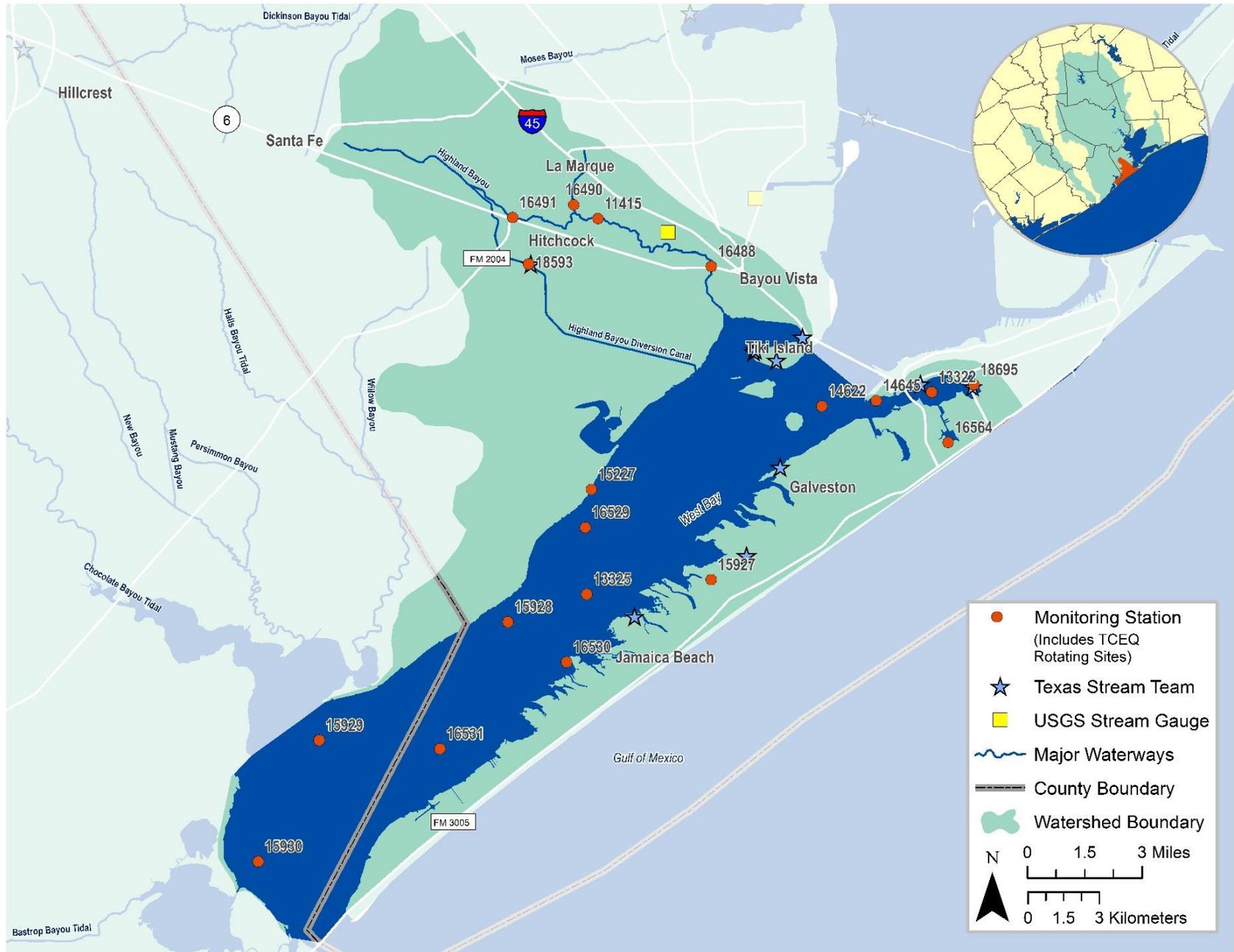
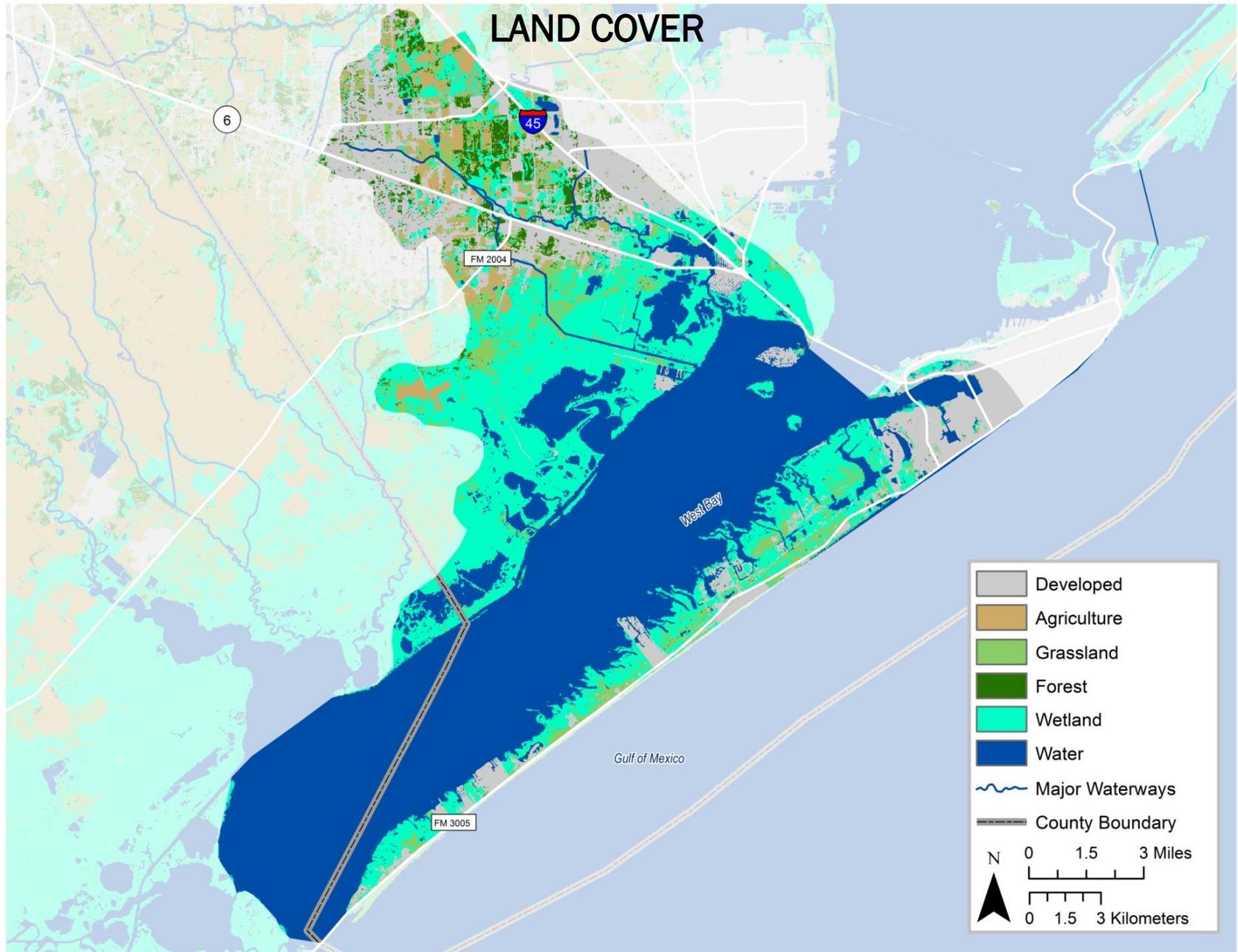
