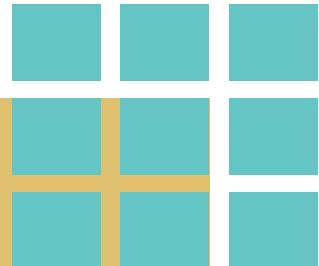


Clean Rivers Program

# HOW'S THE WATER?



2015 Houston-Galveston Area Council  
Basin Highlights Report

*ABRIDGED VERSION*

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## IT'S ALL ABOUT WATER.

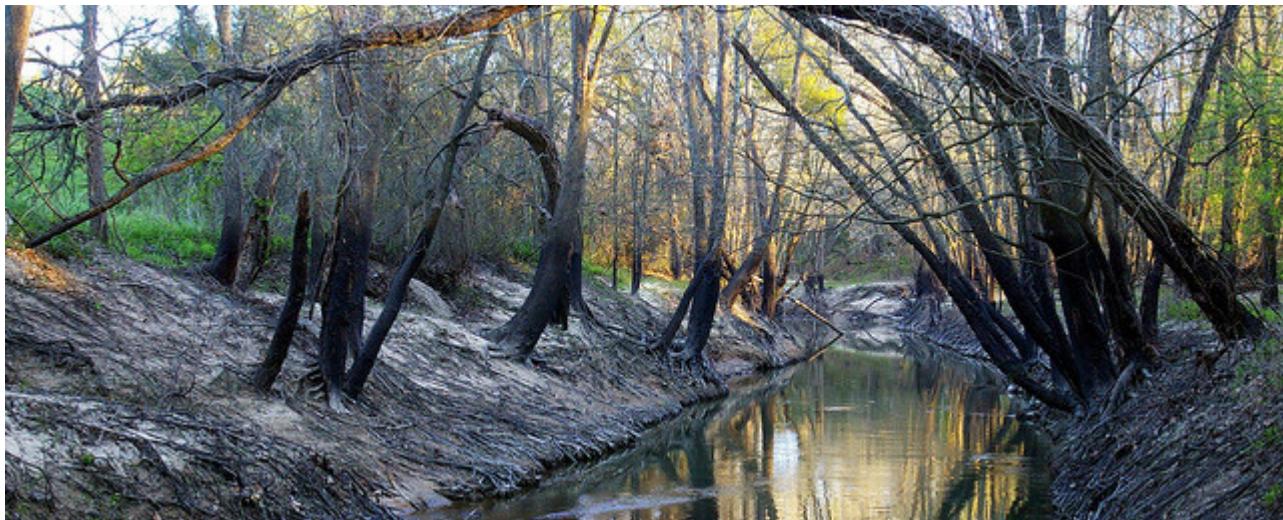
Water is our most precious resource. We drink it, bathe in it and play in it. We share our water with all of the other living things on the planet: plants, animals and microorganisms. **And without water, none of us can survive.**

In the Houston-Galveston region, there aren't scenic vistas with snow-covered mountains for skiing. We don't have mile after mile of beautiful fall foliage to take in.



**But we do have over 16,000 miles of streams and shoreline that lead to one of the most productive estuaries in the United States.**

Houston is the Bayou City. Water is a cornerstone of our regional economy, amounting to \$4 billion annually through ecotourism, oyster harvesting and commercial fishing. It all hinges on clean water.



# SO, HOW'S THE WATER?

The good news is that water quality in the region is improving. But there is still work to be done.

Currently, the region included in the Houston-Galveston Area Council's (H-GAC) service area has an adequate supply of water. However, recent drought has made us much more aware of what a precious resource our water is. It has reminded us that our fast-paced population growth will place greater demand on this finite resource.

H-GAC's Clean Rivers Program (CRP) is charged with collecting surface water samples and then analyzing the *quality* of those samples and communicating the results to the public.

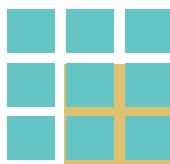
H-GAC strives to find the sources of water quality problems and develop strategies and plans to maintain and improve the quality of our surface waters.

## 2015 BASIN HIGHLIGHTS REPORT

This Basin Highlights Report (BHR) will give you an overview of the current quality of our region's surface waters, as well as trends.

We will also take a detailed look at five specific waterbodies in the region to identify

- what are the specific water quality issues and trends;
- what are the sources of pollution;
- what is being done about the problems; and
- who is working on them?



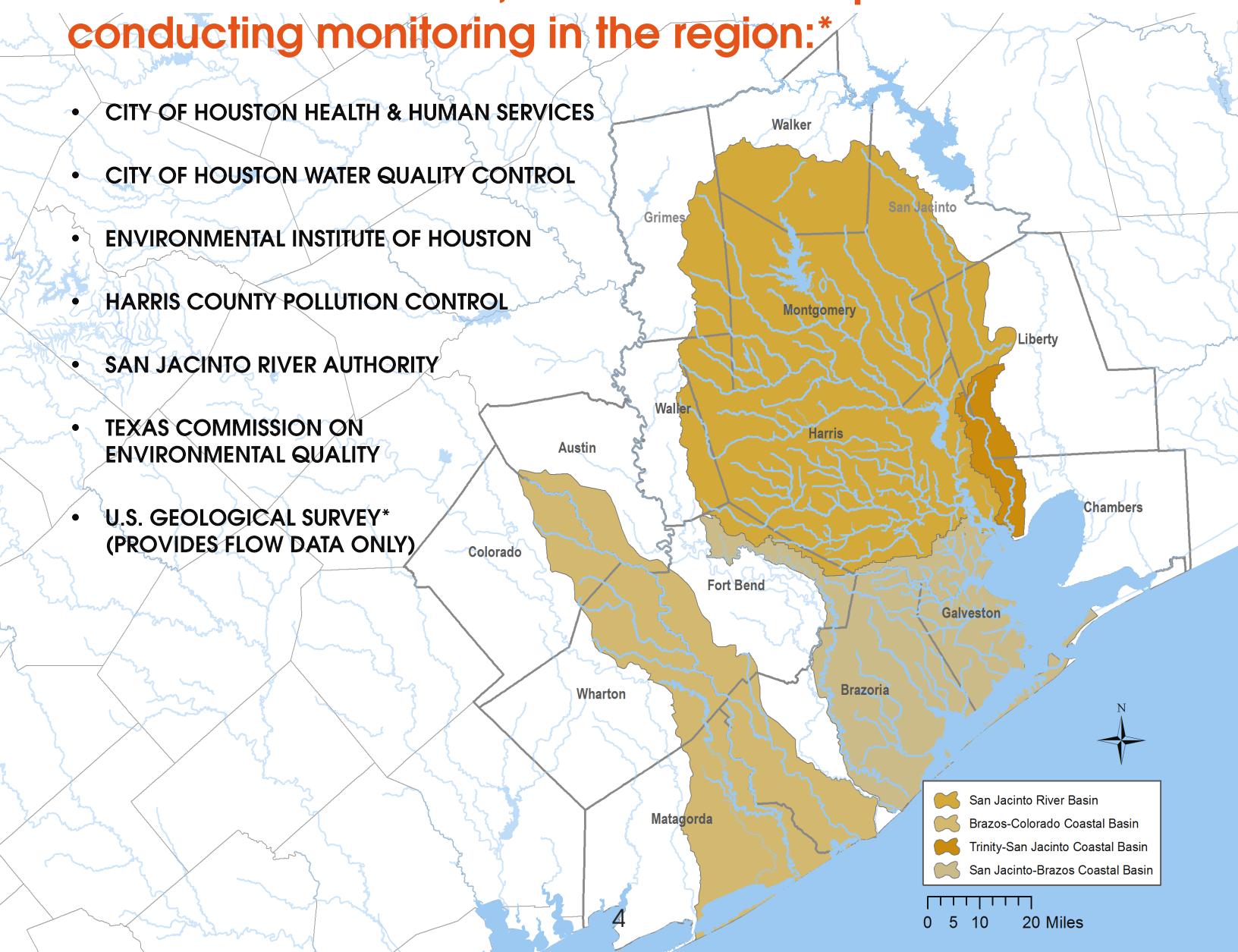
# Assessment Basins

CRP is charged with monitoring and assessing the quality of the region's surface waters and providing information and recommendations to individuals, industry and local governments about what they can do to clean up and preserve local waterways, now and in the future.

H-GAC is the state-designated lead partner agency for the San Jacinto River Basin, the Trinity-San Jacinto Coastal Basin, the San Jacinto-Brazos Coastal Basin and the Brazos-Colorado Coastal Basin. These basins comprise the H-GAC CRP project area, which includes all or a portion of 15 counties, more than 400 sampling sites and seven regional partners.

**In addition to H-GAC, there are seven partners conducting monitoring in the region:\***

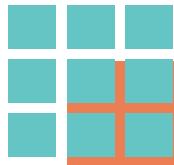
- CITY OF HOUSTON HEALTH & HUMAN SERVICES
- CITY OF HOUSTON WATER QUALITY CONTROL
- ENVIRONMENTAL INSTITUTE OF HOUSTON
- HARRIS COUNTY POLLUTION CONTROL
- SAN JACINTO RIVER AUTHORITY
- TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
- U.S. GEOLOGICAL SURVEY\*  
(PROVIDES FLOW DATA ONLY)



# DID YOU KNOW...

H-GAC's CRP was the first in Texas to coordinate with other local monitoring agencies, helping reduce unnecessary duplications in monitoring and saving approximately \$150,000 annually?

That coordinated approach has become a model in collaboration for other CRPs across the state. Additionally, our CRP set the bar for reporting to the Texas Commission on Environmental Quality (TCEQ) and helped establish the revolving five-year report schedule that is now followed by all Texas CRPs.



## Regional Issues

The H-GAC region includes the third most populous county and fourth most populous city in the United States and is projected to continue growing. More people equates to more wastewater discharges, dogs, septic systems and industry, all of which have an effect on our water.

The good news is that overall water quality is improving; however, more than 80% of the waterways in the H-GAC region fail to meet water quality standards, or screening criteria, for one or more parameters.



H-GAC's CRP tests for *E. coli* and Enterococcus bacteria which come from animal and human excrement.

High levels of these bacteria can cause gastrointestinal illness and infections, and their occurrence may indicate the presence of other dangerous pathogens in the water.

Sources of bacteria contamination may include

- discharge from wastewater treatment facilities (WWTF) with inadequate treatment, by-passes and sanitary sewer system overflows;
- runoff from on-site sewage facilities (OSSFs); and
- runoff contaminated with excrement from pets, wildlife and livestock.

\*Stream miles are the distance measured along the center of a stream.



STANDARDS CRITERIA

## DISSOLVED OXYGEN

27%  
stream miles  
impaired

High levels of dissolved oxygen (DO) are a good thing, but low DO levels hinder the ability of waterways to sustain aquatic life, including fisheries. Fish kills are a common sign of low, or depressed, DO.

DO levels in the region may be negatively impacted by

- high concentrations of nutrients in area waterways;
- the amounts of debris and microscopic matter washing into or being discharged to streams;
- the loss of in-stream habitat to channel modifications or development; and
- reduced streamside canopy, as shaded streams are usually cooler and can support higher DO concentrations.

SCREENING CRITERIA

## NUTRIENTS

28%  
stream miles  
exceed  
state levels

Nutrients in the water, often from fertilizers, are a complex issue.

A certain level of nutrients is necessary for healthy oyster beds, a \$30 million business for the region. But too much can cause taste and odor issues in drinking water sources.

High levels of nutrients can also lead to unsightly algal blooms, which in turn cause low DO, killing fish and other aquatic life.

Sources of nutrient pollution in the region may include

- wastewater and stormwater discharges;
- illegal dumping;
- urban runoff; and
- agricultural-related operations.

## STANDARDS CRITERIA

# PCBs & DIOXIN

76%  
tidal waters\*  
impaired

Contamination of PCBs and Dioxin are different than other water quality parameters.

Typically the result of pollution from industry, PCBs and Dioxin impact the food chain and are most often found in the fatty tissue of fish and larger aquatic life.

People who eat fish or shellfish contaminated by PCBs and Dioxin can develop long-term, serious illnesses, including reproductive and developmental problems, damage to the immune system, interference with hormone levels and even cancer.

\*Tidal waters are waterways directly impacted by the changing tide.

## *WHAT IS...THE STATE WATER QUALITY STANDARD?*

The Texas Surface Water Quality Standards create water quality goals to make sure our water is safe for drinking, recreational use and aquatic life, all of which contribute to a healthy economy.

There are many criteria for evaluating water quality, and H-GAC conducts monitoring of those criteria to help the state ensure local waterbodies meet standards for recreational uses, like swimming, wading and fishing.

Every two years, the TCEQ assembles monitoring data from CRP partners statewide into the Texas Integrated Report of Surface Water Quality (IR), which identifies waterbodies that are not meeting state standards and puts those waterbodies on the 303(d) list.

Waterbodies included on the 303(d) list are either called "impaired" or as having a screening level of "concern" by the TCEQ, depending on the type of criteria. This designation is the first step toward improving water quality in waterbodies that fail to meet state standards.

# 2015 REGIONAL WATER QUALITY SUMMARY

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

Basin	Watershed	Segment	DO	Bact	Chlor	Nut	PCB	Other*	Frogs
Trinity-San Jacinto Coastal	Cedar Bayou Tidal	0901	100	100	100	100	100		
	Cedar Bayou Above Tidal	0902	100						
San Jacinto River	Buffalo Bayou Above Tidal	1014	10.8	79.4		70.7		2.2	
	Buffalo Bayou Tidal	1013	30.8	63.3		36.4		27.0	
	Caney Creek	1010	16.1	34.6					
	Cypress Creek	1009	41.0	84.6		84.6		10.4	
	East Fork San Jacinto River	1003		100					
	Greens Bayou Above Tidal	1016	9.0	91.2		80.3			
	Houston Ship Channel	1006	16.5	47.2	7.8	86.5	36.7	36.7	
	Houston Ship Channel Buffalo Bayou Tidal	1007	19.6	72.8		83.9	23.8	23.8	
	Houston Ship Channel/San Jacinto River Tidal	1005				72.9	100	72.9	
	Lake Conroe	1012	11.0						
	Lake Creek	1015	66.3	11.4				36.8	
	Lake Houston	1002	19.6	6.6	14.1	41.3		0.1	
	Peach Creek	1011		100					
	San Jacinto River Tidal	1001					43.4	43.4	
San Jacinto-Brazos Coastal	Spring Creek	1008	49.8	72.0	1.1	22.3		11.7	
	West Fork San Jacinto River	1004		61.5		18.1			
	White Oak Bayou Above Tidal	1017	11.4	84.6		80.8			
	Armand Bayou Tidal	1113	56.5	64.7	24.7	17.7	24.7	10.2	
	Bastrop Bayou Tidal	1105	84.9	94.3		6.3			
	Chocolate Bayou Above Tidal	1108		100					
	Chocolate Bayou Tidal	1107		100			100		
	Clear Creek Above Tidal	1102	53.4	85.2		72.4	44.3	4.4	
	Clear Creek Tidal	1101	25.7	71.0	13.6	23.8	29.4		
	Dickinson Bayou Above Tidal	1104	41.3	41.3					
	Dickinson Bayou Tidal	1103	65.6	84.3	12.2		42.5		
	Old Brazos River Channel Tidal	1111			100				
	Oyster Creek Above Tidal	1110	66.3	42.2	42.2			100	
	Oyster Creek Tidal	1109		100					

Basin	Watershed	Segment	DO	Bact	Chlor	Nut	PCB	Other*	Frogs
Brazos-Colorado Coastal	San Bernard River Above Tidal	1302	61.8	75.5		9.5		13.0	
	San Bernard River Tidal	1301		100	100				
	Caney Creek Above Tidal	1305	59.7	14.4		59.7		14.4	
	Caney Creek Tidal	1304	33.2	100					
Bays & Estuaries	Barbours Cut	2436				100	100		
	Bastrop Bay / Oyster Lake	2433							
	Bayport Ship Channel	2438	100		100	100	100		
	Black Duck Bay	2428			100	100	100		
	Burnett Bay	2430			85.9	100	100	100	
	Chocolate Bay	2432	23.4	41.4				38.7	
	Christmas Bay	2434							
	Clear Lake	2425	8.4	10.8	65.1	80.0	92.3	65.1	
	Drum Bay	2435							
	East Bay	2423		30.0	100		100		
	Lower Galveston Bay	2439			100		100		
	Moses Lake	2431		34.8	19.6		54.4		
	San Jacinto Bay	2427				100	100	100	
	Scott Bay	2429				100	100	100	
	Tabbs Bay	2426				35.1	100		
	Texas City Ship Channel	2437			100	100	100		
	Trinity Bay	2422			100	60.6	100		
	Upper Galveston Bay	2421			89.5	95.7	100		
	West Bay	2424	15.0	9.3	11.4		88.5		
	Gulf of Mexico	2501						44.0	

## Chart Key



Severe, multiple water quality impairment(s) or concern(s) exist in a majority of the waterbody.



Significant, multiple water quality impairment(s) or concerns exist in the waterbody.



Water quality impairment(s) or concern(s) exist in a substantial portion of the waterbody.



Water quality impairment(s) or concern(s) exist in the waterbody.

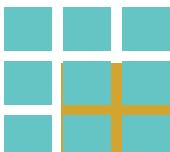


No significant water quality impairments or concerns exist in the waterbody.

IMPROVING

DEGRADING

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



# WATERSHED CHARACTERIZATIONS

In addition to the general overview of regional water quality issues and concerns provided in earlier sections of this BHR, H-GAC has highlighted the following five watersheds for characterization summaries: Cedar Bayou Tidal (0901); Bastrop Bayou (1105); West Fork San Jacinto River (1004); East Fork San Jacinto River (1003); and White Oak Bayou (1017).

