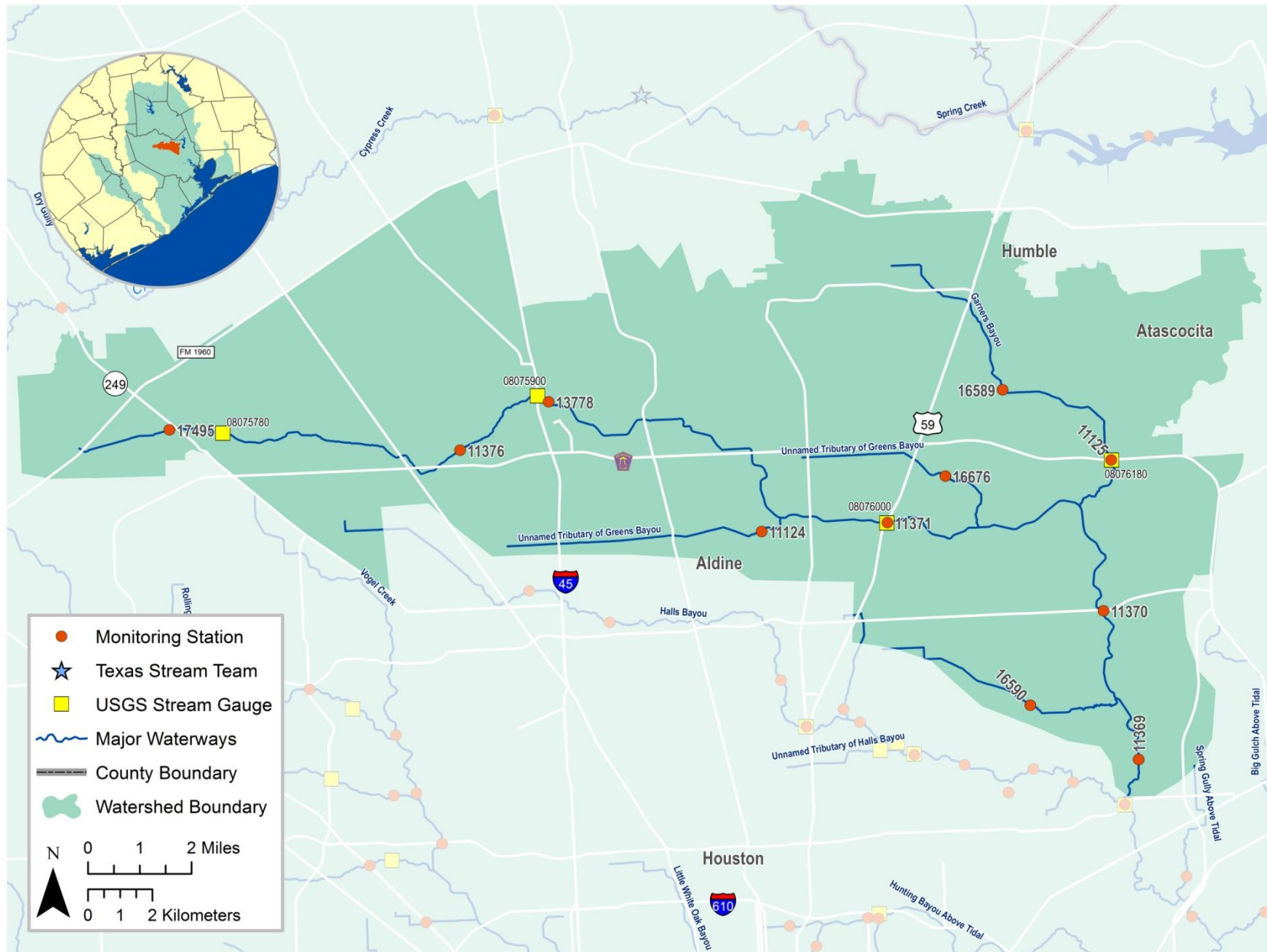
