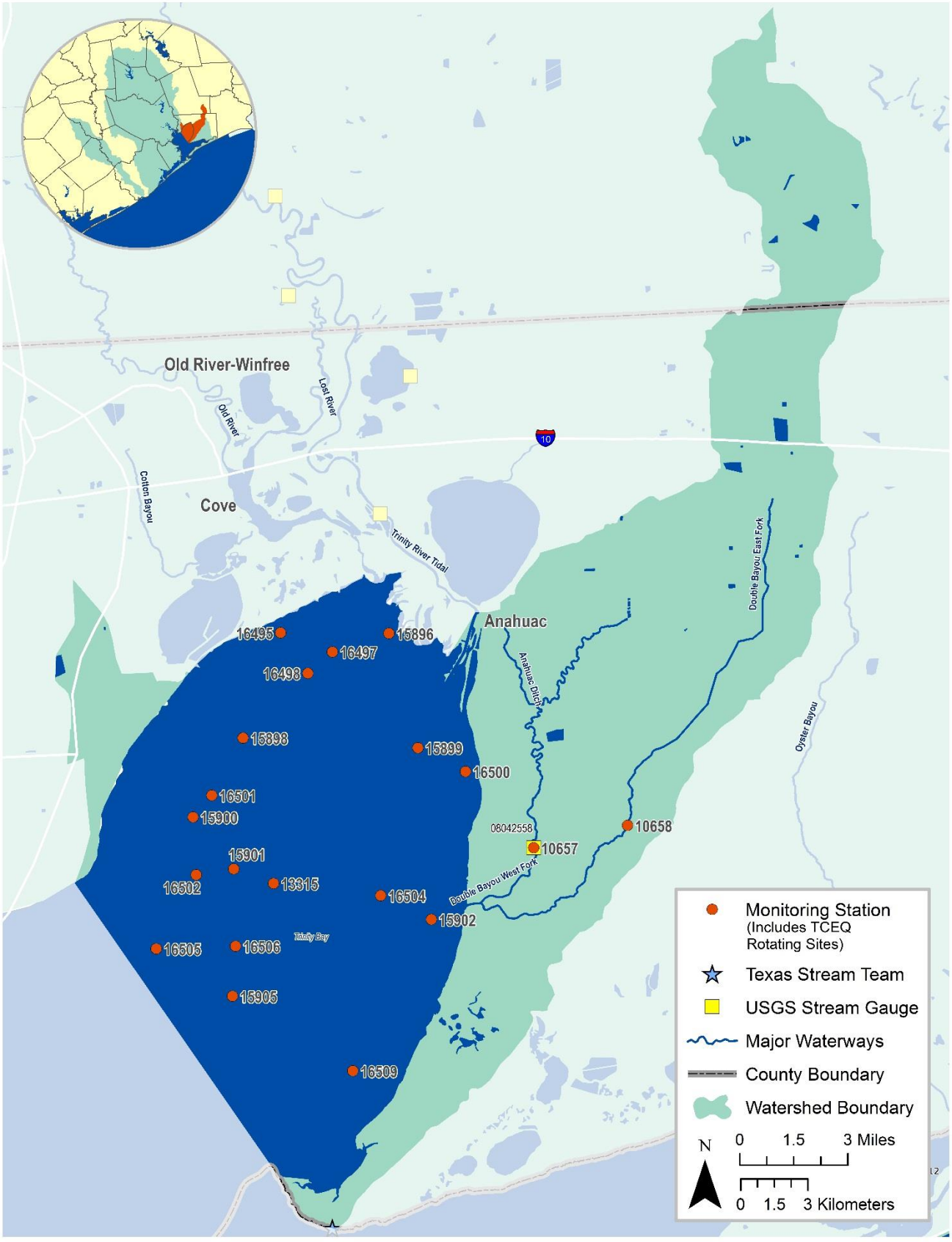
# TRINITY BAY - SEGMENT 2422