## EACH CHARACTERIZATION WILL INCLUDE...

### **Segment Description**

A description of the segment, AU boundaries, historically monitored sites and sites believed to be responsible for any impairments or concerns

### **Hydrologic Characteristics**

Streamflow variability, reservoir dynamics, seasonality of flow and typical flow trends

### **Land Use & Natural Characteristics**

The land surrounding the segment, including cities, agricultural lands, permitted discharges, landfills, quarry operations, industrial areas, animal feeding operations and oil and gas operations

### **Description of Water Quality Issues**

Identification of why the waterbody is listed and when it first appeared on the 303(d) list or why it is an area of interest, including the number of samples, parameters of concern or impairment, assessment results and appropriate state standards for comparison

### **Potential Sources of Water Quality Issues**

Possible sources of water quality issues identified through the use of satellite imagery, watershed surveys and communications with stakeholders and staff from local and state agencies

### **Potential Stakeholders**

Companies, agencies, organizations or individuals who have a vested interest in the area

### **Recommendations for Improving Water Quality**

Proposed next steps based on the potential sources of impairment or concern

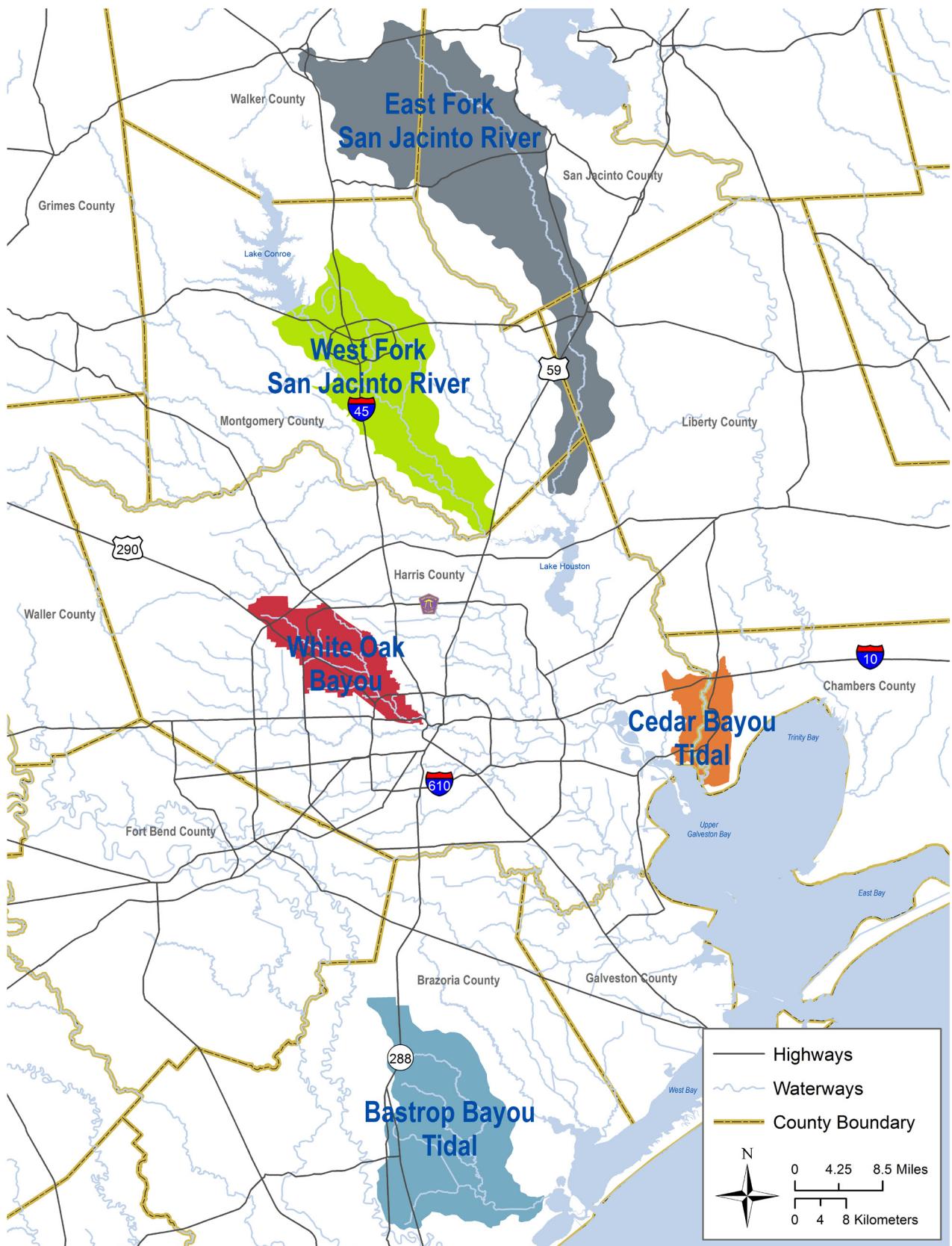
### **Ongoing Projects**

Current or future projects that will occur in the segment

### **Major Watershed Events**

Anticipated or known occurrences that have the potential to either positively or negatively impact water quality

# CHARACTERIZATION SITES



# HERE ARE TWO THINGS YOU SHOULD KNOW BEFORE YOU READ THE CHARACTERIZATION SUMMARIES:

## 1. THREE OF THESE SEGMENTS ARE A PART OF THE BIG.

In 2008, H-GAC established the Bacteria Implementation Group (BIG), a 31-person stakeholder group working together to reduce bacteria in a large geographic area.

This group completed an Implementation Plan (I-Plan) in January 2013 that defined best management practices and voluntary actions that could be taken across the region to address bacteria. Early results are very positive.

You'll learn more about the BIG in the summaries for West Fork San Jacinto River (1004); East Fork San Jacinto River (1003); and White Oak Bayou (1017).

## 2. REMEMBER, THESE ARE ONLY SUMMARIES.

H-GAC has taken seven years worth of data and distilled it down to the highlights.

If you'd like to read about all the technical aspects of the analysis, including modeling and methodology, you can request a full copy of this report by e-mailing [WaterResources@h-gac.com](mailto:WaterResources@h-gac.com).

## Common Acronyms

AU	Assessment Unit	OSSF	On-Site Sewage Facility
BIG	Bacteria Implementation Group	SSO	Sanitary Sewer Overflow
CRP	Clean Rivers Program	TCEQ	Texas Commission on Environmental Quality
EIH	Environmental Institute of Houston	TMDL	Total Maximum Daily Load
DO	Dissolved Oxygen	TSSWCB	Texas State Soil & Water Conservation Board
EPA	Environmental Protection Agency	USGS	U.S. Geological Survey
H-GAC	Houston-Galveston Area Council	WPP	Watershed Protection Plan
I-PLAN	Implementation Plan	WWTF	Wastewater Treatment Facility



## CEDAR BAYOU TIDAL (0901)

### DESIGNATED USES

High Aquatic Life, Contact Recreation, General, Fish Consumption

LENGTH  
19 miles

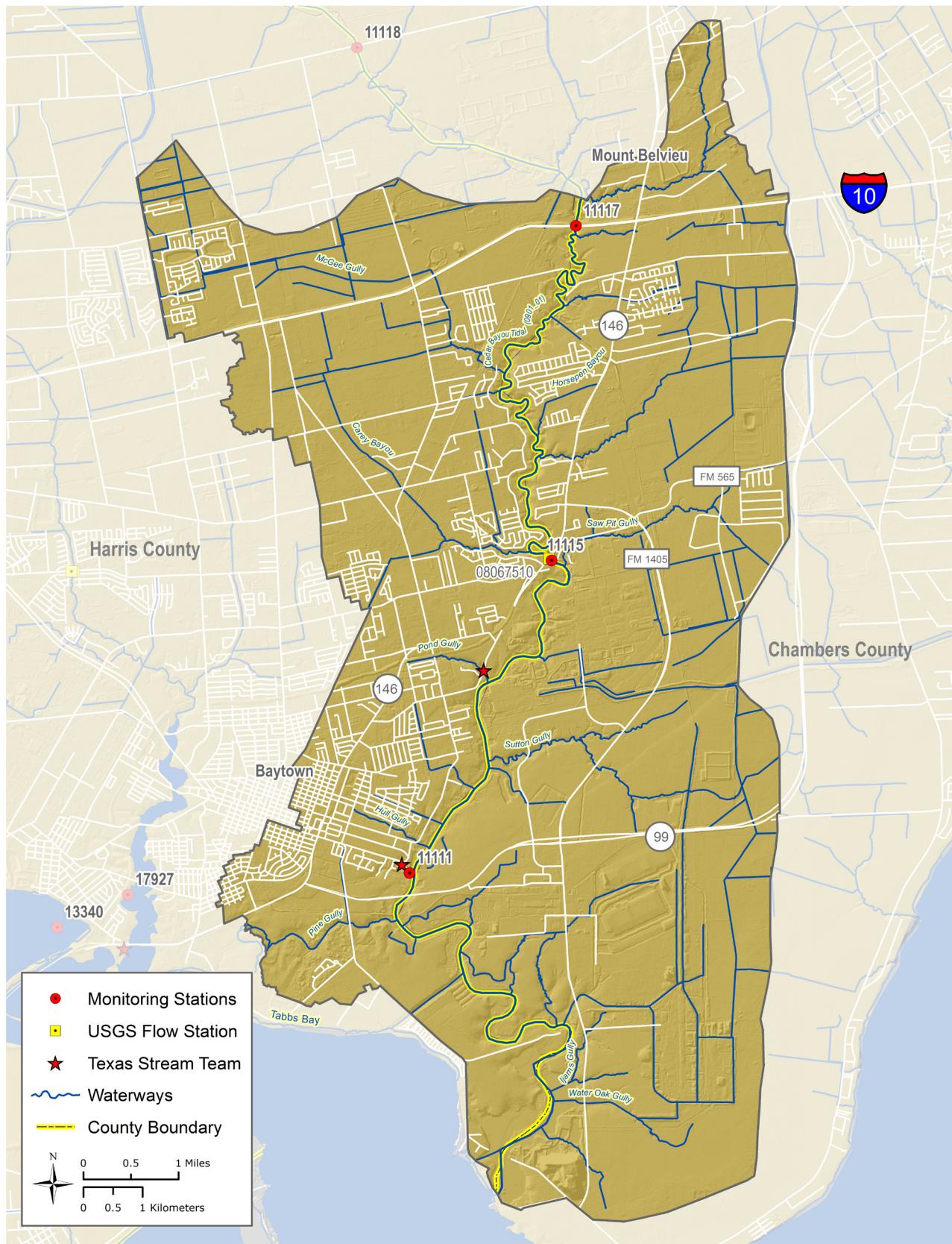
53.5 sq mi  
watershed

2 Texas Stream  
Team sites  
(volunteer monitoring)

3 ACTIVE MONITORING  
STATIONS IN 2015

28 total  
permitted outfalls

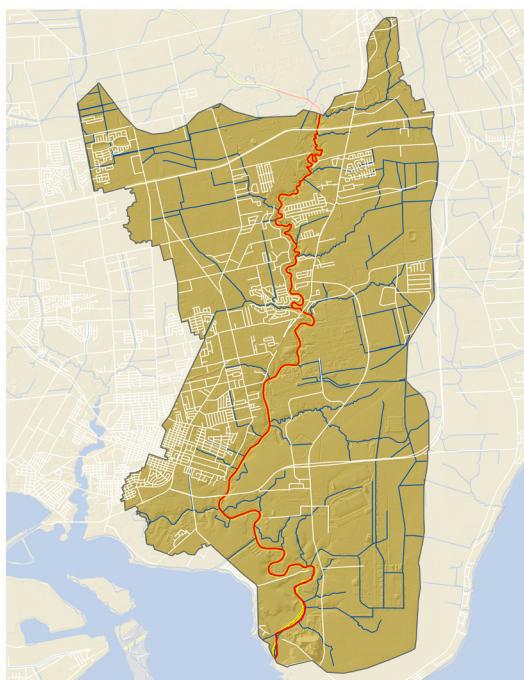
# MONITORING STATIONS MAP



# POTENTIAL SOURCES OF WATER QUALITY ISSUES?

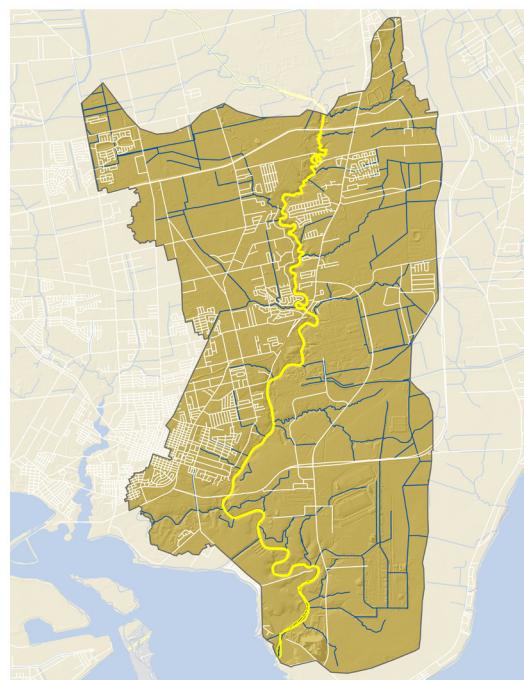
CEDAR BAYOU TIDAL IS IMPACTED BY A LARGE DEGREE OF HUMAN ACTIVITY DUE TO THE DENSE URBAN AND INDUSTRIAL COMPLEXES IN THE AREA.

## BACTERIA



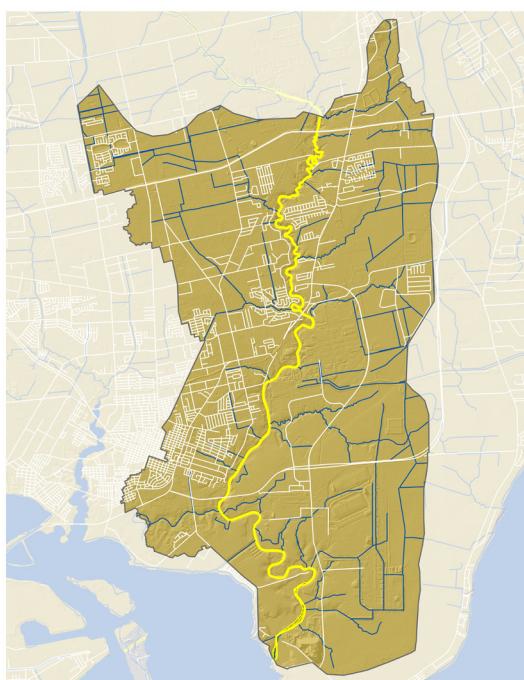
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## DISSOLVED OXYGEN



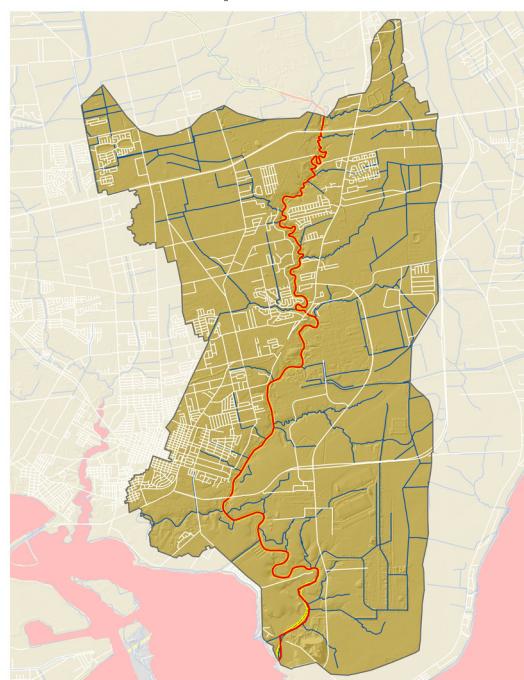
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## NUTRIENTS



Improving

## PCB / DIOXIN



No Change

Impairment

Concern

Unimpacted

# LAND USE & NATURAL CHARACTERISTICS

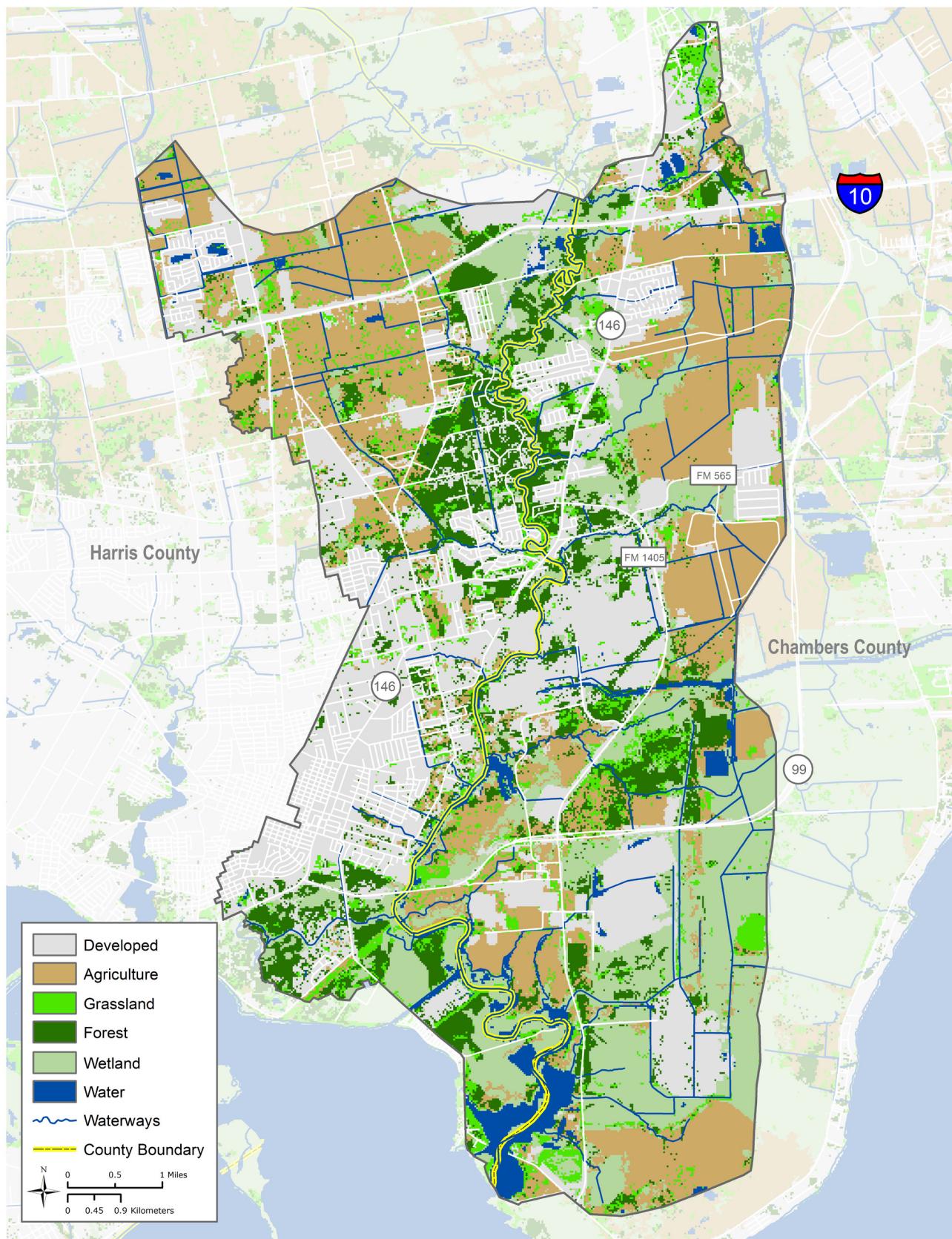
Urban and industrial land uses in Cedar Bayou Tidal have expanded greatly in recent decades, and petrochemical industries are common in the area. Urban development generally increases as you move farther south toward the City of Baytown, with major transportation corridors such as I-10, SH 146 and SH 99 serving as concentrators of new growth. The western portions of the segment are dominated by urban and suburban residential development with industrial complexes and undeveloped land dominating the eastern reaches.