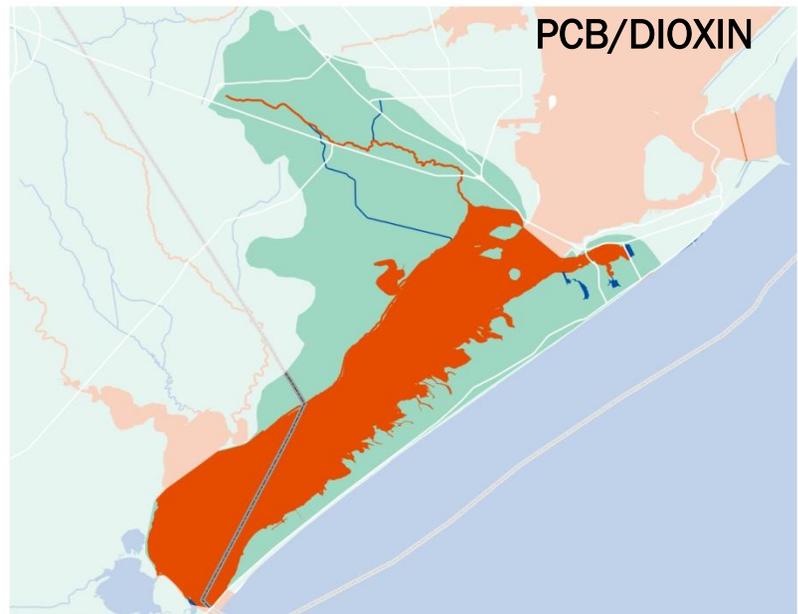
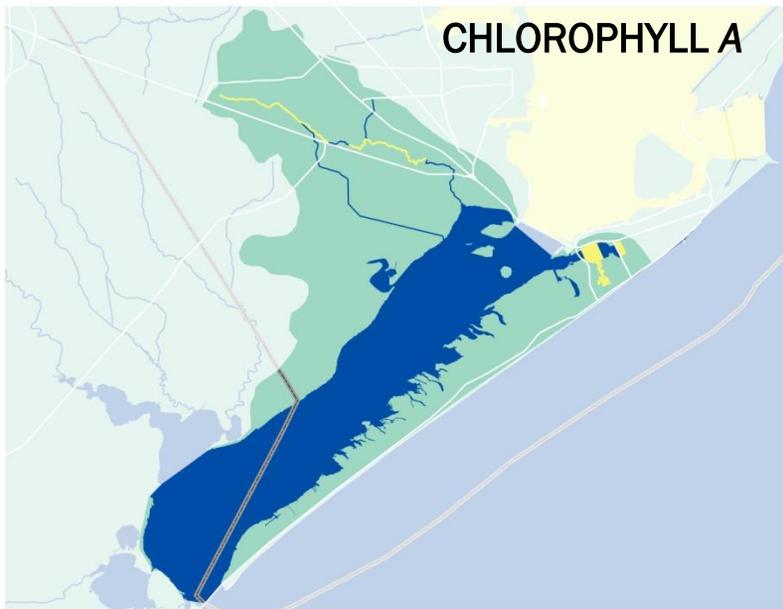
