Central and Southeast Texas Recreational Use Attainability Analyses Project
Navasota River Below Lake Limestone (Segment 1209) Comprehensive RUAA

Results Report

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Table of Contents

List of Figures

List of Tables

Appendices

Appendix 1 Contact Information Forms and Supporting Documents

Appendix 2 Field Data Sheets

Appendix 3 Interview Sheets

Appendix 4 EIH Interview Protocol

Appendix 5 Photographic Record

Appendix 6 Weather Condition Summary

Appendix 7 Public Meetings

Appendix 8 Interactive Google Earth Map

Introduction

Problem Statement

Recreational Use Attainability Analyses (RUAA) are scientific assessments, that are used to determine the existing and attainable recreational use for a water body, and if that use might be different than the presumed recreational use as specified in the Clean Water Act. In September, 2009 a Comprehensive RUAA was initiated on the Navasota River Below Lake Limestone, segment 1209. This Comprehensive RUAA Report will provide the TCEQ Standards Group with relevant information needed to determine the appropriate attainable recreational use for the Navasota River Below Lake Limestone. The completion of this comprehensive RUAA consisted of several important interrelated components including 1) reconnaissance and site selection, 2) conducting the comprehensive RUAA and 3) public outreach. The objectives of each component are listed below.

Objectives

1. Reconnaissance and Site Selection

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. This was accomplished primarily with the input of local, state and regional agency staff familiar with the watershed, as well as aerial imagery. An initial stakeholder meeting occurred on March 9, 2010 at the Navasota Center, Navasota TX. Reconnaissance surveys were conducted on January 12 through the 15, 2010 and provided the basis site selection for discussion at the March 9th meeting. Five additional sites were added to the field survey sites as a result of the participants at the March 9th meeting.

2. Comprehensive Recreational Use Attainability Analysis

The primary objective of the Navasota River Below Lake Limestone RUAA was to characterize the recreational use and potential impediments to recreational use for this stream. The RUAA field surveys were conducted on the weekends of May 28 and June 25 2010, to collect information on the water body and associated uses. During these dates field surveys were conducted at selected sites with the highest probability of detecting recreation use. The objective was to document and characterize observed use, site conditions (hydrology, physical attributes), and weather during the RUAA field surveys, a historical information review and interviews were also conducted for the Comprehensive RUAA. The objective of the historical review and interviews was to supplement the data obtained from the field surveys and increase the probability of detecting and characterizing recreational uses in the watershed.

3. Public Participation

The objective of the public participation phase was 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 the Navasota River Below Lake Limestone. This included sending out email and phone messages to key organizations and staff familiar with the watershed. The stakeholder contact list is provided in Appendix 1. In addition, on March 9, 2010 a stakeholder meeting was held 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 Navasota Center, Navasota TX on August 19, 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 (Appendix 7).

Study Area

Description of Water Body

The Navasota River Below Limestone Lake is located within the Brazos River Basin. Segment 1209 classified by the Texas Commission on Environmental Quality (TCEQ) is approximately 120 miles in length. Segment 1209 begins at the confluence with the Brazos River in Grimes County and extends upstream to Sterling C. Roberts Dam in Leon/Robertson County. This portion of the Navasota River is a natural, narrow stream enclosed by dense hardwood forests of oak, hickory, elm, pecan, sweetgum, and redbud. The river is relatively narrow and streamlined. The stream is gently sloped and bank access to the water is easy in the upstream portions of the river. The bank becomes steeper and it is more difficult to access the water downstream. The Navasota River Below Lake Limestone is on the state's 303(d) list for not meeting the state's bacteria criteria associated with primary recreation uses (TCEQ, 2008).

Environmental Features and Population Characteristics

The climate in the Navasota River watershed is classified as having hot, humid summers and mild winters. The Navasota River Below Lake Limestone frequently floods after a large rainfall. The floodplain is relatively wide and vast. The Navasota River Below Lake Limestone has been disturbed by human activities that have altered both the land use and vegetation cover of the watershed. These activities include the construction of roads and instream sewer lines, conversion of land for agriculture, and the building of commercial businesses and residential neighborhoods (BRA, 2003). The primary direct anthropogenic affects on the movement of water in the Navasota River Below Lake Limestone (segment 1209) is the Sterling C. Roberts Dam in Leon/Robertson County (TCEQ, 2008). Water releases from the dam can greatly change

the flow and subsequent water level of the river. With the exception of the City of Navasota, TX there are no large population centers located directly adjacent to the Navasota River Below Lake Limestone. The area can be described as rural with a very sparse population density.

Watershed Characterization

The Navasota River Below Lake Limestone traverses flat to rolling terrain with local shallow depressions, surfaced by clay and sandy loams that support water-tolerant hardwoods, conifers, and grasses. The riparian zone is minimally impacted by development. The watershed of the Navasota River Below Lake Limestone is predominantly rural with agriculture being the primary land use. There are intermittent patches of urban activity where commercial and residential activities are the principal land use (BRA, 2003)

Permitted Discharges (Municipal, Industrial, Storm water)

The Navasota River Below Lake Limestone is affected by domestic wastewater discharges and by storm water runoff from agricultural, industrial, and urban areas. Under TPDES, the TCEQ has issued permits to discharge treated wastewater to 34 facilities within the segment 1209 watershed (Figure 1).

Potential Nonpoint Sources

Potential sources of nonpoint source pollution in the watershed include municipal point source discharges, on-site sewage facilities, and runoff from agricultural lands (particularly chicken farms in the upstream extent of the river). For any urban collection and treatment system, sanitary sewer overflows and WWTF bypasses are possible sources of bacteria loadings to receiving waters. The Navasota River Below Lake Limestone (segment 1209) watershed can

be described as relatively rural with few permitted WWTF relative to area. This fact suggests that there are potentially a high number of on-site sewage facilities (OSSF or septic systems) in use in the watershed. OSSF require routine repairs and maintenance to avoid failures causing potential leaks or overflows. Poorly maintained OSSF are a potential source of bacteria loadings into the Navasota River Below Lake Limestone.

Directly adjacent to the Navasota River Below Lake Limestone are agriculture grazing tracts. These tracts potentially provide livestock with direct access to the River. Evidence of direct access was witnessed at the reconnaissance for field survey site 14 when cattle tracks were documented on the right bank along the river bank. Direct contact with agriculture grazing is a potential non-point source for the Navasota River Below Lake Limestone.