The primary urban centers of the watershed include the City of Baytown in the southwestern portion of the tidal segment and the City of Mont Belvieu near the tidal/above tidal segment boundary. Agricultural activity in the watershed is primarily relegated to the undeveloped areas at the fringe of the urban/industrial developments.

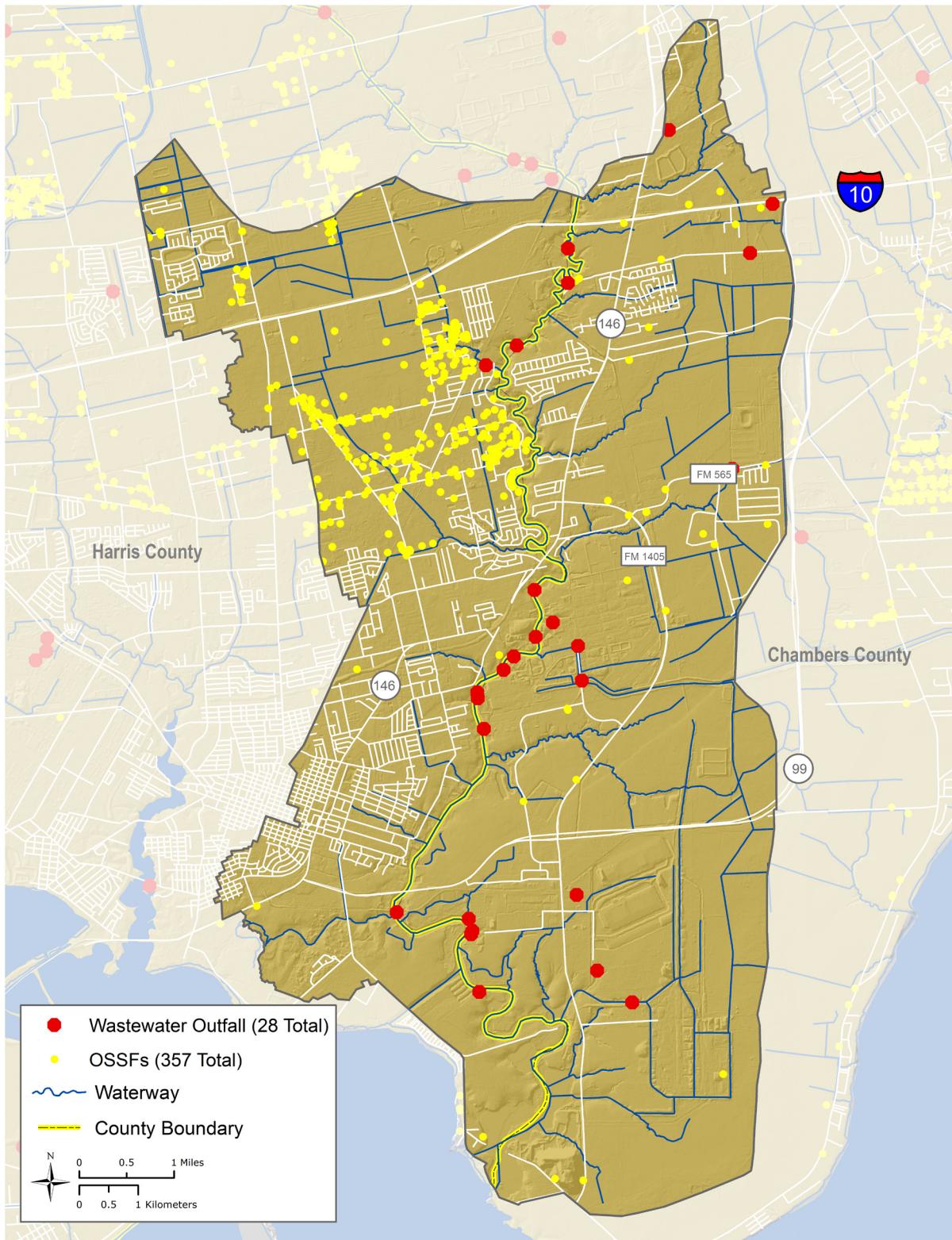
South of the Baytown area, the land uses include a variety of wetland and undeveloped land cover types. Specific uses of note in this area include a large solid waste landfill site adjacent to Cedar Bayou's east shore north of the mouth. Blocks of undeveloped bottomland forest, tidal wetland and coastal prairie can be found at the mouth of Cedar Bayou near its confluence with Upper Galveston Bay. Highly salt-tolerant plants are common to the coastal marshes and estuarine lakes in the lower reach.

**FOR MORE DETAILED LAND USE INFORMATION  
VISIT [WWW.H-GAC.COM/GO/WRIM](http://WWW.H-GAC.COM/GO/WRIM).**

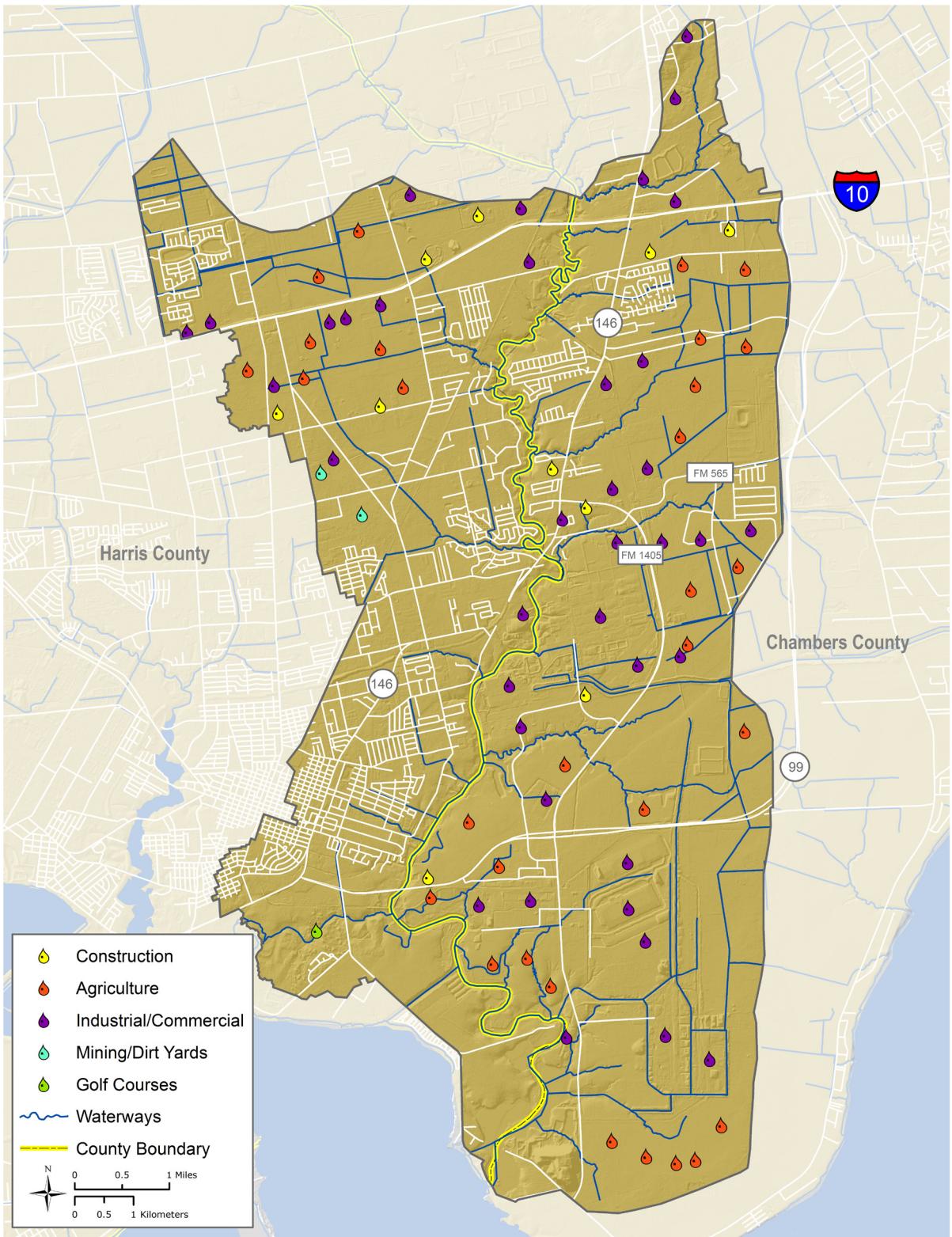
# LAND USE



# POLLUTION SOURCES: WASTEWATER



# POLLUTION SOURCES: OTHER SOURCES



# POTENTIAL STAKEHOLDERS

- Baytown and Mont Belvieu
- Colleges
- Commercial/industrial facilities
- Community groups
- Drainage districts
- Galveston Bay Estuary Program
- Galveston Bay Foundation
- Harris County Flood Control District
- Harris, Liberty and Chambers counties
- Homeowner's Associations
- Independent School Districts
- Lower Trinity River, Trinity Bay and Harris County Soil and Water Conservation Districts
- Residents and landowners
- Road and bridge departments in Harris, Liberty and Chambers counties
- Texas Commission on Environmental Quality (TCEQ)
- Texas State Soil & Water Conservation Board (TSSWCB)
- Texas Parks & Wildlife Department
- Various utility districts

Representatives from most of these entities currently participate in the Cedar Bayou Watershed Partnership through its development of a Watershed Protection Plan (WPP) for the watershed.



# RECOMMENDATIONS

ACTIVITY	ENTITY RESPONSIBLE
Continue facilitating the development and approval of the watershed protection plan	H-GAC, TSSWCB & local stakeholders
Continue collecting water quality data to support actions associated with watershed protection plan implementation	TCEQ & CRP partners
Support, maintain and/or increase programs that conduct septic system inspections and oversee maintenance and repairs	County & local agencies & stakeholders
Continue ongoing public outreach to numerous groups throughout the watershed	H-GAC, CRP partners & other stakeholders
Coordinate with key stakeholders on future projects to maximize dollars and achieve greatest benefits for all projects	H-GAC
Find financial support to implement the watershed protection plan for this watershed	H-GAC & other stakeholders
Pursue new local partners to collect additional data to help better isolate problem areas and expand volunteer monitoring with Texas Stream Team	H-GAC

## Ongoing Projects...

H-GAC, in partnership with Texas State Soil and Water Conservation Board (TSSWCB) and the Environmental Protection Agency (EPA), worked with local stakeholders to form the Cedar Bayou Watershed Partnership in 2011.

The Partnership includes representatives from local government, residents, industry, commerce, agricultural producers, community groups and other interested parties, all of whom seek to reduce high levels of bacteria and other sources of contamination through a WPP for Cedar Bayou.

The WPP is currently being developed and is scheduled for completion in early 2015.

Apart from the WPP, agricultural sources and feral hogs are being addressed by a variety of programs under the U.S. Department of Agriculture (USDA) - Natural Resources Conservation Service, TSSWCB, Texas A&M AgriLife and other organizations.

# *Major Watershed Events*

The known or anticipated changes that have the potential to impact this segment include continued population growth, industrial growth, aging wastewater and storm sewer infrastructure, and future drought conditions. Increased development brings greater wastewater treatment facility flows, more land clearing and more impervious cover. Fertilized lawns and other landscapes and additional pet populations produce waste and pollution in stormwater runoff.

The City of Baytown recently joined the TCEQ's Sanitary Sewer Overflow Initiative, with a commitment to rehabilitate aging sewer infrastructure known to be a source of bacteria in the segment. Hydrologic modification above and beyond routine dredging efforts, which may impact flow conditions, has been proposed for parts of the segment downstream of the City of Baytown.

Recent efforts by WPP stakeholders and other local organizations resulted in removal of more than a dozen abandoned vessels from the segment, eliminating them as impediments to safety, sediment transport and as sources of legacy contamination. The photo below is of one vessel.

Patrolling for additional vessels will occur going forward. The largely undeveloped area east of the City of Baytown in Chambers County is designated for industrial growth and is expected to develop rapidly in the coming decade. Lastly, implementation of the new round of Texas Pollutant Discharge Elimination System (TPDES) stormwater permits in the watershed will bring additional action on urban bacteria sources.





## BASTROP BAYOU (1105)

### DESIGNATED USES

High Aquatic Life, Contact Recreation, General

LENGTH  
19 miles

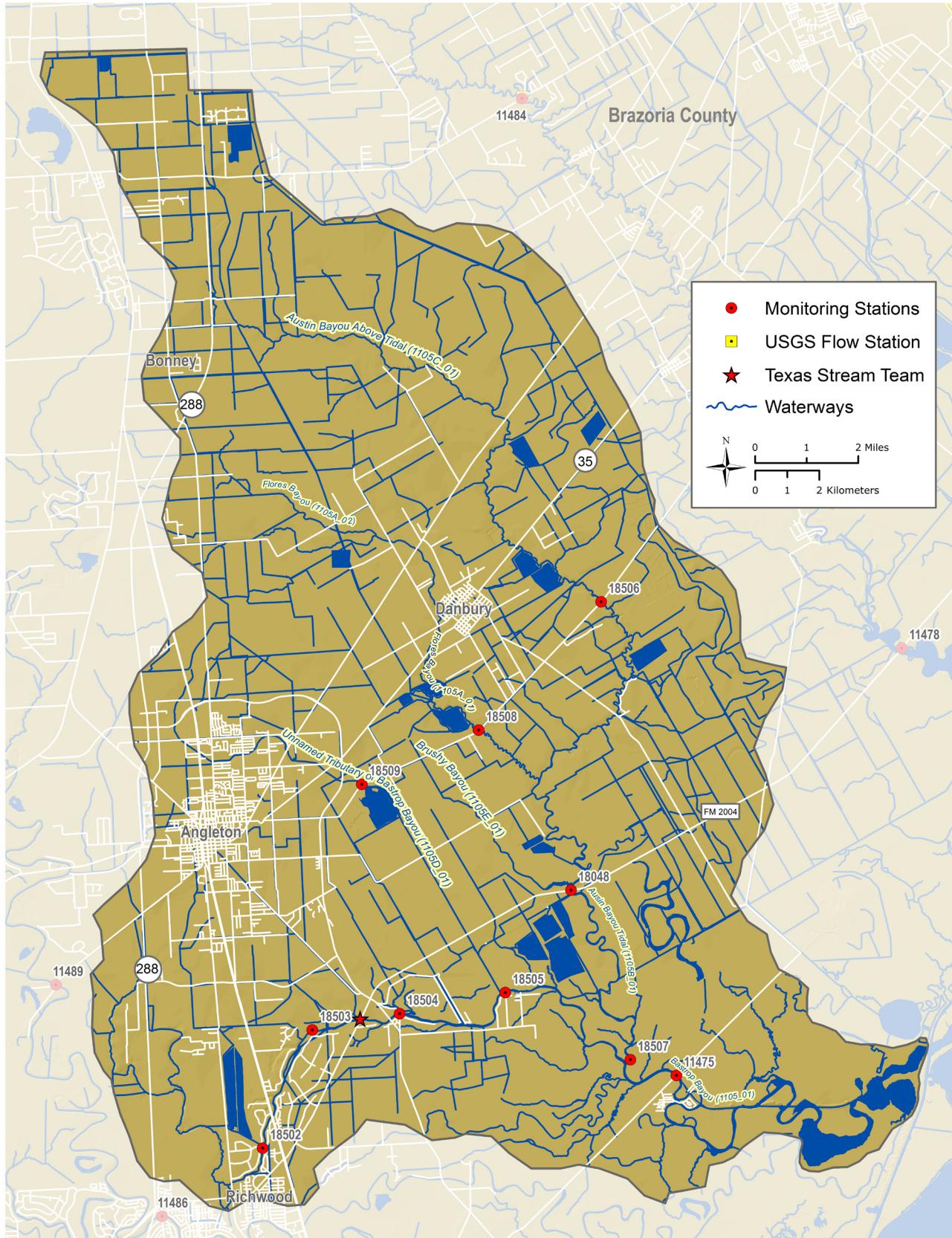
217 sq mi  
watershed

1 Texas Stream  
Team site  
(volunteer monitoring)

10 ACTIVE MONITORING  
STATIONS IN 2015

8 total  
permitted outfalls

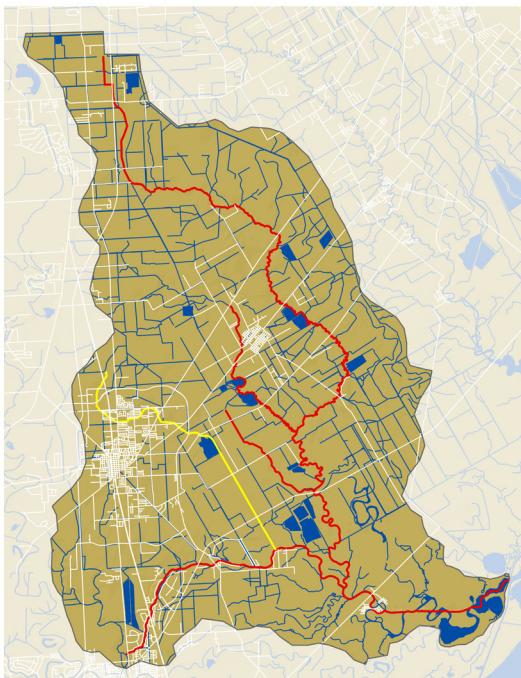
# MONITORING STATIONS MAP



# POTENTIAL SOURCES OF WATER QUALITY ISSUES?

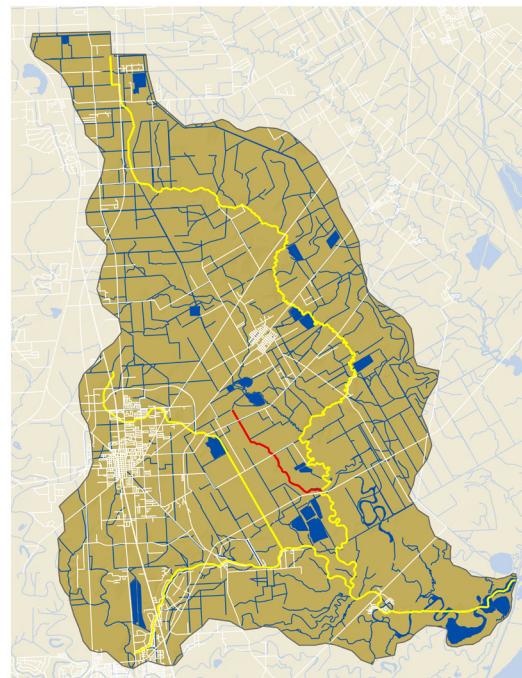
BASTROP BAYOU IS DOMINATED BY RURAL AND AGRICULTURAL LAND USES AND HAS A HIGH CONCENTRATION OF ON-SITE SEWAGE FACILITIES.