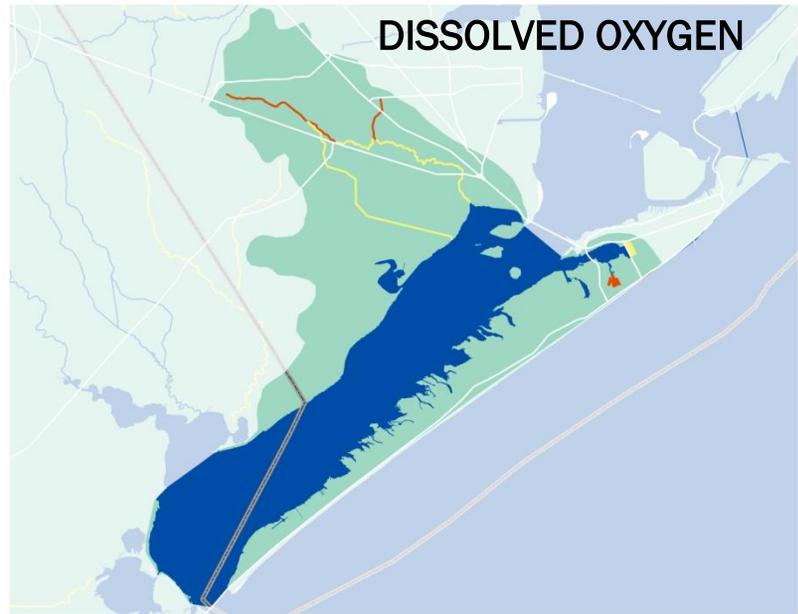
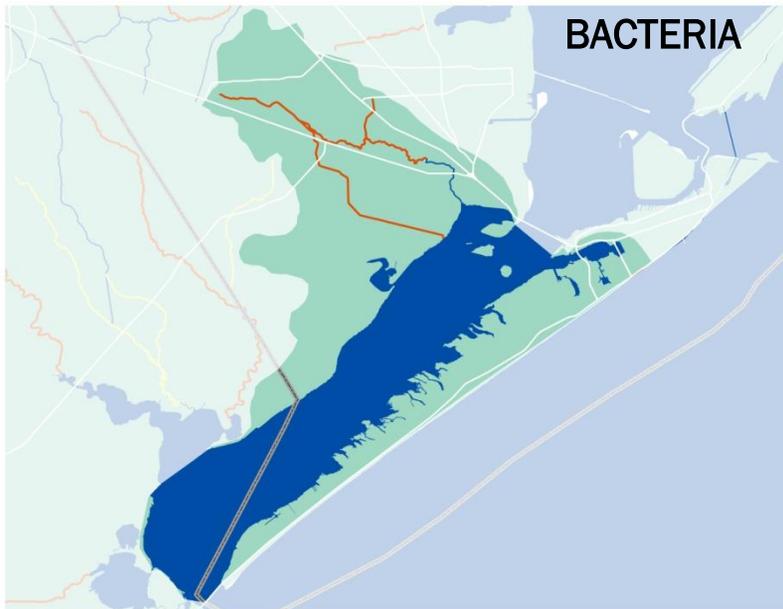


