 there is a concern for nitrate, orthophosphorus and total phosphorus. Between I-45 and Cow Bayou in Nassau Bay, there is a concern for nitrate, chlorophyll-*a*, orthophosphorus and total phosphorus. In the downstream AU between the confluence with Cow Bayou and Clear Lake, there is also a concern for depressed DO due to grab samples being detected below the screening level. There are also six tributaries listed for Clear Creek tidal in the 2012 IR. Magnolia Creek has two AUs with one being impaired for bacteria and the other has a concern for low DO. Cow Bayou and Robinson Bayou are both listed as not supporting their contact recreation use due to having elevated bacteria levels. Both also have concerns for low DO.

A TMDL project was completed for Clear Creek and its tributaries due to elevated levels of bacteria. This segment is a part of a large TMDL project addressing bacteria impairments in the region's waterways. In 2008, H-GAC formed the BIG, a committee of stakeholders with 14 additional workgroups, to create a plan to address the many sources of bacteria. The I-Plan was approved by TCEQ in January 2013. The BIG continues to update the I-Plan and seeks voluntary participation from all agencies/entities within the affected area. For more information, see the discussion about TMDLs and the BIG found earlier in this report.

Local Water Quality



Dickinson Bayou Above Tidal (1104)

Major tributaries: None

The watershed includes portions of the cities of Alvin, Friendswood, League City and Santa Fe. Rapid growth is occurring throughout the watershed. Residential, mixed commercial development and agriculture are the predominant land uses with high intensity developments and business districts at the intersections and along SH 6, SH 35, and FM 528. Ranchettes or hobby farms are common throughout this watershed.

Dickinson Bayou is listed in the 2012 IR as not supporting its contact recreation use designation due to high bacteria. While this listing applies to the entire segment, high bacteria concentrations were only found in the upper AU. The upper AU also has a concern for impaired habitat. Past channelization of the water body may be the cause.

In response to the elevated bacteria levels in the bayous, the TCEQ initiated a Bacteria TMDL to determine measures necessary to support recreational uses in these water bodies. With increasing residential and commercial development in the watershed, greater pressure will be placed on the Bayou to process additional loading from point and nonpoint sources. In a parallel effort, a WPP was developed by TCEQ, Texas AgriLife and the Dickinson Bayou Watershed Partnership. The TMDL document was approved by EPA in June 2012 and the WPP I-Plan was approved January 2014.



Dickinson Bayou Tidal (1103)

Major tributaries: Bordens Gully, Cedar Creek, Geisler Bayou, Gum Bayou

The watershed is heavily developed with the cities of Dickinson, Santa Fe, and League City. Low to medium intensity residential and mixed commercial developments are the predominant land uses. There are also agricultural activities in the western, southeastern and eastern portions of the watershed.

Local Water Quality

The entire segment and five of its six sub-segments are listed in the 2012 IR for not supporting their contact recreation use designation due to elevated bacteria concentrations. The entire segment also has a restricted fish consumption advisory due to elevated levels of PCBs and dioxin in edible fish tissue. Three of the four AUs in Dickinson Bayou tidal fail to support their aquatic life use designation because low DO is common. Both the 24-hour average and minimum DO values are below state standards. In Dickinson Bayou tidal, low DO levels are believed to be a result of a combination of natural processes and anthropogenic influences. The only nutrient screening levels of concern is chlorophyll-*a* between Gum Bayou and Benson Bayou. The unclassified water body, Geisler Bayou (1103C) is listed in the 2012 IR for depressed DO while unclassified water bodies Bensons Bayou (1103A), Bordens Gully (1103B) and Cedar Creek (1103E) are cited as having a concern for depressed DO grab screening levels.

In response to the elevated bacteria levels in the bayous, the TCEQ initiated a Bacteria TMDL to determine measures necessary to support recreational uses in these water bodies. In a parallel effort, a WPP was developed by TCEQ, Texas AgriLife and the Dickinson Bayou Watershed Partnership. The TMDL document was approved by EPA in June 2012 and the WPP I-Plan was approved January 2014.



Old Brazos River Channel (1111)

Major tributaries: None

This watershed comprises what was once the mouth of the Brazos River, in southern Brazoria County. Beach-front residential development along with water recreational activities are observed in the lower reaches of the watershed with large expanses of wetlands surrounding the watershed.

While no impairments are listed for this segment in the 2012 IR, there is a concern for chlorophyll *a* because concentrations frequently exceed the screening levels for this segment.

