

MARCH 2022

FINAL REPORT

GALVESTON BAY COALITION OF WATERSHEDS – A COLLABORATIVE APPROACH TO WATERSHED PLAN IMPLEMENTATION

PREPARED BY THE
TEXAS COMMUNITY WATERSHED PARTNERS
A PROGRAM OF TEXAS A&M AGRILIFE EXTENSION SERVICE
AGREEMENT No. 20-031-000-B738



A report funded by a Texas Coastal Management Program Grant approved by the Texas Land Commissioner pursuant to National Oceanic and Atmospheric Administration Award No. NA19NOS4190106.

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PROJECT OVERVIEW

Numerous bayous, creeks and streams flowing through Coastal Texas are considered impaired by the Texas Commission on Environmental Quality (TCEQ) for high levels of bacteria and low levels of dissolved oxygen. The first watershed protection plan (WPP) in the Galveston Bay area was Armand Bayou in 1997. Since then, many watershed-based plans (WBPs) have been created through local stakeholder processes to improve water quality in coastal waterways.

The increase of WBPs over time has created several autonomous groups, all with similar goals. In 2017, the Texas A&M AgriLife Extension brought together key stakeholders from four watersheds in Brazoria and Galveston Counties to form the Galveston Bay Coalition of Watersheds (Coalition). This group works to implement existing WBPs for bacteria in the Bastrop, Dickinson, Highland, and Jarbo Bayou watersheds. The Coalition also works to create a long-term, sustainable way for the four WBP groups to share the burden and cost of addressing pollution sources. The Coalition needs a Coordinator to manage the activities of the watershed groups and actions to improve local water quality after a WBP is complete.

CMP Cycle 24 funds were utilized to sustain a Coordinator to coordinate and expand the Coalition, create and implement a strategic outreach action plan, assess water quality data, liaise with various local water quality groups and facilitate new Coalition partnerships. The continued success of the Coalition will serve as an example to watersheds in the Coastal Zone and across Texas. As more WBPs are approved and implementation resources continue to be stretched, a regional multi-watershed approach to implementation could likely be the future of WBP implementation and water quality improvement for our impaired water bodies.

Task 1: Coordinate and Expand Galveston Bay Coalition of Watersheds

The Coalition held regular meetings, on an as needed basis, to sustain the group. The Coordinator actively reached out to additional entities and encouraged their participation to better represent the entire geographic scope of the Coalition. The Coordinator worked with existing Coalition Members to engage with new members to encourage participation.

Task 2: Create an Outreach Strategic Action Plan (SAP)

A key focus area for the Coalition is to identify new methods to reach and engage citizens. The Coalition explored barriers and benefits to better serve the stakeholders in partner watersheds through targeted outreach efforts. A SAP for outreach was developed to guide the direction of implementation efforts performed by the Coalition through 2021. Specific outreach activities were focused on non-point sources and established Coalition Goals and Action Items.

Task 3: Implement Outreach in the SAP

The Coalition Coordinator worked with Coalition members to implement items from the SAP created in Task 2. Educational events focused on relevant topics determined by members. The Coalition collaborated with many groups when coordinating or participating in events, to stretch resources and reach a maximum audience. Such groups included: the Galveston Bay Foundation (GBF), Galveston County Health District (GCHD), Houston-Galveston Area Council (H-GAC), and Keep Dickinson Beautiful.

Task 4: Assess water quality improvements using local water quality data

The TCEQ regional office, GCHD, and the H-GAC all collect routine water quality data on Coalition Bayous; however, the data is not assessed in relation the Coalition WBPs. The Coordinator compiled Clean Rivers Program data for Coalition watersheds and completed an assessment to determine changes to water quality parameters for data available during the project period. The resulting report will serve as a State of Water Quality for Coalition Watersheds for use as a water quality benchmark moving forward. This water quality assessment step is essential to understanding the current state of the water bodies and how the implementation of management measures is impacting water quality.

COORDINATE AND EXPAND THE COALITION (TASK 1)

The Coalition was formed to implement existing WBPs for Bastrop, Dickinson, Highland, and Jarbo Bayous (Figure 1). These four watersheds have many of the same or similar implementation activities; therefore, working together for the same objective is a more efficient use of all resources. This multi-watershed approach (1) extends limited resources for coordinating implementation efforts; (2) reduces the redundancy of programs in the region; (3) facilitates coordination between watershed groups; and (4) creates a unified message for outreach.

Stakeholders in the Coalition include multiple entities who hold Municipal Separate Storm Sewer (MS4) permits and others who simply have an interest in protecting water resources in Brazoria and Galveston Counties. All are committed to a Coalition-wide effort to improve water quality. The Coalition continuously seeks to bring new partners into this effort.

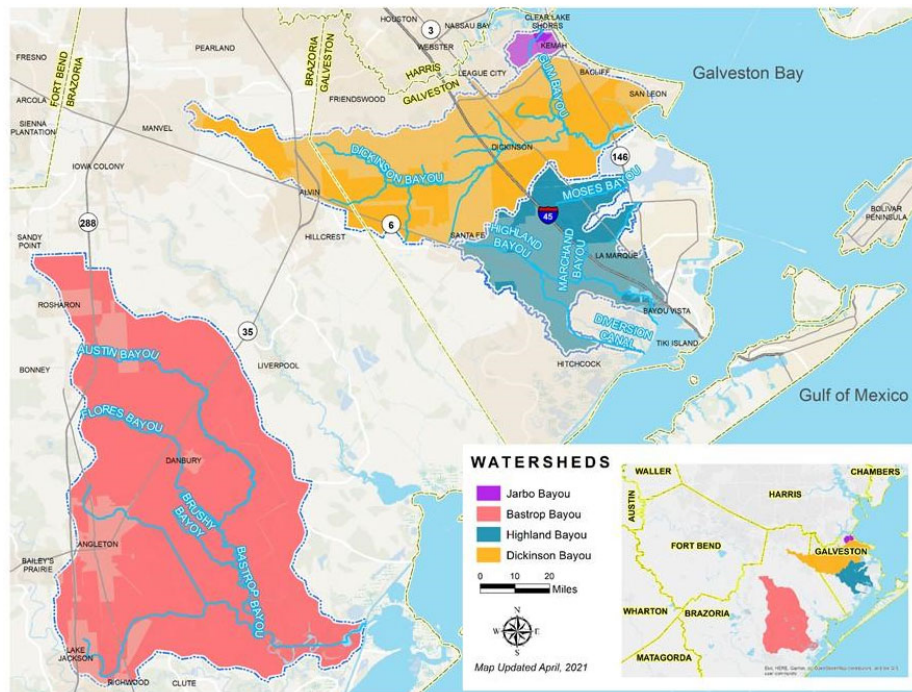


Figure 1. Galveston Bay Coalition of Watersheds partner watersheds

COALITION BUILDING

The Coalition held 11 meetings during the course of the project (Table 1). A combination of whole group and smaller topic specific meetings took place virtually between October 2020 and February 2022. Table 1 includes local stakeholder and technical advisors in attendance. Attendance does not include Texas A&M AgriLife Extension project team members.

Table 1. Coalition Meeting Schedule

Meeting Date	Meeting Type	Attendance
Oct 20, 2020; 1:30-3:30 pm	<i>Full Coalition</i>	25
Mar 3, 2021; 1:30-3:30 pm	<i>Full Coalition</i>	22
Mar 23, 2021; 10:00-11:00 am	<i>FOG and wipes in sanitary sewer systems</i>	8
Mar 23, 2021; 1:30-2:30 pm	<i>Dredging-Erosion Control-Riparian Buffers</i>	8
Mar 24, 2021; 1:30-2:30 pm	<i>Debris in bayous and illegal dumping sites</i>	4
Jun 22, 2021; 1:00-2:00 pm	<i>Dredging-Erosion Control-Riparian Buffers</i>	9
Jul 20, 2021; 1:30-2:30 pm	<i>FOG and wipes in sanitary sewer systems</i>	10
Jul 21, 2021; 10:00-11:00 am	<i>Dredging-Erosion Control-Riparian Buffers</i>	5
Jul 22, 2021; 10:00-11:00 am	<i>Debris in bayous and illegal dumping sites</i>	6
Aug 24, 2021; 1:30-3:30 pm	<i>Full Coalition</i>	14
Feb 2, 2022; 10:00-11:30 am	<i>Full Coalition</i>	17

Table 2. Organizations who participated in the Coalition ¹

Local Stakeholder	Technical Advisor
Brazoria County Drainage District Angleton and Velasco	Galveston Bay Foundation
Brazoria County Engineering	Houston-Galveston Area Council
Brazoria County Environmental Health	Tarleton State University TIAER
Brazoria County Parks	Texas A&M AgriLife Extension Service
Brazoria County Floodplain	Texas Sea Grant
City of Angleton	Texas Commission on Environmental Quality
City of Clear Lake Shores	Texas Commission on Environmental Quality GBEP
City of Dickinson	Texas Parks and Wildlife Department
City of Hitchcock	Texas State Soil and Water Conservation Board
City of Kemah	University of Houston Clear Lake
City of La Marque	U.S. Department of Agriculture
City of Lake Jackson	
City of League City	
City of Santa Fe	
Galveston County Engineering and Right of Way	
Galveston County Health District	

¹ Complete stakeholder list is included as [Appendix A](#).

Texas A&M AgriLife Extension staff also regularly participated in adjacent watershed meetings, including H-GAC's Bacteria Implementation Group meetings, Galveston Bay Estuary Program subcommittee meetings, and other regional watershed protection planning meetings.

COALITION WEBSITE AND VIRTUAL BINDER

The Coalition website at agrifile.org/coalitionofwatersheds contains links to each watershed in the Coalition, lists the vision, goals, and action items, and meeting notes (Figure 2). All meeting materials (Task 1.1) and additional Coalition resources, are available in the virtual binder at www.livebinders.com/b/2673240, access code: Coalition (Figure 3).

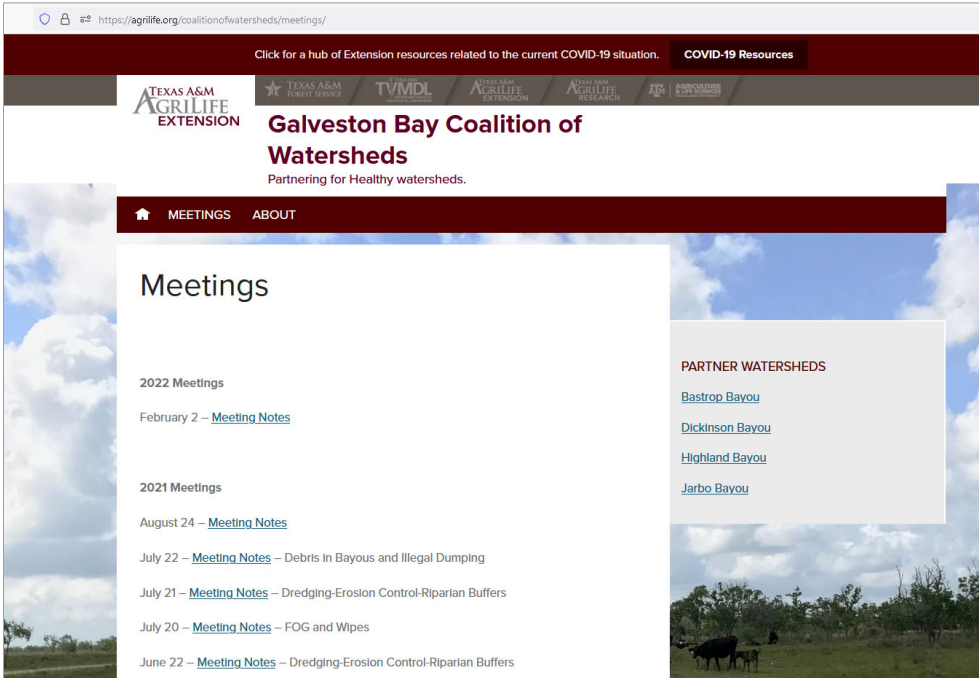


Figure 2. The meetings page for agrifile.org/coalitionofwatersheds

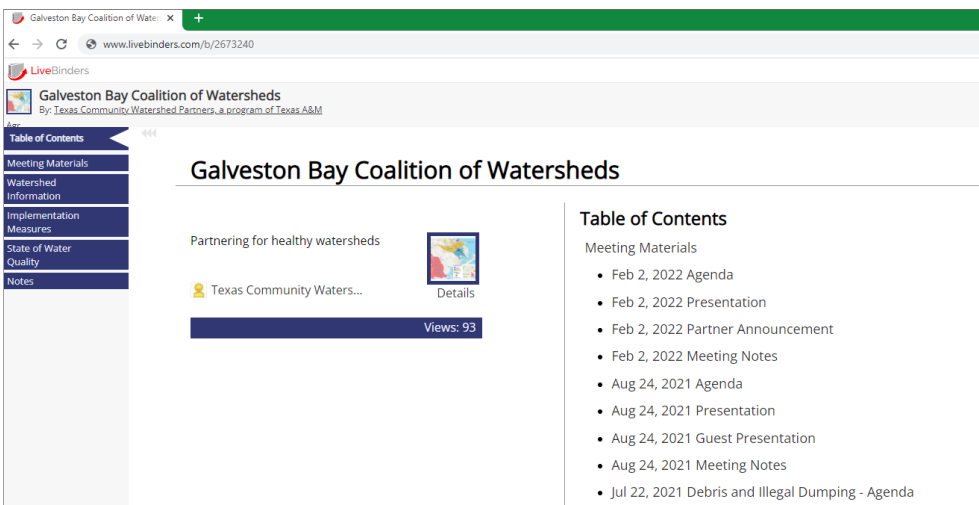


Figure 3. The virtual binder available at www.livebinders.com/b/2673240, access code: Coalition

CREATE AN OUTREACH STRATEGIC ACTION PLAN (SAP) (TASK 2)

A SAP for outreach was developed to guide outreach activities, prioritized as most appropriate and feasible for improving water quality, in partner watersheds through 2021 ([Appendix B](#)). Implementation was focused on non-point sources and established Coalition Goals and Action Items.

During the first cycle of activity (funded by the Galveston Bay Estuary Program), the Coalition consolidated management measures from four WBPs into a top 12 list that led to the development of the Coalitions' Goals and Action Items.

Coalition members narrowed down priority topic areas to determine the focus for 2021 through a multi-part exercise. All other topics were set aside for consideration at a later time. Three topic areas remained at the end of the exercise:

- Reduce fats, oils, and grease (FOG) and wipes in sanitary sewer systems
- Debris in Coalition bayous and illegal dumping sites
- Dredging needs for Coalition bayous; Erosion control, nutrient reduction, and the management of livestock and large groups of animals; Natural riparian buffers and conservation easements (later shortened to Dredging – Erosion control – Riparian buffers)

For each topic area, a pool of project ideas was compiled and refined over several meetings.

Educational activities the Coalition selected for 2021 are listed below. See [Appendix B](#) for the complete SAP.

- Reduce FOG and wipes in sanitary sewer systems
 - Outreach to apartment residents
 - Digital outreach to homeowners
 - Outreach at an interactive booth at in-person event
 - Collection point/receptacle awareness and additions
- Debris in bayous and illegal dumping
 - Tire drop off and abandoned tire awareness
 - Illegal dumping outreach
- Dredging – Erosion control – Riparian buffers
 - Policy decisions regarding drainage practices
 - Misconceptions about bayous, dredging, and land use

IMPLEMENT OUTREACH IN THE SAP (TASK 3)

The Coalition collaborated with many groups, to stretch limited resources and reach a maximum audience. Coalition stakeholders contributed by distributing educational materials, connecting education topics with audiences for presentations, providing materials, and providing technical assistance for outreach efforts.

Outreach materials are included in [Appendix C](#). Educational event reports including additional photos, materials, and sign in sheets (Task 3.1) are available in the virtual binder at www.livebinders.com/b/2673240, access code: Coalition.

FOG AND WIPES OUTREACH AT IN-PERSON EVENTS

MARKET ON THE BAYOU, DICKINSON, TEXAS – JUNE 2021

The Market on the Bayou event held on June 5th, from 10am – 2pm, was hosted by the Dickinson Chamber of Commerce, in Dickinson, Texas. Coalition member, Keep Dickinson Beautiful (KDB) co-hosted a table with Texas A&M AgriLife Extension Service staff featuring several FOG and wipes educational displays and interactive games.

The estimated number of one-on-one contacts at the KDB table was 50+. Leading up to the event, both the KDB and Market on the Bayou event Facebook pages posted about the damage FOG can cause and how to keep these materials out of our pipes.

Train the trainer – At the request of KDB volunteers, training was provided by Texas A&M AgriLife Extension staff on talking points for FOG and wipes in our sewer systems and a “wipes versus toilet paper” demonstration. Based on interactions at the event, KDB determined this topic area would be featured by KDB in the future. Outreach materials and leftover giveaway items were kept by KDB for more outreach on this topic.



Figure 4. KDB booth (left), Market on the Bayou



Figure 5. FOG and wipes outreach by KDB

MARKET ON THE BAYOU, DICKINSON, TEXAS – SEPTEMBER 2021

KDB again featured FOG and Wipes outreach materials at their interactive booth at the September 4 Market on the Bayou event. Estimated attendance at the market was 800+. The Galveston County Health District (GCHD) joined KDB to help with outreach. KDB and GCHD featured many of the same materials developed with Texas A&M AgriLife Extension staff for the June Market event. KDB also adapted the two-sided handout for apartment resident outreach in Lake Jackson into two separate handouts (Figure 9), one on FOG and one on “what not to flush”. The KDB handout included information about their cooking oil recycling location. KDB continues to use these handouts at local Market on the Bayou and additional community events.



Figure 6. FOG and wipes outreach by KDB



Figure 7. FOG and wipes poster pledges



Figure 8. Cooking oil recycling location



Figure 9. KDB FOG handout

BAY AREA PLANT EXCHANGE, DICKINSON, TEXAS – OCTOBER 2021

The Bay Area Plant Exchange “plant swap” held on October 9 from 8am-12pm, was hosted by the Dickinson Chamber of Commerce, in Dickinson, Texas. Event attendance was estimated at 400. KDB hosted a table featuring FOG and wipes displays. Displays included: FOG giveaways provided by GBF, including Cease the Grease magnets, funnels, scrapers, can lids, stickers, and brochures; a demonstration comparing how toilet paper and wipes marketed as flushable or non-flushable dissolve in water; and repair estimates from a local plumber. Following the event, KDB posted photos and information on FOG to their Facebook page.



Figure 10. FOG and wipes outreach by KDB



Figure 11. Bay Area Plant Exchange

FUTURE ACTIVITIES BY KDB

KDB recognizes the connection between sanitary sewer overflows and the water quality in our local bayous and they continue to deliver education on this topic at local events. They have utilized materials from the Coalition and adapted others to their outreach needs.

Feedback from KDB following the events above: “most, if not all, have bought into the advertising of wipes being flushable. I think that is the biggest concern and it will continue to be a focus for KDB”



Figure 12. FOG and wipes materials at KDB office



Figure 13. Wipes versus toilet paper demo

FOG AND WIPES OUTREACH TO APARTMENT RESIDENTS

CITY OF LAKE JACKSON, TEXAS – NEW APARTMENT RESIDENT WELCOME PACKETS

Welcome packets with a FOG and wipes handout and giveaways were distributed to new apartment residents in the City of Lake Jackson over the summer of 2021. Coalition member, City of Lake Jackson Public Works worked with their Code Enforcement department and Texas A&M AgriLife Extension Service staff to develop and supply welcome packets for the 27 apartment complexes located in Lake Jackson. A total of 660 welcome packets were assembled by City staff and delivered to apartment managers for distribution. Welcome packets included: a handout on keeping FOG and wipes out of our pipes ([Appendix C](#)) and the City’s cooking oil recycling location; and giveaways provided by the Galveston Bay Foundation (GBF), including Cease the Grease funnels and scrapers.



Figure 14. Apartment resident welcome packet



Figure 15. FOG scraper and funnel delivery

CITY OF HITCHCOCK, TEXAS – FLYERS FOR APARTMENT RESIDENTS

Coalition member, City of Hitchcock partnered with Texas A&M AgriLife Extension Service staff to develop and supply FOG and wipes flyers to apartment residents and the general public in January 2022.

Outreach to apartment residents:

- 574 flyers delivered by the utility crew to 10 apartment complexes
- for complexes with no office, flyers were taped to each resident’s door
- for complexes with an office, flyers were given to apartment managers for distribution

Outreach to the general public:

- 600 flyers divided between the library, post office, and two banks
- 200 flyers for the City Hall lobby and court lobby

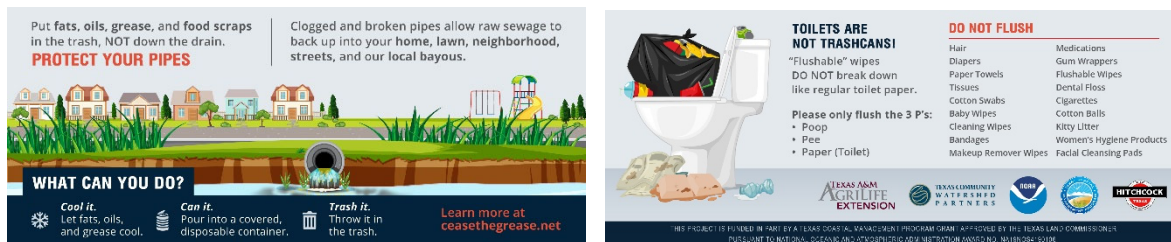


Figure 16. City of Hitchcock FOG and wipes bill insert

FOG AND WIPES OUTREACH TO WATER AND SEWER UTILITY CUSTOMERS

The idea to create a flyer formatted as a 1/3 page bill insert, was generated through the apartment outreach campaign. This water and sewer utility customer category, was originally considered an *Activity Prioritized for Future Efforts* in the SAP. However, the City of Hitchcock requested a bill insert for outreach to all water and sewer customers versus targeting only their apartment residents. Texas A&M provided hard copy flyers and digital files. The City incorporated digital images of the bill insert into their monthly newsletter for the utility bill, leaving the printed flyers available for additional purposes. Total bill insert flyers distributed/allocated by the City of Hitchcock in January 2022 for all audiences is 5,074.

CITY OF HITCHCOCK, TEXAS – WATER AND SEWER UTILITY CUSTOMERS

Coalition member, City of Hitchcock partnered with Texas A&M AgriLife Extension Service staff to develop and supply FOG and wipes flyers to water and sewer utility customers in January 2022.

Outreach to sewer utility customers:

- 2600 utility bills included the bill insert images on the front page of the monthly newsletter
- 900 bill insert flyers at City Hall registers to be stapled with new service agreements and utility bills paid in person
- 200 bill insert flyers for service call follow up by mail



Figure 17. City of Hitchcock newsletter January 2022, page 1

GALVESTON COUNTY WCID8 IN SANTA FE, TEXAS – WATER AND SEWER UTILITY CUSTOMERS

Galveston County Water Control and Improvement District (WCID) No. 8 is partnering with Texas A&M AgriLife Extension Service staff to supply FOG and wipes flyers to water and sewer utility customers. WCID8 anticipates utilization of the bill insert flyers within their March utility bill. Texas A&M provided 2600 hard copy flyers and digital files.

