HOW'S THE WATER?

2019 BASIN HIGHLIGHTS REPORT FOR THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Houston-Galveston Area Council
Clean Rivers Program

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INTRODUCTION

The Houston-Galveston region is rich in water resources, with more than 16,000 miles of streams and shoreline that feed into one of the most productive estuaries in the United States, providing the region with a wealth of ecological, economic, and recreational assets. These water resources are shared among 6.5 million people for recreation, commercial fishing, shipping, and other industrial uses. With another 3.8 million people expected to move to the area over the next 20 years, the strain on these water resources will continue to increase.

The Houston-Galveston Area Council (H-GAC) Clean Rivers Program (www.h-gac.com/community/water/rivers/default.aspx) is charged with conducting water quality monitoring and assessment to determine the health of water bodies throughout the region. The Houston-Galveston Area Council (H-GAC) does this through a coordinated effort with local partners and the Texas Commission on Environmental Quality (TCEQ). Along with analysis of this monitoring data, H-GAC assesses factors and activities impacting water quality. Information and recommendations on what individuals, industry, and local governments can do to make improvements and preserve local waterways now and in the future is provided through public education and outreach

efforts organized by H-GAC. Clean Rivers Program data provides support for all watershed-based planning activities in the region.

Improving water quality requires more than the efforts of just one person or group of people. Progress is made when many stakeholder groups work together to manage water quality. The H-GAC Clean Rivers Program continues to coordinate the work of multiple stakeholder groups resulting in positive effects on water quality in our region.

CLEAN RIVERS PROGRAM OVERVIEW

Overview

The H-GAC Clean Rivers Program is considered a model program throughout the state, thanks in large part to its coordinated approach to water quality monitoring. The H-GAC Clean Rivers Program covers all or a portion of 15 counties (Austin, Brazoria, Chambers, Colorado, Fort Bend, Galveston, Grimes, Harris, Liberty, Matagorda, Montgomery, San Jacinto, Walker, Waller, Wharton), four river basins (Brazos-Colorado Coastal Basin, San Jacinto River Basin, the San Jacinto-Brazos Coastal Basin, Trinity-San Jacinto Coastal Basin), and the Bays and Estuaries.

The H-GAC Clean Rivers Program provides baseline data for many water quality studies and projects within the 15-county monitoring area at more than 370 sampling sites with six regional partners:

- City of Houston Health Department
- City of Houston Drinking Water Operations
- Environmental Institute of Houston | University of Houston-Clear Lake
- Harris County Pollution Control Services
- San Jacinto River Authority ((Lake Conroe and The Woodlands Divisions)
- Texas Research Institute for Environmental Studies (Sam Houston State University)

Other agencies contributing data used by the Clean Rivers Program include:

- Texas Commission on Environmental Quality
- United States Geological Survey

Clean Rivers Program Steering Committee

The H-GAC Clean Rivers Program Steering Committee (www.h-gac.com/community/water/rivers/meeting-materials.aspx) serves as the primary forum for discussion of various water quality issues raised through the assessment process and advises staff on all administrative matters related to the Clean Rivers Program, including

work plan and budget development, monitoring of progress toward project milestones, and review of the draft and final basin reports and other work items.

In 2018, the Steering Committee discussed key components of the Clean Rivers Program, including:

- draft review of 2018 Basin Highlights Report;
- proposed changes to the fiscal year 2019 regional coordinated monitoring schedule;
- updates on watershed protection plans and total maximum daily load/implementation plans using Clean Rivers Program data; and
- public outreach activities for 2018.

Ambient Water Quality Monitoring Program & Regional Monitoring Workgroup

The Regional Monitoring Work Group (www.h-gac.com/community/water/rivers/meeting-materials.aspx), comprised of field and laboratory staff from each of the local Clean Rivers Program partner agencies, meets quarterly to provide updates on individual monitoring programs, discuss quality assurance issues, and discuss solutions to common problems found in field and/or laboratory settings.

Each spring, the work group holds a coordinated monitoring meeting to discuss data gaps and set the monitoring schedule for the coming 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 load implementation plans, watershed protection plans, TCEQ permitting, or changes to budgets.

All monitoring is conducted under a TCEQ-approved Multi-Basin Quality Assurance Project Plan (www.h-gac.com/community/water/rivers/meeting-materials.aspx). All laboratories used by Clean Rivers Program participants are accredited through the National Environmental Laboratory Accreditation Program.

24-Hour Dissolved Oxygen Monitoring

The TCEQ has established aquatic life use designations for all segments and many tributaries in the state. These designations (exceptional, high, intermediate, limited, and minimal) are based upon established numerical criteria and are highly dependent on the desired use of the water body, the sensitivities of aquatic communities expected to be found in those water bodies, and the local physical and chemical characteristics of the water bodies. One of the criteria is dissolved oxygen, which includes both a 24-hour

minimum and a 24-hour average. Routine monitoring generally collects dissolved oxygen grab samples only, which may identify concerns and impairments but must be verified using testing to determine a 24-hour average.

H-GAC conducted 24-hour dissolved oxygen monitoring to verify or determine the extent of the dissolved oxygen concern or impairment at six segments or tributaries which had dissolved oxygen grab samples only. Monitoring was conducted at the following sites:

11367 – Lake Creek at Honea-Egypt Rd (segment 1015)
18191 – Lake Creek at FM 149 (segment 1015)
21957 – Mill Creek at FM 149 (segment 1008A)
21965 – Spring Branch at Shakey Hollow Rd (segment 1010C)
20462 – Walnut Creek at Decker Prairie–Rosehill Rd (segment 1008I)
20463 – Brushy Creek at Glenmont Estates Blvd (segment 1008J)

Preliminary results obtained by combining both sites on Lake Creek (segment 1015) indicate this water body meets its high aquatic life use designation. Only one of the 19 events conducted between October 2015 and August 2018 recorded a minimum dissolved oxygen below the standard of 3 mg/L. Additionally, all 19 events had 24-hour averages above the standard of 5 mg/L.

Walnut Creek also meets its high aquatic life use with all 11 events meeting or exceeding the 24-hour average of 5 mg/L and 10 of 11 events exceeding the assigned minimum dissolved oxygen concentration of 3 mg/L.

A total of 10 events were collected on Brushy Creek between October 2015 and August 2018. Nine of 10 events exceeded the minimum dissolved oxygen standard of 3 mg/L and eight of 10 events exceeded the 24-hour average of 5 mg/L. The two events resulting in noncompliance occurred during August 2016 and August 2018. A discussion is needed with TCEQ to determine if additional data is needed to complete a reassessment of this water body.

Mill Creek at FM 149 and Spring Branch at Shakey Hollow Rd will continue to be monitored through August 2019 to collect the minimum 10 events required at each location to allow for a reassessment of conditions in those streams to determine if the aquatic life designation is met.

So, How's the Water? (Water Quality Overview)

Introduction

The Houston-Galveston region supports a population of more than 7 million residents and includes the fourth-largest city and third-most populous county in the nation. This concentration of people can place significant strain on the surface water quality in our region.

Water Quality Trends

Clean Rivers Program staff summarized water quality in the major watersheds of the region by calculating the percentage of the streams and shoreline in the watershed where water quality impairments or concerns were identified by the TCEQ in the Draft 2016 Texas Integrated Report of Surface Water Quality (www.h-gac.com/community/water/rivers/meeting-materials.aspx). The Integrated Report evaluates the quality of surface water in Texas and is used as a tool to make decisions about water quality programs across the state. Waterways are assigned to categories based on how well they meet the standards established to define and measure their quality. Water bodies can be designated as impaired by not meeting the standards, or of concern, meaning they may not meet the standard in the future.

More than 80 percent of waterway stream or shoreline miles in the Houston-Galveston region have a concern for or fail to meet one or more state water quality standards. The most common water quality indicators for the state water quality standards are bacteria, dissolved oxygen, chlorophyll, and PCBs/dioxin. There are no water quality standards for nutrients (forms of phosphorus, ammonia, and nitrogen), but excessive concentrations are considered concerns.

Staff identified trends for the major water quality indicators in each watershed and included these in the 2019 Regional Water Quality Summary Chart, analyzing data collected from June 1, 2011, through May 31, 2018. Data from the most downstream station in each above tidal (freshwater) or tidal segment and all available data in the bays and estuaries were analyzed. The bacteria geomean trend was calculated using the same seven-year period. Clean Rivers Program staff used nonparametric correlation analysis to detect trends. Trends were considered statistically significant if the p-value was below 0.05.

Trends identified include the following:

- The good news is even though most of the region's waterways do not meet one or more state water quality standards, about 60 percent have not seen further deterioration.

- Four percent of segments have shown improvement in bacteria levels with six percent of segments deteriorating over the seven-year period H-GAC selected for analysis.
- Areas in the original Bacteria Implementation Group implementation plan, which provides recommendations for bacteria reduction in the greater Houston area, have experienced a 44 percent decrease in bacteria levels since 2005.
- Six percent of segments have shown improvement in dissolved oxygen levels over the seven-year assessment period. No segments are getting worse.
- Forty-three percent of segments have shown improvement in nutrient levels over the seven-year assessment period. Just 22 percent have shown deterioration in nutrient levels. Trend analysis for nutrients was done for each nutrient parameter but the reported trends are a composite of the nutrients analyzed. The segment summaries identify which nutrient parameters are of concern for those water bodies.

Improved water quality in the region may be attributed to several factors, including:

- increased investigations of wastewater collection system and resulting line repairs and facility improvements;
- improved regulation and maintenance of on-site sewage facilities and wastewater treatment;
- increased preservation of natural habitat and installation of water quality features in detention basins; and
- heightened public awareness and public participation.

Bacteria

Forty-two percent of stream miles in the Houston-Galveston region are impaired by high levels of bacteria and are listed as impaired or of concern for contact recreational use. High bacteria concentrations can cause swimmers or waders who come into contact with the water to suffer from skin infections or mild to severe gastrointestinal illness.

Bacteria concentrations are measured to ensure a water body is safe for recreation. Enterococci is collected in tidal waterways, while *E. coli* is collected in freshwater. Both are found in the digestive tracts of people and other animals and are used as indicators of the presence of sewage and pathogens (such as infectious bacteria, viruses, and protozoans).

No bays are impaired for enterococci bacteria but may be impaired for oyster harvesting due to elevated concentrations of fecal coliform bacteria.

Sources of bacterial contamination include:

- Untreated wastewater treatment facility (WWTF) releases.
- Sanitary sewer overflows.
- Failing on-site sewage facilities (septic systems).
- Fecal waste from livestock, pets, feral hogs, and wildlife.

The TCEQ evaluates the results of bacteria testing to determine whether a water body is safe for contact recreational activities like swimming. A type of average called a *geometric mean* is calculated for a seven-year period. If the geometric mean is higher than the water quality standard, the water body is considered impaired for contact recreation activities. H-GAC uses Moving Seven-year Bacteria Geometric Mean to show the change in bacteria levels in the H-GAC Clean Rivers Program region. The Bacteria Relative Geomean shows the magnitude of impairments for water bodies, meaning how many times above the state standard the bacteria concentrations are, on average over the seven-year period. Because two different types of indicator bacteria (*E. coli* in freshwater and Enterococci in tidal waters) with different water quality standard levels are analyzed, H-GAC standardizes the results so both can be displayed on the same graph. The moving geometric mean for all H-GAC Clean Rivers Program monitoring stations has been well above the standard every year since 2005 but has been steadily decreasing since 2011.

Dissolved Oxygen

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

DO levels are measured to ensure a water body can support aquatic life. Higher levels of DO can contribute to more abundant and diverse aquatic species. DO levels fluctuate naturally based on season, time of day, and human influences. Sudden or prolonged decreases in DO could result in fish kills.

DO can be negatively impacted by

- High concentrations of nutrients causing algal blooms.
- Sediment from construction sites.
- Overgrazing of livestock.
- Stream channel modification and development.
- Reduced riparian tree cover.

