PRELIMINARY RESULTS OF A RECREATIONAL USE ATTAINABILITY ANALYSIS OF ARENOSA CREEK (2453C)

BY

Dr. Kirk Winemiller

Dr. John Baker

Texas AgriLife Research|Extension

Texas A & M University System

College Station, Texas

March 14, 2016

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Summary

Arenosa Creek

Arenosa Creek, unclassified water body 2453C, is a 32.7 mile stream that was evaluated with 16 RUAA field surveys and 61 recreational use interviews. It originates in the area of J-2 Ranch Road in Victoria County and flows south to the confluence with Garcitas Creek (Figure 1 and Appendix 1). The stream generally has a forested riparian corridor and flows through rural areas that consist mostly of pastures and agricultural fields. Forest (72.5%), pasture (15%), pipe line corridor (5%) and rip rap (5%) were the most frequently recorded riparian zones on Arenosa Creek followed by shrub dominated corridor (2.5%).

All measurements during field surveys on Arenosa Creek were collected during a summer time period that had a moderately moist Palmer drought index. Twenty one substantial pools were found on the 16 reaches surveyed. The average measured thalweg and stream width was 0.66 m and 8.29 m, respectively. The stream type was categorized as perennial (19%), intermittent with perennial pools (50%) and intermittent (31%). The flow was characterized as normal (87.5%) and no flow (12.5%). Eighty one percent of all stream sites (13 out 16 survey sites) were wadeable while the other 19 percent were non-wadeable. For two of the non-wadeable sites the thalweg for the full reach was greater than 1.5 m (11 out of 11 measurements). The third non-wadeable survey site had six thalweg measurements that were over 1.5m. Based on the TCEQ Wastewater Outfall shapefile, no wastewater outfalls were found on Arenosa Creek. No impoundments were found on the stream.

Based on 61 recreational use interviews, fifty one percent of the people that participated in the interviews and their families use Arenosa Creek for recreation. Among the 31 interviewees that use the stream for recreation, 45% engage in primary contact recreational activities including swimming (seven interviews), swimming children (two interviews), swimming and wading children (two interviews), wading children (five interviews) and tubing (two interviews) (Table 10). Seventy four percent engaged in secondary contact 1 recreational activities including fishing, bowfishing, kayaking and boating. Interviewees have witnessed recreational activities

including primary contact recreation (one report of swimming and one report of wading children) and secondary contact recreation, including wading adults, fishing, kayaking and boating.

Interviewees characterized the dominant stream type as perennial (33%), intermittent with perennial pools (29%), intermittent (22%) and ephemeral (2%). Most of the interviewees that do not use the stream state that the stream has little or no water (23%). Other reasons given for not using the stream for recreation were related to other personal interests (18%), private property (14%), poor access (14%), marginal water quality (14%), potentially dangerous wildlife (9%), steep banks (5%), and another stream preventing access (5%).

No primary or secondary contact recreational activities were observed on Arenosa Creek during the field surveys. One potential indication of human use related to primary contact (part of an inner tube) was found at survey site 2453C.14 at the end of Old Highway Road in Inez, Texas, a well-known and important location for primary contact. Seven IHUs related to secondary contact 1 (drop lines) were found at four survey sites. Seventeen IHUs related to non-contact activities were found including a fire pit next to the stream, two chairs next to the stream, a propane tank, a pocket knife next to the water, a tree fort/hunting stand over the water, and two shotgun shells. General public access to Arenosa Creek was estimated to be moderate. Bennett Park, a frequently used area for primary contact recreation or bathing beach, was found downstream (within five stream miles) of two RUAA survey sites on Arenosa Creek.

Introduction

Section 101(a)(2) of the Federal Water Pollution Control Amendments of 1972 or the Clean Water Act (the Act) states it is the national goal, wherever attainable, to provide for the protection and propagation of fish, shellfish, and wildlife and provide for recreation in and on the waters of the United States. Under section 131.10(j) of the Water Quality Standards Regulation of the United States Environmental Protection Agency (EPA), states are required to conduct a use attainability analysis (UAA) whenever the state designates uses of water bodies that do not include the uses specified in section 101(a)(2) of the Act, removes one of these designated uses, or adopts subcategories of these uses that require less stringent criteria.

A UAA (or RUAA) is a structured scientific assessment of the factors affecting the attainment of a use on a water body. The overall purpose of a RUAA is to make sure streams have the correct recreational use classification following the guidelines established in the Act. The ultimate goal is that the new designated use classification is more accurate.

RUAAs may include physical, chemical and biological evaluations to determine what factors impair attainment of designated uses and provide information to determine what uses are appropriate and feasible for the water body in question. Important factors in such analyses can include naturally occurring pollutant concentrations, anthropogenic sources of pollution, water depth, hydrological modifications and natural physical characteristics of streams that could impair the use. In addition, RUAAs typically assess the current uses (recreation and otherwise) of the water bodies under evaluation.

States use the information collected in a RUAA to demonstrate to the EPA that attaining the uses in section 101(a)(2) are not feasible because:

1. naturally occurring pollutant concentrations prevent the attainment of the use;
2. natural, ephemeral, intermittent or low- flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating state water conservation requirements to enable uses to be met;

3. human-caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place;
4. hydrologic modifications preclude the attainment of the use and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use;
5. physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles and the like, unrelated to [chemical] water quality, preclude attainment of aquatic life protection uses; or
6. controls more stringent than those required by sections 30l(b)(l)(A) and (B) and 306 of the Act would result in substantial and widespread economic and social impact.

On June 22 through July 29, 2015, a team from Texas AgriLife Research, Texas A&M University System (TAMU), carried out a RUAA on Arenosa Creek (2453C) (Figures 1-6). Arenosa Creek is a 32.7 mile long unclassified stream that flows from J-2 Ranch Road in Victoria County to the confluence of Arenosa and Garcitas Creek. Following the methodology in TCEQ's 2014 Recreational Use Attainability Analysis Procedures, team members talked with landowners on these streams, interviewed recreational users, and collected data at 16 survey sites along the stream. The Water Quality Standards Group within the TCEQ will use this information to potentially classify or reclassify the stream in the category of primary contact recreation, secondary contact 1 recreation, secondary contact 2 recreation or non-contact recreation.

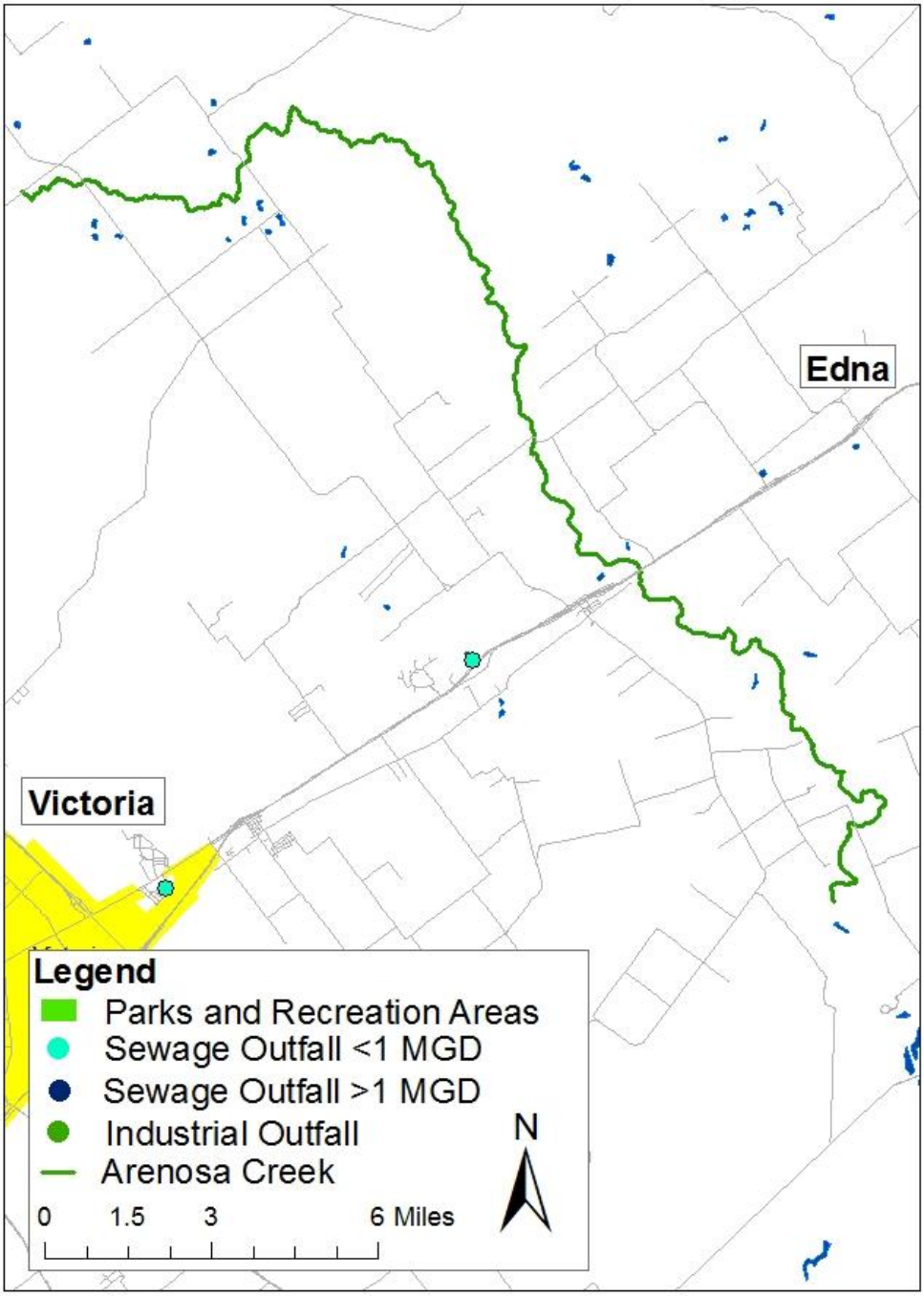


Figure 1. Map of Arenosa Creek with cities, parks, major roads, wastewater outfalls and reservoirs.

