

**Comprehensive Recreational Use Attainability Analysis of
Armand Bayou Above Tidal
Segment 1113A**

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Introduction

Problem Statement

Armand Bayou is a coastal stream located in the San Jacinto-Brazos Coastal Basin. It originates south of the city of Houston and flows southeast. A tributary of Clear Lake, the lower eight miles of Armand Bayou (Segment 1113) is tidally influenced and rich in plant and animal life. However, the portion of Armand Bayou located above tidal influence (Segment 1113A) is characterized by extensive residential development and general urbanization. The Texas Commission on Environmental Quality (TCEQ) evaluated water quality samples collected since 1998 and found that bacteria levels in Armand Bayou Above Tidal (Segment 1113A) were occasionally elevated, indicating a potential risk to people who swim or wade in this portion of the bayou (Texas Commission on Environmental Quality [TCEQ] 2009a). Swimming and other forms of recreation that involve direct contact with the water are referred to as "contact recreation" in the state's standards for the quality of streams, lakes, and bays. In response to these conditions, the TCEQ initiated a project to determine the recreational use-attainability (RUAA) in Armand Bayou Above Tidal segment.

Recreational Use Attainability Analyses (RUAA) are scientific assessments used to determine existing and attainable recreational use for a water body and whether that use might be different than the presumed recreational use as specified in the Clean Water Act. In February 2008 a Basic RUAA was initiated on Armand Bayou Above Tidal, Segment 1113A (UHCL, 2009), the results of which warranted a Comprehensive RUAA. This Comprehensive RUAA Report will provide the TCEQ Water Quality Standards Team with relevant information needed to determine the appropriate recreational use for Armand Bayou Above Tidal (Segment 1113A). The completion of this comprehensive RUAA consisted of several important interrelated tasks

including; 1) reconnaissance and site selection, 2) conducting the comprehensive RUAA, and 3) public outreach. The specific objectives of each task are listed below.

Objectives

1. Reconnaissance and Site Selection

The site reconnaissance and selection phase is considered one of the first steps in a Comprehensive RUAA. The primary objective of this phase is to select survey sites that would be accessible to users and most likely characterize recreational uses in the watershed. Site selection for this Comprehensive RUAA was facilitated by a previous investigation of Armand Bayou Above Tidal, conducted as part of a Total Maximum Daily Load study initiated in February of 2008. The report titled “Pollutant Source Identification Report for Fecal Bacteria in Armand Bayou, Non-tidal Segment (Segment 1113A),” included in Appendix 8, provides useful supplementary information such as watershed characteristics, hydrologic characteristics, the location of important features such as parks and natural areas.

Prior to selecting the final survey sites we also solicited input from regional experts familiar with the watershed via email and telephone. A contact information form was completed which documented contact with appropriate regional authorities in the watershed (Appendix 1).

2. Comprehensive Recreational Use Attainability Analysis

The primary objective of the Armand Bayou Above Tidal Comprehensive RUAA was to characterize the recreational use and potential impediments to use of this stream. A Basic RUAA Survey was conducted prior to the Comprehensive RUAA. The field surveys (associated with the Basic RUAA) were conducted on May 25, July 4, and August 27, 2009, at selected sites

where there is a high probability of detecting recreation use. The objective was to document and characterize observed uses, site conditions (hydrology, physical attributes) and weather during the survey. In addition, a historical information review and interviews were also conducted in 2010 for the Comprehensive RUAA. The objective of these reviews and interviews were to supplement the data obtained from the field surveys conducted during the Basic RUAA and increase the probability of detecting and characterizing recreational uses in the watershed if it exists. In completing the Comprehensive RUAA for Armand Bayou Above Tidal, the TCEQ document *Recreational Use-Attainability Analyses (RUAs) Procedures for a Comprehensive RUAA and Basic RUAA Survey, May 2009* was strictly followed.

3. Public Participation

The objective of the public participation phase of the Comprehensive RUAA is to solicit as much information from various watershed stakeholders; including agency staff, citizens, recreational user groups and other interested parties, on the historical and current recreational uses in Armand Bayou Above Tidal. This includes sending out email and phone messages to key organizations and staff familiar with the watershed. The final and complete stakeholder contact list is provided in Appendix 1. In addition, on August 24th, 2009 an initial stakeholder group meeting was held at the Environmental Institute of Houston at the University of Houston-Clear Lake, Houston TX to gather information on the watershed, including likely recreational access points. Finally, a public meeting was advertised via public notice by TCEQ and held at the Environmental Institute of Houston at the University of Houston-Clear Lake, Houston TX on August 31, 2010 to present the findings of this study and gather more information on potential observed or known recreational uses within the watershed from the attending public.