PCBs/Dioxin

Six percent of freshwater streams, 60 percent of tidal streams, and 75 percent of bays in our region are impaired for PCBs and dioxin. No lakes in this region are impaired. Because fish and shellfish can accumulate contaminants from the waters they live in, they are monitored closely by federal, state, and local governments and bans and advisories are issued when consumption may be a risk to human health.

The U.S. Environmental Protection Agency (EPA) website recommends "when contaminant levels are unsafe, fish and shellfish advisories help people make informed decisions about where to fish or harvest shellfish. Advisories recommend that people limit or avoid eating certain species of fish and shellfish caught in certain places."

The Texas Department of State Health Services Seafood and Aquatic Life Unit protects consumers from contaminants, disease, or other health hazards transmissible or found in fish or shellfish. They issue advisories and bans, and provide easy-to-use maps, including the online Texas Fish Consumption Advisory Viewer (www.dshs.texas.gov/seafood/TFCAV.aspx), to identify current water-body specific health advisories for fish and shellfish for all Texas waters.

Fish and shellfish consumption bans and advisories can also be found on the Texas Parks and Wildlife Department website (www.tpwd.texas.gov/regulations/outdoor-annual/fishing/general-rules-regulations/fish-consumption-bans-and-advisories).

For more information about PCBs/dioxin in area waterways, see the Water Quality Summary Chart in Appendix A.

Nutrients

Nutrients are chemical substances that promote the growth of aquatic organisms. The TCEQ evaluates the amount of these nutrients (which include various forms of phosphorus and nitrogen) as part of their assessment process. Thirty-five percent of stream miles exceed the state screening levels for nutrients, including nitrate, ammonia, and phosphorus. In high concentrations, nutrients can contribute to low dissolved oxygen levels and may result in unsightly or toxic algal blooms. Algae also produce chemicals which can cause taste and odor problems in drinking water.

Sources of nutrient pollution include

- Fertilizer runoff from lawns and agricultural fields.
- Manure.
- Sewage treatment plant discharges.
- Stormwater runoff.
- Failing on-site sewage facilities.

Statewide Development of Nutrient Criteria

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 water bodies throughout the state are meeting their designated uses. Criteria continue to be adjusted for specific regions rather than using a one-size-fits-all criteria. Only 39 lakes or reservoirs in the state currently have numeric criteria for nutrients. Lake Houston and Lake Conroe, the two drinking water supply reservoirs in this region, have narrative criteria only. The Nutrient Criteria Development Advisory Workgroup continues to hold public meetings and seeks stakeholder and subject-matter expert input for developing nutrient criteria.

Hurricane Harvey's Environmental Impacts

In August 2017, Hurricane Harvey caused unprecedented flooding throughout southeast Texas. According to the Harris County Flood Control District, the Category 4 storm dropped more than 40 inches of rainfall on average over the region, flooding an estimated 154,170 home and causing 36 storm-related deaths in Harris County alone.[1]

In addition to the physical damage, Hurricane Harvey affected water quality, creating ongoing health concerns for residents, rescue workers, and the environment. Several EPA Superfund sites were inundated for days, and 813 wastewater treatment plants reported spills.[2] NASA Terra satellite imagery from August 31, 2017, illustrated flood waters transporting large amounts of sediments.[3] Scientists and civil authorities had concerns that urban and industrial pollutants could be mixed into floodwater runoff.

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[1] Lindner, Jeff. (June 4, 2018). *Immediate Report—Final Hurricane Harvey—Storm and Flood Information* Houston, TX: Harris County Flood Control District. [Memorandum]. Accessed May 15, 2019. https://www.hcfcd.org/media/2678/immediate-flood-report-final-hurricane-harvey-2017.pdf

[2] U.S. Environmental Protection Agency. (September 3, 2017). *Status of Water Systems in Areas Affected by Harvey* [News Release]. Accessed May 15, 2019. https://www.epa.gov/newsreleases/status-water-systems-areas-affected-harvey

[3] National Aeronautics and Space Administration. (2017). *Texas Waters Run Brown after Harvey*. [Aerial imagery demonstrating the rivers and bays were loaded with sediment and mud following Hurricane Harvey]. Accessed May 15, 2019. https://earthobservatory.nasa.gov/images/90866/texas-waters-run-brown-after-harvey

While all the impacts from Hurricane Harvey on water quality are not yet known and comprehensive data are not available, some impacts have been noted:

- Samples of floodwater collected from inside residents' homes in Houston were shown to have higher concentrations of *E. coli* and enterococci many times higher than samples collected outside of the home or in the stream. Analysis of those data by the Rice University and Virginia Tech University Departments of Civil and Environmental Engineering indicated that "the elevated abundance of microbial contamination in stagnant indoor floodwaters and sediments increases the potential level of exposure of residents and relief workers in the aftermath of extreme floods."[4]
- According to a report released by the Houston Advanced Research Center, "Sediments were deposited on city streets, residential neighborhoods, and parks, causing potential health concerns from lead, arsenic, and other pollutants." The report also notes that "90 incidents were reported in the greater Houston-Galveston region involving more than 700,000 gallons of pollutants released into water and on land, and more than 38,000 pounds of air pollutants."[5]
- The *Houston Chronicle* reported that 65 wastewater treatment plant releases resulted in 20.7 million gallons of raw sewage discharging into floodwaters in Harris County alone.[6]

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[4] Yu, P., Zelski, A., Li, Q., He, Y., Mapili, K., Pruden, A., Alvarez, P., and Stadler, L. "Elevated Levels of Pathogenic Indicator Bacteria and Antibiotic Resistance Genes after Hurricane Harvey's Flooding in Houston." *Environmental Science & Technology Letters*, no. 5, (2018): 481–486. {Journal Article]. Accessed May 21, 2019. https://cpb-us-e1.wpmucdn.com/blogs.rice.edu/dist/3/1390/files/2012/02/266-2jxakx9.pdf

[5] Houston Advanced Research Center. (2017). *Summarizing Hurricane Harvey's Environmental Impacts – Water: What the Water Carried*. [ESRI Story Map summarizing the environmental impacts of Hurricane Harvey]. Accessed May 15, 2019. https://harcresearch.maps.arcgis.com/apps/MapSeries/index.html?appid=d6b0a3d762ec46ef8ea676f1008f7028/

[6] Stuckey, A. (2017, September 19). "Harvey caused sewage spills." *Houston Chronicle*. [News Article]. Accessed May 15, 2019. https://www.houstonchronicle.com/news/houston-texas/houston/article/Harvey-caused-sewage-spills-12213534.php

- Following the highest freshwater inflow on record because of Hurricane Harvey, Galveston Bay experienced decreased salinity and temperatures contributing to an estimated 90 percent loss of the oyster community.[7]
- Although most municipal drinking water supplies in Harris County were unaffected, a news release from the EPA Office of the Administrator reported that as of September 14, 2017, Hurricane Harvey had affected about 2,238 drinking water systems (about half of the systems potentially affected). Of those, 2,014 systems were fully operational, 77 had boil water notices issued, and 19 plants were shut down in the entire area affected by Harvey.[8]

Water Quality Summary

The Clean Rivers Program provides data for review and summary of ambient water quality conditions for the 54 segments in the four basins and bays and estuaries monitored and assessed by the H-GAC and its Clean Rivers Program partners.

Regional Water Quality Summary Chart

To illustrate the region's impairments or concerns, the Clean Rivers Program compiles a comprehensive summary chart of regional water quality for six parameters for each of the 54 waterway segments in the four basins and bays and estuaries. The chart also illustrates whether the impairment or concern is trending for the better or worse or has stayed the same.

The numbers in the cells in the chart represent the percent of total segment length that is impaired or of concern for each parameter. Cells without numbers (blanks) represent stream segments that are currently meeting state standards but may be improving or degrading for each parameter. Trend columns indicate whether the segment is improving, deteriorating, or staying the same (indicated by being blank) for four parameters.

View the 2019 Regional Water Quality Summary Chart in Appendix A.

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[7] Houston Advanced Research Center. (2017). [ESRI Story Map summarizing the environmental impacts of Hurricane Harvey]. *Summarizing Hurricane Harvey's Environmental Impacts—Health and Safety: Water—Salinity and Temperature*. Accessed May 15, 2019. https://harcresearch.maps.arcgis.com/apps/MapSeries/index.html?a

[8] U.S. Environmental Protection Agency. (September 14, 2017). *Status of Water Systems in Areas Affected by Harvey* [News Release]. Accessed May 15, 2019. https://www.epa.gov/newsreleases/status-water-systems-areas-aff

Regional Water Quality Summaries

In addition to the 2019 Regional Water Quality Summary Chart, water quality information for these segments is provided as Regional Water Quality Summaries for each of the 54 segments.

The data provided on the Water Quality Summary Chart and Water Quality Summaries is derived from water quality monitoring data collected by the H-GAC and Clean Rivers Program partners between June 2011 and May 2018.

Qualifiers are used to describe the portion of segments where areas of concern exist. A *few parts* mean 33 percent or less of a segment; *some parts* mean 34-66 percent of a segment; and *most parts* mean 67 or greater percent of a segment. If only a single portion of a tributary is listed, it is the only portion with the concern.

Each segment summary contains information on the selected segment watershed, a list of associated tributaries, water quality impairments and concerns designated by the Texas Commission on Environmental Quality, and any plans developed to address those issues. Information about watershed projects can be found in the Watershed Project Summaries section of this report.

For information on specific impairments or concerns for a segment down to the Assessment Unit level, review the TCEQ Draft 2016 Integrated Report of Surface Water Quality (www.tceq.texas.gov/waterquality/assessment). In a few instances, this report differs from the listed impairments and concerns in the Draft 2016 Integrated Report due to the data collection period. Fish Consumption Advisories mentioned in the Water Quality Summary Map are issued by the Texas Department of State Health Services.

Cedar Bayou Above Tidal (0902)

The Cedar Bayou Above Tidal segment watershed is largely used for agricultural purposes with small ranchettes scattered throughout. Residential and industrial development is concentrated in the southern portion. Cedar Bayou Above Tidal is designated for use as a public water supply.

Major Tributaries

- Adlong Ditch, Buck Gully

Areas of Concern

- Dissolved oxygen impairments exist in all parts of the segment

Plans

- H-GAC developed the Cedar Bayou watershed protection plan

For more details see the Water Quality Summary Chart.

Cedar Bayou Tidal (0901)
The Cedar Bayou Tidal segment watershed is dominated by residential development in the west and along State Highway 146 in Baytown and by industrial facilities along the eastern shoreline and in Mont Belvieu. Agriculture land use, such as cultivated crops, is found in the northern parts of the watershed.

Major Tributaries
- Cary Bayou, McGee Gully

Areas of Concern
- Dissolved oxygen concerns exist in all parts
- Contact recreation use is not supported in any parts due to high bacteria concentrations
- A restricted fish consumption advisory exists for the segment due to elevated concentrations of PCBs/dioxin in edible fish tissue

Plans
- H-GAC developed the Cedar Bayou watershed protection plan

For more details see the Water Quality Summary Chart.

San Jacinto River Basin

Buffalo Bayou Above Tidal (1014)
The Buffalo Bayou Above Tidal segment watershed extends from the heavily developed areas of Houston's urban core west and north to rural and agricultural areas of western Harris County and southeastern Austin County. Addicks and Barker reservoirs, which serve as flood retention basins, are central to the watershed. Two major parks, Bear Creek Park and George Bush Park, occupy portions of the reservoirs, thus creating multi-use areas.

Major Tributaries
- Bear, Langham, Mason, Rummel, South Mayde, Spring Branch and Turkey creeks; Neimans Bayou

Areas of Concern
- Dissolved oxygen impairments or concerns exist in a few parts
- Contact recreation use is not supported in most parts due to high bacteria concentrations
- Nutrient concerns (nitrate, ammonia, and total phosphorus) exist in some parts
- An impairment exists for fish and macrobenthic communities in Neimans Bayou

Plans

- The Buffalo Bayou Above Tidal segment is part of the Bacteria Implementation Group

For more details see the Water Quality Summary Chart.

