Baseline Fish Collections
Lower Sabine River Priority Instream Flow Study

Final Report

Prepared by:

Sabine River Authority of Texas, Texas Commission on Environmental Quality, Texas Parks and Wildlife Department, and Texas Water Development Board

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Executive Summary

Priority instream flow studies under the Texas Instream Flow Program (TIFP) were selected based on potential or planned water development projects, water rights permitting issues, and other factors. A study on the lower Sabine River was prioritized[1] based on the potential for water transfers within the Sabine Basin, proposed inter-basin water transfer projects, and Federal Energy Regulatory Commission hydropower relicensing of the Toledo Bend Dam.

The Lower Sabine River Priority Instream Flow Study was initiated in September 2004 with the Reconnaissance and Information Evaluation[2] phase – the first step of a study under the TIFP. The purpose of the Reconnaissance and Information Evaluation phase, according to the TIFP Technical Overview, is to compile, review, and geo-reference available studies and data, identify historic and current conditions, identify significant issues and concerns, and conduct preliminary field surveys and analysis. During reconnaissance, the Sabine River Authority of Texas (SRA-TX) compiled a bibliography of information related to the Sabine River from the Toledo Bend Dam to the mouth of the Sabine River at the north end of Sabine Lake.

Biological data compiled during reconnaissance included benthic macro-invertebrate and fish data sets from rapid bio-assessments of many of the main tributary streams of the Sabine River in Texas through a basin-wide effort that began in 1993 to characterize the biological community of the priority subwatersheds of the Sabine River Basin. Biological data has also been collected from the main stem of the river for specific studies but not as a basin-wide effort. Most main stem biological data is from a benthic macro-invertebrate monitoring contract with a local industry from 1989-1992 and from some Texas Commission on Environmental Quality (TCEQ) fish collection work near Anacoco Bayou in 2003.

An analysis of the bibliography compiled during reconnaissance revealed a lack of recent biological data for the main stem of the lower Sabine River. In order to have a more complete biological set, a study under Texas Water Development Board (TWDB) Contract No. 0604830567 between the TWDB and the SRA-TX was funded by a TWDB Research and Planning Fund Research Grant.

Collections and habitat assessments were made at eight sites beginning May 2006 through September 2006 by staff from Texas Parks and Wildlife Department, TCEQ, TWDB, and SRA-TX. The magnitude of the effect of Hurricane Rita and the drought of early spring 2006 on the diversity and population of species collected has not yet been assessed. Additional sampling is proposed to mitigate any seasonal or equipment bias as well as to further assess the effects of the hurricane and the drought.

[1] Texas Parks and Wildlife Department, Texas Commission on Environmental Quality, and Texas Water Development Board. Texas Instream Flow Studies: Programmatic Work Plan. December 19, 2002.
[2] Texas Parks and Wildlife Department, Texas Commission on Environmental Quality, and Texas Water Development Board. Texas Instream Flow Studies: Technical Overview. Draft, May 2006.

Introduction

As noted by Annear et al. (2004) and the National Research Council (NRC 2005), a starting point in addressing natural resource questions relative to instream flow evaluations includes attempting to answer many questions about the biological systems being studied. Areas of importance include identifying the overall community composition, determining which assemblages are likely to be affected, establishing any linkages with flow components, and deciding whether certain assemblages or species should be targeted for study. Much of this information may be available through published literature, though often field sampling will be necessary to develop missing data. The results should be a thorough assessment of flora and fauna sufficient to build an understanding of community composition, connectivity, and function (Annear et al. 2004) that will enable construction of a conceptual model relating assemblage dynamics and flow components (subsistence and base flows, high flow pulses and overbank flows; NRC 2005).

According to the Technical Overview (TPWD, TCEQ, and TWDB 2006) of the Texas Instream Flow Program (TIFP), a critical aspect in scoping an instream flow study is the Reconnaissance and Information Evaluation phase, the initial step in a basin study under the TIFP designed to identify existing literature and data and its geographical and temporal coverage, allowing researchers to evaluate data gaps as well as to develop a preliminary conceptual model of the system. Towards that end, Texas Water Development Board (TWDB) Research and Planning Funds were expended during FY04-05 to develop a geo-referenced database that identified literature and data in the areas of hydrology, biology, physical processes, water quality, and connectivity for the lower Sabine River as the first step of the Lower Sabine River Instream Flow Study (Lower Sabine Study).

Further, historical information was gathered from primary literature, agency reports, and museum collections. The Sabine River system has among the greatest fish species richness of the western Gulf Slope drainages (Conner and Suttkus 1986). Sites on the lower Sabine River, downstream of present day Toledo Bend Reservoir, and major tributaries were sampled extensively from the late 1950s through the early 1980s, mainly by Dr. Royal Suttkus and his students, records of which are found in the Tulane University fish collection. Samples from the main stem of the lower Sabine and two major tributaries, Big Cow Creek and Bayou Anacoco, include more than 85 species of fish, some of which are estuarine or marine. Conner and Suttkus (1986) considered the Sabine and Neches drainages to include 77 strictly freshwater species. The museum records document more than 200 collections in the lower Sabine, greater than 90 in Bayou Anacoco, and approximately 15 in Big Cow Creek. Geographical coverage for collections in the Sabine River proper was fairly extensive from above the confluence with Bayou Anacoco downriver to the Cypress Creek confluence, just upstream of Highway 12 near Deweyville. However, systematic collecting has been infrequent in recent years, creating temporal gaps in the record.

The goal of the biological study documented by this report was to conduct new collections to fill information gaps concerning fish assemblages identified during reconnaissance. Further, these collections were aimed at improving baseline data of the Lower Sabine Study area, supplementing information needed for understanding trends in fish assemblage dynamics, and allowing preparation of a conceptual model of fish assemblage dynamics in the study area.

This work, supported by a TWDB Research and Planning Fund Research Grant, Contract No. 0604830567, was conducted cooperatively by the Sabine River Authority of Texas (SRA-TX), Texas Commission on Environmental Quality (TCEQ) Texas Parks and Wildlife Department (TPWD), and TWDB. The Scope of Work is included in Appendix A.

Study Scope

Study Area Description

The Lower Sabine Study area includes the Sabine River from its mouth where the Sabine River flows into Sabine Lake (river mile 0) to the Toledo Bend Dam (river mile 156.45) and encompasses Texas Surface Water Quality Standards stream segments 0503, 0502, and 0501. Unique among priority instream flow studies under the TIFP, the lower Sabine River is a bi-state river in which one-half of the flow belongs to Texas and one-half belongs to Louisiana. The watershed of the lower Sabine River within the study area has a contributing drainage area from both Texas and Louisiana of approximately 2,578 square miles (Espey, Huston & Associates, Inc. 1985).

The study area is primarily rural, wooded, and isolated, with only five river crossings throughout the entire length of the lower Sabine River. The lower Sabine River between Toledo Bend Dam and US 190 is slow-moving, meandering, and largely characterized by cut-banks and sand bars. Below US 190 to its mouth, the river gradually changes from cut-banks and sand bars to a more swamp-like appearance (Belisle and Josselet 1974).

A study area map (Figure 1) is included in Appendix B.