Study Area

Description of Water Body

Armand Bayou is located in the San Jacinto-Brazos Coastal Basin. It originates south of the city of Houston, and flows southeast through the city of Pasadena, TX. Armand Bayou is composed of two designated segments: the tidal portion, Segment 1113, and the portion above the tidal influence, Segment 1113A. Armand Bayou Above Tidal extends 17.1 square miles and includes portions of Houston, Pasadena, Deer Park, and La Porte City limits. Armand Bayou Above Tidal extends from a point 0.8 km (0.5 miles) downstream of Genoa-Red Bluff Road in Pasadena upstream to Pansy Street – right above Spencer Highway – in Pasadena in Harris County, TX. Segment 1113A as classified by the Texas Commission on Environmental Quality is approximately 5.9 miles in length (TCEQ, 2004).

Environmental Features and Population Characteristics

The climate in the Armand Bayou watershed is classified as subtropical with hot, humid summers and dry winters. The Armand Bayou watershed is within the Gulf Coastal Prairies and Marshes ecoregion, an area characterized as containing nearly level, un-dissected plains with native vegetation types composed of tall grass prairie and post oak savanna.

UHCL was able to secure summary census data for the basin from the Houston-Galveston Area Council (HGAC). Based on summary data tabulated by HGAC, the approximate population for the non-tidal portion of Armand Bayou watershed is 61,406. Based on the HGAC land use classification system (Geographic Information System files), the majority (>80%) of the watershed is classified as low and high density developed land. The majority of the soil associations were classified as TX569 and TX042 (USDA s7308, s7401) which are described as

Lake Charles Bernard association and Midland-Beaumont soil associations (USDA 1976). Both of these are characterized as being nearly level, clayey and loamy prairie soils. These soils are characterized as exhibiting slow drainage and having very low permeability. Less than 10% of the non-tidal portion of Armand Bayou was considered wetlands based on our review of the NWI GIS layers.

Watershed Characterization

Armand Bayou Above Tidal is a highly modified watershed characterized by low to moderate residential land use and poorly drained, highly impermeable clay soils and very low gradient topography. Like many urban areas the watershed has been highly modified for flood management by municipalities. The Armand Bayou watershed, a natural basin of land, collects water and drains it into tributary streams, then into Armand Bayou, the main stream of the watershed. The water collected by the bayou flows into Clear Lake, a secondary bay of Galveston Bay.

Permitted Discharges (Municipal, Industrial, Stormwater)

There are no permitted outfalls within the study watershed. Two candidate wastewater facilities that initially appeared to occur within the watershed (City of Pasadena TCEQ Permit 10053-003 and Heritage Financial TCEQ Permit 12677-001) actually discharge directly or indirectly into TCEQ Segments 1006 (Little Vince Bayou) and 1113 (Armand Bayou Tidal), respectively. Heritage Financial is located 0.25 miles south of the intersection of Spencer Hwy and Canada Street in Harris County. It is highly unlikely therefore that permitted WWTP outfalls contribute significantly to bacteria loading in the non-tidal portion of Armand Bayou.

Potential Nonpoint Sources

For any urban collection and treatment system, sanitary sewer overflows and waste water treatment facility (WWTF) bypasses are possible sources of bacteria loadings to receiving waters. Concerns related to overflows and bypasses are heightened in areas subject to occasional high rainfall events. Because of the rapid and continuing population growth in the Armand Bayou watershed, some of the supporting infrastructure has been built recently and has underutilized capacity, which reduces the likelihood of overflow and bypass events. Nonetheless, occurrences of such events and their subsequent impacts on bacteria loading can occur.

We interviewed Mr. Bryan Eastham from the TCEQ Region 12 office. Mr. Eastham is responsible for coordination of the Onsite Wastewater inspection program within the region. Based on conversations with him, he indicated that there were few if any septic systems in the watershed. He indicated that there have been few if any reports of problems in this watershed. He stated that he examined Segment 1113 on the watershed map and local key map and that it does not look like there are many areas that he was aware of with onsite systems nearby. Other than a few systems on the south side of Genoa- Red Bluff, all of the area is on sanitary sewer. He stated that it looks like most of the residential areas are in the city and most likely connected to city sewer.