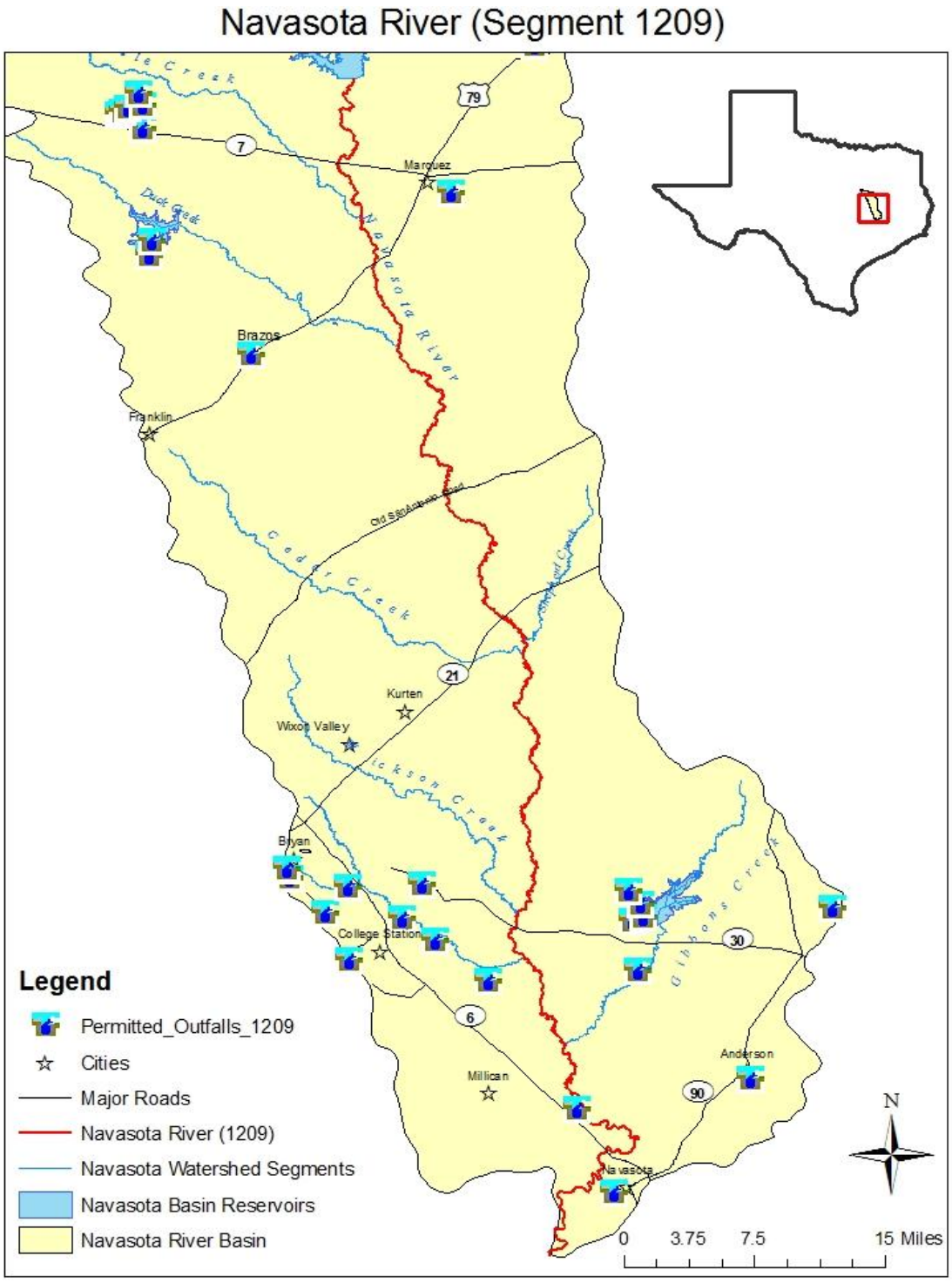

Figure 1. Permitted outfalls in the Navasota River Below Lake Limestone (Segment 1209) for Comprehensive Recreational Use Attainability Analysis Survey.

History of Recreational Use in the Navasota River Below Lake Limestone

Historical Summary

The Navasota River has been known by several names throughout its history. The Indians called it the Nabasoto, Domingo Teran de los Rios called it San Cypriano, Fray Isidro Felix de Espinosa called it the San Buenaventura, and in 1727 Pedro de Rivera y Villalon named it the Navasota. Numerous archeological sites have been found along the river, which served early settlers as an access route into the area. By 1860, however, river transportation had declined as the first railroad lines reached the Navasota Community (Handbook of Texas, 2010). Fishing was the most common use documented through the historical review.

Boating

Multiple makeshift boat launches that are publically accessible under bridges and roadways provide access to the Navasota River Below Lake Limestone for boats, canoes, and kayaks. The physical characteristics of the waterbody are conducive to many forms of boating; however water control structures and log jams restrict long distance navigation by boat throughout the segment.

Fishing

Like boating, fishing was and still is a popular form of recreation the Navasota River Below Lake Limestone. Documentation of recreational fishing on the Navasota River Below Lake Limestone (segment 1209) is common on numerous on-line fishing and kayak fishing forums. Fishermen regularly blog about recent trips on the Navasota River Below Lake Limestone describing what they caught and how far they paddled. Some frequently visited websites are: TexasKayakFisherman.com, FishingTX.com, and Paddling.com. Large expanses

of private property can restrict shoreline public fishing along large segments of the Navasota River Below Lake Limestone. Fishing from personal piers and private property throughout the segment is apparent through interviews with stakeholders and evidence of fishing paraphernalia found at field survey sites.

Swimming

Swimming and other primary contact recreational uses such as children wading are well documented in the Navasota River Below Lake Limestone as seen in the field surveys for this RUAA, however historical documentation of swimming was sparse.

Parks

There are no publicly accessible parks directly adjacent to the Navasota River Below Limestone Lake. The shoreline is dominated by private property fences, and no trespassing signs are common along the river. Public access to the waterway is limited to bridge crossings. It is notable that some of the public access points under bridge crossings have been highly modified for recreational use. Makeshift boat ramps, chairs, and well worn foot paths to the water were found at these locations and along the banks. It was evident that these access points are frequented year round.

Site Reconnaissance Summary

Perspective sites were chosen based on public access and documented uses from the stakeholder response to the request for information e-mail which is included in Appendix 1. Initial reconnaissance surveys were conducted on January 12 through 15 2010. A total of 35 perspective sites were visited, of these 10 were accessible enough to consider for field survey sites (Table 1, Figure 3). All sites that were not recommended were either not publically

accessible, or in the case of recon site 4, there was no access to the water due to barbed wire fences running parallel to the river. Public access was lacking due to the posting of numerous no trespassing signs, gated roadways, no parking signs, etc. Access to river was further limited by the frequent presence of steep banks with heavy vegetation and barbed wire fences. An additional 5 sites located on private property were added to the site list making 15 total field survey sites. Site suggestions were submitted to TCEQ as part of the Quality Assurance Project Plan's (QAP) Monitoring Plan which was approved by TCEQ on May 27, 2010.