Local Water Quality



Oyster Creek Above Tidal (1110)

Major tributaries: None

Sugar Land and Stafford lay in the upper watershed, with smaller communities such as Fresno, Arcola, Bailey's Prairie, Bonney Village, and Holiday Lakes scattered throughout the watershed, and dense residential and commercial communities of Missouri City, and Sienna Plantation. Most of the lower two-thirds of the watershed are either undeveloped with lots of woody wetlands or

The greater portion of the watershed is bottomland forest, grassland or wetland habitat. Oyster Creek is very sinuous with numerous oxbow lakes, typical of the Texas Gulf Coast region.

In the 2012 IR, Oyster Creek Above Tidal is listed as having depressed DO in the upper and lower AUs. The lower AU also has high bacteria concentrations and fails to support its contact recreation designation as well as having a concern for high levels of chlorophyll a.



Oyster Creek Tidal (1109)

Major tributaries: None

The watershed lies in a region of fertile alluvial soil which previously supported cotton and sugarcane plantations back to the days of the Texas Republic. Development is largely limited to the northwest section of the watershed including the cities of Lake Jackson, Richwood, Clute and Oyster Creek Village while most is covered by natural forests and grasslands.

Oyster Creek is very sinuous with numerous oxbow lakes, typical of the Texas Gulf Coast region. There are large expanses of coastal wetlands at the southern and eastern edges of the watershed.

In the 2012 IR, this segment is listed as not supporting its contact recreation use designation due to high bacteria concentrations.

Local Water Quality

Brazos-Colorado Coastal Basin

(Segments are listed alphabetically, upstream to downstream.)



San Bernard River Above Tidal (1302)



Major tributaries: Coushatta, East Bernard, Little San Bernard, Peach and West Bernard Creeks; Middle Bernard River

The watershed is predominantly agricultural with the communities of East Bernard, Eagle Lake, Kendleton, and Hungerford located in the middle of the watershed. Rice and cotton fields as well as for pastures grazing cattle dominate the landscape. Riparian habitats crisscross the land following streams as they meander across the watershed.

With the exception of the lower reaches, many fields are cleared to the edge of the flood way leaving little buffer between turned soils and the water body.

The segment is divided into four AUs in the 2012 IR and is listed as not supporting contact recreation use due to elevated bacteria concentrations in the lower 50 miles which is downstream of the confluence with Coushatta Creek southwest of Sealy. The two middle AUs also have concerns for depressed DO due to grab samples being measured less than the screening level.

There were two unclassified water bodies evaluated in the 2012 IR as well. Gum Tree Branch (1302A) was listed as not supporting contact recreation due to high bacteria concentrations and has a concern for depressed DO. West Bernard Creek (1302B) was divided into 2 AUs in the IR. The lower AU (1302B-01) is listed as not supporting its aquatic life use because 24-hour DO averages are depressed. Likewise, the upper AU has a concern for low DO because grab sample results are below the screening level. The upper AU (1302_02) is also listed as being impaired for contact recreation due to high bacteria concentrations. In this AU there is also a concern for exceeding screening levels for ammonia.

A WPP project was funded by the American Recovery and Reinvestment Act and subsequently by TCEQ, with additional funding for monitoring provided by the TSSWCB, for this watershed to address the ongoing bacteria issues and to develop a plan to address all pollutants. The project was started in September 2009 and the WPP is expected to be approved in 2014. See the WPP section earlier in this document for further discussion.

Local Water Quality



San Bernard River Tidal (1301)

Major tributaries: Halls Bayou, Mound Creek

The watershed is predominantly undeveloped with the exception of small towns including West Columbia, Wild Peach Village, Sweeny, Brazoria and Jones Creek Village. The watershed consists mainly of forest, woody wetlands, or grasslands with large areas of coastal wetlands located throughout the southern end of the watershed.

The San Bernard National Wildlife Refuge is located among the coastal wetlands. Agriculture is the main economic activity in the watershed.

In 2006, the mouth of the San Bernard River became completely silted in. This was caused by a combination of sediment deposition from the Brazos River, as well as Hurricanes Katrina and Rita. All water flowing down the San Bernard had to flow through the Intracoastal Waterway to get to the Gulf of Mexico. This caused severe currents that are very dangerous to barge traffic. In 2009, the mouth of the river was successfully opened and the river's original flow was restored. However, due to a variety of factors, the mouth has since closed again. Currently, stakeholders are working on a plan to reopen the mouth of the San Bernard in the near future.

In the 2012 IR, San Bernard Tidal is listed as not supporting its contact recreation use due to high levels of bacteria found in the waterway. There is also a concern for nutrients because chlorophyll a frequently exceeds the screening level.