Feedback from Galveston County WCID8: “We are experiencing a lot of growth, so this information will definitely help educate our customer base.” “You would not believe the things that people flush.”

PRINT READY BILL INSERT FILES FOR COALITION MEMBERS UPON REQUEST

Galveston Bay Coalition of Watersheds’ stakeholder organizations were offered digital FOG and wipes bill insert flyers as both JPEG and print-ready PDF files at the February 2022 Coalition meeting.

- Custom flyers with organization logos were provided for: City of Lake Jackson, Galveston County Health District, and Keep Dickinson Beautiful
- Generic flyers without a local partner logo were provided for: Galveston Bay Foundation, Houston-Galveston Area Council Coastal Communities, and Texas Parks and Wildlife Department ([Appendix C](#))

DIGITAL FOG AND WIPES OUTREACH

Coalition members partnered with Texas A&M AgriLife Extension Service staff to share education about reducing FOG and wipes in sanitary sewer systems through local government communications online.

WEBPAGES

- The City of Hitchcock incorporated the FOG and wipes flyer on the front page of their January 2022 newsletter at, www.cityofhitchcock.org/departments_/city_administrator/monthly_newsletters.php.
- The City of Lake Jackson placed flyer images on their homepage (Figure 18) at, www.lakejackson-tx.gov.

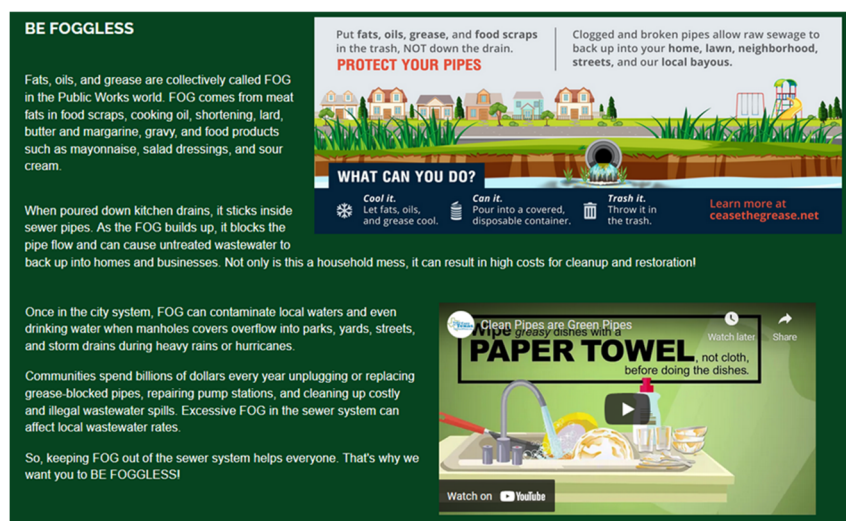


Figure 18. FOG education on the City of Lake Jackson homepage

SOCIAL MEDIA

A social media toolkit was developed at the request of Coalition members, including newly created graphics, sample text, a resource list of content created by others in our region, and general information on FOG and wipes ([Appendix C](#)). Coalition members were invited to participate in a social media push using the toolkit starting October 2021. The complete toolkit is available for download from, <https://agrillife.org/coalitionofwatersheds/fog-wipes-digital-files/> and <https://u.tamu.edu/SocialMediaToolkit>

Table 3. Potential impact on social media through Facebook posts

Facebook Page	Posts	Followers
Keep Dickinson Beautiful	6	1,550
Market on the Bayou – By Dickinson Tx Chamber of Commerce	4	1,464
City of Lake Jackson - Government	1	19K

Feedback from Keep Dickinson Beautiful: “The social media files you sent are awesome!! Thank you!”

Comments on social media posts:

- “Yep! There is NO new Water, lets protect what we have.”
- “Time for the coffee can for grease under the kitchen sink”
- [Response to KDB post inviting people to the Market on the Bayou to “find out what this nasty mess is and what causes it] “I can’t stop by, but can I please still know what it is?”

The screenshot displays the Social Media Toolkit content, which is organized into several sections:

- SAMPLE TEXT:** Includes instructions to use or modify text and combine it with graphics. It features a section for **GENERAL FOG AND WIPES** with text explaining that sanitary sewer systems transport waste from homes and businesses to treatment facilities, and that overflows can lead to untreated wastewater entering local bayous. It provides instructions on how to properly dispose of FOG (fat, oil, and grease) in the trash.
- HASHTAG LIBRARY:** Lists various hashtags for different categories:
 - ALL PIPES:** #ProtectYourPipes, #DefendYourDrains, #NoClogsInThePipes
 - FOG, KITCHEN SINK:** #NoFatsOilsGrease, #CeaseTheGrease, #DontFeedTheGreaseMonster
 - WIPES, TOILET:** #Wipes, #NoWipes, #NoWipesDownPipes, #What2Flush, #3Ps
 - WATER QUALITY:** #BackTheBay, #EyesOnGalvBay, #waterquality, #cleanwater, #water, #BastropBayou, #HighlandBayou, #DickinsonBayou, #JarboBayou
 - LOCATION SPECIFIC:** A note to not forget organization-specific hashtags.
- GRAPHICS TO SHARE:** A collection of six graphics with the following messages:
 - "PROTECT YOUR PIPES: Fat, oil, and grease don't clog your drains."
 - "Do you know what causes this mess? Fat, oil, and grease."
 - "Keep Fats, Oils, and Grease out of your pipes. Don't. Don't. Don't."
 - "BROKEN PIPES IN OUR STREETS, DRAINING UNTREATED WASTEWATER INTO OUR NEIGHBORHOODS AND LOCAL BAYOUS."
 - "Do Not Flush: Fat, Oil, and Grease."
 - "Protect Your Pipes: Don't put fats, oils, and grease down the drain."
- MORE SOCIAL MEDIA RESOURCES:** A list of external resources including:
 - Coastal Communities (Houston-Galveston Area Council) - [Outreach Messages](#)
 - Cease the Grease (Galveston Bay Foundation) - [Partner Tool Kit](#), [Social Media Graphics](#), [Video](#)
 - Patty Potty - [Social Media Graphics](#) and shareable content on [Twitter](#), [Facebook](#). Please tag Patty (@nowipes) if you share her content.
 - Example webpage and outreach materials:
 - [Defend your Drains](#): North Central Texas Council of Governments (NCTCOG)
 - [Protect our Pipes](#): City of Houston
 - [Cease the Grease](#): City of League City
 - [FOG \(Fats, Oils, and Grease\)](#): City of Pearland
 - Search for related posts on social media platforms using hashtags from the library above.
- File List:** A table listing the toolkit files:

Name	Date	Type
FOG_general_01	10/4/2021 1:43 PM	PNG File
FOG_general_02	10/4/2021 2:15 PM	PNG File
FOG_general_03	10/8/2021 1:16 PM	PNG File
FOG_general_04_video	10/8/2021 1:23 PM	MP4 File
FOG_general_photo_01	10/5/2021 1:15 PM	PNG File
FOG_holiday_video	10/25/2021 3:00 PM	MP4 File
Wipes_general_01_video	10/25/2021 12:58 PM	MP4 File
Wipes_Toilets Are Not Trashcans_01	10/11/2021 5:34 PM	PNG File

Figure 19. Social media toolkit, content and resources for Coalition communities

City of Lake Jackson - Government
February 17 at 10:23 AM

BE FOGGLESS: A COMMUNITY MESSAGE AS PART OF OUR COLLABORATION TO KEEP OUR WATERWAYS & CITY SEWER SYSTEMS CLEAN |

Fats, oils, and grease are collectively called "FOG" in the Public Works world. FOG comes from meat fats in food scraps, cooking oil, shortening, lard, butter and margarine, gravy, and food products such as mayonnaise, salad dressings, and sour cream.

When poured down kitchen drains, FOG sticks inside sewer pipes. As the FOG builds up, it blocks the pipe flow a... See more



24

4 Comments 12 Shares

Keep Dickinson Beautiful
April 28, 2021

Stop by the KDB booth at the Dickinson Chamber of Commerce's Farmer's Market, Hwy 3 and 45th Street, this Saturday, May 1st, 10am till 2pm and find out what this nasty mess is and what causes it.



6

7 Comments 7 Shares

Figure 20. Social media posts on FOG and wipes

ILLEGAL DUMPING OUTREACH AT IN-PERSON EVENTS

ECO-FEST, LEAGUE CITY, TEXAS – SEPTEMBER 2021

Illegal dumping was the focus of outreach at the Eco-Fest event in League City. Texas A&M AgriLife Extension Service staff hosted a resource table on topics including watershed health, illegal dumping, recycling for residents, rain gardens, and WaterSmart practices. Staff also gave two classroom presentations. Estimated attendance at Eco-Fest was 1,000 people.

Resource Table

Texas A&M AgriLife Extension staff interacted with at least 150 people at the resource tables. Fifty-two households participated in the "What Watershed Do You Live In?" map activity, including residents from three of the four Coalition watersheds: Dickinson, Highland, and Jarbo Bayous.

Materials at the resource table were provided by Coalition members to share information about existing free programs, so more residents could utilize them. Coalition members identified tires specifically as routinely being removed from bayous and as a dumping problem in general, even though a number of recycling programs currently exist. The Galveston Bay Action Network (GBAN) is a reporting tool allowing residents to report pollution to the proper authority without the hassle of figuring out who to contact. Some Coalition members receive and respond to these reports. The Coalition has indicated that increasing the number of reports by sharing this tool with residents, gives their organizations more "eyes on the ground".

Classroom Presentations

Two classroom presentations were given by Texas A&M AgriLife Extension staff during Eco-Fest, each lasted around 30 minutes. The "Rain Gardens" presentation by Charriss York was attended by 35 people. The "We All Live in a Watershed" presentation and hands-on nonpoint source demonstration by Celina Gauthier Lowry was attended by 20 people



Figure 21. Residents with watershed address map activity

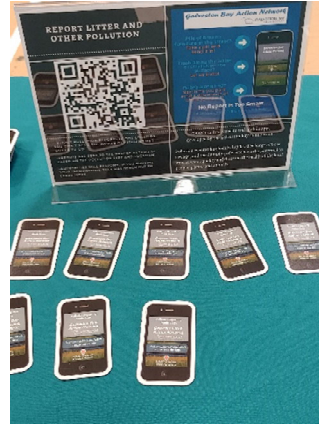


Figure 22. GBAN pollution reporting tool QR code and giveaway magnets



Figure 23. "Rain Gardens" classroom presentation

ADDRESSING MISCONCEPTIONS ABOUT BAYOUS AND LAND USE

ECO-FEST, LEAGUE CITY, TEXAS – SEPTEMBER 2021

See above for educational activities on land use at the Eco-Fest event.

RIPARIAN AND STREAM ECOSYSTEM TRAINING, LA MARQUE, TEXAS – FEBRUARY 2022

The one-day Texas Riparian and Stream Ecosystem training was co-hosted by the Coalition, the Texas A&M AgriLife Extension Service office in Galveston County, the Texas Riparian Association, and the Texas Water Resources Institute. Held on February 22nd in La Marque, the workshop included both indoor classroom presentations by natural resource agencies and an outdoor field stream walk along Marchand Bayou. A total of 35 were in attendance, including 24 participants and 11 instructors and/or facilitators. Participants included local landowners, public and private practitioners, and decision makers.

This training was requested by the Coalition to help address misconceptions about how the land and vegetation adjacent to our bayous contribute to the health of the water within the channel. Outreach was targeted to local leaders along with public works, parks, road and bridge, drainage, floodplain staff, and landowners whose decisions impact stream health and water quality.

For this workshop, the Coalition requested a lunchtime presentation that delivered local project examples to inform and inspire future projects. To that end, Roberto Vega III with the Harris County Flood Control District’s Environmental Quality Section, shared examples of natural channel design on smaller streams in Harris County that are representative of the bayous in Brazoria and Galveston counties.



Figure 24. Indoor classroom presentations by natural resource agencies



Figure 25. Outdoor stream walk along Marchand Bayou

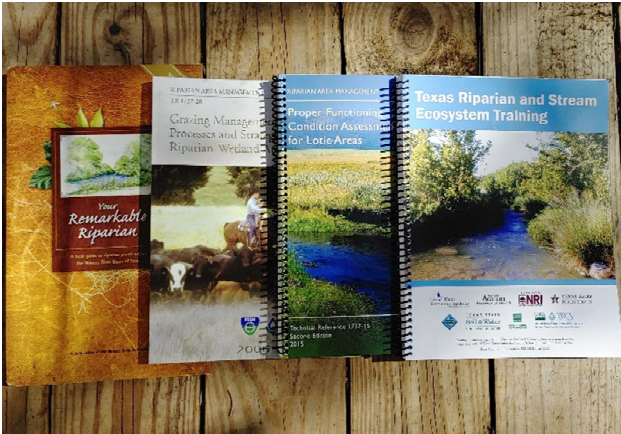


Figure 26. Presentation slides and additional handouts

Texas Riparian & Stream Ecosystem Training



Galveston Bay Coalition of Watersheds: La Marque, TX ~ Agenda ~ February 22, 2022

- 8:00 Meeting Registration
- 8:15 Welcome & Introductions
- Phoenix Rogers, Galveston County AgriLife Extension
- 8:30 Program Overview, Watershed Management and Water Quality
- Lucas Gregory, Texas Water Resources Institute
- 9:20 How Creeks Function & Bear Creek Example
- Ryan McGillicuddy, Texas Parks and Wildlife Department / TRA Board
- 10:10 Break
- 10:25 Riparian Vegetation
- Ricky Linex, Retired USDA NRCS
- 11:15 Management Practices, Local Resources and Photo Monitoring of Streams
- Lucas Gregory, Texas Water Resources Institute
- 12:00 Catered Lunch – Sponsored by the Texas Water Resources Institute
- 12:20 Lunch time Presentation: Conveyance Channel Improvements Using Natural Stable Channel Design
- Roberto Vega III, Harris County Flood Control District
- 12:50 Role of Forests and Trees in Watershed Protection
- Donna Work, Texas A&M Forest Service
- 1:30 Trip to Marchand Bayou (Lead by NRCS, TPWD, and TWRI)
- Stream Walk
 - Feral Hog Education: Josh Helcel, Texas A&M Natural Resources Institute
- 4:30 Wrap up and Head for Home!

<http://texasriparian.org/> and <https://www.facebook.com/TexasRiparianAssociation>



Life's better outside.
PROUD PARTNER



Funding provided through a Clean Water Act Nonpoint Source Grant from the Texas State Soil and Water Conservation Board and U.S. Environmental Protection Agency.

Figure 27. Texas Riparian and Stream Ecosystem agenda



Texas Riparian & Stream Ecosystem Workshop

Galveston Bay Coalition of Watersheds

February 22, 2022 | 8:00 a.m. - 4:30 p.m.

Galveston County Extension Office

4102-B Main Street (Carbide Park), La Marque, Texas 77568

Online RSVP and Agenda: <https://twri.tamu.edu/riparian/lamarque>

For more information and to register please contact Lucas Gregory at 979-314-2361 or LFGregory@ag.tamu.edu.

Continuing Education Units available: Texas Department of Agriculture Pesticide Applicators License – 3 CEUs; Texas Water Resources Institute – 1 CEU; Certified Crop Advisor - 7 CEUs; Texas Nutrient Management Planning Specialists – 6 hours; Texas Floodplain Management Association – 7 CECs; Texas Forestry Association – 6 hours; Society of American Foresters – 6 hours; Texas Board of Architectural Examiners “Acceptable for HSW credit”; and may also be used for CEUs for Professional Engineers.

The free workshop will include both indoor classroom and outdoor presentations by multiple natural resource agency experts and an outdoor field portion on a creek to discover how it functions and the role of riparian vegetation in properly functioning systems. RSVPs by February 15, 2022 at the link above or by contacting Gregory. A catered lunch is being sponsored by the Texas Water Resources Institute or you may bring your own lunch. There will also be coffee, tea, crackers and cookie snacks. The workshop is being co-hosted by the Texas Community Watershed Partners, the Texas A&M AgriLife Extension Office in Galveston County, Texas Riparian Association, and the Texas Water Resources Institute.

First name: _____ Last name: _____

Email address: _____ Phone: _____

Org./Employer: _____ Lunch Options: I will have the catered lunch
 I will bring my own



Funding provided through a Clean Water Act Nonpoint Source Grant from the Texas State Soil and Water Conservation Board and U.S. Environmental Protection Agency.

Figure 28. Texas Riparian and Stream Ecosystem flyer with CEU list

ASSESS WATER QUALITY IMPROVEMENTS USING LOCAL WATER QUALITY DATA (TASK 4)

The initial State of Water Quality report serves as a benchmark to inform priorities, target efforts, and assess water quality improvements over time, during successive implementation activities. In the report, Texas A&M AgriLife Extension staff compiled and evaluated quality assured water quality data from the Houston-Galveston Area Council Clean Rivers Program, collected under a TCEQ-approved Quality Assurance Project Plan (QAPP) from the four Coalition watersheds, between January 2019 and December 2020.

Bacteria continues to be the most widespread and pervasive pollutant in the Houston-Galveston region (H-GAC 2021²). Local stakeholders in the Coalition implement management measures in an effort to reduce bacteria levels under the thresholds set by the State in support of improved water quality. Observed values of *E. coli* and Enterococci collected from Coalition watersheds exceeded the standard or screening level in more than 50% of samples during the project period.

This State of Water Quality will inform the next cycle of implementation activities and continue to move the goals and action items established by Coalition stakeholders forward. A copy of the State of Water Quality report, which includes bacteria data for each of the four Coalition watersheds, is provided in [Appendix D](#).

² Houston-Galveston Area Council (2021). H-GAC, How's the Water?, Basin Summary Report. Retrieved from: <https://www.h-gac.com/getmedia/09d11fb2-0022-40b1-91c2-a5fb77902a02/2021-Basin-Highlights-Report>.

DISCUSSION AND OBSERVATIONS

The Coalition was formed in response to a need for coordinated implementation of WBPs that would minimize the administrative costs, and reduce the overall number of meetings that stakeholders are asked to attend, all of this while improving water quality. Coalition members have expressed a desire to continue the group, and to expand implementation efforts. Having a coordinator is essential to maintaining a regular meeting schedule and coordinating efforts between watersheds. Active participation from all watersheds is also essential.

The greatest strength of the Coalition has been the ability to meet the changing needs of partner watersheds. The Coalition set out to identify new methods to reach citizens and make real change, and the group was pushed further by the COVID-19 outbreak. This project started in September 2020, six months after the COVID-19 outbreak was declared a pandemic. Most Coalition representatives were taking on extra duties, and a shift in priority to world health brought opportunities along with challenges. Moving to all virtual meetings resulted in engagement from additional stakeholders from Brazoria County, further strengthening the Coalition. The COVID-19 pandemic was not expected, however the Coalition was able to move implementation efforts in Brazoria and Galveston Counties forward. To this end, it is important that the Coalition continue to re-assess Goals and Action items on a regular basis, and to continue to align these goals with the management measures in WBPs.

There is no current funding in place to continue Coalition meetings. Grant applications were submitted for implementation action through the Coalition, but none were funded. Additional grant proposals will be submitted as opportunities arise. Several partner organizations have existing programs that implement the WBPs in the Coalition watersheds, these programs and other implementation efforts will continue but without the coordinated focus provided by the Coalition.

At the February 2022 meeting, attendees were asked through a poll, “What has been the most impactful for your work?”. Participants were able to select more than one answer, and responded:

- 80% Shared resources for a larger impact
- 33% Setting the stage; making inroads for future efforts
- 20% Moving actions forward through this external group
- 20% Flexibility in implementation, based on current needs and capabilities
- 13% Coalition actions were impactful, but not specific to my organization
- 7% Similar actions would have happened, even without the Coalition
- 0% Other [I'll add feedback in meeting chat]

Feedback from Coalition stakeholders:

- *“This group helps us connect tools we've developed to users in the area!”*, Galveston Bay Foundation
- *“I really believe getting the information out [FOG and wipes] is making an impact.”*, Keep Dickinson Beautiful
- *“Very thankful for this group. Thanks!”*, Galveston County Health District



APPENDIX A. COALITION STAKEHOLDER LIST

LOCAL STAKEHOLDERS¹

Organization

Brazoria County Commissioner's Court
Brazoria County Commissioner's Court
Brazoria County Drainage District Angleton
Brazoria County Drainage District Angleton
Brazoria County Drainage District Angleton & Velasco
Brazoria County Drainage District Angleton & Velasco
Brazoria County Engineering
Brazoria County Engineering
Brazoria County Environmental Health
Brazoria County Freshwater Supply District 2
Brazoria County Groundwater Conservation District
Brazoria County Parks
Brazoria County Parks
Brazoria County Floodplain
City of Angleton
City of Angleton
City of Clear Lake Shores
City of Clear Lake Shores
City of Dickinson
City of Dickinson
City of Hitchcock
City of Kemah
City of Kemah
City of La Marque
City of La Marque
City of La Marque
City of Lake Jackson
City of Lake Jackson
City of League City
City of League City
City of League City
City of League City
City of League City
City of Santa Fe
City of Texas City
Galveston County Commissioner's Court
Galveston County Drainage District 1
Galveston County Drainage District 1
Galveston County Drainage District 2

Name, Position

Sonja Draper, Chief Administrator, Precinct 1
Dude Payne, Commissioner, Precinct 1
David Spoor, Chairman of the Board
Karen Gibson, Secretary
Larry Boyd
Doug Roesler*
Matt Hanks, County Engineer
Clay Forister, Assistant Engineer*
Jessica Stell, OSSF and Nuisance Complaints Supervisor*
Don West
Michael White, Field Operations Coordinator
Bryan Frazier, Director
Mike Mullenweg, Lead Interpretive Ranger and Programs Coordinator*
Joe Ripple, Floodplain Determination & Building Permit Administrator*
Chris Whittaker, City Manager*
Jeff Sifford, Public Works Director
Brent Spier, City Administrator*
Angie Galvan, Secretary
Julie Masters, Mayor*
Sean Skipworth, Mayor*
Chris Armacost, Mayor*
Carl Joiner, Mayor
Wanda Zimmer, City Council
Chaise Cary, Interim City Manager*
Michael Carlson, City Council District C*
Robert Michetich, former City Council District C*
Debbie Webb, Assistant Director of Public Works*
Modesto Mundo, City Manager
Alex Noel, Floodplain and Stormwater Management Coordinator
Jack Murphy, Senior Civil Engineer for Drainage*
Sonia Phillips, Floodplain Administrator/Drainage Engineer*
Eric Combs, Wastewater Pre-Treatment Technician*
Joseph (Joe) Nowetner, Wastewater Senior Plant Operator*
Stacey Baker, Community Services
Doug Kneupper, Engineer
Joe Giusti, Commissioner, Precinct 2
Dennis Wagner, Chairman of Commissioners, Position 1
Phillip Tilinzki
Roland Buchanon

¹ An (*) indicates attendance at one or more meetings.