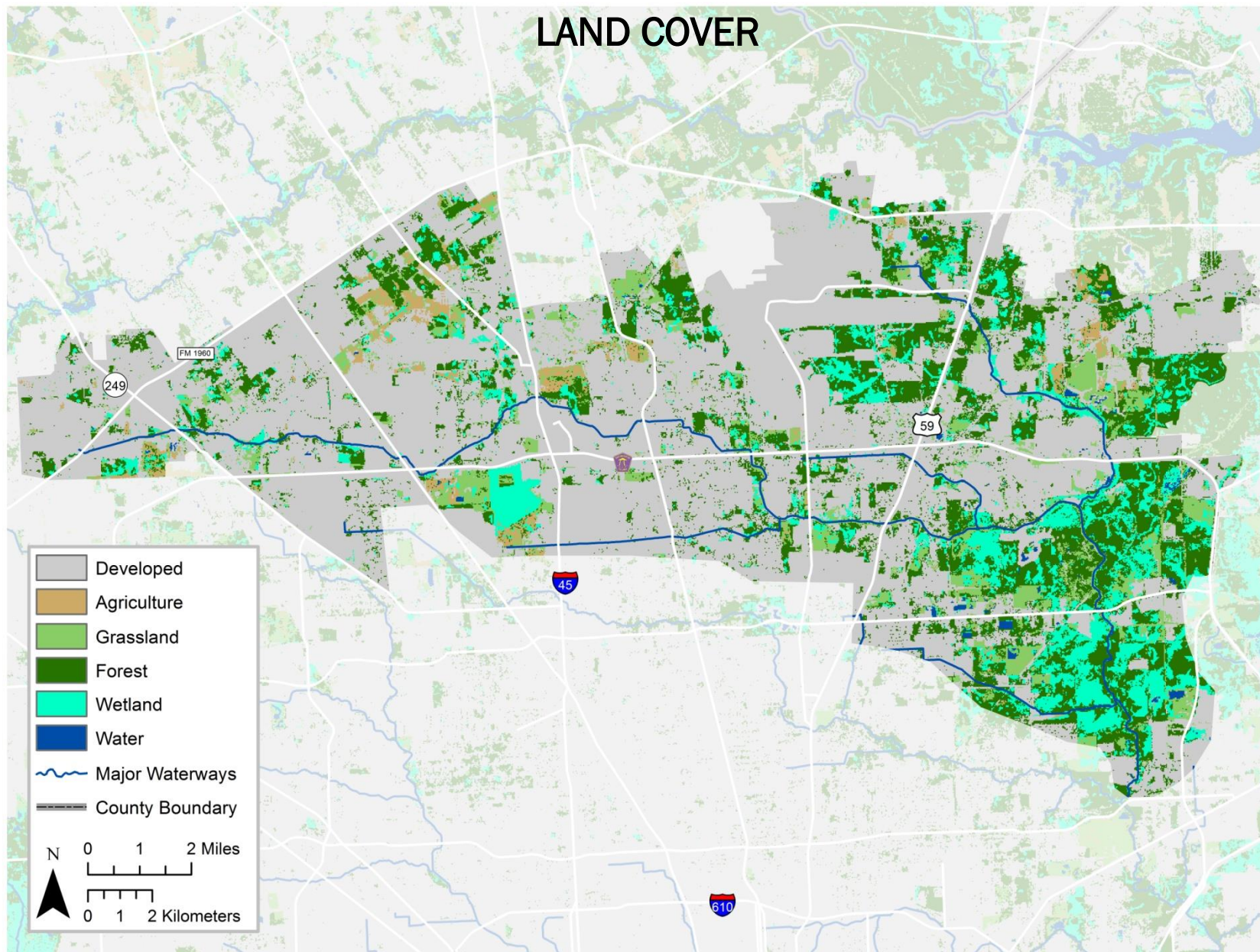