A WPP project was funded by the ARRA and subsequently by TCEQ, with additional funding for monitoring provided by the TSSWCB, for this watershed to address the ongoing bacteria issues and to develop a plan to address all pollutants. The project was started in September 2009 and the WPP is expected to be approved in

Local Water Quality



Caney Creek Tidal (1304)

Major tributaries: Linnville Bayou, Red Bayou, Little Linnville Bayou, Dance Bayou, Dead Slough

The majority of this watershed is rural or uncultivated with the exceptions of a community of Old Ocean in the northeast and the small fishing villages of Sargent and Bay City near the mouth of the creek. A few medium and small farms are found within the watershed; however, the bulk of the agricultural activity consists of hay pastures which are most prevalent running along the banks of Linnville Bayou.

The southern portion of the watershed is dominated by herbaceous and woody wetlands which follow the creek down to the Intracoastal Waterway and thence to the Gulf of Mexico.

Caney Creek Tidal has two AUs identified in the 2012 IR. The AU from the downstream end of the segment near the Intracoastal Waterway to the confluence with Dead Slough is listed in the IR as not supporting its contact recreation use designations due to high concentrations of bacteria. The second AU also has a concern for high bacteria concentrations but is not considered impaired at this time. The downstream AU (1304_01) also has a concern for depressed DO because grab sample results have been below screening levels.

Linnville Bayou (1304A), a tributary to Caney Creek Tidal, was also evaluated in the 2012 IR and is listed as not supporting its contact recreation use designations due to high bacteria concentrations.

For several years in the past, the Lower Colorado River Authority conducted the CRP special study monitoring in this segment for H-GAC. Beginning in the fall of 2013, H-GAC took over the routine CRP monitoring for this segment. Monitoring results will be reported in the annual Basin Highlights or Summary Reports.



Caney Creek Above Tidal (1305)

Major tributaries: Hardeman Slough, Quinine Slough, Water Hole Creek, Gardner Slough, Snead Slough

This watershed is primarily rural with the exception of small urban centers that are found along the creek as it snakes its way southward. Towns within the watershed include Wharton, Boling, Pledger, and Van Vleck. Many large farms and hay pastures are located throughout the watershed, especially around the outskirts of Wharton and Boling to the north and Van Vleck to the west.

Local Water Quality

A large swath of forested wetland cuts through the middle of the watershed between the tributaries of Water Hole Creek and Snead Slough.

In the 2012 Texas IR, Caney Creek Above Tidal has three AUs. The downstream AU (1305_01) is fully supporting of its designated uses at this time. The middle AU (1305_02) is identified as not supporting contact recreation due to high bacteria concentrations. This AU also has concerns for impaired habitat and nutrients. The upper AU (1305_03) is not supporting its aquatic life use designation because 24-hour average DO measurements are too low. There is also a concern for the 24-hour minimum DO measurement. This same AU has a concern for orthophosphorus and total phosphorus as well.

For several years in the past, the Lower Colorado River Authority conducted the CRP special study monitoring in this segment for H-GAC. Beginning in the fall of 2013, H-GAC took over the routine CRP monitoring for this segment. Monitoring results will be reported in the annual Basin Highlights or Summary Reports.

Bays and Estuaries



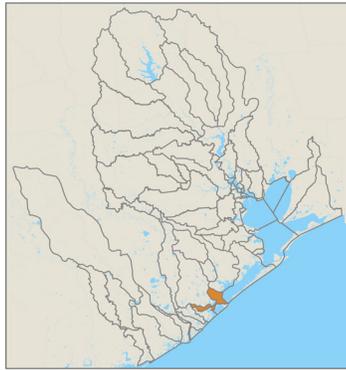
Barbours Cut(2436)

Major tributaries: None

This segment is in a heavily industrialized area located off the southern end of the Houston HSC. The area is surrounded by wetlands, a residential area, and the Port of Houston container yard.

This tidal segment is listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish and/or crab tissues. The 2012 IR also identifies – nitrate, ammonia, orthophosphorus, and total phosphorus as a concern due to concentrations frequently exceeding the screening levels.

Local Water Quality



Bastrop Bay/Oyster Lake (2433)



Major tributaries: None

The Bay and Lake are in an undeveloped estuarine environment and are part of the Christmas Bay system. Oyster Lake is listed in the 2012 IR as being an impaired water body for bacteria in oyster waters. The lake was first listed in 2006.

The bay and lake are in an undeveloped estuarine environmental located at the far west end of West Galveston Bay. Oyster Lake is located on the southeast side of the Intracoastal Waterway (ICW) and experiences complete water exchanges with the ICW. Bastrop Bay sits northeast of and adjoins Christmas Bay. Bastrop Bay water can flow between the ICW, Bastrop Bayou, West Galveston Bay and Christmas Bay. Bastrop Bay is fully supporting of all its uses while Oyster Lake is listed as not meeting uses for harvesting of oysters. The lake has been listed for bacteria impaired oyster waters since 2006. Sources of the bacteria are unknown but likely sources include the local and migratory bird populations, transient fisherman and the nearly dozen or more fish camps located along the shoreline of each water body.