Galveston County Engineering and Right of Way
Galveston County Health District
Galveston County Health District
Galveston County MUD #12
Galveston County Parks and Cultural Services
Galveston County Road and Bridge

Michael Shannon, County Engineer*
Marty Entringer, Consumer Health Services Manager*
Katie Wilson, Water Program Manager*
Richard Matthews, Board President
Julie Diaz, Director
Lee Crowder, Director

TECHNICAL ADVISORS¹

Organization-Position

Galveston Bay Foundation
Galveston Bay Foundation
Houston-Galveston Area Council
Houston-Galveston Area Council
Houston-Galveston Area Council
Houston-Galveston Area Council
Houston-Galveston Area Council
Houston-Galveston Area Council
Tarleton State University TIAER
Tarleton State University TIAER
Tarleton State University TIAER
Texas A&M AgriLife Extension Service
Texas A&M AgriLife Extension Service
Texas A&M AgriLife Extension Service/Texas Sea Grant
Texas A&M AgriLife Extension Service/Texas Sea Grant
Texas Commission on Environmental Quality GBEP
Texas Commission on Environmental Quality GBEP
Texas Commission on Environmental Quality GBEP
Texas Commission on Environmental Quality
Texas Commission on Environmental Quality
Texas Commission on Environmental Quality
Texas Parks and Wildlife Department
Texas Parks and Wildlife Department
Texas State Soil and Water Conservation Board
Texas State Soil and Water Conservation Board
Texas State Soil and Water Conservation Board
University of Houston Clear Lake
U.S. Department of Agriculture
U.S. Fish and Wildlife Service

Name

Charlotte Cisneros, Advocacy Programs Manager*
Haille Leija, Habitat Restoration Manager
Kendall Guidroz, Environmental Planner*
Justin Bower, Principal Planner*
Daniel Albanese, Program Support*
Jean Wright, Senior Planner*
Steven Johnston, Senior Planner*
Rachel Windham, Senior Planner*
Barbara Bellows, Assistant Research Scientist*
Todd Adams, Research Associate
Jimmy Millican, Assistant Research Scientist*
Jessica Chase, Brazoria County Agricultural and Natural Resources
Phoenix Rogers, Galveston County Agricultural and Natural Resources*

Julie Massey, Coastal and Marine Resources

John O'Connell, Brazoria County Coastal and Marine Resources
Lindsey Lippert, Natural Resource Uses Coordinator*
Lisa Marshall, Program Manager
Christian Rines, Water and Sediment Quality Coordinator*
Tim Cawthon, TMDL Program*
Elizabeth Kompanik, SWQM Aquatic Scientist*
Stacey Carr, SWQM Aquatic Scientist*
Bryan Eastham, Ecosystem Team Lead*
Nicole Plowman, Ecosystem Resources Team*
Brian Koch, Regional Watershed Coordinator*
Mary Smith, Waters Davis SWCD #318
Tony Franklin, Waters Davis SWCD #318 Field Representative
Michael LaMontagne, Assistant Professor of Microbiology*
Chris Morgan, NRCS District Conservationist Angleton*
Cody Dingee, Refuge Manager

¹ An (*) indicates attendance at one or more meetings.



APPENDIX B. 2021 OUTREACH STRATEGIC ACTION PLAN (TASK 2.2)

2021 OUTREACH STRATEGIC ACTION PLAN

GALVESTON BAY COALITION OF WATERSHEDS

WITH TEXAS COMMUNITY WATERSHED PARTNERS,
A PROGRAM OF TEXAS A&M AGRILIFE EXTENSION SERVICE



This project is funded in part by a Texas Coastal Management Program Grant approved by the Texas Land Commissioner pursuant to National Oceanic and Atmospheric Administration Award No. NA19NOS4190106.

EXECUTIVE SUMMARY

Numerous bayous, creeks and streams flowing through Coastal Texas, are considered impaired by the State of Texas for high levels of bacteria and low levels of dissolved oxygen. In the Lower Galveston Bay watershed, major pollution sources include pets and livestock, feral hogs, sanitary sewer overflows and leaks, and malfunctioning on-site sewage facilities, as well as stormwater runoff. The Texas Community Watershed Partners, a program of the Texas A&M AgriLife Extension Service, established the Galveston Bay Coalition of Watersheds (Coalition) as a next step in the effort of regional implementation of watershed based plans (WBPs) for Bastrop, Dickinson, Highland, and Jarbo Bayous. This approach (1) extends limited resources for coordinating implementation efforts, (2) reduces the number of meetings stakeholders are asked to attend, and (3) facilitates the information coordination occurring between watershed groups.

The primary goal of the 2021 Outreach Strategic Action Plan (Plan) is to provide a framework to guide the direction of education and outreach efforts through 2021. A complementary goal is to increase clarity of outreach endeavors for all parties involved in the Coalition to better utilize resources and coordinate efforts. This Plan moves implementation activities forward for two of the three goals established by Coalition stakeholders in 2017 (Table 1):

- Promote widespread community awareness and engagement in the protection and improvement of Coalition watersheds; and
- Work as a team to implement management measures from plans in Coalition watersheds.

This document is organized into 3 major sections. The *Introduction and Background* section reviews Coalition Goals and Action items and provides a brief history of the group, including a list of stakeholders currently represented. The *Implementation- Education and Outreach* section provides the pool of education and outreach project ideas prioritized by Coalition stakeholders. The *Plan Implementation* section outlines the path forward for carrying out implementation activities through 2021, including efforts already underway. A list of outreach resources is included as *Appendix A* and *Appendix B* is a list of reoccurring local events.

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INTRODUCTION AND BACKGROUND

Numerous bayous, creeks and streams flowing through Coastal Texas, are considered impaired by the State of Texas for high levels of bacteria and low levels of dissolved oxygen. The first watershed protection plan (WPP) in the lower Galveston Bay Watershed was for Armand Bayou in 1997. Since then, many state resources have been put toward creating watershed based plans (WBPs) through local stakeholder processes to improve water quality in our coastal waterways. Once these WBPs are approved by state and federal agencies, the burden of implementation falls on local partners. The increase in WPPs and Implementation Plans (I-Plans) over time has created a number of autonomous groups, all with similar goals. After the reformation of the Armand Bayou Watershed Partnership as a 501(c)(3) non-profit, options for the future of the Dickinson Bayou Watershed Partnership were explored. Based on this research, a group with a larger focus, (similar to the Bacteria Implementation Group (BIG)) with support from local governments (like the Plum Creek Watershed Partnership), was identified as a sustainable model for coordinating local watershed efforts.

FORMING THE COALITION

The Galveston Bay Coalition of Watersheds (Coalition) was convened in the spring of 2017 by the Texas Community Watershed Partners, a program of Texas A&M AgriLife Extension Service, with funding from Galveston Bay Estuary Program. The Coalition was created to implement existing watershed based plans for Bastrop, Dickinson, Highland, and Jarbo Bayous (Figure 1.) This approach is meant to reduce burden on stakeholders in implementing watershed based plans by reducing the overall number of meetings they and technical advisors are asked to attend. The Coalition also provides opportunities to increase partnerships between watersheds. These four watersheds have many of the same or similar implementation activities; therefore, working together for the same objective is a more efficient use of all resources.

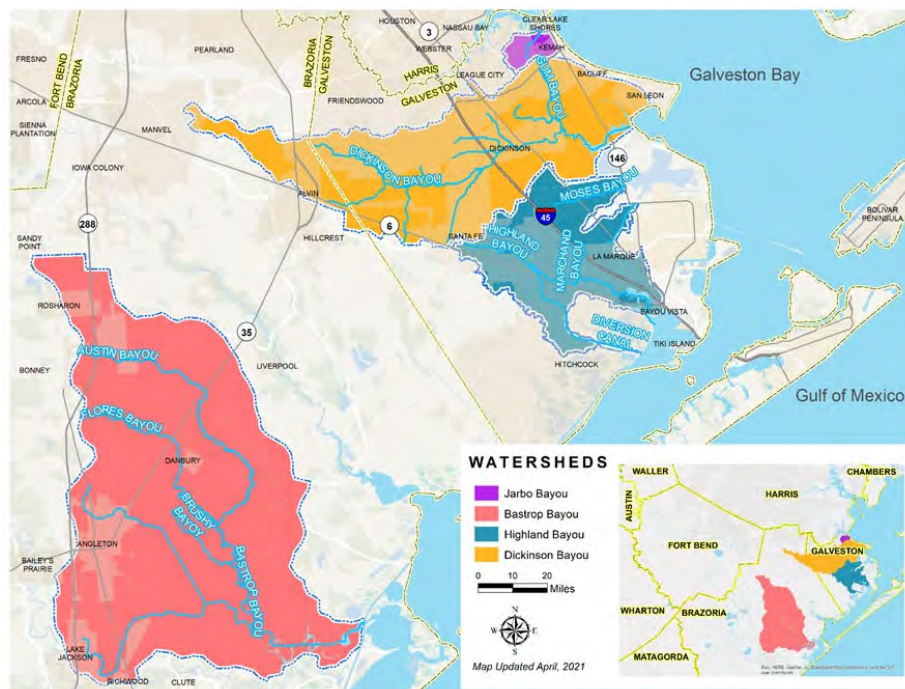


FIGURE 1. GALVESTON BAY COALITION OF WATERSHEDS PARTNER WATERSHEDS

WHO IS THE GALVESTON BAY COALITION OF WATERSHEDS?

The Coalition is open to stakeholders in the Bastrop, Dickinson, Highland, and Jarbo Bayou watersheds. Stakeholders in the Coalition include multiple entities who hold MS4 permits and many who simply have an interest in protecting water resources in Brazoria and Galveston counties. All are committed to a Coalition-wide effort to improve water quality. The Coalition continuously seeks to bring new partners into this effort.

Brazoria County
City of Angleton
City of Clear Lake Shores
City of Dickinson
City of Lake Jackson
City of League City
Galveston Bay Estuary Program (GBEP)
Galveston Bay Foundation (GBF)
Galveston County
Keep Dickinson Beautiful (KDB)
Houston-Galveston Area Council (H-GAC)
Texas A&M AgriLife Extension Service
Texas Commission on Environmental Quality (TCEQ)
Texas Institute for Applied Environmental Research (TIAER)
Texas Parks and Wildlife Department (TPWD)
Texas State Soil and Water Conservation Board (TSSWCB)

PAST HIGHLIGHTS

The Coalition held 10 meetings during the Galveston Bay Estuary Program (GBEP) funded project scope in 2017-2018.

The Galveston Bay Foundation (GBF) and Houston-Galveston Area Council (H-GAC) cohosted an OSSF maintenance workshop in May of 2017 in Bayou Vista to target homeowners in Galveston and Brazoria Counties. In June of 2017, Coalition members had settled on a Vision Statement. Big picture Goals and project focused Action Items were determined.

After Hurricane Harvey impacted all four Coalition watersheds, stakeholders discussed challenges to their communities and unmet needs. Coalition members discussed topics related to both flooding and water quality, and the connection between the two. They wanted to take steps as a group to address misconceptions that arose during and after the storm related to water quality, how water moves across the land, and the impact of impervious surfaces. At the suggestion of a Coalition member and based on feedback at meetings, the Post-Harvey Community Open House has held in February of 2018 in partnership with the GBF. Over fifty people attended and heard two talks, one on water quality by Sarah Gosset (GBF), and one on flooding and land development by Dr. John Jacob (Texas A&M University). Council member Robert Mitchtich (City of La Marque) spoke about the steps the City is taking to make improvements Post-Harvey. Twelve groups also had informational tables set up including the Texas Well Owners Network, Galveston County Health District, Texas Department of Insurance, and the Federal Emergency Management Agency.

In October 2020, the group was reconvened for Coalition WBP implementation, through education and outreach activities, under TXGLO Coastal Management Program funding. Coalition meetings and implementation activities will continue through 2021.



GOALS AND ACTION ITEMS

VISION

Partnering for healthy watersheds.

TABLE 1. GALVESTON BAY COALITION OF WATERSHEDS GOALS AND ACTION ITEMS, DETERMINED AUGUST 2017.

Goals	Action Items
Promote widespread community awareness and engagement in the protection and improvement of Coalition watersheds	<ul style="list-style-type: none"> • Work to establish a household hazardous waste facility for Galveston County • Identify new methods to reach citizens and make real change • Find appropriate advocates to engage local governments/officials • Coordinate with Coalition partners for education and implementation measures
Work as a team to implement management measures from plans in Coalition watersheds	<ul style="list-style-type: none"> • Work with partners to remove debris for Coalition bayous • Determine and pursue dredging needs for Coalition bayous • Support bacteria source tracking projects that benefit Coalition watersheds • Support wastewater infrastructure improvements for public and private entities in Coalition watersheds • Work with partners to reduce FOG & wipes in sanitary sewer systems • Support communities in Coalition watersheds in their efforts to manage development • Promote the use of natural riparian buffers
Ensure the long term funding of the Coalition	<ul style="list-style-type: none"> • Obtain funding for a Coalition Coordinator • Apply for 3 grants per year to support Coalition efforts • Establish a secure local funding mechanism to support Coalition efforts

IMPLEMENTATION- EDUCATION AND OUTREACH

This section includes the specific efforts and educational activities local stakeholders prioritized as most appropriate and feasible for improving water quality in partner watersheds through 2021. The implementation activities outlined in this section were selected to meet several of the established Coalition Goals and Action Items above, based on existing conditions and resources. Several of the established Action Items were grouped together by stakeholders during the planning meetings to form three focus areas:

1. Reduce fats, oils, and grease (FOG) and wipes in sanitary sewer systems
2. Debris in Coalition Bayous and illegal dumping sites
3. Dredging needs for Coalition bayous; erosion control, nutrient reduction, and the management of livestock and large groups of animals; natural riparian buffers and conservation easements.

Implementation activities below are organized by focus area, not in order of significance or implementation timeline. This list of activities will be used by Coalition stakeholders and additional partners to guide implementation efforts through 2021. Additional suggested actions and discussions with stakeholders are welcome to ensure that a robust set of ideas related to water quality are considered.

REDUCE FOG & WIPES IN SANITARY SEWER SYSTEMS

Campaign Name	FOG and Wipes Outreach to Apartment Residents
Description	Share FOG and wipes education materials with apartment residents through apartment management
Delivery	Include outreach materials in welcome packet for new residents; share digital media through apartment management webpages
Materials	One-page handouts; giveaways (Cease the Grease funnels, scrapers, or lids); request for some materials in Spanish
Interested Partners	City of Lake Jackson, City of Dickinson, City of League City, Coastal Communities (H-GAC), Galveston Bay Foundation

Campaign Name	FOG and Wipes Outreach to Homeowners (Digital)
Description	Share FOG and wipes education materials with homeowners through local government communications
Delivery	Share digital media through webpages, newsletters, and social media
Materials	Cease the Grease and Patty Potty digital downloads
Interested Partners	City of Lake Jackson, City of League City, Coastal Communities (H-GAC), Galveston Bay Foundation

Campaign Name	FOG and Wipes Interactive Booth at In-Person Event
Description	Share FOG and wipes education materials and demonstrations with the general public
Delivery	Host table at farmer's market or trade show with educational activities, including a demonstration of what FOG is by cooking or proper disposal. Activities will vary based on event type and other restrictions; share nearby collection locations when applicable
Materials	Wipes versus toilet paper in water demonstration; FOG interactive game; giveaways (Cease the Grease funnels, scrapers, or lids)
Interested Partners	Keep Dickinson Beautiful, City of Lake Jackson, City of League City, Coastal Communities (H-GAC), Galveston Bay Foundation

Campaign Name	FOG Collection Point/Receptacle Awareness and Additions
Description	Host in-person meeting with Keep Beautiful affiliates and similar organizations
Delivery	Meeting presentation on FOG with shared stories from those who host local collection receptacles
Materials	Display of materials and demonstration options if attendees are interested in delivering outreach - wipes versus toilet paper in water demonstration; FOG interactive game; giveaways (Cease the Grease funnels, scrapers, or lids)
Interested Partners	Keep Dickinson Beautiful, Coastal Communities (H-GAC), Galveston Bay Foundation

DEBRIS IN COALITION BAYOUS AND ILLEGAL DUMPING

Campaign Name	Tire Drop Off and Abandoned Tire Awareness
Description	Share locations and instructions on how to dispose of used tires or who to notify when you see them abandoned
Delivery	Share digital media through webpages, newsletters, and social media
Materials	
Interested Partners	Keep Dickinson Beautiful, City of Dickinson, Brazoria County, Galveston County, Coastal Communities (H-GAC)

Campaign Name	General Illegal Dumping Outreach
Description	Outreach to the general public on problems associated with illegal dumping, how to report illegal dumping, and how we are connected to local bayous and Galveston Bay
Delivery	Share information with general public through social media and additional means that become feasible, from movie theatre advertisements before the movie to boat parade events
Materials	Galveston Bay Action Network, Back the Bay, Coastal Communities
Interested Partners	Keep Dickinson Beautiful, City of Dickinson, Brazoria County, Galveston County, Coastal Communities (H-GAC)

DREDGING - EROSION CONTROL - RIPARIAN BUFFERS

Campaign Name	Policy decisions regarding drainage practices
Description	Outreach to policy makers on policy decisions regarding dredging, drainage practices and erosion control, including post-Harvey status/actions
Delivery	Educational workshop targeted to city leaders/officials; may include boat ride for local officials
Materials	Drone flight footage of local bayous to include in presentation as alternative to boat ride
Potential Partners	Brazoria County, Galveston County, TPWD, Drainage Districts

Campaign Name	Misconceptions about Bayous, Dredging, and Land Use
Description	Outreach to the general public on bayous versus rivers and dredging versus drainage maintenance
Delivery	Share information with general public through social media, live events, or an educational workshop to address misconceptions surrounding the natural hydrology of bayous, dredging, and maintenance
Materials	Include local data where available (e.g. topography, bathymetry, cross section, etc.)
Potential Partners	Brazoria County, Galveston County, Drainage Districts, USACE

ACTIVITIES PRIORITIZED FOR FUTURE EFFORTS

Several of the education and outreach activities prioritized by stakeholders were not considered feasible for implementation during 2021 due to timing, lack of resources, or other limitations. They are documented below for consideration during future efforts.

Campaign Name	FOG and Wipes Outreach to Utility District Residents
Description	Share FOG and wipes education materials with residents through Utility District Communications
Delivery	Share digital media through webpages, newsletters, and social media
Materials	Cease the Grease and Patty Potty digital downloads
Potential Partners	

Campaign Name	Video or Art Contest for Students
Description	Host a video or art contest for students on litter or illegal dumping
Delivery	Share digital media through webpages, newsletters, and social media; in-person events for Earth Day, Bay Day, or similar
Materials	
Potential Partners	Brazoria and Galveston County 4H Groups

Campaign Name	Direct Interested Groups to Established Litter Prevention Programs
Description	Direct communities and other interested groups to established litter prevention programs for adding additional pickup sites, build awareness for volunteers, or partner in related efforts
Delivery	Host meeting to facilitate introductions
Materials	
Potential Partners/Resources	Plastics Pollution Prevention Partnership (P3), Partners in Litter Prevention, Trash Bash through H-GAC, Trash Free Texas, statewide waterway trash and marine debris database by HARC

Campaign Name	Abandoned Vessel Prevention and Notification
Description	Publicize abandoned vessel drop off events in Brazoria and Galveston counties; share information on how to report abandoned vessels
Delivery	Share digital media through webpages, newsletters, and social media; share printed media with TPWD during in-person boat registration; signage at boat ramps
Materials	
Potential Partners/Resources	Brazoria County, Galveston County, TX GLO, TPWD, Galveston Bay Foundation

Campaign Name	Adjacent Landowners and Land Management Practices
Description	Share information with landowners adjacent to any waterway on riparian buffers, various household-based low impact development (LID) and erosion control measures on their land
Delivery	
Materials	
Potential Partners	Galveston Bay Foundation, Natural Resource Conservation Service, Texas State Soil and Water Conservation Board, TPWD

Campaign Name	Boaters and Shoreline Erosion
Description	Outreach to boaters regarding boater responsibility and shoreline erosion
Delivery	
Materials	
Potential Partners	

PLAN IMPLEMENTATION

Given the widespread nature of nonpoint source pollution, programs exist at various levels that apply to Coalition watersheds. This Plan is not intended to be an exhaustive description of every effort, program, or initiative to address nonpoint source pollution occurring in Coalition watersheds.

The implementation activities outlined in this plan, provide the framework, and will guide the direction of education and outreach efforts performed by the Coalition through 2021. Additionally, the Plan identifies available targeted outreach materials, determines new practices to improve the delivery and impact of efforts, and highlights actions the Coalition will take over the next several months to execute this plan. At the same time, the plan allows for refinement, supplementation, and flexibility as Coalition efforts evolve.

Coalition stakeholders are already moving forward on several of the implementation activities presented in this plan:

- FOG and Wipes Interactive Booth at In-Person Events – Market on the Bayou in Dickinson, TX on May 1, 2021 will be the first effort under this implementation activity. Keep Dickinson Beautiful will host a table at the market that includes several FOG and wipes educational displays and interactive games. The Houston-Galveston Area Council will provide the interactive game and Galveston Bay Foundation is providing FOG giveaway items. Keep Dickinson Beautiful may choose to repeat this effort during future market events.
- FOG and Wipes Outreach to Apartment Residents – City of Lake Jackson Code Enforcement has communicated with apartment managers to gauge their interest in distributing FOG and wipes education to new residents. Managers are willing to distribute materials in welcome packages to new residents. Materials will be distributed to managers in early summer once messaging is confirmed and materials are obtained.
- FOG Collection Point/Receptacles Awareness and Additions –There are three FOG collection receptacles in Coalition watersheds, two are hosted by active Coalition stakeholders who are willing to share their experiences. A list of Keep Beautiful affiliates and similar organizations within the Coalition has been created for outreach for an educational meeting on FOG, collection locations, and shared stories from Coalition stakeholders who currently host collection receptacles.
- Tire Drop Off and Abandoned Tire Awareness – The City of Dickinson offers a free drop off location for tires to Galveston County residents the first Monday of every month. Tire drop off was suspended due COVID-19 restrictions. They have opened back up again giving a good opportunity to publicize. Coalition stakeholders will share drop off information through digital media. Several other Keep Beautiful affiliates within Coalition watersheds have hosted tire drop off events in the past 24 months. The Coalition will work with Brazoria and Galveston counties to inquire about other drop off opportunities to publicize.

Stakeholders are in various stages of planning, whether to garner interest within their organization or obtain the information or materials necessary. The Coalition will continue to meet on a reoccurring basis during implementation. Outreach to prospective stakeholders are ongoing to share lessons learned and duplicate efforts across Coalition watersheds where feasible.

APPENDIX A. AVAILABLE OUTREACH RESOURCES

Several organizations represented in the Coalition have developed resources and tools for education and outreach on water quality in the Galveston Bay region. The following list of resources are items brought up by Coalition stakeholders during recent project planning meetings.