WEST GALVESTON BAY - SEGMENT 2424



WEST GALVESTON BAY - SEGMENT 2424





 Impairment  Concern  No Impairments or Concerns

Segment Number:	2424	Name:	West Galveston Bay		
------------------------	-------------	--------------	---------------------------	--	--

Area:	74 square miles	Miles of shoreline	172 miles	Designated Uses:	Primary Contact Recreation 1; High Aquatic Life Use; Oyster Waters
--------------	-----------------	---------------------------	-----------	-------------------------	--

Number of Active Monitoring Stations:	14	Texas Stream Team Monitors:	13	Permitted Outfalls:	9
--	----	------------------------------------	----	----------------------------	---

Description:	<p>Segment 2424: A 179.5 square kilometer (69.3 square mile) portion of the Galveston Bay system located on the landward side of Galveston Island, extending from the Galveston Causeway (IH-45) in Galveston County to the western side of San Luis Pass and the eastern shore of Mud Island in Brazoria County</p> <p>Segment 2424A (Tidal Stream w/ high ALU): Highland Bayou (unclassified water body) – 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</p> <p>Segment 2424B (Estuary w/ high ALU): Lake Madeline (unclassified water body) – Located between Jones Street, Stewart Stree, and Pine Street, north of the seawall on Galveston Island</p> <p>Segment 2424C (Tidal Stream w/ high ALU): Marchand Bayou (unclassified water body) – From Highland Bayou confluence to 0.72 km (0.45 mi) north of IH 45 in Galveston County</p> <p>Segment 2424D (Estuary w/ high ALU): Offatts Bayou (unclassified water body) – Located on the east end of Galveston Island, running parallel with the southern terminus of IH 45, and joins West Bay near Teichman Point</p> <p>Segment 2424E (Estuary w/ high ALU): English Bayou (unclassified water body) – Between IH 45, Bayou Shore Drive, South ShoreRear and SH 342 on Galveston Island</p> <p>Segment 2424F (Estuary w/ high ALU): Crash Basin (unclassified water body) – Located off West Bay near the outlet of Offatts Bayou and adjacent to Teichman Point in Galveston County</p> <p>Segment 2424G (Tidal Stream w/ high ALU): Highland Bayou Diversion Canal (unclassified water body) – From the confluence with an unnamed tributary adjacent to Jones Bayou upstream to the Highland Bayou confluence</p> <p>Segment 2424OW (Oyster Waters)</p> <p>Segment 2424S: Galveston Island State Park (Recreational beaches)</p>
---------------------	---