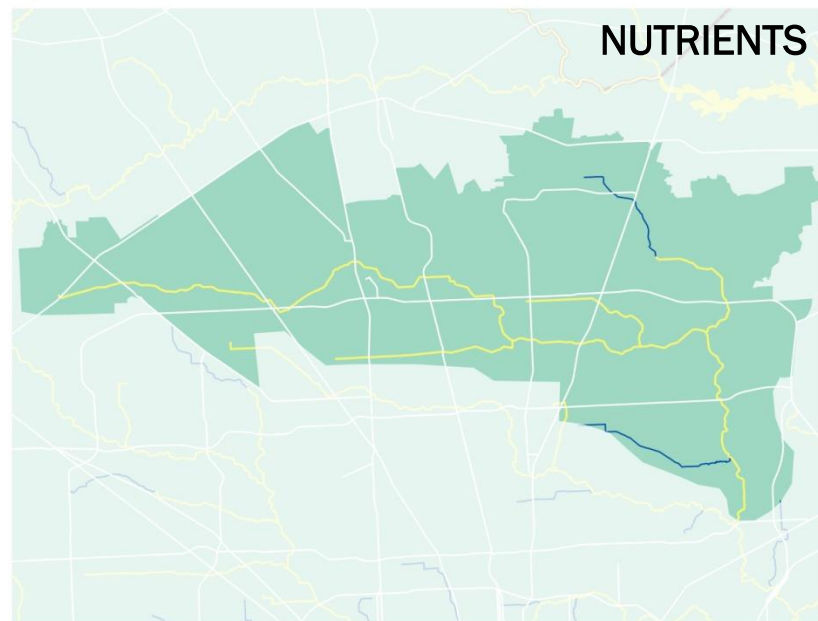
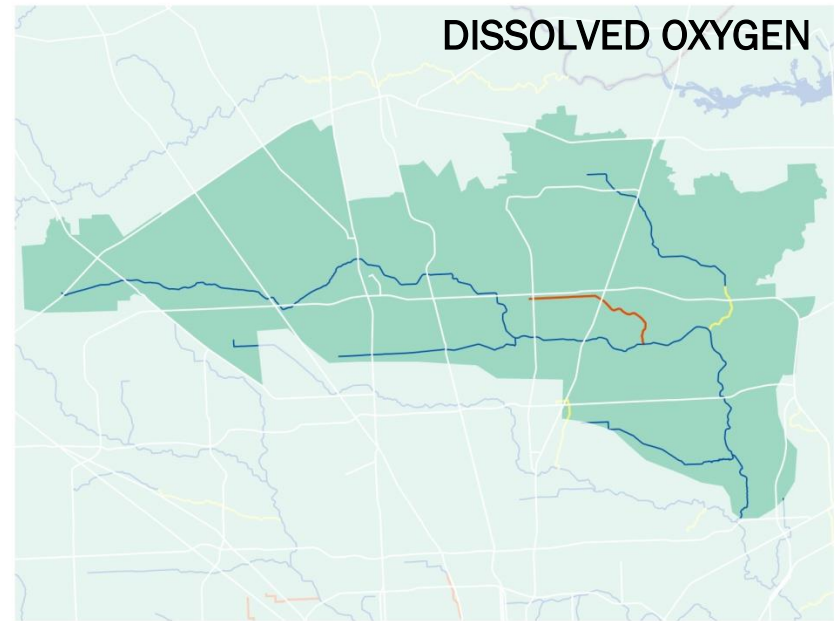
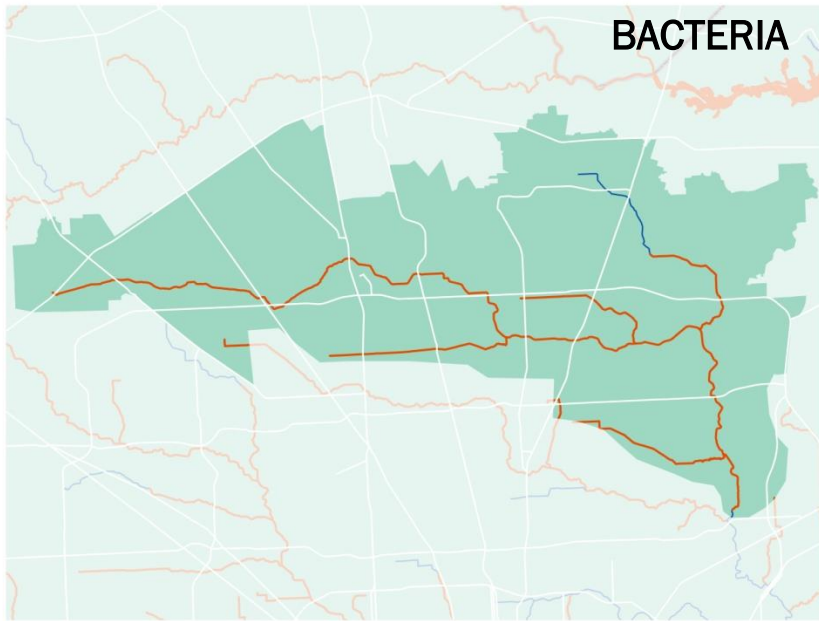
GREENS BAYOU ABOVE TIDAL - SEGMENT 1016