Methodologies

RUAA Survey Site Selection and Descriptions

The Navasota River Below Lake Limestone flows through mostly rural areas where most of the land is privately owned. The target density of survey sites should be approximately three (3) sites per every five (5) miles of stream (TCEQ 2009). During our study survey sites were established in areas where the water body is accessible to the public and has the highest potential for recreational use (road crossings, public lands/parks located near the water body, and populated areas). A total of fifteen (15) survey sites were established (Table 2 & Figure 3). These sites were chosen based on public access potential and also providing sufficient spatial coverage throughout each assessment unit. In portions where the recommended three (3) sites per every five (5) miles of stream was not possible, supplementary information was gathered through coordination with local authorities in stakeholder meetings, conducting interviews (Appendix 3), and using topographic maps and aerial photos to document any additional potential access points (reconnaissance sites). Large portions of land directly adjacent to the Navasota River Below Lake Limestone were privately owned (gated, fenced, no trespassing signage), thus inaccessible for field surveys.

Extensive interviews were collected to help determine what kind of contact recreation occurred along the privately owned potions of the stream. These interviews resulted in additional background information which confirmed that recreation was most likely to occur at sites identified in this study, and also confirmed the many limitations to public access along the stream. Every effort was made for the interviewees to provide recreational use information about the entire length of the segment including areas other than the selected sites in this RUAA. Topographic maps were used to provide the needed geographic information about potential recreational opportunities and potential access points along the Navasota River Below Lake Limestone. The topographic map and aerial imagery review resulted in site selection for the reconnaissance site visits. The reconnaissance site visits confirmed the limited public access along the Navasota River Below Lake Limestone. Limited public access due to fences, gates, and no trespassing signage are common on the Navasota River Below Lake Limestone and resulted in less than three (3) sites for every five (5) miles of stream. Figure 2 was taken at field survey site 5, and is a good representation of the general site conditions along the Navasota River Below Lake Limestone.

Five (5) of the 15 field survey sites were located on private property of which the University of Houston-Clear Lake attempted to secure access in order to provide a more spatially heterogeneous scale to the field survey sites. At the time of the Monitoring Plan, access to the private property sites was still under discussion with the owners. Of the 5 established survey sites on private property, only 2 were sampled because of property owner unwillingness to participate at sites: 4, 8, and 10. Many other private land owners that were contacted about access opportunities did not respond to e-mails and/or phone calls.

Figure 2. Picture of field survey site 5, showing the general representation of the physical conditions seen on the Navasota River Below Lake Limestone (Segment 1209)

Table 1. Site reconnaissance for comprehensive RUAA on the Navasota River Below Lake Limestone (Segment 1209).

Recon Site #	Description	Latitude	Longitude	Public Access	Water Access	Recommended Site?
1	Dam boat launch @ Navasota	N/A	N/A	N/A	N/A	No
2	Power lines @ Navasota	N/A	N/A	Private	N/A	No
3	CR 386 A @ Navasota	N/A	N/A	Private	N/A	No
4	SH 7 @ Navasota	31.25429	-96.33028	Can park on side of road	Fence on right bank and left banks under bridge, cannot get to water	No
5	FM 937 @ Navasota	N/A	N/A	Private	N/A	No
6	US 79 @ Navasota	31.16965	-96.29893	Can pull off on worn path on southeast side, downstream right bank	Easier slope on upstream right bank, otherwise steep	Yes
7	Reeves Rd @ Navasota	31.15377	-96.30361	Private	N/A	No
8	CR 365 @ Navasota	31.12700	-96.31030	Private	N/A	No
8.5	Hoxie Chapel Rd @ Navasota	N/A	N/A	Private	N/A	No
9	Farm Rd Bridge 2 @ Navasota	31.04948	-96.21443	Private	N/A	No
10	County Line Rd @ Navasota	30.97355	-96.24085	Can pull off under bridge on right bank	Gentle slope	Yes
11	P2-717 @ Navasota	N/A	N/A	N/A	N/A	No
12	Williams Rd @ Navasota	30.95614	-96.23849	Private	N/A	No
13	CR 355 @ Navasota	N/A	N/A	Private	N/A	No
14	CR 431 @ Navasota	N/A	N/A	Private	N/A	No
15	Duck Lake @ Navasota	N/A	N/A	Private	N/A	No
16	Wilson Pasture Rd @ Navasota	N/A	N/A	Private	N/A	No
17	River Lake Rd @ Navasota	N/A	N/A	Private	N/A	No
18	US 190 @ Navasota	30.86976	-96.19234	Can pull off	Gentle slopes up and downstream left bank	Yes
19	Unnamed Rd 1 @ Navasota	N/A	N/A	N/A	N/A	No
20	Democrat Rd @ Navasota	30.81110	-96.17566	Can pull off rd on upstream left bank	Relatively easy slopes at bridge	Yes
21	Clear Lake Rd @ Navasota	30.76956	-96.20049	Private	N/A	No
22	CR 103 @ Navasota	30.72930	-96.13898	Private	N/A	No
23	CR 162 @ Navasota	30.72069	-96.16795	Can pull off side of road, not much room	Somewhat steep but do-able banks	Yes
24	Roese Rd @ Navasota	30.65204	-96.16721	Worn path at dead end, public	Easy slopes in a couple of spots, banks	Yes
25	SH 30 @ Navasota	30.60751	-96.18205	Worn path on southwest side or downstream left bank	Easy slopes	Yes
26	Sulphur Springs Rd 1 @ Navasota	30.57111	-96.16674	Parking at dead end	Some areas of easy slope (left bank)	Yes
27	Sulphur Springs Rd 2 @ Navasota	N/A	N/A	Potentially accessible, may be private	N/A	No
28	Harlan Rd @ Navasota	30.46538	-96.13797	Private	N/A	No
29	SH 6 @ Navasota	30.41858	-96.10667	Can park on side of road	Under bridge left, very steep banks elsewhere	Yes
30	N Lasalle St @ Navasota	30.40481	-96.10583	Private	N/A	No
31	P1-739 @ Navasota	30.38236	-96.14973	Private	N/A	No
32	SH 105 @ Navasota	30.36583	-96.14004	Can pull off on northwest side (upstream left bank)	Worn footpath down slightly, steep bank	Yes
33	Old Hwy 105 @ Navasota	30.36420	-96.14649	Private	N/A	No
34	CR 423 @Navasota	30.34922	-96.13778	Private	N/A	No