Percent of Stream Impaired or of Concern

Segment ID	PCBs/Dioxin	Bacteria	Dissolved Oxygen	Nutrients	Chlorophyll a	Other
2424	100	-	-	-	-	-
2424A	100	45.6	100	-	28.7	-
2424B	-	-	100	-	100	-
2424C	-	100	100	-	-	-
2424D	100	-	-	-	61	-
2424E	-	-	100	-	100	-
2424F	-	-	-	-	-	-
2424G	-	100	100	-	-	-
2424OW	-	100	-	-	-	-

Segment 2424

Standards	Screening Levels	
	Bays & Estuaries	Tidal Streams
Temperature (°C/°F):	35	35 / 95
Dissolved Oxygen (24-Hr Average) (mg/L):	4.0	4.0
Dissolved Oxygen (Absolute Minima) (mg/L):	3.0	3.0
pH (standard units):	6.5-9.0	6.5-9.0
Enterococci (MPN/100mL) (grab):	104	104
Enterococci (MPN/100mL) (geometric mean):	35	35
Fecal Coliform in Oyster Waters (CFU/100mL) (median/grab):	14/43	

FY 2016 Active Monitoring Stations

Site ID	Site Description	Frequency	Monitoring Entity	Parameter Groups
11415	Highland Bayou at Fairwood Rd	Quarterly	EIH	Field, Conventional, Bacteria, Chlorophyll a
13322	Offat Bayou opposite canal	Quarterly	EIH	Field, Conventional, Bacteria, Chlorophyll a
13325	West Bay near Carancahua Reef	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll a
13325	West Bay near Carancahua Reef	Once/ Year	TCEQ	Benthics, Metals in Sediment
14622	West Bay at Range Marker D	Quarterly	EIH	Field, Conventional, Bacteria, Chlorophyll a
14645	Offatts Bayou off CM 18	Quarterly	EIH	Field, Conventional, Bacteria, Chlorophyll a
16488	Highland Bayou upstream of SH 6 bridge	Quarterly	EIH	Field, Conventional, Bacteria, Chlorophyll a
16490	Marchand Bayou tidal at FM 519	Quarterly	EIH	Field, Conventional, Bacteria
16491	Highland Bayou at FM 2004	Quarterly	EIH	Field, Conventional, Bacteria
16529	West Bay at 98GB036	Quarterly	EIH	Field, Conventional, Bacteria, Chlorophyll a
16530	West Bay at 98GB037	Quarterly	EIH	Field, Conventional, Bacteria, Chlorophyll a
16531	West Bay at 98GB038	Quarterly	EIH	Field, Conventional, Bacteria, Chlorophyll a
16531	West Bay at 98GB038	Once/ Year	TCEQ	Benthics, Metals in Sediment
16564	Lake Madeline at Beluche Drive	Quarterly	EIH	Field, Conventional, Bacteria, Chlorophyll a
18593	Diversion Canal at 2nd Street	Quarterly	EIH	Field, Conventional, Bacteria
18695	English Bayou mid bayou	Quarterly	EIH	Field, Conventional, Bacteria, Chlorophyll a

Water Quality Issues Summary

Issue	2014 Assessment <i>I – Impaired C – Of Concern</i>	Possible Causes / Influences / Concerns Voiced by Stakeholders	Possible Solutions / Actions To Be Taken
<p>Elevated Levels of Indicator Bacteria and in Oyster Waters</p>	<p>2424A I 2424C I 2424G I 2424OW I</p>	<ul style="list-style-type: none"> ▪ Rapid urbanization and increased impervious cover ▪ Constructed stormwater controls failing ▪ Animal waste from agricultural production, hobby farms, and riding stables ▪ Improper disposal of waste from boats ▪ Developments with malfunctioning OSSFs ▪ Improper or no pet waste disposal ▪ Waste haulers illegal discharges/improper disposal ▪ Direct and dry weather discharges ▪ Poorly operated or undersized WWTFs ▪ WWTF non-compliance, overflows, and collection system by-passes 	<ul style="list-style-type: none"> ▪ 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 ▪ 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 ▪ Install and/or conserve vegetative buffer areas along all waterways ▪ More public education on proper boat waste disposal ▪ More public education regarding OSSF operations and maintenance ▪ More public education on pet waste disposal ▪ 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
<p>Dissolved Oxygen Concentrations</p>	<p>2424A I 2424B C 2424C I 2424E C 2424G C</p>	<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 (e.g., grass clippings and pet waste) ▪ Vegetative canopy removed 	<ul style="list-style-type: none"> ▪ Create and implement Water Quality Management Plans for individual agricultural properties ▪ Improve compliance and enforcement of existing stormwater quality permits ▪ Install and/or maintain riparian buffer areas between agricultural fields and waterways ▪ More public education regarding OSSF operation and maintenance ▪ More public education regarding disposal of household fats, oils, and grease ▪ Improve operation and maintenance of existing