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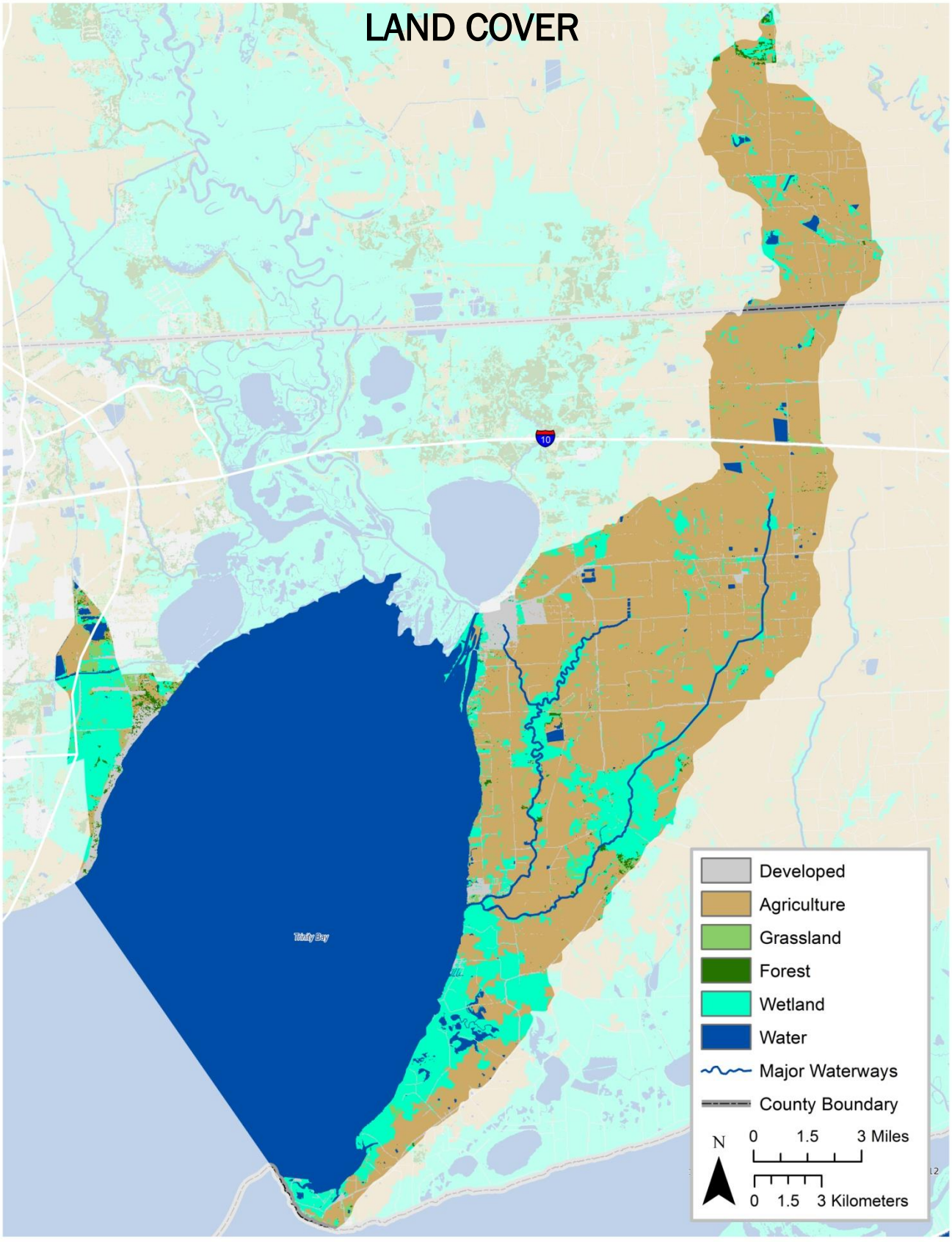
