

Targeted Bacteria Monitoring Report

Field Investigation Final Report

Assessment Unit 1017E_01, Unnamed Tributary of White Oak Bayou



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Segment Description

Segment 1017E is an unnamed tributary of White Oak Bayou (Figure 1). This segment consists of one assessment unit (AU) of concern, AU 1017E_01, that is 3.1 km long and is defined as from the confluence with White Oak Bayou Above Tidal, near West 11th Street, upstream to West 27th Street south of Loop 610 West in Harris County. There is one current (station ID: 16596) and one historic (station ID: 11151) surface water quality monitoring (SWQM) station located on this AU. This AU was selected for targeted monitoring due to a bacteria (*Escherichia coli*) seven-year geometric mean of 2288 MPN/100 mL (H-GAC QAPP, 2022) and has a current impairment category of 4a (TCEQ, 2022). The potential sources of bacteria are non-point source pollution, urban runoff, and sanitary sewer overflows (TCEQ, 2022). This AU was previously monitored as part of the FY20-21 Targeted Monitoring Study.

The contributing watershed for this segment is 3 km² (Data source: HGAC, SWRC, 2023). The soil types in the area have slow to very slow infiltration rates (Data source: United States Department of Agriculture Hydrologic Soil Groups from gSSURGO 2016) and land cover in the watershed is dominated by 99.9 % developed land (Data source: National Land Cover Database NLCD 2019). There are no permitted wastewater outfalls in the watershed (Data source: H-GAC). There are also no documented permitted or unpermitted on-site sewage facilities (OSSF) on the segment (Data source: H-GAC).

Background

Clean Rivers Program (CRP) routine monitoring data are analyzed each year as part of the Houston-Galveston Area Council (H-GAC) Basin Summary/Basin Highlights Report process. Bacteria continues to be the most prevalent pollutant in the H-GAC CRP Basins (H-GAC, 2022). The Bacteria Implementation Group (BIG), formed in 2008, oversees the Total Maximum Daily Load (TMDL) Implementation Plan (I-Plan). The BIG requested that H-GAC produce a list of the water bodies with the highest bacteria concentrations in the BIG project area and conduct targeted monitoring to identify potential bacteria sources.

Houston-Galveston Area Council, using information from previous Basin Highlights/Summary Reports, BIG annual reports, and previous targeted monitoring efforts, identified and selected waterways for targeted bacteria monitoring to refine our understanding of the spatial distribution of elevated bacterial concentrations contributing to these waterways. Phase 1 of this targeted monitoring project includes an intensive desktop review of the most up to date imagery available and compilation of data from field investigations (FI) conducted in 2021. Phase 2 of this targeted monitoring project includes a FI of the entire AU conducted during dry conditions where all flowing point and non-point sources are evaluated.