			<ul style="list-style-type: none"> WWTF and collection systems Regionalize chronically non-compliant WWTFs More public education on pet waste disposal Work with drainage districts and agencies to change practices of clear cutting and channelizing waterways to protect from solar heating
PCBs/Dioxin in Edible Fish Tissue	2424 I 2424A I 2424D I	<ul style="list-style-type: none"> Concentrated deposits outside boundaries of the waste pits located adjacent to San Jacinto River and I-10 bridge Unknown industrial or urban sources 	<ul style="list-style-type: none"> Remove or contain contamination from locations already identified Encourage additional testing to locate all unknown sources/deposits
Elevated Chlorophyll a Concentrations	2424A C 2424D C 2424E C	<ul style="list-style-type: none"> Fertilizer runoff from surrounding watershed promotes algal growth in waterways Nutrient loading from WWTF effluent, sanitary sewer overflows, and malfunctioning OSSFs promotes algal growth 	<ul style="list-style-type: none"> Improve compliance and enforcement of existing stormwater quality permits Improve stormwater controls in new developments Reduce or manage fertilizer runoff from agricultural areas More public education regarding nutrients

Segment Discussion:

Watershed Characteristics: The West Galveston Bay watershed encompasses the bay side of Galveston Island, a barrier island and many coastal wetlands on the landward side of the bay. There are several classified and unclassified bays and tributaries that drain into the bay system. The bay side of Galveston Island includes sporadically placed low intensity developments, grasslands with coastal scrub and wetlands. On the mainland, the communities of Hitchcock, La Marque, Bayou Vista, and Tiki Island, are located west of IH-45 and are drained by Highland and Marchand Bayous to Jones Bay. Most of the land cover in this sub-watershed is low intensity, mixed residential and commercial development. Grazing lands and domestic animal facilities are common in the southwestern and northwestern portions of the sub-watershed.

Water Quality Issues: The 2014 Texas IR lists [Highland Bayou](#) (Assessment units 2424A_02 – 2424A_05), Marchand Bayou (2424C_01), and the [Highland Bayou Diversion Canal](#) (2424G_01) as impaired for contact recreation due to elevated levels of enterococci bacteria. The Highland Bayou Diversion Canal is a new addition to the 303(d) list. Assessment unit 2424O_02, which is the area of the bay adjacent to Lower Galveston Bay and Galveston Island, is listed in the 2014 IR as impaired for oyster waters due to elevated levels of fecal coliform bacteria. This area is closed by the Seafood Safety Division of the Texas Department of State Health Services for the harvesting of oysters and other shellfish for direct marketing

Assessment Unit	TCEQ Assessment (2005-2012)	HGAC Analysis 2001-2008	HGAC Analysis 2008-2015
	Geomean (MPN/100 mL) / % Grab Exceedance	Geomean (MPN/100 mL) / % Grab Exceedance	Geomean (MPN/100 mL) / % Grab Exceedance
2424A_01	30 / NA	25 / 14.5	26 / 14.3
2424A_03	78 / NA	58 / 37.5	106 / 35.5
2424A_05	184 / NA	166 / 64.6	503 / 77.4
2424C_01	139 / NA	84 / 46.9	161 / 57.1
2424G_01	38 / NA	19 / 23.8	85 / 35.7

The assessment units 2424A_05 (Highland Bayou), 2424B_01 (Lake Madeline), and 2424C_01 (Marchand Bayou) are impaired for depressed dissolved oxygen. The assessment unit 2424A_05 is impaired for both the dissolved oxygen 24 hour minimum and 24 hour average with 100% of DO measurements below the standards. Assessment unit 2424B_01 is impaired for dissolved oxygen grab with 25 percent of measurements below the 3.0 mg/L standard. Marchand Bayou is impaired for DO 24 hour minimum with 43% of DO measurements below the minimum standard.