Bayport Channel (2438)



Major tributaries: None

This segment is in a heavily industrialized area between the cities of Pasadena and La Porte. The area is surrounded by a residential area to the north, with the Port of Houston container yard, and an industrial complex to the south. Wetlands can be found in the southern portion of the segment.

This tidal segment is listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish and/or crab tissues. The 2012 IR also identifies nutrients as a concern due to concentrations frequently exceeding the screening levels.

The IR also indicates there is a concern for nutrients since concentrations frequently exceed the screening levels for more than one nutrient.

Local Water Quality



Black Duck Bay (2428) 🌿 🌿

Major tributaries: None

This segment is located off the southwest side of the city of Baytown. It is bordered by a residential area to the east, an industrial tank farm to the north, wastewater stabilization ponds to the west, and the Fred Hartman Bridge and causeway to the south.

This tidal segment is listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish tissue and/or crabs. The 2012 IR also identifies nutrients as a concern due to concentrations frequently exceeding the screening levels.



Burnett Bay (2430) 🌿 🌿 Crystal Bay (2430A)

Major tributaries: None

This segment is located off the west shore of the city of Baytown with Crystal Bay towards the south. The north and east shores are residential while the south shore is the location of Brownwood Park and the Baytown Nature Center.

Both Burnett Bay and Crystal Bay tidal segments are listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish tissue and/or crabs. The 2012 IR also identifies nutrients as a concern due to concentrations frequently exceeding the screening levels.

Local Water Quality



Chocolate Bay (2432)

Major tributaries: Chocolate Bayou, Cloud Bayou, Halls Bayou, Mustang Bayou, Persimmon Bayou, Willow Bayou, New Bayou

The Chocolate Bay segment includes several unclassified bayous that drain a large amount of land. One of these is Mustang Bayou which drains land all the way upstream through Alvin to Pearland, Fresno, and Missouri City. Downstream of the city of Alvin are large agricultural fields of rice and row crops. South of FM 2004 coastal marshes dominate the landscape. Upstream of Alvin, ranches and hobby farms are more common.

Chocolate Bay and Halls Bayou (2432C) are listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish tissue and/or crabs. Chocolate Bay also has a shellfish harvesting restriction due to unacceptable bacteria concentrations in waters where oysters generally grow. The 2012 IR also identifies Halls Bayou Tidal (2432C) as not supporting its contact recreation use designation due to bacteria concentrations greater than the state standard. There are bacteria concerns in Mustang Bayou, Persimmon Bayou, and New Bayou.

The aquatic life use designation for Mustang Bayou, Willow Bayou, Persimmon Bayou, and New Bayou is a concern due to depressed DO in grab screening levels. Nutrients are also a concern due to concentrations frequently exceeding the screening levels in Persimmon Bayou (2432D).



Christmas Bay (2434)

Major tributaries: None

Christmas Bay is a Coastal Preserve and part of the Texas General Land Office/ Texas Parks and Wildlife Department Coastal Preserves Program. Christmas Bay is one of the most pristine areas in the Galveston Bay system and home to numerous species of birds, fish, crustaceans, mollusks, and several species of sea grass. The area is surrounded by undeveloped wetland habitat and is part of a larger system of smaller bays and lakes.

Local Water Quality

There are only a few small subdivisions built with access to this Bay. All structures which include weekend homes and a few isolated 'fish camps' must rely on on-site sewage facilities to handle waste.

In the 2012 IR, there are two AUs one of which is not supporting of its oyster waters use designation. Those areas are adjacent to West Bay. However, contact recreation within Christmas Bay is fully supported.



Clear Lake (2425) 🌿 🌿

Major tributaries: Taylor Lake, Jarbo Bayou, Taylor Bayou, and Harris County Flood Control District (HCFCD) Ditch A

Clear Lake is home to one of the most concentrated fleets of recreational boats in Texas and the United States. Numerous marinas are located around the lake providing easy access to Upper Galveston Bay. The entire lake is a recreational playground for boaters on everything from sunfish sailboats, to jet skis, to multi-million-dollar yachts.

On the south shore of Clear Lake, the watershed encompasses the cities of League City, Clear Lake Shores, and Kemah. The north shore includes Taylor Lake Village, El Lago, Seabrook, Shoreacres, and Pasadena.

Clear Lake (2425), Taylor Lake (2425A), Jarbo Bayou (2425B), and Taylor Bayou (2425D) are listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish tissue and/or crabs.