Cease the Grease, Galveston Bay Foundation

Map of used cooking oil recycling locations	http://ceasethegrease.net/
Partner toolkit (social media posts, etc.)	http://ceasethegrease.net/partner-toolkit/
Giveaway items (funnels and scrapers)	Availability is contingent on funding

Coastal Communities, H-GAC

FOG materials available for printing	https://www.coastalcommunitiestx.com/h-gacs-featured-materials.html
Outreach messages by month (social media posts, bill inserts, etc.); FOG, wipes, and other topics	https://www.coastalcommunitiestx.com/the-roadmap-messages.html
Don't feed the grease monster exhibit	Available to borrow upon request

Project our Pipes, City of Houston

Example city webpage and outreach materials	https://www.publicworks.houstontx.gov/protect-our-pipes
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Patty Potty, Save Water Texas Coalition

Social media images to share	https://www.pattypotty.com/media/
Various customizable outreach materials for purchase	https://www.pattypotty.com/products/

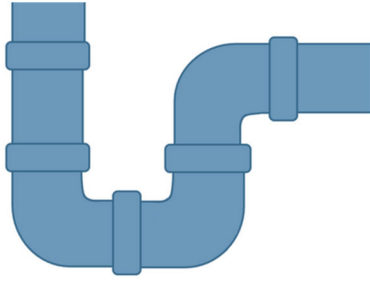
APPENDIX B. LOCAL EVENTS LIST

Several reoccurring in-person events in Coalition watersheds provide additional opportunities for outreach. While some of the 2021 dates have passed, this list provides options for implementation efforts at established local events in the future.

Name	Date	City	Occurrence
Market on the Bayou	First Saturday	Dickinson, TX	Monthly
Bridal Show	January 13, 2021	Lake Jackson, TX	Annual
Mardi Gras Boat Parade	February 6, 2021	Kemah, TX	Annual
Bigass Crawfish Bash	March 27, 2021	La Marque, TX	Annual
Dickinson Little Italy Festival of Galveston County	March 19, 2022	Dickinson, TX	Annual
Fish Fry at local VFW and Knights of Columbus	Fridays during Lent	Multiple	Annual
Space City Cruisers Car Show	April 3, 2021	La Marque, TX	Annual
Vintage Market Days of Southwest Houston	April 9-11, 2021	Angleton, TX	Annual
Galveston County Fair and Rodeo	April 16-24, 2021	Hitchcock, TX	Annual
League City Music Festival	May 1, 2021	League City, TX	Annual
National Trails Day	June 5, 2021	League City, TX	Annual
Bay Day Festival	May 15, 2021	Kemah, TX	Annual
Vintage Market Days of Southwest Houston	August 27-29, 2021	Angleton, TX	Annual
Eco Fest	September 18, 2021	League City, TX	Annual
Harvest Festival	October 2021	League City, TX	Annual
National Night Out	October 1, 2021	League City, TX	Annual
Taste of the Bay - Octoberfest	October 7, 2021	League City, TX	Annual
Brazoria County Fair	October 15, 2021	Angleton, TX	Annual
America Recycles Day	November 15, 2021	League City, TX	Annual
Christmas Boat Lane Parade	December	League City, TX	Annual
Gator Bayou Lighted Boat Parade	December	Dickinson, TX	Annual
Hitchcock Winter Fest	December 3-4, 2021	Hitchcock, TX	Annual
Christmas Boat Parade	December 11, 2021	Kemah, TX	Annual



APPENDIX C. OUTREACH MATERIALS



When cooking waste like fats, oils, and grease (FOG) go down the drain, it damages and clogs pipes. Clogged pipes cause sewer overflows where raw sewage can back up into your home, lawn, neighborhood, streets, and our local bayous. Clogged pipes can be a very expensive problem to fix.

PROTECT YOUR PIPES

WHAT YOU CAN DO:

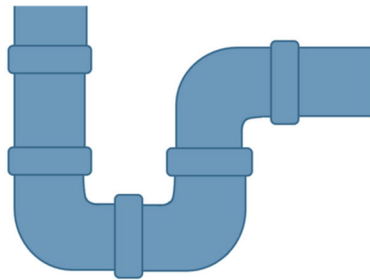
- Clean up cookware with a paper towel before rinsing
- Place FOG in covered (sealable) collection containers
- Once collection containers are full, dispose of in the trash
- Avoid using the garbage disposal and scrape food scraps into the trash
- Cover the kitchen sink drain with a catch basket and empty into the trash
- Learn more at ceasethegrease.net

Drop off Used Cooking Oil for Recycling:

City of Lake Jackson Mulch Site
103 Canna Lane, Lake Jackson, TX
Tues-Fri: 8:30-11:45 am and 1:15-4:30 pm
Sat: 8:30 am-3:30 pm



www.lakejackson-tx.gov/



When cooking waste like fats, oils, and grease (FOG) go down the drain, it damages and clogs pipes. Clogged pipes cause sewer overflows where raw sewage can back up into your home, lawn, neighborhood, streets, and our local bayous. Clogged pipes can be a very expensive problem to fix.

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103 Canna Lane, Lake Jackson, TX
Tues-Fri: 8:30-11:45 am and 1:15-4:30 pm
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www.lakejackson-tx.gov/

DO NOT FLUSH

HAIR	ALL PURPOSE CLEANING WIPES	DENTAL FLOSS
DIAPERS	ADHESIVE BANDAGES	CIGARETTES
PAPER TOWELS	MAKEUP REMOVER WIPES	COTTON BALLS
FACIAL TISSUE	MEDICATIONS	Q-TIPS
COTTON SWABS	GUM WRAPPERS	SCOOPES OF KITTY LITTER
BABY WIPES	FLUSHABLE WIPES	WOMEN'S HYGIENE PRODUCTS
GUM WRAPPERS	CANDY	FACIAL PADS

Toilets Are Not Trashcans

Please only flush - PEE, POO, and (toilet) PAPER



GALVESTON BAY
FOUNDATION

This project is funded in part by a Texas Coastal Management Program Grant approved by the Texas Land Commissioner pursuant to National Oceanic and Atmospheric Administration Award No. NA19NOS4190106.

DO NOT FLUSH

HAIR	ALL PURPOSE CLEANING WIPES	DENTAL FLOSS
DIAPERS	ADHESIVE BANDAGES	CIGARETTES
PAPER TOWELS	MAKEUP REMOVER WIPES	COTTON BALLS
FACIAL TISSUE	MEDICATIONS	Q-TIPS
COTTON SWABS	GUM WRAPPERS	SCOOPES OF KITTY LITTER
BABY WIPES	FLUSHABLE WIPES	WOMEN'S HYGIENE PRODUCTS
GUM WRAPPERS	CANDY	FACIAL PADS

Toilets Are Not Trashcans

Please only flush - PEE, POO, and (toilet) PAPER



GALVESTON BAY
FOUNDATION

This project is funded in part by a Texas Coastal Management Program Grant approved by the Texas Land Commissioner pursuant to National Oceanic and Atmospheric Administration Award No. NA19NOS4190106.

Put fats, oils, grease, and food scraps
in the trash, NOT down the drain.

PROTECT YOUR PIPES

Clogged and broken pipes allow raw sewage to
back up into your home, lawn, neighborhood,
streets, and our local bayous.



WHAT CAN YOU DO?

Cool it.
Let fats, oils,
and grease cool.

Can it.
Pour into a covered,
disposable container.

Trash it.
Throw it in
the trash.

Learn more at
ceasethegrease.net





TOILETS ARE NOT TRASHCANS!

“Flushable” wipes
DO NOT break down
like regular toilet paper.

Please only flush the 3 P’s:

- Poop
- Pee
- Paper (Toilet)

DO NOT FLUSH

- | | |
|----------------------|--------------------------|
| Hair | Medications |
| Diapers | Gum Wrappers |
| Paper Towels | Flushable Wipes |
| Tissues | Dental Floss |
| Cotton Swabs | Cigarettes |
| Baby Wipes | Cotton Balls |
| Cleaning Wipes | Kitty Litter |
| Bandages | Women’s Hygiene Products |
| Makeup Remover Wipes | Facial Cleansing Pads |



THIS PROJECT IS FUNDED IN PART BY A TEXAS COASTAL MANAGEMENT PROGRAM GRANT APPROVED BY THE TEXAS LAND COMMISSIONER PURSUANT TO NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION AWARD NO. NA19NOS4190106.

SOCIAL MEDIA TOOLKIT

TOPIC: FATS, OILS, GREASE (FOG) AND WIPES IN SANITARY SEWER SYSTEMS

OVERVIEW

Fats, oils, and grease (FOG) come from meat fats, cooking oil, shortening, lard, butter, margarine, gravy, mayonnaise, salad dressings, sour cream, and other products.

In our pipes, FOG clings to materials, such as wipes that have been flushed or roots that have infiltrated sewer pipes underground, to create clogs. These clogs can cause sewer pipes to break, bringing untreated wastewater back up into homes and businesses or into our neighborhoods. When manholes overflow into parks, yards, streets, and storm drains, FOG and bacteria can contaminate local waters, including drinking water. Exposure to untreated water is a serious health hazard.

Communities spend BIG every year unplugging or replacing grease-blocked pipes, repairing pump stations, and cleaning up costly wastewater spills.

Keeping FOG, wipes and other items out of our pipes helps everyone and protects our local bayous too.

THE TOOLKIT

We understand you are creating a social media presence to best represent your organization. Images mean different things to different people. We've included newly created and existing content established by others in our region, for you to choose from. The toolkit contains:

- already-made sample text under three categories: generic, holiday, and cooking oil recycling;
- links to download Coalition developed graphics and those developed by other organizations;
- a hashtag library; and background information on fats, oils, and grease for those creating social media posts.

Join us for a social media push to reduce FOG and wipes from going down the drain. Share these materials as is or modify them to fit your needs.

SAMPLE TEXT

Use or modify text and combine with the *Graphics to Share* below.

GENERAL FOG AND WIPES

Sanitary sewer systems transport waste from our homes and businesses to wastewater treatment facilities. Did you know that overflows in these systems, called Sanitary Sewer Overflows, lead to thousands of gallons of raw sewage and waste in our regions streets and waters every month? You can help reduce the amount of untreated wastewater entering our local bayous from sanitary sewer overflows by protecting your pipes. Throw fats, oils, and grease (FOG) in the trash. Cool it. Can it. Trash it.

FOG (fats, oils, and grease) belong in the trash, not down the drain. FOG clogs pipes inside our homes and outside in our sewer system. Protect your home and our local bayous: (1) pour FOG into an empty jar or can (2) allow it to cool and solidify (3) throw it in the trash

Protect our local bayous by preventing clogs in our pipes. Keep FOG (fats, oils, and grease) out of the sewer system!

Avoid the drain of costly sewer backups on private sanitary sewer lines and public sanitary sewer mains. Broken pipes release untreated water and bacteria into our neighborhoods and local bayous. Toss fats, oils, grease, food scraps, and wipes in the trash. Contain it, don't drain it.

You may think that when you flush your toilet or empty your sink that it isn't your problem anymore, but that's not the case. Your home's sewer pipes run far, eventually feeding into a larger pipe which goes into a sanitary manhole, before it heads toward the wastewater treatment plant.

That's why what you flush and put down your sink can affect you and your neighbor. Avoid putting fats, oils, grease, and all wipes (yes, even 'flushable' ones) into your sewer system.

HOLIDAY SPECIFIC

FOG from butter, gravy, oil, and sauces can look like harmless liquids, but when it is poured down the drain, it becomes thick and sticky, clogging pipes and causing sewer backups in your home. Instead of pouring it down your drain, dispose of FOG by COOLING IT, CANNING IT, and TRASHING IT.

Fats, oils, and grease (FOG) can clog pipes in your home and pipes further down the line, causing backups and breaks. Did you know that [insert organization name here] sees an increase in problems caused by FOG during the holiday season? Protect your pipes by throwing fats, oils, and grease in the trash, not down the drain.

Don't let fats, oils, and grease (FOG) become a pain in your drain. As you cook your holiday meals, remember, COOL IT, CAN IT, AND TRASH IT. Broken pipes in our streets release untreated wastewater into our neighborhoods and local bayous. Protect your pipes.

COOKING OIL RECYCLING SPECIFIC

Why should you recycle grease?

Keeping oil out of your pipes will help reduce the stop-ups in your drains and down the line, helping you, your neighbors and the city avoid costly plumbing bills. Clogs and broken pipes also bring untreated wastewater into our neighborhoods and our local bayous. You can collect cooking oil in a container with a lid and throw it in the trash. OR We have a place for you to recycle used cooking oil.

[insert link to your local recycling location here; Examples.....
Lake Jackson: <https://goo.gl/maps/HLRdA3UNWVtXVF7V8> and
Dickinson: <https://goo.gl/maps/JoQp1t3bCoqdtbpa6>]

What do you do with cooking oil if you shouldn't put it down the drain?

Throw it in the trash or recycle it. [waste company name here] has collected and processed [# of gallons here] of cooking oil from our recycling location from [timeframe here, e.g. in 2021, over x # of months,...]. Bring your cooking oil to our recycling drop off location. Preventing cooking oil from going down your drain also prevents broken pipes down the line and untreated wastewater from entering our neighborhoods and local bayous.

[insert link to your recycling location here; Examples.....
Lake Jackson: <https://goo.gl/maps/HLRdA3UNWVtXVF7V8> and
Dickinson: <https://goo.gl/maps/JoQp1t3bCoqdtbpa6>]

GRAPHICS TO SHARE

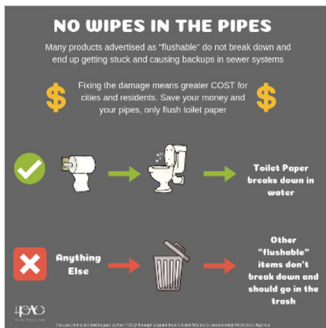
Combine these images and videos with the *Sample Text* above or with your own text.



> Download these images +more from the Galveston Bay Coalition of Watersheds.

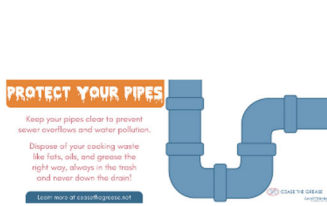
<https://agriflife.org/coalitionofwatersheds/fog-wipes-digital-files/>

<https://u.tamu.edu/SocialMediaToolkit>

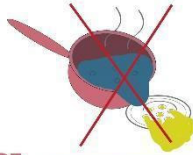


> Download these images +more from H-GAC's Coastal Communities.

<https://www.coastalcommunitiestx.com/the-roadmap-messages.html>



MYTH: Grease blockages can be cleared by pouring hot water down the drain.



FACT: Once grease goes into the drain and cools, it sticks to the pipes & is there to stay.



MYTH: It is okay to pour cooking oil down the drain since it is liquid.



FACT: Liquid cooking oil contributes to blockage in pipes just like fats and greases.



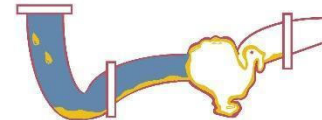
MYTH: Pouring dish soap down the drain helps to clear grease.



FACT: Soap loses its effectiveness and the grease will solidify and congeal in pipes.



DO NOT LET GREASE GOBBLE UP YOUR PIPES THIS THANKSGIVING!



> Download these images +more from Cease the Grease.

<http://ceasethegrease.net/partner-toolkit/>

Tag @GalvestonBayFoundation



> Download these images +more from Patty Potty.

<https://www.pattypotty.com/media/>

Tag @nowipes; Patty has asked we tag her in our Patty Potty posts

HASHTAG LIBRARY

Add to *Sample Posts* above.

ALL PIPES

#ProtectYourPipes #DefendYourDrains #NoClogsInThePipes

FOG, KITCHEN SINK

#NoFatsOilsGrease #CeasetheGrease #DontFeedTheGreaseMonster

WIPES, TOILET

#Wipes #NoWipes #NoWipesDownPipes #What2Flush #3Ps

WATER QUALITY

#BackTheBay #EyesOnGalvBay #waterquality #cleanwater #water
#BastropBayou #HighlandBayou #DickinsonBayou #JarboBayou

LOCATION SPECIFIC

Don't forget your organization hashtags!

MORE SOCIAL MEDIA RESOURCES

- Coastal Communities (Houston-Galveston Area Council) – [Outreach Messages](#)
- Cease the Grease (Galveston Bay Foundation) – [Partner Tool Kit](#), [Social Media Graphics](#), [Video](#)
- Patty Potty – [Social Media Graphics](#) and Shareable Content on [Twitter](#), [Facebook](#). Please tag Patty (@nowipes) if you share her content.
- Example webpage and outreach materials:
 - [Defend your Drains](#), North Central Texas Council of Governments (NCTCOG)
 - [Protect our Pipes](#), City of Houston
 - [Cease the Grease](#), City of League City
 - [FOG \(Fats, Oils, and Grease\)](#), City of Pearland
- Search for related posts on social media platforms using hashtags from the library above

THE GALVESTON BAY COALITION OF WATERSHEDS

Numerous bayous, creeks and streams flowing through Coastal Texas, are considered impaired by the State of Texas for high levels of bacteria and low levels of dissolved oxygen. The [Galveston Bay Coalition of Watersheds](#) (Coalition) includes local stakeholders from both Brazoria and Galveston counties within the Bastrop, Dickinson, Highland, and Jarbo Bayou watersheds. One of the Coalition’s goals is to promote widespread community awareness and engagement in the protection and improvement of Coalition watersheds.



This project is funded in part by a Texas Coastal Management Program Grant approved by the Texas Land Commissioner pursuant to National Oceanic and Atmospheric Administration Award No. NA19NOS4190106.



APPENDIX D. STATE OF WATER QUALITY FOR COALITION WATERSHEDS (TASK 4.2)

STATE OF WATER QUALITY FOR COALITION WATERSHEDS

GALVESTON BAY COALITION OF WATERSHEDS

WITH TEXAS COMMUNITY WATERSHED PARTNERS,
A PROGRAM OF TEXAS A&M AGRILIFE EXTENSION SERVICE



This project is funded in part by a Texas Coastal Management Program Grant approved by the Texas Land Commissioner pursuant to National Oceanic and Atmospheric Administration Award No. NA19NOS4190106.

EXECUTIVE SUMMARY

Numerous bayous, creeks and streams flowing through Coastal Texas, are considered impaired by the State of Texas for high levels of bacteria and low levels of dissolved oxygen. In the Lower Galveston Bay watershed, major pollution sources include pets and livestock, feral hogs, sanitary sewer overflows and leaks, and malfunctioning on-site sewage facilities, as well as stormwater runoff. The Texas Community Watershed Partners, a program of the Texas A&M AgriLife Extension Service, established the Galveston Bay Coalition of Watersheds (Coalition) as a next step toward regional implementation of existing watershed based plans (WBPs) for Bastrop, Dickinson, Highland, and Jarbo Bayous. The Coalition is a group of stakeholders from the four Coalition watersheds, representing communities and organizations in both Brazoria and Galveston counties. This multi-watershed approach (1) extends limited resources for coordinating implementation efforts; (2) reduces the redundancy of programs in the region; (3) facilitates coordination between watershed groups; and (4) creates a unified message for outreach. Implementation of management measures in existing WBPs through the Coalition is anticipated to prevent degradation of water quality and reduce pollutant loads through education and outreach initiatives.

This initial State of Water Quality report for Coalition watersheds serves as a benchmark to assess water quality improvements over time, during successive implementation activities. Texas Community Watershed Partners staff compiled and evaluated quality assured water quality data from the Houston-Galveston Area Council Clean Rivers Program for the Coalition watersheds collected between January 2019 and October 2020. The State of Water Quality will inform the next cycle of implementation activities and continue to move the goals and action items established by Coalition stakeholders forward.

This document is organized into four sections. The *Introduction and Background* section introduces the Coalition and provides a brief history of the group, including a list of stakeholders currently represented. The *Water Quality and Standards* section provides information on the regulatory standards. The *Monitoring Results* section outlines the state of water quality for each Coalition watershed. The *Water Quality Improvements* section includes more on using local water quality data to guide implementation activities. A list of references is included as *Appendix A*.

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INTRODUCTION AND BACKGROUND

Numerous bayous, creeks and streams flowing through Coastal Texas, are considered impaired by the State of Texas for high levels of bacteria and low levels of dissolved oxygen. In the Lower Galveston Bay watershed, major pollution sources include pets and livestock, feral hogs, sanitary sewer overflows and leaks, and malfunctioning on-site sewage facilities, as well as stormwater runoff. The first watershed protection plan (WPP) in the lower Galveston Bay Watershed was for Armand Bayou in 1997. Since then, many state resources have been put toward creating watershed based plans (WBPs) through local stakeholder processes to improve water quality in our coastal waterways. Once these WBPs are approved by state and federal agencies, the burden of implementation falls on local partners. The increase in WPPs and Implementation Plans (I-Plans) over time has created a number of autonomous groups, all with similar goals. After the reformation of the Armand Bayou Watershed Partnership as a 501(c)(3) non-profit, options for the future of the Dickinson Bayou Watershed Partnership were explored. Based on this research, a group with a larger focus, (similar to the Bacteria Implementation Group (BIG)) with support from local governments (like the Plum Creek Watershed Partnership), was identified as a sustainable model for coordinating local watershed efforts.

The Texas Community Watershed Partners, a program of the Texas A&M AgriLife Extension Service, established the Galveston Bay Coalition of Watersheds (Coalition) as a next step toward regional implementation of existing WBPs for Bastrop, Dickinson, Highland, and Jarbo Bayous. The Coalition is a group of stakeholders from the four Coalition watersheds, representing communities and organizations from both Brazoria and Galveston counties. This multi-watershed approach (1) extends limited resources for coordinating implementation efforts; (2) reduces the redundancy of programs in the region; (3) facilitates coordination between watershed groups; and (4) creates a unified message for outreach. In 2021, the Coalitions developed a Outreach Strategic Action Plan (SAP) to provide a framework to guide the direction of education and outreach efforts. A complementary goal of the SAP is to increase clarity of outreach endeavors for all parties and to better utilize resources through coordinated efforts. Implementation of management measures in existing WBPs through the Coalition is anticipated to prevent degradation of water quality and reduce pollutant loads.

This initial State of Water Quality report serves as a benchmark to assess water quality improvements over time, during successive implementation activities. Texas Community Watershed Partners staff compiled and evaluated quality assured data from the Houston-Galveston Area Council Clean Rivers Program for the Coalition watersheds collected during this project timeline. Resources within existing WBPs (maps and watershed demographics) were utilized within this report to limit the creation of new materials. This State of Water Quality will inform the next cycle of implementation activities and continue to move the goals and action items established by Coalition stakeholders forward.

Water quality data used for analysis in this report were provided by the Houston-Galveston Area Council and collected under a TCEQ-approved Quality Assurance Project Plan (QAPP). Data represents actively monitored stations in Coalition watersheds from January 2019 through October 2020. Data through December 2021 is being processed by H-GAC during the time of this report and is not yet available for use.

WHO IS THE GALVESTON BAY COALITION OF WATERSHEDS?

The Coalition was convened in the spring of 2017 with funding from the Galveston Bay Estuary Program. The Coalition was formed to implement existing watershed based plans for Bastrop, Dickinson, Highland, and Jarbo Bayous (Figure 1). This approach is meant to reduce burden on stakeholders in implementing watershed based plans by reducing the overall number of meetings they and technical advisors are asked to attend. The Coalition also provides opportunities to increase partnerships between watersheds. These four watersheds have many of the same or similar implementation activities; therefore, working together for the same objective is a more efficient use of all resources.