Site Selection

The SRA-TX, TCEQ, TPWD, and TWDB coordinated to select representative sampling locations to fill baseline data needs within the lower Sabine Basin. Site selection considerations included:

- Select at least one representative site in each reach of the lower Sabine River
    - Reach 1 – the Blue Elbow area (Segment 0501)
    - Reach 2 – Big Cypress Creek area (Segment 0502)
    - Reach 3 – Little Cow Creek area (Segment 0503)
- Select tributary areas providing sanctuary to the biological population

In selecting sampling locations for this study, efforts were made to fill geographical data gaps as well as update collections at sites that have been infrequently sampled in recent years. Eight sites were ultimately selected, with six sites spread longitudinally along the Sabine River and two sites on major tributaries – Bayou Anacoco, and Big Cow Creek. Extensive historical data was available for six sites—5030, 5040, 5050, 5060, 5070, and 5080. The most downstream sites, upstream of Indian Lake (5020) and at Blue Elbow (5010), were added to extend the geographical coverage of sampling, since historical data has not been identified for those reaches. Locations and descriptions of sites sampled in this study are provided in Table 1 and an aerial photograph of each site (Figures 2 – 9) is found in Appendix B.

Table 1. Site locations and descriptions

Site No.	Latitude	Longitude	Location Description	County 1	County 2
5080	31.06389	-93.51917	Sabine River at Burkeville	Newton	Beauregard Parish, LA
5070	30.86833	-93.55833	Sabine River At Bayou Anacoco	Newton	Beauregard Parish, LA
5060	30.86778	-93.50889	Bayou Anacoco Upstream of Sabine River Confluence	Beauregard Parish, LA	
5050	30.74667	-93.60806	Sabine River Downstream of Bon Wier	Newton	Beauregard Parish, LA
5040	30.60611	-93.79417	Big Cow Creek at FM 1416	Newton	
5030	30.35750	-93.75639	Sabine River Upstream of Deweyville	Newton	Calcasieu Parish, LA
5020	30.23500	-93.71111	Sabine River Upstream of Indian Lake	Orange/Newton	Calcasieu Parish, LA
5010	30.14694	-93.70944	Sabine River at Blue Elbow	Orange	Calcasieu Parish, LA

Sampling Scheduling

Collection events were scheduled in consideration of:

- River flow as it is influenced by
    - Toledo Bend Dam hydropower releases
        - Hydropower peaking period of May – September
        - Hydropower releases related to rainfall
    - Sabine River Basin rainfall
        - Rainfall above Toledo Bend Dam requiring spillway releases from the reservoir
        - Localized rainfall
- Biological population recovery from Hurricane Rita
- River conditions and collection needs rather than an arbitrary contract period

Methodology

In general, sampling methods for fish assemblages follow those outlined in *Surface Water Quality Monitoring Procedures, Vol. 2: Methods for Collecting and Analyzing Biological Community Habitat Data* (TCEQ 2005). Though sampling protocols follow that outlined in the above reference, fish collections were segregated by identified major habitat types (e.g., riffle, run, pool). Since the goal in baseline fish sampling is to collect a representative sample of the species present in their relative abundances, all available habitats and combinations of habitats were sampled with the most effective sampling gear that could be feasibly deployed. Habitat data were collected for each sampling event.

A reach was located for each study site that measured 40 times the mean wetted width of the stream up to 1000 m. Reaches may have exceeded 1000m if the scale of the stream dictated in order to cover at least one full meander wavelength. This ensured that the reach included most of the representative habitats in the area of the study site.

Seines were used at each study site. Deep pools and runs were typically sampled with a 9.1 m x 1.8 m x 6.4 mm mesh seine, whereas riffles, runs, and small pools were usually sampled using a 4.6 m x 1.8 m x 4.8 mm or a 1.8 m x 1.8 m x 4.8 mm mesh seine. A minimum of 10

effective seine hauls were made but sampling continued until no new species were added. The number of effective seine hauls, the length of seine, and a measurement of the distance of each seine haul were recorded.

Backpack electrofishers (Smith-Root Model 12) were used in wadeable areas that could not be sampled as effectively with other methods; most sites did not require the use of backpack electrofishers. Boat-mounted electrofishers (Smith-Root GPP series) were used in non-wadeable habitats, such as deep pools or runs. All species observed but not captured were noted (along with an estimated total length). Sites were sampled (with one or both types of electrofishers) for a minimum of 900 seconds of combined actual shock time.

Fish samples were preserved for each sampling event (each seine haul or habitat type shocked) and processed independently (e.g., one seine haul was processed separately from another seine haul). Fish that were too large for sample containers were positively identified, measured on a portable measuring board (total length), checked for disease or anomaly, photographed for vouchering, and released.

A global positioning system receiver was used to take a location at the mid-point of each habitat type sampled (datum=WGS84; units=decimal degrees; reception=3D) and was tied to a photograph of habitat sampled. Average habitat depth, dominant substrate type, instream cover type and density, and current velocity were measured and recorded for each sampling event. Typically a Marsh-McBirney electronic flow meter was used to collect current velocity, and depth was measured using a top-setting wading rod. In some cases, an Acoustic Doppler Current Profiler was used to collect representative depth and velocity measurements. Habitat type and lateral location (e.g., bank, mid-channel) were recorded for each sampling event. Substrate was classified using the modified Wentworth scale and instream cover was classified using quartiles and codes. A sampling protocol and field guide were developed and used to ensure consistency in reach layout, habitat measurements, and fish sampling.

Results

Data collection occurred:

- May 16 – 18, 2006 -- Collection at 5070 (Sabine River at Bayou Anacoco), 5050 (Sabine River Downstream of Bon Wier), and 5040 (Big Cow Creek at FM 1416);
- July 13 – 15, 2006 -- Collection at 5010 (Sabine River at Blue Elbow), 5020 (Sabine River Upstream of Indian Lake), and 5030 (Sabine River Upstream of Deweyville); and
- September 18 – 19, 2006 -- Collection at 5080 (Sabine River at Burkeville) and 5060 (Bayou Anacoco Upstream of Sabine River Confluence).

Table 2 shows the mean discharge at the three US Geological Survey (USGS) gages on the lower Sabine River, Big Cow Creek, and Bayou Anacoco on collection days.

Table 2. Discharge at USGS Gages on Sabine River and Sampled Tributaries

		Mean Discharge, CFS				
Collection Date	Station	Burkeville	Bon Wier	Ruliff	Big Cow Creek	Bayou Anacoco
		8026000	8028500	8030500	08029500	08028000
5/16/2006	5070	2,760	1,890	3,420		
5/17/2006	5050	2,820	3,100	3,420		
5/18/2006	5040	2,890	3,170	3,180	48	
7/13/2006	5010	5,130	2,900	1,540		
7/14/2006	5020	5,180	4,960	1,720		
7/15/2006	5030	4,180	5,080	3,850		
9/18/2006	5080	498	604	1,220		
9/19/2006	5060	555	653	1,160		152

Habitat results and fish data are compiled on succeeding pages in Table 3 and Table 4 respectively. Complete sets of data at these sites as well as photographs are available on a DVD accompanying this report and described in Appendix C.