A detailed reconnaissance of the watershed was conducted during June 2008. All stormwater outfalls and drainage ditch tributaries were mapped during this phase of the study. Four hundred eighty three (483) outfalls were identified within the non-tidal and portions of the tidal section of Armand Bayou. Only a small fraction (11) of these storm-water outfalls actually contained flowing water during dry periods. This suggests that there are only a few potential

chronic sources of bacteria within the watershed. Of these outfalls most exhibited extremely low flows with only a small amount of dripping water exiting the pipe or ditch.

Mr. Jim Rice at the Region 12 TCEQ office provided us with overflow and bypass reports for Segment 1113 for incidents reported since 2003. Based on a review of these records there were no reported bypasses and overflows within the non-tidal portion of the watershed. All reported bypasses occurred in the tidal portions of Armand Bayou, including Horsepen Bayou.

We also evaluated the potential for bacteria loading from livestock. The only livestock that were observed or could occur within the study watershed were located in the extreme lower portion of the watershed on areas leased by several oil companies and at the Pasadena Fairgrounds located near the mouth of Willow Spring Bayou and Red Bluff Road. The private land is held by Kinder Morgan and is leased to both Exxon Mobil and Shell Oil Pipeline companies. The rancher said he was currently grazing 236 female and 11 male cattle. He also indicated that approximately 80% of the females should be calving soon. Furthermore the calves would graze from July through October with the herd. The total estimated acreage used was about 2,500 acres.

History of Recreational Use in Armand Bayou Above Tidal

Historical Summary

Middle Bayou became Armand Bayou in 1974 when 2119 acres of the watershed was purchased to be preserved. Several smaller bayous, gullies, and sloughs feed the watershed. They are: Spring Gully, Big Island Slough, Horsepen Bayou, and Little Bayou at Mud Lake. The bayou was named after Armand Yramatequi, the curator of the Burke Baker Planetarium who

was a grassroots conservationist and political activist who helped bring public awareness to environmental issues in Texas (McFarlane et. al., 1991).

Boating

Boating has been a constant use of upper Armand Bayou. It began as a transportation route for the Native Americans, explorers and early settlers and has continued in recreational use. Today there are motor boat restrictions on the bayou making it the perfect waterway for canoeing and kayaking. The physical characteristics of Armand Bayou Above Tidal upstream of Fairmont Parkway can restrict boating and canoeing/kayaking after long periods of dry weather due to shallow water. A Texas Paddling trail is located in the tidal segment of Armand Bayou. It is unknown what proportion of users may venture into the non-tidal segment. There are no real barriers that prevent this movement. During our final field survey evidence of paddling (a paddle found on the bank and documented in the photographic record) was observed at Site 2.

Fishing

Like boating, fishing has always been a popular form of recreation in Armand Bayou, however there is little historical evidence of fishing in the Above Tidal portions of the bayou. The physical characteristics in the upstream extent of the above tidal portion of the waterbody can limit recreational fishing due simply to the narrow and at times very shallow waterway. Bank fishing is commonly found where Red Bluff Blvd. intersects with Armand Bayou in the downstream extents of Armand Bayou Above Tidal.

Swimming

Little documentation was found regarding swimming in the Above Tidal Portion of the waterbody post 1975. An Interview with a stakeholder described a rope swing on the non-tidal

segment of Armand Bayou Above Tidal between Fairmont Parkway and Genoa-Red Bluff Rd. The presence of this swing would suggest possible use of the water body for contact recreation. Also notable, the principal investigator has taken UHCL college students for aquatic biological collection field trips to the Armand Bayou at Fairmont Parkway (field survey site 2) approximately every 1-2 years. During these trips it is not uncommon for students to periodically become immersed in the stream while picking up specimens, while wading, or accidentally during falls.

Parks

The city of Pasadena has constructed a hike and bike trail in the middle reaches of Armand Bayou Above Tidal and its intersection with Fairmont Parkway. There are plenty of bank fishing and wading spots along the length of these trails. They are also used by birders. The city park has only recently been completed and opened to the public (Figure 1). Bike/hike trails run adjacent to the Bayou for nearly one mile, where it then follows Red Bluff Drive to Bay Area Blvd.