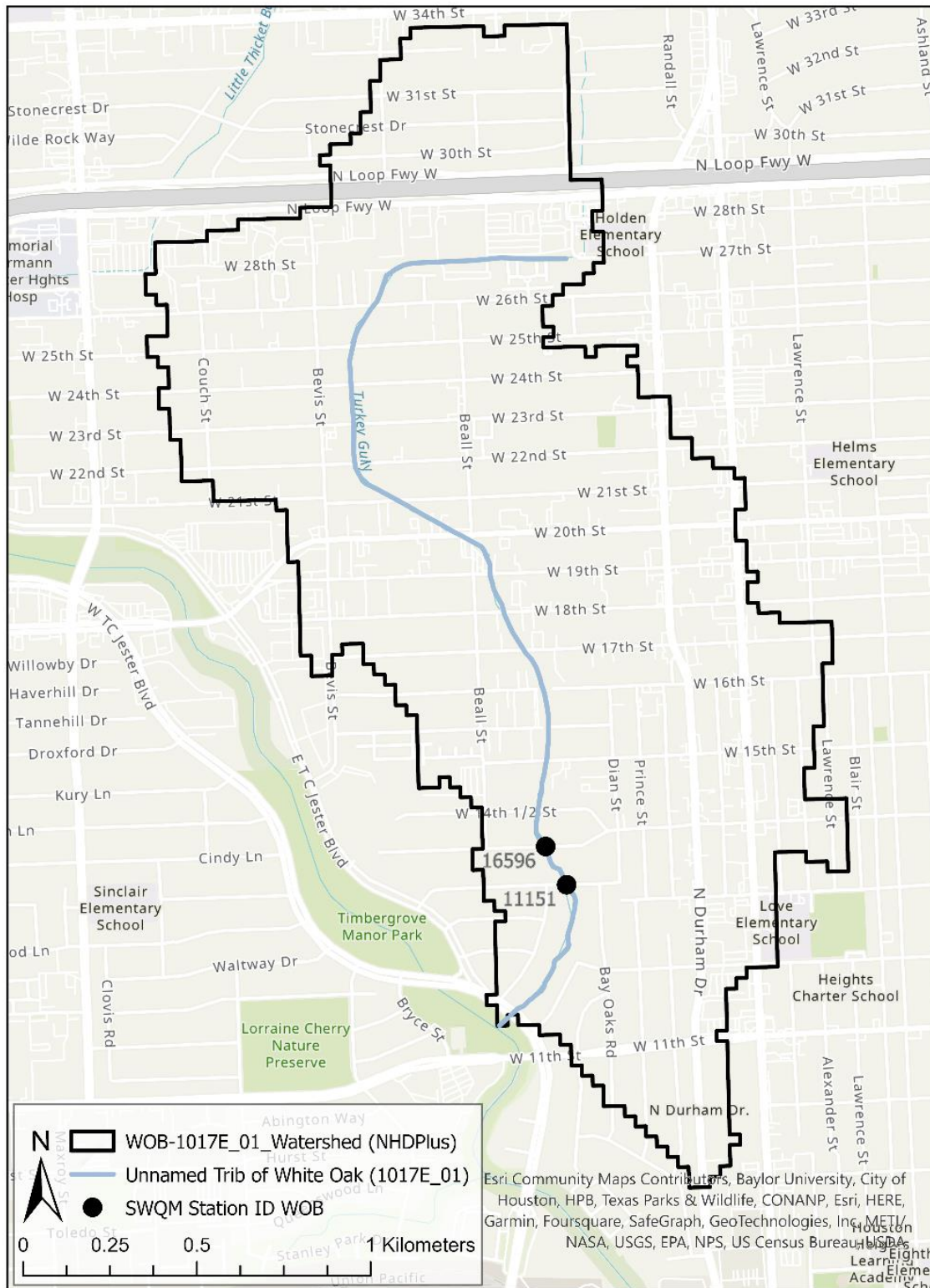


Figure 1: Watershed Map for Unnamed Tributary of White Oak Bayou, Assessment Unit 1017E_01.

Desktop Review

Methods

The intensive desktop review included an evaluation of permitted discharges, outfalls, and potential sources of point and nonpoint source pollution that may contribute to bacteria loading in the AU. Using Google Earth imagery and GIS, the locations of wastewater treatment facilities, permitted on-site sewage facilities (OSSFs), and potential locations of unpermitted OSSFs were identified. If present, other potential sources such as landfills and industrial facilities, were also identified. Parks were noted, as these can contribute to bacterial sources through runoff of animal wastes but also provide opportunity for contact recreation. Bridge crossings and other public entry points were identified to provide access into the stream to collect bacteriological samples. The Environmental Institute of Houston conducted this review in 2021 and AU 1017E_01 was reviewed prior to beginning the 2023 FI.

Results

The results of the desktop review indicated that this unnamed tributary of White Oak runs between residential areas and commercial businesses. Potential sources of bacteria were identified during the FI in 2021 from an outfall from a broken concrete apron leading from a metal pipe, a permitted leaking metal pipe, and a concrete pipe that was discharging cloudy and sudsy water (Oakley and Leshner, 2021). Publicly accessible entry points into the stream were identified at Timbergrove Lane and the confluence of White Oak Bayou and the Unnamed Tributary of White Oak Bayou, at Wynnwood Lane, West 14th Street, West 14th ½ Street, West 15th Street, West 15th ½ Street, West 16th Street, West 17th Street, West 19th Street, Beall Street, West 20th Street, West 21st Street, West 22nd Street, West 23rd Street, West 24th Street, West 25th Street, West 26th Street, and finally at the parking lot located at 999 N Loop W, Houston, TX 77008.

Windshield Survey

Methods

All field events must take place during dry weather (after three or more days without significant rainfall in the watershed). This ensures that any flowing water into the segment is not stormwater. Windshield surveys (WS) of the watershed were conducted in 2021 and bacteria sampling was performed at public access points throughout the AU (primarily at bridge crossings). The survey consisted of driving the catchment area to confirm identified pollution sources found during the desktop review and to find any potential sources not identified during that review. Bridge crossings chosen for sampling were spatially distributed to provide a spatial snapshot of bacteria concentrations in the AU and identify sections of the AU where elevated bacteria concentrations were found. Those areas with elevated bacteria levels identified in the

WS monitoring were focused on during the Phase 2 of the FY20-21 study FI. The results from the 2021 sampling events were used to plan the 2023 FI. Therefore, a WS was not completed in 2023.