Table 3. Summary of depth, velocity, and dominant substrate types by site, sample collection method, and habitat

										Number of samples					
			Number	Depth (ft)			Velocity (ft/s)			Silt/			Rubble/		
Site_id	Method	Habitat	of samples	Min	Mean	Max	Min	Mean	Max	Clay	Sand	Gravel	Cobble	Boulder	Bedrock
5010	BE	pool	6	4.9	10.4	21.1	0.87	0.94	0.97	6	0	0	0	0	0
5010	BP	backwater	1	0.5	0.5	0.5	-0.04	-0.04	-0.04	1	0	0	0	0	0
5010	BP	run	4	0.7	1.1	1.7	-0.07	0.02	0.09	3	1	0	0	0	0
5010	S	backwater	1	0.5	0.5	0.5	-0.05	-0.05	-0.05	1	0	0	0	0	0
5010	S	run	9	1.0	1.6	2.1	-0.13	0.14	0.53	2	7	0	0	0	0
5020	BE	backwater	1	4.7	4.7	4.7	1.28	1.28	1.28	1	0	0	0	0	0
5020	BE	run	5	4.2	5.4	7.2	1.74	1.92	2.20	5	0	0	0	0	0
5020	S	backwater	5	1.1	2.1	4.0	-0.72	-0.11	0.18	3	2	0	0	0	0
5020	S	run	11	1.4	2.3	4.2	0.29	0.83	1.52	4	7	0	0	0	0
5030	BE	backwater	1	9.3	9.3	9.3	0.99	0.99	0.99	1	0	0	0	0	0
5030	BE	pool	1	5.7	5.7	5.7	1.65	1.65	1.65	1	0	0	0	0	0
5030	BE	run	8	4.5	8.2	12.0	1.10	1.62	2.10	7	1	0	0	0	0
5030	S	backwater	2	3.1	3.5	3.9	-0.21	-0.10	0.02	1	1	0	0	0	0
5030	S	run	8	1.6	2.4	3.8	0.29	0.73	1.22	1	7	0	0	0	0
5040	BP	backwater	2	0.5	1.4	2.3	-0.13	-0.09	-0.04	0	2	0	0	0	0
5040	BP	run	7	1.2	1.9	2.8	0.27	0.93	1.28	0	7	0	0	0	0
5040	S	pool	1	1.8	1.8	1.8	1.40	1.40	1.40	0	1	0	0	0	0
5040	S	riffle	1	1.6	1.6	1.6	1.54	1.54	1.54	0	0	1	0	0	0
5040	S	run	9	0.4	1.6	4.0	-0.80	0.77	1.82	4	5	0	0	0	0
5050	BE	backwater	1	9.5	9.5	9.5	1.73	1.73	1.73	1	0	0	0	0	0
5050	BE	pool	1	4.8	4.8	4.8	1.45	1.45	1.45	0	1	0	0	0	0
5050	BE	run	5	5.8	8.0	12.1	1.46	1.63	1.88	0	5	0	0	0	0
5050	BP	backwater	1	11.2	11.2	11.2	-0.02	-0.02	-0.02	1	0	0	0	0	0
5050	BP	run	1	1.4	1.4	1.4	0.05	0.05	0.05	1	0	0	0	0	0
5050	S	backwater	1	2.5	2.5	2.5	-0.50	-0.50	-0.50	0	1	0	0	0	0
5050	S	run	14	0.5	1.6	3.1	0.41	1.17	1.98	0	14	0	0	0	0

[sample collection method: seine "S", boat electrofishing "BE", backpack electrofishing "BP"]

Table 3 (continued). Summary of depth, velocity, and dominant substrate types by site, sample collection method, and habitat

										Number of samples					
			Number	Depth (ft)			Velocity (ft/s)			Silt/			Rubble/		
Site_id	Method	Habitat	of samples	Min	Mean	Max	Min	Mean	Max	Clay	Sand	Gravel	Cobble	Boulder	Bedrock
5060	BE	pool	1	3.5	3.5	3.5	0.86	0.86	0.86	0	0	0	0	0	0
5060	BP	run	4	0.6	1.0	1.3	0.54	0.83	1.18	0	4	0	0	0	0
5060	S	backwater	1	1.0	1.0	1.0	-0.03	-0.03	-0.03	1	0	0	0	0	0
5060	S	riffle	2	0.3	0.6	0.8	0.89	1.15	1.41	0	2	0	0	0	0
5060	S	run	7	0.5	1.0	1.6	1.18	1.54	2.19	1	6	0	0	0	0
5070	BE	run	6	3.6	9.0	12.1	1.13	1.82	2.37	0	6	0	0	0	0
5070	BP	backwater	1	1.4	1.4	1.4	-0.16	-0.16	-0.16	1	0	0	0	0	0
5070	BP	pool	1	1.2	1.2	1.2	0.03	0.03	0.03	1	0	0	0	0	0
5070	BP	run	4	0.9	1.4	2.0	0.41	0.81	1.09	1	3	0	0	0	0
5070	S	backwater	1	1.5	1.5	1.5	1.12	1.12	1.12	0	1	0	0	0	0
5070	S	run	12	0.5	1.9	3.3	0.49	1.08	1.77	6	6	0	0	0	0
5080	BP	backwater	2	0.9	1.4	1.8	0.00	0.00	0.00	0	1	1	0	0	0
5080	BP	run	5	0.5	1.7	2.5	0.09	0.37	0.85	1	4	0	0	0	0
5080	S	backwater	2	1.0	1.7	2.4	0.16	0.22	0.28	0	2	0	0	0	0
5080	S	run	9	1.1	1.8	3.7	0.01	0.62	1.35	0	9	0	0	0	0

[sample collection method: seine "S", boat electrofishing "BE", backpack electrofishing "BP"]

Table 4. Fish species collected at Sabine River Basin sites during 2006

Species	Common name	5010	5020	5030	5040	5050	5060	5070	5080
Alosa chrysochloris	skipjack herring			X					
Amia calva	bowfin	X							
Ammocrypta vivax	scaly sand darter		X	X	X	X	X	X	
Anchoa mitchilli	bay anchovy	X							
Anguilla rostrata	American eel					X			
Aphredoderus sayanus	pirate perch				X		X		
Aplodinotus grunniens	freshwater drum		X						
Atractosteus spatula	alligator gar			X					
Brevoortia patronus	Gulf menhaden	X							
Carpiodes carpio	river carpsucker		X			X		X	
Citharichthys spilopterus	bay whiff	X							
Cycleptus elongatus	blue sucker					X			
Cyprinella venusta	blacktail shiner		X	X	X	X	X	X	X
Dorosoma cepedianum	gizzard shad	X	X	X		X		X	
Dorosoma petenense	threadfin shad	X	X			X		X	
Elassoma zonatum	banded pygmy sunfish							X	
Esox americanus	redfin pickerel					X			
Etheostoma histrio	harlequin darter				X				X
Fundulus chrysotus	golden topminnow					X			
Fundulus notatus	blackstripe topminnow			X	X	X	X	X	X
Fundulus olivaceus	blackspotted topminnow		X		X				X
Gambusia affinis	western mosquitofish	X	X	X	X	X		X	X
Hybognathus nuchalis	Mississippi silvery minnow		X	X	X	X			
Hybopsis amnis	pallid shiner						X		
Ichthyomyzon sp. (larval)	larval lamprey				X				
Ictalurus furcatus	blue catfish		X	X		X			
Ictalurus punctatus	channel catfish	X	X			X	X		