Site Reconnaissance Summary

Initial reconnaissance surveys were conducted in May of 2008 as part of the Total maximum Daily Load (TMDL) reconnaissance for the Armand Bayou Above Tidal watershed. A total of three (3) survey sites were established.

Methodologies

RUAA Survey Site Selection and Descriptions

In general, the target density of survey sites should be approximately three (3) sites per every five (5) miles of stream (Texas Commission on Environmental Quality (TCEQ) 2009b). A total of three (3) survey sites were established (Table 1 & Figure 1). These sites were chosen based on public access potential with the highest potential for recreational use (road crossings, public lands/parks located near the water body, and populated areas) and also providing sufficient spatial coverage and even distribution throughout each assessment unit.

Table 1. RUAA field survey sites on Armand Bayou Above Tidal (corresponding to Figure 1).

Survey Site #	Site Description	Lat	Long
1	Armand Bayou and Genoa Red Bluff Rd	29.6339	-95.1142
2	Armand Bayou and Fairmont Pkwy	29.6502	-95.1289
3	Armand Bayou and Space Center Blvd	29.6630	-95.1450

Sampling Methods

Recreational use attainability analyses (RUAAAs) are used to identify and assign attainable uses and criteria to individual water bodies. Applicable uses and associated criteria are defined in the Texas Surface Water Quality Standards (TSWQS). Prior to June, 2010, Texas had two recreation use categories in the 2000 TSWQS: contact and noncontact recreation. These recreation use categories were expanded to include two more categories: Secondary Contact Recreation (1 &2).

Armand Bayou Above Tidal (Segment 1113A) Comprehensive RUAA



Figure 1. RUAA survey sites selected based on river mile, accessibility, and recreational features. Aerial photos of the sites are included in the photographic record (Appendix 5).

Contact recreation consists of recreational activities involving a significant risk of ingestion of water including: wading by children, swimming, water skiing, diving, and surfing. Secondary contact recreation is considered aquatic recreational pursuits not involving a significant risk of water ingestion: including fishing, commercial and recreational boating, and limited body contact incidental to shoreline activity. Noncontact recreation are activities such as ship and barge traffic, birding, and using hike and bike trails near a water body, not involving a significant risk of water ingestion and where primary and secondary contact recreation should not occur because of unsafe conditions.

RUAA field surveys are typically conducted during the normal warm season and a period when people are most likely to use the water body for contact recreational purposes. RUAs are also conducted during optimal sampling conditions that are representative of the normal flow conditions of the stream and have not been influenced by storms. RUAA field surveys for Armand Bayou Above Tidal (Segment 1113A) were conducted during Memorial Day (May 25, 2009), Independence Day (July 4, 2009), and Saturday, July 25, 2009. The TCEQ is investigating a pending non-conformance regarding the Memorial Day site visit; however it is not anticipated to have a negative effect on the quality of the data collected. More specific procedures can be found in *TCEQ's RUAA Procedures Document, May 2009*.

Field Survey Descriptions

An RUAA field survey begins by marking off a 300 meter (m) reach of the waterway, flagging every 30 meters. Sites with public accessibility limitations may not be fully assessed in this way; in instances such as these a laser range finder was used to document the length of the stream reach that could be observed. A flow measurement (where possible) is then taken within the 300m stream reach. If the waterbody is wadeable, a depth measurement is taken every 30m

and width measurements are taken at the widest, narrowest, and average width points within the 300m reach. Pictures are taken to document the survey at 30, 150, and 300m facing upstream, right bank, downstream, and left bank. Air temperature and water temperature are also recorded at an easily accessible location. Finally the Comprehensive RUAA datasheets are completed to document any recreational uses, signs of recreational use, recreation impeding conditions, or other field notes taken during the field survey.