Figure 2. Photograph of Arenosa Creek at RUAA survey site 2453C.1 on July 24, 2015.

Figure 3. Photograph of Arenosa Creek at RUAA survey site 2453C.10 on July 11, 2015.

Figure 4. Photograph of Arenosa Creek at RUAA survey site 2453C.23 on July 18, 2015.

Figure 5. Photograph of Arenosa Creek at RUAA survey site 2453C.Con on July 17, 2015.

Figure 6. Photograph of the confluence of Arenosa Creek (right side of the photo) and Garcitas Creek (left side of the photo, fallen trees are partially blocking the stream). Photograph was taken down stream of the confluence (on the stream segment named Garcitas Creek Tidal) on July 17, 2015.

Methods

Creation of a GIS Project

An ESRI ArcMap GIS project was created to acquire the information needed to carry out the RUAA site surveys. A stream shapefile was obtained from the TCEQ. Shapefiles of Texas counties, cities, major roads and stream point sources (TCEQ Wastewater Outfalls) were obtained from (TCEQ's Atlas of Texas Surface Waters). A watershed shapefile (basinspy) was obtained from Texas Parks and Wildlife. Aerial photographs (NAIP12 nc-cir 1m) and street shapefiles were obtained from the Texas Natural Resources Information System. Shapefiles (polygons) of private property parcels were obtained from county property appraisal district offices. Shapefiles of public recreation areas were obtained from the Texas Parks and Wildlife Department (TPWD) and Texas General Land Office (TGLO). These included TPWD parks (parkpy.shp and tpwdparks.shp), state preserves (preserves.shp), sanctuaries managed by the Audubon Society (sanctuaries.shp) and wildlife refuges managed by the U.S. Fish and Wildlife Service (wildliferefuges.shp).

Photograph Naming Convention

In sequence, photograph names (i.e. 1.11_Dwn150_2453C.23_07182015_124159) provide the camera number, a period, a photo number assigned by the camera, an underscore, a code which describes the contents of the photograph, the location in meters along the stream reach where the photograph was taken, an underscore, the segment identification code for the specific survey site, an underscore, the date, an underscore and the time of day to the nearest second in military time. Photographs taken at locations other than 0, 150, or 300 meters along the reach do not have reach location (distance along the reach) information. The example photograph name above was taken by camera 1, was the 11th photograph assigned by the camera, and was depicting a downstream photograph of the stream 150 meters along the reach at survey site 2453C.23 (Survey site 23 on Arenosa Creek (2453C)). This example photograph was taken on July 18, 2015 at 12:41 and 59 seconds. Content codes include Up (upstream), Dwn (downstream), LB (left bank), RB (right bank), HP (human presence), IHU (indications of human use), IPC (indication of primary contact

recreation), SC (surrounding conditions), SPA (site/public access), PR (promote recreation), PP (public park), IR (impede recreation), G (garbage or debris), UC (unsafe condition), CO (channel obstructions), FPS (flowing point source or NPDES discharge), HM (hydrologic modifications), Dam (dam or on channel impoundment), W (wildlife or animal evidence (not related to sustained aquatic habitat)) and SAH (sustained aquatic habitat).

Sampling Design and Site Selection

Systematic and purposive sampling methods were used to select survey sites on Arenosa Creek. Using TCEQ's stream shapefile, survey stations were generally evenly spaced every 1.67 miles or three points per five mile segment on Arenosa Creek. This methodology ensured that the survey sites provide a representative sample of the conditions that exist along the entire population of the stream. In order to ensure that recreational use was targeted for measurement, evenly spaced points were replaced with sites near these points where recreation was most likely to occur. These targeted areas of recreational use included bridges and other areas that are accessible to recreational users. Every effort was made to survey all sites. Some survey sites were not sampled due to the lack of permission from private property owners.

Collected Data for Each Stream Survey Sites

Field data was collected based on TCEQ's Recreational Use Attainability Analyses Procedures for a Basic RUAA Survey (2014). Following these procedures, the Contact Information Form (Appendix 2), the RUAA Summary (Appendix 5), Field Data Sheets (Appendix 3) and RUAA Interview Forms (Appendix 4) were completed for each RUAA stream survey site. Monthly Palmer Drought Index data was obtained NOAA's National Climatic Data Center's Climate Monitoring (Historical Palmer Drought Indices). Daily precipitation data was obtained from (NOAA's National Climatic Data Center). Averaged daily precipitation data was used to produce preceding 30 day, 7 day, and 1 day precipitation summary statistics.

Statistical Analyses

Basic statistical analyses were used to summarize collected RUAA data. Quantitative data such as average thalweg and average precipitation were determined by calculating the mean. Categorical data was summarized by counting the number of occurrences or calculating the proportion of occurrences out of the total number recorded.

Completion of the RUAA Summary

The average thalweg for Arenosa Creek was determined by calculating the mean thalweg for each survey site and then the mean of these means. Microsoft Autofilter was used to sort the data and determine if Arenosa Creek had substantial pools deeper than 1m. Observations on use and the general level of public access were determined by using multiple sources of information. Observations on use including primary contact, secondary contact (1 & 2) and noncontact recreation activities were primarily determined by considering information provided by interviews with land owners and residents surrounding the stream. The second factor considered came from the information recorded by field surveys and the last factor considered were field observations of indications of human use at survey sites. The general level of public access was determined primarily by the survey team's responses to "Describe Access Opportunities" for each survey site and secondarily on "Bank Access", "Surrounding Conditions that Impede Recreation," and the number of recreation areas located on Arenosa Creek.

Results

Summary of the Informational Meetings

An informational meeting was carried out to present information to the public about TCEQ's RUAA Program, answer questions about the RUAA and our work on Arenosa Creek, and talk to local residents and stakeholders about their knowledge and use of this stream. Joe Martin from the Water Quality Standards Group at the TCEQ, Allen Berthold from the Texas Water Resources Institute and John Baker from TAMU presented Microsoft PowerPoint presentations describing TCEQ's RUAA program and the purpose of carrying out a RUAA on Arenosa Creek. A technician from TAMU collected information from landowners and stakeholders during the informational meeting.

The informational meeting was held in the auditorium of the Jackson County Services Building (411 N Wells St., Edna, TX 77957) on Tuesday, July 7, 2015 at 6:00 pm. To advertise for the meeting, public announcements were placed in the Victoria Advocate on Wednesday, July 1 and Sunday, July 5 and in the Jackson County Herald on Wednesday, July 1. Lastly, 540 letters describing the RUAA and advertising for the informational meeting were sent on June 17 and June 19, 2015 to landowners living on and around the stream. Fifty four people attended this meeting.

General Stream Characteristics

Forests were found to be the most frequently recorded riparian zone on Arenosa Creek (72.5%) (found by calculating the sum of the left bank and right bank riparian zone corridor categorical observations and dividing by the total), followed by pasture (15%), pipe line corridor (5%), rip rap (5%) and shrub dominated corridor (2.5%).

Seven hydrological stream measurements, including continuous and categorical hydrological field observations, were collected during the RUAA to provide a measure of the amount of water in the stream at the time of survey and the stream's potential for recreation (Table 1). All

measurements were collected in periods that had a moderately moist Palmer drought index. Arenosa Creek had an average thalweg of 0.66m and an average width of 8.29m. Field technicians characterized the flow frequency as normal 87.5 % of the time and stream type as perennial (19%), intermittent with perennial pools (50%) and intermittent (31%). The channel frequency was characterized as wadeable 81% of the time (13 out 16 survey sites) and non-wadeable 19% of the time. The thalweg for the whole reach was greater than 1.5m for two of the non-wadeable survey sites (11 out of 11 measurements). The third non-wadeable survey site had seven (out of 11 measurements) thalweg measurements that were over 1.5 m. Based on the TCEQ Wastewater Outfall shapefile, Arenosa Creek had no wastewater outfalls. No impoundments were found on the stream.

The RUAA summary for each stream (Appendix 5) is presented in Table 2. Primary contact, secondary contact 1, secondary contact 2 and non-contact recreation were characterized as occurring frequently on Arenosa Creek. General public access for Arenosa Creek was characterized as moderate. Arenosa Creek was accessible at five bridges and by canoe, kayak and/or boat from boat ramps downstream of the confluence of Arenosa and Garcitas Creek (i.e. Bennett Park and the FM 616 public boat ramp).

Table 1. Hydrological stream characteristics. Proportional frequencies represent the number of times a condition was recorded at a stream over the number of sites surveyed per stream.

Stream	Avg. thalweg (m)	Avg. width (m)	Subst. pools	Flow category	Freq.	Stream type frequency	Freq.	Channel category	Freq.	Palmer drought index (PDI)	Freq.
Arenosa Creek	0.66	8.29	21	No flow	0.125	Ephemeral		Non-wadeable	0.19	Mod. moist	1
				Low		Intermittent	0.31	Wadeable	0.81		
				Normal	0.875	Intermittent w/ per. pools	0.50				
				High		Perennial	0.19				
				Flooded							

Table 2. RUAA summary for Arenosa Creek.