Buffalo Bayou Tidal (1013)

The Buffalo Bayou Tidal segment watershed 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 along the banks of Buffalo Bayou. A major portion of the Houston metropolitan area drains to or through this segment.

Major Tributaries

- Tidal portions of White Oak and Little White Oak bayous

Areas of Concern

- Dissolved oxygen impairments or concerns exist in some parts
- Contact recreation use is not supported in most parts due to high bacteria concentrations
- Nutrient concerns (nitrate and total phosphorus) exist in some parts
- A macrobenthic community impairment exists in Little White Oak Bayou

Plans

- The Buffalo Bayou Tidal segment is part of the Bacteria Implementation Group

For more details see the Water Quality Summary Chart.

Caney Creek (1010)

The Caney Creek segment 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 northern portions of the watershed. 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 watershed

Major Tributaries

- Camp, White Oak, Little Caney, McRae and Dry Creeks, Spring and West Fork Spring branches

Areas of Concern

- A dissolved oxygen impairment exists in Spring Branch
- Contact recreation use is not supported in most parts due to high bacteria concentrations

Plans

- The Caney Creek segment is part of the Bacteria Implementation Group

For more details see the Water Quality Summary Chart.

Cypress Creek (1009)

The eastern portion of the Cypress Creek segment watershed is dominated by dense residential development within forested lands, and the western portion is 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.

Major Tributaries

- Dry, Little Cypress, Live Oak, Mound, Pillot, and Seals creeks; Dry, Faulkey, Lemm, and Spring gullies

Areas of Concern

- Dissolved oxygen concerns exist in a few parts
- Contact recreation use is not supported in most parts due to high bacteria concentrations
- Concern for chlorophyll-*a* levels exists for a part of Cypress Creek
- Nutrient concerns (nitrate, ammonia, and total phosphorus) exist in most parts
- A macrobenthic community impairment exists in Little White Oak Bayou
- A concern for an impaired habitat exists for a part of Cypress Creek

Plans

- The Cypress Creek segment is part of the Bacteria Implementation Group
- H-GAC is developing a watershed protection plan for Cypress Creek

For more details see the Water Quality Summary Chart.

East Fork San Jacinto River (1003)

The East Fork San Jacinto River segment watershed is primarily undeveloped forested land with scattered ranchettes or small homesteads, except for the lower portion which is populated by Plum Grove and Cleveland. Part of Huntsville is 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 been cleared for grazing and hay production.

Major Tributaries

- Orange Branch, Miller Creek, Whiskey Branch, and Winters Bayou

Areas of Concern

- Contact recreation use is not supported in any parts due to high bacteria concentrations

Plans

- The East Fork San Jacinto River segment is part of the Bacteria Implementation Group
- The East Fork San Jacinto River segment is included in the total maximum daily load implementation plan for the East and West Fork of the San Jacinto River project

For more details see the Water Quality Summary Chart.

Greens Bayou Above Tidal (1016)

The Greens Bayou Above Tidal segment watershed is an urban watershed. 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. Highway 59, and State Highway 249. Bush Intercontinental Airport is in the north-central portion of the watershed.

Major Tributaries

- Garners Bayou, Williams Gully

Areas of Concern

- A dissolved oxygen impairment exists in Greens Bayou
- Contact recreation use is not supported in most parts due to high bacteria concentrations
- Nutrient concerns (nitrate, ammonia, and total phosphorus) exist in most parts

Plans

- The Greens Bayou Above Tidal segment is part of the Bacteria Implementation Group

For more details see the Water Quality Summary Chart.

Houston Ship Channel (1006)

The Houston Ship Channel segment watershed is urbanized and receives discharges from many regulated wastewater and stormwater outfalls. The lower portion of the watershed includes heavy industrial complexes lining both sides of the Ship Channel, including Deer Park, Channelview, Houston, Pasadena, and parts of unincorporated Harris County.

Major Tributaries

- Boggy, Carpenters and Patrick Bayous, Goodyear and Halls creeks, Tidal portions of Greens Bayou

Areas of Concern

- Dissolved oxygen concerns exist for a few parts
- Contact recreation use is not supported in some parts due to high bacteria concentrations
- A concern for chlorophyll-*a* levels exists for a few parts
- Nutrient concerns (nitrate, ammonia, and total phosphorus) exist in most parts
- Parts of the segment do not support general use provisions due to toxicity
- A restricted fish consumption advisory exists for the Houston Ship Channel due to elevated concentrations of PCBs/dioxin in edible fish tissue
- Concerns and impairments exist in a few parts of the Ship Channel for concentrations of mercury and other toxins in the sediment and water

Plans

- The above tidal portions of the segment are part of the Bacteria Implementation Group

For more details see the Water Quality Summary Chart.

Houston Ship Channel/Buffalo Bayou Tidal (1007)

The urbanized Houston Ship Channel/Buffalo Bayou Tidal segment watershed includes the Houston Ship Channel and more than 70 miles of tidal and above tidal tributary streams. The watershed includes the cities of Bellaire, Houston, Pasadena, Galena Park, and South Houston, and contains large petrochemical complexes along the shores of the Ship Channel. Numerous permitted wastewater and stormwater discharges are throughout the watershed.

Major Tributaries

- Berry, Brays, Country Club, Hunting, Keegans, Little Vince and Vince bayous; Plum and Berry creeks, Pine Gully

Areas of Concern

- Dissolved oxygen impairments and concerns exist for a few parts
- Contact recreation use is not supported in most parts due to high bacteria concentrations
- Nutrient concerns (nitrate, ammonia, and total phosphorus) exist in most parts
- Parts of the segment do not support general use provisions due to toxicity
- A restricted fish consumption advisory exists in a few parts due to elevated concentrations of PCBs/dioxin in edible fish tissue
- An impairment exists in Vince Bayou Tidal for toxicity in the sediment

Plans

- The above tidal parts of the segment are part of the Bacteria Implementation Group

For more details see the Water Quality Summary Chart.

Houston Ship Channel/San Jacinto River (1005)
The Houston Ship Channel/San Jacinto River segment watershed includes Baytown and Highlands on the eastern shore of the Ship Channel and the San Jacinto River with the heavily industrialized cities of Channelview, Deer Park, and La Porte along the western shoreline.

Major Tributaries
- Black Duck, Burnet, San Jacinto, Scott and Tabbs bays; Goose Creek, Old River, Barbours Cut

Areas of Concern
- Nutrient concerns (nitrate) exist in most parts of the segment
- A restricted fish consumption advisory exists for all parts due to elevated concentrations of PCBs/dioxin in edible fish tissue

Plans
- No watershed plans exist for the Houston Ship Channel/San Jacinto River segment

For more details see the Water Quality Summary Chart.

Lake Conroe (1012)
The Lake Conroe segment watershed 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.

Major Tributaries
- Caney, East Sandy, Lewis, Little Lake, McDonald, McGary and West Sandy creeks; West Fork San Jacinto River

Areas of Concern
- A dissolved oxygen concern exists for the southern part of Lake Conroe

Plans
- Lake Conroe is part of the Lake Conroe watershed protection plan

For more details see the Water Quality Summary Chart.

Lake Creek (1015)

The Lake Creek segment watershed is primarily rural and dominated by forest and grasslands with the major land cover/land use being pastureland or hay production. Limited row crop cultivation is scattered throughout the upper portion. Mixed residential and commercial development including subdivisions, strip centers, and ranchettes or hobby farms is in the lower part of the watershed.

Major Tributaries

- Caney, Fish, Garretts, Landrum, Little Caney, and Mound creeks

Areas of Concern

- Dissolved oxygen concerns exist for most parts of the segment
- Contact recreation use is not supported in Mound Creek due to high bacteria concentrations
- A concern for an impaired macrobenthic community exists in a few parts of Lake Creek

Plans

- The Lake Creek segment is part of the Bacteria Implementation Group
- The Lake Creek segment is part of the West Fork San Jacinto River watershed protection plan

For more details see the Water Quality Summary Chart.

Lake Houston (1002)

Lake Houston is a large reservoir in northeast Harris County. It is the primary source of drinking water for Houston and surrounding communities. The lake receives inflow from the segment's major tributaries.

Major Tributaries

- East Fork San Jacinto River, Luce Bayou, March Branch, Tarkington Bayou, West Fork San Jacinto River

Areas of Concern

- A dissolved oxygen concern exists for Tarkington Bayou
- Contact recreation use is not supported in the northwestern part of Lake Houston due to high bacteria concentrations
- A concern exists for chlorophyll-*a* levels in the southern part of Lake Houston
- Nutrient concerns (nitrate and total phosphorus) exist in some parts of Lake Houston
- A concern for pH exists in a few parts of Lake Houston

- A restricted fish consumption advisory exists for Lake Houston due to elevated concentrations of mercury in edible fish tissue

Plans

- Lake Houston is part of the Bacteria Implementation Group
- Lake Houston is included in the total maximum daily load implementation plan for the East and West Fork of the San Jacinto River project

For more details see the Water Quality Summary Chart.

Peach Creek (1011)

The Peach Creek segment watershed is dominated by forested land with the Sam Houston National Forest 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 in the lower reaches of the watershed.

Major Tributaries

- Boggy, Duck, Jayhawker, Lawrence and Mare creeks; Gully, Gum, Waterhole and Bee branches

Areas of Concern

- Contact recreation use is not supported in any parts due to high bacteria concentrations
- A concern for an impaired habitat exists in a few parts of Peach Creek

Plans

- The Peach Creek segment is part of the Bacteria Implementation Group

For more details see the Water Quality Summary Chart.

San Jacinto River Tidal (1001)

The lower portion of the San Jacinto River Tidal segment watershed is heavily developed, with industrial activity along the Houston Ship Channel 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. The rural communities of Highlands, Barrett, and Crosby on the east side and Sheldon on the west side of the river are in the watershed.

Major Tributaries

- Gum Gully Creek

Areas of Concern

- A restricted fish consumption advisory exists for some parts due to elevated concentrations of PCBs/dioxin in edible fish tissue

Plans

The tidal segment of the San Jacinto River is not included in any watershed plan

For more details see the Water Quality Summary Chart.

Spring Creek (1008)

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

Major Tributaries

- Three Mile, Walnut, Willow, Birch, Brushy, Dry and Mill creeks; Bear, Mill, Mink, Panther, and Sulfur branches; and Lake Woodlands

Areas of Concern

- Dissolved oxygen impairments and concerns exist for some parts
- Contact recreation use is not supported in most parts due to high bacteria concentrations
- A concern for chlorophyll-*a* levels exists for a few parts
- Nutrient concerns (nitrate and total phosphorus) exist in some parts
- A fish community impairment exists in a few parts
- A concern for cadmium in the water exists in a few parts of Upper Panther Branch

Plans

- The Spring Creek segment is a part of the Bacteria Implementation Group
- A Spring Creek watershed protection plan is scheduled for development in 2019

For more details see the Water Quality Summary Chart.

West Fork San Jacinto River (1004)

The West Fork San Jacinto segment watershed is primarily forested with residential and commercial development scattered throughout. Conroe is at the upper end of the watershed with several small communities in the lower area.

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

Areas of Concern

- Portions of the river and Stewarts Creek are impaired or have a concern for bacteria
- Contact recreation use is not supported in a few parts due to high bacteria concentrations
- Nutrient concerns (nitrate and total phosphorus) exist in a few parts
- A concern for an impaired macrobenthic community exists in a few parts

Plans

- The West Fork of the San Jacinto River is part of the Bacteria Implementation Group
- The West Fork of the San Jacinto River is included in the total maximum daily load implementation plan for the East and West Fork of the San Jacinto River project
- The West Fork of the San Jacinto River is included in the West Fork San Jacinto River watershed protection plan

For more details see the Water Quality Summary Chart.

White Oak Bayou Above Tidal (1017)

The White Oak Bayou Above Tidal segment watershed is almost entirely developed with pockets of parklands and wooded acreages scattered throughout. The most densely populated area is found in the lower reaches inside I-610. Heavy commercial development occurs along the US-290 corridor with residential and mixed developments adjacent to the corridor.