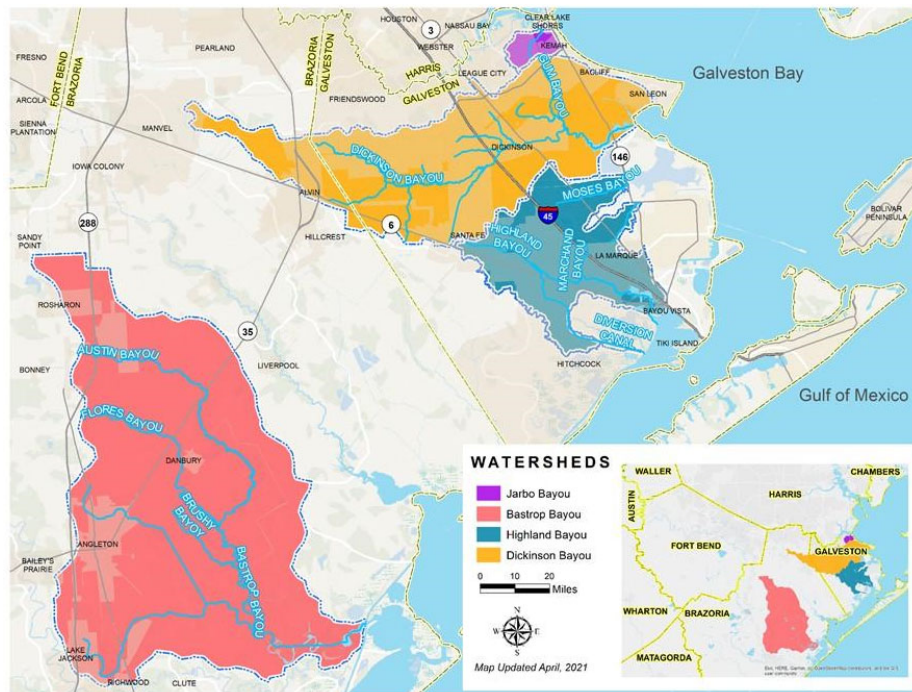


FIGURE 1. GALVESTON BAY COALITION OF WATERSHEDS PARTNER WATERSHEDS

The Coalition is open to stakeholders in the Bastrop, Dickinson, Highland, and Jarbo Bayou watersheds. Stakeholders in the Coalition include multiple entities who hold Municipal Separate Storm Sewer (MS4) permits and others who simply have an interest in protecting water resources in Brazoria and Galveston counties. All are committed to a Coalition-wide effort to improve water quality. The Coalition continuously seeks to bring new partners into this effort.

- Brazoria County
- City of Angleton
- City of Dickinson
- City of Hitchcock
- City of Lake Jackson
- City of League City
- Galveston Bay Estuary Program (GBEP)
- Galveston Bay Foundation (GBF)

- Galveston County
- Keep Dickinson Beautiful (KDB)
- Houston-Galveston Area Council (H-GAC)
- Texas A&M AgriLife Extension Service
- Texas Commission on Environmental Quality (TCEQ)
- Texas Institute for Applied Environmental Research (TIAER)
- Texas Parks and Wildlife Department (TPWD)
- Texas State Soil and Water Conservation Board (TSSWCB)

WATER QUALITY AND STANDARDS

Water quality refers to the physical characteristics of water and the degree to which it contains chemical or biological contaminants.

Water quality standards are numeric benchmarks that surface water must meet in order to be used safely. These standards have been established through research studies, and they vary according to the intended purpose for the water. Water quality standards are set and enforced by various authorities, including the Texas Commission on Environmental Quality (TCEQ). All major waterbodies in Texas are classified by TCEQ into basins and segments. Stream segments are assigned a designated use and an associated water quality standard. The predominant use for segments in Coalition watersheds is primary contact recreation, the most stringent use class after drinking water sources.

When the physical, chemical, or biological condition of a body of water exceeds acceptable limits for its designated use, it is considered impaired and is included in a list of impaired waterways (referred to as the 303(d) list of the Integrated Report). Local stakeholders in the Coalition implement management measures in an effort to reduce bacteria levels under the thresholds set by the State in support of improved water quality.

POLLUTANT OF CONCERN - BACTERIA

Bacteria and nutrients are a normal and important part of a healthy aquatic ecosystem. However, when any of these exceeds acceptable concentrations, they become harmful and are considered pollutants.

The most common surface water impairment in Texas is bacteria. Water quality analysis test for specific bacteria species found in the intestines of warm-blooded animals, referred to as indicator bacteria. The presence of indicator bacteria implies the presence of fecal matter, pathogenic bacteria, and viruses in the water. In the case of tidally influenced waterways, the indicator *Enterococcus* is used. *Escherichia coli* (*E. coli*) is used as the fecal bacteria indicator in freshwater segments.

Potential sources of indicator bacteria can be divided into two categories: regulated and unregulated. Sources that are regulated have permits under the Texas Pollutant Discharge Elimination System (TPDES) and National Pollutant Discharge Elimination System (NPDES) programs. Regulated sources under these programs are wastewater treatment facility discharges and stormwater discharges generated by industry, construction operations, and municipal separate stormwater sewer systems (MS4s). Unregulated sources are typically nonpoint sources where the pollution originates from multiple locations and is carried to surface waters by rainfall runoff. Nonpoint sources are not regulated by a permit.

The TCEQ limit for primary contact recreation is 35 per 100 mL (geometric mean) and 130 per 100 mL (single sample) for *Enterococcus* in saltwater segments and 126 per 100 mL (geometric mean) and 399 per 100 mL (single sample) for *E. coli* in freshwater segments (30 Texas Administrative Code §307.7, 2018). Waterbodies that do not meet this standard are considered “not supporting” of primary contact recreation uses. Contact recreation is defined as “recreational activities involving a significant risk of ingestion of water, including wading by children, swimming, water skiing, diving, and surfing”.

MONITORING RESULTS

Water quality data used for analysis in this report were provided by the Houston-Galveston Area Council, obtained from the TCEQ Surface Water Quality Monitoring Information System (SWQMIS), and collected under a TCEQ-approved QAPP. The data represents routine ambient data collected in Coalition watersheds from January 2019 through October 2020.

Bacteria continues to be the most widespread and pervasive pollutant in the Houston-Galveston region (H-GAC 2021). Observed values of *E. coli* and Enterococci collected from Coalition watersheds exceeded the standard or screening level in more than 50% of samples during the project period.

Figures 2 and 3 show the average Enterococci counts at the furthest downstream monitoring station¹ for each Coalition watershed in 2019 and 2020. Every Coalition watershed exceeded the 130 per 100 mL (single sample) standard at the furthest downstream station at least once in 2019 (Figure 2). Of the forty-eight samples collected at these downstream stations, eleven exceeded the 130 per 100 mL standard. The four highest Enterococci counts (all greater than 1500 MPN/100mL), were taken in October of 2019, one day after the last recorded precipitation. In 2020, there was no data available for the furthest downstream station in Bastrop Bayou; this watershed is not included in Figure 3. Enterococci counts remained below the standard for all downstream stations throughout 2020 with the exception of the Highland Bayou Diversion Canal watershed which had an Enterococci count of 800 in January (Figure 3).

¹ The monitoring station located furthest downstream for each watershed is indicated by a footnote in Tables 1-4.

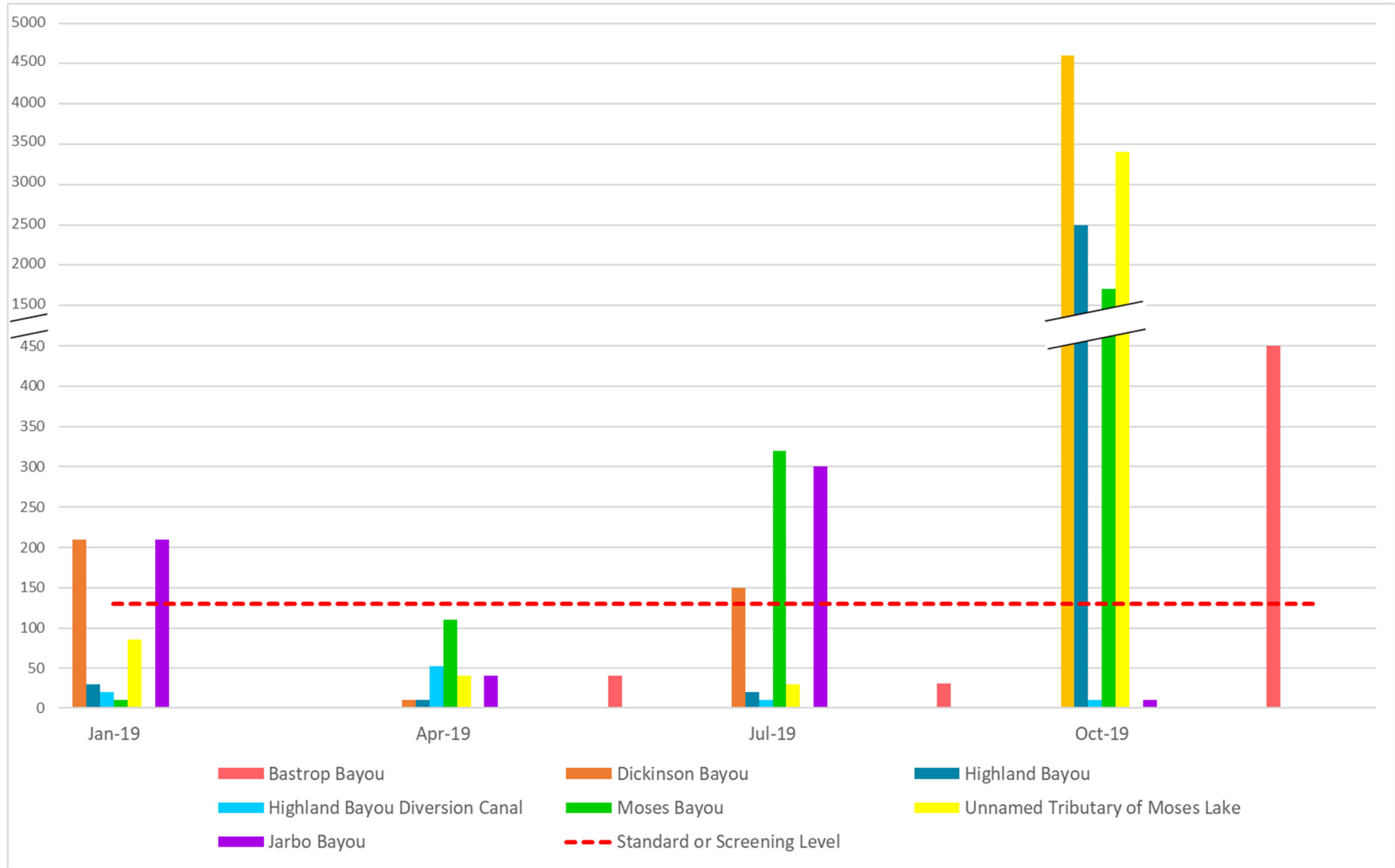


FIGURE 2. AVERAGE ENTEROCOCCI CONCENTRATIONS FOR EACH COALITION WATERSHED IN 2019 (FURTHEST DOWNSTREAM MONITORING STATIONS)

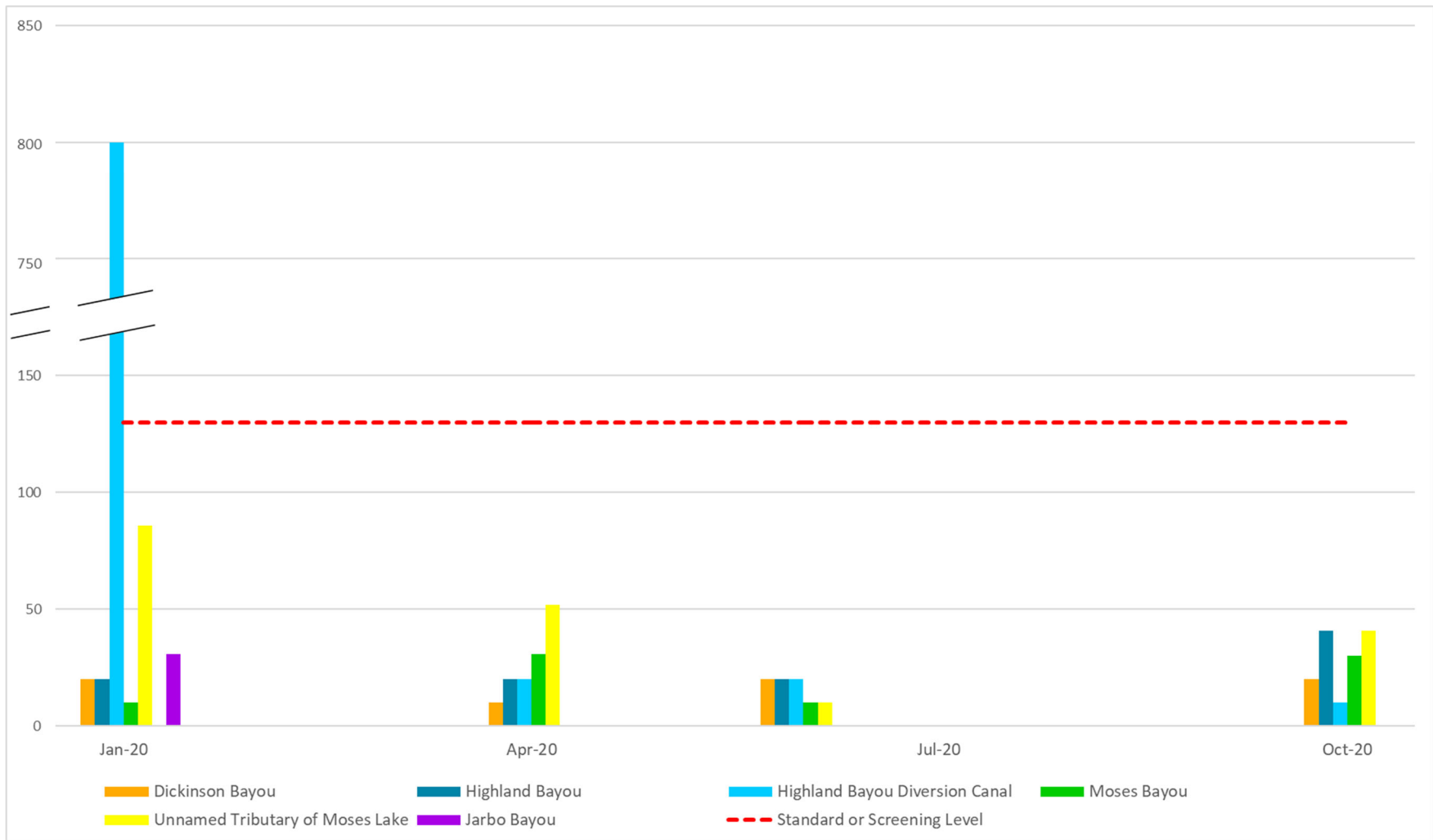


FIGURE 3. AVERAGE ENTEROCOCCI CONCENTRATIONS FOR EACH COALITION WATERSHED IN 2020 (FURTHEST DOWNSTREAM MONITORING STATIONS)

Bacteria data specific to each Coalition watershed is reported in the sections below.

BASTROP BAYOU WATERSHED

DESCRIPTION

The Bastrop Bayou watershed is the largest of the Coalition watersheds and includes approximately 217 square miles of land located in Brazoria County (Figure 4). Most of the watershed is rural with active agricultural production including production livestock and rotation row crop farming. Small urban centers include the City of Angleton and City of Lake Jackson. Many small developments are also found throughout the watershed. The southeast area of the watershed is within the Brazoria National Wildlife Refuge, managed by the US Fish and Wildlife Service. Water from the Bastrop Bayou watershed eventually enters Christmas Bay, in the southwestern portion of the Galveston Bay system (H-GAC, 2016; H-GAC, 2021a).

The Bastrop Bayou watershed includes several bayous and tributaries which are organized below by the TCEQ stream segment name and description.

- **Bastrop Bayou Tidal**, Segment 1105, from the confluence with Bastrop Bay 1.1 km (0.7 miles) downstream of the Intracoastal Waterway in Brazoria County to a point 8.6 km (5.3 mi) upstream of Business 288 at Lake Jackson in Brazoria County
- **Flores Bayou**, Segment 1105A, from a point 2.6 km (1.6 mi) downstream of County Road 171 upstream to SH35 in Brazoria County
- **Austin Bayou Tidal**, Segment 1105B, from the Bastrop Bayou Tidal confluence to the FM 2004 bridge crossing in Brazoria County
- **Austin Bayou Above Tidal**, Segment 1105C, from FM 2004 upstream (Austin Bayou Tidal upper boundary) to 1.73 mi upstream from where the water body crosses County Road 51
- **Unnamed Tributary of Bastrop Creek**, Segment 1105D, from the Bastrop Bayou Tidal confluence to 0.57 km (0.35 mi) upstream of SH 288 Bus in Brazoria County
- **Brushy Bayou**, Segment 1105E, from the confluence with Austin Bayou Above Tidal (1105C) upstream to end of canal approximately 0.4 mi upstream of FM210 crossing east of the City of Angleton in Brazoria County

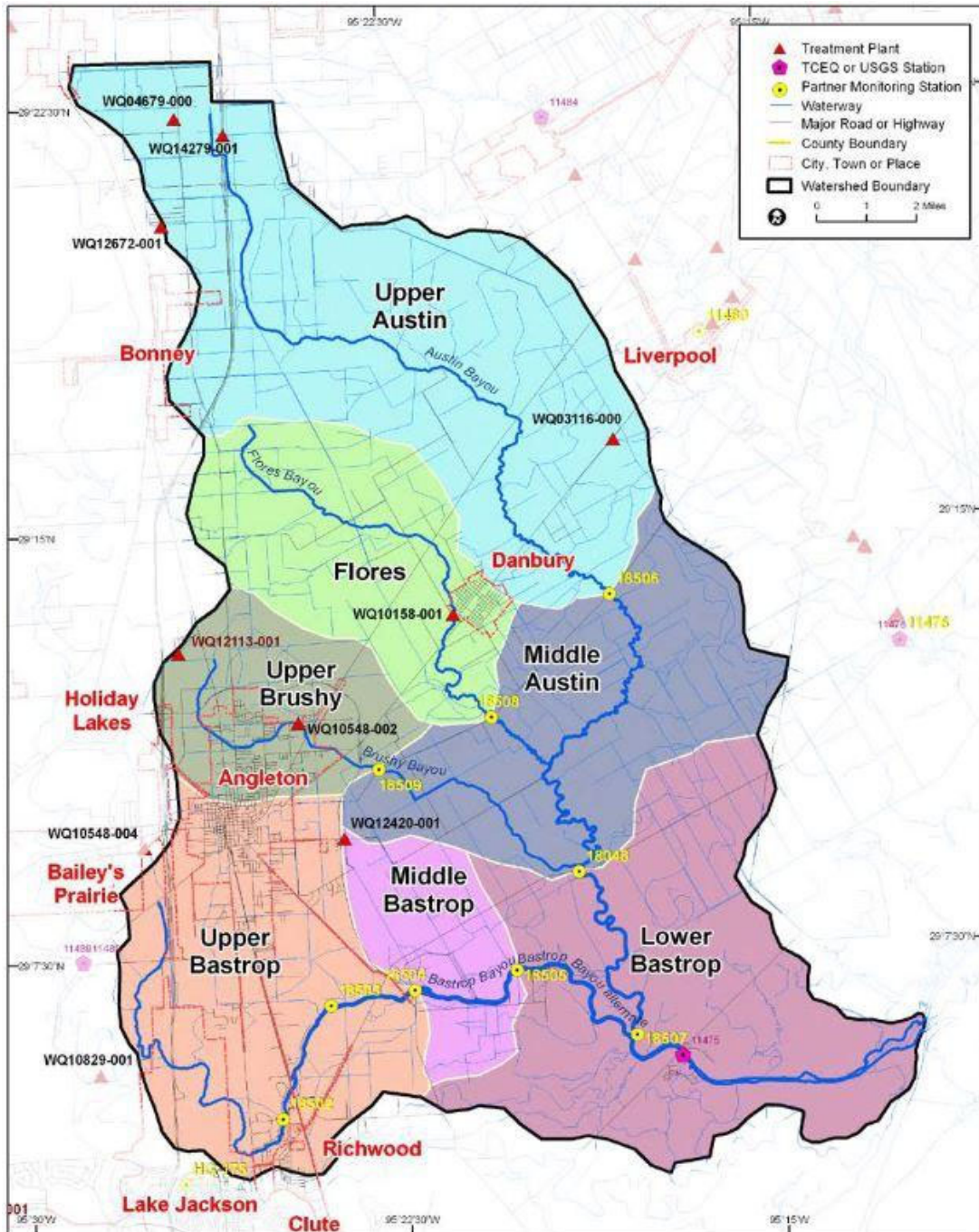


FIGURE 4. BASTROP BAYOU WATERSHED²

Table 1 lists the eleven water quality monitoring stations where routine data is collected under TCEQ’s Surface Water Quality Monitoring Program and the Clean Rivers Program within the Bastrop Bayou watershed. Bacteria counts for above tidal segments are *E. coli* and bacteria counts for tidal segments are Enterococci. Figure 5 illustrates the location of the monitoring stations from which data was reviewed for this report (H-GAC, 2021a).

² Image Source: *Bastrop Bayou Watershed Protection Plan* (H-GAC, 2016).

TABLE 1. TCEQ WATER QUALITY MONITORING STATIONS IN THE BASTROP BAYOU WATERSHED

Station ID	Segment ID	Station Description	Bacteria
18508	1105A	FLORES BAYOU IMMEDIATELY UPSTREAM OF DANBURY-ANGLETON ROAD/BRAZORIA CR 210 EAST OF ANGLETON	<i>E. coli</i>
18506	1105C	AUSTIN BAYOU IMMEDIATELY UPSTREAM OF DANBURY-ANGLETON ROAD/BRAZORIA CR 210 EAST OF DANBURY	<i>E. coli</i>
21735	1105D	UNNAMED TRIBUTARY OF BASTROP BAYOU TIDAL AT BRAZORIA CR 213 / SHELL ROAD 7.0 KILOMETERS EAST OF ANGLETON	<i>E. coli</i>
21734	1105E	BRUSHY BAYOU AT BRAZORIA CR 213 / SHELL ROAD 8.9 KILOMETERS EAST OF ANGLETON	<i>E. coli</i>
18502	1105	BASTROP BAYOU OFF BAYOU WOOD DR DUE EAST OF BRAZORIA CR 201 AT BASTROP BAYOU DR	Enterococci
18503	1105	BASTROP BAYOU TIDAL APPROXIMATELY 15 M OFF NORTH BANK AND 1.55 KM UPSTREAM OF FM 2004 IN RICHWOOD VILLAGE	Enterococci
18504	1105	BASTROP BAYOU TIDAL MID CHANNEL AT NORTH END OF BASTROP BEACH ROAD 350 M DOWNSTREAM OF FM 523 SE OF ANGLETON	Enterococci
18505	1105	BASTROP BAYOU TIDAL 38 M NORTH OF N END OF COMPASS DR/BRAZORIA CR 504 APPROXIMATELY 4.4 KM DOWNSTREAM OF FM 523 SE OF ANGLETON	Enterococci
11475 ³	1105	BASTROP BAYOU TIDAL AT CR 227	Enterococci
22012	1105B	AUSTIN BAYOU TIDAL 1.60 KILOMETERS UPSTREAM OF THE CONFLUENCE WITH BASTROP BAYOU IN BRAZORIA COUNTY	Enterococci
18048	1105B	AUSTIN BAYOU TIDAL AT FM 2004	Enterococci

³ Monitoring station 11475 is located furthest downstream.