Interviews

Consistent with the RUAA guidance manual, interviews from users, including streamside landowners and local residents, present during the field survey visits were attempted (Appendix 3). This was done in order to obtain information on existing and historical (post 1975) uses and stream type (e.g. ephemeral, intermittent, intermittent with perennial pools, perennial) of the water body in question. Targets for in person interviews were selected because of proximity to the waterbody and in some cases adjacent land/homeowners were solicited. In addition, other stakeholders were interviewed via telephone (Appendix 3). With the exception of site 3 (furthest upstream) the other sites were not located immediately adjacent to a neighborhood. In addition, a large portion of site 3 was downstream of the adjacent neighborhood. Due to the limited number of adjacent landowner properties we therefore relied heavily on referrals to known landowners and experts familiar with the waterbody to insure we had gathered sufficient information from individuals knowledgeable of the stream. The Environmental Institute of Houston's Interview Protocol Guideline is attached as Appendix 4 and the Informed Informational Document about Research is attached in Appendix 3. The TCEQ RUAA Guidance manual suggests that at least five interviews be conducted for each water body.

Results

Physical Evaluation and Flow

All three sites were visited on all occasions and all required data were recorded. Completed scanned datasheets are included as Appendix 2. The flow on the first day of sampling (5/25/09) was significantly higher than the observed flow on the later two sampling events (7/4/09 and 7/25/09). This was due to the fact that a significant rainfall occurred on the day (5/24/09) previous to the first survey (Figure 2). Thus the average flow (cfs) that is being presented in this report is believed to be higher than the average base flow for Armand Bayou Above Tidal watershed (Segment 1113A). However, flow conditions in the bayou on 5/25/09 did not resemble flood conditions; the stream was nominally wadeable, water in the stream was not turbid and conditions were deemed appropriate for assessment. The average air temperature and water temperatures were well within the requirements for sampling conditions as outlined in the RUAA procedures manual. Average stream depth and stream width are also reported in Table 2.

A photographic record was taken at each site during each site survey. Photographs include an upstream view, left and right bank views, downstream views, and any evidence of observed uses or indications of human use, hydrologic modifications, etc. Photographs are accompanied by the photographic record that depicts the site, date, location, view description, and view direction of each photograph (Appendix 5).