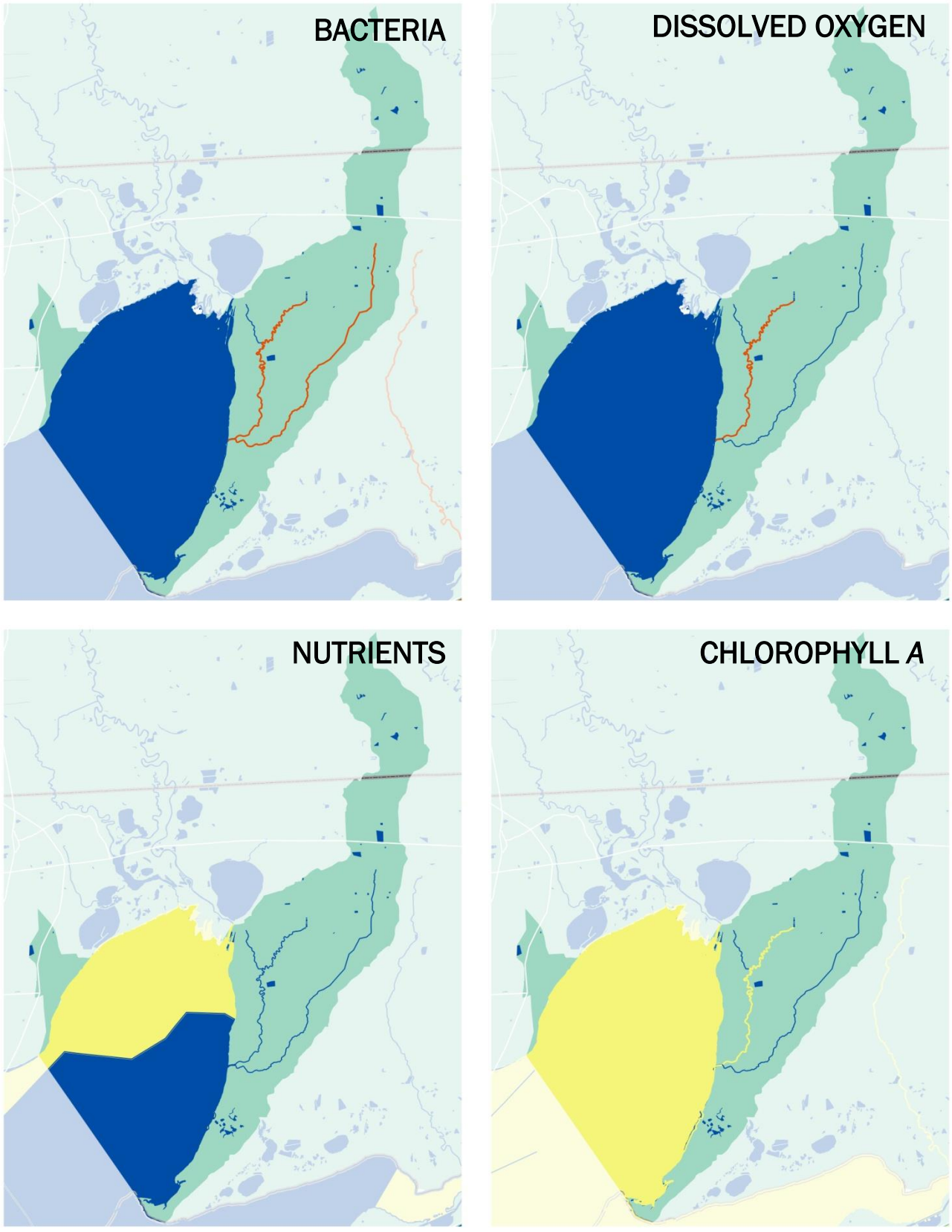
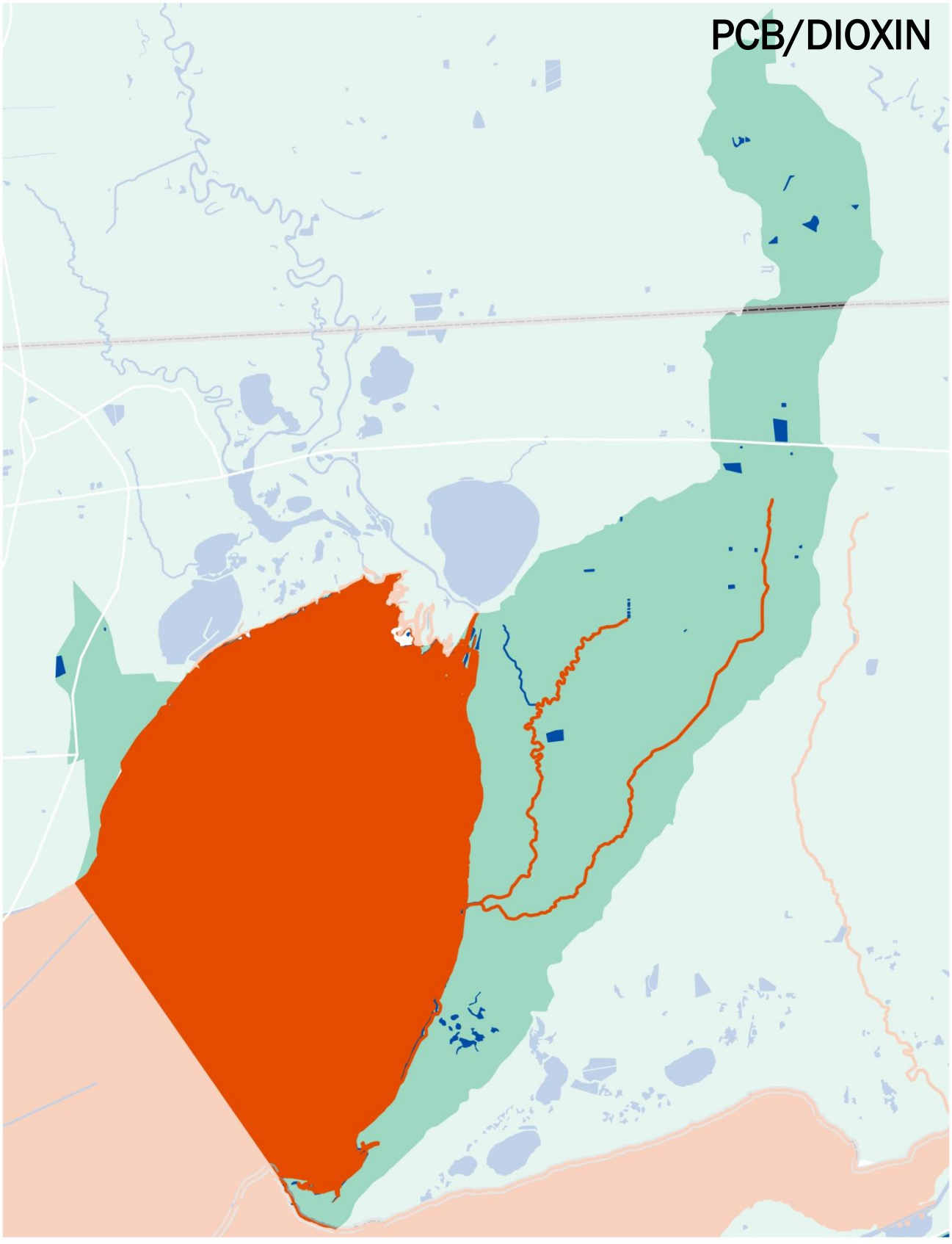
## LAND COVER