## BACTERIA



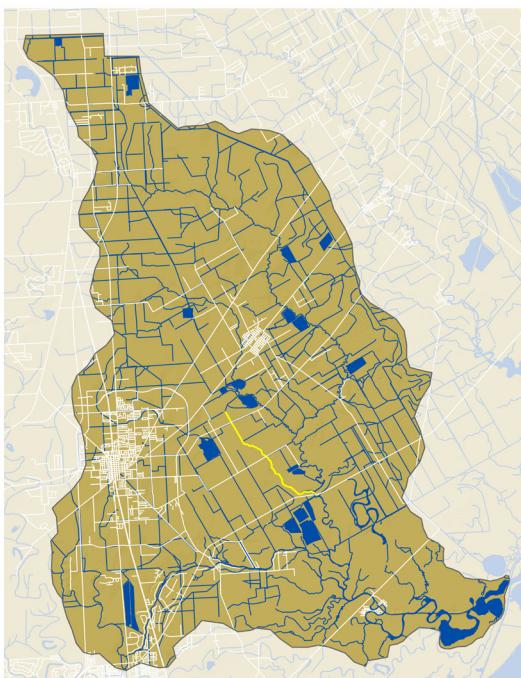
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## DISSOLVED OXYGEN



No Change

## NUTRIENTS



Deteriorating.

Impairment

Concern

Unimpacted

# LAND USE & NATURAL CHARACTERISTICS

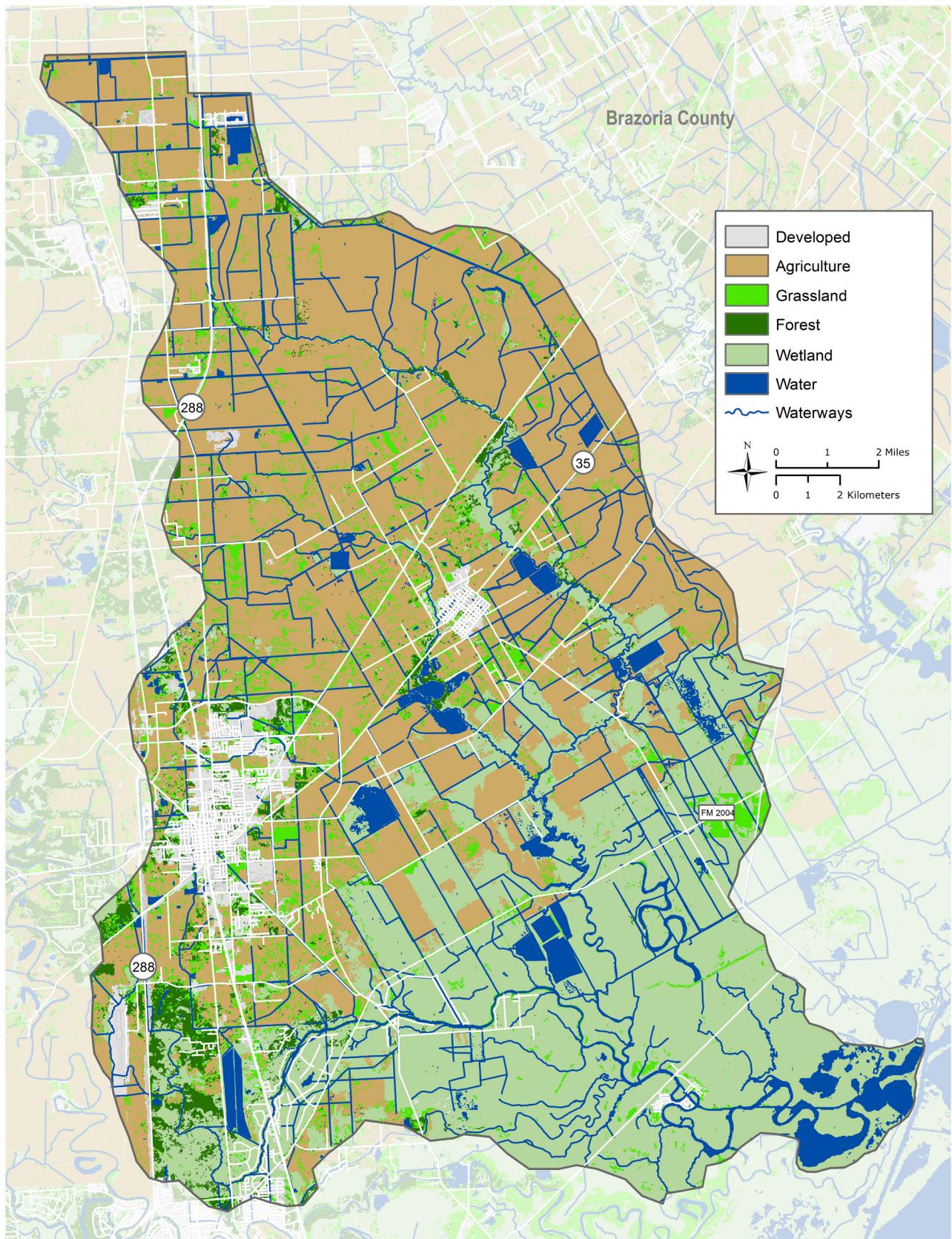
The Bastrop Bayou watershed contains four primary land use/land cover types – hay/pasture lands (29%), emergent herbaceous wetlands (22%), cultivated crop lands (19%) and woody wetlands (11%). Bastrop Bayou plays an integral role in Brazoria County’s commerce through agricultural and seafood production. The upper watershed, which includes Austin Bayou and Flores Bayou, provides an extensive freshwater wetland habitat which is home to endangered or threatened shorebirds as well as waterfowl, grassland species and birds of prey.

Brazoria National Wildlife Refuge is located in the tidal portion of the watershed adjacent to Bastrop and Christmas bays along the southern shoreline. Bastrop Bayou eventually flows into Christmas Bay Coastal Preserve which hosts sea grass beds important to Texas’ coastal ecology.

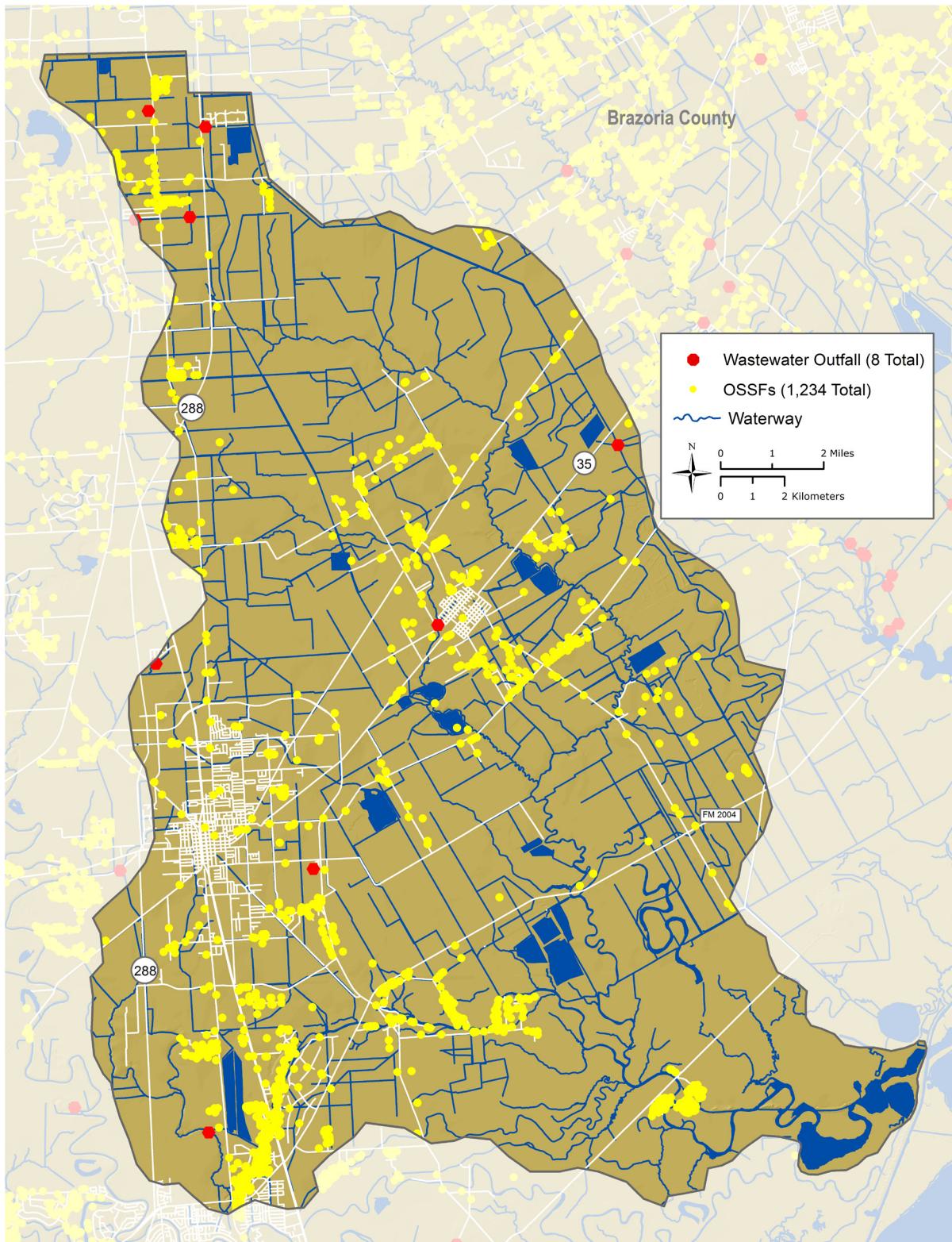
Although the watershed is dominated by rural and agricultural land uses, projected growth will likely accelerate urban and residential development in coming years. The City of Angleton is located along the northwestern portion of the Unnamed Tributary of Bastrop Bayou at the intersection of SH 288 and SH 35 and is the most developed residential area in the watershed. Additionally, the City of Danbury, portions of northeastern Richwood and northeastern Lake Jackson, and a number of other small communities fall within the Bastrop Bayou watershed.

**FOR MORE DETAILED LAND USE INFORMATION  
VISIT [WWW.H-GAC.COM/GO/WRIM](http://WWW.H-GAC.COM/GO/WRIM).**

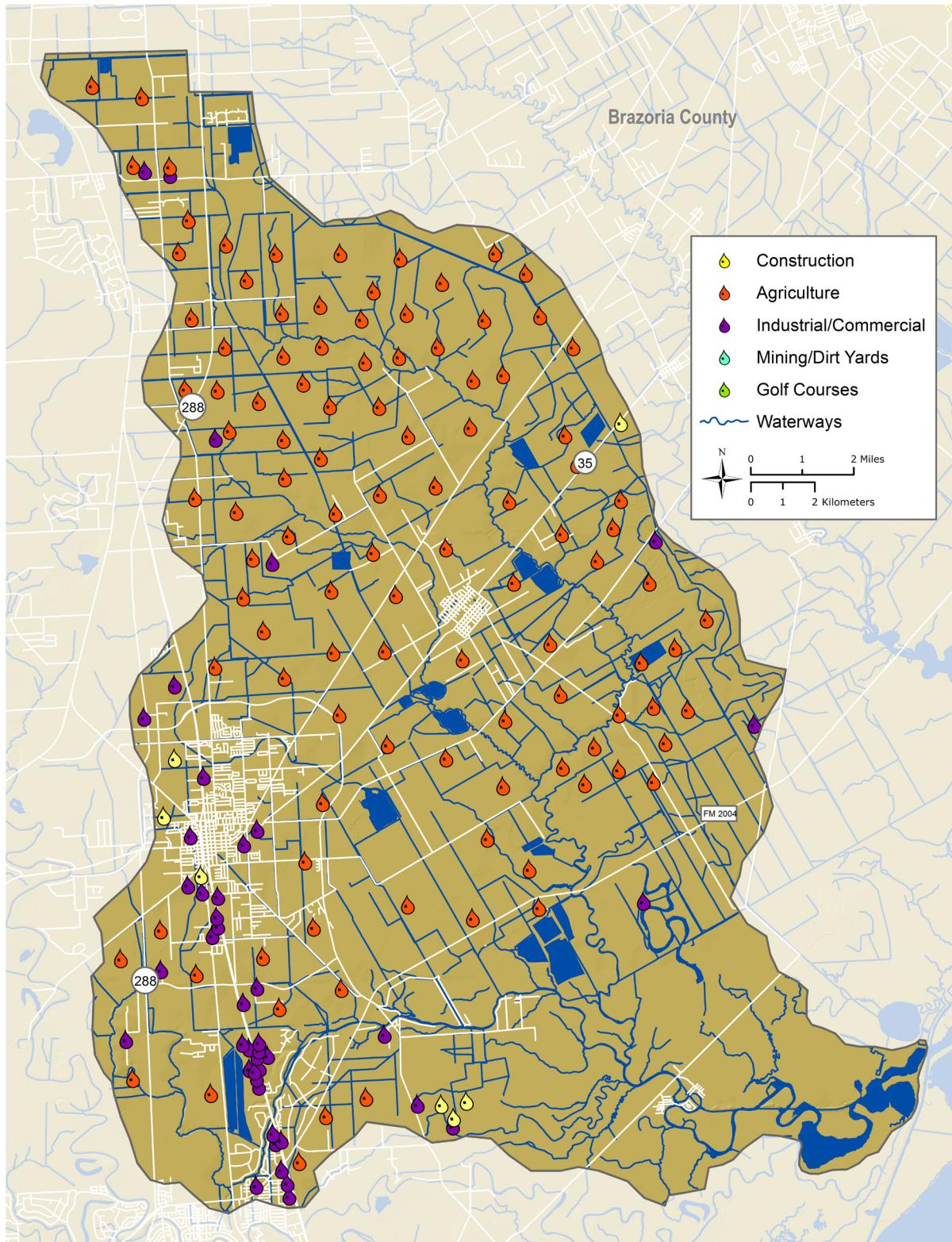
# LAND USE



# POLLUTION SOURCES: WASTEWATER



# POLLUTION SOURCES: OTHER SOURCES



# POTENTIAL STAKEHOLDERS

- Agricultural producers
- Angleton, Lake Jackson, Danbury, Richwood and Demi John
- Brazoria County Health Department
- Brazoria County
- Brazoria National Wildlife Refuge
- Commercial/industrial facilities
- Community groups
- Drainage districts
- Galveston Bay Estuary Program
- Galveston Bay Foundation
- Homeowner's Associations
- Independent School Districts
- Residents & land owners
- Special districts (municipal utility districts, freshwater supply districts, etc.)
- TCEQ
- Texas Parks & Wildlife Department
- TSSWCB
- USDA – Natural Resources Conservation Service

Representatives from most of these entities have participated or currently do participate on the WPP committee for the bayou.



# RECOMMENDATIONS

ACTIVITY	ENTITY RESPONSIBLE
Address bacteria and various other concerns through stakeholder involvement and best management practices	H-GAC, Stakeholders and concerned citizens
Support, maintain and/or increase programs that replace failing OSSFs and oversee maintenance and repairs	County/local agencies & stakeholders, discharge permittees
Continue collecting water quality data and expand monitoring efforts to support actions associated with watershed protection plan implementation and future modeling	TCEQ, H-GAC & CRP partners
Coordinate with key stakeholders on future projects to maximize dollars and achieve greatest benefits for all projects	H-GAC
Pursue new local partners to collect additional data to help better isolate problem areas and expand volunteer monitoring with Texas Stream Team	H-GAC

## Ongoing Projects...

Development of the Bastrop Bayou WPP was facilitated by H-GAC prior to 2014, in partnership with TCEQ, Galveston Bay Estuary Program (GBEP), TSSWCB, Brazoria County and other concerned stakeholders. Key implementation efforts identified in the WPP include remediation of failing OSSFs, installation of pet waste stations, facilitation of partner efforts and education and outreach activities. The WPP is currently under review by the TCEQ and EPA.