RUAA Summary	
Stream Name	Arenosa Creek
Waterbody	2453C
Classified	No
Primary Contact	Frequently
Secondary Contact Recreation 1	Frequently
Secondary Contact Recreation 2	Frequently
Non-Contact	Frequently
Average Thalweg (m)	0.66
Substantial pools>1m	21
General Public Access	Moderate
Palmer Drought Index	Moderately Moist

Observations and Evidence of Recreational Use

No primary or secondary contact recreational activities were observed on Arenosa Creek during the field surveys conducted in this RUAA project. One indication of human use (IHU) possibly related to primary contact (part of an inner tube) was found at survey site 2453C.14 (at the end of Old Highway Road in Inez, Texas), a well-known location for primary contact (Table 3, Figure 9C, see Primary Contact Recreation Site Found on Arenosa Creek on page 43). This piece of an inner tube; however, could also be related to old tires being dumped into the stream rather than evidence of primary contact recreation. Seven IHUs related to secondary contact I (drop lines) were found at four survey sites (Figure 9D). Seventeen IHUs related to non-contact activities were found including a fire pit next to the stream (Figure 9A), two chairs next to the stream (Figure 9B), a propane tank (Figure 9E), a pocket knife next to the water (Figure 9F), a tree fort/hunting stand over the water (Figure 9G) and two shotgun shells (Figure 9H).

Bennett Park, an important area for primary contact recreation or bathing beach, was found downstream (within five stream miles) of two RUAA survey sites on Arenosa Creek. Bennett Park is a Jackson County public park located on Garcitas Creek, 3.5 stream miles downstream of the confluence of Arenosa and Garcitas Creek.

Table 3. Indications of Human Use (IHU) recorded during field surveys on Arenosa Creek. The presence/absence of each IHU was recorded at each survey site. Values represent the sum of these records for the whole stream.

Indications of human use (IHU) found at each survey site	Total
IHU related to primary contact activities	
Part of an inner tube (2453C.14)	1
IHU related to secondary contact I activities	
Drop lines (2453C.14, 2453C.17, 2453C.19, 2453C.Con)	7
IHU related to non-contact activities	
Fire pit, chair and a shallow bank (2453C.Con)	1
Slightly rusty pocket knife found on the bank (2453C.Con)	1
Deer feeders (2453C.7, 2453C.14)	2
Shotgun shells (2453C.11, 2453C.22)	2
Tree forts/hunting stands (Between 2453C.11 and 2453C.12, 2453C.14, 2453C.17, 2453C.21)	6
Chair/stool next to stream (2453C.12)	1
Camping propane tank (2453C.21)	1
Graffiti under a bridge (2453C.19)	1
Top of a cooler (2453C.9)	1
Tractor tracks (2453C.12)	1

Figure 7. Photographs of indications of human use found on Arenosa Creek. A) Fire pit on the bank. B) Chair next to the stream. C) Part of an inner tube possibly related to primary contact recreation D) Drop line. E) Camping propane tank. F) Pocket knife found on the bank. G) Tree fort/hunting stand over the stream. H) Shotgun shell.

Surrounding Conditions on Arenosa Creek

Seventy one surrounding conditions that promote recreation were recorded during surveys on Arenosa Creek (Table 4). Scenic natural surroundings (15, Figure 10A and 10B) were recorded as the most frequent surrounding condition that promotes recreation followed by wildlife and wildlife evidence (14, Figure 10C and 10D), rural area (14), the presence of fish (5), bridge crossings (5, Figure 10E and 10F) and utility corridors that could improve access to the stream (4, Figure 10H). Other surrounding conditions that promote recreation include deep water, water that appears clean, boat access from boat ramps downstream, gently sloping banks, and a maintained road/trail going up to the stream (Figure 10G).

Seventy surrounding conditions that impede recreation were recorded during surveys on the stream (Table 5). Private property (16, Figure 11A) was recorded as the most frequent surrounding condition that impedes recreation followed by fences (13, Figure 11B), no public access (7), cattle having access to the stream (6), steep banks (5, Figure 11D), dangerous wildlife (5, Figure 11G), harsh vegetation (3, Figure 11E and 11F), fallen trees across the stream (3, Figure 11C), marginal water quality (3), and cow manure next to the water (3). Shallow water (2), no flow at the time of the survey (2, Figure 11H), a no trespassing sign (1, Figure 11B), and remote locations (1) were also recorded. Fences, fallen trees across the stream, and log jams were recorded as being channel obstructions.

As mentioned above, field technicians recorded that the water looked clean at three field survey sites and marginal at three sites (Table 4 and 5). Significant amounts of algae were observed at a few sites (Figure 12A). In addition, the water in Arenosa Creek in the vicinity of the La Salle Road bridge appeared green in color (Figure 12B). During field surveys, it was found that cattle (Figure 12C and 12D) as well as feral pigs (Figure 12E) and deer (Figure 12F) have access to the stream. Cattle watering ponds away from Arenosa Creek were observed on two separate ranches (Figure 12H) and multiple ranches were found to prevent the access of cattle to Arenosa Creek with barbed wire fences (Figure 12G).

Seventy four records of sustained aquatic habitat were recorded during field surveys on Arenosa Creek (Table 6). Crawfish burrows/carapaces (14, Figure 13C) were recorded as the most frequent sustained aquatic habitat followed by wetland plants (11, Figure 13A), clam shells (11,

Figure 13B), fish (11, Figure 13E), frogs (10, Figure 13F), snail trails (5), and aquatic snakes (3, Figure 10D). Small burrows in the sand (2), cottonmouth moccasins (2, Figure 11G), wading birds (2), a snail shell (1), a fish spawning bed (1, Figure 13D), a turtle burrow in the stream bank (Figure 13G), and an otter den (1, Figure 13H) were also recorded.

Table 4. Surrounding conditions (SC) that promote recreation recorded during field surveys on Arenosa Creek. The presence/absence of each SC was recorded at each survey site. Values represent the sum of these records.

Surrounding conditions that promote recreation		**Total**
General conditions that promote recreation		
Gar and/or other fish		5
Wildlife and wildlife evidence		14
Natural surroundings/corridor		15
Rural area		14
Relatively clean water		3
Cows fenced off from stream		1
Deep pools and/or deep average thalweg		3
A confluence of 2 streams plus salt water species from the bay		1
	Subtotal	**56**
Surrounding conditions that promote access		
Bridge crossing		5
Boat access from boat ramps located down stream		2
Gently sloping banks		2
Near US 59 (bridge crossing) and Inez		1
Utility corridors going to the stream		4
Unimproved parking lot		1
	Subtotal	**15**
	Total	**71**

Figure 8. Factors that promote recreation on Arenosa Creek. A-B) Natural and scenic riparian corridor and stream. C-D) Wildlife (Bobcat tracks and water snake). E-F) Bridges providing access. G) Maintained road/trail leading up to the stream. H) Utility corridor crossing the stream.

Table 5. Surrounding conditions (SC) that impede recreation recorded during field surveys on Arenosa Creek. The presence/absence of each SC was recorded at each survey site. Values represent the sum of these records.

Surrounding conditions that impede recreation		Total
Surrounding conditions that impede access		
Relatively remote		1
Fallen tree across stream		3
Steep banks		5
Extremely thorny shrubs on bank		3
Dangerous wildlife (snakes, hogs and alligators)		5
	Subtotal	**17**
Surrounding conditions related to private property		
No public access		7
Fences		13
Private Property		16
No trespass sign		1
	Subtotal	**37**
Water characteristics that impede recreation		
No flow at the time of the survey.		2
Shallow water		2
Water looked marginal		3
Cow manure next to the water		3
Cattle have access to the stream		6
	Subtotal	**16**
	Total	**70**