BACTERIA
DISSOLVED OXYGEN
NUTRIENTS
CHLOROPHYLL A
Impairment
Concern
No Impairments or Concerns


PCB/DIOXIN
Impairment
Concern
No Impairments or Concerns

| Segment Number: | 2422 | Name: | Trinity Bay | | |
|---|---|---|---|---|---|
| **Area:** | 123 square miles | **Miles of Shoreline:** | 80 miles | **Designated Uses:** | Primary Contact Recreation 1; High Aquatic Life Use; Oyster Waters |
| **Number of Active Monitoring Stations:** | 14 | **Texas Stream Team Monitors:** | 0 | **Permitted Outfalls:** | 6 |

**Description:**

Segment 2422: A 280.2 square kilometer (108.2 square mile) portion of the Galveston Bay complex located east of Upper Galveston Bay and entirely within Chambers County extending east/northeast from an imaginary north-south line extending from Beach City to Smith Point in Chambers County

Segment 2422A (Perennial Stream w/ high ALU): Perennial Stream from the confluence with the West Fork Double Bayou upstream to FM 563 near the City of Anahuac

Segment 2422B (Tidal Stream w/ high ALU): Double Bayou West Fork (unclassified water body) – From the Trinity Bayou confluence to Belton Road in Chambers County

Segment 2422C (Tidal Stream w/ high ALU): Cotton Bayou (unclassified water body) – Retired segment description. Reassigned to segment 0801C

Segment 2422D (Tidal Stream w/ high ALU): Double Bayou East Fork (unclassified water body) – From the Trinity Bayou confluence to a point 2.6 km (1.6 mi) upstream of SH 65

Segment 24220W (Oyster Waters)

**Percent of Stream Impaired or of Concern**

| Segment ID | PCBs/Dioxin | Bacteria | Dissolved Oxygen | Nutrients | Chlorophyll *a* | Other |
|---|---|---|---|---|---|---|
| 2422 | 100 | - | - | 60.6 | 100 | - |
| 2422B | 100 | 100 | 100 | - | - | - |
| 2422D | 100 | 100 | - | - | - | - |
| 24220W | - | 100 | - | - | - | - |