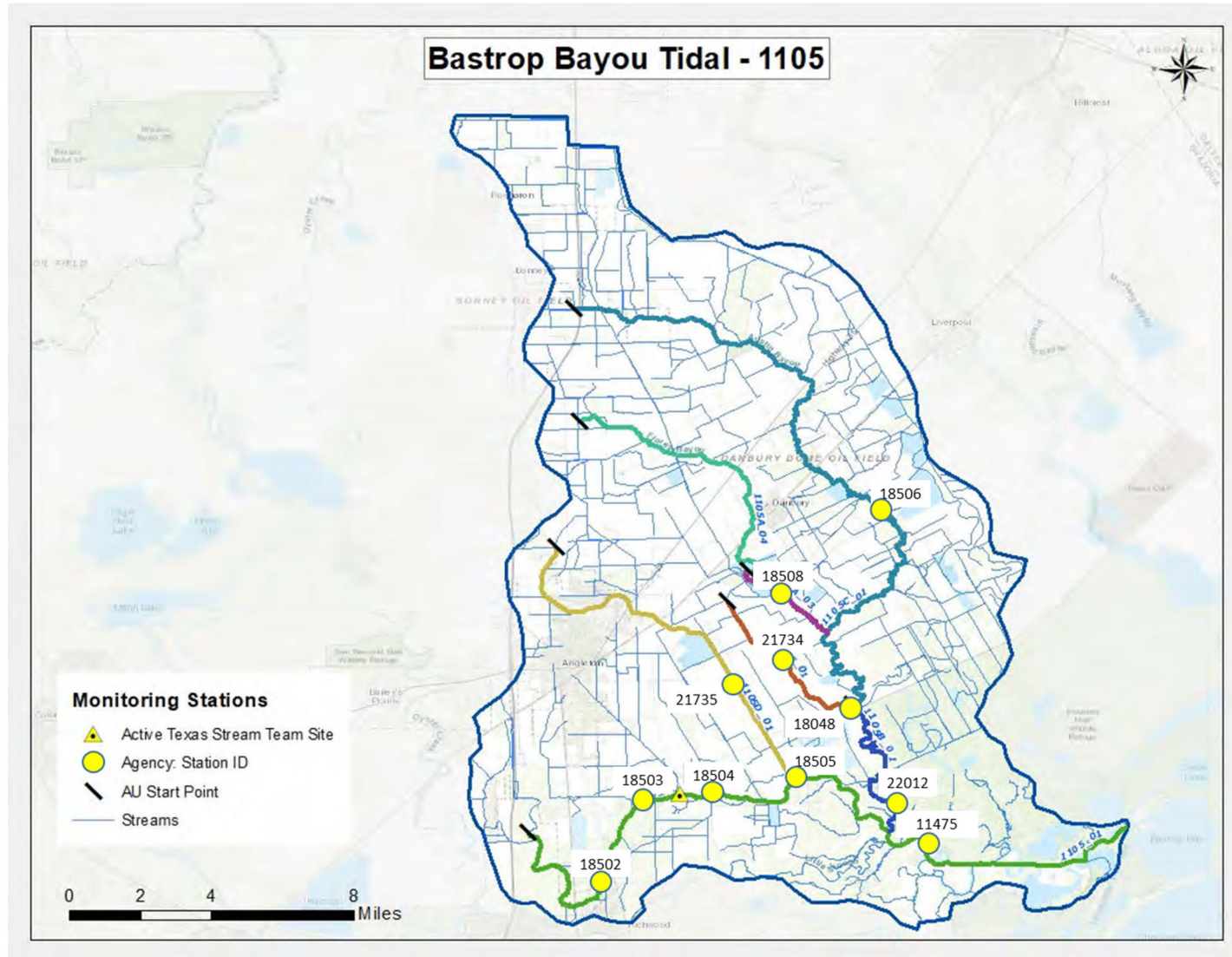


FIGURE 5. TCEQ WATER QUALITY MONITORING STATIONS IN THE BASTROP BAYOU WATERSHED⁴

⁴ Image modified with updated symbology and legend. Original image obtained from, H-GAC, *How's the Water? Basin Summary Report* (H-GAC, 2021a).

BACTERIA IMPAIRMENT SUMMARY

The 2020 Integrated Report lists Bastrop Bayou Tidal (1105), Flores Bayou (1105A), and Austin Bayou Tidal (1105B) as impaired for contact recreation due to elevated levels of Enterococci bacteria. Austin Bayou Above Tidal (1105C) and Brushy Bayou (1105E) are listed as impaired due to elevated levels of *E. coli* bacteria.

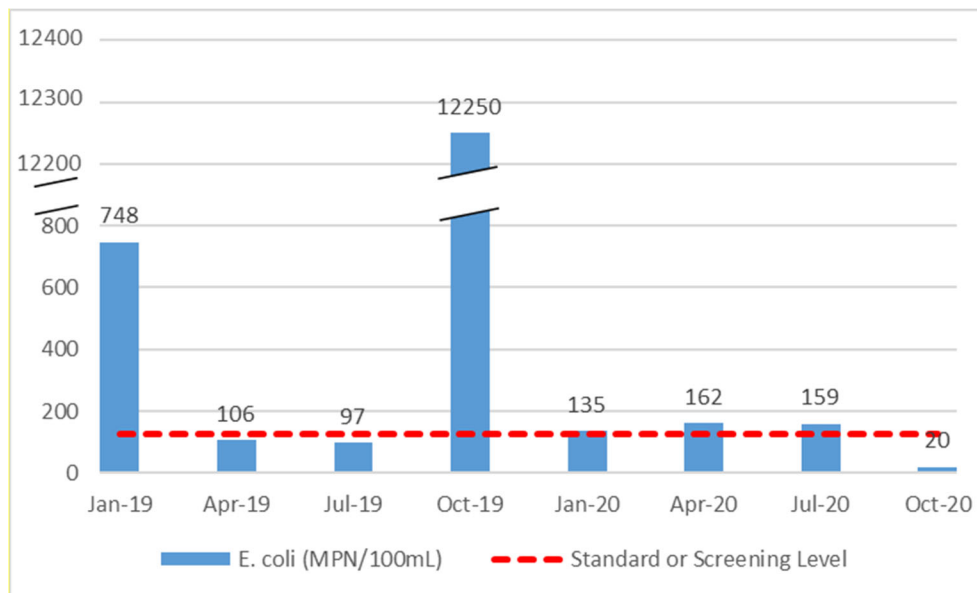


FIGURE 6. AVERAGE *E. COLI* CONCENTRATIONS FOR BASTROP BAYOU ABOVE TIDAL MONITORING STATIONS

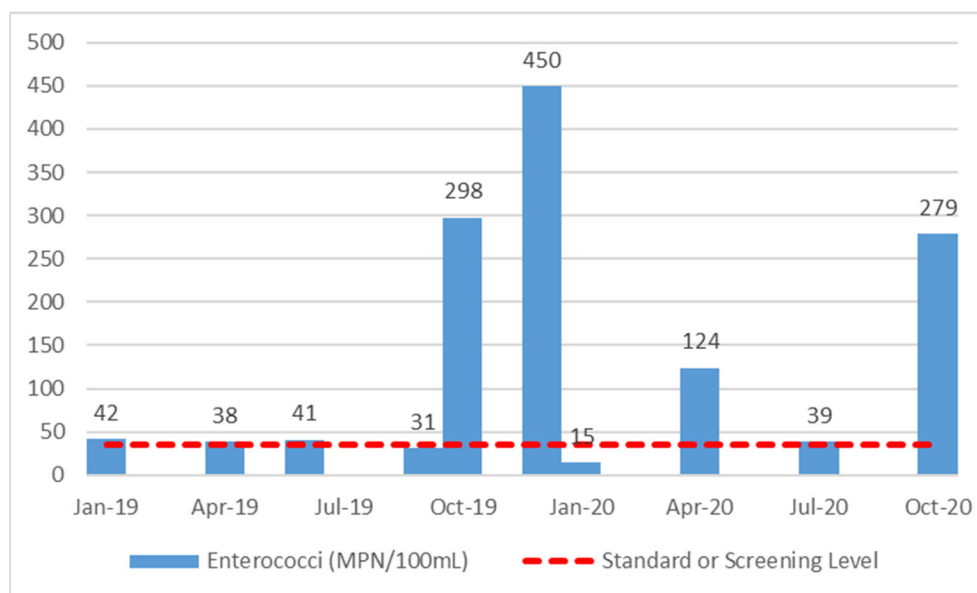


FIGURE 7. AVERAGE ENTEROCOCCI CONCENTRATIONS FOR BASTROP BAYOU TIDAL MONITORING STATIONS

TRENDS

Bastrop Bayou Above Tidal – Thirty-one water quality samples were collected from above tidal stations from January 2019 – October 2020. *E. coli* levels for sixteen of the thirty-one samples were greater than the 126 MPN/100mL standard. *E. coli* levels exceeded the 126 MPN/100mL standard on five out of the eight sampling events during the project period. The geometric mean for *E. coli* during each sampling event is reported in Figure 6.

E. coli counts ranged from 20-24000 MPN/100mL. Each of the four sampling stations had levels ranging from below the standard into the highest values in the Above Tidal portion of Bastrop Bayou. 1105A (Flores Bayou) had values ranging from 41-1000 MPN/100mL. 1105C (Austin Bayou) had values ranging from 31-10000 MPN/100mL. 1105D (Unnamed Tributary of Bastrop Bayou Tidal) had values ranging from 20-14000 MPN/100mL. 1105E (Brushy Bayou) had values ranging from 63-24000 MPN/100mL.

Bastrop Bayou Tidal – Fifty-one water quality samples were collected from tidally influenced stations from January 2019 – October 2020. Enterococci levels for twenty-three of the fifty-one samples were greater than the 35 MPN/100mL standard. Enterococci levels exceeded the 35 MPN/100mL standard for eight out of the ten sampling events during the project period. The geometric mean for Enterococci during each sampling event is reported in Figure 7.

Enterococci counts had the lowest variability at station 18503 (Bastrop Bayou Tidal Upstream of FM 2004) ranging from 10-61 MPN/100mL. The highest values were found at station 18048 (Austin Bayou Tidal at FM2004) at 1500 MPN/100mL in October of 2020 and station 18505 (Bastrop Bayou Brazoria CR 504) at 630 MPN/100mL in October of 2019.

DICKINSON BAYOU WATERSHED

DESCRIPTION

The Dickinson Bayou watershed includes approximately 106 square miles of land located in Galveston and Brazoria counties (Figure 8). It originates south of the City of Alvin in Brazoria County and includes portions of Manvel, Friendswood, Dickinson, Texas City, Kemah, and Santa Fe. The Dickinson Bayou watershed is predominantly rural in land-use including agricultural lands, natural areas, and commercial and residential development. Water from the Dickinson Bayou watershed flows east through the city of Dickinson before joining Dickinson Bay, a sub-bay of the Galveston Bay system (Painter and Hauck, 2014; TCEQ, 2014; H-GAC, 2021a).

The Dickinson Bayou watershed includes several bayous and tributaries which are organized below by the TCEQ stream segment name and description.

- **Dickinson Bayou Tidal**, Segment 1103, from the confluence with Dickinson Bay 2.1 km (1.3 mi) downstream of SH 146 in Galveston County to a point 4.0 km (2.5 mi) downstream of FM 517 in Galveston County
- **Bensons Bayou**, Segment 1103A, from the Dickinson Bayou Tidal confluence to point 0.6 km (0.37 mi) upstream of FM 646
- **Bordens Gully**, Segment 1103B, from the Dickinson Bayou Tidal confluence to a point 1.4 km (0.87 mi) upstream of FM 646 in Galveston County
- **Geisler Bayou**, Segment 1103C, from the Dickinson Bayou Tidal confluence to a point 1.37 km (0.85 mi) upstream of FM 646 in Galveston County
- **Gum Bayou**, Segment 1103D, from the Dickinson Bayou Tidal confluence to State Hwy 96 in Galveston County
- **Cedar Creek**, Segment 1103E, from the Dickinson Bayou Tidal confluence to a point 0.63 km (0.39 mi) upstream FM 517 in Galveston County
- **Unnamed tributary of Dickinson Bayou Tidal**, Segment 1103F, from the Dickinson Bayou Tidal confluence to a point 0.36 km (0.22 mi) upstream of State Hwy 6
- **Unnamed Tributary of Gum Bayou**, Segment 1103G, from the confluence with Gum Bayou to a point 0.39 miles south of the FM 646/FM 1266 intersection between League City and Dickinson
- **Dickinson Bayou Above Tidal**, Segment 1104, from a point 4.0 km (2.5 mi) downstream of FM 517 in Galveston County to FM 528 in Galveston County
- **Unnamed Tributary of Dickinson Bayou Above Tidal**, Segment 1104A, from the Dickinson Bayou Above Tidal confluence to State Hwy 6
- **Unnamed Tributary of Dickinson Bayou Above Tidal**, Segment 1104B, from the Dickinson Bayou Above Tidal confluence to a point 0.46 km (0.73 mi) upstream of State Hwy 6

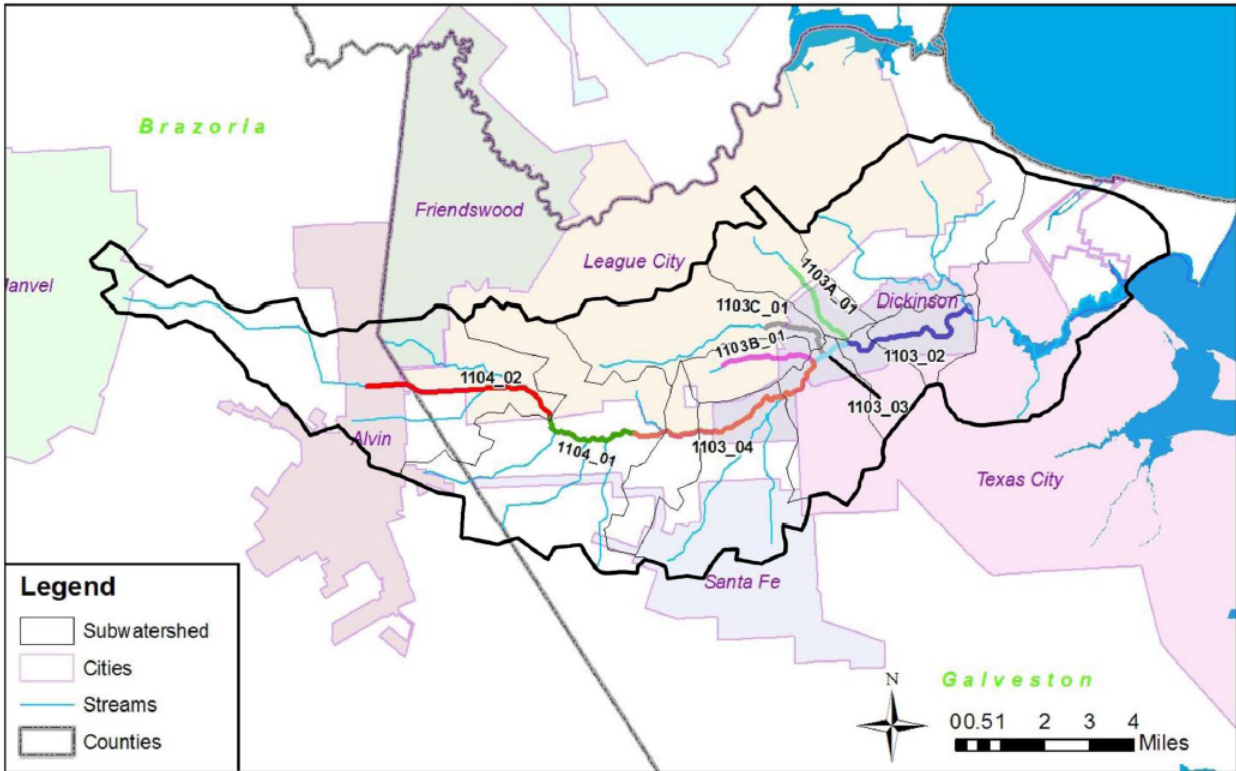


FIGURE 8. DICKINSON BAYOU WATERSHED⁵

Table 2 lists the twelve water quality monitoring stations where routine data is collected under TCEQ’s Surface Water Quality Monitoring Program and the Clean Rivers Program within the Dickinson Bayou watershed. Bacteria counts for above tidal segments are *E. coli* and bacteria counts for tidal segments are Enterococci. Figure 9 illustrates the location of the monitoring stations from which data was reviewed for this report (H-GAC, 2021b).

TABLE 2. TCEQ WATER QUALITY MONITORING STATIONS IN THE DICKINSON BAYOU WATERSHED

Station ID	Segment ID	Station Description	Bacteria
20724	1103B	BORDENS GULLY AT SPRUCE DRIVE IN DICKINSON	<i>E. coli</i>
11434	1103E	CEDAR CREEK AT FM 517 W OF DICKINSON	<i>E. coli</i>
11467	1104	DICKINSON BAYOU TIDAL AT CR 227 NEAR MIMS	<i>E. coli</i>
11455 ⁶	1103	DICKINSON BAYOU TIDAL AT SH 146 BRIDGE EAST OF DICKINSON	Enterococci
11460	1103	DICKINSON BAYOU TIDAL AT SH 3 BRIDGE IN DICKINSON CAMS733	Enterococci
11462	1103	DICKINSON BAYOU TIDAL AT IH 45	Enterococci

⁵ Image Source: *Implementation plan for eight total maximum daily loads for indicator bacteria in Dickinson and three tidal tributaries* (TCEQ, 2014).

⁶ Monitoring station 11455 is located furthest downstream.

11464	1103	DICKINSON BAYOU TIDAL AT CEMETERY ROAD NORTH OF ARCADIA	Enterococci
16471	1103A	BENSONS BAYOU AT FM 517 / PINE DR IN DICKINSON	Enterococci
16470	1103C	GEISLER BAYOU AT FM517 BRIDGE 0.19MI UPSTREAM OF DICKINSON BAYOU IN DICKINSON	Enterococci
11436	1103D	GUM BAYOU AT FM 517 E OF DICKINSON	Enterococci
20477	1103F	UNNAMED TRIBUTARY OF DICKINSON BAYOU AT AVENUE L 88 METERS SOUTH TO THE INTERSECTION OF OAK LANE AND AVENUE L SOUTHWEST OF DICKINSON	Enterococci
20728	1103G	UNNAMED TRIBUTARY OF GUM BAYOU AT OWENS DRIVE 1.51 KILOMETERS UPSTREAM OF CONFLUENCE WITH GUM BAYOU IN DICKINSON	Enterococci

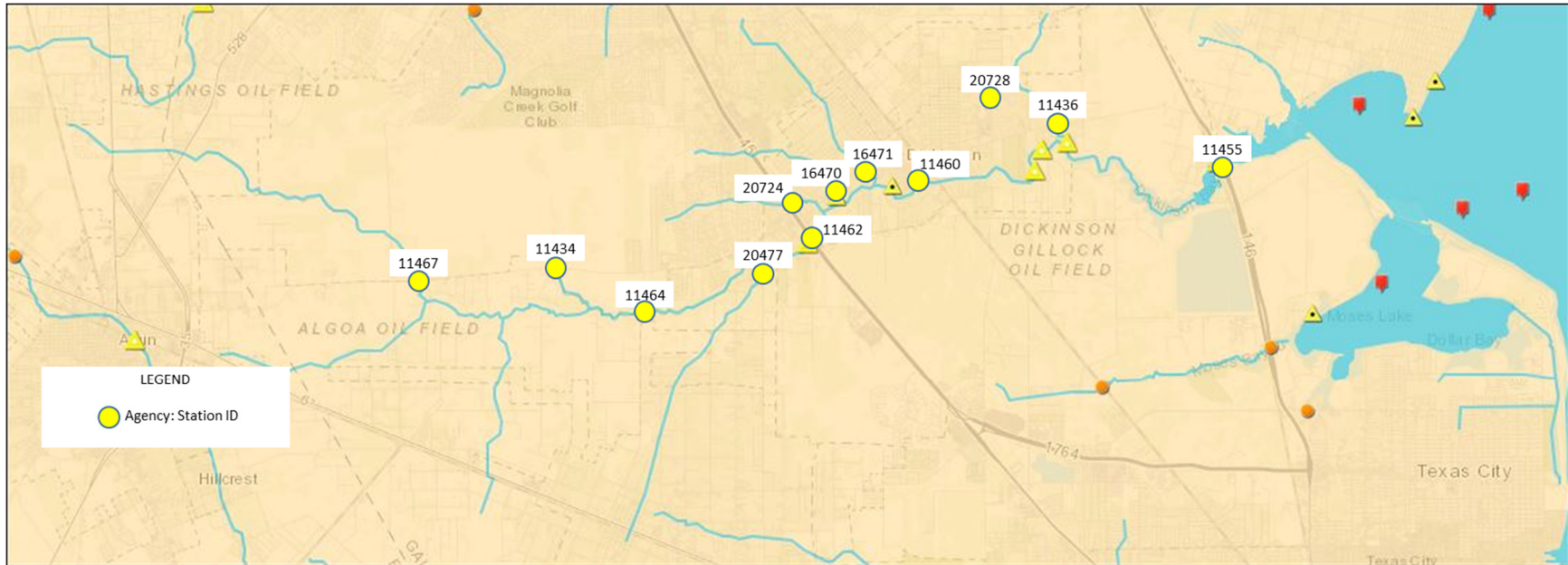


FIGURE 9. TCEQ WATER QUALITY MONITORING STATIONS IN THE DICKINSON BAYOU WATERSHED⁷

BACTERIA IMPAIRMENT SUMMARY

In the 2020 Integrated Report the entire Dickinson Bayou watershed is designated as impaired for bacteria. Both above and below tidal segments do not meet the primary contact recreation use designation (H-GAC, 2021a).

⁷ Image modified with updated symbology and legend. Original image obtained from, H-GAC’s *Water Resources Information Map* (H-GAC, 2021b).