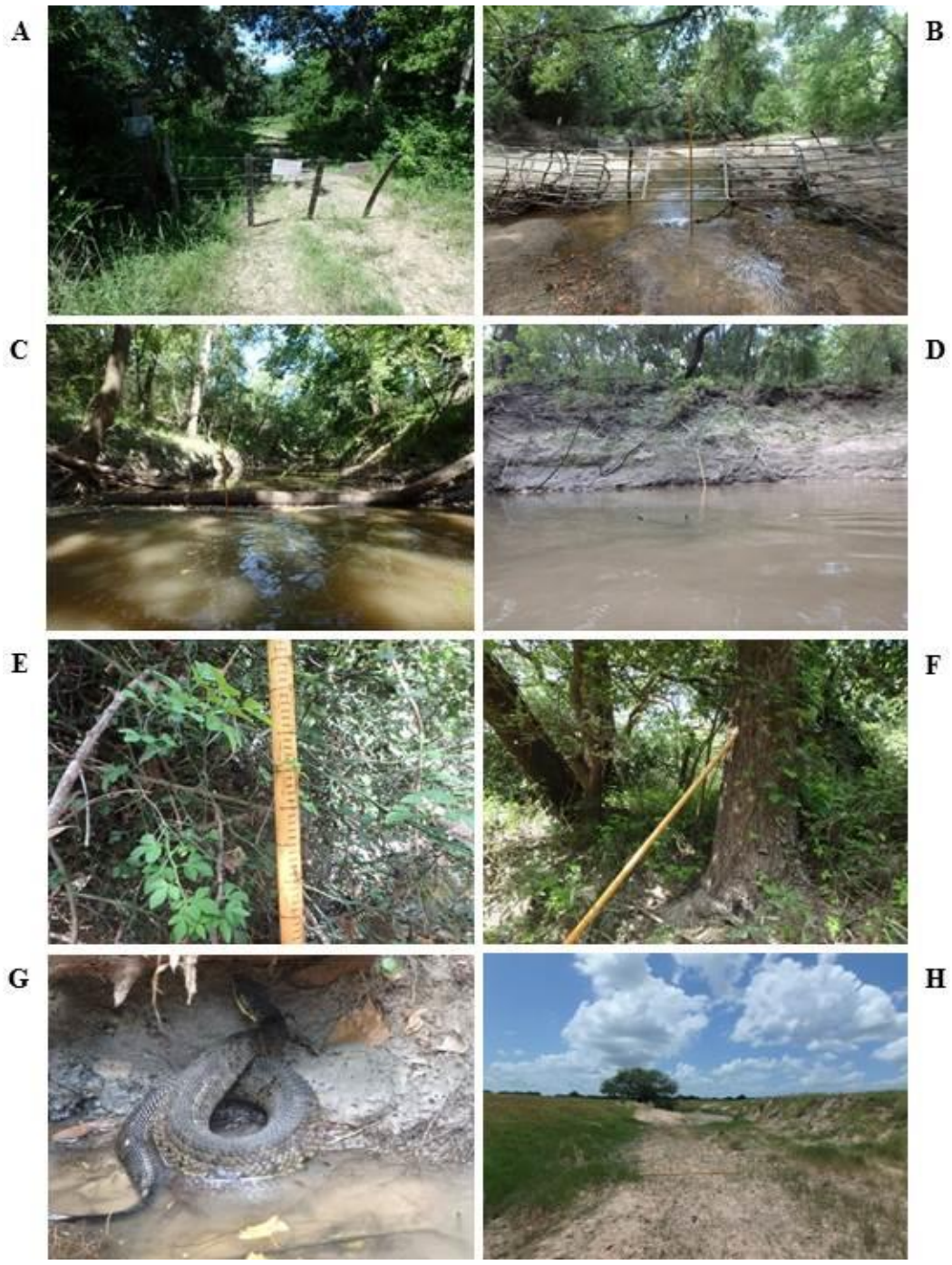


Figure 9. Factors that impede recreation on Arenosa Creek. A) No trespassing signs. B) Fence crossing the stream reducing accessibility. C) Log jam reducing accessibility. D) Steep banks. E-F) Prickly or poisonous vegetation on the banks (Very thorny shrub and poison ivy). G) Dangerous wildlife (Cottonmouth moccasin). H) Dry stream channel (Upstream site near J-2 Ranch Road).

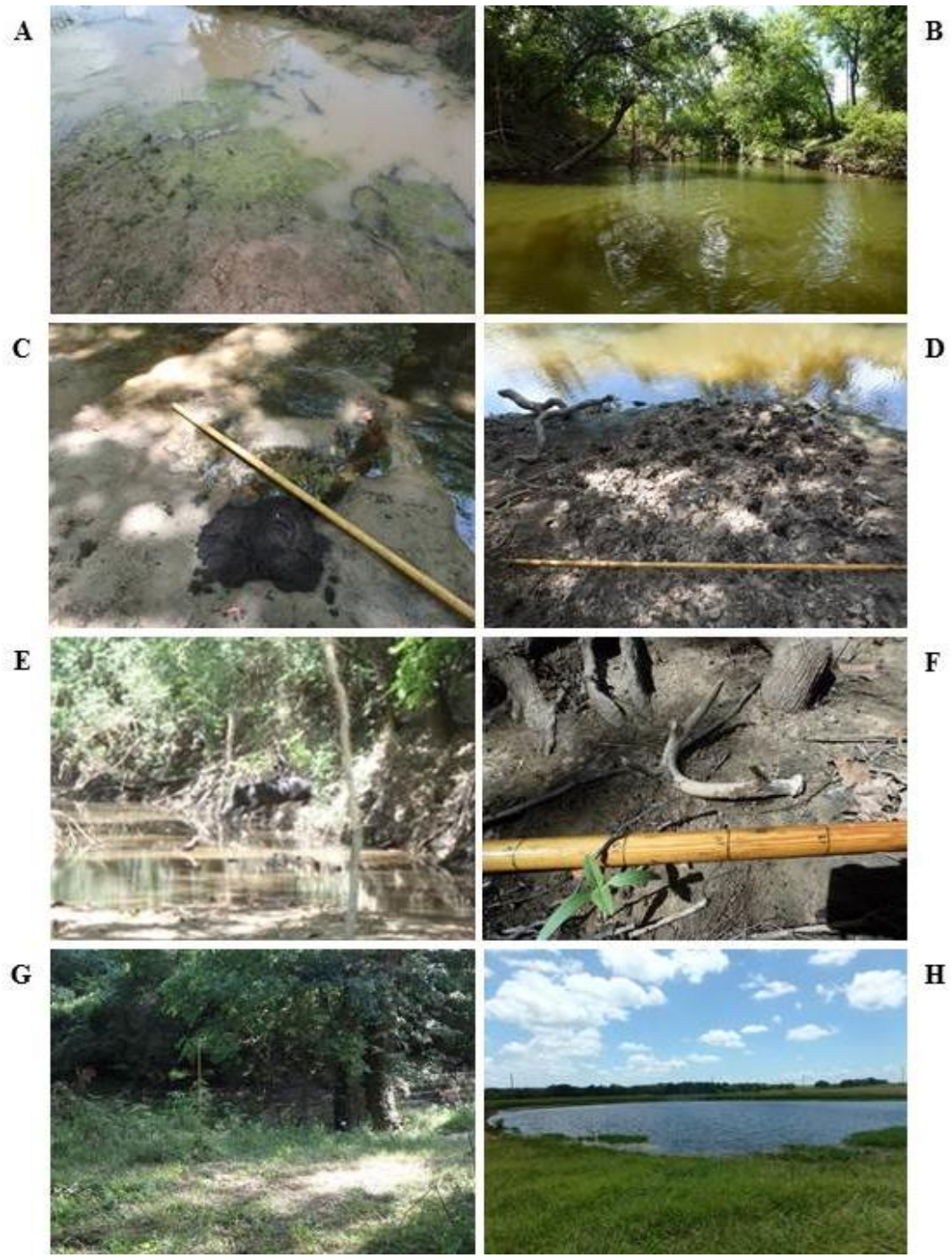


Figure 10. Photographs relating to water quality on Arenosa Creek. A) Algae in the stream. B) Green colored water in the area of La Salle Road bridge. C) Cow manure next to the stream. D) Footprints of cattle accessing the stream. E) Feral pig jumping into the stream (part of a group of several pigs running across the stream). F) Deer antler next to the stream. G) Barbed wire fence built by a rancher to prevent cows from accessing Arenosa Creek. H) Cattle watering pond providing a source of water for cattle away from the stream.

Table 6. Sustained aquatic habitat recorded during field surveys on Arenosa Creek.

Sustained aquatic habitat	Total
Wetland plants	11
Small burrows in the sand	2
Snail shell	1
Snail trails	5
Clam shells	11
Crawfish burrows/carapaces	14
Fish spawning bed	1
Fish	11
Frogs	10
Cottonmouth moccasins	2
Aquatic snakes	3
Wading birds	2
Otter den	1
Total	**74**

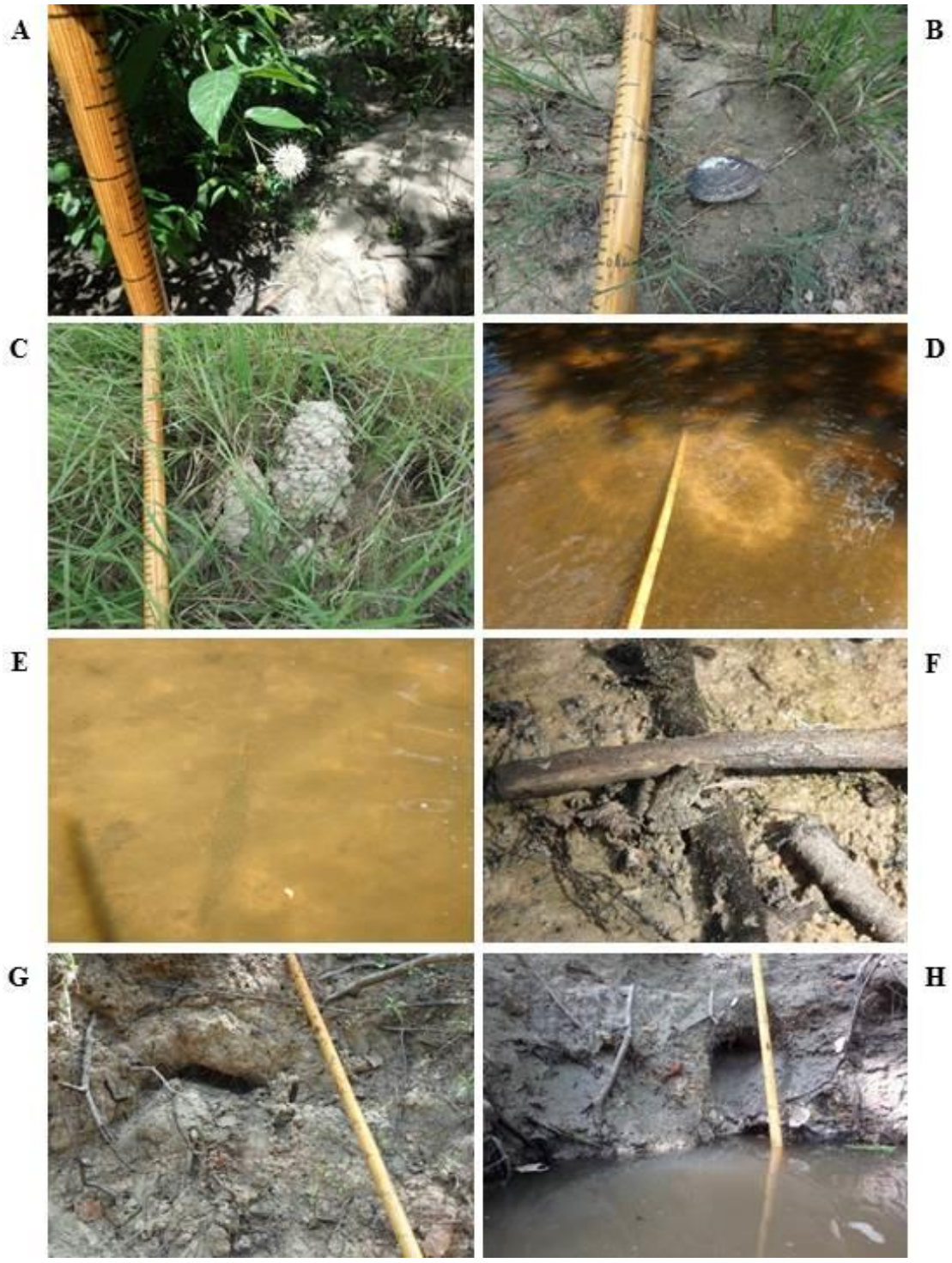


Figure 11. Photographs of sustained aquatic habitat recorded during field surveys on Arenosa Creek. A) Wetland shrub (*Cephalanthus occidentalis* or buttonbush) in the stream channel. B) Clam shell in the stream channel. C) Crawfish burrows. D) Spawning bed of a fish in the stream. E) Gar in the stream. F) A frog near the water. G) Turtle burrow in the stream bank. H) Otter den.