Major Tributaries

- Brickhouse Gully, Cole Creek, Little White Oak Bayou, Vogel Creek

Areas of Concern

- Dissolved oxygen impairments and concerns exist in a few parts
- Contact recreation use is not supported in most parts due to high bacteria concentrations
- Nutrient concerns (nitrate, ammonia, and total phosphorus) exist in most parts

Plans

- The White Oak Bayou Above Tidal segment is part of the Bacteria Implementation Group

For more details see the Water Quality Summary Chart.

<u>San Jacinto-Brazos Coastal Basin</u>

Armand Bayou (1113)

The Armand Bayou segment watershed is densely developed, including the cities of Taylor Lake Village, La Porte, and parts of Houston, Deer Park, and Pasadena. High- and low-intensity residential and mixed commercial developments are the dominant land uses. Large industrial facilities are scattered in the north. Ellington Airport and the Armand Bayou Nature Center are in the watershed.

Major Tributaries

- Big Island Slough, Horsepen and Middle Bayou, Mud Lake, Spring Gully, and Willow Spring Bayou

Areas of Concern

- Dissolved oxygen impairments or concerns exist in some parts
- Contact recreation use is not supported in most parts due to high bacteria concentrations
- Concerns exist for chlorophyll-a levels in some parts
- Nutrient concerns (nitrates, ammonia, total phosphorus) exist in the Horsepen Bayou Tidal part of the segment
- A restricted fish consumption advisory exists for Armand Bayou Tidal due to elevated concentrations of PCBs/dioxin in edible fish tissue
- A fish community impairment exists for Armand Bayou Above Tidal

Plans

- The Armand Bayou segment is part of the Bacteria Implementation Group

For more details see the Water Quality Summary Chart.

Bastrop Bayou Tidal (1105)

The Bastrop Bayou Tidal segment watershed is mostly rural with agriculture and cattle grazing as the primary land use. Urban development is limited to Angleton and Danbury. The main stem of Bastrop Bayou originates near State Highway 288 south of Angleton and flows due east through forested wetlands and cultivated land to coastal prairies and wetlands.

Major Tributaries

- Austin, Brushy, and Flores bayous

Areas of Concern

- Dissolved oxygen concerns exist in some parts; Brushy Bayou is impaired
- Contact recreation use is not supported in most parts due to high bacteria concentrations
- Nutrient concerns (ammonia) exist in Brushy Bayou

Plans

- The Bastrop Bayou Tidal segment is part of the Bastrop Bayou watershed protection plan

For more details see the Water Quality Summary Chart.

Chocolate Bayou Above Tidal (1108)
Chocolate Bayou Above Tidal terminates at a saltwater barrier downstream of the confluence with the Chocolate Bayou Rice Canal. This segment watershed is primarily rural with agriculture as the dominant land use. Agricultural fields are concentrated in the middle portion with urban development in or near Manvel, Arcola, Iowa Colony, and Alvin. Rapid population growth along this segment is expected in the next 20 years.

Major Tributaries
- Hayes Creek, West Fork Chocolate Bayou

Areas of Concern
- Contact recreation use is not supported in any parts due to high bacteria concentrations

Plans
- H-GAC is developing a total maximum daily load implementation plan for Chocolate Bayou

For more details see the Water Quality Summary Chart.

Chocolate Bayou Tidal (1107)
The Chocolate Bayou Tidal segment watershed is primarily rural, with Liverpool as the only urban area. Agriculture is the major land use, and a large system of irrigation canals crisscross the watershed. A large industrial complex comprised of several major petrochemical plants is in the southeast sector and uses the bayou for barge traffic hauling raw materials and finished products to and from the complex.

Major Tributaries
- Corner, Cottonwood, Perry, Pleasant, and Salt bayous

Areas of Concern
- Contact recreation use is not supported in any parts due to high levels of bacteria
- A restricted fish consumption advisory exists in all parts due to elevated concentrations of PCBs/dioxin in edible fish tissue

Plans
- H-GAC is developing a total maximum daily load implementation plan for Chocolate Bayou

For more details see the Water Quality Summary Chart.

Clear Creek Above Tidal (1102)
The Clear Creek Above Tidal segment watershed continues to experience rapid residential and commercial development especially around the State Highway 288 corridor and FM 518 throughout Pearland and eastern Friendswood. Agricultural land use is found near the headwaters of Cowart Creek and in the far upper reaches. Medium and small farms occupy the nonresidential areas.

Major Tributaries
- Cowart Creek, Hickory Slough, Mary's Creek, Turkey Creek, Mud Gully

Areas of Concern
- Dissolved oxygen concerns exist in some parts
- Contact recreation use is not supported in some parts due to high bacteria concentrations
- Nutrient concerns (nitrates, ammonia, total phosphorus) exist in most parts
- A restricted fish consumption advisory exists for Clear Creek Above Tidal due to elevated concentrations of PCBs/dioxin in edible fish tissue
- An impaired habitat concern exists for part of Clear Creek Above Tidal

Plans
- The Clear Creek Above Tidal segment is part of the Bacteria Implementation Group

For more details see the Water Quality Summary Chart.

Clear Creek Tidal (1101)
The Clear Creek Tidal segment watershed continues to experience rapid growth with mixed residential and commercial development throughout. Most of the high intensity development is located near I-45 and the NASA/Johnson Space Center and Baybrook Mall complexes in the northeastern part of the watershed.

Major Tributaries
- Chigger and Magnolia Creeks; Cow and Robinson Bayous

Areas of Concern
- Dissolved oxygen concerns exist in a few parts
- Contact recreation use is not supported in some parts due to high bacteria concentrations
- Concern for chlorophyll-*a* levels exists in a few parts
- Nutrient concerns (nitrates and total phosphorus) exist in a few parts

- A restricted fish consumption advisory exists for the segment due to elevated concentrations of PCBs/dioxin in edible fish tissue

Plans

- The Clear Creek Tidal segment is part of the Bacteria Implementation Group

For more details see the Water Quality Summary Chart.

Dickinson Bayou Above Tidal (1104)

The Dickinson Bayou Above Tidal segment watershed includes portions 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 of and along State Highway 6, State Highway 35, and FM 528. Ranchettes or hobby farms are common throughout this watershed.

Major Tributaries

- None

Areas of Concern

- Dissolved oxygen concerns exist in a few parts
- Contact recreation use is not supported in some parts due to high bacteria concentrations

Plans

- A total maximum daily load implementation plan was developed for Dickinson Bayou
- A watershed protection plan was developed for Dickinson Bayou

For more details see the Water Quality Summary Chart.

Dickinson Bayou Tidal (1103)

The Dickinson Bayou Tidal segment watershed is heavily developed, including 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 agricultural activities in the western, southeastern and eastern portions of the watershed.

Major Tributaries

- Bordens Gully; Cedar Creek; and Geisler, Gum, and Bensons bayous

Areas of Concern

- Dissolved oxygen impairments or concerns exist in most parts
- Contact recreation use is not supported in any parts due to high bacteria concentrations

- A concern for chlorophyll-*a* levels exists in parts of the segment
- A restricted fish consumption advisory exists for the segment due to elevated concentrations of PCBs/dioxin in edible fish tissue

Plans

- A total maximum daily load implementation plan and a watershed protection plan were developed for Dickinson Bayou

For more details see the Water Quality Summary Chart.

Old Brazos River Channel (1111)

The Old Brazos River Channel segment watershed comprises what was once the mouth of the Brazos River in southern Brazoria County. Beachfront residential development and water recreational activities are in the lower reaches of the watershed, with large expanses of wetlands surrounding the watershed.

Major Tributaries

- None
- Areas of Concern
- Concern for chlorophyll-*a* levels exists in all parts

Plans

- The Old Brazos River Channel segment is not included in any watershed plans

For more details see the Water Quality Summary Chart.

Oyster Creek Above Tidal (1110)

The Oyster Creek Above Tidal segment watershed is largely undeveloped in the lower portions, with dense residential and commercial communities including Missouri City and Stafford in the upper portion. Smaller communities are scattered throughout. Oyster Creek is sinuous with numerous oxbow lakes. The greater portion of the watershed is bottomland forest, grassland, or wetland habitat.

Major Tributaries

- None

Areas of Concern

- Dissolved oxygen impairments exist in some parts
- Contact recreation use is not supported in a few parts due to high bacteria concentrations
- A concern for chlorophyll-*a* levels exists in a few parts
- A concern for impaired habitat exists in most parts
- A concern for impaired macrobenthic community exists in a few parts

Plans

- Public stakeholder meetings are in progress as part of the San Jacinto-Brazos Coastal Basin Bacteria Reduction Project

For more details see the Water Quality Summary Chart.

Oyster Creek Tidal (1109)
The Oyster Creek Tidal segment watershed is in a region which previously supported cotton and sugarcane plantations. Development is largely limited to the northwest portion, including Lake Jackson and Clute. Most of the watershed is covered by natural forests and grasslands with large expanses of coastal wetlands at the southern and eastern edges. Oyster Creek is sinuous with numerous oxbow lakes.

Major Tributaries
- None

Areas of Concern
- Contact recreation use is not supported in any parts due to high bacteria concentrations.

Plans
- Public stakeholder meetings are in progress as part of the San Jacinto-Brazos Coastal Basin Bacteria Reduction Project

For more details see the Water Quality Summary Chart.

San Bernard River Above Tidal (1302)
The San Bernard River Above Tidal segment watershed is primarily agricultural with rice and cotton fields and grazing pastures dominating the landscape. The cities of East Bernard, Eagle Lake, Kendleton, and Hungerford are in the middle of the watershed, and riparian habitats crisscross the land.

Major Tributaries
- Coushatta, East Bernard, Little San Bernard, Peach, and West Bernard Creeks, and Middle Bernard River

Areas of Concern
- Dissolved oxygen impairments or concerns exist in some parts
- Contact recreation use is not supported in most parts due to high bacteria concentrations
- Nutrient concerns (ammonia) exist in a few parts
- An impaired habitat concern exists in a few parts

Plans
- H-GAC developed a watershed protection plan for the San Bernard River

For more details see the Water Quality Summary Chart.

San Bernard River Tidal (1301)
The San Bernard River Tidal segment watershed is primarily undeveloped, with agriculture as the main activity around the cities of West Columbia and Brazoria. The landscape consists mostly of forests, woody wetlands, or grasslands, with large areas of coastal wetlands, including the San Bernard National Wildlife Refuge, throughout the southern end. The closure of the San Bernard River mouth with silt continues to pose problems, although it has been relatively open since Hurricane Harvey in 2017 and is scheduled to be permanently opened with monies from the RESTORE ACT.

Major Tributaries
- Halls Bayou, Mound Creek

Areas of Concern
- Contact recreation use is not supported in any parts due to high bacteria concentrations

Plans
- H-GAC developed a watershed protection plan for the San Bernard River

For more details see the Water Quality Summary Chart.

Caney Creek Tidal (1304)
The Caney Creek Tidal segment watershed is primarily rural with the exceptions of Old Ocean in the northeast and Sargent and Bay City near the mouth of the creek. A few farms are in the watershed, but the bulk of the agricultural activity consists of hay pastures concentrated along Linnville Bayou.

Major Tributaries
- Linnville, Red, Little Linnville, and Dance Bayous, and Dead Slough

Areas of Concern
- Dissolved oxygen concerns exist in most parts
- Contact recreation use is not supported in most parts due to high bacteria concentrations
- A concern for chlorophyll-*a* levels exists in some parts
- Nutrient concerns (total phosphorus) exist in a few parts

Plans
- Public stakeholder meetings are in progress as part of the Brazos-Colorado Coastal Basin Bacteria Reduction Project

For more details see the Water Quality Summary Chart.

Caney Creek Above Tidal (1305)
The Caney Creek Above Tidal segment watershed is primarily rural except for the cities of Wharton and Van Vleck along the creek. Many large farms and hay pastures are throughout. A large area of forested wetlands is between the tributaries of Water Hole Creek and Snead Slough in the middle of the watershed.