Segments 2424, 2424A, and 2424D are listed as impaired in the 2014 IR for fish consumption due to high levels of dioxin/PCBs. Due to the high levels found in this segment, the Texas Department of State Health Services has issued a Limited Consumption Fish Advisory for these segments.

This segment does not fully support its primary contact recreation, high aquatic life, or oyster waters use designations.

Special Studies/Projects: This segment is included in the TMDL for the Galveston Bay System Survey on Dioxin and PCBs, which is currently under way. West Galveston Bay is also included in the Oyster Waters I-Plan for bacteria which began in 2010 after the TMDL was approved by the EPA. The final draft I-Plan was submitted to the TCEQ in August of 2014 and final approval of the draft was given in August of 2015. For more information about these projects, please refer to the detailed discussions located in the Public Involvement and Outreach section of the 2016 Basin Summary Report.

Trends: Regression analysis of water quality data identified a total of 32 statistically significant parameter trends for seven classified and unclassified assessment units (AUs) in the West Galveston Bay watershed. The main West Bay segment showed eight significant trends including increasing alkalinity, ammonia, chloride, pH, salinity, specific conductivity (SPCond), and sulfate while chlorophyll a levels are decreasing over time. Highland Bayou, AU 2424A, had a total of five significant parameter trends – increasing nitrate, salinity, and total suspended solids (TSS) and decreasing chlorophyll a and Secchi transparency. AUs 2424B and 2424C had two significant trends each including decreasing chlorophyll a and Secchi transparency, and increasing salinity and total phosphorous (TP), respectively. Offatts Bayou, AU 2424D, showed ten significant trends – ammonia, enterococci, pH, salinity, SPCond, TKN, TP, and TSS are increasing over time while chlorophyll a and Secchi transparency are the only parameters with a decreasing trend. Three significant parameter trends were detected on English Bayou, AU 2424E, including increasing ammonia and enterococci and decreasing chlorophyll a. Finally, increasing trends in ammonia and TP were detected for the Highland Bayou Diversion Canal (2424G).

Regression analysis of [enterococci](#) data for Highland Bayou revealed relatively stable bacteria concentrations over time, however, extreme spikes continue to occur on an infrequent basis with concentrations reaching as high as 60,000 MPN/100 mL during the period of record. Spikes at this magnitude are likely related to illicit discharges or sanitary sewer overflows (SSOs) that introduce large volumes of raw sewage into waterways. Refer to the Water Quality Issues discussion above for more information about oyster water bacteria and PCB/dioxin impairments.

Depressed dissolved oxygen (DO) is also of concern ([2424B](#), [2424E](#), 2424G) or impaired for many segments within the West Galveston Bay watershed. Regression analysis of DO concentrations for the impaired AUs ([2424A](#) and 2424C) revealed relatively stable concentrations over time with the majority of samples measuring within compliance during the period of record. [Marchand Bayou, AU 2424C](#), which is currently designated as having an impairment for depressed DO, has had the most samples fall below the 3.0 mg/L minimum standard since 2000. A concern for chlorophyll a also exists for segments [2424A](#), [2424D](#), and 2424E in the 2014 Integrated Report. Regression analysis of chlorophyll a levels for these segments suggest a gradual decrease over time with the majority of samples collected after 2012 measuring below the state screening criteria.

Recommendations

Address concerns found in this segment summary through stakeholder participation.

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

Increase the number of yearly representative stations to provide consistent time series. Need fewer stations with more data.

Support Galveston Bay Foundations efforts to complete Oyster Waters TMDL on this segment.