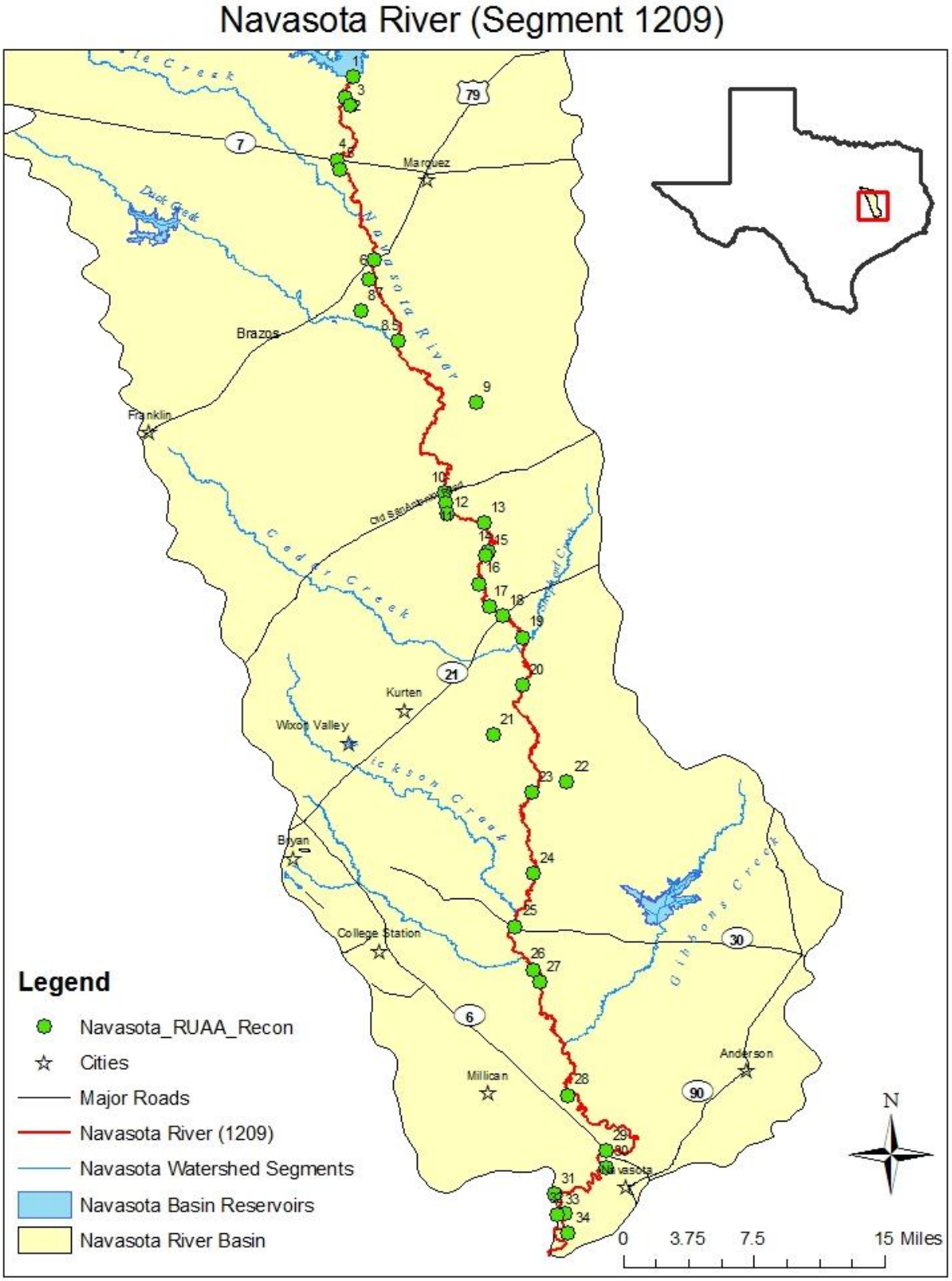

Figure 3. Reconnaissance sites for comprehensive RUAA on the Navasota River Below Lake Limestone (Segment 1209). Note: Sites # 8, 9, 21, and 22 are marked on the map where the potential access road was that was explored in attempt to gain access to the waterway.

Sampling Methods

Recreational use attainability analyses (RUAAs) 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). Until recently, Texas had two recreation use categories in the 2000 TSWQS: contact and noncontact recreation. Recently these recreation use categories were expanded to include more categories: primary contact, and secondary contact recreation (1 &2). Primary 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 1 is considered water recreation activities not involving a significant risk of water ingestion: including fishing, commercial and recreational boating, and limited body contact incidental to shoreline activity. Secondary contact recreation 2 follows the same definition as secondary contact recreation 1 except that it occurs less frequently due to (1) physical characteristics of the water body and/or (2) limited public access.

According to TCEQ agency guidance, a comprehensive RUAA must be conducted on the Navasota River below Limestone Lake since it is a classified water body (Segment 1209). RUAA Surveys must be conducted during the normal warm season and periods when people would be most likely use the water body for contact recreational purposes. RUAA surveys must also be conducted during optimal sampling conditions that are representative of the normal flow conditions of the stream and are not storm-influenced. RUAA field surveys for the Navasota River Below Lake Limestone (Segment 1209) were conducted during the weekend of May 28 and June 25, 2010. More specific procedures can be found in *TCEQ's RUAA Procedures Document, May 2009.*

Table 2. Survey sites for the Comprehensive RUAA Survey on the Navasota River Below Lake Limestone (Segment 1209) (corresponding to Figure 3). Field Survey Sites 4,6,8,10, and 12 were added after the initial public meeting and are located on private property, thus they did not have corresponding reconnaissance (recon) site numbers. Filed surveys were not completed at sites: 4, 8, and 10 due to access constraints.