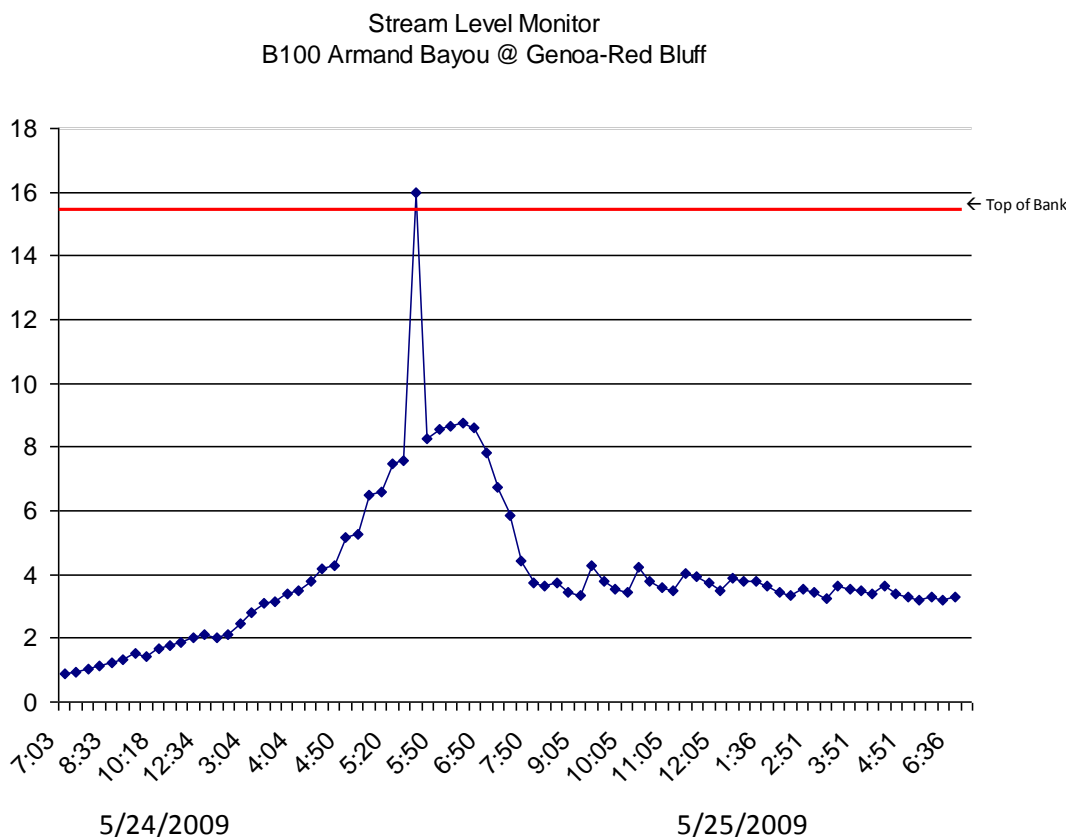


Figure 2. Stream Level Monitor data from the Harris County Office of Homeland Security & Emergency Management (OHSEM) website for the 24hours prior to field surveys conducted on 5/25/2009.

Table 2. Field data collected on Armand Bayou Above Tidal (TCEQ Segment 1113A) on 5/25/09, 7/4/09 and 7/25/09 for Recreational Use Attainability Analysis field surveys. Flow data for 7/4/09 has been removed due to equipment malfunction.

Date	Site #	Site Description	Stream Flow (cfs)	Air Temp. (°C)	Water Temp. (°C)	Average Depth (m)	Average Width (m)
5/25/2009	1	Genoa Red Bluff @ Armand Bayou	36.731	31.6	36.9	1.39	5.64
	2	Fairmont Parkway @ Armand Bayou	26.657	32.3	26.9	0.66	3.69
	3	Space Center Blvd @ Armand Bayou	2.394	30.4	26.6	0.53	5.33
7/4/2009	1	Genoa Red Bluff @ Armand Bayou	-----	32	30	1.095	7.01
	2	Fairmont Parkway @ Armand Bayou	-----	37.5	30	0.31	3.51
	3	Space Center Blvd @ Armand Bayou	-----	36	31	1.325	2.29
7/25/2009	1	Genoa Red Bluff @ Armand Bayou	8.2467	33	28.5	0.8866	6.157
	2	Fairmont Parkway @ Armand Bayou	5.4036	31	28	0.3837	4.176
	3	Space Center Blvd @ Armand Bayou	2.3952	31	29	0.411	3.871

The riparian zone of Armand Bayou Above Tidal and its tributaries are generally forested or are located adjacent to urban/suburban areas with portions also located in natural, agricultural, pastoral, commercial and industrial areas. The upper portion of Armand Bayou Above Tidal was dominated by urban and mowed/maintained corridor riparian zones, while the middle and lower portion of Armand Bayou Above Tidal was dominated by forest (Table 3). The dominant substrate along Armand Bayou Above Tidal (Segment 1113A) was generally composed of mud/clay.

A summary of weather conditions during field survey days and for the past month is included in Appendix 6. The weather data includes, air temperature, dew point, humidity, wind speed, wind gusts, pressure, and precipitation.

Table 3. Riparian zone and substrate field data collected on Armand Bayou Above Tidal (TCEQ Segment 1113A) on 5/25/09, 7/4/09 and 7/25/09 for Recreational Use Attainability Analysis field surveys.

Site #	Site Description	Left Bank Riparian Zone	Right Bank Riparian Zone	Dominant Primary Substrate
1	Genoa Red Bluff @ Armand Bayou	Forest	Forest	Mud/Clay
2	Fairmont Parkway @ Armand Bayou	Forest	Forest	Mud/Clay
3	Space Center Blvd @ Armand Bayou	Mowed/maintained corridor	Urban	Mud/Clay

Recreational Uses

Primary contact recreation was not observed during any of the three (3) RUAA field surveys that were completed. Secondary contact recreation in the form of fishing was observed on one occasion at site #1 at Armand Bayou @ Genoa Red-Bluff Rd on 5/25/2009 (Table 4). Other non-contact recreation such as walking, jogging, bicycling, standing, and sitting were observed over the entire spatial reach of the study. Observed evidence of recreational uses included: foot paths/prints, children's toys, RV/ATV, and a kayak paddle. An electronic

supplement depicting the observed uses, evidence of uses, interviewed uses in the form of personal uses, witnessed use, and hear-say use, as well as impediments can be found in Appendix 9.