Major Tributaries
- Hardeman and Quinine Sloughs, Water Hole Creek, and Gardner and Snead Sloughs

Areas of Concern
- Dissolved oxygen impairments or concerns exist in a few parts
- Contact recreation use is not supported in some parts due to high levels of bacteria
- Nutrient concerns (total phosphorus) exist in some parts
- An impaired habitat concern exists in a few parts

Plans
- Public stakeholder meetings are in progress as part of the Brazos-Colorado Coastal Basin Bacteria Reduction Project

For more details see the Water Quality Summary Chart.

<u>Bays and Estuaries</u>

Barbours Cut (2436)
The Barbours Cut segment watershed is in a heavily industrialized area off the southern end of the Houston Ship Channel. The area is surrounded by wetlands, a residential area, and the Port Houston container yard.

Major Tributaries
- None

Areas of Concern
- Nutrient concerns (nitrates, ammonia, total phosphorus) exist in all parts
- A restricted fish consumption advisory exists for Barbours Cut due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue

Plans
- No watershed plans currently exist for Barbours Cut

For more details see the Water Quality Summary Chart.

Bastrop Bay/Oyster Lake (2433)
The Bastrop Bay/Oyster Lake segment watershed is in an undeveloped estuarine environment and is part of the Christmas Bay system at the far west end of West Galveston Bay. Oyster Lake is on the southeast side of the Intercoastal Waterway and experiences complete water exchange with it. Bastrop Bay sits northeast of and adjoins Christmas Bay, and its water can flow between the Intercoastal Waterway, Bastrop Bayou, West Galveston Bay, and Christmas Bay.

Major Tributaries
- None

Areas of Concern
- Oyster harvesting is not supported in parts of the segment due to high levels of bacteria

Plans
- Oyster Lake is part of the Galveston Bay Bacteria Reduction Plan

For more details see the Water Quality Summary Chart.

Bayport Channel (2438)
The Bayport Channel segment watershed is in a heavily industrialized area between the cities of Pasadena and La Porte. The area is surrounded by residential development to the north, with the Port of Houston container yard and an industrial complex to the south. Wetlands can be found the southern portion of the segment watershed.

Major Tributaries
- None

Areas of Concern
- Dissolved oxygen concern exists for all parts
- Concerns exist for chlorophyll-*a* levels in all parts
- Nutrient concerns (nitrates, ammonia, total phosphorus) exist in all parts
- A restricted fish consumption advisory exists for Bayport Channel due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue

Plans
- The Bayport Channel segment is not included in any watershed plans

For more details see the Water Quality Summary Chart.

Black Duck Bay (2428)
The Black Duck Bay segment watershed is on 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.

Major Tributaries

- None

Areas of Concern

- Concerns exist for chlorophyll-*a* levels in all parts
- Nutrient concerns (nitrates, total phosphorus) exist in all parts
- A restricted fish consumption advisory exists for the segment due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue

Plans

- The Black Duck Bay segment is not included in any watershed plans

For more details see the Water Quality Summary Chart.

Burnett Bay (2430 /Crystal Bay (2430A)

Burnett Bay is the western shore of the City of Baytown, with Crystal Bay to the south. The north and east shores are residential. The southern shore is also the location of Brownwood Park and the Baytown Nature Center.

Major Tributaries

- None

Areas of Concern

- Concerns exist for chlorophyll-*a* levels in Burnett Bay
- Nutrient concerns (nitrates, ammonia, total phosphorus) exist in all parts
- A restricted fish consumption advisory exists for Burnett Bay and Crystal Bay due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue

Plans

- Burnett and Crystal Bays are not included in any watershed plans

For more details see the Water Quality Summary Chart.

Chocolate Bay (2432)

The Chocolate Bay segment watershed includes several unclassified bayous draining a large amount of land. Mustang Bayou stretches to the cities of Pearland, Fresno, and Missouri City. Downstream of Alvin are large agricultural fields of rice and row crops. South of FM 2004 costal marshes dominate the landscape, and upstream of 2004 ranches and small farms are common.

Major Tributaries

- Chocolate, Cloud, Halls, Mustang, New, Persimmon, and Willow Bayous

Areas of Concern

- Dissolved oxygen concern exists for Halls Bayou
- Contact recreation use impairments or concerns exist for some parts due to high bacteria concentrations
- A restricted fish consumption advisory exists for Chocolate Bay and Halls Bayou due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue
- Oyster harvesting is not supported in parts of Chocolate Bay due to bacteria levels

Plans

- Chocolate Bay is part of the Galveston Bay Bacteria Reduction Plan

For more details see the Water Quality Summary Chart.

Christmas Bay (2434)

The Christmas Bay segment watershed is a coastal preserve and is 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 watershed. The area is surrounded by undeveloped wetland habitat and is part of a larger system of smaller bays and lakes. Only a few small subdivisions are built with access to Christmas Bay, and all structures must rely on on-site sewage systems to handle waste.

Major Tributaries

- None

Areas of Concern

- Oyster harvesting is not supported in parts of the segment due to bacteria levels

Plans

- The Christmas Bay segment is part of the Galveston Bay Bacteria Reduction Plan

For more details see the Water Quality Summary Chart.

Clear Lake (2425)

The Clear Lake segment watershed is home to one of the most concentrated fleets of recreational boats in the United States. Numerous marinas around the lake provide easy access to Upper Galveston Bay. On the south shore, the watershed encompasses the cities of League City, Clear Lake Shores, and Kemah. The north shore includes the cities of Taylor Lake Village, El Lago, Seabrook, Shoreacres, and Pasadena.

Major Tributaries

- Harris County Flood Control District Ditch A, Jarbo and Taylor Bayous, and Taylor Lake

Areas of Concern

- Contact recreation use concerns exist for Jarbo Bayou due to high bacteria concentrations
- Concerns exist for chlorophyll-*a* levels in Burnett Bay
- Nutrient concerns (nitrates, ammonia, total phosphorus) exist in most parts
- A restricted fish consumption advisory exists in most parts due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue
- An impairment for copper in the water exists for Clear Lake

Plans

- Jarbo Bayou is part of the Bacteria Implementation Group

For more details see the Water Quality Summary Chart.

Drum Bay (2435)

The Drum Bay segment watershed is a small bay located down the coast from West Bay and immediately southwest of Christmas Bay. The Brazoria National Wildlife Refuge is to the north, and development is limited to a small subdivision on Follets Island.

Major Tributaries

- None

Areas of Concern

- Oyster harvesting is not supported in parts of Drum Bay due to bacteria levels

Plans

- The Drum Bay segment is part of the Galveston Bay Bacteria Reduction Plan

For more details see the Water Quality Summary Chart.

East Bay (2423)

The East Bay segment watershed encompasses East Bay, the Upper Bolivar Peninsula, and portions of Chambers County that are predominantly undeveloped. Abundant wetlands, marshes, and coastal prairie cover most of the peninsula. Development consists mostly of residential buildings, both permanent and vacation homes, fish and bait camps, and small commercial businesses.

Major Tributaries

- Oyster Bayou

Areas of Concern

- Dissolved oxygen concern exists in Oyster Bayou

- Contact recreation use is not supported in Oyster Bayou due to high bacteria concentrations
- Concerns exist for chlorophyll-*a* levels in all parts
- A restricted fish consumption advisory exists in all parts due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue
- Oyster harvesting is not supported in parts of East Bay due to bacteria levels

Plans

- The East Bay segment is part of the Galveston Bay Bacteria Reduction Plan

For more details see the Water Quality Summary Chart.

Lower Galveston Bay (2439)

The Lower Galveston Bay segment watershed primarily receives flow from other water bodies, including 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.

Major Tributaries

- None

Areas of Concern

- Concerns exist for chlorophyll-*a* levels in all parts
- A restricted fish consumption advisory exists in all parts due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue
- Oyster harvesting is not supported in parts of Lower Galveston Bay due to bacteria levels

Plans

- The Lower Galveston Bay segment is part of the Galveston Bay Bacteria Reduction Plan

For more details see the Water Quality Summary Chart.

Moses Lake (2431)

The Moses Lake segment watershed is surrounded by large tracts of undisturbed wetland and marsh habitats. The northeastern and northwestern portions of the watershed consist mostly of grasslands and forested lands, while the southern section is highly urbanized, containing parts of the cities Texas City and La Marque. Part of the Texas City petrochemical complex is included in the southern portion of the watershed.

Major Tributaries

- Moses Bayou

Areas of Concern

- Contact recreation use is not supported in some parts due to high bacteria concentrations
- Concerns exist for chlorophyll-*a* levels in a few parts
- A restricted fish consumption advisory exists in some parts due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue

Plans

- The Moses Lake segment is part of the Highland Bayou watershed protection plan

For more details see the Water Quality Summary Chart.

San Jacinto Bay (2427)

The San Jacinto Bay segment watershed contains the Upper and Lower San Jacinto Bays, separated from the Houston Ship Channel by dredge spoil island/impoundments. Portions of the 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.

Dick

Major Tributaries

- None

Areas of Concern

- Nutrient concerns (nitrates, ammonia, total phosphorus) exist in all parts
- A restricted fish consumption advisory exists in San Jacinto Bay due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue

Plans

- The San Jacinto Bay is not included in any watershed plans

For more details see the Water Quality Summary Chart.

Scott Bay (2429)

The Scott Bay segment watershed is along the Houston Ship Channel 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.

Major Tributaries

- None

Areas of Concern

- Nutrient concerns (nitrates, ammonia, total phosphorus) exist in all parts
- A restricted fish consumption advisory exists in Scott Bay due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue

Plans

- Scott Bay is not included in any watershed plans

For more details see the Water Quality Summary Chart.

Tabbs Bay (2426)/Goose Creek Tidal (2426C)

The Tabbs Bay and Goose Creek Tidal segment watersheds are surrounded by heavily industrialized areas and dense residential and commercial areas in Baytown. Tabbs Bay is located south of State Highway 146.

Major Tributaries

- None

Areas of Concern

- Nutrient concerns (nitrates, ammonia, total phosphorus) exist in Tabbs Bay
- A restricted fish consumption advisory exists in some parts due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue

Plans

- The Tabbs Bay/Goose Creek Tidal segment is not included in any watershed plans

For more details see the Water Quality Summary Chart.

Texas City Ship Channel (2437)

The Texas City Ship Channel segment watershed supports heavy barge and ship traffic on a regular basis. The Texas City petrochemical complex occupies most of the watershed, and the entire northern shoreline and turning basin are occupied by docks for loading and unloading raw materials and finished products. The ship channel receives stormwater and wastewater discharges from industrial complexes.

Major Tributaries

- None

Areas of Concern

- Concerns exist for chlorophyll-*a* levels in all parts
- Nutrient concerns (nitrates, ammonia) exist in all parts
- A restricted fish consumption advisory exists in all parts due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue

Plans

- The Texas City Ship Channel segment is part of the Highland Bayou watershed protection plan

For more details see the Water Quality Summary Chart.

Trinity Bay (2422)
The Trinity Bay segment watershed is in Liberty County. Coastal wetlands dominate the near shore landscape with agricultural activities, such as cattle grazing, with row crops throughout the east side of the bay. The City of Anahuac is on the northeast shore. Double Bayou West and East forks drain significant crop pasture lands. Smith Point separates Trinity Bay from East Bay and Lower Galveston Bay.

Major Tributaries
- Double Bayou West Fork, Double Bayou East Fork, Red Bayou, Old River, Trinity River, Anahuac Channel, and Cotton Bayou

Areas of Concern
- Dissolved oxygen impairments exist in Double Bayou West Fork
- Contact recreation use is not supported in Double Bayou East and West Forks due to high bacteria concentrations
- Concerns exist for chlorophyll-*a* levels in most parts
- A restricted fish consumption advisory exists in all parts due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue
- Oyster harvesting is not supported in parts of Lower Galveston Bay due to bacteria levels

Plans
- Trinity Bay is part of the Galveston Bay Bacteria Reduction Plan

For more details see the Water Quality Summary Chart.