Assessment units, sample collection and laboratory methods, and data handling practices for the 2021 study are provided in Appendix J of the FY 2020-2021 H-GAC Multi-Basin Clean Rivers Program Quality Assurance Project Plan (H-GAC QAPP, 2020). For all WS bacteria monitoring conducted in 2021, field personnel documented the latitude and longitude of sample location. All bacteria samples were analyzed by a National Environmental Laboratory Accreditation Program (NELAP)-Accredited laboratory.

Results

The WS was conducted on March 10, 2021. At that time, it had been four days since the last significant rainfall in the watershed. A total of 13 bacteria samples were collected during the WS. Bacteria results from the ambient water samples collected during the WS ranged from 10-1990 MPN/100 mL.

Field Investigation

Methods

The following methods were conducted for the FI in 2021 and for the FI in 2023. Assessment Units, collection and laboratory methods, and data handling practices for the 2023 FI are detailed in Appendix J of the FY 2022-2023 H-GAC Multi-Basin Clean Rivers Program Quality Assurance Project Plan (H-GAC QAPP, 2022). The FI was a thorough survey where a team of two, either walked or paddled the entire assessment unit and sampled dry-weather flow into the segment. Water could be flowing in from a pipe, culvert, natural tributary, or earthen/concrete-lined ditch. Flowing water was categorized into two source types: permitted outfalls or unpermitted outfalls. Permitted outfalls included wastewater facilities and municipal separate storm sewer systems (MS4). Any pipe greater than 12 inches (in.) in diameter was assumed to be permitted by our field crews.

When flowing water was observed from a permitted outfall, two samples were collected. One sample was collected immediately downstream of the outfall where the flowing outfall was mixing with the ambient water. The second sample was taken upstream of the flowing outfall outside of the realm of influence from the outfall to provide the ambient bacteria levels of the assessment unit in that area. The second type of source was an unpermitted outfall, which was any other flowing source of water that was not assumed to be permitted including flowing small (<12 in. diameter) “homemade” pipes and tributaries.

When a flowing unpermitted outfall was observed, the bacteria sample was taken directly from the source. If the source was a flowing pipe, the sample was collected directly from the pipe,

before it entered the segment. If it was an open-top earthen ditch or natural tributary, the sample was collected from far enough into the inflow source that there was no mixing with the receiving water. In certain cases, when no flowing permitted or unpermitted outfalls were observed in an extended section of the segment, a single ambient reference sample was taken mid-stream. Left and right bank references are oriented with the observer facing downstream.

For all FIs the field team recorded location of the flowing outfall (latitude and longitude), the diameter, material, and water depth of the flowing outfall, and documented site conditions by taking photos and other relevant notes. All bacteria samples were collected following procedures listed in Appendix J of the FY 2022-2023 H-GAC Multi-Basin Clean Rivers Program Quality Assurance Project Plan (H-GAC QAPP, 2022) and analyzed by a National Environmental Laboratory Accreditation Program (NELAP)-Accredited laboratory.

2021 Results and Recommendations

The FI was conducted on March 22, 2021 (five days since last significant rainfall) and a total of 26 bacteria samples were collected. The values of the bacteria samples collected from downstream of permitted outfalls, or directly from unpermitted outfalls are illustrated in Figure 2. Based on the data collected, three outfall locations with elevated *E. coli* bacteria levels measured during the FI were recommended for further investigation (Oakley and Leshner, 2021).

Based upon the results of the 2021 FI, a second FI in 2023, covering the entire length of the AU, was recommended. It was expected that if the previously reported referral sites were not successfully addressed, potential point or non-point sources of elevated bacteria would be identified near the following portions of the AU:

1. Site WOB-FI-01 was located where the main assessment unit intersects with W 14½ Street, between Beall Street and Dian Street. This metal pipe is located on the left bank. Just one sample was taken here from the broken concrete apron leading from the pipe with a bacteria value of 4,350 MPN/100 mL. This site, WOB-FI-01, was located just downstream of site WOB-FI-02, which also indicated bacteria loading.
2. Site WOB-FI-02 was a sealed, permitted metal pipe that runs about the main assessment unit of this tributary of White Oak Bayou. It is just upstream of site WOB-FI-01. Connected to the main pipe is a holding pump that was broken and leaking water into the stream along the left bank. One direct sample was taken here from the leaking pipe with a bacteria value of 3,870 MPN/100 mL. It appeared that this permitted pipe needs repair and has been leaking high bacteria water into the stream.
3. Site WOB-FI-15 was located under the road at the intersection of W 20th Street and Beall Street. It is downstream of a car dealership and many townhouses. The pipe located under the street is concrete. The sample taken just downstream of the outfall pipe was 1,620 MPN/100 mL. The ambient sample taken upstream of the outfall had a relatively low bacteria value (109 MPN/100 mL) indicating that this outfall is likely a source contributing to the elevated *E. coli* levels in this assessment unit. When initially

passing this pipe, there was no water observed, but it began to flow while the team was sampling another area. The water coming from the pipe was sudsy and cloudy.