GREENS BAYOU ABOVE TIDAL - SEGMENT 1016

LAND COVER





 Impairment  Concern  No Impairments or Concerns

Segment Number:	1016	Name:	Greens Bayou Above Tidal			
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Length:	29 miles	Watershed Area:	143 square miles	Designated Uses:	Primary Contact Recreation 1; Limited Aquatic Life Use
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Number of Active Monitoring Stations:	11	Texas Stream Team Monitors:	0	Permitted Outfalls:	97
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Description:	Segment 1016 (Perennial Stream w/ limited ALU): From a point 0.7 km (0.4 miles) above the confluence of Halls Bayou in Harris County to a point 100 meters (110 yards) above FM 1960 in Harris County
	Segment 1016A (Perennial Stream w/ high ALU): Garners Bayou (unclassified water body)—From the Greens Bayou confluence to a point 1.5 km (0.93 mi) upstream of Will Clayton Pkwy in Harris County
	Segment 1016B (Perennial Stream w/ limited ALU): Unnamed Tributary of Greens Bayou (unclassified water body) — From the Greens Bayou Above Tidal confluence to Hirsch Road in Harris County
	Segment 1016C (Perennial Stream w/ limited ALU): Unnamed Tributary of Greens Bayou (unclassified water body) — From the Greens Bayou Above Tidal confluence to 1.6 km (0.99 mi) west of IH-45 in Harris County
	Segment 1016D (Perennial Stream w/ high ALU): Unnamed Tributary of Greens Bayou (unclassified water body)—From the Greens Bayou Above Tidal confluence to 0.19 km (0.12 mi) west of JFK Blvd in Harris County

Percent of Stream Impaired or of Concern						
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Segment ID	PCBs/Dioxin	Bacteria	Dissolved Oxygen	Nutrients	Chlorophyll a	Other
1016	-	100	-	100	-	-
1016A	-	55	18.5	55	-	-
1016B	-	100	-	-	-	-
1016C	-	100	-	100	-	-
1016D	-	100	100	100	-	-

Segment 1016

Standards	Perennial Stream	Screening Levels	Perennial Stream
Temperature (°C/°F):	33 / 92	Ammonia (mg/L):	0.33
Dissolved Oxygen (24-Hr Average) (mg/L):	5.0 / 3.0	Nitrate-N (mg/L):	1.95
Dissolved Oxygen (Absolute Minima) (mg/L):	3.0 / 2.0	Orthophosphate Phosphorus (mg/L):	0.37
pH (standard units):	6.5-9.0	Total Phosphorus (mg/L):	0.69
<i>E. coli</i> (MPN/100mL) (grab):	399	Chlorophyll a (µg/L):	14.1
<i>E. coli</i> (MPN/100 mL) (geometric mean):	126		
Chloride (mg/L as Cl):	150		
Sulfate (mg/L as SO ₄):	150		
Total Dissolved Solids (mg/L):	1,000		

FY 2016 Active Monitoring Stations

Site ID	Site Description	Frequency	Monitoring Entity	Parameter Groups
11124	Unnamed Trib of Greens Bayou at Green Ranch Road	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
11125	Garners Bayou at Beltway 8 North	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
11369	Greens Bayou at Tidwell Road	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
11369	Greens Bayou at Tidwell Road	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll a, Flow
11370	Greens Bayou at Mt Houston Parkway	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
11371	Greens Bayou at US 59	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
11376	Greens Bayou at West Greens Parkway	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
13778	Greens Bayou at Knobcrest Street	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
16589	Garners Bayou at Old Humble Road	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
16590	Unnamed Trib of Greens Bayou at Mesa Dr	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
16676	Unnamed Trib of Greens Bayou at Smith Rd	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
17495	Greens Bayou at Mills Road	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria

Water Quality Issues Summary

Issue	2014 Assessment <i>I - impaired</i> <i>C - Of Concern</i>	Possible Causes / Influences / Concerns Voiced by Stakeholders	Possible Solutions / Actions To Be Taken
Elevated Levels of Indicator Bacteria	1016 I 1016A I 1016B I 1016C I 1016D I	<ul style="list-style-type: none"> ▪ Rapid urbanization and increased impervious cover ▪ Constructed stormwater controls failing ▪ Poorly operated or undersized WWTFs ▪ WWTF non-compliance, overflows, and collection system by-passes ▪ Direct and dry weather discharges ▪ Waste haulers illegal discharges/improper disposal ▪ Improper or no pet waste disposal ▪ Developments with malfunctioning OSSFs ▪ Animal waste from agricultural production, hobby farms, and riding stables 	<ul style="list-style-type: none"> ▪ Install and/or conserve vegetative buffer areas along all waterways ▪ Improve compliance and enforcement of existing stormwater quality permits ▪ Improve construction oversight to minimize TSS discharges to waterways ▪ Add water quality features to stormwater systems ▪ Impose new or stricter bacteria limits than currently designated by TCEQ ▪ Increase monitoring requirements for self-reporting ▪ Regionalize chronically non-compliant WWTFs ▪ Require all systems to develop and implement a utility asset management program and protect against power outages at lift stations ▪ More public education on pet waste disposal ▪ More public education regarding OSSF operation and maintenance ▪ Ensure proper citing of new or replacement OSSFs ▪ Implement stream fencing or alternative water supplies to keep livestock out of or away from waterways ▪ Create and implement Water Quality Management Plans for individual agricultural properties
Dissolved Oxygen Concentrations	1016A C 1016D I	<ul style="list-style-type: none"> ▪ Excessive nutrients and organic matter from agricultural production, and related activities ▪ Excessive nutrients and organic matter from WWTF effluent, SSOs, malfunctioning OSSFs, illegal disposal of grease trap waste, and biodegradable solid waste, such as grass clippings and pet waste ▪ High temperature discharges from industrial WWTFs 	<ul style="list-style-type: none"> ▪ Install and/or maintain riparian buffer areas between agricultural fields and waterways ▪ Create and implement Water Quality Management Plans for individual agricultural properties ▪ Improve compliance and enforcement of existing stormwater quality permits ▪ Improve operation and maintenance of existing WWTF and collection systems ▪ Regionalize chronically non-compliant WWTFs ▪ More public education regarding disposal of household fats, oils, and grease

			<ul style="list-style-type: none"> ▪ More public education regarding OSSF operation and maintenance ▪ More public education on pet waste disposal
Elevated Nutrients	1016 C 1016A C 1016C C 1016D C	<ul style="list-style-type: none"> ▪ Fertilizer runoff from urbanized properties, such as landscaped areas, residential lawns, and sport fields ▪ Nutrient loading from WWTF effluent, SSOs, and malfunctioning OSSFs ▪ Fertilizer runoff from agricultural properties. 	<ul style="list-style-type: none"> ▪ Implement YardWise and Watersmart landscape practices ▪ Install and/or conserve riparian buffer areas along all waterways ▪ More public education regarding nutrients and consequences ▪ Improve compliance and enforcement of existing stormwater quality permits ▪ Improve stormwater controls in new developments ▪ Reduce or manage fertilizer runoff from agricultural areas ▪ Create and implement Water Quality Management Plans for individual agricultural properties