Upper Galveston Bay (2421)
The Upper Galveston Bay segment 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.

Major Tributaries
- Clear Lake Channel

Areas of Concern
- Concerns exist for chlorophyll-*a* levels in most parts
- Nutrient concerns (nitrates, ammonia, total phosphorus) exist in all parts

- A restricted fish consumption advisory exists in all parts due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue
- Oyster harvesting is not supported in parts of Lower Galveston Bay due to bacteria levels

Plans

- Upper Galveston Bay is part of the Galveston Bay Bacteria Reduction Plan

For more details see the Water Quality Summary Chart.

West Galveston Bay (2424)

The West Galveston Bay segment watershed encompasses the bay side of Galveston Island and includes several small bays, lakes, and bayous. West Bay is between the Galveston causeway bridge and San Luis Pass to the west. Primary land uses in the watershed are related to agriculture, with residential development in the coastal communities of Galveston, Jamaica Beach, Tiki Island, Bayou Vista, Hitchcock, La Marque, and Santa Fe.

Major Tributaries

- Basford, English, Highland, Marchand, and Offats, Karankawa Bayous, Greens Lake, and Lake Madeline

Areas of Concern

- Dissolved oxygen impairments or concerns exist in a few parts
- Contact recreation use is not supported in a few parts due to high bacteria concentrations
- Concerns exist for chlorophyll-*a* levels in a few parts
- Nutrient concerns (nitrates) exist in part of Highland Bayou
- A restricted fish consumption advisory exists in most parts due to elevated concentrations of PCBs/dioxin in edible fish and/or crab tissue
- Oyster harvesting is not supported in parts of West Galveston Bay due to bacteria levels

Plans

- West Galveston Bay is part of the Galveston Bay Bacteria Reduction Plan
- Several tributaries are part of the Highland Bayou watershed protection plan

For more details see the Water Quality Summary Chart.

Gulf of Mexico (2501)

The Gulf of Mexico segment watershed is along the Texas Coast between Sabine Pass to the mouth of the Rio Grande. The sections within the H-GAC region stretch from the Jefferson-Chambers County line to between Freeport and Port Aransas.

Major Tributaries

- None

Areas of Concern

- A restricted fish consumption advisory exists in most parts due to elevated concentrations of mercury in edible fish and/or crab tissue

For more details see the Water Quality Summary Chart.

Conclusion

Elevated levels of bacteria continue to be the biggest water quality issue throughout the region. High bacteria levels can inhibit safe contact recreation and the harvest of oysters. With the guidance of local stakeholders, nearly two dozen watershed-based plans, completed or in progress, have been designed to reduce bacteria levels and bring those water bodies with elevated levels of bacteria back into compliance with state standards.

Fish consumption advisories, a result of elevated levels of PCBs/dioxin in fish tissue, continue to be an important issue in the regions bays and many tidal water bodies. Federal, state, and local agencies and organizations continue to locate major sources of these toxic chemical compounds and develop procedures to remediate them.

Low levels of dissolved oxygen and increasing levels of nutrients are tracked through routine monitoring. Many of the best management practices being put in place through watershed-based plans to reduce bacteria levels have a positive impact by raising dissolved oxygen levels and reducing nutrients.

The H-GAC Clean Rivers program generates approximately 70 percent of data used for water quality decision making by the TCEQ. The data are used to help with the development and implementation of TMDLs, watershed protection plans, and other local actions. The ability to understand the developing health of the water bodies throughout the region is paramount. H-GAC will continue to work with state and local stakeholders to find ways to do more systematic and focused monitoring in areas with elevated bacteria to locate and remove chronic sources.

WATERSHED PROJECT SUMMARIES

Introduction

Every two years, the TCEQ submits the Texas Integrated Report of Surface Water Quality to the EPA for approval. The report provides an assessment of existing water quality in

the state and an overview of past and proposed water pollution reduction efforts. Clean Rivers Program monitoring data is included in the Integrated Report.

The Texas 303(d) list, part of the Integrated Report (www.tceq.texas.gov/waterquality/assessment), identifies water bodies that are impaired or threatened due to pollutant(s). The list may be used by planning agencies to prioritize watershed projects and acts as a catalyst for planning and mitigation strategies to address impairments and concerns, including bacteria, dissolved oxygen, nutrients, and PCBs/dioxin.

After a water body is added to the 303(d) list, there are two primary watershed-based planning paths for resolution available, conducting a total maximum daily load/implementation plan or developing a watershed protection plan.

The H-GAC and other regional partners are actively involved in both types of watershed-based plans.

Watershed Protection Plans

Watershed protection plans are a voluntary approach to addressing water quality issues with local stakeholders to improve their community's waterways. The plans are based on an EPA template to identify causes and sources of pollution, establish improvement goals, identify feasible and effective voluntary measures to address them, and establish ways to evaluate the effectiveness of the efforts. While the development of a watershed protection plan is usually due to a water body's inability to meet one or more state water quality standards, the plans can be implemented as a preventative measure. Unlike total maximum daily load projects that focus on specific impairments, watershed protection plans can consider a wide range of stakeholder concerns related to water. Implementation activities outlined by watershed protection plans are voluntary, contain no regulatory requirements, and generally focus on nonpoint source pollution. Watershed protection plans use Clean Rivers Program data to determine water quality priorities.

Watershed protection plans are led by partnerships of local stakeholders (including governments, residents, businesses, and community organizations) with significant interests within the watershed plans approved or in development for the H-GAC region. These plans are described in the following text.

More Information about H-GAC watershed protection plans is available at www.h-gac.com/community/water/watershed_protection/default.aspx.

H-GAC Watershed Protection Plans

Bastrop Bayou

The Bastrop Bayou watershed drains a mix of land uses in rapidly growing eastern Brazoria County, including active agricultural production and small urban centers. Since 2004, the TCEQ and the H-GAC have worked with a diverse group of local stakeholders to develop and implement the Bastrop Bayou watershed protection plan (www.bastropbayou.org/) to address the bayou's elevated levels of bacteria. Potential sources of bacteria in the watershed include livestock, failing on-site sewage systems, pet waste, wildlife and feral hogs, urban runoff and overflows from sanitary sewers.

Status

The watershed protection plan was approved by the TCEQ, accepted by the EPA in August 2016, and is being implemented by H-GAC and local stakeholders. Implementation efforts include education and outreach activities, remediation of failing septic and aerobic wastewater systems, installation of pet waste management systems, and promotion of voluntary best management practices for agriculture.

Cedar Bayou

The Cedar Bayou watershed is at the junction of Harris, Liberty, and Chambers counties. It contains a mix of urban and rural land uses in a rapidly developing area. The watershed spans approximately 173 square miles and drains into the Galveston Bay system. It has both tidal and above tidal (freshwater) segments.

Cedar Bayou has impairments for elevated levels of bacteria and PCBs/dioxin in fish tissue in its tidal segment. The above tidal segment has been removed from the list of impaired waterways for macrobenthic communities by the TCEQ. Potential sources of bacteria in the watershed include failing on-site sewage systems, sanitary sewer overflows, wildlife and feral hogs, pet waste, urban runoff, land development activities, and farming and ranching activities.

Because of local concern for water quality, the Texas State Soil and Water Conservation Board, H-GAC, and local community stakeholders formed the Cedar Bayou Watershed Partnership (www.cedarbayouwatershed.com/) to develop a watershed protection plan.

Status

The watershed protection plan was approved by the EPA in July 2016 and is in implementation, using voluntary activities such as reducing pet waste, improving sanitary sewer maintenance, remediating failing septic systems, and improving riparian corridors to address the bayou's water quality challenges. The impacts of Hurricane

Harvey and other flooding events have focused additional attention on the watershed since 2017. H-GAC is working with local governments and state agencies on the Cedar Bayou Initiative, which seeks to incorporate flood and resiliency planning with the water quality issues addressed in the watershed protection plan.

San Bernard River

The San Bernard River watershed covers approximately 900 square miles in Austin, Colorado, Wharton, Fort Bend, and Brazoria counties. It is primarily rural and agricultural, and a few small communities, including West Columbia, East Bernard, Sweeny, and Wharton. Contact recreation in the river is impaired by high bacteria levels, while excessive nutrients and low dissolved oxygen levels threaten fish and other aquatic life. Potential sources of bacteria include human and animal wastes from livestock, failing on-site sewage systems, wildlife and feral hogs, and pet waste. H-GAC, key community stakeholders, and the TCEQ developed the San Bernard watershed protection plan (www.h-gac.com/community/water/watershed_protection/san-bernard-river.aspx).

Status

The watershed protection plan was approved by the EPA in July 2017 and is in implementation. Local partners are implementing education and outreach efforts, dredging projects to restore hydrologic function, promotion of agricultural best management practices, and remediation of failing on-site sewage systems. Severe flooding during Hurricane Harvey increased attention to this watershed.

Spring Creek and Cypress Creek

Spring Creek and Cypress Creek are two of the primary tributaries for the West Fork San Jacinto River. These watershed systems drain areas of Harris, Montgomery, and Waller counties. Land use ranges from native grasslands and agricultural areas of the Katy Prairie to the dense suburban communities adjacent to the Houston metropolitan area downstream.

Both waterways have elevated levels of bacteria, and parts of Spring Creek have issues with low levels of dissolved oxygen. Potential sources of bacteria include livestock, pet waste, wildlife and feral hogs, failing septic and aerobic systems, and sanitary sewer overflows. Potential sources of low dissolved oxygen include fertilizers, livestock, pet waste, wildlife and feral hogs, failing septic and aerobic systems, and sanitary sewer overflows. These waterways have experienced numerous large-scale flooding events in the past decade, including impacts from Hurricane Harvey.

Status

H-GAC is working with the TCEQ to develop projects for both watersheds, with watershed protection plan development to start with Cypress Creek in 2019 and Spring Creek in 2020.

West Fork San Jacinto River and Lake Creek
The West Fork of the San Jacinto River is between the drinking water supply reservoirs of Lake Conroe to the north and Lake Houston to the south. It traverses the Interstate-45 corridor between Houston, the Woodlands, and Conroe, an area of robust growth and development. While much of the land in the watershed is developed or being developed, large portions in the southeast watershed remain light agricultural lands or undeveloped riparian forests and wetlands. Its northernmost tributary, Lake Creek, has its headwaters in rural/agricultural areas in western Montgomery and eastern Grimes counties. Its downstream area is rapidly being developed into suburban communities.

Parts of both the West Fork San Jacinto River and Lake Creek have impairments because of bacteria. Potential sources of bacteria include failing on-site sewage systems, pet waste, agricultural livestock, wildlife and feral hogs, and sanitary sewer overflows. There is concern about sediment from development and sand and gravel mining operations. H-GAC, the Galveston Bay Estuary Program, and TCEQ-supported local stakeholders in forming the West Forks Watershed Partnership (www.westfork.weebly.com/) to develop and implement the West Fork San Jacinto River and Lake Creek watershed protection plan.

Status
The watershed protection plan was approved by the TCEQ and accepted by the EPA in January 2019. H-GAC and the TCEQ are working with local stakeholders on implementation work, such as remediating failing septic and aerobic systems, promoting agricultural best management practices, and conducting various outreach and education efforts.

Other Area Watershed Protection Plans
In addition to H-GAC, other local entities are working with the TCEQ and the Texas State Soil and Water Conservation Board to develop or implement watershed protection plans for local waterways.

Dickinson Bayou
The Dickinson Bayou Watershed Protection Plan (www.agrilife.org/dickinsonbayou/watershed-information/) was developed by the Texas Coastal Watershed Program of Texas A&M University AgriLife. The plan addresses

bacteria and nutrient issues in this coastal tributary to Galveston Bay in coastal Galveston, Harris, and Brazoria counties.