In keeping with the goals of the WPP, H-GAC developed an approved third-party Supplemental Environmental Project (SEP) to provide assistance to low-income homeowners to repair or replace failing OSSFs, with a specific focus in and around the Bastrop Bayou project area. Brazoria County is also addressing OSSF issues through an SEP. The community of Demi John is addressing failing OSSFs through planned installation of sanitary sewer.

Contamination from urban areas in the watershed, including the City of Angleton, is being partially addressed through the implementation of TPDES stormwater permits. Agricultural sources and feral hogs are being addressed by a variety of programs under the USDA, TSSWCB, Texas A&M AgriLife and other organizations. An annual River, Lakes, Bays 'N Bayous Trash Bash event is held in the watershed to reduce trash along lower Bastrop Bayou and to educate residents.

# *Major Watershed Events*

The known or anticipated changes that have the potential to impact this segment include continued population growth, industrial growth, aging wastewater infrastructure and future drought conditions. Development brings more impervious cover, OSSFs, increased flows from WWTFs, more land clearing, fertilized lawns and other landscapes, and pets producing waste.

As a coastal watershed, Bastrop Bayou will be impacted from time to time by major weather events, including hurricanes, and experiences periodic drought conditions. Drought may change salinity levels and impact stream ecology.





## WEST FORK SAN JACINTO RIVER (1004)

### DESIGNATED USES

Contact Recreation, High Aquatic Life Use, Public Water Supply

LENGTH  
40 miles

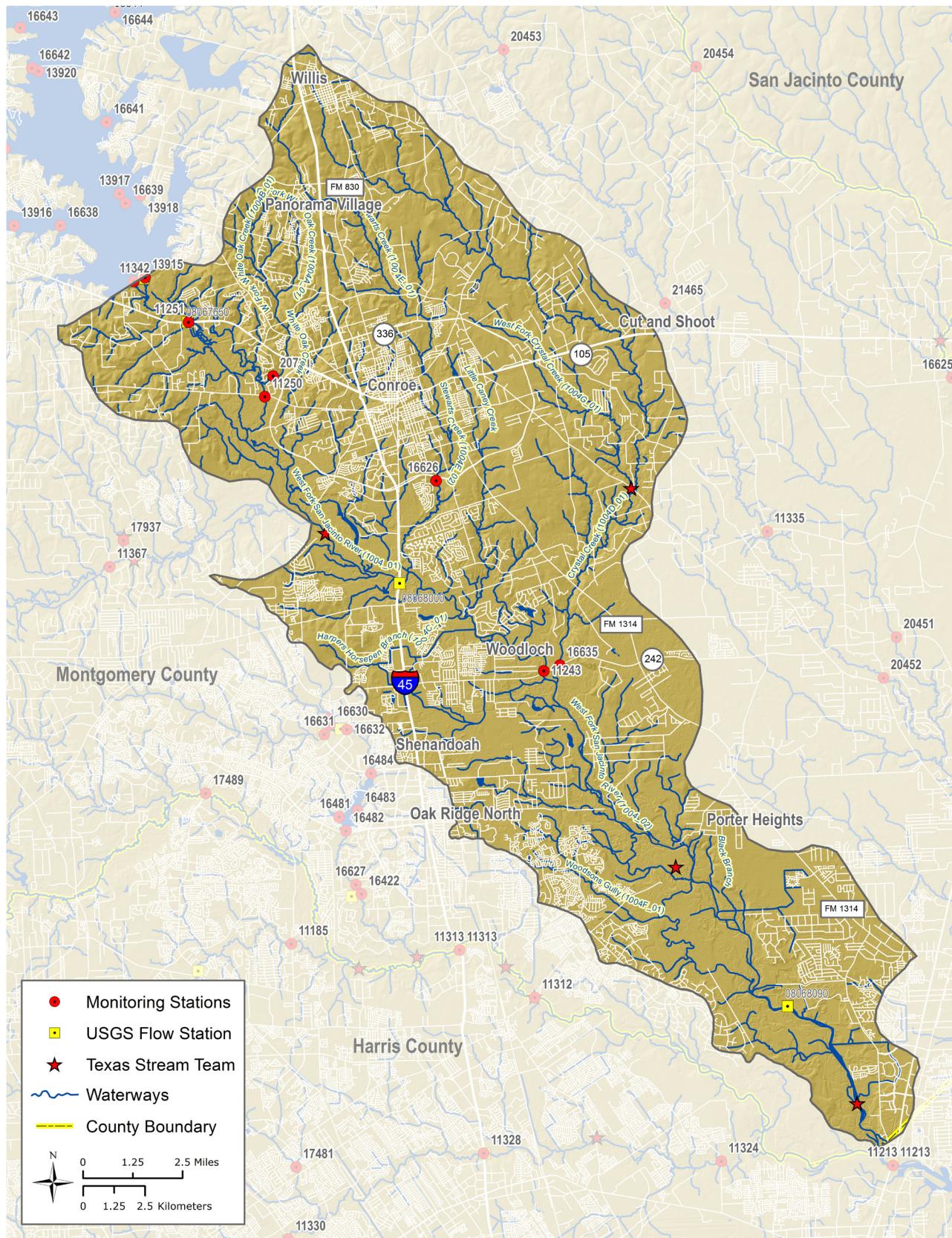
216 sq mi  
watershed

3 Texas Stream  
Team sites  
(volunteer monitoring)

6 ACTIVE MONITORING  
STATIONS IN 2015

30 total  
permitted outfalls

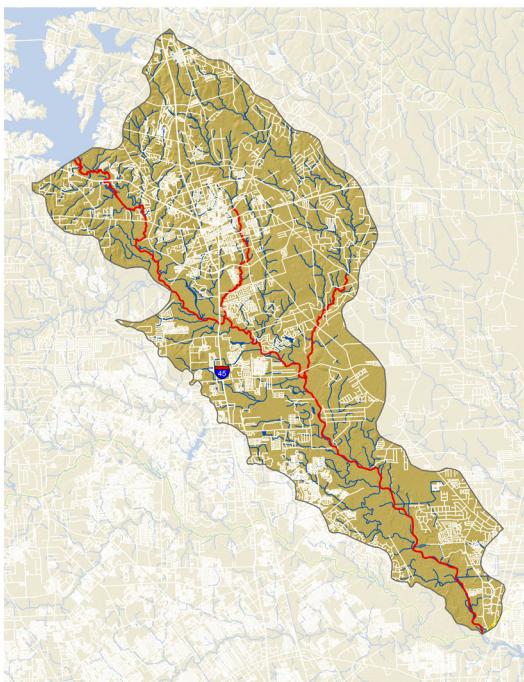
# MONITORING STATIONS MAP



# POTENTIAL SOURCES OF WATER QUALITY ISSUES?

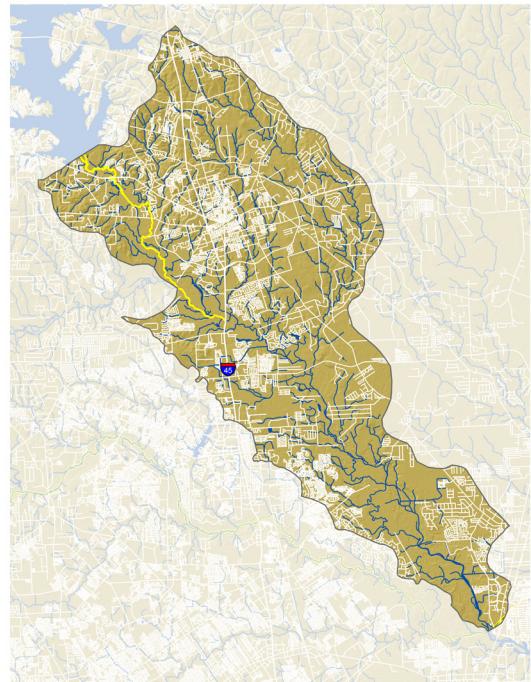
WATER QUALITY ISSUES STEM FROM A VARIETY OF SOURCES SINCE WEST FORK IS A MIX OF RURAL, AGRICULTURAL AND URBAN LAND USES.

## BACTERIA



No Change

## NUTRIENTS



Deteriorating.

Impairment

Concern

Unimpacted

## Additionally...

There are 24 domestic and six industrial wastewater outfalls in the watershed. Numerous sanitary sewer overflows have been reported in the watershed. Causes include inflow and infiltration problems and blockages from debris, grease and/or tree roots.

Due to rapid growth in the watershed outside of areas serviced by sanitary sewers, OSSFs are common. The failure rate for OSSFs in the region is approximately 12%.

# LAND USE & NATURAL CHARACTERISTICS

Forests are the dominant land use/land cover at 30%, with developed open space (14%), woody wetlands (14%) and developed low intensity areas (13%) equally represented in the segment. The City of Conroe sits in the northern portion of this segment where development is concentrated along the I-45 corridor and SH 105.

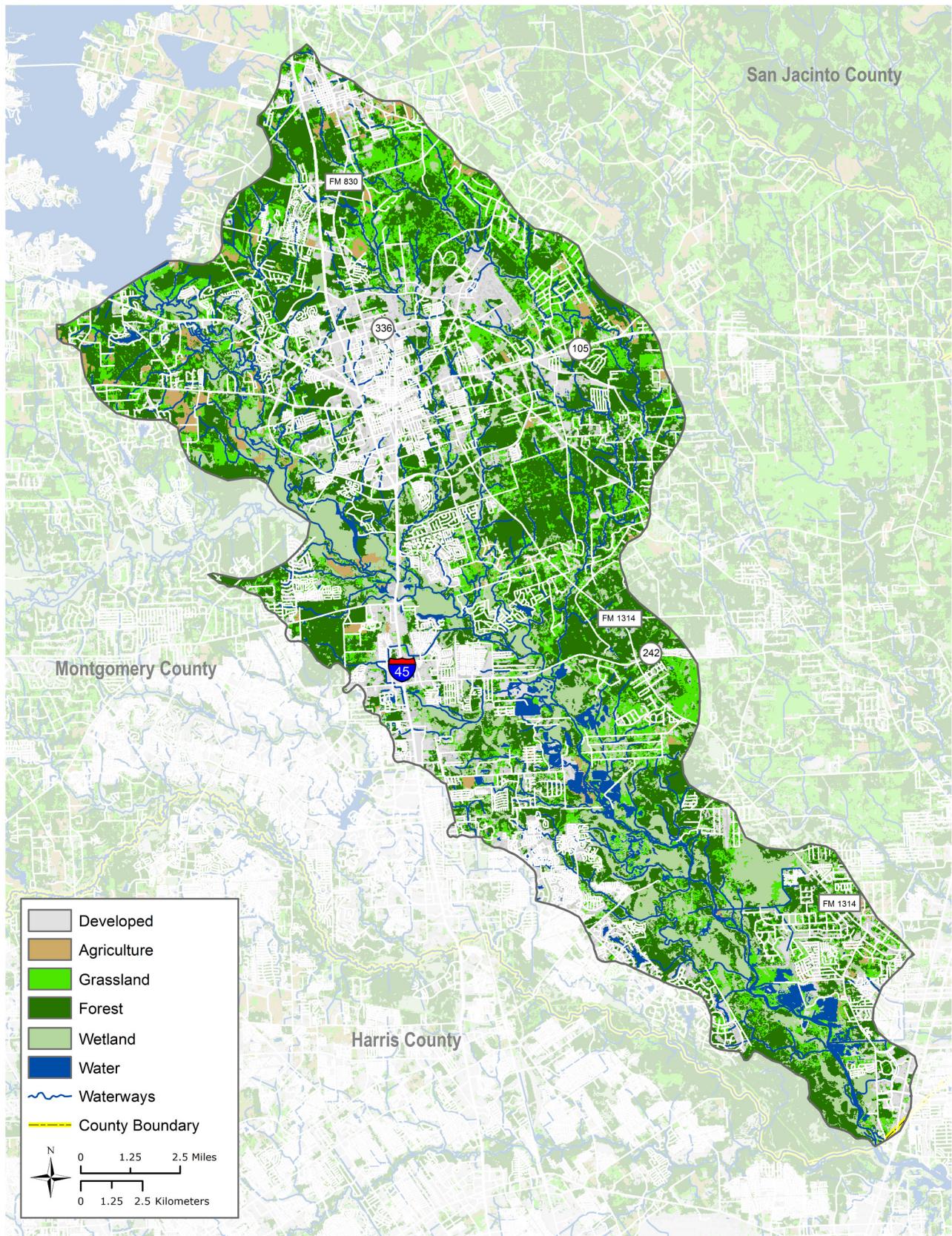
The cities of Shenandoah, Woodloch and Oak Ridge North, along with The Woodlands Township, lie in the central and western portions of the segment. The unincorporated communities of Porter and Kingwood populate the southern end of the segment. Commercial development is clustered along the main highways, crisscrossing the segment with many low-density single-family homes and neighborhoods scattered throughout.

The Crystal Creek watershed, located southeast of Conroe, is dominated by forests and open space in the lower reach and by low-density development in the northern reach.

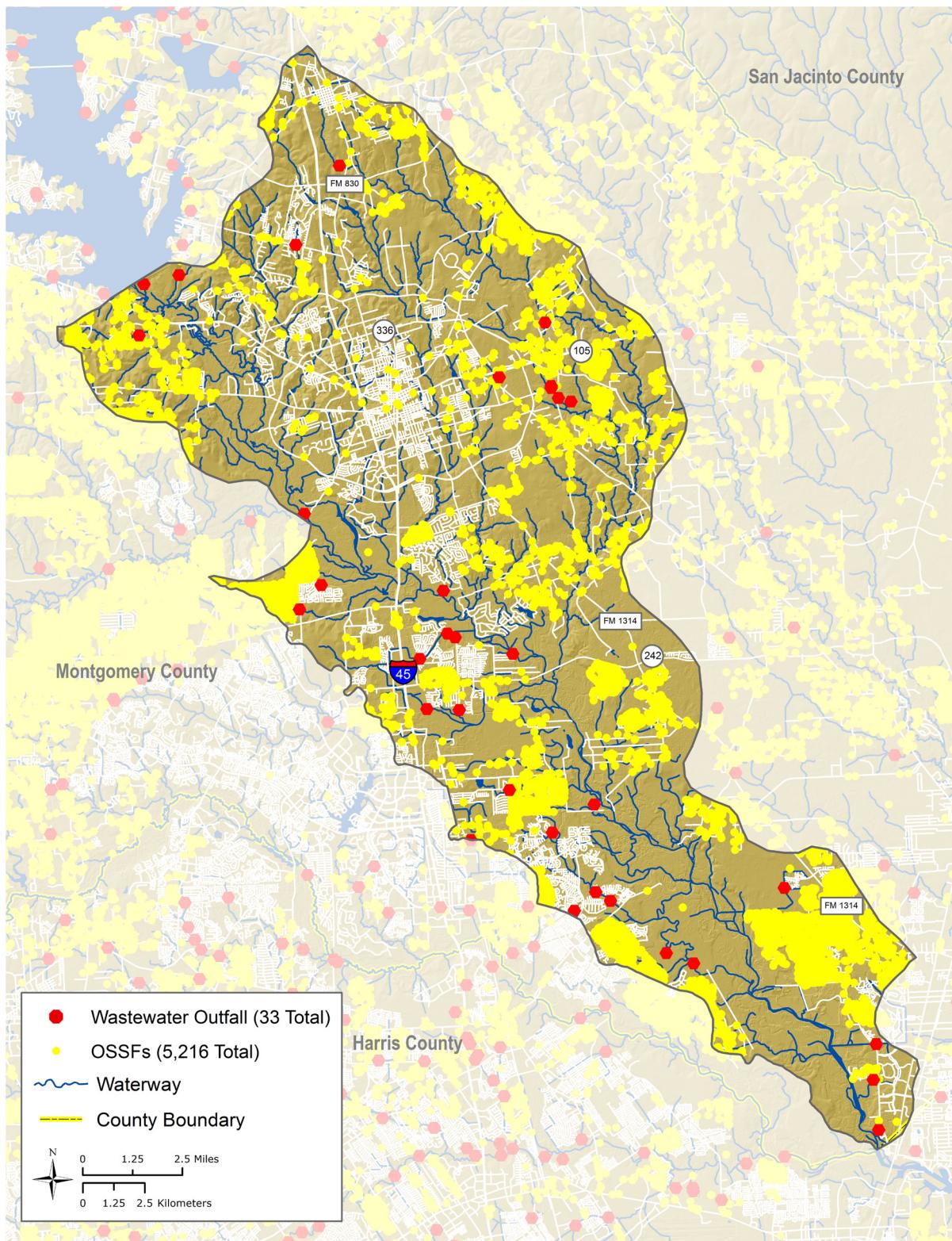
The population in the West Fork is significantly higher than surrounding watersheds, resulting in more OSSFs. Numerous natural areas, parks and golf courses are located within the watershed. Finally, the West Fork San Jacinto River flood plain supports a wide riparian corridor comprised of forests, woody wetlands, herbaceous wetlands and shrub/scrub lands.