Jarbo Bayou (2425B) is listed as not supporting its contact recreation use designation and Ditch A has a concern for high bacteria as well. Clear Lake, Taylor Lake and Jarbo Bayou are also listed in the 2012 IR for nutrient concerns due to several parameters exceeding the screening levels frequently. Jarbo Bayou is the only unclassified water body in the segment that has depressed DO due to grab samples being measured below the screening level.

Local Water Quality



Drum Bay (2435)

Major tributaries: None

Drum Bay is a small bay located down the coast from West Bay and immediately southwest of Christmas Bay. In the 2012 IR, there are two AUs identified in this water body, one of which is not supporting of its oyster waters use designation. Those AUs are adjacent to Christmas Bay.

However, like Christmas Bay, Drum Bay fully supports its contact recreation designation.



East Bay (2423)

Major tributaries: Oyster Bayou

The East Bay watershed encompasses East Bay, the Upper Bolivar Peninsula and portions of Chambers County which are predominantly undeveloped. Significant development was wiped out in the Hurricane Ike storm surge but rebuilding is occurring at a fast pace. In addition to year round residents of the peninsula, vacation homes, fish and bait camps, and small commercial businesses are common.

Abundant wetlands, marshes, and coastal prairie habitats cover most of the peninsula. East Bay (2423) and Oyster Bayou (2423A) are listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish tissue and/or crabs. There is also a shellfish harvesting restriction on East Bay due to high bacteria making oysters unsafe for human consumption. Chlorophyll a is a concern in both water bodies while depressed DO is a concern in Oyster Bayou only.

Local Water Quality

Impaired oyster waters use is the most common impairment use among Texas bay and gulf waters. Due to elevated bacteria concentrations, restricted areas are closed to the harvesting of shellfish for direct marketing to the public. Bacteria from human and animal waste contaminate oysters and other shellfish, making them unsafe to eat, especially since oysters are frequently eaten raw. A TMDL project with follow up I-Plan development for bacteria in oyster waters was initiated to improve water quality so oyster beds can routinely harvest without fear of contamination. The TMDL was approved back in 2009 and amended in 2012. The I-Plan is being developed by the Galveston Bay Foundation and is yet to be approved.



Lower Galveston Bay (2439)

Major tributaries: None

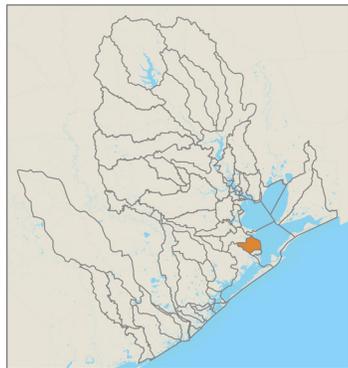
This segment primarily receives flow from other bodies of water such as Upper Galveston Bay, East Bay, and West Bay and is influenced by tides from the Gulf of Mexico. The land portion of the watershed includes parts of the cities of Galveston and Texas City. The entire Bay is a major recreational area with boating, recreational and commercial fishing, and birding.

Lower Galveston Bay is listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish tissue and/or crabs. There is also a shellfish harvesting restriction on Lower Galveston Bay due to high bacteria making oysters unsafe for human consumption. Chlorophyll a is also identified as a concern in the 2012 IR due to concentrations frequently exceeding the screening levels.

Impaired oyster waters use is the most common impairment use among Texas bay and gulf waters. Due to elevated bacteria concentrations, restricted areas are closed to the harvesting of shellfish for direct marketing to the public. Bacteria from human and animal waste contaminate oysters and other shellfish, making them unsafe to eat, especially since oysters are frequently eaten raw.

A TMDL project with follow up I-Plan development for bacteria in oyster waters was initiated to improve water quality so oyster beds could be routinely harvested without fear of contamination. The TMDL was approved back in 2009 and amended in 2012. The I-Plan is being developed by the Galveston Bay Foundation and is yet to be approved.

Local Water Quality



Moses Lake (2431) 🌳 🌳 🌳

Major tributaries: Moses Bayou

The watershed, which includes much of Texas City and part of the city of La Marque, presents a wide range of environmental habitat conditions. The northeastern and northwestern portions of the watershed consist mostly of grasslands and forested lands while the southern section is highly urbanized and includes a part of the Texas City petrochemical complex.

Large tracts of undisturbed wetlands and marsh habitats surround Moses Lake and Dollar Bay an adjacent lagoon.

Moses Lake (2431) and Moses Bayou (2431A) are listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish tissue and/or crabs. Chlorophyll a and total phosphorus are also identified as a concern in the 2012 IR due to concentrations frequently exceeding the screening levels. Both water bodies fully support their contact recreation designation at this time.