Recon Site #	Field Survey Site #	Description	latitude	longitude	Approx. river mile
6	1	US 79 @ Navasota (TCEQ site: 11877)	31.16965	-96.29893	88.3
10	2	County Line Rd @ Navasota (TCEQ site: 18341)	30.97355	-96.24085	67.6
18	3	US 190 @ Navasota (TCEQ site: 11876)	30.86976	-96.19234	56.1
N/A	4	Soggy Bottom ATV Ranch @ Navasota River	30.85677	-96.17760	53.3
20	5	Democrat Rd @ Navasota	30.81110	-96.17566	48.1
N/A	6	Birdwell property @ Navasota River	30.75002	-96.17041	43.7
23	7	CR 162 @ Navasota (TCEQ site: 16398)	30.72069	-96.16795	40.8
N/A	8	Dudley property North @ Navasota River	30.67933	-96.17258	38.0
24	9	Roese Rd @ Navasota	30.65204	-96.16721	35.2
N/A	10	Dudley property South @ Navasota River	30.63924	-96.16939	35.0
25	11	SH 30 @ Navasota (TCEQ site: 11875)	30.60751	-96.18205	31.2
N/A	12	Tonkaway Ranch @ Navasota River	30.58680	-96.18323	28.9
26	13	Sulphur Springs Rd 1 @ Navasota	30.57111	-96.16674	27.4
29	14	SH 6 @ Navasota (TCEQ site: 11873)	30.41858	-96.10667	11.4
32	15	SH 105 @ Navasota (TCEQ site: 11872)	30.36583	-96.14004	3.8

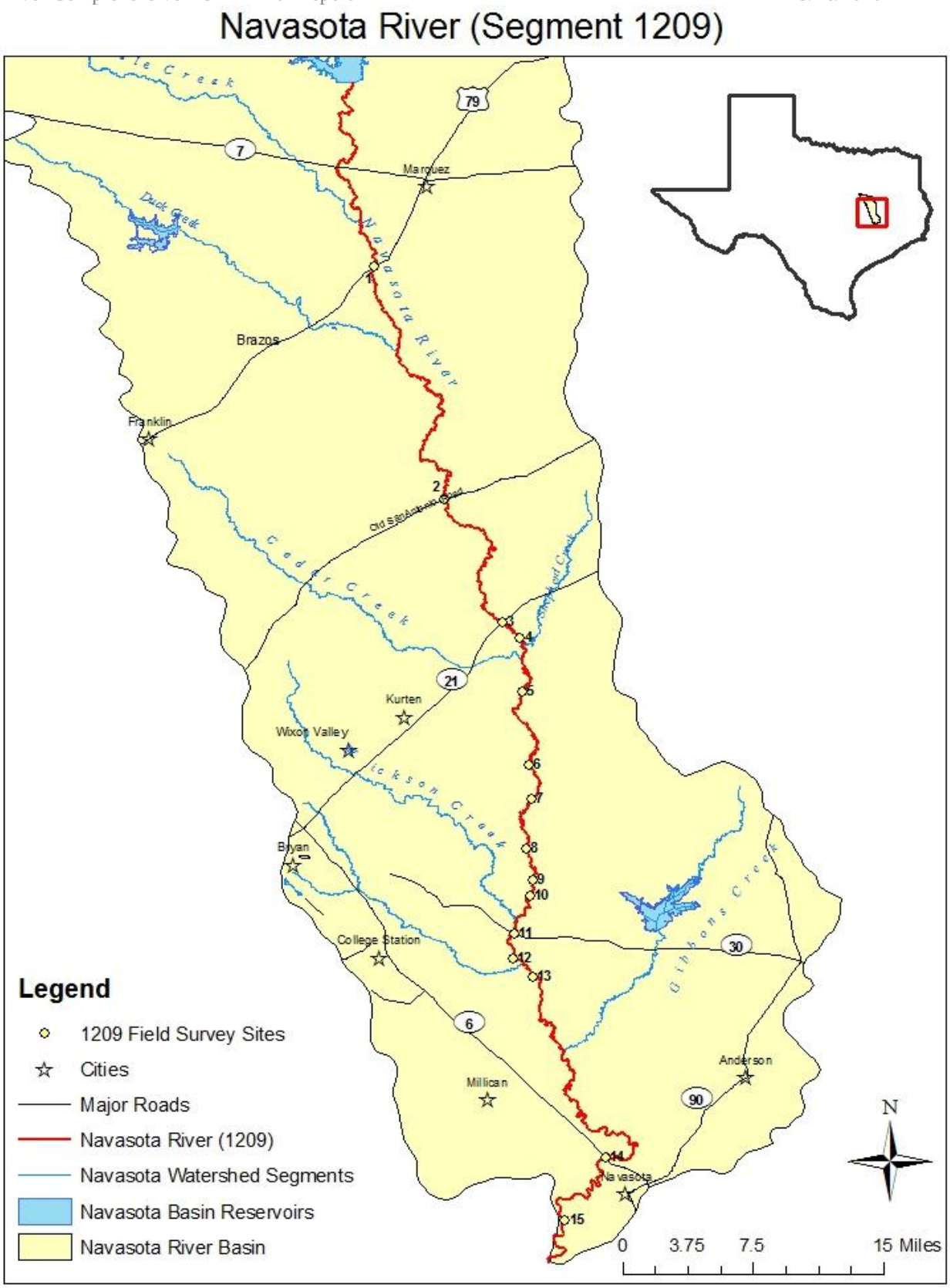

Figure 4. Comprehensive RUAA survey sites on the Navasota River Below Lake Limestone (Segment 1209) selections based on river mile/assessment units, accessibility, and recreational features. Field surveys were not completed at sites: 4, 8, and 10 due to access constraints.

Field Survey Descriptions

A Comprehensive RUAA field survey begins with marking off a 300 meter (m) reach of the waterway, flagging every 30m. 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) was then taken within the 300m stream reach. If the waterbody is wadeable, a depth measurement was 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 were also recorded at an easily accessible location. Finally the Comprehensive RUAA datasheets were completed to document any recreational uses, signs of recreational use, impeding conditions, or other field notes taken during the field survey. Depth measurements for sites that were considered non-wadeable were taken from available bridges at the deepest point accessible.

Due to impediments affecting stream access, complete field survey methods were not possible at some locations on the Navasota River Below Lake Limestone. Impediments to stream access, such as steep banks and water depth exceeding 1.5 meters, at times limited the field survey team's ability to survey the complete 300m stretch of stream. In each case where this was a factor, the impediments were documented on the field data sheet and documenting pictures of these conditions were taken. Specific impediments causing access constraints for each site can be found in Appendix 2 and 5.

Interviews

When possible, interviews were conducted during field survey visits (Appendix 3). In person interviews were performed with interviewees located in close proximity to the waterbody and in some cases adjacent land/homeowners. Other stakeholders were interviewed via telephone (Appendix 3). The Environmental Institute of Houston's Interview Protocol Guideline is attached as Appendix 4.

Results

The 120 miles of the Navasota River Below Lake Limestone was evaluated using a total of 12 field surveys. Twelve (12) sites were surveyed once and 10 were surveyed twice. The two field survey sites located on private property were not surveyed a second time because it was determined that the physical parameters relating to recreational use potential, as well as interviews with the land owners were well documented during the first field survey. Roadside surveys were conducted when access was not permitted or possible. Field Survey Sites 4, 8, and 10 were located on private property of stakeholders and at the time of the field surveys the property owners were not willing to permit access to their property, thus no field surveys were completed at these three sites. Field survey visits were completed between May and June, 2010. All field data sheets are attached (Appendix 2). The initial field surveys took place over the span of three days (5/28/2010 through 5/30/2010). The second site visits took place on 6/25/2010 and 6/26/2010.