**FOR MORE DETAILED LAND USE INFORMATION  
VISIT [WWW.H-GAC.COM/GO/WRIM](http://WWW.H-GAC.COM/GO/WRIM).**

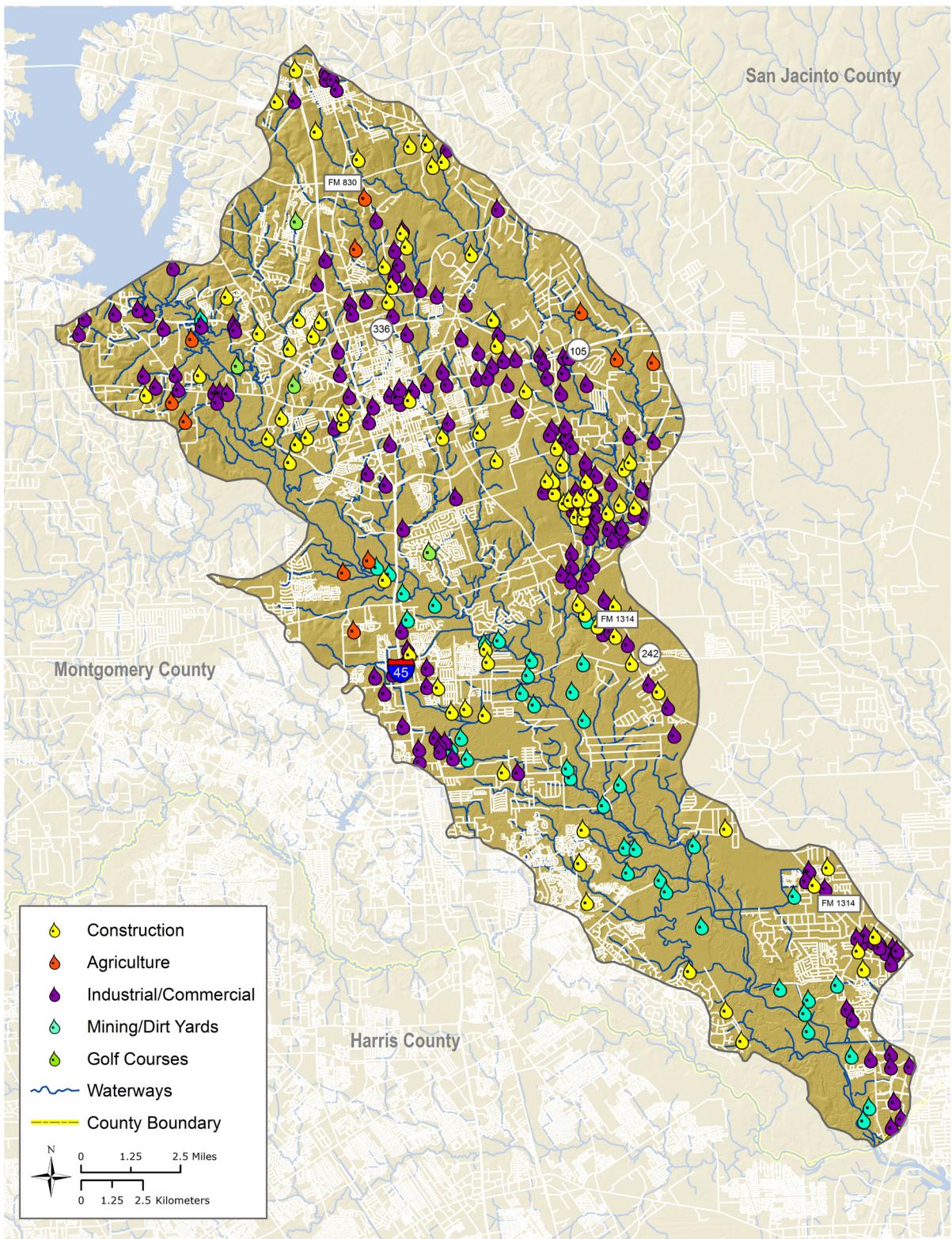
# LAND USE



# POLLUTION SOURCES: WASTEWATER



# POLLUTION SOURCES: OTHER SOURCES



# POTENTIAL STAKEHOLDERS

- Colleges
- Commercial/industrial facilities
- Conservancies/environmental groups
- Drainage districts and flood control districts
- Galveston Bay Foundation
- Homeowner's Associations
- Houston, Conroe, Cut and Shoot, Pinehurst, Shenandoah and The Woodlands
- Independent School Districts
- Law enforcement/environmental enforcement agencies
- Lone Star Groundwater Conservation District
- Montgomery and Harris counties
- San Jacinto River Authority
- Texas A&M Forest Service
- TCEQ
- Texas State Soil and Water Conservation Districts and Board
- Utility districts

There are representatives from most of these entities currently serving on the Watersheds of the East and West Forks of the San Jacinto River Total Maximum Daily Load (TMDL) Steering Committee.



# RECOMMENDATIONS

ACTIVITY	ENTITY RESPONSIBLE
Begin implementing the I-Plan for bacteria reduction	Stakeholders
Continue collecting water quality data and expand monitoring efforts to support actions associated with TMDL and I-Plan implementation	TCEQ, H-GAC & CRP partners
Support, maintain, and/or increase programs that conduct septic system inspections and oversee maintenance and repairs	County/local agencies & stakeholders
Continue ongoing public outreach to numerous groups throughout the watershed	H-GAC, CRP partners & other stakeholders
Address the various concerns found in this segment summary through stakeholder participation in the BIG	H-GAC, local agencies & other stakeholders
Coordinate with key stakeholders on future projects to maximize dollars and achieve greatest benefits for all projects	H-GAC
Pursue new local partners to collect additional data to help better isolate problem areas and expand volunteer monitoring with Texas Stream Team	H-GAC

## Ongoing Projects...

In 2013, H-GAC began stakeholder outreach for a TMDL project to address bacteria impairments in the East/West Forks of the San Jacinto River. Following submission of a Technical Support Document created by the Texas Institute for Applied Environmental Research at Tarleton State University to TCEQ in July 2013, H-GAC began coordinating public meetings for this project. Stakeholders unanimously voted to join the BIG and agreed to implement the TCEQ-approved BIG I-Plan in October 2014.

Moving forward, the TMDL stakeholders will work with the BIG to discuss bringing the two groups together. BIG members will vote to either approve including the East/West Forks of the San Jacinto River watersheds (including Crystal Creek and the western arm of Lake Houston) in the BIG project area or provide comments and feedback to the TMDL stakeholder work group. TCEQ's Commissioners must also approve the merger through adoption of a TMDL in lieu of a separate I-Plan.

# *Major Watershed Events*

The known or anticipated changes that have the potential to impact this segment include Montgomery County's partial conversion to surface water due to groundwater conservation district requirements. As a result, a large surface water treatment facility is being constructed at the dam on the southeast corner of Lake Conroe to provide drinking water to area residents.

Continued development is expected in the West Fork, with new areas of impervious surface, more industry and residential development. Development brings more OSSFs or WWTF flows, more land clearing, fertilized lawns and other landscapes, and pets producing waste.

West Fork stakeholders have expressed interest in preparing for future development and growth through the use of several mechanisms, including conservation, infrastructure improvements and water reuse. These options will be explored further in conjunction with the BIG.





## EAST FORK SAN JACINTO RIVER (1003)

### DESIGNATED USES

Contact Recreation, High Aquatic Life Use, Public Water Supply

LENGTH  
81 miles

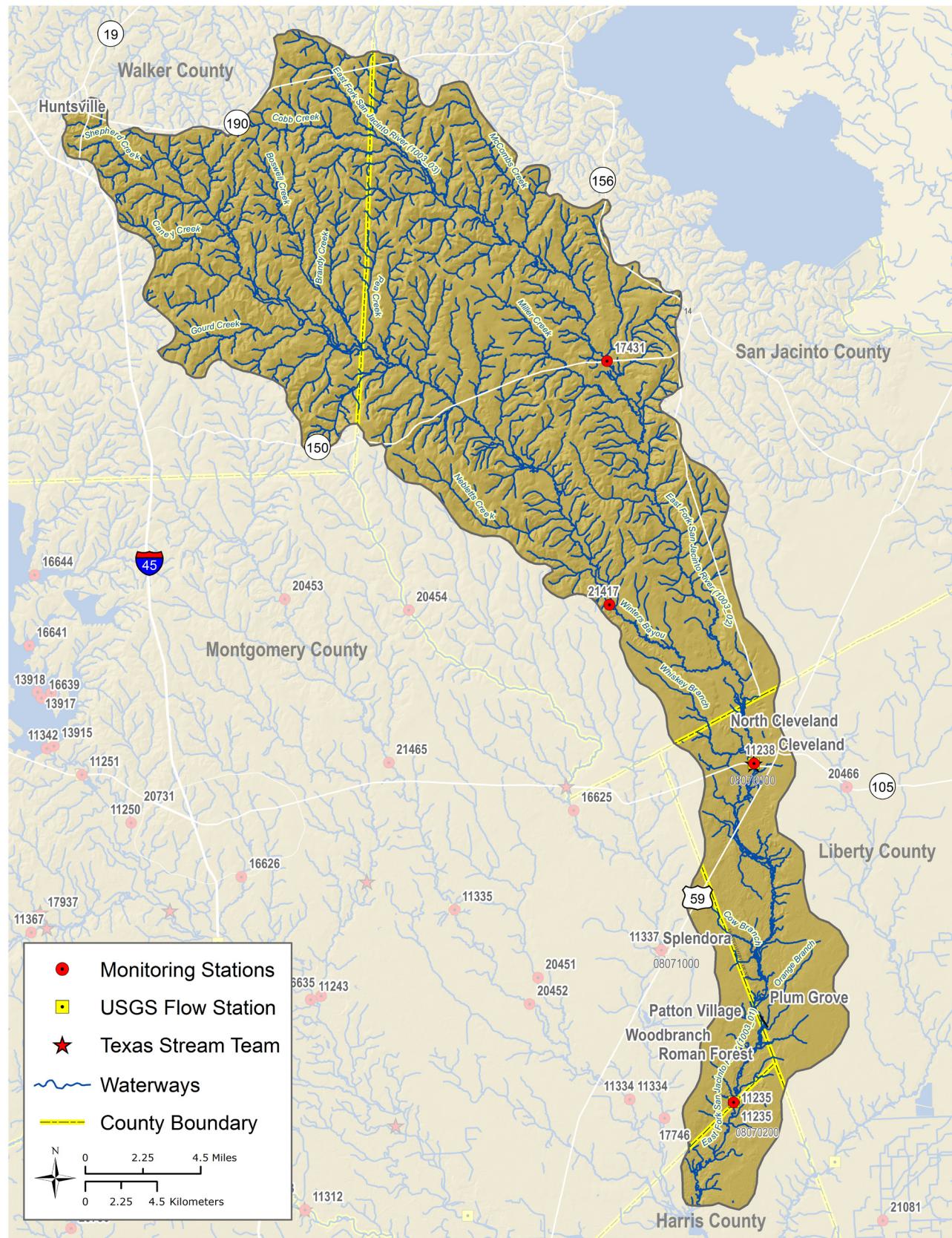
404 sq mi  
watershed

0 Texas Stream  
Team sites  
(volunteer monitoring)

4 ACTIVE MONITORING  
STATIONS IN 2015

5 total  
permitted outfalls

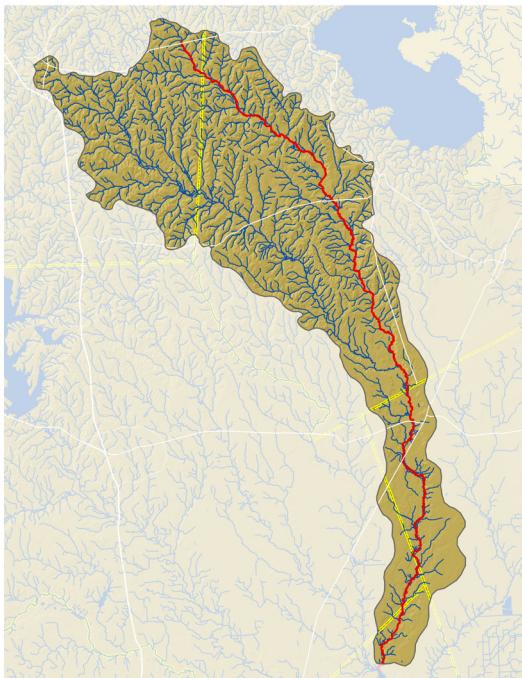
# MONITORING STATIONS MAP



# POTENTIAL SOURCES OF WATER QUALITY ISSUES?

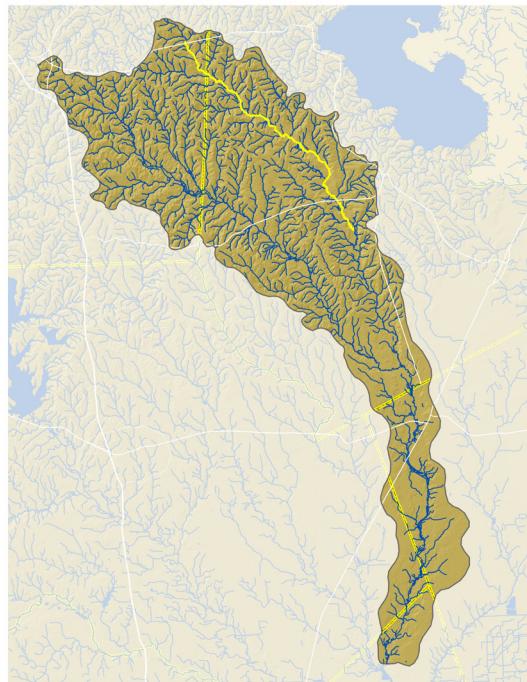
EAST FORK IS PRIMARILY RURAL, WITH A SIZABLE PORTION OF THE POPULATION USING ON-SITE SEWAGE FACILITIES INSTEAD OF SANITARY SEWER.

## BACTERIA



No Change

## NUTRIENTS



Improving.

Impairment

Concern

Unimpacted

## *Additionally...*

The East Fork San Jacinto River is home to large populations of cattle, poultry, horses, sheep and goats. Many have direct access to smaller streams and tributaries, or their fields and pastures border the waterways.

Illegal dumping has also been an issue in this watershed, including improper disposal of solid and liquid waste in or around the waterways.

# LAND USE & NATURAL CHARACTERISTICS

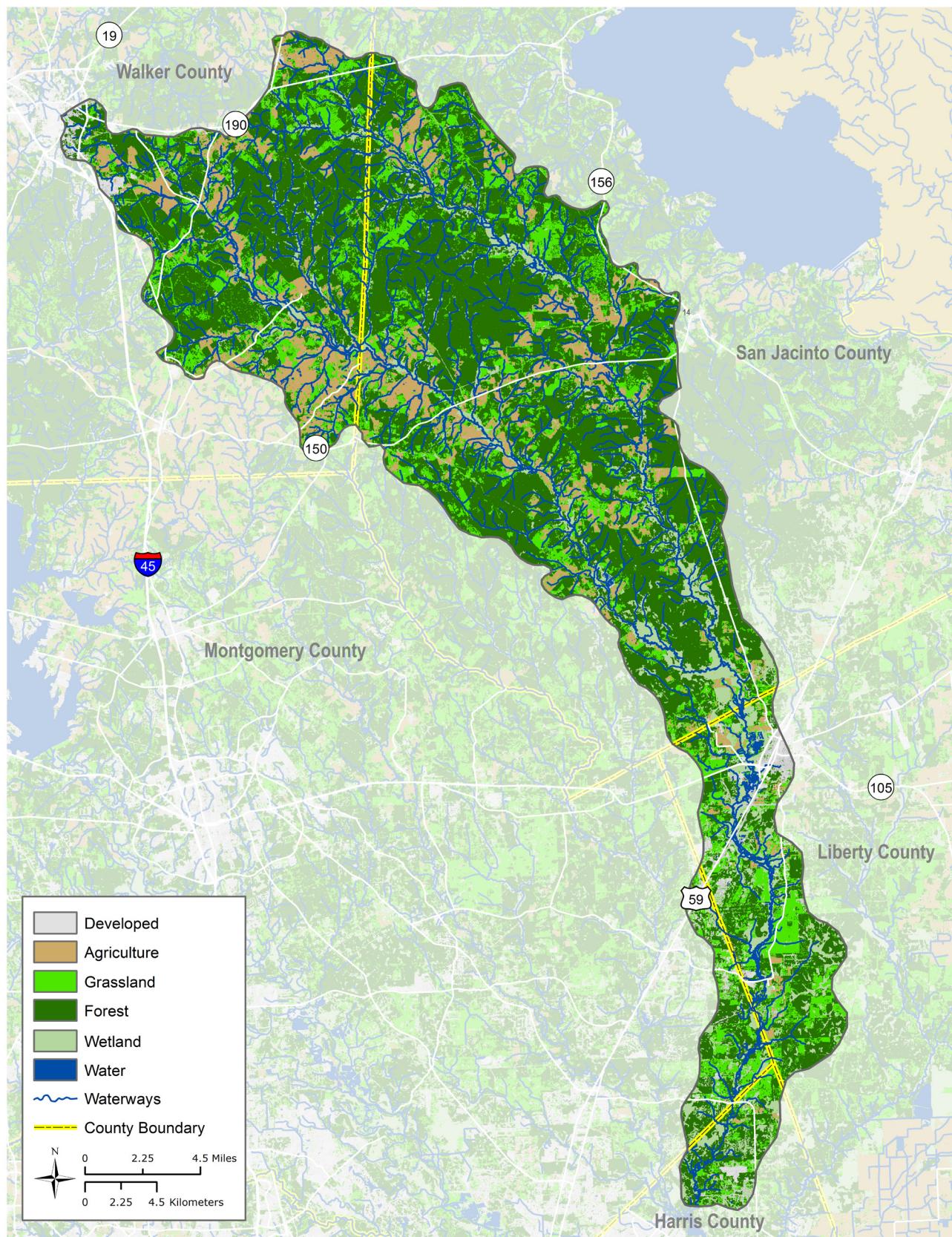
The East Fork San Jacinto River segment is primarily gently rolling, undeveloped rural hills. More than 50% of the land cover is forest. The Sam Houston National Forest covers most of the northern portion of the watershed.

Other notable land use/land covers are woody wetlands (13%), hay/pasture (10%), grasslands (8%) and shrubs/scrub (7.5%).