Table 4 (continued). Fish species collected at Sabine River basin sites during 2006

Species	Common name	5010	5020	5030	5040	5050	5060	5070	5080
Ictiobus bubalus	smallmouth buffalo			X		X			
Lagodon rhomboides	pinfish	X							
Lepisosteus oculatus	spotted gar	X	X	X	X	X		X	
Lepisosteus osseus	longnose gar	X	X	X		X			
Lepomis gulosus	warmouth				X	X			
Lepomis macrochirus	bluegill	X	X	X	X	X	X	X	X
Lepomis megalotis	longear sunfish		X	X	X	X	X	X	X
Lepomis microlophus	redear sunfish	X	X	X		X		X	
Lepomis miniatus	redspotted sunfish		X		X				
Lythrurus fumeus	ribbon shiner				X				
Macrhybopsis hyostoma	shoal chub		X	X			X		
Menidia beryllina	inland silverside	X	X	X					
Micropterus punctulatus	spotted bass	X	X	X	X	X	X	X	X
Micropterus salmoides	largemouth bass	X	X	X	X	X		X	
Minytrema melanops	spotted sucker	X	X	X	X	X		X	
Moxostoma poecilurum	blacktail redhorse		X	X	X	X		X	
Mugil cephalus	striped mullet	X	X	X		X		X	
Notropis sabinae	Sabine shiner			X	X	X	X	X	
Notropis texanus	weed shiner		X	X	X	X	X		
Notropis volucellus	mimic shiner			X	X		X	X	
Noturus nocturnus	freckled madtom				X		X		
Opsopoeodus emiliae	pugnose minnow		X	X					
Paralichthys lethostigma	southern flounder	X							
Percina sciera	dusky darter			X	X	X	X	X	X
Phenacobius mirabilis	suckermouth minnow					X		X	
Pimephales vigilax	bullhead minnow		X	X	X	X	X	X	
Pomoxis annularis	white crappie					X		X	

Table 4 (continued). Fish species collected at Sabine River basin sites during 2006

Species	Common name	5010	5020	5030	5040	5050	5060	5070	5080
Pomoxis nigromaculatus	black crappie		X			X			
Pylodictis olivaris	flathead catfish		X			X	X		
Strongylura marina	Atlantic needlefish	X				X		X	X
Trinectes maculatus	hogchoker	X	X			X			

Conclusions

Concurrent to this project, Dr. Tim Bonner, Texas State University, has been preparing annotated species lists that outline historical fish species distribution and abundance within the Lower Sabine Study area (as well as in the San Antonio and Brazos rivers), temporal trends in occurrence, life history information, and linkages between life history and physical habitat, and other environmental requirements. The overall intent of that project is to develop an understanding of fish assemblage dynamics.

This project complements that work by providing current information about fish assemblages in the lower Sabine River and filling obvious spatial and temporal data gaps. Additional work is anticipated in evaluating sub-basin areal and historical trends in fish species occurrence and assemblage dynamics as well as preliminary efforts to evaluate habitat utilization and guilding. Historical and contemporary species occurrences will be examined for geographical trends, to determine any discernable differences in fish assemblages over time, and to identify additional sampling strategies for augmenting the collection record. Habitat and fish assemblage data from this study will be analyzed to evaluate correlations between physical habitat variables and species occurrence. Preliminary consideration will also be given to defining mesohabitat-based guilds for future testing.

Recommendations for Additional Work

Since this study was conducted during principally the summer months, it would be useful to revisit some sites during winter and spring, employing the same fish collection and habitat assessment methods. This would provide an opportunity to collect additional species which may have been missed during the summer and provide information on seasonal habitat associations. Further, additional sampling should be conducted using hoop nets to ensure detection of larger species. Sampling additional tributary sites would be helpful to better establish relationships between tributary and main stem populations.

Fish sampling for this contract study began in May 2006, eight months after Hurricane Rita made landfall as a Category 3 storm near Sabine Pass on September 24, 2005. Hurricane Rita altered normal conditions in the lower Sabine River resulting in a major fish kill and in the addition of tons of organic material into the river. The Sabine River, from its mouth to Toledo Bend, was affected in varying degrees by the storm. Thousands of fish were killed in the lower Sabine River and tributaries for at least the lower 50 river miles of the study area due to the anoxic conditions caused by the storm. Tree leaves were shredded by the wind action and that organic material as well as downed trees was added to the river and the watershed area. The biological diversity in the Lower Sabine Study area during the collection period was not reflective of pre-Rita conditions, and the extent to which the overall fish assemblages were impacted by that event has not been determined.

Fish diversity and populations considered normal prior to Rita may have been altered. Additional fish sampling should occur over several years during all seasons in order to track recovery from the storm and to establish a new baseline for the lower Sabine River.

The impact of Hurricane Rita was followed in 2006 by the Lower Sabine Study area receiving below average rainfall in the early spring, a time of historical higher precipitation and higher river flow. However, by the second week of July 2006, during a historically dry time, the study area had more than made up the rainfall deficit for the year. To date, July 2006 is one of the wettest on record.

Finally, TCEQ, TPWD, and TWDB should coordinate with like agencies from the State of Louisiana on additional work on the Lower Sabine Study.

References

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Appendix A Scope of Work

Scope of Work

SUPPLEMENT EXISTING BIOLOGICAL DATA
Lower Sabine River Priority Instream Flow Study Area

Background: A preliminary evaluation of existing biological data in the lower Sabine River basin indicated potential gaps in historical collections that should be supplemented to allow a thorough understanding of the system and its biology. The goal of this proposal is to conduct new biological collections, which would facilitate a better understanding of the fish assemblage dynamics within this basin. These collections are aimed at improving baseline data as part of scoping the potential instream flow study in this basin and allowing preparation of a conceptual model of fish assemblage dynamics in the study area.

Task 1: Collect fish assemblage and associated data

Through coordination between the Sabine River Authority of Texas (SRA-TX), Texas Parks and Wildlife Department, Texas Water Development Board, and Texas Commission on Environmental Quality (TCEQ), the Tri-agencies, representative sampling locations will be developed to fill baseline data needs within the lower Sabine River Basin. Site selection and collection scheduling considerations are:

- At least one representative site in each reach of the lower Sabine River
  1. Reach 1
     - Blue Elbow area
  2. Reach 2
     - Big Cypress Creek area
  3. Reach 3
     - Little Cow Creek area
- Tributary areas providing sanctuary to the biological population should also be considered in sampling site selection
- Collection events should be scheduled in consideration of
  1. River flow as it is influenced by
     a. Toledo Bend Dam hydropower releases
        i. Hydropower peaking period of May – September
        ii. Hydropower releases related to rainfall
     b. Sabine River Basin rainfall
        i. Rainfall above Toledo Bend Dam requiring spillway releases from the reservoir
        ii. Localized rainfall
  2. Biological population recovery from Hurricane Rita
  3. River conditions and collection needs rather than an arbitrary contract period

In general, sampling methods for fish assemblages will follow those outlined in *Surface Water Quality Monitoring Procedures, Vol. 2: Methods for Collecting and Analyzing Biological Community Habitat Data* (TCEQ 2005). Collections will include boat and backpack

electroshocking as well as seining, as appropriate. The Tri-agencies will provide the electroshocking boat and staff to oversee its operation. Tri-agency staff will also assume leadership for each collection event with the SRA-TX providing four biologists per event. SRA-TX staff will use a global positioning system receiver to determine the geographic location of each habitat at the mid-point, and the location will be associated with an upstream, downstream, left bank, and right bank photograph (left and right banks as facing downstream). Tri-agency and SRA-TX staff will measure the average habitat depth, dominant substrate, and current velocity.