The Highland Bayou project, coordinated by the Texas Sea Grant and Texas A&M AgriLife Extension Service Texas Coastal Watershed Program, is a multi-year effort to identify steps for improving the quality and safety of several area waterways. The watersheds included in this project are: Moses Lake and Moses Bayou, Highland Bayou, Marchand Bayou, the Diversionary Canal, the Texas City Ship Channel, Campbells Bayou, Basford Bayou, Greens Lake, and Karankawa Bayous. Go to <http://agrilife.org/highlandbayou> for more information on the project.



San Jacinto Bay (2427) 🌳 🌳

Major tributaries: None

This segment is composed of Upper and Lower San Jacinto Bays separated from the HSC by dredge spoil island/impoundments. Portions of the city of Pasadena petrochemical complex line the western and southern shores of the bays with the Fred Hartman Bridge crossing the north end of Lower San Jacinto Bay.

Local Water Quality

San Jacinto Bay is listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish tissue and/or crabs. The 2012 IR also identifies nutrients such as chlorophyll a, total phosphorus, and ammonia as a concern due to concentrations frequently exceeding the screening levels.



Scott Bay (2429)

Major tributaries: None

This segment is located along the HSC and off the west shore of the city of Baytown. Heavy industry is located on the east shore of the Bay with residential areas to the north and the Baytown Nature Center and Brownwood Park to the northwest.

Scott Bay is listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish tissue and/or crabs. The 2012 IR also identifies nutrients such as chlorophyll a, total phosphorus, and ammonia as a concern due to concentrations frequently exceeding the screening levels.



Tabbs Bay (2426) Goose Creek tidal (2426C)

Major tributaries: None

This segment is surrounded by heavily industrialized areas as well as the dense residential and commercial areas of the city of Baytown. All of Tabbs Bay is south of SH 146. Both Tabbs Bay and Goose Creek Tidal are listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish tissue and/or crabs.

The 2012 IR also identifies nutrients as a concern due to concentrations of several parameters frequently exceeding the screening levels.

Local Water Quality



Texas City Ship Channel (2437)



Major tributaries: None

The majority of the Texas City Ship Channel watershed is occupied by the Texas City petrochemical complex. The Texas City Ship Channel supports heavy barge and ship traffic on a regular basis. Docks used to load and unload raw materials and finished products occupy the entire northern shoreline and the turning basin. The ship channel receives stormwater and wastewater discharges from these industrial complexes.

The Texas City Ship Channel is listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish tissue and/or crabs. The 2012 IR also identifies chlorophyll a, total phosphorus, and ammonia as a concern due to concentrations frequently exceeding the screening levels.

The Highland Bayou project, coordinated by the Texas Sea Grant and Texas A&M AgriLife Extension Service Texas Coastal Watershed Program, is a multi-year effort to identify steps for improving the quality and safety of several area waterways. The watersheds included in this project are: the Texas City Ship Channel, Highland Bayou, Marchand Bayou, Moses Lake and Moses Bayou, the Diversionary Canal, Campbells Bayou, Basford Bayou, Greens Lake, and Karankawa Bayous. Go to <http://agrilife.org/highlandbayou/> for more information on the project.



Trinity Bay (2422)



Major tributaries: Double Bayou West Fork, Double Bayou East Fork, Red Bayou, Old River, Trinity River, Anahuac Channel, Cotton Bayou

Trinity Bay is entirely within Liberty County. Coastal wetlands dominate the near shore landscape with agricultural activities such as cattle grazing and row crops found throughout Liberty County on the east side of the Bay. Anahuac is the major city in close proximity of the Bay on the northeast shore. Double Bayou – West and East Forks – drain significant crop pasture lands.

Local Water Quality

Smith Point separates Trinity Bay from East Bay and Lower Galveston Bay.

Trinity Bay (2422), Double Bayou West Fork (2422B), and Double Bayou East Fork (2422D) are listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish tissue and/or crabs. There is also a shellfish harvesting restriction on the upper portion of Trinity Bay due to high bacteria making oysters unsafe for human consumption. The contact recreation designation for Double Bayou West Fork is not supported and there is a concern for Double Bayou East Fork due to high bacteria concentrations.

Double Bayou West Fork is also not supporting its aquatic life use due to depressed chlorophyll a which is also identified as a concern in the 2012 IR due to concentrations frequently exceeding the screening levels.

Impaired oyster waters use is the most common impairment use among Texas bay and gulf waters. Due to elevated bacteria concentrations, restricted areas are closed to the harvesting of shellfish for direct marketing to the public. Bacteria from human and animal waste contaminate oysters and other shellfish, making them unsafe to eat, especially since oysters are frequently eaten raw. A TMDL project with follow up I-Plan development for bacteria in oyster waters was initiated to improve water quality so oyster beds could be routinely harvested without fear of contamination. The TMDL was approved back in 2009 and amended in 2012. The I-Plan is being developed by the Galveston Bay Foundation and is yet to be approved.