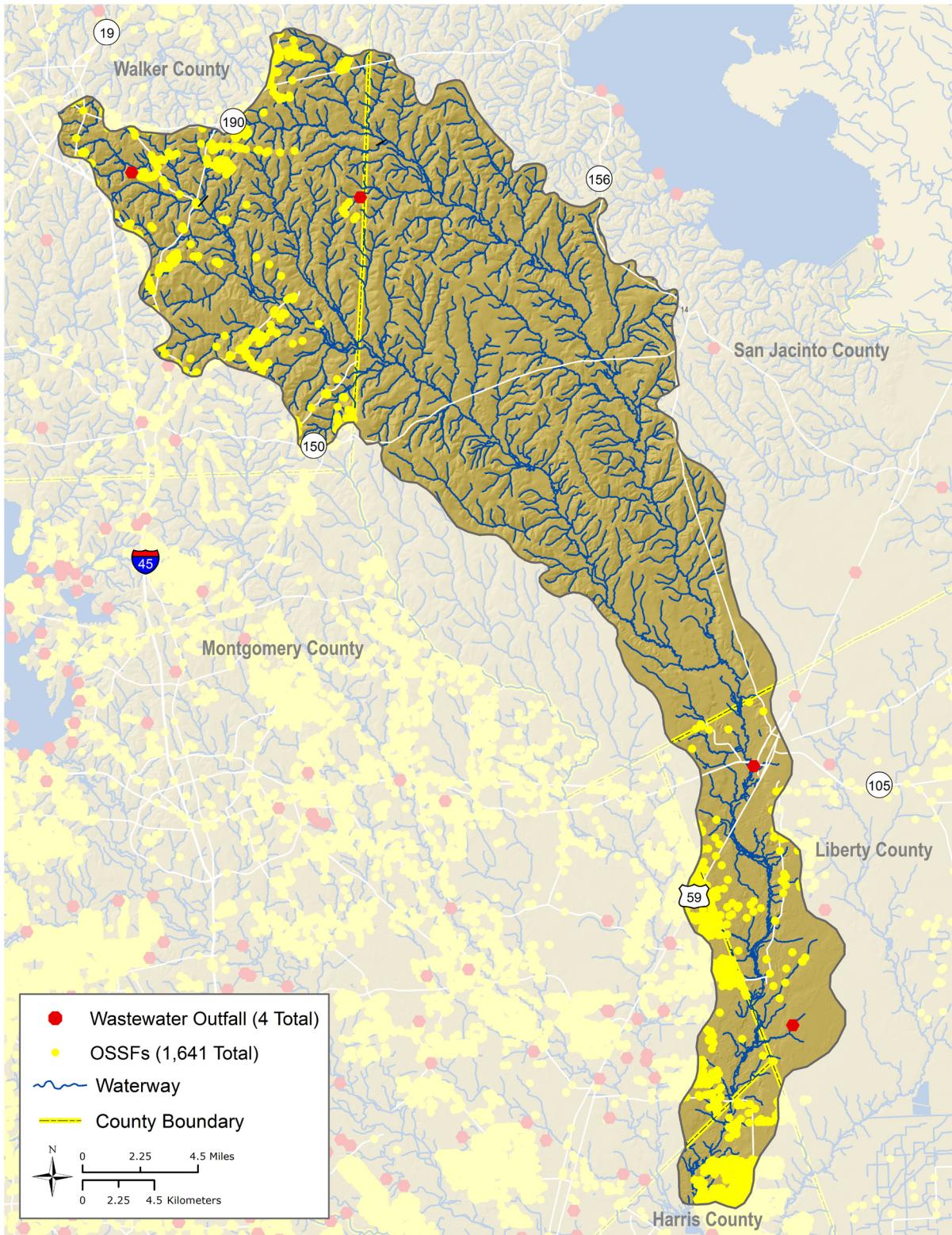
Commercial and residential developments are scattered throughout the segment and depend primarily on OSSFs to manage wastewater disposal. The City of Cleveland is located in the middle of the watershed along the US 59 corridor. There are four active WWTs that discharge to the East Fork.

FOR MORE DETAILED LAND USE INFORMATION  
VISIT [WWW.H-GAC.COM/GOWRIM](http://WWW.H-GAC.COM/GOWRIM).

# LAND USE

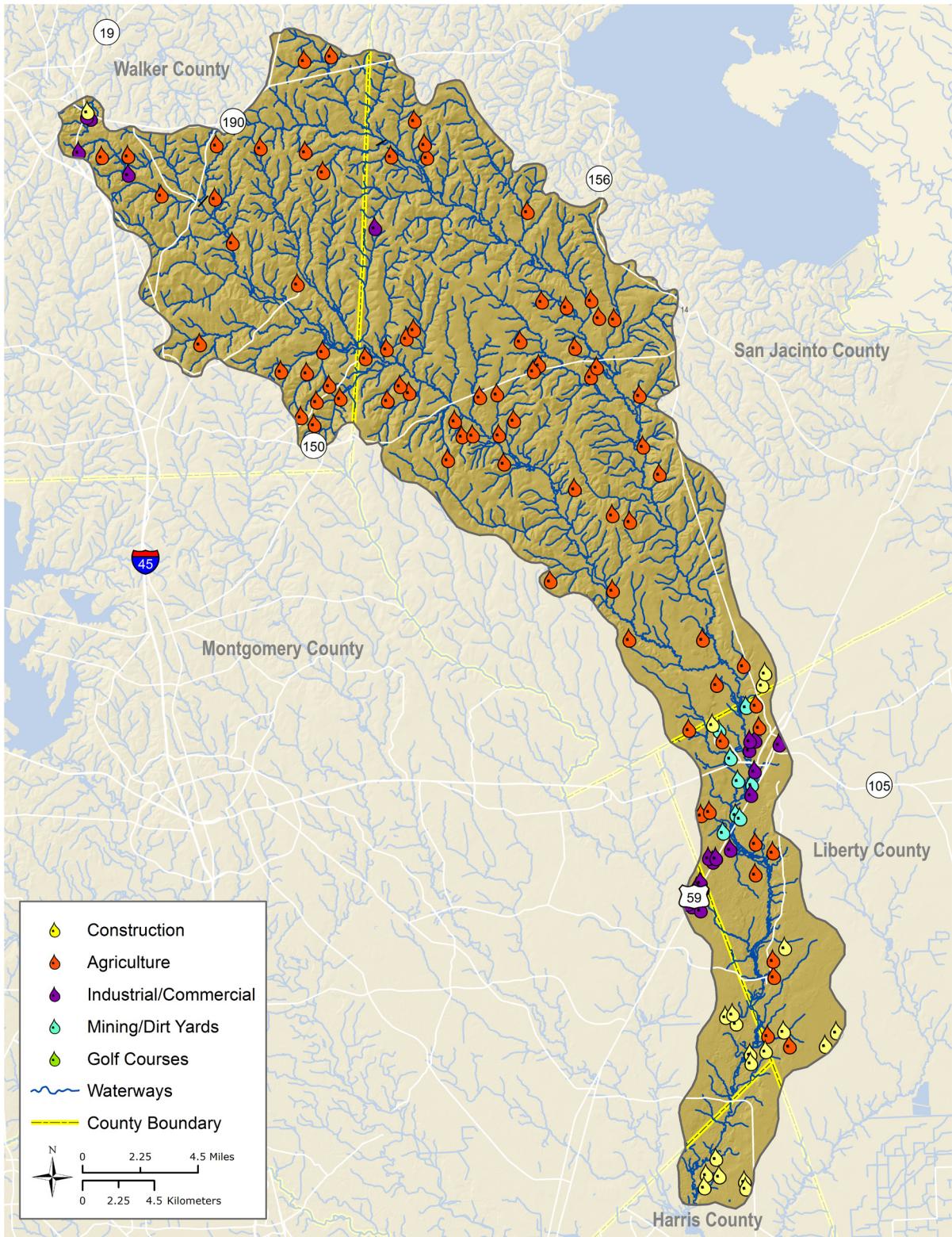


# POLLUTION SOURCES: WASTEWATER



*Because it is outside of H-GAC's service area, WWTF and OSSF data for San Jacinto County is unavailable for this map.*

# POLLUTION SOURCES: OTHER SOURCES



# POTENTIAL STAKEHOLDERS

- Colleges
- Commercial/industrial facilities
- Conservancies/environmental groups
- Drainage districts
- Galveston Bay Foundation
- Homeowner's Associations
- Houston (Kingwood), Plum Grove, Roman Forest, Huntsville, Cold Spring, and Cleveland
- Independent School Districts
- Law enforcement/environmental enforcement agencies
- Lone Star Groundwater Conservation District
- Montgomery, San Jacinto, Liberty and Walker counties
- Sam Houston National Forest
- San Jacinto River Authority
- Texas A&M Forest Service
- TCEQ
- Texas State Soil and Water Conservation Districts and Board
- Utility districts

There are representatives from most of these entities currently serving on the Watersheds of the East and West Forks of the San Jacinto River TMDL Coordination Committee.



# RECOMMENDATIONS

ACTIVITY	ENTITY RESPONSIBLE
Begin implementing the I-Plan for bacteria reduction	Stakeholders
Continue collecting water quality data to support actions associated with TMDL/I-Plan implementation	TCEQ, H-GAC & CRP partners
Support, maintain, and/or increase programs that conduct septic system inspections and oversee maintenance and repairs	County/local agencies & stakeholders
Continue ongoing public outreach to numerous groups throughout the watershed	H-GAC, CRP partners & other stakeholders
Address the various concerns found in this segment summary through stakeholder participation in the BIG	H-GAC, local agencies & other stakeholders
Coordinate with key stakeholders on future projects to maximize dollars and achieve greatest benefits for all projects	H-GAC
Pursue new local partners to collect additional data to help better isolate problem areas and expand volunteer monitoring with Texas Stream Team	H-GAC

## Ongoing Projects...

In 2013, H-GAC began stakeholder outreach for a TMDL project to address bacteria impairments in the East/West Forks of the San Jacinto River. Following submission of a Technical Support Document created by the Texas Institute for Applied Environmental Research at Tarleton State University to TCEQ in July 2013, H-GAC began coordinating public meetings for this project. Stakeholders unanimously voted to join the BIG and agreed to implement the TCEQ-approved BIG Implementation Plan (I-Plan) in October 2014.

Moving forward, the TMDL stakeholders will work with the BIG to discuss bringing the two groups together. BIG members will vote to either approve including the East/West Forks of the San Jacinto River watersheds (including Crystal Creek and the western arm of Lake Houston) in the BIG project area or provide comments and feedback to the TMDL stakeholder work group. TCEQ's Commissioners must also approve the merger through adoption of a TMDL in lieu of a separate I-Plan.

# *Major Watershed Events*

The known or anticipated changes that have the potential to impact this segment include Montgomery County's partial conversion to surface water due to groundwater conservation district requirements and population growth.

Additionally, land use in the East Fork is expected to shift from rural to developed, with new areas of impervious surface, more industry and residential development. Development brings more OSSFs or WWTF flows, more land clearing, fertilized lawns and other landscapes, and pets producing waste.

East Fork stakeholders have expressed interest in preparing for future development and growth through the use of several mechanisms, including conservation, infrastructure improvements and water reuse. These options will be explored further in conjunction with the BIG.





## WHITE OAK BAYOU (1017)

### DESIGNATED USES

Limited Aquatic Life, Contact Recreation

LENGTH  
26 miles

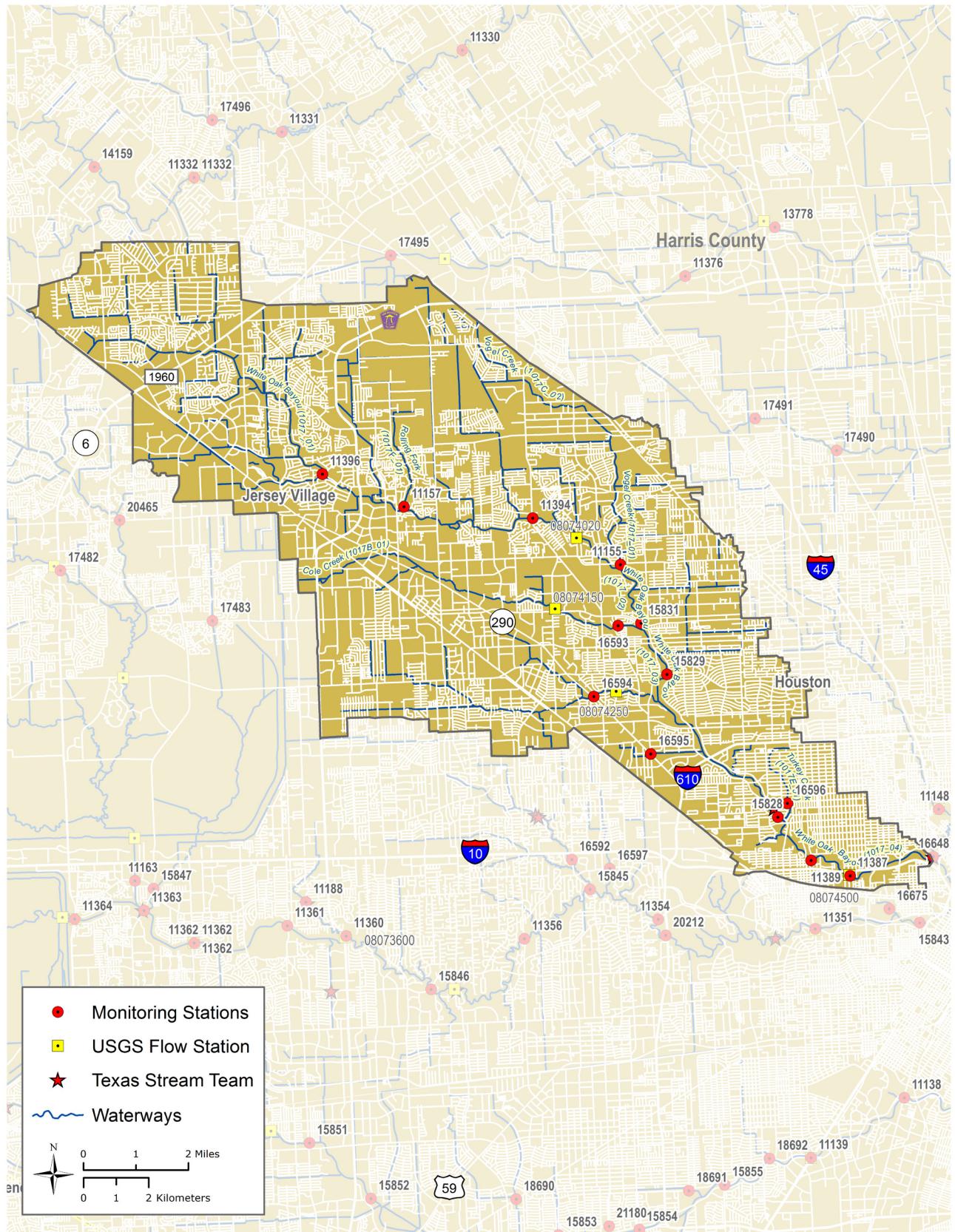
88 sq mi  
watershed

1 Texas Stream  
Team site  
(volunteer monitoring)

13 ACTIVE MONITORING  
STATIONS IN 2015

48 total  
permitted outfalls

# MONITORING STATIONS MAP

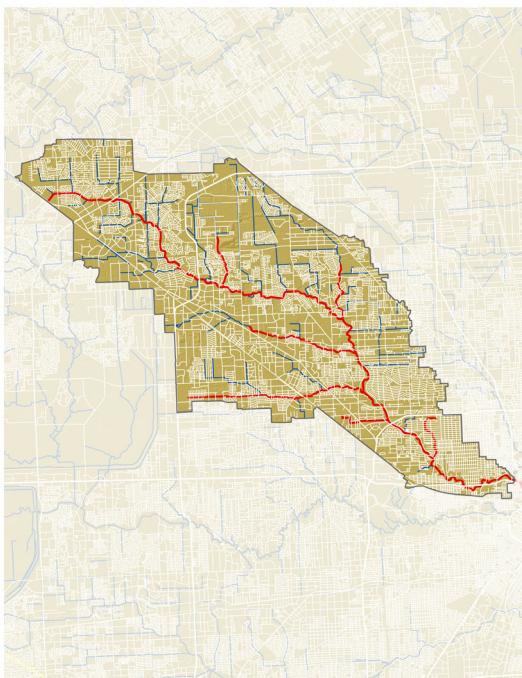


## WHITE OAK BAYOU (1017)

# POTENTIAL SOURCES OF WATER QUALITY ISSUES?

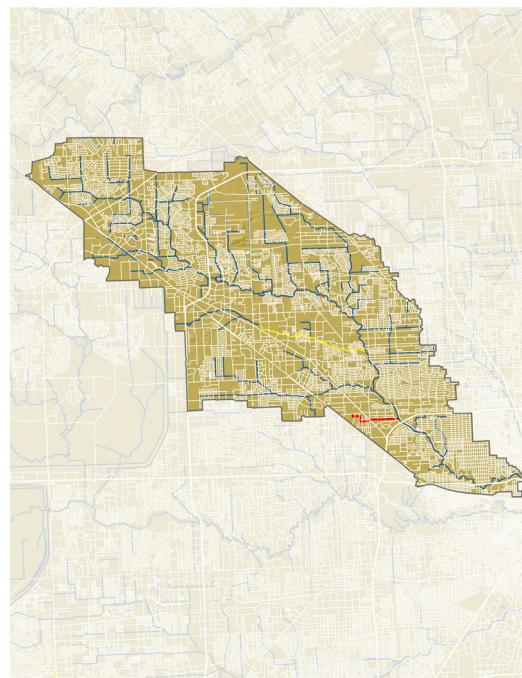
WHITE OAK BAYOU IS HIGHLY URBANIZED AND IMPACTED BY A  
LARGE DEGREE OF HUMAN ACTIVITY.