Double Bayou
The watershed of the East and West Forks of Double Bayou drains 94 square miles of Liberty and Chambers counties before discharging to Trinity Bay. Local concern about elevated levels of bacteria and other water quality issues led to the formation of the Double Bayou Watershed Partnership (www.doublebayou.org/). The Houston Advanced Research Center, Galveston Bay Estuary Program, and Texas State Soil and Water Conservation Board supported local stakeholders of the Partnership in identifying voluntary measures to address bacteria sources as part of the development of the Double Bayou watershed protection plan. The plan was approved by the EPA in July 2016. It is currently in implementation.

Highland and Marchand Bayous and Moses-Karankawa Bayous
The watershed protection plan effort for Highland and Marchand Bayous (www.agrilife.org/highlandbayou/) in coastal Galveston County was developed by the Texas Coastal Watershed Program of Texas A&M University AgriLife, the Galveston Bay Estuary Program, the TCEQ, and local stakeholders to address elevated levels of bacteria and low levels of dissolved oxygen.

Based on preliminary work completed using Clean Rivers Program data in 2007, communities in Galveston County, coordinated by Texas A&M AgriLife Extension, established the Moses-Karankawa Bayous Alliance to begin addressing high bacteria levels and decreased levels of dissolved oxygen through a watershed characterization project and a watershed protection plan. The work of the alliance is ongoing.

Lake Conroe
The Lake Conroe watershed protection plan (www.sjra.net/home/lake-conroe-watershed-protection-plan/) was developed by the San Jacinto River Authority and local stakeholders to address potential sources of contamination in lands immediately adjacent to the Lake Conroe reservoir. It is currently in implementation.

Total Maximum Daily Load/Implementation Plans

Total maximum daily load is a regulatory process triggered when a waterway is placed on the 303(d) list of impaired water bodies. The total maximum daily load calculates the maximum amount of a pollutant that a water body can receive and still meet water quality standards. An implementation plan is completed by stakeholders to address the pollutant of concern, contains a series of recommended regulatory and/or

nonregulatory best practices, identifies funding sources and implementing partners, and determines a project timeline. Like watershed protection plans, Clean Rivers Program data provides support for focusing water quality priorities.

More information about H-GAC total maximum daily loads and implementation plans is available at www.h-gac.com/community/water/tmdl/default.aspx.

H-GAC Implementation Plans

Bacteria Implementation Group

The Bacteria Implementation Group (www.h-gac.com/community/water/tmdl/big/default.aspx) project area encompasses 104 approved total maximum daily loads, covering an area similar in size to Delaware and Rhode Island combined. The project area spans parts of Brazoria, Harris, Fort Bend, Grimes, Liberty, Montgomery, San Jacinto, Walker, and Waller counties.

Formed in 2008, the Bacteria Implementation Group is a 33-member stakeholder group charged with overseeing an implementation plan to improve water quality in the greater Houston region and reduce bacteria levels. The implementation plan covers 11 management strategy areas with 38 activities.

The Bacteria Implementation Group's *Implementation Plan for 72 total maximum daily loads for Bacteria in the Houston-Galveston Region* received approval from the TCEQ in January 2013. The plan is anticipated to be implemented over 25 years, with annual reviews to track success and make necessary course corrections. Four addendums to the plan have been made to update the number of total maximum daily loads completed within the project boundary and to expand the boundary to include Armand Bayou, East and West Forks of the San Jacinto River and Upper Lake Houston, and Jarbo Bayou.

To track success, the Bacteria Implementation Group uses H-GAC Clean Rivers Program data to benchmark environmental progress toward implementation goals as directed in the plan through the production of an annual report.

Status

Bacteria Implementation Group partners implementing plan activities have helped reduce bacteria levels overall by 32.1 percent between January 2005 and August 2018, including the expanded watersheds. The partners have implemented elements of the plan for five years and are evaluating plan actions to determine what changes may be needed to see the improvement trend continue over the next five years.

Upper Oyster Creek

The Upper Oyster Creek system begins near Fulshear, is greatly augmented by Brazos River water, and meanders downstream through impoundments in Sugar Land to rejoin the Brazos. Along the way, natural and human influences in the watershed contribute pollutants to the waterway. Total maximum daily load studies were completed for the system after data indicated it was unable to support the state water quality standards for contact recreation (due to elevated levels of bacteria) and aquatic life (based on low levels of dissolved oxygen). Two total maximum daily load reports were completed for the water body.

Status

The Upper Oyster Creek Implementation Plan (www.h-gac.com/community/water/tmdl/upper-oyster-creek-tmdl-and-implementation-plan.aspx) for bacteria and aquatic life was approved in January 2014. A variety of local partners are implementing solutions which benefit water quality in the Upper Oyster Creek system. The progress made suggests the waterway is benefitting from the continuation of Texas Pollutant Discharge Elimination System stormwater permits, good housekeeping for local utility systems, a robust set of public education efforts, and shared benefits from other unrelated local efforts. Continued rapid growth will require sustained support for these partner efforts in the watershed.

Basin Bacteria Reduction Water Quality Projects

The San Jacinto-Brazos Coastal Basin and Brazos-Colorado Coastal Basin projects are part of a new EPA and TCEQ approach to target impairments within smaller focused areas with a goal to improve water quality conditions in a shorter period. The previous approach targeted individual watershed impairments across the state without considering opportunities where an adjacent impaired watershed sharing common stakeholder interests and water quality impairments could be addressed together. For a basin-targeted approach, watershed data and information are gathered across the entire basin and reviewed. Impaired water bodies are prioritized for further study and if needed, total maximum daily loads and watershed plans are developed with the assistance of stakeholders to address the impairments.

San Jacinto-Brazos Coastal Basin (Basin 11)

Much of Basin 11 is currently under approved or developing watershed plans (i.e. Bacteria Implementation Group in Clear Creek and Armand Bayou, Dickinson Bayou total maximum daily load implementation plan and watershed protection plan, Bastrop Bayou watershed protection plan, and Highland/Marchand Bayou watershed protection plan). Information about Basin 11 is available at www.h-gac.com/go/basin11.

The following watersheds are the focus of further study in Basin 11.

Chocolate Bayou
The water body was listed as impaired for bacteria on Texas's list of impaired waterways since 2010. H-GAC completed a technical source document a total maximum daily load document. Stakeholders will draft an implementation plan in 2019.

Oyster Creek
The water body has been listed as impaired for bacteria on Texas's list of impaired waterways since 2006. A portion of the above tidal segment has also been listed as impaired for dissolved oxygen since 1996. H-GAC developed a technical source document and a total maximum daily load document is being developed to address bacteria concerns. Stakeholders will meet in 2019 to create a watershed-based plan.

Halls Bayou
The tidal water body has been listed as impaired for bacteria on Texas's list of impaired waterways since 2012. Willow Bayou, a freshwater tributary has been listed with a concern for bacteria. H-GAC staff completed a watershed characterization report and a technical source document will be drafted in 2019.

Mustang Bayou
The water body, while not listed for a bacteria impairment on Texas's list of impaired waterways, has been listed with a bacteria concern. A watershed characterization report will be drafted by H-GAC in 2019.

Brazos-Colorado Coastal Basin (Basin 13)
The San Bernard River watershed takes up much of Basin 13. The river has impairments for bacteria and some concerns for dissolved oxygen, and there is an approved watershed protection plan in place with local implementation continuing.

Information about Basin 13 is available at www.h-gac.com/go/basin13.

Caney Creek and its tributary Linnville Bayou are listed with bacteria impairments or concerns for bacteria. Part of the segment demonstrates concerns for dissolved oxygen, poor habitat, and/or total phosphorus. H-GAC staff finished the Caney Creek technical support document and the total maximum daily load document will be drafted and Caney Creek stakeholders will begin drafting a watershed-based plan in 2019.

Other Area Total Maximum Daily Load/Implementation Plans

Other total maximum daily load/implementation plan watershed projects, not led by H-GAC, are taking place in the H-GAC Clean Rivers Program region.

Dickinson Bayou
The Dickinson Bayou implementation plan development was led by Texas A&M AgriLife Extension (www.agrilife.org/dickinsonbayou/). The *Implementation Plan for Eight Total Maximum Daily Loads for Indicator Bacteria in Dickinson Bayou and Three Tidal Tributaries* was approved by the TCEQ in January 2014. The implementation plan addresses high concentrations of bacteria in Dickinson Bayou Tidal and its tributaries.

Texas A&M AgriLife Extension is the managing stakeholder group implementing the Dickinson Bayou Watershed Partnership. Focus areas address traditional sources of pollution, including on-site sewage facilities, wastewater treatment, and animal wastes, and recommend restoring natural buffering systems, such as riparian zones, preserving wetlands, and constructing wetlands.

Status
The implementation plan is complete, and a parallel watershed protection plan is being drafted. The TCEQ is working with Texas A&M AgriLife Extension to complete the watershed protection plan. Texas A&M AgriLife Extension continues to meet with stakeholders to develop the watershed protection plan and implement the bacteria reduction measures of the implementation plan.

Upper Gulf Coast Oyster Waters
The Upper Gulf Coast Oyster Waters implementation plan (www.tceq.texas.gov/waterquality/tmdl/25-oystercreek.html), led by the Galveston Bay Foundation with support from H-GAC, addresses 11 total maximum daily loads related to bacterial contamination of oyster fisheries in and around Galveston Bay. Eighteen stakeholder organizations along with a group of concerned residents developed an implementation plan. The *Implementation Plan for 11 total maximum daily loads for Bacteria in Waters of the Upper Gulf Coast* was approved by the TCEQ in August 2015. The implementation 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.

Status
The Galveston Bay Foundation regularly meets with stakeholders to implement activities through public education and outreach, including Cease the Grease, a regional campaign to reduce the impacts of fats, oils, and grease in sanitary sewers

(www.CeasetheGrease.net). The program focuses on teaching proper disposal techniques to residents and establishing approved locations to recycle used cooking oil in the region. Funnels and pan scrapers are provided to residents at public events.

Pump, Don't Dump, a boater waste education campaign focused on Galveston Bay (www.galvbay.org/how-we-protect-the-bay/in-our-communities/boater-waste-education/), has developed an interactive mapping application of all public, mobile, and private/member pump out stations and services. Promotional materials (flags, key chains, whistles, cozies, etc.) with the pump, don't dump message on them are provided to boaters at public events.

Houston Ship Channel/Upper Galveston Bay

The Houston Ship Channel/Upper Galveston Bay Dioxin and PCB total maximum daily loads (www.tceq.texas.gov/waterquality/tmdl/26-houston_group.html) are in the southern portion of the San Jacinto River, Houston Ship Channel, Galveston Bay and several tidal tributaries to the bay system. total maximum daily loads were developed in response to fish consumption advisories issued for the presence of PCBs/dioxin in edible fish and shell fish tissues.

The purpose of developing total maximum daily loads was to determine the necessary reductions in PCBs/dioxin in these watersheds to meet water quality standards. During the total maximum daily load development process, historic and legacy sources of the chemicals were identified and considered likely causes for most of the sediment contamination in the San Jacinto River and Houston Ship Channel. The stakeholder group has not met since 2012. Focus shifted to cleanup of the legacy sources.

The San Jacinto River Waste Pits (www.epa.gov/tx/sjrwp) were identified as a primary contributor of dioxin to the Galveston Bay Estuary. In 2008, EPA Region 6 listed the San Jacinto River Waste Pits as a Superfund Site.

<u>Status</u>

The Galveston Bay Foundation places seafood consumption advisory signage at fishing locations and boat ramps throughout the San Jacinto River, Houston Ship Channel, and Upper Galveston Bay.

A feasibility study including identification of cleanup alternatives for the Superfund site was completed and the EPA announced a proposed plan for cleanup and public comment period in September 2016. In January 2017, the EPA released a Record of Decision (www.epa.gov/tx/record-decision-san-jacinto-river-waste-pits-harris-county-texas) explaining which cleanup alternative(s) will be used at the site.

Other Watershed Programs and Projects

On-site Sewage System Management

Regular maintenance and inspection of on-site sewage facilities protects public and environmental health, increases system longevity, and enhances private property use and value. In conjunction with the Clean Rivers Program, H-GAC offers programs (www.h-gac.com/community/water/ossf.aspx) to help reduce bacteria levels in waterways near these facilities.