Arenosa Creek Recreational Use Interviews

Sixty one recreational use interviews were conducted in the Arenosa Creek area to determine how the stream is being used for recreation. Most of the interviews were conducted in person (85%), while 15% of the interviews were conducted over the phone. The majority of the interviewees were selected because they live near the stream (39%). Other interviewees were selected because they were recreating at Bennett Park (23%), the stream flows through or borders their property (16%), they own property on Arenosa Creek (8%), they live next to the stream (5%), they were swimming at Bennett Park (3%), they were at the La Salle Road bridge over Arenosa Creek (2%), they manage property on the stream (2%), or they raise cattle near Arenosa Creek (2%) (Figure 14).

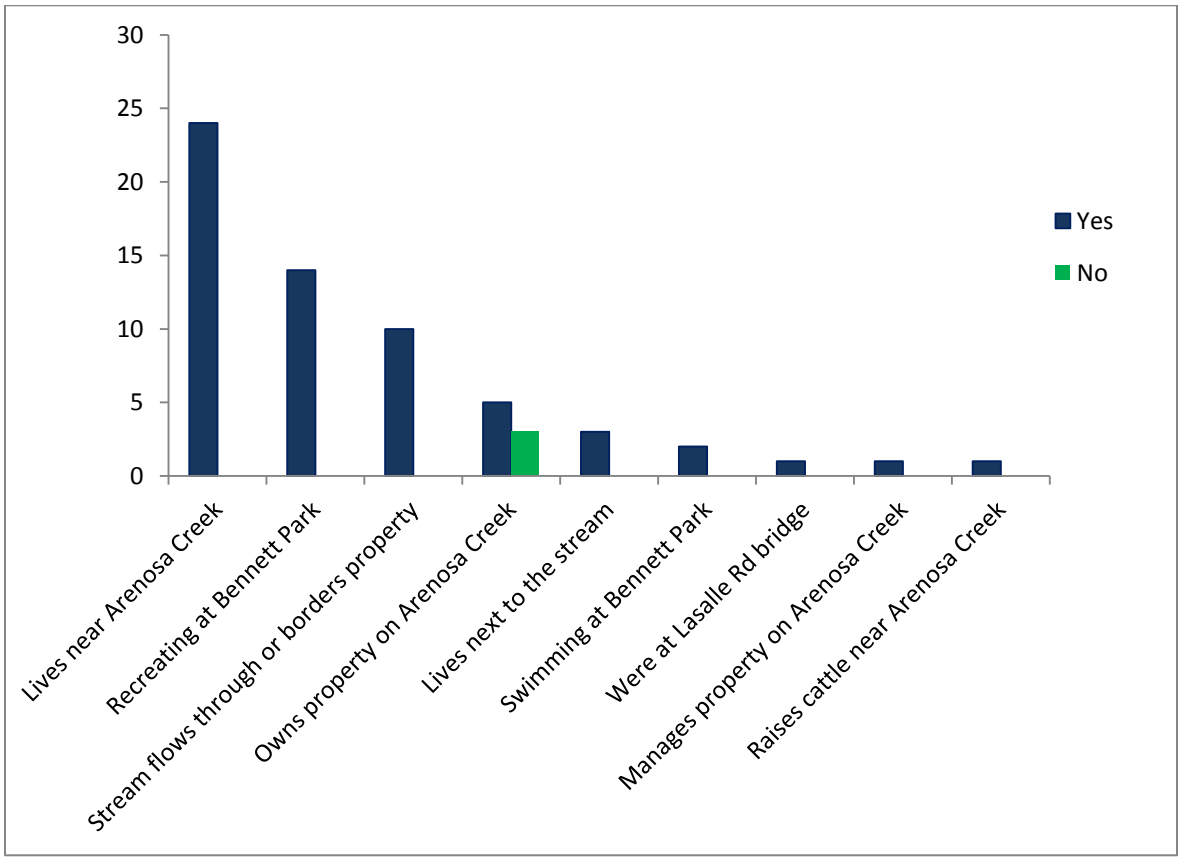


Figure 12. Number of interviewees that participated in interviews assessing recreation on Arenosa Creek. Categories represent the reason why interviewees were selected. Yes/No indicates whether interviews were completed.

The majority of people that were interviewed have been familiar with the water body between 20 and 50 years (38%) (Table 7). Sixty nine percent of the 61 interviewees have been familiar with the stream for over 10 years. Thirty three percent of the interviewees classified the stream as perennial and another 29% classified Arenosa Creek as being intermittent with perennial pools (Table 8).

Table 7. Number of years interviewees have been familiar with Arenosa Creek.

No. of years familiar	Percentage of interviews
≤5	3%
5-<10	3%
10-<20	11%
20-<50	38%
≥50	20%
Not applicable	10%
Did not specify, No data	15%

Table 8. Stream classification by interviewees which are familiar with portions of Arenosa Creek.

Classification	Percentage of interviews
Perennial	33%
Intermittent with perennial pools	29%
Intermittent	22%
Ephemeral	2%
No data	13%

More than half of the people that participated in the interviews and their families use Arenosa Creek for recreation (51%). Among the 31 interviewees that use the stream for recreation, 45% engage in primary contact recreational activities, while 74% engage in secondary contact 1 recreational activities. Primary contact recreational activities include swimming (seven interviews), swimming children (one interview), swimming and wading children (two interviews), wading children (one interview) and tubing (two interviews) (Tables 9 and 10). Secondary contact recreational activities include fishing, bowfishing, kayaking and boating.

Based on 28 interviews in which data was obtained on the number of days per year recreation occurs in Arenosa Creek, 71% of the interviewees and their families recreate on Arenosa Creek between 1 and 30 days per year (Average = 6 ± 7 days/year), 18% use the stream between 31 and 60 days per year (Average = 46 ± 9 days/year) and 11% use the stream between 61 and 104 days per year (Average = 91 ± 23 days/year). On average, interviewees and their families who carry out primary contact activities use the stream 25 ± 35 days per year (Based on 10 interviews). Recreation on Arenosa Creek occurs in all seasons.

Table 9. Recreational activities reported on Arenosa Creek that involve the person that was interviewed and or his/her family. Note that a single interviewee can report one or more recreational activities.

Personal or family recreational uses	Number of reports
Primary contact recreational activities	
Swimming	7
Swimming children	2
Swimming and wading children	2
Wading children	5
Tubing	2
Secondary contact recreational activities	
Fishing	18
Bowfishing for gar	1
Kayaking	4
Boating	4
Noncontact recreational activities	
Children playing in the creek bed	1
Hiking	2
Walking to the stream	1
Hunting	4
Horseback riding	1
Picnicking	1
No recreational activities	
Do not use	17

Table 10. Comments by fourteen interviewees relating to personal or family primary contact recreational activities on Arenosa Creek collected by TAMU field technicians during the RUAA. Paraphrased comments of interviewees are displayed.

Paraphrased comments of interviewees
1. The 3 year old daughter of the landowner's son's girlfriend wades and plays in Arenosa Creek.
2. The interviewee regularly brings girlfriends' children to wade in Arenosa Creek on his property. Interviewee used to swim in Arenosa Creek 30 years ago
3. Interviewees young boy (around 10 years of age) indicated that he has waded in the water in the stream. Interviewee said that she, her husband, her cousin and his girlfriend went tubing in the stream within the last 10 years.
4. About 17 years ago, interviewee said his children would wade and play in the creek when it had water after heavy rain events.
5. Interviewee swims in Arenosa Creek while boating 2 times per year with one or two friends.
6. Interviewee's kids used to swim in Arenosa Creek 30 years ago.
7. Interviewee's family used to swim in the 1980s.
8. Interviewee's grandchildren swim and wade in Arenosa Creek a few times per year.
9. Interviewee's children, who were 10 and 12 years old, used to swim in Arenosa Creek 20 years ago.
10. Interviewee's seventeen year old son and 3 of his friends swam in Arenosa Creek 3 times in the last 3 years.
11. A fifteen year old went swimming in Arenosa Creek one time last year.
12. Interviewee went swimming in Arenosa Creek 30 years ago with 15 other people.
13. Interviewee's children used to wade in the stream near US 59.
14. Interviewee's family swim (including children), wade (including children) and tube behind a boat in Arenosa Creek.

Most of the 17 interviewees that do not use the stream for recreation mention that Arenosa Creek has little or no water (23%) (Table 11). Other reasons given for not using the stream were related to other personal interests (18%), no access due to private property (14%), poor access (14%), water quality (14%), potentially dangerous wildlife (9%), steep banks (5%), and no access due to other streams (5%).

Table 11. Reasons stated by interviewees for not using Arenosa Creek. Note that a single interviewee can report one or more reasons for not using the stream for recreation.

Reasons for not using the Arenosa Creek	Percentage of total responses
Physical characteristics (Little or no water)	23
Other personal interests	18
Stream is mostly on private property	14
Physical characteristics (Poor access)	14
Physical characteristics (Water quality)	14
Potentially dangerous wildlife	9
Physical characteristics (Steep banks)	5
Another stream is blocking access	5

Interviewees have witnessed a variety of recreational activities currently occurring on Arenosa Creek (Table 12). These activities included primary contact recreation (one report of swimming and one report of wading children) and secondary contact recreation including wading adults, fishing, kayaking and boating. Fishing was the most frequently witnessed activity. Noncontact recreational activities witnessed included hunting, ATVing, camping and picnicking. Sixty four percent of interviewees have not witnessed recreation in Arenosa Creek.