## BACTERIA



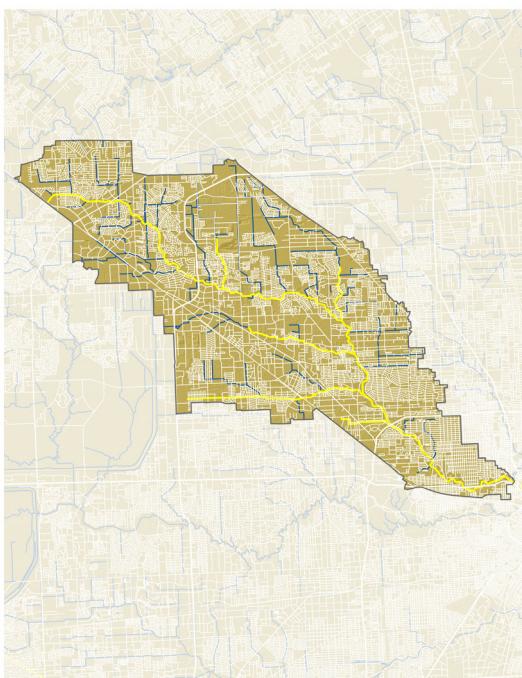
Improving

## DISSOLVED OXYGEN



Improving

## NUTRIENTS



Deteriorating

Impairment

Concern

Unimpacted

# LAND USE & NATURAL CHARACTERISTICS

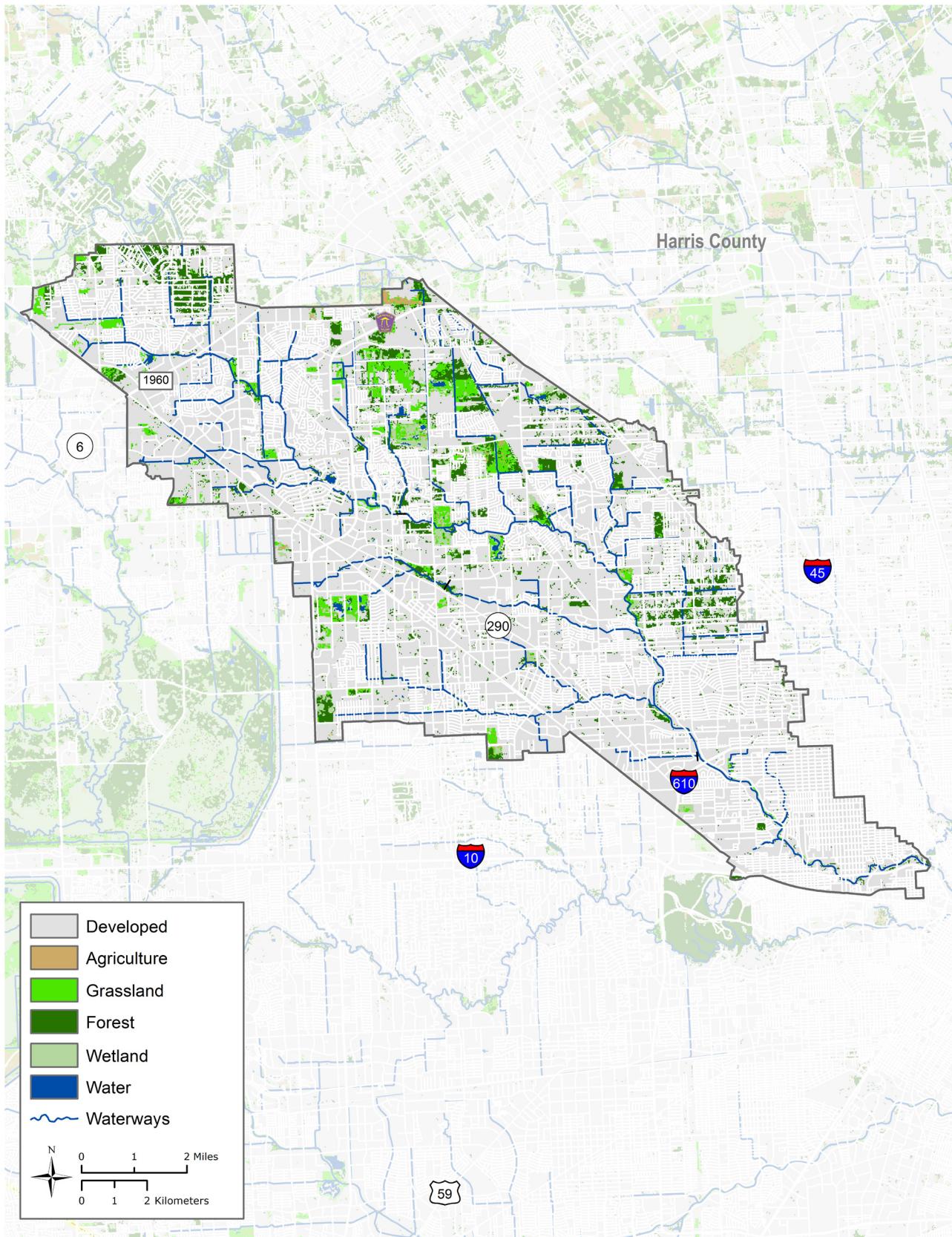
The White Oak Bayou segment is one of the most highly urbanized watersheds in the Houston-Galveston region. The four dominant land cover/land uses are medium intensity developed (38%), low intensity developed (22%), high intensity developed (17%) and open space (14%). Deciduous, evergreen and mixed forests make up only 6% of the land use/land cover.

The area continues to develop rapidly as single family homes are replaced with townhouses and apartments, and the population continues to grow in this area. Most homes and businesses are on sanitary sewer; however, there are still pockets of OSSFs in the watershed. The area along the bayou is used heavily for recreation.

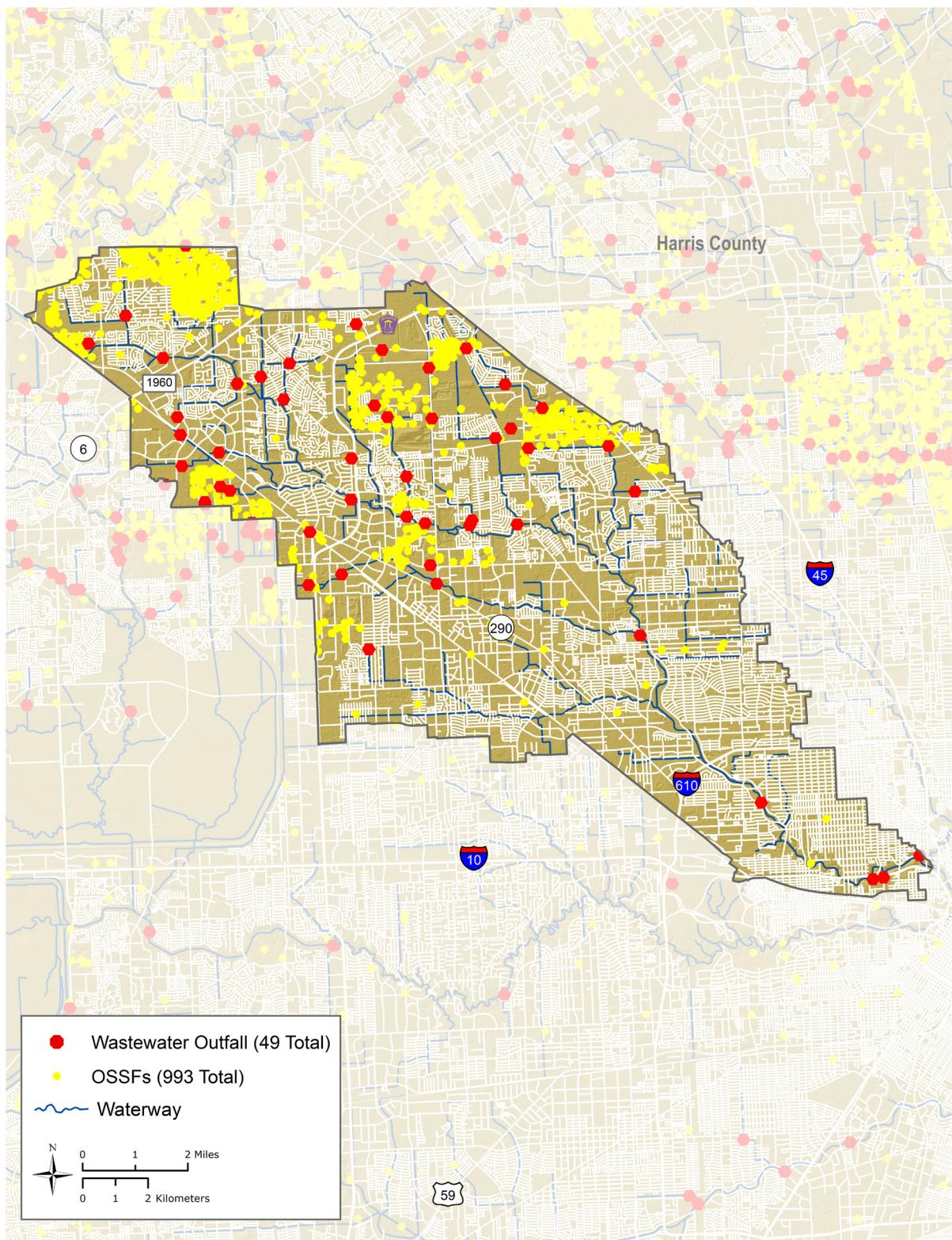
A walking, hiking and biking trail runs along the bayou between N. Main Street upstream and Studewood Street. The West White Oak Bayou trail begins at W. 11th Street and parallels White Oak Bayou upstream to Alabonson Road. Upstream of Antoine Drive are several stormwater detention basins constructed and maintained by the Harris County Flood Control District (HCFCD). Many of these have a trail system around each basin. There are also a number of neighborhood parks located throughout the watershed, many of which are used as dog parks.

**FOR MORE DETAILED LAND USE INFORMATION  
VISIT [WWW.H-GAC.COM/GO/WRIM](http://WWW.H-GAC.COM/GO/WRIM).**

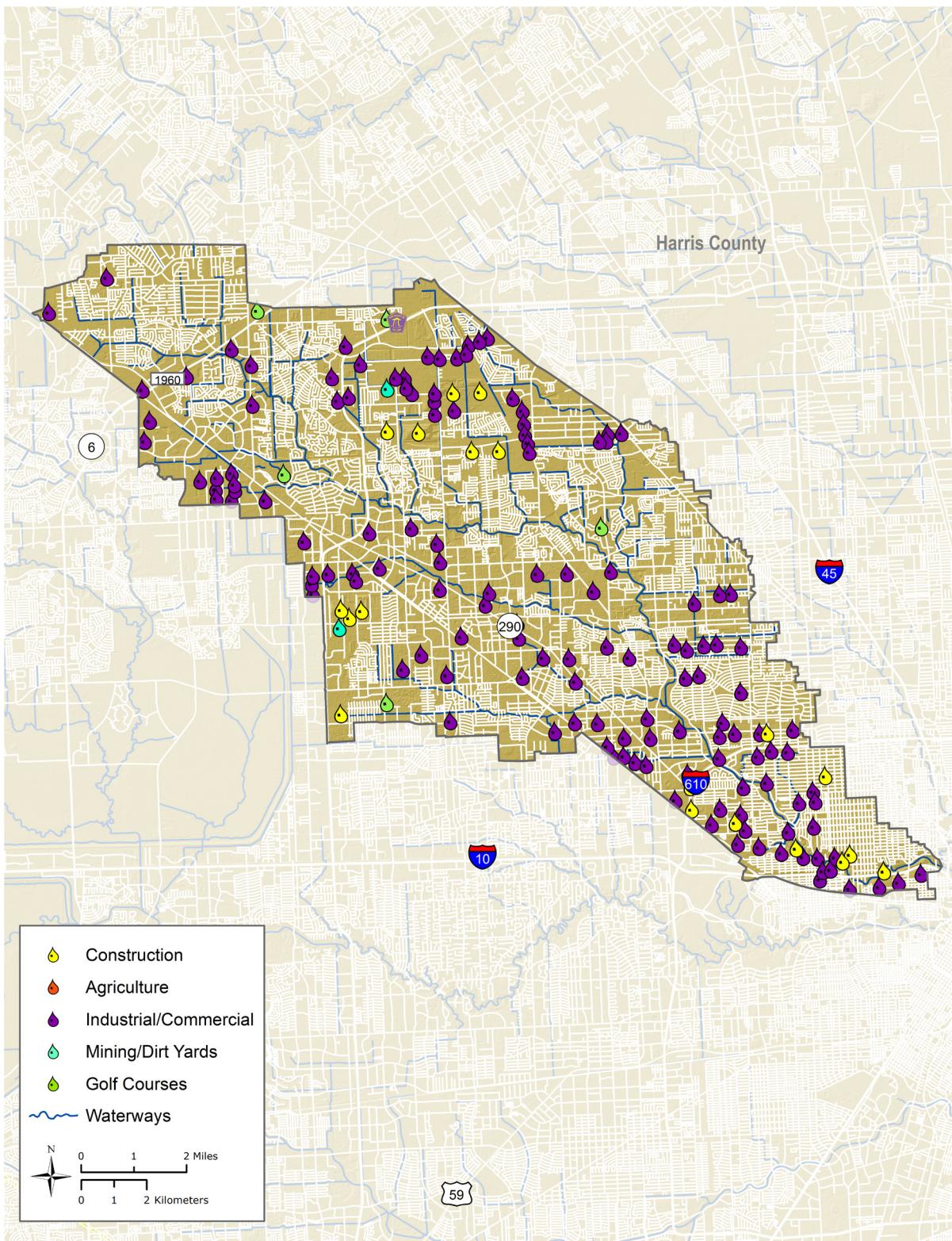
# LAND USE



# POLLUTION SOURCES: WASTEWATER



# POLLUTION SOURCES: OTHER SOURCES



# POTENTIAL STAKEHOLDERS

- Colleges
- Commercial/industrial facilities
- Harris County
- Harris County Flood Control District
- Harris-Galveston Subsidence District
- Homeowner's Associations
- Houston, Jersey Village & several smaller communities
- Independent School Districts
- Road & bridge departments in Harris County
- Utility districts

There are representatives from most of these entities currently serving on the Bacteria Implementation Group (BIG) Steering Committee.

## Ongoing Projects...

In 2009, a TMDL for Buffalo and White Oak Bayous was approved by TCEQ. White Oak Bayou subsequently became a part of the BIG Implementation Plan (I-Plan) for bacteria reduction, which was approved by TCEQ January 31, 2013. Stakeholders are currently addressing bacteria impairments and concerns in the various manners identified through a consensus process.

There has been a significant reduction in bacteria levels since stakeholders began discussing implementation activities in 2008. The annual E. coli geometric mean declined by almost 75% since 2008. While there is currently no means for correlating this decline with implementation efforts of BIG partners, the period of decline coincides with bacteria reduction activities carried out by BIG partners.

In 2008, the Joint Taskforce, consisting of the City of Houston, Harris County, HCFCD and the Texas Department of Transportation, developed the Bacteria Reduction Plan in response to the bacteria impairment and to address their MS4 Phase I permit requirements.

The Bacteria Reduction Plan (Reduction Plan) includes adaptive components for monitoring, assessment and best management practices. As part of the Reduction Plan, the City of Houston initiated a program to identify and fix illicit discharges. Additionally, voluntary illicit discharge detection programs like those investigations carried out by Bayou Preservation Association used data provided by the BIG, monitored the area for illicit discharges and notified local jurisdictions concerning the need for repairs.

During this time, HCFCD saw completion of five regional stormwater detention basins in White Oak Bayou that were designed with water quality enhancement features to treat stormwater. HCFCD also completed conveyance improvements and channel rehabilitation projects to remove excess sediment deposits, regrade and revegetate eroding channel slopes, and repair outfall pipe structures.

# RECOMMENDATIONS

## ACTIVITY

## ENTITY RESPONSIBLE

Continue implementing the I-Plan for bacteria reduction

Stakeholders

Continue collecting water quality data and expand monitoring efforts to support actions associated with TMDL and I-Plan implementation

TCEQ, H-GAC & CRP partners

Support, maintain, and/or increase programs that conduct septic system inspections and oversee maintenance and repairs

County/local agencies & stakeholders

Continue ongoing public outreach to numerous groups throughout the watershed

H-GAC, CRP partners & other stakeholders

Continue to work with the BIG to implement the I-Plan recommendations for bacteria reduction

H-GAC

Coordinate with key stakeholders on future projects to maximize dollars and achieve greatest benefits for all projects

H-GAC & BIG stakeholders



# *Major Watershed Events*

The known or anticipated changes that have or may impact this segment include continued population growth, aging infrastructure and future drought conditions.

Development and infilling high intensity development brings greater WWTF flows, more land clearing and more impervious cover. Fertilized lawns and other landscapes, plus additional pet populations, produce waste and pollution in stormwater runoff.





# HOW TO GET INVOLVED

There's a lot of good work happening in the Houston-Galveston region. Here are a few ways you can help.

## Volunteer for the River, Lakes, Bays 'N Bayous Trash Bash®

This waterway cleanup event draws nearly 5,000 volunteers annually and has collected more than 2,083.15 tons of trash since 1994.

Information on the next cleanup can be found on [www.TrashBash.org](http://www.TrashBash.org).

## Become a Texas Stream Team volunteer

The Houston-Galveston region's Texas Stream Team program, funded locally by CRP, has enabled citizens to become certified volunteer water quality monitors since 1993.

Visit [www.h-gac.com/go/texas-stream-team](http://www.h-gac.com/go/texas-stream-team) to view upcoming training sessions and current monitoring locations.

## Be a friend to the environment

The easiest way to improve water quality is to make small changes in your daily routine. Pick up your dog's poop instead of leaving it on the ground, keep neighborhood storm drains free of leaves and other debris, and never pour fats, oils or grease down your drain.

E-mail [WaterResources@h-gac.com](mailto:WaterResources@h-gac.com) to learn more about what you can do to protect local waterways.



*This report prepared in cooperation with the Texas Commission on  
Environmental Quality under the authorization of the Texas Clean Rivers Act.*

CE0515