2023 Field Investigation Results

The FI was conducted on March 30, 2023 (13 days since last significant rainfall) and a total of 27 bacteria samples were collected. The values of the bacteria samples collected from downstream of permitted outfalls, directly from unpermitted outfalls, or as ambient samples are summarized in Table 1 and Figure 3. Based on the data collected, two locations with elevated *E. coli* bacteria levels measured during the FI are recommended for high priority investigation by the proper authorities. High priority sites had the highest potential bacteria loading observed and are recommended to be the areas for local authorities to focus efforts on should there be insufficient resources to address all referral sites. As time and resources allow the low priority and investigate further referrals also are recommended for further investigation. These locations are summarized in Table 1 and Figure 4. In addition, two locations were flagged where ambient or upstream samples had elevated bacteria levels with no obvious explanations. Further investigation of these areas by the proper authorities are recommended. Each of these referrals are summarized by site, herein. The referral summaries are listed in order of priority (High, Low, then Investigate Further). Within each priority group, sites are listed from downstream to upstream.

Table 2: Field investigation bacteria results from sampling on 03/30/2023 on Unnamed Tributary of White Oak Bayou (AU 1017E_01). Referrals (gray rows): N = No, Y-H = Yes – High Priority, Y-L = Yes-Low Priority, IF = Investigate Further, US = Upstream, DS = Downstream. LB = Left Bank, RB = Right Bank.

Sample ID	Lat	Long	DS or Direct <i>E. coli</i> Sample Results (MPN/100 mL)	US <i>E. coli</i> Sample Results (MPN/100 mL)	Difference* DS - US (MPN/100 mL)	Referral	Comments
WOB-FI2-01	29.79100	-95.41759	300	NA	NA	N	Ambient sample taken just upstream of confluence.
WOB-FI2-02	29.79152	-95.41685	860	NA	NA	N	Ambient sample from where water goes under road.
WOB-FI2-03	29.79377	-95.41531	5,200	NA	NA	Y-H	Substrate is black with a white film. Sample from mixing zone of submerged pipe. Could not tell if it was flowing. Pooled in front of pipe. LB.
WOB-FI2-04-D	29.79548	-95.41610	630	850	-220	N	Submerged pipe on LB.
WOB-FI2-05-D	29.79790	-95.41599	410	1,480	-1,070	N	Water coming out of pipe on LB appears sudsy. Evidence people go into pipe (graffiti).
WOB-FI2-06-D	29.79862	-95.41595	310	1,210	-900	N	Trickle coming out of pipe on LB.
WOB-FI2-07-D	29.79956	-95.41592	< 100	1,600	-1,500	N	Sheen on water downstream of culvert on LB.
WOB-FI2-08	29.80142	-95.41703	41,000	NA	NA	N	Big pool that was cloudy/milky. Potential source unknown. Ambient sample. Snapping turtle present.
WOB-FI2-09	29.80362	-95.41795	173,000	NA	NA	Y-H	Ambient sample of where segment goes underground.
WOB-FI2-10	29.80381	-95.41857	100	NA	NA	N	Ambient sample between 2 tunnels.
WOB-FI2-11	29.80416	-95.41933	100	NA	NA	N	Ambient sample where water resurfaces. oyster shells
WOB-FI2-12	29.80464	-95.42014	750	NA	NA	N	Ambient sample taken downstream of bridge. Choked with elephant ear, alligator weed, and arrowhead.
WOB-FI2-13	29.80570	-95.42143	630	NA	NA	N	Ambient sample taken DS of construction on bank.
WOB-FI2-14	29.80879	-95.42142	6,130	NA	NA	IF	Ambient sample taken upstream of bridge.
WOB-FI2-15	29.80970	-95.42075	310	NA	NA	N	Sample taken downstream of bridge.
WOB-FI2-16-D	29.81024	-95.42041	100	980	-880	N	Submerged pipe on RB. No visible flow.
WOB-FI2-17-D	29.81088	-95.41992	1,350	11,800	-10,450	IF	Submerged culvert on right bank.
WOB-FI2-18-D	29.81091	-95.41962	630	520	110	N	Trickling out of pipe on LB.
WOB-FI2-19-D	29.81091	-95.41907	< 100	200	-100	N	Dripping out of pipe on LB. Upstream sample taken was almost at top of AU.