Table 12. Recreational activities witnessed by interviewees on Arenosa Creek. Note that a single interviewee may report witnessing one or more recreational activities.

Witnessed recreational activities	Number of reports
Primary contact recreational activities	
Swimming	1
Wading children	1
Secondary contact recreational activities	
Wading adults	1
Fishing	16
Kayaking	1
Boating	3
Noncontact recreational activities	
Hunting	3
ATVing	1
Camping	1
Picnicking	1

Interviewees also reported hearing of a variety of recreational activities occurring on Arenosa Creek (Table 13). These activities included one report of swimming and secondary contact recreation including fishing, boating and duck hunting. Fishing (three reports) was the most frequent recreational activity that people have heard of occurring on the stream. Noncontact recreational activities heard of include hunting and one report of poaching. Eighty nine percent of interviewees have not heard of recreation occurring on Arenosa Creek.

Table 13. Recreational activities that interviewees have heard of occurring on Arenosa Creek. Note that a single interviewee can report hearing of one or more recreational activities.

Recreational activities heard of occurring on Arenosa Creek	Number of reports
Primary contact recreational activities	
Swimming	1
Secondary contact recreational activities	
Fishing	3
Boating	2
Duck hunting	1
Noncontact recreational activities	
Hunting	2
Poaching	1

A Primary Contact Recreation Site Found On Arenosa Creek

While carrying out the RUAA on Arenosa Creek, an area for primary contact recreation was identified. Five collected interviews along Arenosa Creek (Table 13) provided evidence of primary contact on the property that is located on the west bank of Arenosa Creek immediately south of and adjacent to US 59 (at the end of Old Highway Rd. in Inez,). According to these interviews, this site has been heavily used since the mid-1970s and before. It has been heavily used for recreation due to its close proximity to the town of Inez and due to the fact that the public school bus used to turn around on the property after traveling to the end of Old Highway Road while picking up and dropping off students, making it highly visible and known to young adults in the area. Based on one interview, primary contact recreation was common here until about 10 years ago. In the last few years, the land owner of the property has restricted access by patrolling the property and posting no trespassing signs. Based on the interviews conducted, about five people currently carry out primary contact recreation on this property.

Table 14. Interviews collected by TAMU field technicians highlighting primary contact recreational activities on one property on the west bank of Arenosa Creek immediately south of and adjacent to US 59 in the town of Inez. Paraphrased comments of interviewees are displayed.

Paraphrased comments by interviewees
1. Used to use the stream before a private landowner restricted access. Now, many kids are afraid to use the area but would like to.
2. Recently, the interviewee's 17 year old son has gone swimming with 3 friends 3 times. The owner restricted access 2 years ago.
3. Thirty years ago, the interviewee used to swim and boat on the Arenosa near US 59 with 15 other people.
4. Interviewee regularly brings his girlfriends' children to wade in the stream. Has seen wading children in the last 10 to 30 years. Interviewee used to swim here 30 years ago.
5. Kids used to fish and swim under the US 59 bridge in the 1980s.

Acknowledgements

Many people contributed to the success of this Recreational Use Attainability Analysis including scientists at the TCEQ, TWRI, and at TAMU.

The authors of this report would like to acknowledge:

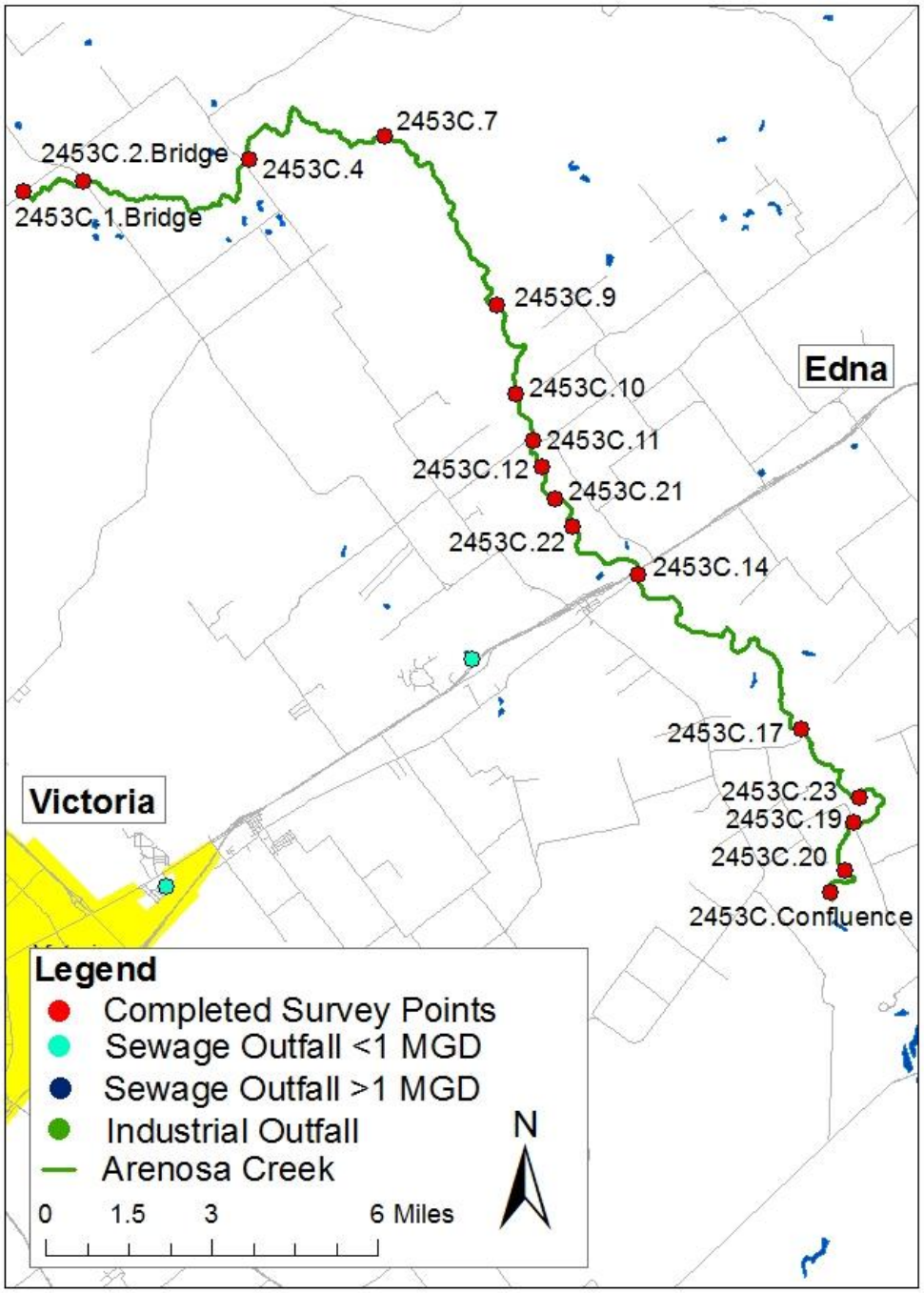
Lauren Young and Joe Martin for their support and guidance in carrying out this project.

Kevin Wagner and Allen Berthold for their oversight and assistance.

Andie Ladigo for her hard work in collecting project field data.

Appendices

Appendix 1. Map of study area around Arenosa Creek.



Map of completed survey sites, cities, and wastewater outfalls along Arenosa Creek (2453C).

Appendix 2

Contact Information Form
(This form must be completed prior to conducting a RUAA survey.)

River or stream name: _____

Notify the contacts that a recreational use-attainability analysis is being planned for the river or stream. Document whether or not the entity was notified, the name of the person contacted, and the date they were notified about the proposed RUAA project.

Required Local Contacts:

TCEQ region staff	Notified: ☐ Yes ☐ No Date: _____ Name: _____
Clean Rivers Partners (River Authority and other local partners)	Notified: ☐ Yes ☐ No Date: _____ Name: _____
Texas Parks and Wildlife Department Point of Contact: Cindy Hobson 512.389.8195 cindy.hobson@tpwd.texas.gov	Notified: ☐ Yes ☐ No Date: _____
Texas State Soil Water Conservation Board Point of Contact: T.J. Helton 254.773.2250 ext. 234 thelton@tsswcb.texas.gov	Notified: ☐ Yes ☐ No Date: _____

Suggested Additional Local Contacts to Notify (*Notify the contacts that a recreational use-attainability analysis is being planned for the river or stream. If contacted, include whether or not the entity was notified, the name of the person contacted, and the date they were notified about the proposed RUAA project on a separate page and attach it to this form*):

Local Parks and Recreation Departments	Yes ☐ No☐
Local Government/Jurisdiction	Yes ☐ No☐
Local Recreation Groups	Yes ☐ No☐
Conservation Groups	Yes ☐ No☐
Local County Extension Agent	Yes ☐ No☐
Watershed Groups	Yes ☐ No☐
Long-term Landowners/Adjacent Landowners	Yes ☐ No☐
Texas Stream Team	Yes ☐ No☐
Canoe Clubs	Yes ☐ No☐
City Commissioners Office	Yes ☐ No☐
Real estate agents	Yes ☐ No☐
Local non-profits	Yes ☐ No☐
City/county offices (Engineer, Health, Law Enforcement)	Yes ☐ No☐
Flood control districts	Yes ☐ No☐
Councils of Government	Yes ☐ No☐
TPWD Game Warden	Yes ☐ No☐
Other:_____	Yes ☐ No☐

Contact Information Form from TCEQ's 2014 Recreational UAA Procedures.