Physical Evaluation and Flow

During the RUAA surveys the air and water temperatures fell within the range of acceptable temperatures for sampling described in the TCEQ procedures manual (Table 3). The average thalweg depth of the Navasota River Below Lake Limestone was greater than 1.5m

(unwadable) and the average width is 22.08m. The average secchi tube reading taken at the field survey sites was 0.2m (Table 3). The average flow for the Navasota River Below Lake Limestone based on measurements taken at accessible sites was 44.8cfs. The stream type recorded throughout the segment was perennial.

The Navasota River Below Lake Limestone riparian zone can be generally categorized as forested (Table 4). The dominant substrate along the Navasota River Below Lake Limestone (Segment 1209) was generally composed of mud/clay, with occasional sand bars present which made it difficult to navigate at times. Investigators would often sink to their knees while attempting to wade across the waterway.

Surrounding Conditions that Impede Recreation and Channel Obstructions

Impediments to stream recreation and channel obstructions on the Navasota River Below Lake Limestone were recorded at the field survey site visits and include: fallen trees, and debris, private property, no trespassing signs, steep slopes, fences along the banks, and across the waterway, log jams, a dam, and rip rap. The Navasota River Below Limestone Lake has very limited public access due to the large amount of privately owned land surrounding the river. A complete listing of the documented stream recreational use impediments and their locations can be found in Table 5, and Appendix 8.

Recreational Uses

Uses observed from all combined site visits include: children-wading, swimming, and fishing (Table 5). A total of 6 people were observed carrying out primary contact recreation activities on the Navasota River Below Limestone Lake. The instance of children-wading, adults-wading, and swimming occurred at field survey site number 2. Adult swimming occurred at field survey site number 5 (photo documentation of these observed uses are included in

Appendix 5). Four people were observed carrying out secondary contact recreation activities on the Navasota River Below Lake Limestone. The dominant secondary contact recreation activity observed was fishing. Various non-contact activities were recorded. A rope swing was found at field survey site number 5. Fishing tackle was found at 9 of the field survey sites. Foot paths/prints were documented at 10 of the field survey sites. Remnants of kid's play were found at field survey site number 14.

Interviews

During the Comprehensive Recreational Use Attainability Analysis on the Navasota River Below Lake Limestone (TCEQ Segment 1209) a total of 105 individuals were contacted for an interview. A total of 100 of those individuals agreed to participate in the interview. Of the 100 total, 22 were interviewed in person, 7 by mail, and 71 by phone. A total of 66 out of the 100 interviewed answered yes to the question "Are you familiar with the Navasota River Below Limestone Lake?" Of those, 43 had personally used the stream for recreation, 54 had observed recreation activities, and 48 had heard about recreation on the Navasota River Below Lake Limestone. The total numbers of years that interviewees were familiar with the Navasota River Below Lake Limestone watershed were over 1,316 man-years.

The types of recreational uses documented by interviews included the following primary contact recreation activities: swimming, wading-children, and water skiing (Figure 4, Table 7). Secondary contact uses documented by interviews included: wading-adults, rafting, tubing, boating, kayaking, canoeing, and fishing. Non contact uses included: trapping, hunting, walking/hiking, and wildlife watching. Figure 4 does not include all recorded uses, and the locations are approximate. Please see Appendix 8, an electronic supplement for the complete

depiction of the observed uses, evidence of uses, interviewed uses in the form of personal uses, witnessed use, and hear-say use, and impediments.

Table 3.Average physical parameters from the two comprehensive recreational use attainability analysis field surveys conducted on the Navasota River Below Lake Limestone (Segment 1209) * = no significant flow ** = unable to take flow measurements due to physical parameters and accessibility. Note: Flow at site 13 was recorded as appearing similar to that of site 12.

Site #	Site Description	Air Temp (°C)	Water Temp (°C)	Average Depth (m)	Average Width (m)	Secchi (m)	Flow (cfs)
1	US 79 @ Navasota River	29.00	27.10	>1.5	16.80	0.22	24.21
2	County Line Rd @ Navasota River	33.00	29.75	0.79	13.50	0.26	44.26
3	US 190 @ Navasota River	31.00	28.00	>1.5	18.75	0.29	*
4	Soggy Bottom ATV Ranch @ Navasota River	No Access: private property owner not willing to participate					
5	Democrat Rd @ Navasota River	34.50	31.00	>1.5	22.80	0.19	57.77
6	Birdwell property @ Navasota River	31.00	27.00	>1.5	19.50	0.16	44.27
7	CR 162 @ Navasota River	34.50	30.00	>1.5	21.75	0.15	68.00
8	Dudley property North @ Navasota River	No Access: private property owner not willing to participate					
9	Roese Rd @ Navasota River	33.75	31.50	>1.5	20.30	0.18	**
10	Dudley property South @ Navasota River	No Access: private property owner not willing to participate					
11	SH 30 @ Navasota River	34.00	30.00	>1.5	34.40	0.17	**
12	Tonkaway Ranch @ Navasota River	32.50	30.00	>1.5	14.90	0.16	30.29
13	Sulphur Springs Rd 1 @ Navasota River	34.50	30.00	>1.5	23.00	0.34	**
14	SH 6 @ Navasota River	33.25	30.50	>1.5	29.70	0.14	**
15	SH 105 @ Navasota River	32.25	30.25	>1.5	29.60	0.12	**
	Total Average	**32.77**	**29.59**	**>1.5**	**22.08**	**0.20**	**44.80**

Table 4.Physical Characteristics of Riparian Zone and Dominant substrate of the field survey sites sampled during the Comprehensive Recreational Use Attainability Analysis on the Navasota River Below Lake Limestone (Segment 1209)

Site #	Site Description	Left Bank Riparian Zone	Right Bank Riparian Zone	Ease of Bank Access	Dominant Primary Substrate
1	US 79 @ Navasota River	Forest	Forest	Moderatly Easy	Sand
2	County Line Rd @ Navasota River	Forest	Forest	Easy	Sand
3	US 190 @ Navasota River	Forest	Forest	Moderatly Easy	Mud/Clay
4	Soggy Bottom ATV Ranch @ Navasota River	No Access: private property owner not willing to participate			
5	Democrat Rd @ Navasota River	Forest	Forest	Moderatly Easy	Mud/Clay
6	Birdwell property @ Navasota River	Forest	Forest	Moderatly Difficult	Mud/Clay
7	CR 162 @ Navasota River	Forest	Forest	Moderatly Difficult	Mud/Clay
8	Dudley property North @ Navasota River	No Access: private property owner not willing to participate			
9	Roese Rd @ Navasota River	Forest	Forest	Moderatly Easy	Mud/Clay
10	Dudley property South @ Navasota River	No Access: private property owner not willing to participate			
11	SH 30 @ Navasota River	Forest	Forest	Moderatly Easy	Mud/Clay
12	Tonkaway Ranch @ Navasota River	Forest	Forest	Difficult	Sand
13	Sulphur Springs Rd 1 @ Navasota River	Forest	Forest	Moderatly Easy	Sand
14	SH 6 @ Navasota River	Forest	Forest	Easy	Mud/Clay
15	SH 105 @ Navasota River	Forest	Forest	Moderatly Difficult	Mud/Clay

Table 5. Recreational uses observed and interviewed documented by number of observed occurrences for the Navasota River Below Lake Limestone (Segment 1209) collected during the Comprehensive Recreational Use Attainability Analysis.