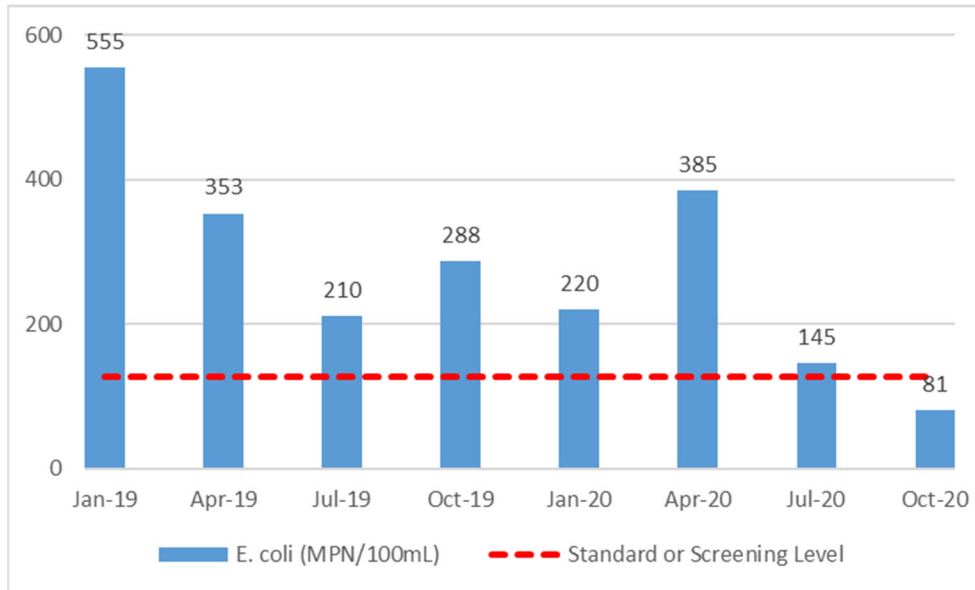


FIGURE 10. AVERAGE *E. COLI* CONCENTRATIONS FOR DICKINSON BAYOU ABOVE TIDAL MONITORING STATIONS

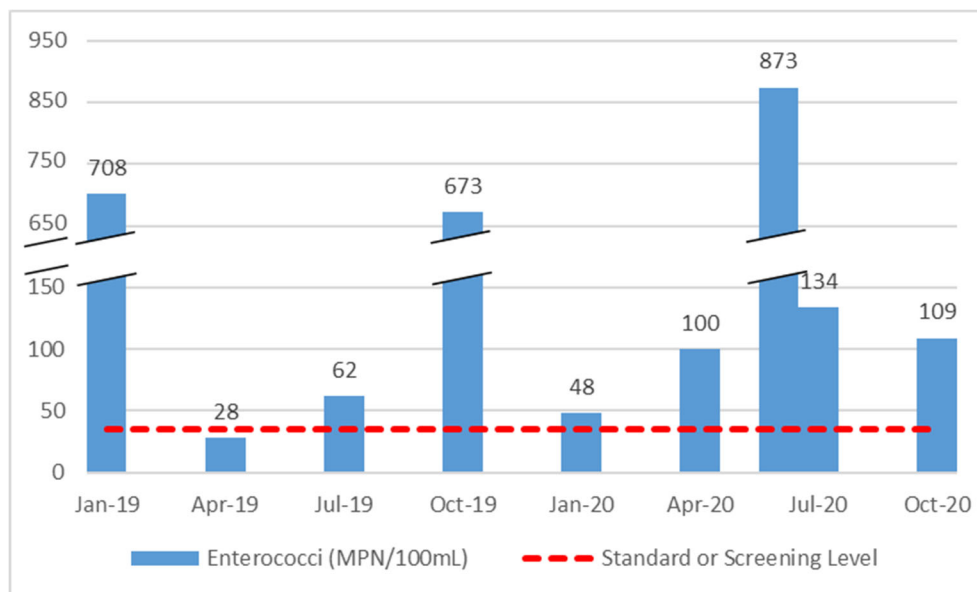


FIGURE 11. AVERAGE ENTEROCOCCI CONCENTRATIONS FOR DICKINSON BAYOU TIDAL MONITORING STATIONS

TRENDS

Dickinson Bayou Above Tidal – Nineteen water quality samples were collected from above tidal stations from January 2019 – October 2020. *E. coli* levels for twelve of the nineteen samples were greater than the 126 MPN/100mL standard. *E. coli* levels exceeded the 126 MPN/100mL standard on seven out of the eight sampling events during the project period. The geometric mean for *E. coli* during each sampling event is reported in Figure 10.

E. coli counts were lowest in 1104 (Dickinson Bayou Tidal at CR227) ranging from 93-120 MPN/100mL and highest in 1103B (Borden's Gully) and 1103E (Cedar Creek) ranging from 41 to 620 MPN/100mL.

Dickinson Bayou Tidal – Fifty-four water quality samples were collected from tidally influenced stations from January 2019 – October 2020. Enterococci levels in thirty-six of the fifty-four samples were greater than the 35 MPN/100mL standard. Enterococci levels exceeded the 35 MPN/100mL standard on eight out of the nine sampling events during the project period. The geometric mean for Enterococci during each sampling event is reported in Figure 11.

Enterococci counts had the lowest variability at 1103F (Unnamed Tributary of Dickinson Bayou) ranging from 20-98 MPN/100mL. The highest values were found in 1103 (Dickinson Bayou Tidal, multiple stations) ranging from 10-4600 MPN/100mL, 1103D (Gum Bayou) ranging from 10-1400 MPN/100mL, and 1103G (Unnamed Tributary of Gum Bayou) ranging from 97-2500 MPN/100mL. The three highest measurements were collected on three different dates.

HIGHLAND BAYOU COASTAL BASIN

DESCRIPTION

The Highland Bayou Coastal Basin covers several coastal watersheds in southern mainland Galveston County including: Highland Bayou, Highland Bayou Diversion Canal, Moses Bayou, and an Unnamed Tributary of Moses Lake (Figure 12). Each of these waterways flows into a portion of Galveston Bay and is tidally influenced. The basin is bounded on the north by Dickinson Bayou and on the west by Halls Bayou. Marchand Bayou is a tributary that flows into Highland Bayou, which then drains into Jones Bay and the West Bay of Galveston Bay. The Highland and Marchand bayous watershed covers almost 23 square miles of land. The Highland Bayou Diversion Canal intercepts and diverts the headwaters of Highland Bayou near Jack Brooks Park, diverting it southward through old Basford Bayou and into West Bay. These historical headwaters are now considered the Diversion Canal watershed and are separate from the Highland Bayou watershed. Moses Bayou flows east into Moses Lake, a sub-bay of Galveston Bay. The Unnamed Tributary of Moses Lake flows into the southern arm of Moses Lake. Communities in the coastal basin include the cities of Santa Fe, Hitchcock, La Marque, Texas City, and Bayou Vista. Most of the developed land cover in this watershed is low intensity, mixed residential and commercial development (TCWP, 2021).

The Highland Bayou Coastal Basin includes several bayous and tributaries which are organized below by the TCEQ stream segment name and description.

- **Highland Bayou**, Segment 2424A, from Jones Bay confluence to Avenue Q 0.8 km (0.5 mi) north of SH 6 between Arcadia and Alta Loma in Galveston County
- **Marchand Bayou**, Segment 2424C, from Highland Bayou confluence to 0.72 km (0.45 mi) north of IH 45 in Galveston County
- **Highland Bayou Diversion Canal**, Segment 2424G, from the confluence with an unnamed tributary adjacent to Jones Bayou upstream to the Highland Bayou confluence
- **Moses Bayou**, Segment 2431A, from Moses Lake confluence to 2.2 km (1.4 mi) upstream of SH 3 in Galveston County
- **Unnamed Tributary to the Southern Arm (west) of Moses Lake**, Segment 2431C, from the confluence with the southern arm (west) of Moses Lake to a point 0.45 mi upstream of State Highway 3 near La Marque

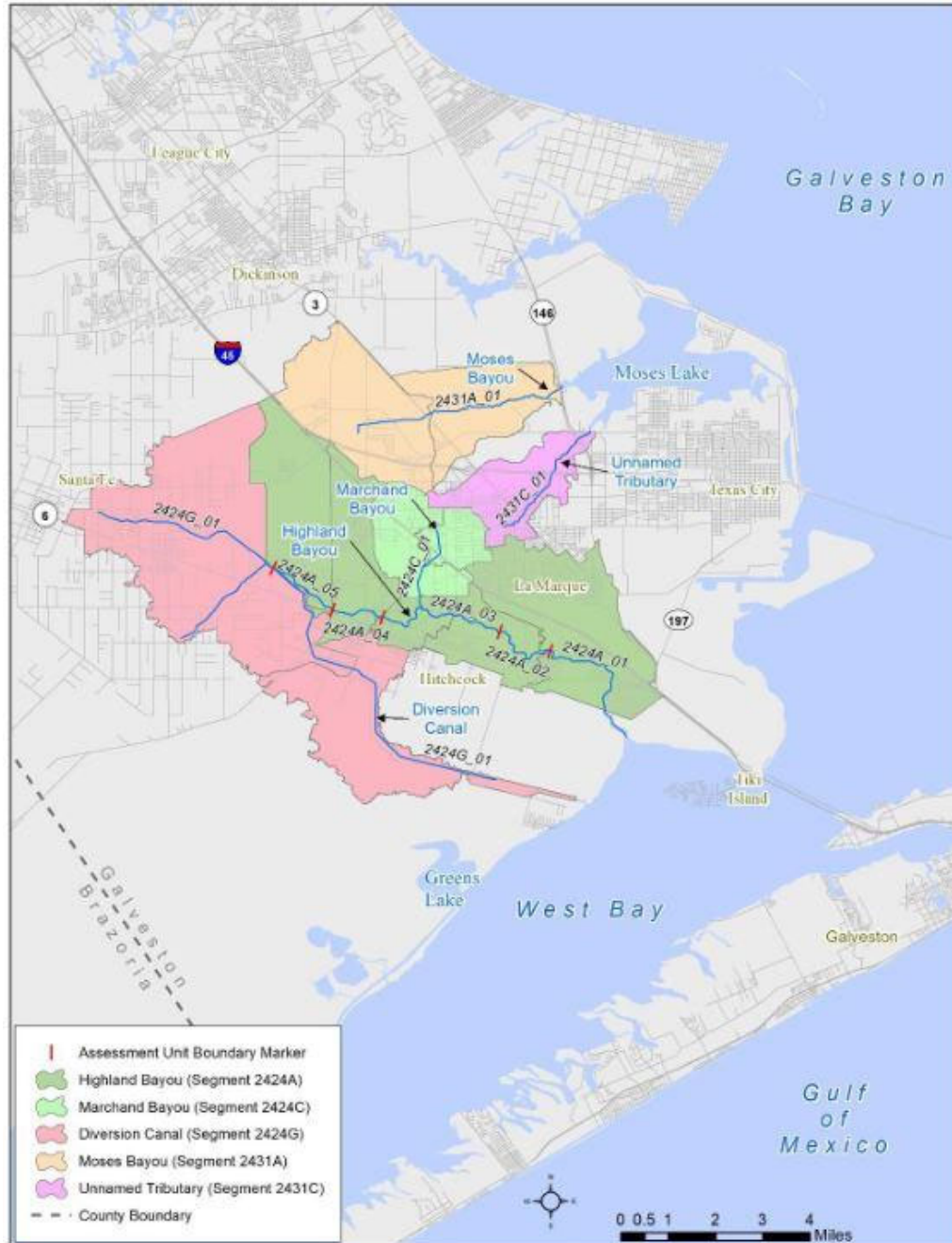


FIGURE 12. HIGHLAND BAYOU COASTAL BASIN AND WATERSHEDS⁸

Table 3 lists the ten water quality monitoring stations where routine data is collected under TCEQ’s Surface Water Quality Monitoring Program and the Clean Rivers Program within the Highland Bayou Coastal Basin. Bacteria counts for above tidal segments are *E. coli* and bacteria counts for tidal segments are Enterococci. Figure 13 illustrates the location of the monitoring stations from which data was reviewed for this report (TCWP, 2021).

⁸ Image Source: *Highland Bayou Coastal Basin Watershed Protection Plan for Highland Bayou, Highland Bayou Diversion Canal, Marchand Bayou, Moses Bayou, and Unnamed Tributary of Moses Lake* (Texas Community Watershed Partners, 2021).

TABLE 3. TCEQ WATER QUALITY MONITORING STATIONS IN THE HIGHLAND BAYOU COASTAL BASIN BY WATERSHED

Station ID	Segment ID	Station Description	Bacteria
Highland Bayou			
16488 ⁹	2424A	HIGHLAND BAYOU 80 M NORTHEAST OF SH 6 BRIDGE CENTER POINT IN BAYOU VISTA WEST OF IH 45 IN GALVESTON COUNTY	Enterococci
16562	2424A	HIGHLAND BAYOU AT END OF BAYOU LANE FREDDIESVILLE	Enterococci
11415	2424A	HIGHLAND BAYOU AT FAIRWOOD ROAD IN LA MARQUE IN GALVESTON COUNTY	Enterococci
15941	2424A	HIGHLAND BAYOU TIDAL AT FM 519, 335M NORTH OF SH6 IN CITY OF HITCHCOCK	Enterococci
16491	2424A	HIGHLAND BAYOU AT FM 2004 IN HITCHCOCK IN GALVESTON COUNTY	Enterococci
16490	2424C	MARCHAND BAYOU TIDAL AT FM519 IN HITCHCOCK	Enterococci
Highland Bayou Diversion Canal			
18593 ¹⁰	2424G	HIGHLAND BAYOU DIVERSION CANAL MID CHANNEL AT SECOND STREET BRIDGE 467 M UPSTREAM OF PRICE ROAD WWTP RELEASE IN HITCHCOCK	Enterococci
Moses Bayou			
17910	2431A	MOSES BAYOU AT SH 3 IN TEXAS CITY	<i>E. coli</i>
11400 ¹¹	2431A	MOSES BAYOU AT NORTHBOUND SH 146 BRIDGE AT MID-BRIDGE NORTH OF LA MARQUE	Enterococci
Unnamed Tributary of the Southern Arm of Moses Lake (West)			
18592 ¹²	2431C	UNNAMED TRIBUTARY OF MOSES LAKE AT STATE LOOP 197/25TH AVE NORTH 432 M EAST OF NORTHBOUND SH 146 IN TEXAS CITY	Enterococci

⁹ Monitoring station 16488 is located the furthest downstream in the Highland Bayou watershed.

¹⁰ Monitoring station 18593 is located the furthest downstream (and is the only station) in the Highland Bayou Diversion Canal watershed.

¹¹ Monitoring station 11400 is located the furthest downstream in the Moses Bayou watershed.

¹² Monitoring station 18592 is located the furthest downstream (and is the only station) in the Unnamed Tributary watershed.

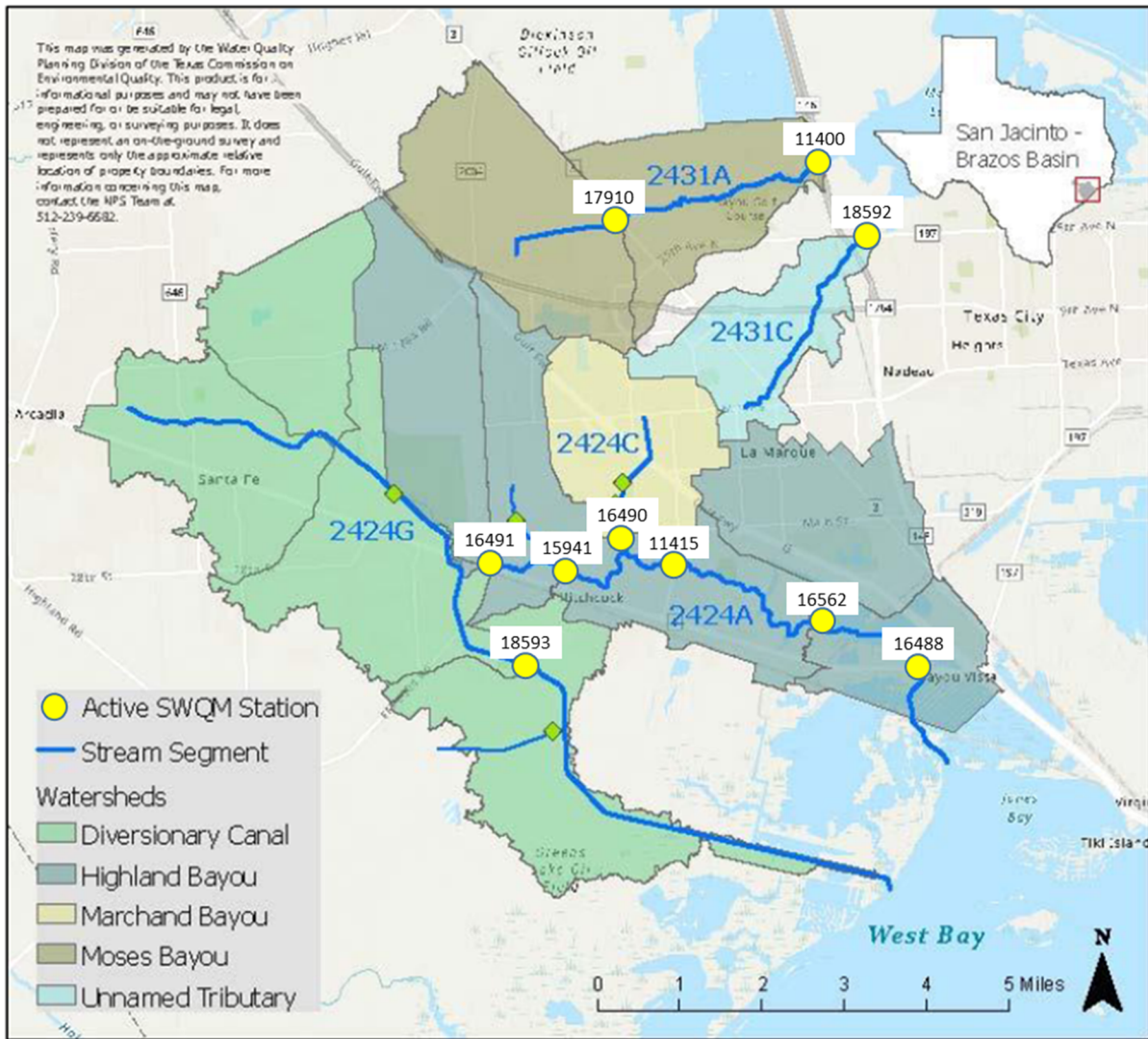


FIGURE 13. TCEQ WATER QUALITY MONITORING STATIONS IN THE HIGHLAND BAYOU COASTAL BASIN¹³

BACTERIA IMPAIRMENT SUMMARY

In the 2020 Integrated Report, all segments included in the Highland Bayou Coastal Basin do not support contact recreation due to elevated levels of Enterococci with the exception of one supporting portion, the furthest downstream part of segment 2424A, from the confluence of West Bay upstream to Bayou Lane.

¹³ Image modified with update symbology and legend. Original image obtained from, *Highland Bayou Coastal Basin Watershed Protection Plan for Highland Bayou, Highland Bayou Diversion Canal, Marchand Bayou, Moses Bayou, and Unnamed Tributary of Moses Lake* (Texas Community Watershed Partners, 2021).