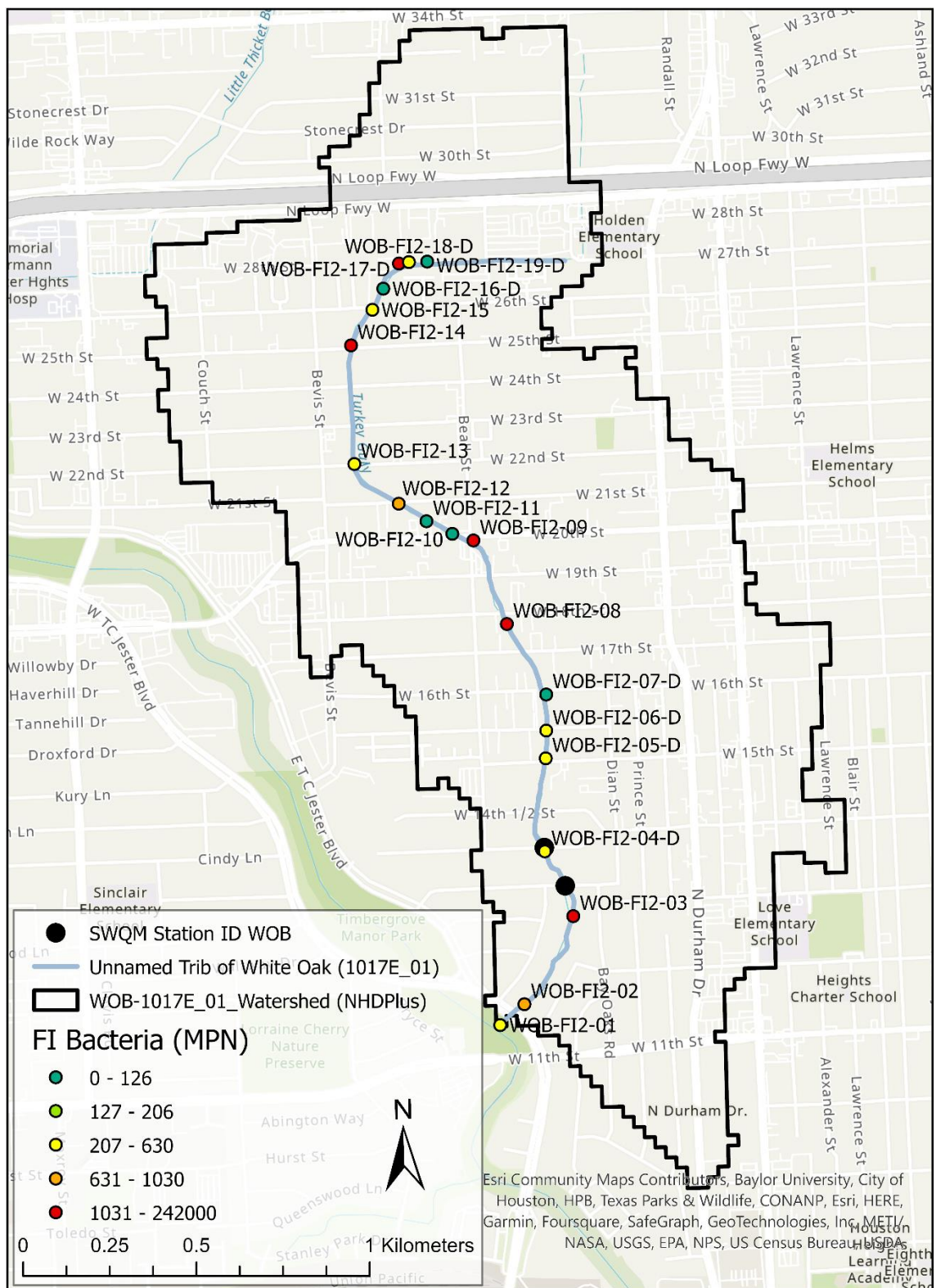


Figure 3: Field investigation bacteria sampling Results from 03/30/2023 on the Unnamed Tributary of White Oak Bayou (Assessment Unit 1017E_01).