The field sampling sites, sampling frequency, and schedule will be determined jointly by the tri-agencies and the SRA-TX.

Task 2: Identify fishes, prepare species lists, and report data

Tri-agency and SRA-TX staff will identify fishes collected in the field following the requirements for identification, retention, and vouchering outlined in the TCEQ manual cited above. Tri-agency staff will oversee project quality assurance. SRA-TX staff will report fish assemblage, location, and habitat information in a Microsoft Excel format provided by the tri-agencies. SRA-TX staff will submit digital photographs in JPEG format and the photographs will be georeferenced.

Project budget

Field Collections	$13,980.00
Data Management	$2,000.00
Report Preparation	$1,200.00
Fringe Benefits (25%)	$4,295.00
Travel / Mileage	$2,525.00
TOTAL DIRECT COSTS	$24,000.00
Total Indirect Costs (0%)	$ -
TOTAL PROJECT COSTS	$24,000.00

Budget Task 1	$ 20,000.00
Budget Task 2	$ 4,000.00

Appendix B Maps of Study Area and Collection Sites

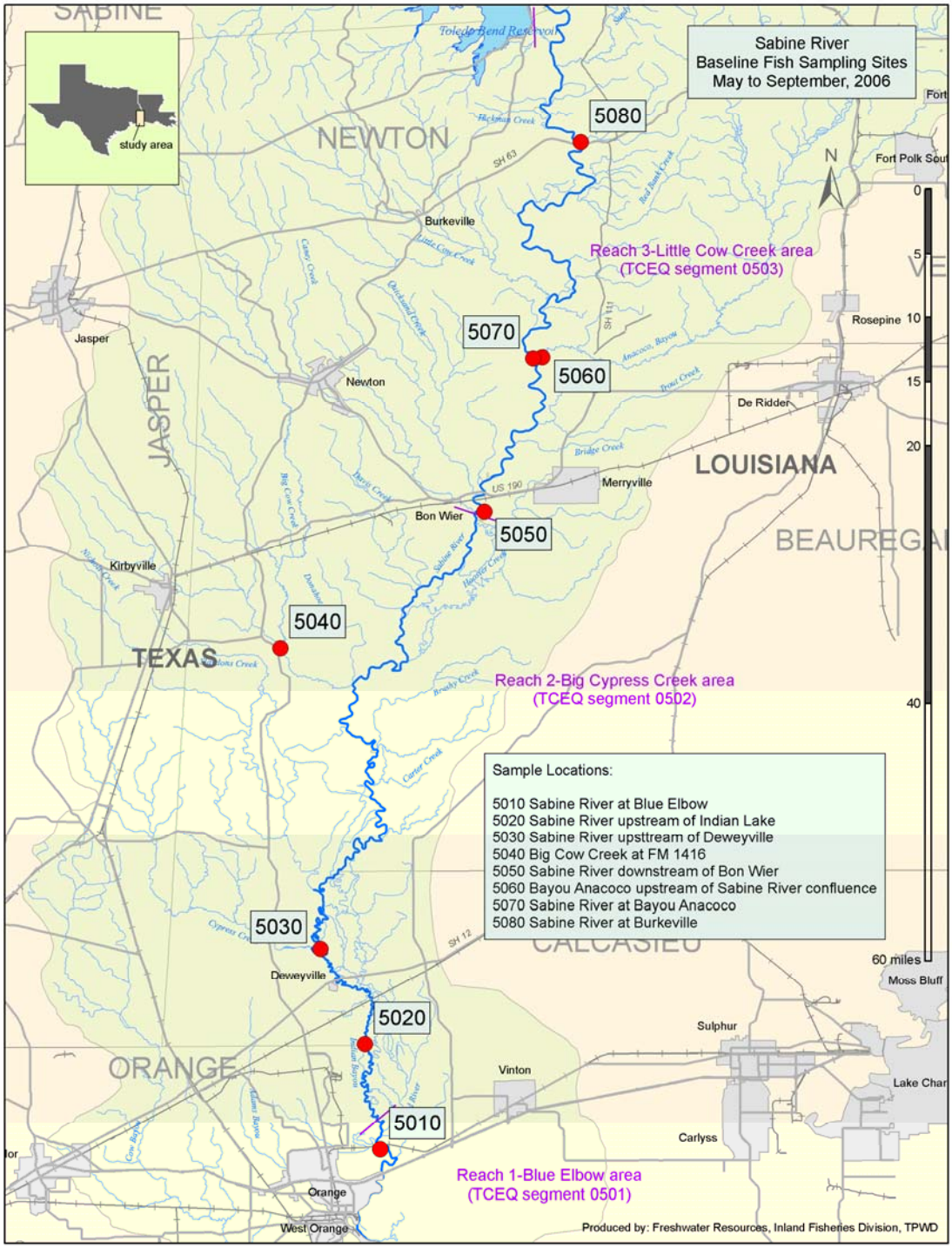

Figure 1. Sabine River Baseline Fish Sampling Sites, May to September 2006

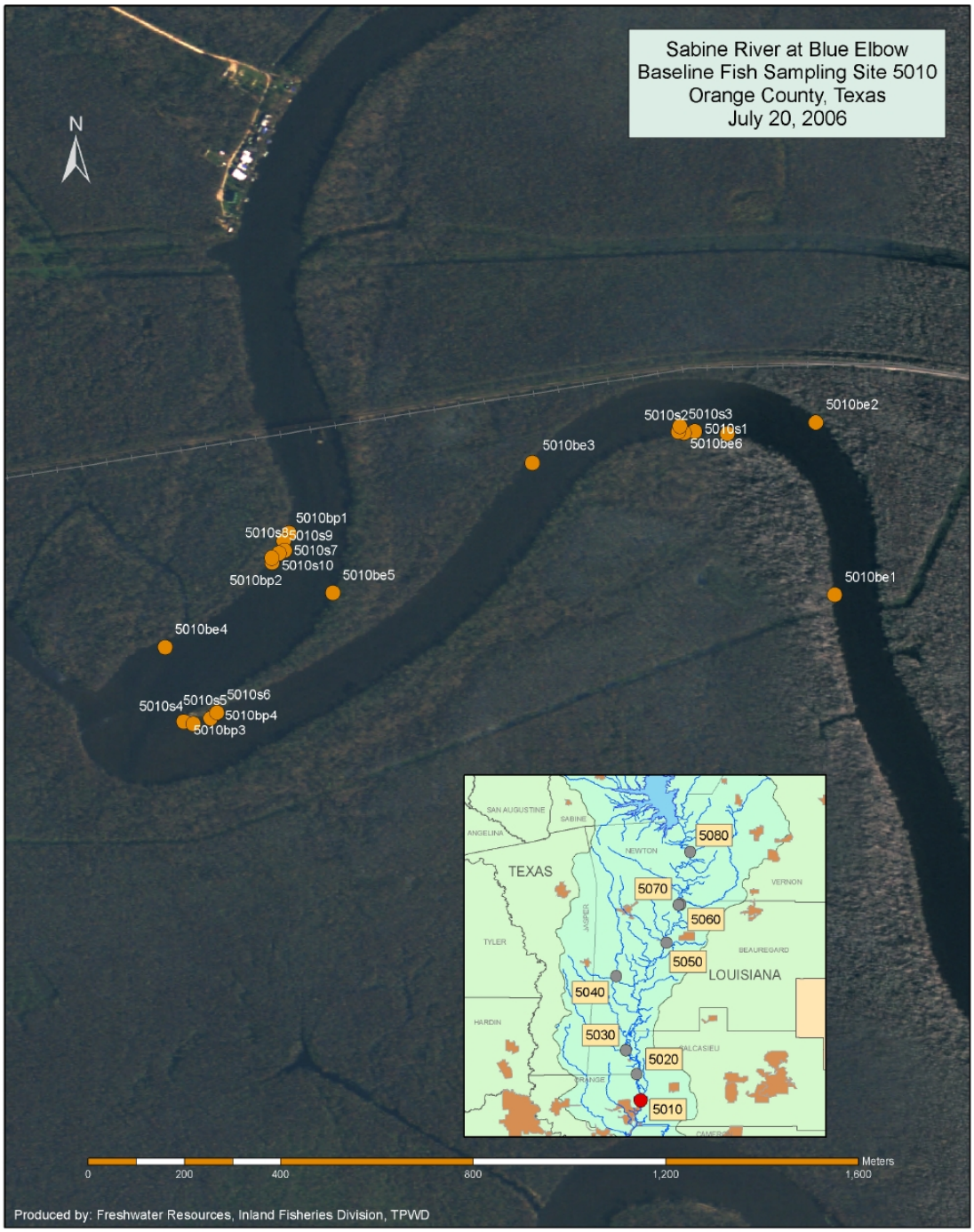

Figure 2. Site 5010, Sabine River at Blue Elbow

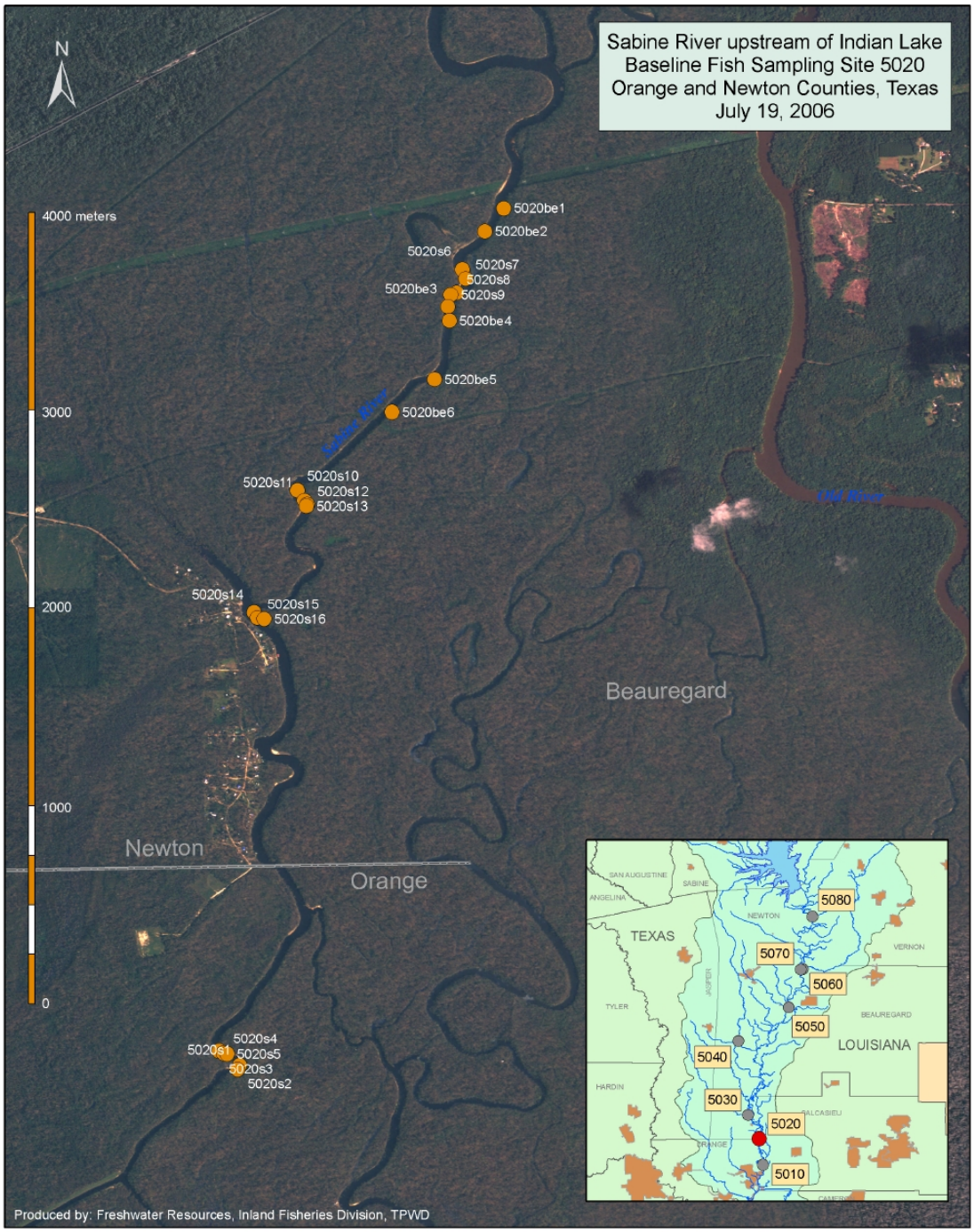

Figure 3. Site 5020, Sabine River Upstream of Indian Lake