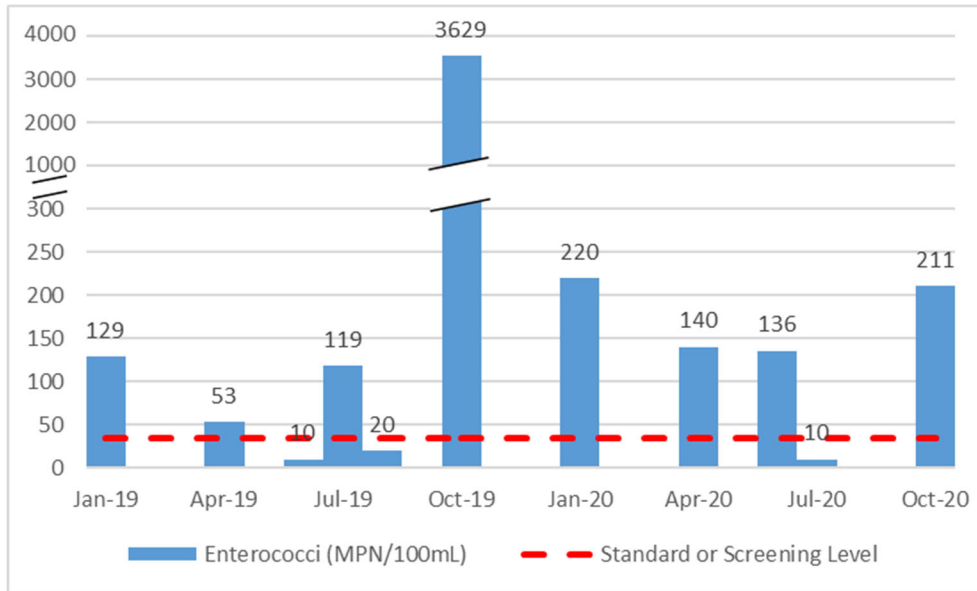


FIGURE 14. AVERAGE ENTEROCOCCI CONCENTRATIONS FOR HIGHLAND BAYOU MONITORING STATIONS

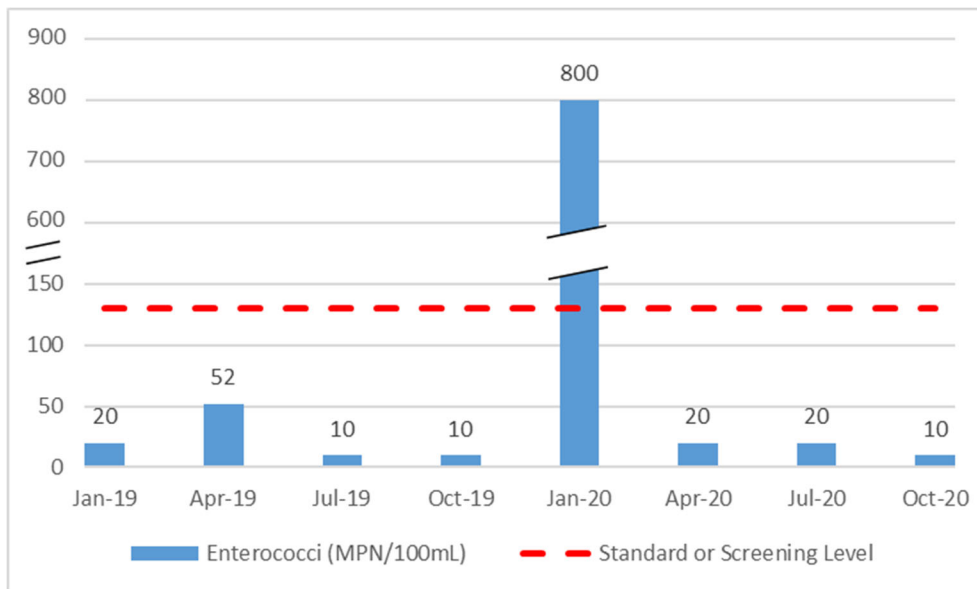


FIGURE 15. AVERAGE ENTEROCOCCI CONCENTRATIONS FOR HIGHLAND BAYOU DIVERSION CANAL MONITORING STATIONS

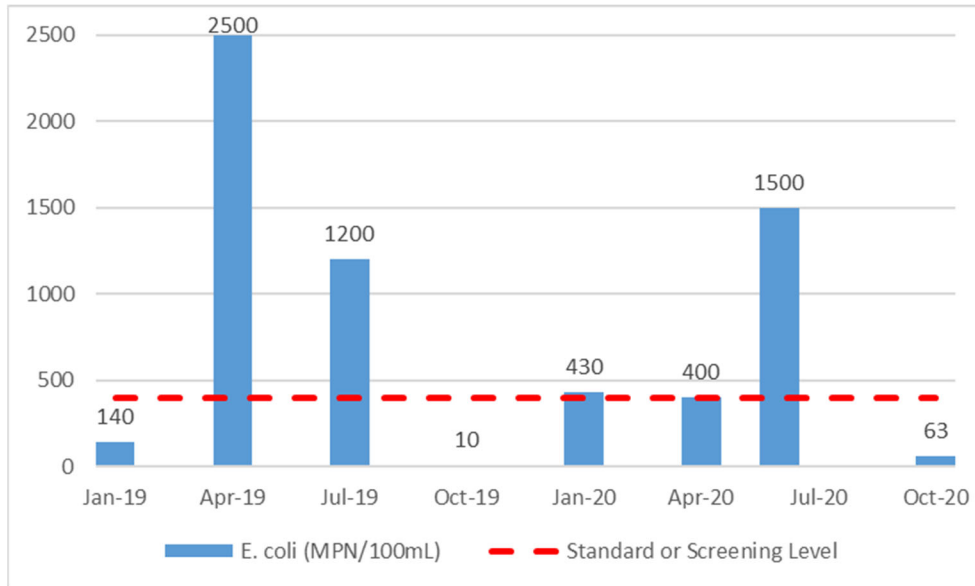


FIGURE 16. AVERAGE *E. COLI* CONCENTRATIONS FOR MOSES BAYOU ABOVE TIDAL MONITORING STATIONS

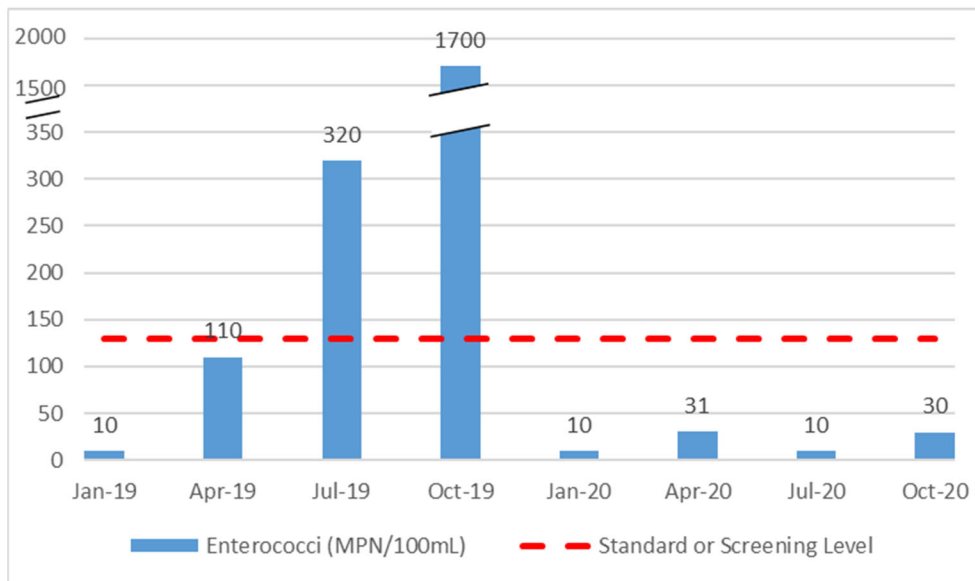


FIGURE 17. AVERAGE ENTEROCOCCI CONCENTRATIONS FOR MOSES BAYOU TIDAL MONITORING STATIONS

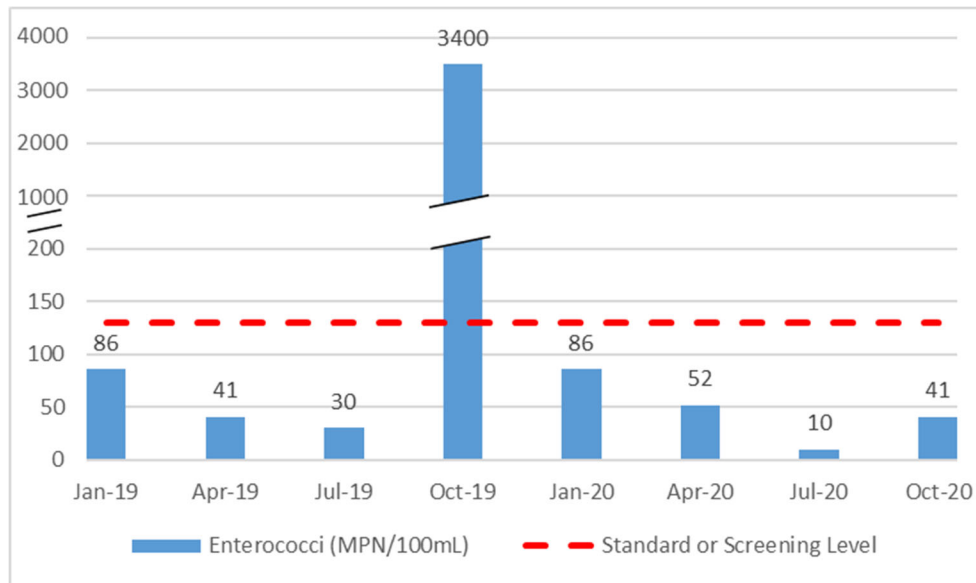


FIGURE 18. AVERAGE ENTEROCOCCI CONCENTRATIONS FOR UNNAMED TRIBUTARY OF MOSES LAKE MONITORING STATIONS

TRENDS

Highland Bayou – Data for Highland and Marchand bayous were combined for this effort. Fifty water quality samples were collected from tidally influenced stations from January 2019 – October 2020. Enterococci levels in thirty-four of the fifty samples were greater than the 35 MPN/100mL standard. Enterococci levels exceeded the 35 MPN/100mL standard on eight out of the eleven sampling events during the project period. The geometric mean for Enterococci during each sampling event is reported in Figure 14.

Enterococci counts ranged from 10-7300 MPN/100mL. Each of the five sampling stations had levels ranging from below the standard to the highest values present in the watershed with the exception of station 16490 (Marchand Bayou) with values ranging from 41-2100 MPN/100mL. The highest values were all measured in October of 2019 and found at the following stations: station 16562 (Highland Bayou at the End of Bayou Lane Freddiesville) at 7300 MPN/100mL, station 15941 (Highland Bayou Tidal at FM 519) at 4900 MPN/100mL, station 11415 (Highland Bayou at Fairwood Road in La Marque) at 4900 MPN/100mL, station 16488 (Highland Bayou’s furthest downstream station) at 2500 MPN/100mL, and station 16490 (Marchand Bayou) at 2100 MPN/100mL.

Highland Bayou Diversion Canal – Eight water quality samples were collected from one tidally influenced station (18593) from January 2019 – October 2020. Enterococci levels in one of the eight samples were greater than the single grab standard of 130 MPN/100mL at 800 MPN/100mL. Enterococci levels exceeded the 130 MPN/100mL standard on one out of the eight sampling events during the project period. The geometric mean for Enterococci during each sampling event is reported in Figure 15.

Moses Bayou Above Tidal – Eight water quality samples were collected from one above tidal station (17910) from January 2019 – October 2020. *E. coli* levels for five of the eight samples were greater than

the single grab standard of 399 MPN/100mL. *E. coli* levels exceeded the 399 MPN/100mL standard on five out of the eight sampling events during the project period. The maximum value was measured at 2500 MPN/100mL. The geometric mean for *E. coli* during each sampling event is reported in Figure 16.

Moses Bayou Tidal – Eight water quality samples were collected from one tidally influenced station (11400) from January 2019 – October 2020. Enterococci levels in two of the eight samples were greater than the single grab standard of 130 MPN/100mL. Enterococci levels exceeded the 130 MPN/100mL standard on two out of the eight sampling events during the project period. The maximum value was measured at 1700 MPN/100mL. The geometric mean for Enterococci during each sampling event is reported in Figure 17.

Unnamed Tributary of Moses Lake – Eight water quality samples were collected from one tidally influenced station (18592) from January 2019 – October 2020. Enterococci levels in one of the eight samples were greater than the single grab standard of 130 MPN/100mL at 3400 MPN/100mL. Enterococci levels exceeded the 130 MPN/100mL standard on one out of the eight sampling events during the project period. The geometric mean for Enterococci during each sampling event is reported in Figure 18.

JARBO BAYOU WATERSHED

DESCRIPTION

The Jarbo Bayou watershed is the smallest of the Coalition watersheds and includes approximately 4.8 square miles of land in Galveston County located on the southeast border of Clear Lake (Figure 19). Jarbo Bayou is a tidal tributary within the basin, consisting of a single TCEQ stream segment that feeds directly into Clear Lake. Jarbo Bayou, segment 2425B, is located from Clear Lake confluence with Clear Lake to 1.1 km (0.67 mi) upstream of FM 518 in Galveston County. Areas bordering Clear Lake as well as the western section of the watershed are heavily developed. The central and southeastern regions are less developed with pasture land and pockets of wooded wetlands (TCEQ, 2018; H-GAC, 2021a; UH, 2016).

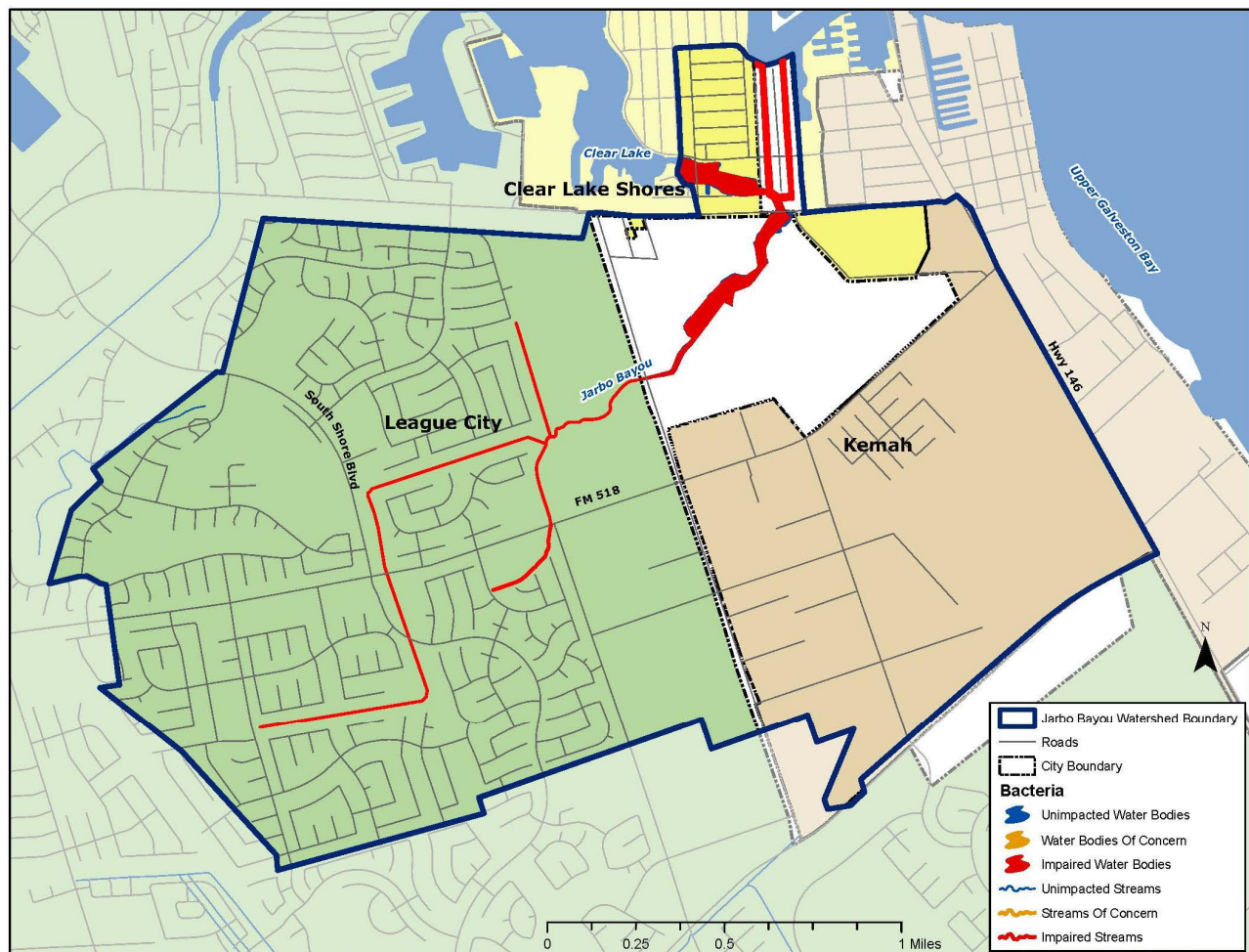


FIGURE 19. JARBO BAYOU WATERSHED¹⁴

¹⁴ Image obtained from (H-GAC, 2018)

Table 4 lists the two water quality monitoring stations where routine data is collected under TCEQ’s Surface Water Quality Monitoring Program and the Clean Rivers Program within the Jarbo Bayou watershed. Because Jarbo Bayou is a tidal stream, all bacteria counts are Enterococci. Figure 20 illustrates the location of the monitoring stations from which data was reviewed for this report (University of Houston, 2016).

TABLE 4. TCEQ WATER QUALITY MONITORING STATIONS IN THE JARBO BAYOU WATERSHED

Station ID	Segment ID	Station Description	Bacteria
16485	2425B	JARBO BAYOU AT LAWRENCE ROAD IN KEMAH	Enterococci
16476 ¹⁵	2425B	JARBO BAYOU AT FM2094 APPROX 0.3MI UPSTREAM OF CLEAR LAKE CONFLUENCE IN KEMAH	Enterococci

¹⁵ Monitoring station 16476 is located furthest downstream.

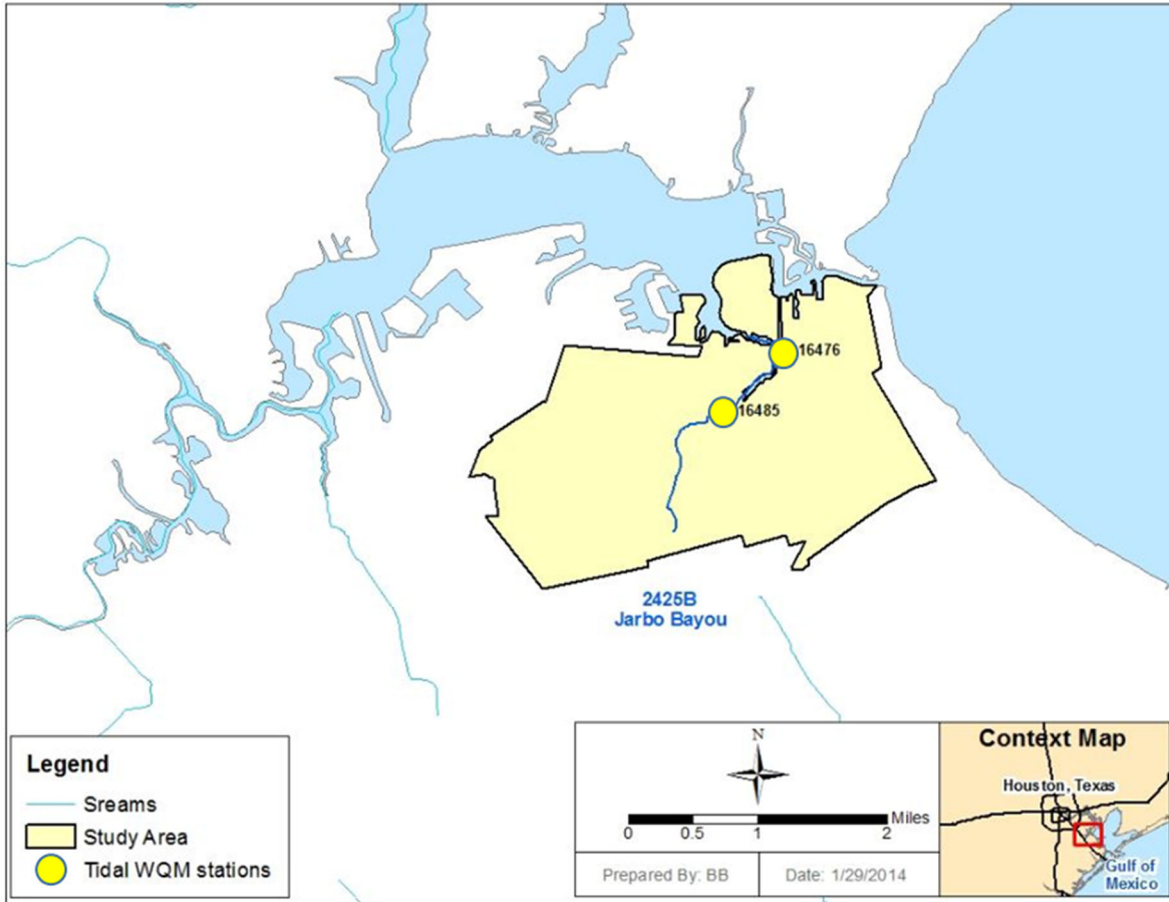


FIGURE 20. TCEQ WATER QUALITY MONITORING STATIONS IN THE JARBO BAYOU WATERSHED¹⁶

BACTERIA IMPAIRMENT SUMMARY

The 2020 Texas Integrated Report lists Jarbo Bayou (segment 2425B) as impaired for elevated levels of indicator bacteria. Elevated levels of Enterococci were identified in 4 out of the 5 sampling events during the project period (Figure 19).

¹⁶ Image modified with update symbology and legend. Original image obtained from, *UH Technical Support Document Bacteria TMDL for Jarbo Bayou* (University of Houston, 2016).

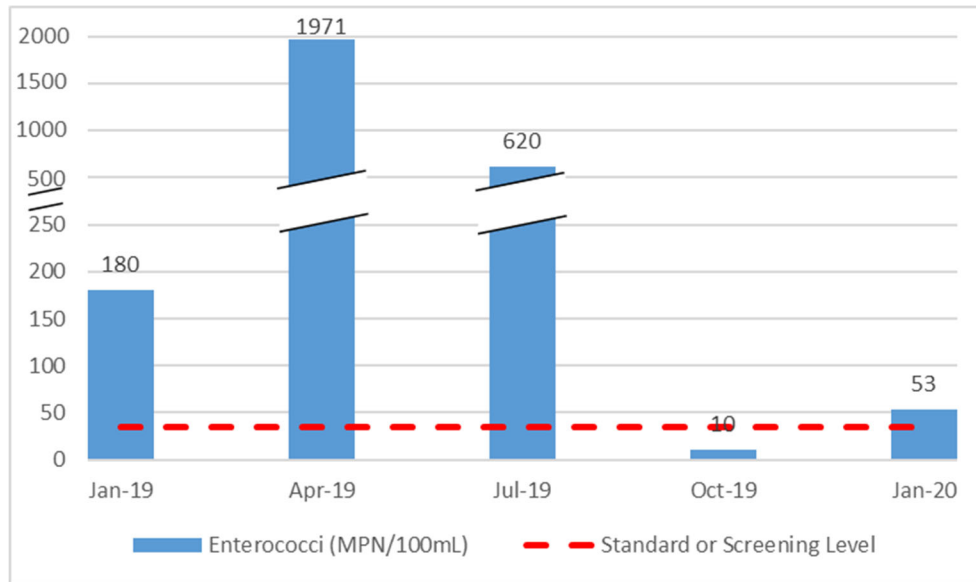


FIGURE 21. AVERAGE ENTEROCOCCI CONCENTRATIONS FOR JARBO BAYOU MONITORING STATIONS

TRENDS

Ten water quality samples were collected within Jarbo Bayou segment 2425B from January 2019 – January 2020. Enterococci levels for seven of the ten samples were greater than the 35 MPN/100mL standard, with values ranging from 10-3900 MPN/100mL. Enterococci levels exceeded the 35 MPN/100mL standard on four out of the five sampling events during the project period. The two highest values (940 and 3900) were collected from Station 16485 in April and July of 2019. The 940 value was observed one day since last recorded precipitation and the 3900 value was observed 20 days since last recorded precipitation. The geometric mean for Enterococci during each sampling event is reported in Figure 21.

WATER QUALITY IMPROVEMENTS

Ambient water quality data for Coalition watersheds shows higher than acceptable levels of indicator bacteria, with many stream segments on the state's list of impaired waters. The management measures outlined in local WBPs as well as those prioritized by the Coalition, were developed to drive the reduction of pollutant loads through an adaptive management approach. To improve water quality and restore the health of each bayou, future cycles of implementation will have a greater impact if they are guided by available data and adjust to changing conditions. The ultimate water quality goal is a reduction in bacteria concentrations sufficient to delist these stream segments from their current impairment status.

This initial State of Water Quality report serves as a benchmark to inform successive implementation actions with data limited to bayous within the Coalition area. As the Coalition continues to take action in specific locations and individual communities, we can evaluate average bacteria concentrations in nearby stream segments over time for a more targeted approach, increasing efficacy and impact toward improving local water quality. In addition, the Coalition can review bacteria concentrations for each watershed in relation to one another, over time, to determine which watersheds are showing improvement following implementation activities. Figures 2 and 3 provide a side-by-side comparison of bacteria counts for each Coalition watershed.

The bacteria reductions required to meet water quality goals may not be linear, but should follow a general downward trend. Linking a specific education effort with bacteria reductions is challenging. Water quality conditions change constantly due to variations in weather and land use activities. Fluctuations in population size and a consistent influx of new residents drive an ongoing need for education and on-the-ground actions to maintain and improve surface water quality. The weather events that frequent Coastal communities around Galveston Bay are occasionally very severe. Hurricanes and tropical disturbances deliver physical destruction through high winds and heavy rainfall in addition to lasting effects on water quality, through damage to infrastructure and disruption of sanitation services.

NEXT STEPS AND RECOMMENDATIONS

- Revisit action items and pursue selected measures through an adaptive management process with flexibility in implementation
- Update the State of Water Quality report to add additional years of data, revealing longer term water quality trends
- Assess whether any change in impairment status has been achieved or if water quality is improving or degrading
- Attempt to answer questions regarding bacteria sources through a review of specific implementation efforts against water quality data
- Work with stakeholders to identify local leveraged funds for further implementation
- Incorporate additional sources of monitoring data outside of the Clean Rivers Program, from local partners including the Galveston County Health District and Texas Stream Team
- Supplement quarterly Clean Rivers Program monitoring with targeted monitoring efforts to better understand the extent and variability of bacteria concentrations

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