## Segment 2422

| Standards | Bays & Estuaries | Tidal Streams | Screening Levels | Bays & Estuaries | Tidal Streams |
|---|---|---|---|---|---|
| Temperature (°C/°F): | 35 / 95 | 35 / 95 | Ammonia-N (mg/L): | 0.10 | 0.46 |
| Dissolved Oxygen *(24-Hr Average)* (mg/L): | 4.0 | 4.0 | Nitrate-N (mg/L): | 0.17 | 1.10 |
| Dissolved Oxygen *(Absolute Minima)* (mg/L): | 3.0 | 3.0 | Orthophosphate Phosphorus (mg/L): | 0.19 | 0.46 |
| pH (standard units): | 6.5-9.0 | 6.5-9.0 | Total Phosphorus-P (mg/L): | 0.21 | 0.66 |
| Enterococci (MPN/100mL) (grab): | 104 | 104 | Chlorophyll *a* (µg/L): | 11.6 | 21 |
| 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 |
|---|---|---|---|---|
| 10657 | Double Bayou West Fork at Eagle Rd | Quarterly | TCEQ | Field, Conventional, Bacteria, Chlorophyll *a* |
| 10658 | Double Bayou East Fork at FM562 | Quarterly | TCEQ | Field, Conventional, Bacteria, Chlorophyll *a* |
| 10658 | Double Bayou East Fork at FM 562 | Twice / Year | LL | Field, Conventional |
| 13315 | Trinity Bay 200 yards N of EXXON C-1 platform | Quarterly | TCEQ | Field, Conventional, Bacteria, Chlorophyll *a* |
| 13315 | Trinity Bay 200 yards N of EXXON C-1 platform | Once / Year | TCEQ | Benthics, Metals in Sediment |
| 16495 | Trinity Bay at 98GB002 | Quarterly | TCEQ | Field, Conventional, Bacteria, Chlorophyll *a* |
| 16497 | Trinity Bay at 97GB003 | Quarterly | TCEQ | Field, Conventional, Bacteria, Chlorophyll *a* |
| 16498 | Trinity Bay at 98GB005 | Quarterly | TCEQ | Field, Conventional, Bacteria, Chlorophyll *a* |
| 16498 | Trinity Bay at 98GB005 | Once / Year | TCEQ | Benthics, Metals in Sediment |
| 16500 | Trinity Bay at 98GB006 | Quarterly | TCEQ | Field, Conventional, Bacteria, Chlorophyll *a* |
| 16501 | Trinity Bay at 98GB008 | Quarterly | TCEQ | Field, Conventional, Bacteria, Chlorophyll *a* |
| 16501 | Trinity Bay at 98GB008 | Once / Year | TCEQ | Benthics, Metals in Sediment |
| 16502 | Trinity Bay SE of Umbrella Point | Quarterly | TCEQ | Field, Conventional, Bacteria, Chlorophyll *a* |
| 16504 | Trinity Bay at 98GB011 | Quarterly | TCEQ | Field, Conventional, Bacteria, Chlorophyll *a* |
| 16505 | Trinity Bay at 98GB013 | Quarterly | TCEQ | Field, Conventional, Bacteria, Chlorophyll *a* |
| 16506 | Trinity Bay at 98GB012 | Quarterly | TCEQ | Field, Conventional, Bacteria, Chlorophyll *a* |
| 16506 | Trinity Bay at 98GB012 | Once / Year | TCEQ | Benthics, Metals in Sediment |
| 16509 | Trinity Bayou at 98GB016 | Quarterly | TCEQ | Field, Conventional, Bacteria, Chlorophyll *a* |

| | | | | |
|---|---|---|---|---|
| 16509 | Trinity Bayou at 98GB016 | Once / Year | TCEQ | Benthics, Metals in Sediment |
| 18361 | Double Bayou West Fork at FM 2936 | Twice / Year | LL | Field, Conventional |