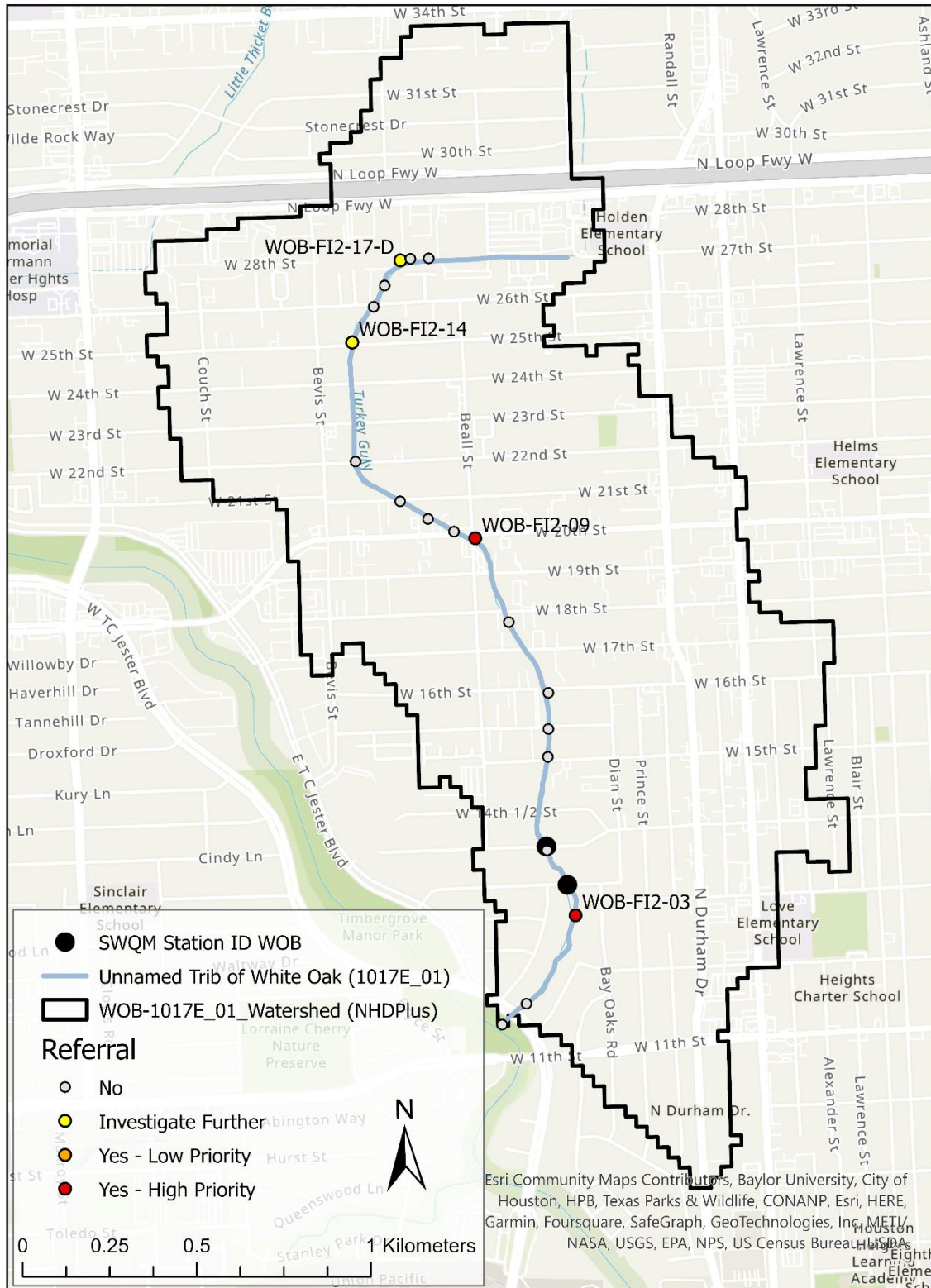
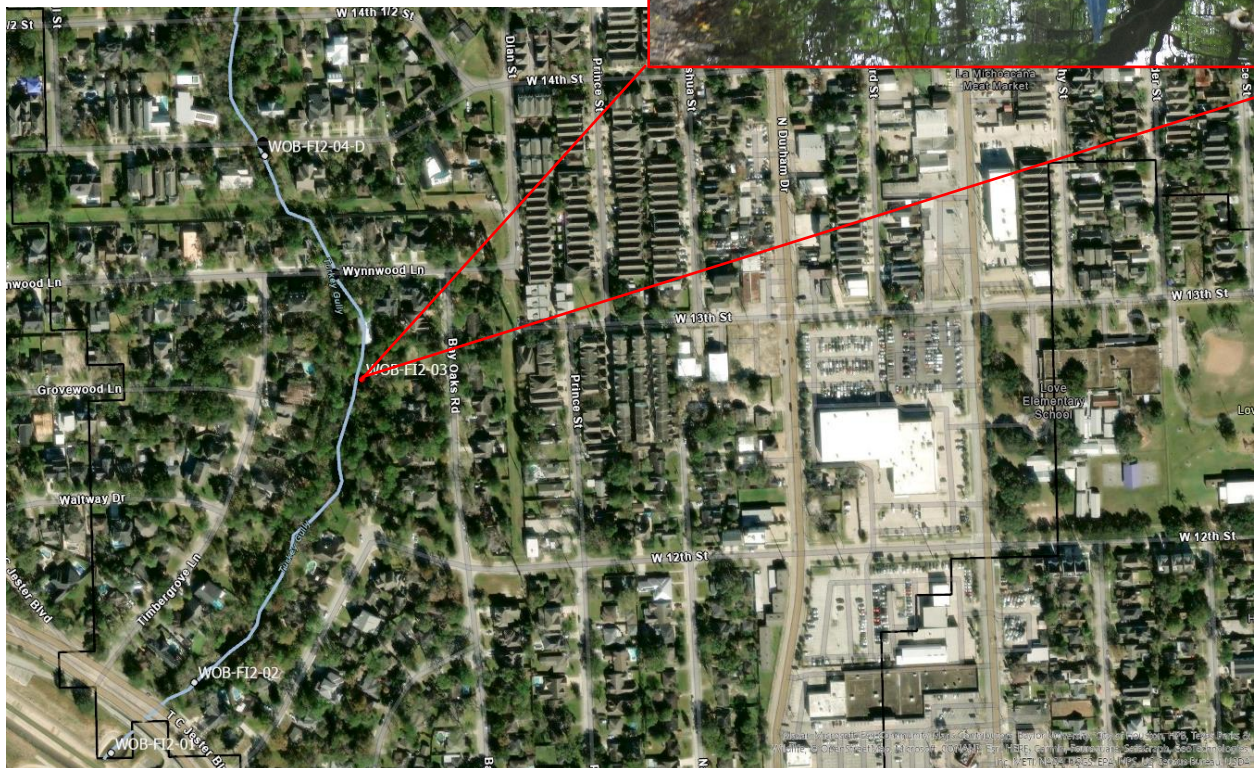