In the Homeowner Education Course, residents receive an overview of both types of on-site sewage systems, information on system maintenance and inspection, and details on available resources to maintain, repair, and replace aging systems. The course provides homeowners the basics of septic system and on-site sewage system maintenance and visual inspection but does not provide for or allow homeowners to inspect their own aerobic system in place of professional inspections as part of a regular maintenance contract.

The Wastewater Assistance Program provides funding for the repair and replacement of failing on-site sewage systems (septic or aerobic). Funding is available to homeowners who meet certain income restrictions. No matching funds are required. This program is funded through a Supplemental Environmental Project through the TCEQ, with additional funding from the Harris County District Attorney's Office. Funding from corporate donations is also available for this project.

The On-Site Sewage Facility Information System Mapping Tool contains data on the locations of permitted on-site sewage facilities by age, authorized agent, permitting authority, number of permits per square mile, and likely locations of unpermitted systems. Updates to the mapping tool are conducted as part of the annual Water Quality Management Plan.

Water Quality Management Plan

H-GAC conducts water quality management planning as part of a Clean Water Act Section 604(b) grant program funded by the EPA through the Texas Commission on Environmental Quality. The Water Quality Management Plan Update (www.h-gac.com/community/water/quality/default.aspx), completed annually, describes a series of data collection, special study, and coordination activities completed through this project. The purpose of these activities is to provide data and analysis regarding wastewater infrastructure, watershed planning, and sources or nonpoint source pollution that affect water quality in the Houston-Galveston region.

Data acquired and assessed through this project include geospatial data for wastewater treatment plant outfalls and service area boundaries, self-reported effluent monitoring data, and occurrences of sanitary sewer overflows. Updates to the on-site sewage facility information system mapping tool are coordinated through this project.

The quality-assured data from this project are used extensively to inform decisions in multiple watershed projects and programs, such as the Clean Rivers Program, Bacteria Implementation Group, and numerous watershed protection plan and total maximum daily load projects. Data are also made available to project partners and H-GAC member entities for use in their water quality planning activities.

Coastal Communities Outreach Program

H-GAC is committed to working to improve education and outreach about water pollution in Brazoria, Chambers, Galveston, and Matagorda counties, supplementing eight active water-quality related projects underway in those counties.

The Coastal Communities Outreach project bridges the gap between the needs identified by coastal communities and implementation measures for outreach identified in new or existing watershed-based plans by working with partners to offer an overarching engagement, education, and outreach program.

The program helps small communities without municipal separate storm sewer system permits engage residents in education and outreach promoting behavior change to reduce the potential for water pollution. These communities typically lack financial and staff capacity to develop, launch, implement, and maintain public outreach campaigns.

The project focuses on four pillars of behavior change: pet waste management; fats, oils, and grease disposal; litter and illegal dumping; and on-site sewage system repair and maintenance.

Through site visits with city leadership and staff to assess needs, H-GAC developed a website for coastal communities (www.coastalcommunitiestx.com). The cornerstone of the website is the outreach plan and roadmap, offering resources, tools, and techniques, and technical assistance from H-GAC outreach staff, for planning and implementing residential education and outreach about reducing sources of water pollution in these communities. This plan and roadmap can be used by local governments, utility districts, schools, civic organizations, homeowner associations, apartment managers, and other volunteers to engage residents in positive behavior change.

OUTREACH ACTIVITIES

Public outreach is a cornerstone of the H-GAC Clean Rivers Program. In all its projects, the H-GAC water resources group seeks to inform and educate local stakeholders about water quality issues and empower them to take an active role in the health of local waterways.

Outreach Priorities

Stakeholder engagement, education, and outreach takes several forms in the H-GAC Clean Rivers Program. Outreach activities are often coordinated with other water resource programs and projects in the region. Coordination among these groups allows the Clean Rivers Program to reach a broad audience, while tailoring information to the needs of a specific geographic or project boundary.

An overview of key stakeholder engagement and outreach activities from the past year follows.

Outreach Projects and Programs

Texas Stream Team

The H-GAC Texas Stream Team program (www.h-gac.com/texas-stream-team/default.aspx), managed locally by the Clean Rivers Program, with support from the Galveston Bay Foundation, City of Sugar Land, Bayou Land Conservancy, and Bayou Preservation Association, trains and certifies volunteer water quality monitors. There are 100 active monitoring stations in the four basins managed by H-GAC.

Texas Stream Team data is found on the Water Resources Information Map (www.h-gac.com/go/wrim/).

Texas Stream Team data are used to supplement professionally-collected data and provide data in areas where professional monitoring does not take place. This monitoring is valuable to the Clean Rivers Program by helping identify areas with emerging water quality problems to determine where new professional monitoring might be needed.

H-GAC publishes a quarterly e-newsletter for monitors, interested governments, organizations, and residents.

Clean Waters Initiative

The Clean Waters Initiative (www.h-gac.com/community/water/cwi/default.aspx), a workshop series facilitated by H-GAC Clean Rivers Program staff, offers education and information to local governments, nonprofit organizations, landowners, and residents to help develop effective strategies to reduce pollution in local waterways. The workshops provide an opportunity for diverse stakeholder groups to network.

In 2018, four workshops focused on water quality and transportation, water quality and public health, recovery and resiliency after Hurricane Harvey, and minimum control measures for municipal separate storm systems.

Water Resources Information Map

The Water Resources Information Map (www.h-gac.com/go/wrim/) is an interactive mapping tool displaying all Clean Rivers Program professional and Texas Stream Team volunteer water quality monitoring sites in the region, with photos and data associated with each site. This tool, compatible with mobile devices, is available to anyone interested in current and historic water quality data, issues, and trends in the region.

Outreach Activities

River, Lakes, Bays 'N Bayous Trash Bash®

The Rivers, Lakes, Bays 'N Bayous Trash Bash® (www.TrashBash.org), established by the H-GAC Clean Rivers Program and the Texas Natural Resource Conservation Commission in 1993, is the largest single-day waterway cleanup in Texas. Trash Bash is managed by the Texas Conservation Fund, with support from the Gulf Coast Authority and a volunteer steering committee. H-GAC staff provide regional coordination for the event.

Trash Bash® promotes environmental stewardship of the Galveston Bay watershed through public education by using hands-on educational tools and developing partnerships between environmental, governmental, and private organizations. Since its inception, more than 109,000 volunteers have cleaned up 4.5 million pounds of trash. In 2018, 3,600 volunteers at 14 locations collected 85.5 tons of trash, 356 tires, and a ton of recyclable material while cleaning 158.5 miles of area shoreline. More than half the volunteers are under 18-years of age, and nearly a quarter participate in scouting.

In 2018, Trash Bash® held its 25th consecutive event, and was the recipient of the 2018 Texas Environmental Excellence Award in the Civic/Community category, the 2019 EPA Gulf Guardian Award, and a City of Houston Keep Houston Beautiful Mayor's Proud Partner Award.

Other Education and Outreach Activities

H-GAC Clean Rivers Program staff attended public-facing education and outreach events in 2018 to encourage residents of the region to adopt positive water pollution prevention behaviors in their daily lives.

Staff selects materials and messaging for each event from a collection of interactive exhibits H-GAC created in recent years using grant funding from the TCEQ and the Galveston Bay Estuary Program.

Materials focus on common residential behaviors that can result in water pollution, with the primary focus on reducing bacterial levels in local waterways. All materials can be borrowed at no charge by groups wishing to talk about water quality in their communities.

Materials

- Pitch the Poop: reinforces the need to pick up pet waste. Participants can win pet waste bag dispensers for dog leashes by playing the game;
- Defeat the Grease Monster: demonstrates the effects of improper disposal of fats, oils, and grease on sanitary sewer pipes and on-site sewage facilities. Participants can win funnels and plate scrapers, donated by the Galveston Bay Foundation, by playing the game;
- Turn Your Yard into a Sponge: illustrates the pollutants contained in stormwater runoff from residential home surfaces (roof, yard, impervious surfaces). Participants receive a brochure on how to prevent stormwater pollution at home; and
- Fish Me from the Watershed: In 2019, H-GAC debuts a new exhibit focusing on proper disposal of trash. Participants will decide where to dispose of common types of trash (landfill, recycling cart, other recycling options, household hazardous waste, composting). Participants can decide if this is a viable item for reusing or reducing. Participants can receive a refrigerator magnet, donated by the H-GAC Solid Waste Management program, to remind them to check www.Earth911.com for recycling options.

From September 1, 2017 to August 31, 2018, H-GAC Clean Rivers Program staff participated in or provided materials to partner organizations for 47 outreach activities, including the following events, presentations, and meetings.

Public Outreach Events

- Nature Fest, an outdoor environmental education event in the Spring Creek watershed, attended by more than 1,000 residents (March 2018)

- Sam Houston Area Council Boy Scout Fair, attended by nearly 30,000 scouts and families from across the region (April 2018)
- Nurture Nature, an outdoor environmental education event hosted by the Baytown Nature Center in the Cedar Bayou Tidal watershed (April 2018)
- Bay Day, an outdoor environmental education event hosted by the Galveston Bay Foundation on the Kemah Boardwalk, attended by residents from across the region (April 2018)
- World Oceans Day, an outdoor environmental education event hosted by Artist Boat, attended by residents and tourists visiting the beach in Galveston (June 2018);
- Brazoria County Hurricane Preparedness Expo, attended by more than 400 county residents (June 2018)
- Bayou Preservation Association Symposium, attended by about 150 water quality professionals and organizations from the region (October 2018)
- Distributed pet waste bag leash dispensers at several events through a partnership with the Girls Scouts and Citizens for Animal Protection organization

Corporate Outreach Events

- Schlumberger Health, Safety, and Environment Day, attended by 250 employees at their Houston facility on Ardmore Street
- CITGO Employee Volunteer Fair, attended by about 75 employees at the Energy Corridor facility
- H-GAC Board of Directors Annual Meeting, displayed information about Trash Bash for elected officials from the 13-county service region
- H-GAC Employee Health Fair, attended by about 200 employees

Educational Events

- Conducted two Texas Stream Team Phase I/II volunteer monitor trainings, in Brazoria County and downtown Houston, and certified 17 new monitors with Phase III training
- Partnered with the Student Conservation Association, Bayou Preservation Association, and Japhet Creek Association to host two full-day Texas Stream Team field trips with Houston ISD Carnegie-Vanguard High School
- Partnered with the Galveston Bay Foundation to host two on-site sewage system homeowner education courses in Galveston and Chambers counties

Other Outreach

- Provided facilitation and steering committee representation for the Trash Summit, a regional collaborative to develop a marine debris reduction action plan (www.donttrashagoodthing.org);

- Provided steering committee representation for the Trash Free Texas Adopt-a-Spot project (www.trashfreetexas.org), a statewide collaborative through the EPA Trash Free Waters Program to consolidate litter adopt-a-spot programs into one interactive mapping application;
- Presented Clean Rivers Program public engagement efforts at the statewide Clean Rivers Program meeting in Seguin;
- Discussed bacteria in area bayous and related outreach opportunities at the Bayou Preservation Association watershed meeting;
- Used Clean Rivers Program data to focus outreach at Holiday Lakes and Danbury city council meetings; and
- Used Clean Rivers Program data for planning at Basin 11 and Basin 13 bacteria reduction project and regional watershed protection plan stakeholder meetings.

Online
H-GAC's water quality programs and activities are listed on the agency and program website and on social media. Water resources staff also monitor a dedicated e-mail account for questions and more information.

These sources include the following:
- Houston-Galveston Area Council website (www.H-GAC.com)
- Email (waterresources@h-gac.com)
- H-GAC Facebook (www.facebook.com/HouGalvAreaCog/)
- Trash Bash Facebook (www.facebook.com/TrashBash/)
- H-GAC Water Resources Twitter
- Twitter @HGACWater (www.twitter.com/HGACWater)

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Funding Acknowledgement

Prepared in cooperation with the Texas Commission on Environmental Quality.

The preparation of this website was financed through funding from the Texas Commission on Environmental Quality.

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