Upper Galveston Bay (2421)

Major tributaries: Clear Lake Channel

The upper portion of the watershed contains a significant amount of industrial activity with the majority derived from barge transportation and ocean going vessels. The lower portion of the watershed is a mix of residential and commercial communities.

The Upper Galveston Bay and Clear Lake Channel are listed in the 2012 IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish tissue and/or crabs. There is also a shellfish harvesting restriction on Upper Galveston Bay due to high bacteria, making oysters unsafe for human consumption. Chlorophyll a and other nutrients are also identified as a concern in the 2012 IR due to concentrations frequently exceeding the screening levels.

Impaired oyster waters use is the most common impairment use among Texas bay and gulf waters. Due to elevated bacteria concentrations, restricted areas are closed to the harvesting of shellfish for direct marketing to the public. Bacteria from human and animal waste contaminate oysters and other shellfish, making them unsafe to eat, especially since oysters are frequently eaten raw.

Local Water Quality

A TMDL project with follow up I-Plan development for bacteria in oyster waters was initiated to improve water quality so oyster beds could be routinely harvested without fear of contamination. The TMDL was approved back in 2009 and amended in 2012. The I-Plan is being developed by the Galveston Bay Foundation and is yet to be approved.



West Galveston Bay (2424)

Major tributaries: Basford Bayou, English Bayou, Highland Bayou, Marchand Bayou, Offats Bayou, Karankawa Bayou, Greens Lake

The West Galveston Bay watershed encompasses the bay side of Galveston Island, a barrier island with many coastal wetlands. West Bay is located between the Galveston Island Causeway Bridge and San Luis Pass to the west. It includes several small bays, lakes and bayous that drain into the Bay. Primary land uses/land cover in this watershed is related to agriculture.

Coastal communities include Galveston, Jamaica Beach, Tiki Island Bayou Vista, Hitchcock, La Marque, and Santa Fe.

West Bay and two sub-segments, Highland Bayou (2424A) and Offats Bayou (2424D), are listed in the 2012 Texas IR as having a restricted fish consumption advisory issued by the TDSHS due to high concentrations of dioxin and PCBs in edible fish tissue and/or crabs. Oyster harvesting is also prohibited in the main part of the Bay due to elevated bacteria levels. Impaired oyster waters use is the most common impairment use among Texas bay and gulf waters. Due to elevated bacteria concentrations, restricted areas are closed to the harvesting of shellfish for direct marketing to the public. Bacteria from human and animal waste contaminate oysters and other shellfish, making them unsafe to eat, especially since oysters are frequently eaten raw. A TMDL project with follow up I-Plan development for bacteria in oyster waters was initiated to improve water quality so oyster beds could be routinely harvesting without fear of contamination. The TMDL was approved back in 2009 and amended in 2012. The I-Plan is being developed by the Galveston Bay Foundation and is yet to be approved.

West Bay and several sub-segments fully support their contact recreation and aquatic life use designations; however, Highland Bayou and Marchand Bayou do not. The 2012 IR identified five AUs in Highland Bayou. The geometric means for bacteria concentrations in each AU increase moving upstream. Likewise, there are depressed DO issues throughout both sub-segments resulting in impaired aquatic life use designations for the upstream AU in Highland Bayou and Marchand Bayou. High chlorophyll a concentrations are also a concern in three of the five AUs in Highland Bayou.

Local Water Quality

Lake Madeline (2424B) has a concern with depressed DO due to low grab sample results and nutrients since total phosphorus and chlorophyll a samples have frequently exceeded nutrient screening levels. Portions of Offats Bayou and English Bayou also have a concern for chlorophyll a concentrations exceeding the screening level for these water bodies.

Galveston Island State Park beaches are monitored through the Texas Beach Watch Program. While there have been some advisories posted for high bacteria, generally, these recreational waters are fully supporting of their contact recreation use designation.

The Highland Bayou project, coordinated by the Texas Sea Grant and Texas A&M AgriLife Extension Service Texas Coastal Watershed Program, is a multi-year effort to identify steps for improving the quality and safety of several area waterways. The watersheds included in this project are: Highland Bayou, Marchand Bayou, Moses Lake and Moses Bayou, the Diversionary Canal, the Texas City Ship Channel, Campbells Bayou, Basford Bayou, Greens Lake, and Karankawa Bayous.