Segment Discussion

Watershed Characteristics: The watershed is heavily developed with residential and mixed commercial developments as the dominant land uses. The T.H. Wharton power plant cooling water discharges provide year-round flow to Greens Bayou from its headwaters. Beltway 8 runs through the middle of the watershed with large, high intensity developments and business districts found adjacent to, and at the intersections with, I-45, US Highway 59 and Texas Highway 249. Development has continued to expand along the Hwy 59 and Beltway 8 corridors in recent years where high intensity residential development has replaced single family homes. Bush Intercontinental Airport is located in the north central section of the watershed. The eastern most portion of the watershed is mostly undeveloped with mixed residential and commercial developments scattered throughout. The majority of the area is served by waste water treatment facilities (WWTF), but on-site sewage facilities (OSSF) are still used in some parts of the watershed

Water Quality Issues: Recreation use is not supported in this watershed. The 2014 Texas Integrated Report designates the entire segment as impaired for bacteria. *E. coli* samples collected exceed the single grab criteria in more than 35% of the measurements for all AUs with the main segment seeing the highest number of exceedances (87% of samples collected) since 2008.

Nutrient concerns are also listed in the 2014 Integrated Report for all segments in this watershed except 1016B. The main segment is seeing the highest levels of nitrate with exceedances occurring over 90% of the time in the 2008-2015 assessment which is up from 86% in the 2001-2008 assessment. Orthophosphate and total phosphorous levels (TP) are also a significant concern for the majority of AUs in the watershed with 100% and 93% of samples collected on the main segment during the 2008-2015 assessment exceeding the set screening criteria, respectively.

A dissolved oxygen (DO) impairment exists for segment 1016D and a concern is present for segment 1016A. In segment 1016D, over 38% of samples collected since 2008 fell below the 3.0 mg/L DO minimum standard, an increase from 2001-2008 when only 13% of samples were below the minimum.

Special Studies/Projects: This segment is part of a larger geographic area covered under several TMDLs, collectively known as the Bacteria Implementation Group (BIG) I-Plan. Refer to Section 2 of the 2016 Basin Summary Report for more information about the BIG.

Trends: Regression analysis of water quality data detected a total of 33 significant parameter trends for all unclassified and classified tributaries in the Greens Bayou Tidal watershed. Trends of concern include increasing [nitrate](#) and [TP](#) levels throughout most of the watershed. [Nitrate](#) and [TP](#) concentrations for segments 1016A (Garners Bayou) and 1016 (main segment of Greens Bayou) frequently reached levels more than four times the set screening criteria during the period of record. Segment 1016B and 1016D, unnamed tributaries of Greens Bayou, are the only segments with decreasing trends in TP and nitrate, respectively. This increase in nutrient levels is likely related to runoff from urban lawns and landscaping or from wastewater treatment facility (WWTF) discharges.

A decreasing trend in [bacteria](#) and [ammonia](#) concentrations were also detected for the majority of monitoring stations and segments in the watershed. Ammonia levels have been improving since 2000 and the frequency of exceedances continues to decrease. The decline in ammonia levels over time are likely related to improved storm water controls or upgrades to WWTF operations. Moving seven-year [bacteria geomeans for the main segment](#) show declines in *E. coli* concentrations gradually approaching the 126 MPN/100 mL water quality standard, but there is still a long way to go before the waterway is back in compliance. Segment [1016D](#) is the only segment with a statistically significant increasing bacteria trend during the period of record. Additionally, segment 1016D is the only segment in the Greens Bayou Above Tidal watershed with a DO impairment. Regression analysis of DO data from monitoring station [16676](#), located on segment 1016D, revealed no significant change in DO concentrations over time, however, sample concentrations have frequently been lower than the 3.0 mg/L DO minimum. Beltway 8 runs adjacent to this segment and the intersection of Beltway 8 and Hwy 59 is located upstream of station 16676. Large areas of impervious cover are present at this location due to the dense residential and commercial development along Beltway 8 and Hwy 59 that are likely contributing bacteria during rain events when collection systems overflow, WWTFs and OSSFs malfunction, and pet waste, livestock fields and enclosures lead to higher bacteria levels in stormwater. Implementation of best management practices that reduce bacteria levels will also help improve DO conditions in area waterways.

Recommendations

Address concerns found in this segment summary through stakeholder participation in the BIG.

Continue collecting water quality data to support actions associated with any future watershed protection plan development and possible modeling.