Appendix 3

Field Data Sheets –RUAA Survey

(complete for each site)

Site:

Data Collectors & Contact Information:
Date & Time: County Name:
Stream Name:
Segment No. or nearest downstream Segment No.:
Description of Site:

A. Stream Characteristics:

1. Check the following channel flow status that applies.

☐ dry ☐ no flow ☐ low ☐ normal ☐ high ☐ flooded

2. Check the following stream type that applies on the day of the survey:

☐ Ephemeral: A stream which flows only during or immediately after a rainfall event, and contains no refuge pools capable of sustaining a viable community of aquatic organisms.

☐ Intermittent: A stream which has a period of zero flow for at least one week during most years. Where flow records are available, a stream with a seven-day, two-year low-flow (7Q2) flow of less than 0.1 cubic feet per second is considered intermittent.

☐ Intermittent w/ perennial pools: An intermittent stream which maintains persistent pools even when flow in the stream is less than 0.1 cubic feet per second.

☐ Perennial: A stream which flows continuously throughout the year. Perennial streams have a 7Q2 equal to or greater than 0.1 cubic feet per second.

☐ Designated or unclassified tidal stream: A stream that is tidally influenced. If you checked this box, you will need to contact the TCEQ Water Quality Standards Group and evaluate whether or not a bathing beach is located along the tidal stream and whether or not a bathing beach is located along the estuary, bay or Gulf water that the tidal stream flows into.

3. Riparian Zone (Mark dominant categories with L (Left Bank) and R (Right Bank). Bank orientation is determined by the investigator facing downstream.)

_____ Forest	_____Urban	_____ Rip rap
_____ Shrub dominated corridor	_____ Pasture	_____ Concrete
_____ Herbaceous marsh	_____ Row crops	Other (specify): _____
_____ Mowed/maintained corridor	_____ Denuded/Eroded bank	

4. Ease of bank access to the water body: ☐ Easy ☐Moderately easy ☐Moderately difficult ☐Difficult

5. Please describe access opportunities or explain why the site is not easily accessible (Attach photos for documentation):

_____

_____

_____

_____

6. Dominant Primary Substrate

☐Cobble ☐Sand ☐Silt ☐Mud/Clay ☐Gravel ☐Bedrock ☐Rip rap ☐ Concrete

Field Data Sheet (Page 1 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name_____ Site: _____

Date: _____ Time: _____

B. Primary Contact Water Recreation Evaluation:

- Primary contact recreation definition: Activities that are presumed to involve a significant risk of ingestion of water (e.g. wading by children, swimming, water skiing, diving, tubing, surfing, and the following whitewater activities: kayaking, canoeing, and rafting).

1. Were water recreation activities that involve a significant risk of ingestion (full body immersion) observed at this site?

☐ Yes ☐ No primary contact recreation activities were observed

a. Check the following boxes of primary contact recreation activities observed at the time of the sampling event at the site (Attach photos of the activities or lack of activities).

☐ Wading-Children ☐ Tubing
☐ Wading-Adults ☐ Surfing
☐ Swimming ☐ Whitewater-kayaking, canoeing, rafting
☐ Water skiing ☐ Other : _____
☐ Diving ☐ frequent public swimming-created by publicly owned land or commercial operations

b. Check the number of individuals observed at the site: ☐ None ☐ 1-10 ☐ 11-20 ☐ 20-50 ☐ greater than 50

c. Check the following that apply regarding the individuals proximity to the water body.

☐ Water in mouth or nose of the individual ☐ Primary touch: Individual's body (or portion) immersed in water
☐ Secondary touch: fishing, pets and related contact with water ☐ Individual is in a boat touching water
☐ Individual is on shore near water within 8 meters (25ft) of water ☐ Individual is well away from water between 8 and 30 meters (100 ft) ☐ Not applicable

2. If primary contact recreation activities are not observed, describe the physical characteristics of the water body that may hinder the frequency of primary contact (depth, etc.) (Attach photos, etc. for documentation).

_____
_____

3. Describe if there is public access (e.g. parks, roads, etc.) (Attach photos, maps, etc. for documentation).

_____
_____

4. Is an area with primary contact recreation activities or a bathing beach (e.g. state/local parks with swimming, etc.) located near (e.g. within 5 miles upstream and downstream) this site?

_____
_____

C. Secondary Contact Water Recreation Evaluation:

- Secondary contact recreation 1: Activities that commonly occur but have limited body contact incidental to shoreline activity (e.g. fishing, canoeing, kayaking, rafting and motor boating). These activities are presumed to pose a less significant risk of water ingestion than primary contact recreation but more than secondary contact recreation 2.
- Secondary contact recreation 2: Activities with limited body contact incidental to shoreline activity (e.g. fishing, canoeing, kayaking, rafting and motor boating) that are presumed to pose a less significant risk of water ingestion than secondary contact recreation 1. These activities occur less frequently than secondary contact recreation 1 due to physical characteristics of the water body or limited public access.

Field Data Sheet (Page 2 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name: _____ Site: _____

Date: _____ Time: _____

1. Were water recreation activities observed at the site, but the nature of the recreation does not involve a significant risk of ingestion (e.g. secondary contact recreation activities)? ☐ Yes ☐ No secondary contact recreation activities were observed

a. Check the following boxes of secondary contact recreation activities that were observed at the time of the sampling event at the site (Attach photos of activities or lack of activities).

☐ Fishing
☐ Boating-commercial, recreational
☐ Non-whitewater-kayaking, rafting, canoeing
☐ No secondary contact recreation activities were observed
☐ Other secondary contact activities: _____

b. Check the number of individuals observed at the site.
☐ None ☐ 1-10 ☐ 11-20 ☐ 20-50 ☐ greater than 50

c. Check the following that apply regarding the individuals proximity to the water body.
☐ Secondary touch: fishing, pets and related contact with water ☐ In a boat touching water
☐ Body on shore near water within 8 meters (25ft) of water ☐ Body well away from water between 8 and 30 meters (100 ft)

2. If secondary contact recreation activities are not observed, describe the physical characteristics of the water body that may hinder the frequency of secondary contact (Attach photos, etc. for documentation).
_____
_____

3. If secondary contact recreation activities are observed, how often do water recreational activities occur that do not involve a significant risk of water ingestion? ☐frequently ☐ infrequently
Please describe how often the activities occur? ☐ Unknown ☐ Never ☐ Daily ☐ Monthly ☐ Yearly

4. If infrequently, what is the reason? ☐ physical characteristics of the water body ☐ limited public access ☐ other
If other, list reasons: _____

5. Describe the physical characteristics of the water body that hinders the frequency of secondary contact recreation (depth, etc.) (Attach photos or depth measurements, etc. for documentation).
_____
_____
_____

6. Describe why there is limited public access (e.g. lack of roads, river or stream banks overgrown, etc.) (Attach photos, maps, etc. for documentation).
_____
_____
_____

D. Noncontact Recreation Evaluation

Noncontact recreation applies to water bodies where recreation activities do not involve a significant risk of water ingestion (e.g. activities with limited body contact incidental to shoreline activity, including birding, hiking, and biking), and where primary and secondary contact recreation uses do not occur because of unsafe conditions, such as barge traffic.

1. Provide site-specific information and documentation (including photographs) regarding unsafe conditions, recreation activities, and presence or absence of water recreation activities.
_____
_____

Field Data Sheet (Page 3 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name_____ Site: _____

Date: _____ Time: _____

E. Stream Channel and Substantial Pools Measurements

Please check the following which best describes the river or stream (A non-wadeable stream is one that is too deep to wade. Dry streams are considered wadeable.): □ Wadeable □ Non-wadeable

1. Wadeable Streams

Determine whether or not the average depth at the thalweg is greater than 0.5 meters and if there are substantial pools with a depth of 1 meter or greater. Walk an approximately 300 meter reach (total) at the site and take the following measurements within the 300 meter reach. Measurements should be taken during dry weather flows (sustained or typical dry, warm-weather flows between rainfall events, excluding unusual antecedent conditions of drought or wet weather

Also, take photos facing upstream, downstream, left bank, and right bank at 0 meters, 150 meters, and 300 meters.

Photos #s (0 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (150 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (300 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____

a) Substantial pools - Measure the length of each pool within the 300 meter reach (if > 10 pools only measure 10 pools). Also measure the width (at the widest point) and deepest depth of each pool. A substantial pool is considered a pool greater than 10 meters in length for the purposes of a RUAA Survey. Report measurements to two significant figures. If depths are too deep to measure then report >1.5 meters.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1			
Pool 2			
Pool 3			
Pool 4			
Pool 5			
Pool 6			
Pool 7			
Pool 8			
Pool 9			
Pool 10			

b)Average depth at the thalweg –Take depth measurements every 30 meters within the 300 meter reach to calculate an average depth at the thalweg (at least 11 measurements needed). Report measurements to two significant figures. If depths are too deep at a particular transect to measure then report >1.5 meters. Use 1.5 when calculating the mean.

Distance	Depth (meters)
0 meters	
30 meters	
60 meters	
90 meters	
120 meters	
150 meters	
180 meters	
210 meters	
240 meters	
270 meters	
300 meters	
Average	

Field Data Sheet (Page 4 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name_____ Site: _____

Date: _____ Time: _____

c) Stream width - Measure (1) the width at one point which represents the typical average width of the 300 meter reach; (2) the width at the narrowest point of the stream within the 300 meter reach; and (3) the width at the widest point of the stream within the 300 meter reach. Report measurements to two significant figures.

Measurement Type	Width (meters)
Typical Average Width of 300 meter reach	
Width at narrowest point of the stream within 300 meter reach	
Width at the widest point of the stream within 300 meter reach	

2. Non-wadeable Streams

If accessible, take 11 width measurements which represent typical widths of the 300 meter reach. If the water is too deep the entire 300 meter reach then record the estimated average width of the water body. Report measurements to two significant figures.

Also, take photos facing upstream, downstream, left bank, and right bank at 0 meters, 150 meters, and 300 meters.