Navasota River Comprehensive RUAA

		Field Survey	Interviews			
	Types of Recreation	**Observations**	**Personal Use**	**Witnessed**	**Hearsay**	**Total**
1°	Swimming	2	11	11	10	**34**
	Water skiing		3			**3**
	Wading -Children	1	3	4	4	**12**
2°	Wading -Adults	1	4	7	4	**16**
	Rafting		1	1	1	**3**
	Boating		14	26	20	**60**
	Kayaking		3	18	15	**36**
	Canoeing		11	12	27	**50**
	Fishing	3	34	51	38	**126**
non	Hunting		16	18	22	**56**
	Trapping		1	4	1	**6**
	Walking/Standing	4		1		**5**
	Wildlife Watching	1	1			**2**

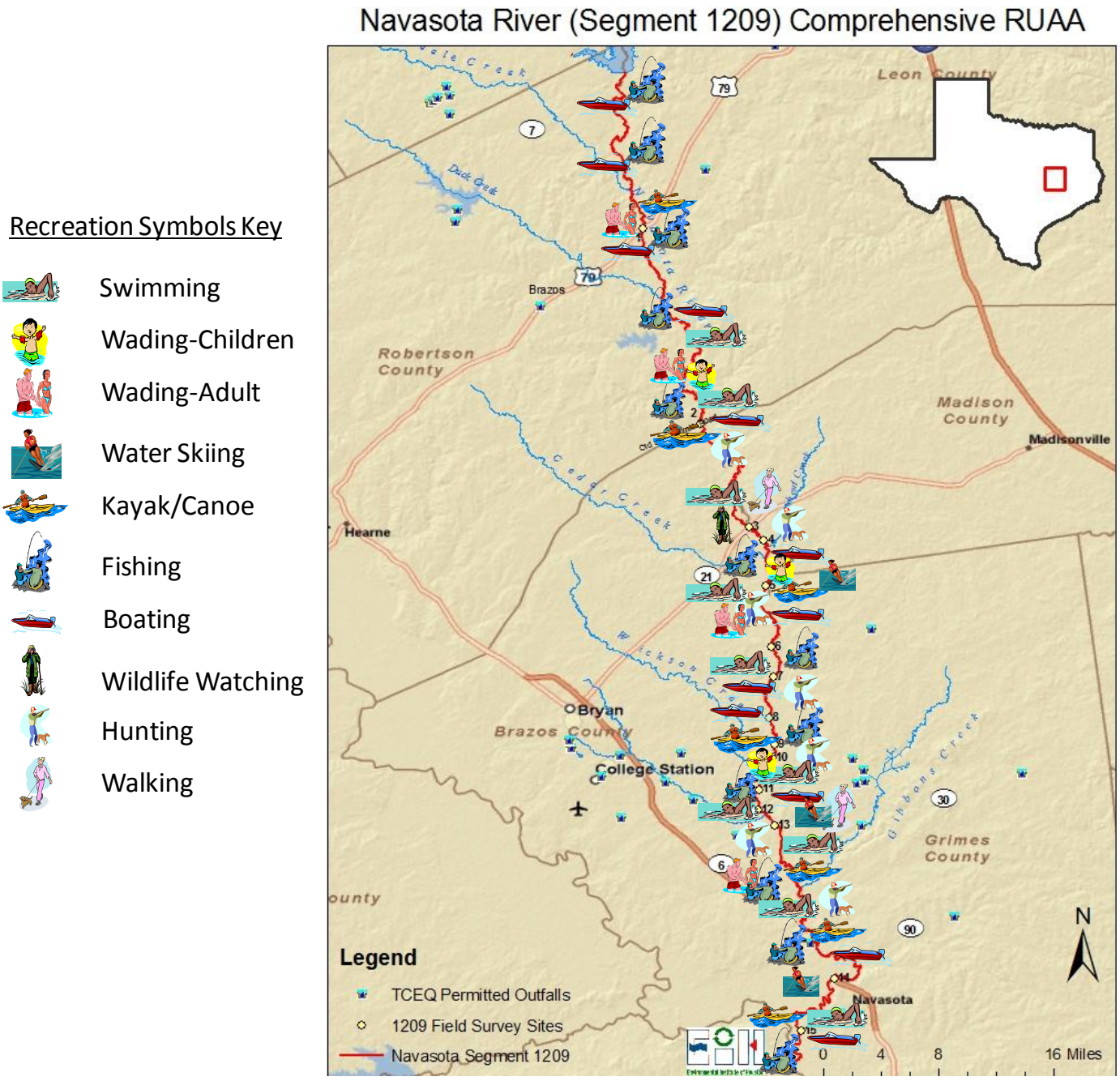

Figure 5. Comprehensive RUAA survey sites on the Navasota River Below Lake Limestone (Segment 1209) selections based on river mile/assessment units, accessibility, and recreational features. (Constructed from observations, interviews, and evidence) This map does not include all recorded uses and locations are approximate. See Appendix 8 for an interactive Google Earth map depicting exact locations of uses, impediments, and evidence.

Table 6. Impediments, evidence of recreational uses, observed recreational uses, and interviewed documented uses by site on the Navasota River Below Lake Limestone (Segment 1209) for the Comprehensive Recreational Use Attainability Analysis by location.