Gulf of Mexico (2501)

Major tributaries: None

The only documented issue in the 2012 IR for the Gulf of Mexico between the Jefferson-Chambers county line to Bolivar Point to San Luis Pass area to Freeport and down the coast to Port Aransas is elevated mercury levels in edible fish tissue. This resulted in the TDSHS to issue a restricted fish consumption advisory for the area.

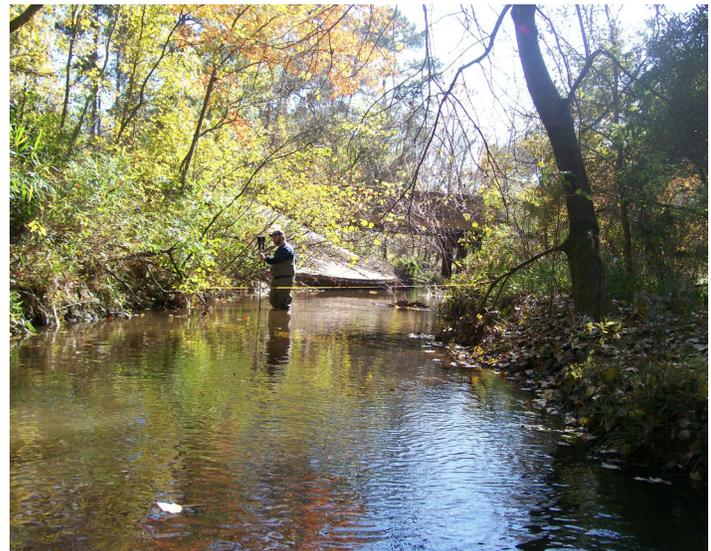
All the public access beaches from Bolivar Peninsula to San Luis Pass to Surfside Beach and beyond are monitored through the Texas Beach Watch Program. All beaches in this region are fully supporting of contact recreation.

Local Water Quality

Conclusion

The biggest water quality issue throughout the region continues to be elevated levels of bacteria, which inhibit safe contact recreation and oyster harvests. Toxicity, particularly PCB/dioxin in fish tissue, continues to be an important issue. Several TMDLs are currently underway to address these issues. Routine monitoring is being used to address some of the less severe issues, such as low DO levels in streams and small tributaries. WPPs have been initiated to identify sources of contamination and to help in the development of reasonable remediation and control strategies.

Expanded ambient monitoring continues to give water quality managers data to conduct better and more comprehensive assessments. Monitoring watersheds in rural areas that previously had limited data has expanded the knowledge of water quality conditions, ensuring that more water bodies in the region are being addressed. The combination of data collection, data analysis, education, stakeholder involvement, and reasonable implementation strategies are key factors in watershed management, understanding of aquatic ecological systems, and water quality improvement.



“We count H-GAC as a valuable partner in accomplishing our environmental stewardship goals. The H-GAC sponsored water quality monitoring and Watershed Protection Plan helps us to know where to focus our efforts and decide which Best Management Practices to employ. Their seminars on topics such as OSSFs and RESTORE Act funding provide valuable information that our attendees can take back to the entire river community.”

*Tom Ronayne, Vice President
Friends of the River San Bernard*

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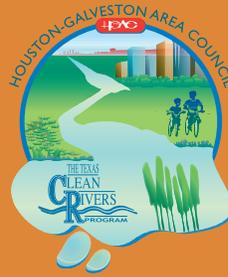
Resource Information

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Photo Descriptions

- Pg 4 CRP staff conducting 24-Hour DO monitoring at Cedar Bayou
- Pg 8 Excessive floating vegetation at Linville Bayou (bottom right)
Excessive floating vegetation at Caney Creek (bottom left)
- Pg 11 CRP staff conducting monitoring at various water bodies (bottom right)
EIH staff conducting habitat assessment (bottom left)
- Pg 13 Armand Bayou
Image courtesy Andrew Sipocz, via Armand Bayou Conservancy
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Public Meeting in Clear Lake Shores, TX (bottom left)
- Pg 17 Cedar Bayou
- Pg 18 Dickinson Bayou Bridge
- Pg 19 East Fork Double Bayou
Image courtesy of Stephanie Glenn at HARC
- Pg 23 Children playing games at the Reliant World Series Dog Show (upper right)
Staff at Our Great Region 2040 stakeholder meeting (lower right)
- Pg 23 Citizen Scientists at water quality training workshop (both photos)
- Pg 26 Volunteers at the 2013 River, Lakes, Bays 'N Bayous Trash Bash® (all photos)
- Pg 27 Participant taking the “Pet Waste Pledge” at the Reliant World Series Dog Show
- Pg 65 CRP staff conducting flow monitoring (bottom right)
Participants with Lucky the Lady Bug at the Reliant World Series Dog Show (bottom left)



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