Interviews

The TCEQ RUAA Guidance manual suggests that at least five interviews be conducted for each water body. A total of 111 individuals were contacted for an interview throughout the Comprehensive Recreational Use Attainability Analysis on Armand Bayou Above Tidal (TCEQ Segment 1113A), and a total of 64 of those individuals agreed to participate in the interview. Of the 64 total, four were interviewed in person, three by mail, and 57 by phone. A total of 46 out of the 64 interviewed answered yes to the question “Are you familiar with Armand Bayou Above Tidal?” Of those, 14 had personally used the stream for recreation, 26 had observed recreation activities, and 21 had heard about recreation on Armand Bayou Above Tidal. The total numbers of years that interviewees were familiar with the Armand Bayou Above Tidal watershed was over 720 man-years¹. The types of recreational uses documented by interviews included one primary contact recreation use: wading-children. Secondary contact recreation uses documented by interviews included: wading adults, fishing, kayaking, and canoeing. There were also as numerous non-contact recreation activities documented. (Figure 3, Table 4).

¹ Man-years = cumulative years of experience/knowledge of waterbody by multiple people.

Table 4. Recreational uses observed and documented on Armand Bayou Above Tidal (TCEQ Segment 1113A) for the Comprehensive Recreational Use Attainability Analysis.

Armand Bayou Above Tidal Comprehensive RUAA

Types of Recreation	Field Survey	Interviews			Total	
	Observations	Personal Use	Witnessed	Hearsay		
1°	Swimming					
	Snorkeling					
	Water skiing					
	Wading -Children			1	1	2
2°	Wading -Adults		1	2	1	4
	Rafting					
	Tubing					
	Jet Skiing					
	Boating			2		2
	Kayaking		4	11	8	23
	Canoeing		8	9	8	25
	Tubing					
	Fishing	2	4	13	5	24
non	Hunting				1	1
	Trapping					
	Walking/Hiking	4	4	9	2	19
	Jogging/Running	1				1
	Bicycling	1	1	2	1	5
	Camping					
	Motorcycle/ATV			1		1
Wildlife watching		3	3	1	7	

Armand Bayou Above Tidal Comprehensive RUA

Recreational Uses Key

-  Swimming
-  Wading-Children
-  Wading-Adult
-  Rope Swing
-  Kayak/Canoe
-  Boating
-  Fishing
-  Walking
-  Hunting
-  Bicycling
-  ATV/Motorcycle
-  Wildlife Watching



Figure 3. Recreational uses visualization (constructed from observations, interviews, and evidence) for Armand Bayou Above Tidal (Segment 1113A) Comprehensive RUA. This map does not include all recorded uses and locations and locations are approximate. Please refer to Appendix 9: Google Earth Interactive Map Electronic Supplement for more specific use location as well as evidence of recreational use and impediments to recreational use.

SUMMARY

Our observations of recreational activities in Armand Bayou tidal are primarily based on our onsite observations and interviews of 46 respondents who were either familiar with the stream and/or had spoken to residents who use the stream. The total numbers of years that interviewees were familiar with the Armand Bayou Above Tidal watershed was over 720 man-years. Based on our field surveys alone we did not personally observe any primary contact (e.g. swimming) recreation activities within the surveyed portions of Armand Bayou Above Tidal. However, we did not observe any physical conditions (impediments, depth, width, and slope) which would restrict primary or secondary contact recreational activities. In addition, numerous water related activities were reported through interviews. These reported activities included: wading children, wading adults, fishing, kayaking, canoeing and other non-contact recreation activities.

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RUAA Summary Form

RUAA Summary

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: Armand Bayou Above Tidal
 Segment No. or Nearest Downstream Segment No.: 1113A
 Classified?: No
 County: Harris

1. Observations on Use

- a. Do primary contact recreation activities occur on the water body?
 frequently seldom not observed or reported unknown
- b. Do secondary contact recreation 1 activities occur on the water body?
 frequently seldom not observed or reported unknown
- c. Do secondary contact recreation 2 activities occur on the water body?
 frequently seldom not observed or reported unknown
- d. Do noncontact recreation activities occur on the water body?
 frequently seldom not observed or reported unknown

2. Physical Characteristics of Water Body

- a. What is the average thalweg depth? 0.78 meters
- b. Are there substantial pools deeper than 1 meter? yes no N/A
- c. What is the general level of public access?
 easy moderate very limited

3. Hydrological Conditions (Based on Palmer Drought Severity Index)

- Mild-Extreme Drought Incipient dry spell Near Normal Incipient wet spell Mild-Extreme Wet