**Water Quality Issues Summary**

| Issue | 2014 Assessment<br>*I – Impaired*<br>*C – Of concern* | Possible Causes / Influences / Concerns Voiced by Stakeholders | Possible Solutions / Actions To Be Taken |
|---|---|---|---|
| Elevated Levels of Indicator Bacteria and in Oyster Waters | 2422 C<br>2422B I<br>2422D I<br>2422OW I | ▪ Agricultural runoff from row crops, pastures, and fallow fields<br>▪ Rapid urbanization and increased impervious cover<br>▪ Constructed stormwater controls failing<br>▪ Bird rookeries on islands throughout the bay and along the shoreline<br>▪ Improper disposal of waste from boats<br>▪ Developments with malfunctioning OSSFs<br>▪ Improper or no pet waste disposal<br>▪ Direct and dry weather discharges<br>▪ Poorly operated or undersized WWTFs<br>▪ Waste haulers illegal discharges/improper disposal<br>▪ WWTF non-compliance, overflows, and collection system by-passes | ▪ Create and implement Water Quality Management Plans for individual agricultural properties<br>▪ Improve compliance and enforcement of existing stormwater quality permits<br>▪ Improve construction oversight to minimize TSS discharges to waterways<br>▪ Add water quality features to stormwater systems<br>▪ More public education on proper boat waste disposal<br>▪ More public education regarding OSSF operations and maintenance<br>▪ Ensure proper citing of new or replacement OSSFs<br>▪ More public education on pet waste disposal<br>▪ Regionalize chronically non-compliant WWTFs<br>▪ Impose new or stricter bacteria limits than currently designated by TCEQ<br>▪ Increase monitoring requirements for self-reporting<br>▪ Require all systems to develop and implement a utility asset management program and protect against power outages at lift stations |
| Impaired Dissolved Oxygen Levels | 2422B I | ▪ Excessive nutrients and organic matter from WWTF effluent, sanitary sewer overflows, malfunctioning OSSFs, and biodegradable solid waste, such as boat waste and pet waste | ▪ Educate agricultural community about riparian buffers and other conservation practices that reduce nutrient loads from fertilizer runoff.<br>▪ Conserve or restore trees and habitat along waterways to maintain/create vegetated riparian buffer zones<br>▪ More public education regarding OSSF operation and maintenance<br>▪ Regionalize chronically non-compliant WWTFs |
| PCBs/Dioxin in Edible Fish Tissue | 2422 I<br>2422B I<br>2422D I | ▪ Waste pit located along the San Jacinto River immediately upstream of I-10 bridge<br>▪ Concentrated deposits outside boundaries of the waste pits located adjacent to San Jacinto River | ▪ Encourage regulators and responsible parties to work together to remediate Superfund site<br>▪ Remove or contain contamination from locations already identified |

| | | | | |
|---|---|---|---|---|
| | | | and I-10 bridge<br>▪ Unknown industrial or urban sources | ▪ Encourage additional testing to locate all unknown sources/deposits |
| **Elevated Nutrients** | 2422 | C | ▪ Agricultural runoff from row crops, pastures, and fallow fields<br>▪ Fertilizer runoff from urbanized properties, such as landscaped areas, residential lawns, and sport fields<br>▪ WWTF effluent, sanitary sewer overflows, and malfunctioning OSSFs | ▪ Educate agricultural community about riparian buffers and other conservation practices that reduce nutrient loads from fertilizer runoff.<br>▪ Implement YardWise and Watersmart landscape practices<br>▪ Promote LID in urbanized areas.<br>▪ If DO swings are significant and biology shows a related effect, some phosphorus controls may be needed for wastewater treatment plants |
| **Elevated Chlorophyll *a* Concentrations** | 2422 | C | ▪ Fertilizer runoff from surrounding watershed promotes algal growth in waterways<br>▪ Nutrient loading from WWTF effluent, sanitary sewer overflows, and malfunctioning OSSFs promotes algal growth | ▪ Improve compliance and enforcement of existing stormwater quality permits<br>▪ Improve stormwater controls in new developments<br>▪ More public education regarding nutrients and consequences |

## Segment Discussion:

**Watershed Characteristics:** Trinity Bay lies within Chambers County. An imaginary line drawn from the north shore Houston Point area near Tri City Beach Rd to Smith Point on the southern shore separates Trinity Bay from Upper Galveston Bay. East Bay and Lower Galveston Bay lie south and southwest of Smith Point respectively. Coastal wetlands dominate the near shore landscape while cattle grazing, rice farming, and oil production are found throughout the county on the east side of the Bay. Anahuac is the major city in close proximity of the Bay situated on the northeast shore. The Double Bayou sub-watershed is located on the east side of the bay. Located in Liberty County, the headwaters of East Fork Double Bayou flow south before merging with West Fork Double Bayou and then draining to Trinity Bay at the community of Oak Island.