Photos #s (0 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (150 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (300 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____

# Measurements	Width (meters)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

Field Data Sheet (Page 5 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name_____ Site: _____

Date: _____ Time: _____

F. Additional RUAA Information. ***Summarize your observations for the entire 300 meter reach.***

1. Check the following activities observed over the site reach.

☐ Drinking or water in mouth	☐ Playing on shoreline
☐ Bathing	☐ Picnicking
☐ Walking	☐ Motorcycle/ATV
☐ Jogging/running	☐ Hunting/Trapping
☐ Bicycling	☐ Wildlife watching
☐ Standing	☐ None
☐ Sitting	☐ Other: _____
☐ Lying down/sleeping	

2. Are there permanent or long-term hydrologic modifications that are constructed and operated in a way that affects the recreational uses? ☐ Yes ☐ No (If yes, please provide supporting documentation and photos.)

Comments: _____

_____

3. Check any channel obstructions that apply (Attach photos).

☐ Culverts	☐ Fences	☐ Log jams	☐ Rip rap	☐ Water control structure
☐ Barbed wire	☐ Dams	☐ Thick vegetation	☐ Low bridges	☐ None
☐ Utility pipe	☐ Other (specify):_____			

4. Check all surrounding conditions that promote recreational activities (Attach photos of evidence or unusual items of interest).

☐ Campgrounds	☐ Stairs/walkway	☐ Roads (paved/unpaved)	☐ Other:_____
☐ Playgrounds	☐ Boating access (ramps)	☐ Populated area	☐ None of the Above
☐ Rural area	☐ Beach	☐ Docks or rafts	
☐ Residential	☐ Bridge crossing	☐ Commercial outfitter	
☐ National forests	☐ Commercial boating	☐ Trails/paths (hiking/biking)	
☐ Urban/suburban location	☐ Nearby school	☐ Power Line Corridor	
☐ Golf Course	☐ Paved parking lot	☐ Parks (national/city/county/state)	
☐ Sports Field	☐ Unimproved parking lot	☐ Public Property	

Comments:_____

_____

5. Check all surrounding conditions that impede recreational activities (Attach photos of evidence or unusual items of interest).

☐ Private Property	☐ Fence
☐ No trespass sign	☐ Barge/ship traffic
☐ Wildlife	☐ Industrial
☐ Steep slopes	☐ None of the Above
☐ No public access	☐ Other:_____
☐ No roads	

Comments:_____

_____

6. Check any indications of human use (Attach photos).

☐ Roads	☐ RV/ATV Tracks	☐ NPDES Discharge	☐ Organized event
☐ Rope swings	☐ Camping Sites	☐ Gates on corridor	☐ No Human Presence
☐ Dock/platform	☐ Fire pit/ring	☐ Children's toys	
☐ Foot paths/prints	☐ Fishing Tackle	☐ Remnants of kids' play	
☐ Other: _____			

Comments_____

_____

Field Data Sheet (Page 6 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name_____ Site: _____

Date: _____ Time: _____

7. Please list any additional items that may impede recreation, such as excessive aquatic vegetation or algae, excessive debris, garbage, snakes, alligators, abundant wildlife, etc.? (Attach photos).

_____
_____
_____
_____

8. Please list any evidence of sustained aquatic habitat such as clam shells, aquatic or marsh vegetation, turtle shells, etc. (Attach photos)

_____
_____
_____
_____

9. Is the site located in a wildlife preserve with large wildlife (i.e waterfowl) population? ☐ Yes ☐ No

10. Please document any other relevant information regarding recreational activities and the water body in general (for example, area outside of the stream reach evaluated).

_____
_____
_____
_____
_____

Field Data Sheet (Page 7 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Severity Value	Description
☐ 1 No Flow	When a flow severity of *1* is recorded for a sampling visit, record a flow value of 0 ft/s (using parameter code 00061) for that sampling visit. A flow severity of *1* describes situations where the stream has water visible in isolated pools. There should be no obvious shallow subsurface flow in sand or gravel beds between isolated pools. "No flow" not only applies to streams with pools but also to long reaches of streams that have water from bank to bank but no detectable flow.
☐ 2 Low Flow	When streamflow is considered low, record a flow-severity value of *2* for the visit, along with the corresponding flow measurement (parameter code 00061). In streams too shallow for a flow measurement where water movement is detected, record a value of < 0.10 ft/s. ***Note:*** Use a stick or other light object to verify the direction of water movement. Make sure the movement is downstream and not the effect of wind. What is low for one stream could be high for another.
☐ 3 Normal Flow	When streamflow is considered normal, record a flow severity value of *3* for the visit, along with the corresponding flow measurement (parameter code 00061). "Normal" is highly dependent on the stream. Like low flow, what is normal for one could be high or low for another.
☐ 4 Flood Flow	Flow-severity values for high and flood flows have long been established by the EPA and are not sequential. Flood flow is reported as a flow severity of *4*. Flood flows are those which leave the confines of the normal stream channel and move out onto the floodplain (either side of the stream).
☐ 5 High Flow	High flows are reported as a flow severity of *5*. High flow would be characterized by flows that leave the normal stream channel but stay within the stream banks.
☐ 6 Dry	When the stream is dry, record a flow-severity value of *6* for the sampling visit. In this case the flow (parameter code 00061) is not reported. This will indicate that the stream is completely dry with no visible pools.

Field Data Sheet (Page 8 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Appendix 4

RUAA Interview Form

Stream Name: _____ Segment #: _____ Site: _____

Interviewer's Name: _____

Date & Time (include AM or PM): _____

Interviewed: ☐ In person ☐ By phone ☐ By mail ☐ By e-mail

☐ No interviews were conducted
If no interviews were conducted, please provide an explanation:
_____
_____

*Are you willing to respond to a short survey about this stream? ☐ Yes ☐ No

Interviewee selected because (e.g., resource manager, Gov. official, conservationist, property owner, local resident, standing by stream, etc.)
_____
_____

Questions:

1. Are you familiar with this stream? ☐ Yes ☐ No If yes, how many years? _____
   If yes, proceed to #2. If no, stop here and do not conduct an interview.

2. What location(s) along the stream are you familiar with:
_____
_____

3. Have the interviewer characterize the stream flow. Since the interviewer may not be familiar with TCEQ's definitions or distinction between the different water bodies, please refer to the definitions listed below when asking this question.

☐ Ephemeral: A stream which flows only during or immediately after a rainfall event
☐ Intermittent: A stream which has a period of zero flow for at least one week during most years. (Channel contains flowing water for only a portion of the year and surface water may be absent at times.)
☐ Intermittent w/ perennial pools: An intermittent stream which maintains persistent pools even when flow in the stream is less than 0.1 cubic feet per second. (When not flowing, the water may remain in isolated pools.)
☐ Perennial: A stream which flows continuously throughout the year.

4. Have you or your family personally used the stream for recreation? ☐ Yes ☐ No
   If yes, proceed to #6. If no, proceed to #5.

5(a). List reasons stream not used. _____
_____

5(b). Proceed to #7.

Interview Form (Page 1 of 2) from TCEQ's 2014 Recreational UAA Procedures.

RUAA Interview Form

Stream Name: _____ Segment #: _____ Site: _____

6.) a) How do you use the stream? ☐ Swimming ☐ Wading-Children
☐ Water Skiing ☐ Wind surfing ☐ Tubing ☐ Wading-Adults
☐ Hunting ☐ Kayaking ☐ Rafting ☐ Trapping ☐ SCUBA diving
☐ Snorkeling ☐ Fishing ☐ Boating ☐ Canoeing ☐ Skin Diving

b) When did these uses occur (e.g. year(s); season) and how often (times/year)?

_____
_____

c) What location did these uses occur (get specific location and mark on a map)?

_____
_____

7. Have you observed others using this stream for recreation? ☐ Yes ☐ No
If yes, proceed to #8. If no, proceed to #9.

8. a) What kinds of uses have you witnessed? ☐ Swimming ☐ Wading-Children
☐ Water Skiing ☐ Wind surfing ☐ Tubing ☐ Wading-Adults
☐ Hunting ☐ Kayaking ☐ Rafting ☐ Trapping ☐ SCUBA diving
☐ Snorkeling ☐ Fishing ☐ Boating ☐ Canoeing ☐ Skin Diving

b) When did these uses occur (e.g. year(s); season) and how often (times/year)?

_____
_____

c) What location did these uses occur (get specific location and mark on a map)?

_____
_____

9. Have you heard about anyone using this stream for recreation? ☐ Yes ☐ No
If yes, proceed to #10. If no, conclude the interview.

10. a) What kind of uses have you heard about? ☐ Swimming ☐ Wading-Children
☐ Water Skiing ☐ Wind surfing ☐ Tubing ☐ Wading-Adults
☐ Hunting ☐ Kayaking ☐ Rafting ☐ Trapping ☐ SCUBA diving
☐ Snorkeling ☐ Fishing ☐ Boating ☐ Canoeing ☐ Skin Diving

b) When did these uses occur (e.g. year(s); season) and how often (times/year)?

_____
_____

c) What location did these uses occur (get specific location and mark on a map)?

_____
_____

11. Can you recommend someone else we could contact that knows the stream? ☐ Yes ☐ No
If yes, list person's contact information: _____
_____

12. Additional comments (from the interviewee or interviewer):

_____
_____

Interview Form (Page 2 of 2) from TCEQ's 2014 Recreational UAA Procedures.

Appendix 5

RUAA Summary
(Not part of the Field Data Sheet)

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: _____
Segment No. or Nearest Downstream Segment No.: _____
Classified?: _____
County: _____

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? _____ meters

   b. Are there substantial pools deeper than 1 meter? yes no

   c. What is the general level of public access?
      easy moderate very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)
   Mild-Extreme Drought Incipient dry spell Near Normal Incipient wet spell Mild-Extreme Wet

RUAA Summary Sheet (Page 1 of 1) from TCEQ's 2014 Recreational UAA Procedures.