Figure 4: Field investigation sites sampled on 03/30/2023 and identified for referral to the proper authorities on the Unnamed Tributary of White Oak Bayou (Assessment Unit 1017E_01).

Referral site: WOB-FI2-03 – High Priority

This is a 51 in. diameter concrete pipe that was submerged on the left bank of the Unnamed Tributary of White Oak Bayou. Water within the pipe was 36 in. deep and the field crew was unable to tell if it was flowing into the segment due to it being submerged. The area in front of the pipe was a stagnant pool and the substrate appeared to be black in color with a white film on top. When disturbed, the substrate gave off an anoxic odor. A sample was taken from the mouth of the submerged pipe and had a bacteria value of 5,200 MPN/100 mL. An ambient sample was not collected directly upstream of this pool, but the next ambient sample collected approximately 200m upstream of the pipe had a bacteria value of 850 MPN/100 mL. This pipe is a high priority referral site for the proper local authority.



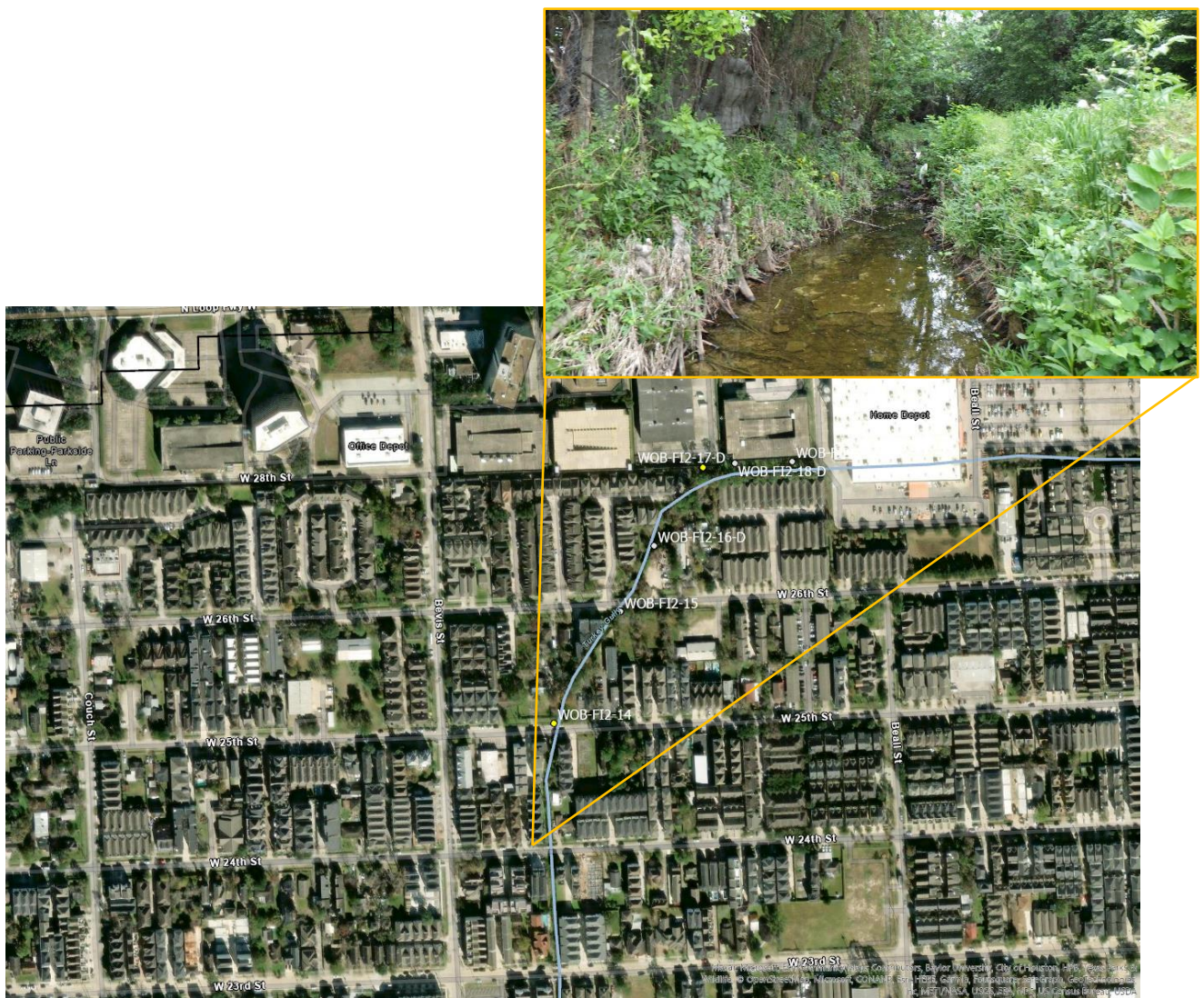
Referral site: WOB-FI2-09 – High Priority