**Water Quality Issues:** The 2014 Texas IR lists Double Bayou West Fork (2422B_01) and Double Bayou East Fork (2422D_01) as impaired for contact recreation due to elevated levels of enterococci bacteria. Double Bayou East Fork is a new addition to the 303(d) list for bacteria.

Both Forks of Double Bayou as well as Trinity Bay (2422) are impaired for fish consumption due to elevated levels of dioxin and PCBs found in edible fish tissue. The Texas Department of State Health Services has issued a Limited Fish Consumption Advisory for these segments. Double Bayou West Fork is also listed for depressed dissolved oxygen with 42 percent of DO 24 hour average samples and 36 percent of dissolved oxygen 24 hour minimum samples below the standards. The East and West Forks of Double Bayou as well as Trinity Bay have chlorophyll *a* concerns based upon water quality screening criteria levels. In each segment over 50 percent of chlorophyll *a* samples were above the 11.6 micrograms per liter criteria level.

**Special Studies/Projects:** This segment is included in two TMDL projects: the Houston Ship Channel TMDL for Dioxin, and the Galveston Bay System Survey for Dioxin and PCBs, which are currently under way. A watershed protection plan (WPP) addressing elevated bacteria and low DO in Double Bayou is also under development by HARC using CWA 319 funds administered by TSSWCB. The Double Bayou WPP began in 2013 with the most recent full Draft WPP released for public comment in January of 2016. Additionally, Trinity 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 on water quality data detected 19 statistically significant parameter trends for the three AUs associated with this segment. Eight statistically significant trends were detected for Trinity Bay including increasing alkalinity, chloride, pH, salinity, specific conductance (SPCond), and sulfate while decreasing trends in ammonia and nitrate were seen over time. The West Fork Double Bayou AU, 2422B, had six significant increasing trends - alkalinity, chlorophyll *a*, dissolved oxygen (DO), pH, salinity, and total phosphorous (TP). East Fork Double Bayou (2422D) had a total of five increasing parameter trends during the period of record including chloride, enterococci, pH, salinity, and SPCond.

The 2014 Texas Integrated Report lists Trinity Bay as having a concern for elevated levels of nutrients, bacteria, and chlorophyll *a* in water. Regression analysis of nutrient data for Trinity Bay show stable nitrate concentrations during the period of record with the majority of samples measuring below the set screening criteria. Concentrations of TP have remained relatively stable since 2000, but again, the majority of samples fall under the 0.21 mg/L screening criteria. Occasional spikes in nutrient concentrations are likely related to nutrient loadings from agricultural stormwater runoff. Regression analysis of enterococci data for Trinity Bay revealed a slight decreasing trend over time with only a couple exceedances detected during the period of record. Chlorophyll *a* levels present the greatest concern at this time due to the majority of samples collected during the period of record exceeding the 35 MPN/100 mL standard.

Regression analysis of chlorophyll *a* data for the west fork of Double Bayou identified a statistically significant increasing trend with a visible rise in chlorophyll *a* levels noticeable after 2008. Double Bayou West Fork is listed as being impaired for elevated levels of bacteria and depressed DO. Enterococci data for this AU has hovered at or near the 35 MPN/100 mL geometric mean standard during the period of record, however, extreme spikes were detected several times since 2000 with levels approaching as high as 250,000 MPN/100 mL. Spikes at this magnitude are likely related to illicit discharges or sanitary sewer overflows (SSOs) that introduce large volumes of raw sewage into waterways. Regression analysis of DO data for Double Bayou West Fork show a gradual improvement in DO levels over time with the majority of samples falling in compliance with state water quality standards. Occasional dips in DO are still present and have reached extreme lows that are likely related to elevated nutrient and bacteria levels resulting in periods of eutrophication.

Segment 2422B, Double Bayou East Fork, is also impaired for elevated levels of bacteria. Routine monitoring of this segment began in 2002 and regression analysis detected a statistically significant increasing trend in enterococci levels over time. Nearly half of the samples exceed the enterococci geometric mean water quality standard for bays and estuaries during the period of record. Trinity Bay and both the West Fork and East Fork of Double Bayou are also impaired for PCBs and dioxin in edible fish tissue in the 2014 Texas Integrated Report.

| 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. |