Site	Site Description	Impediments	Evidence	Observed	Personal Use	Witnessed Use	Hear-say Use
1	US 79 @ Navasota River	Rip Rap	Fishing Tackle, Foot Paths/Prints		Fishing, Boating	Fishing, Boating, Kayaking, Wading-Adults	
2	County Line Rd @ Navasota	Private Property, Steep Slopes, Fence on banks, Fallen Trees	Foot Paths/Prints, Boat Ramp, Fire Pit/Ring, Fishing Tackle	Wading-Children, Wading-Adults, Swimming, Fishing, Drinking or water in mouth, Standing, Sitting, Playing on Shoreline	Swimming, Fishing, Boating	Kayaking, Fishing, Hunting, Boating	Fishing, Hunting, Swimming, Canoeing
3	US 190 @ Navasota	Fallen Trees and Debris, Bridge, Private Property, No Trespassing Sign, Steep Slopes, Fence	Foot Paths/Prints, Fishing Tackle, Folding Chair	Walking, Wildlife Watching	Walking, Wildlife Watching, Fishing, Boating, Hunting, Swimming, Wading-Adults, Wading-Children, Canoeing	Fishing, Hunting, Kayaking, Boating, Canoeing, Swimming	Fishing, Boating, Kayaking, Hunting, Swimming, Canoeing
4	Soggy Bottom ATV Ranch @ Navasota	No Access - Private property owner not willing to participate					
5	Democrat Rd @ Navasota	Downed Trees, Private Property, Steep Slopes	Rope Swing, Foot Paths/Prints, Fire Pit/Ring, Fishing Tackle, Boat Ramp	Swimming	Kayaking, Fishing, Boating, Canoeing, Hunting, Water Skiing, Swimming	Kayaking, Fishing, Boating, Canoeing, Hunting, Swimming, Trapping, Wading-Adults, Boating, Wading-Children	Kayaking, Fishing, Boating, Canoeing, Hunting, Wading-Adults, Wading-Children, Trapping, Swimming
6	Birdwell Property @ Navasota	Downed Trees, Private Property, Steep Slopes, No Public Access	ATV Tracks, Stairs from Reinforced Flattened Area		Swimming, Fishing, Boating	Swimming, Fishing, Boating	
7	CR 162 @ Navasota	Log Jams, Fallen Trees, Private Property, Steep Slopes, Fence (barbed wire)	Fishing Tackle, Foot Paths/Prints, Gun Shell		Fishing, Canoeing, Hunting	Fishing, Hunting, Kayaking, Boating, Canoeing, Trapping	Fishing, Hunting, Kayaking, Boating, Canoeing, Trapping
8	Dudley Property North @ Navasota	No Access - Private property owner not willing to participate					Fishing, Boating
9	Roese Rd @ Navasota	Log Jams, Private Property, Fence, Dam and Fast Flowing Water, Water Control Structure	Fire Pit/Ring, Gun Shell, Target, Chair, Foot Paths/Prints	Standing, Sitting, Fishing	Fishing	Fishing, Kayaking, Boating, Hunting	Kayaking, Boating, Fishing
10	Dudley Property South @ Navasota	No Access - Private property owner not willing to participate					
11	SH 30 @ Navasota	Private Property, Steep Slopes, Fence, No Trespassing Sign, Debris	Foot Paths/Prints, Fire Pit/Ring, Fishing Tackle, Gun Shell, Broken Chair, Make-Shift Boat Ramp, Air Mattress	Fishing, Sitting, Lying Down/Sleeping	Fishing, Canoeing, Hunting, Swimming, Boating	Kayaking, Fishing, Canoeing, Boating, Swimming, Hunting, Camping	Kayaking, Fishing, Canoeing, Hunting, Boating, Swimming
12	Tonkaway Ranch @ Navasota	Fallen Trees and Debris, Private Property			Swimming, Fishing, Rafting, Boating, Trapping, Canoeing, Hunting, Wading-Children, Wading-Adults	Kayaking, Fishing, Boating, Trapping, Hunting	Hunting
13	Sulphur Springs Rd 1 @ Navasota	Rip Rap, No Trespassing Sign, Private Property	Foot Paths/Prints, Fire Pit/Ring, Fishing Tackle, Styrofoam Container		Fishing	Swimming, Kayaking, Fishing, Wading-Adults	
14	SH 6 @ Navasota	Steep Slopes	Foot Paths/Prints, Fishing Tackle, RV/ATV Tracks, Children's Toys		Fishing, Canoeing	Fishing, Boating, Kayaking, Canoeing, Hunting	Kayaking, Canoeing, Fishing, Boating, Hunting
15	SH 105 @ Navasota	Fallen Trees, Private Property, Fence, Steep Slopes	Foot Paths/Prints, Fire Pit/Ring, Fishing Tackle			Fishing, Boating	Fishing, Swimming, Canoeing

Summary

Twelve (12) surveys on the Navasota River Below Lake Limestone in the Brazos River Basin were completed in this RUAA to evaluate whether the existing and/or attainable recreational uses of the Navasota River Below Lake Limestone might be different than the current presumed recreational uses. Important data collected in this RUAA included general stream characteristics, observations and evidence of recreational use and surrounding conditions that promote recreation, and surrounding conditions that impede recreation including channel obstructions.

While the Navasota River Below Lake Limestone had several impediments to recreational use such as steep banks, barbed wire, log jams, fences, a muddy substrate, and limited public access; the RUAA documented a variety of recreation activities. Limited public access made it difficult to meet the recommended three (3) survey sites for every five (5) miles of stream recommended by the TCEQ. The most common recreation activity was fishing. This was observed during field surveys, cited by interviewees, and evidence of fishing was encountered at several survey sites. Canoeing, boating, hunting, kayaking and swimming were also reported by interviewees. Swimming was observed at two survey sites (children-wading/swimming and adults swimming), and 11 interviewees reported personally swimming in the river. A total of 3 adults and 3 children were observed carrying out primary contact recreation activities on Navasota River Below Lake Limestone. Depths in the stream often exceeded 1.5 m and the average flow value for all the survey sites was 42.7cfs. No public recreation areas in the form of maintained parks were found as part of this RUAA. RUAA summary analysis indicates that primary contact, secondary contact (1 & 2), and non-contact recreation activities occur on the Navasota River Below Lake Limestone (Segment 1209).

Literature Cited

Brazos River Authority (BRA). 2003. Basins Highlight Report

Handbook of Texas Online. 2010. Texas State Historical Association (TSHA) web resource: http://www/tshaonline.org

Texas Commission on Environmental Quality (TCEQ). 2008. Texas 303(d) list (March 19, 2008). TCEQ, Austin, Texas.

Texas Commission on Environmental Quality (TCEQ). 2009. Recreational Use-Attainability Analyses (RUAAs) Procedures for a Comprehensive RUAA and a Basic RUAA Survey. TCEQ, Austin, Texas.

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: __*Navasota River Below Lake Limestone*_____
Segment No. or Nearest Downstream Segment No.: ____*1209*_____
Classified?: __*Yes*_____
County: _____*Limestone, Leon, Robertson, Madison, Brazos, and Grimes*_____

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? __*>1.5*__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