This is where the Unnamed Tributary of White Oak Bayou goes underground. An ambient sample was collected just downstream of this bridge and had a bacteria value of 173,000 MPN/100 mL. The next ambient sample collected ~460 m upstream had a bacteria value of 100 MPN/100 mL. There were no pipes between these two ambient samples that were observed to be flowing into the AU at the time of sampling. This portion of the AU runs through a mix of restaurants, clubs, and residences. This section of the AU is a high priority referral site for the proper local authority.



Referral site: WOB-FI2-14 – Investigate Further

This was an ambient sample taken just upstream of the bridge of W 25th St. on the Unnamed Tributary of White Oak Bayou. This ambient sample had a bacteria value of 6,130 MPN/100 mL. The next ambient sample was collected 115 m upstream and had a bacteria value of 310 MPN/100 mL. No pipes were observed to be flowing between these two sampling locations during the time of sampling. Further investigation is recommended by the proper local authority to determine the source of elevated bacteria in this section of the AU. There are apartment and single-family homes located upstream of the site.



Referral site: WOB-FI2-17-U – Investigate Further

This portion between two pipes had suspect levels of bacteria. The ambient sample taken just upstream of this pipe had a bacteria value of 11,800 MPN/100 mL yet the sample collected downstream of the next pipe (18-D), which was only 30 m upstream, had a bacteria value of 630 MPN/100 mL. There were no pipes that were observed to be flowing into the AU between pipes 17-D and 18-D at the time of sampling. Further investigation is recommended by the proper local authority to determine the source of elevated bacteria in this section of the AU. There are apartments and single-family homes located upstream of the site, as well as commercial properties.



List of Acronyms and Abbreviations

AU	Assessment Unit
BIG	Bacteria Implementation Group
CRP	Clean Rivers Program
DS	Downstream
E. Coli	Escherichia coli
FI	Field Investigation
FY	Fiscal Year
GIS	Geographic Information Systems
H-GAC	Houston-Galveston Area Council
IF	Investigate Further
in.	inch
I-Plan	Implementation Plan
km	kilometer
LB	Left Bank
m	meter
mL	milliliter
MPN	Most probable number
N	No
NELAP	National Environmental Laboratory Accreditation Program
NLCD	National Land Cover Database
OSSF	On-Site Sewage Facilities
QAPP	Quality Assurance Project Plan
RB	Right Bank
SWQM	Surface Water Quality Monitoring
SWRC	Stroud Water Research Center
T or trib.	Tributary
TCEQ	Texas Commission on Environmental Quality
TMDL	Total Maximum Daily Load
US	Upstream
WOB	Unnamed Tributary of White Oak Bayou 1017E_01
WS	Windshield Survey
Y-H	Yes – High Priority
Y-L	Yes-Low Priority

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