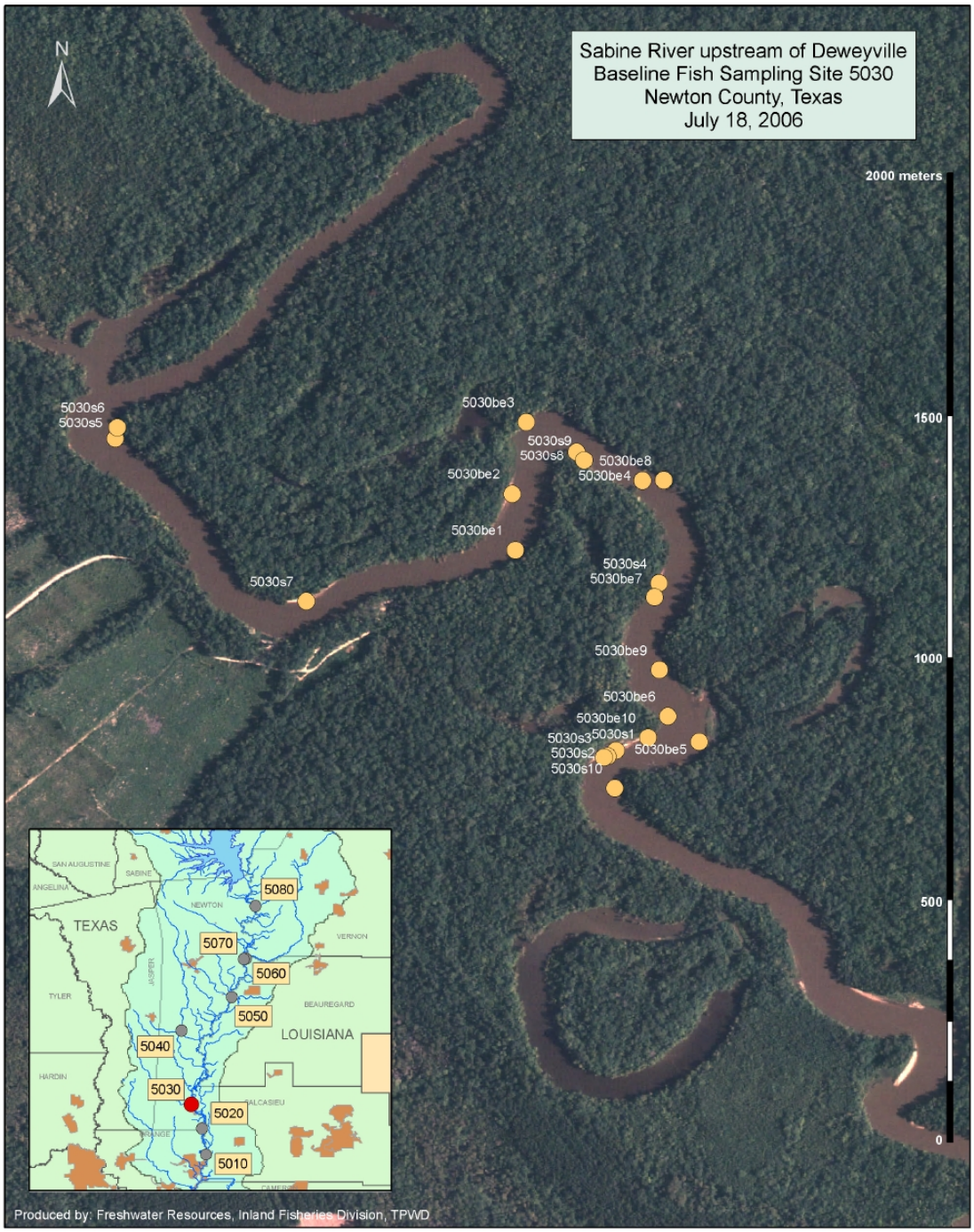

Figure 4. Site 5030, Sabine River Upstream of Deweyville, Texas

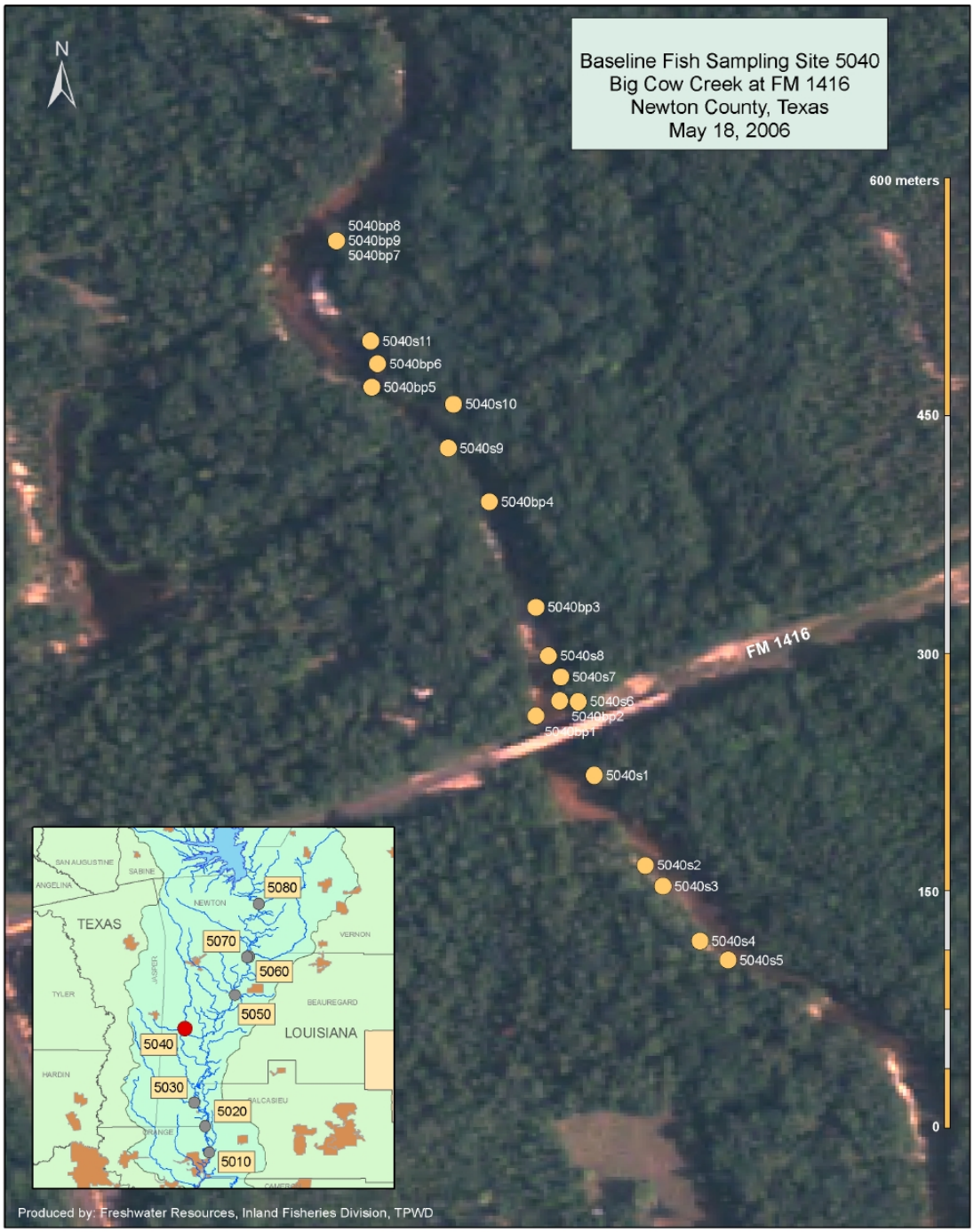

Figure 5. Site 5040, Big Cow Creek at FM 1416

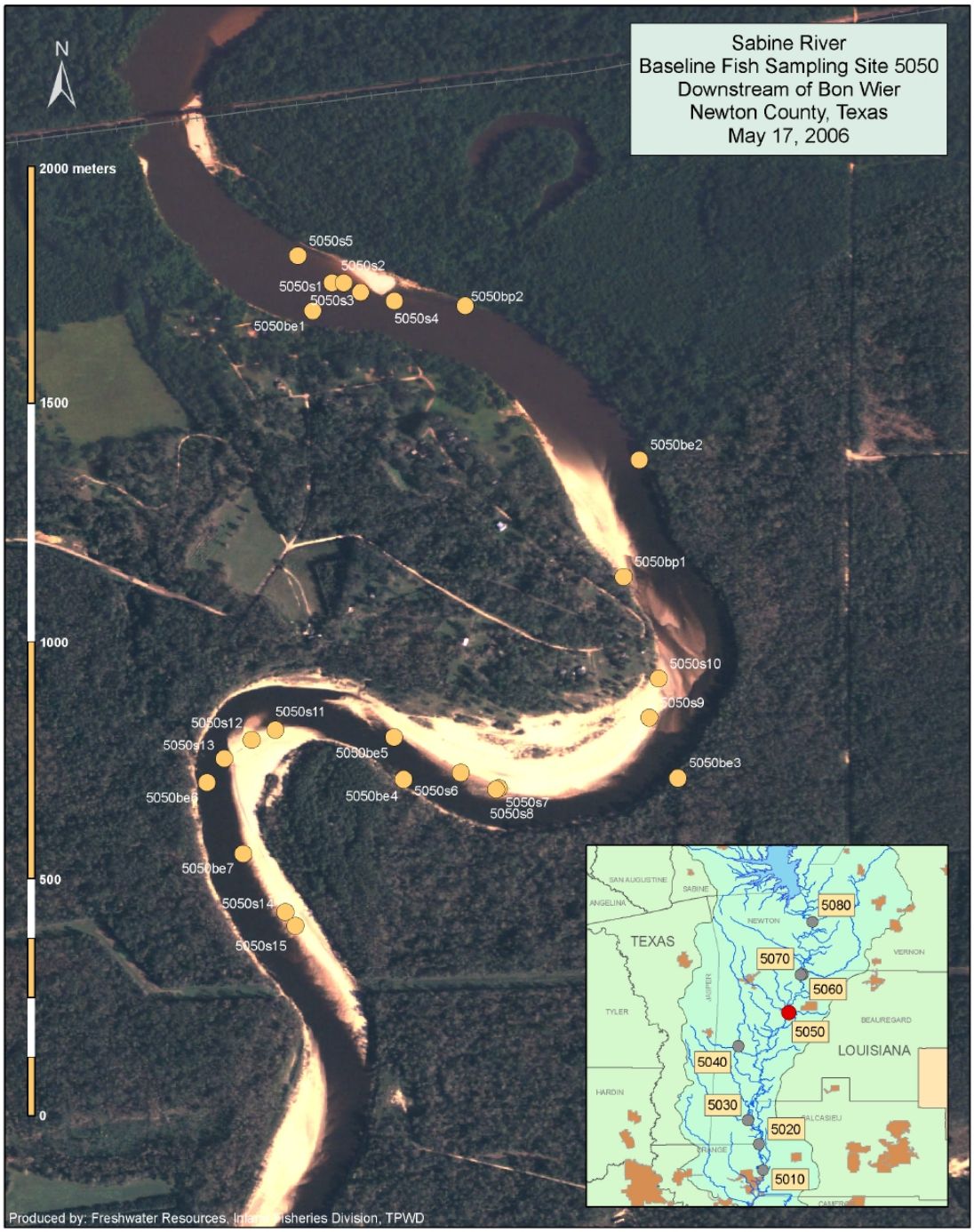

Figure 6. Site 5050, Sabine River Downstream of Bon Wier, Texas

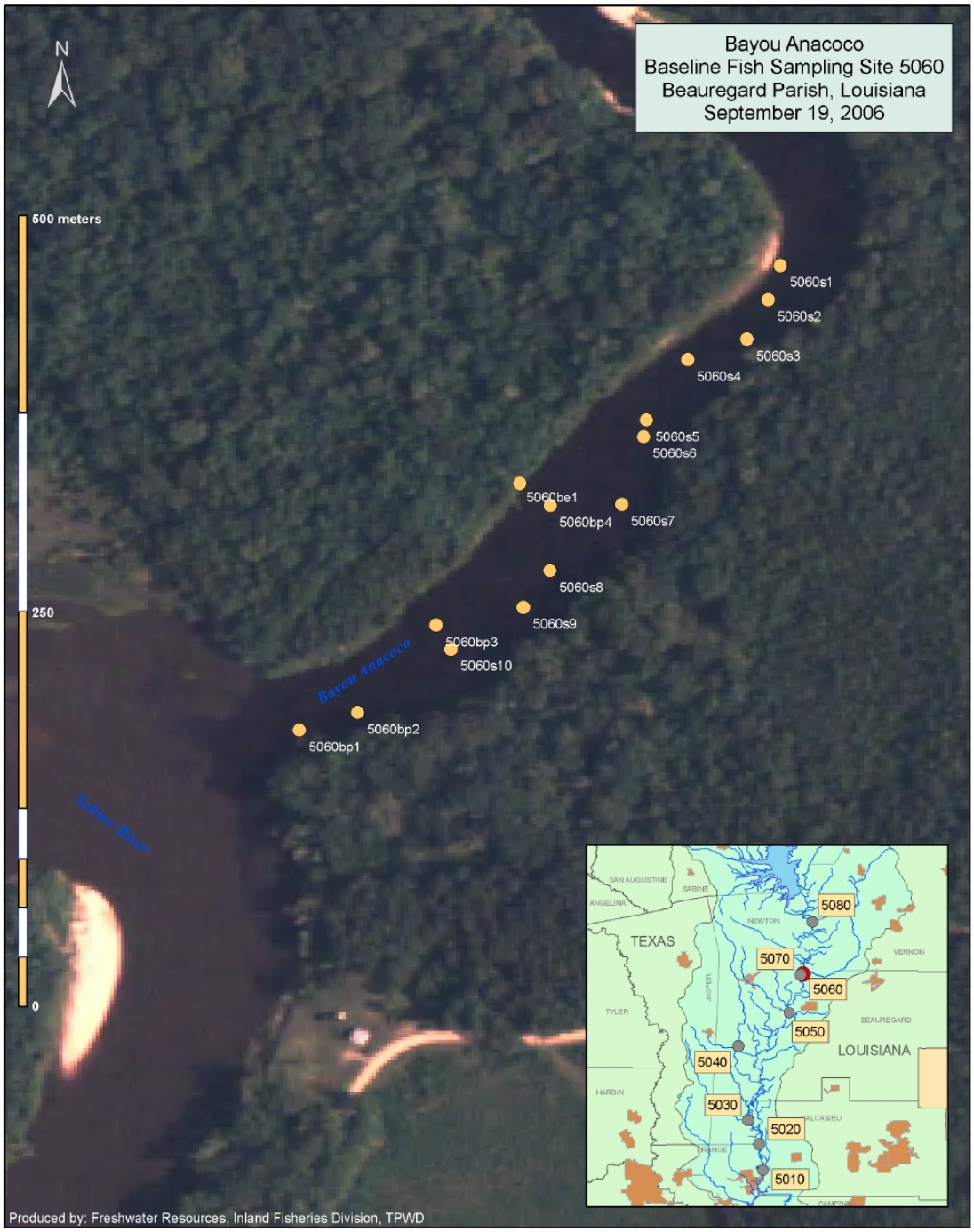

Figure 7. Site 5060, Bayou Anacoco
[NOTE: 5060be1 sampled 05/16/06]

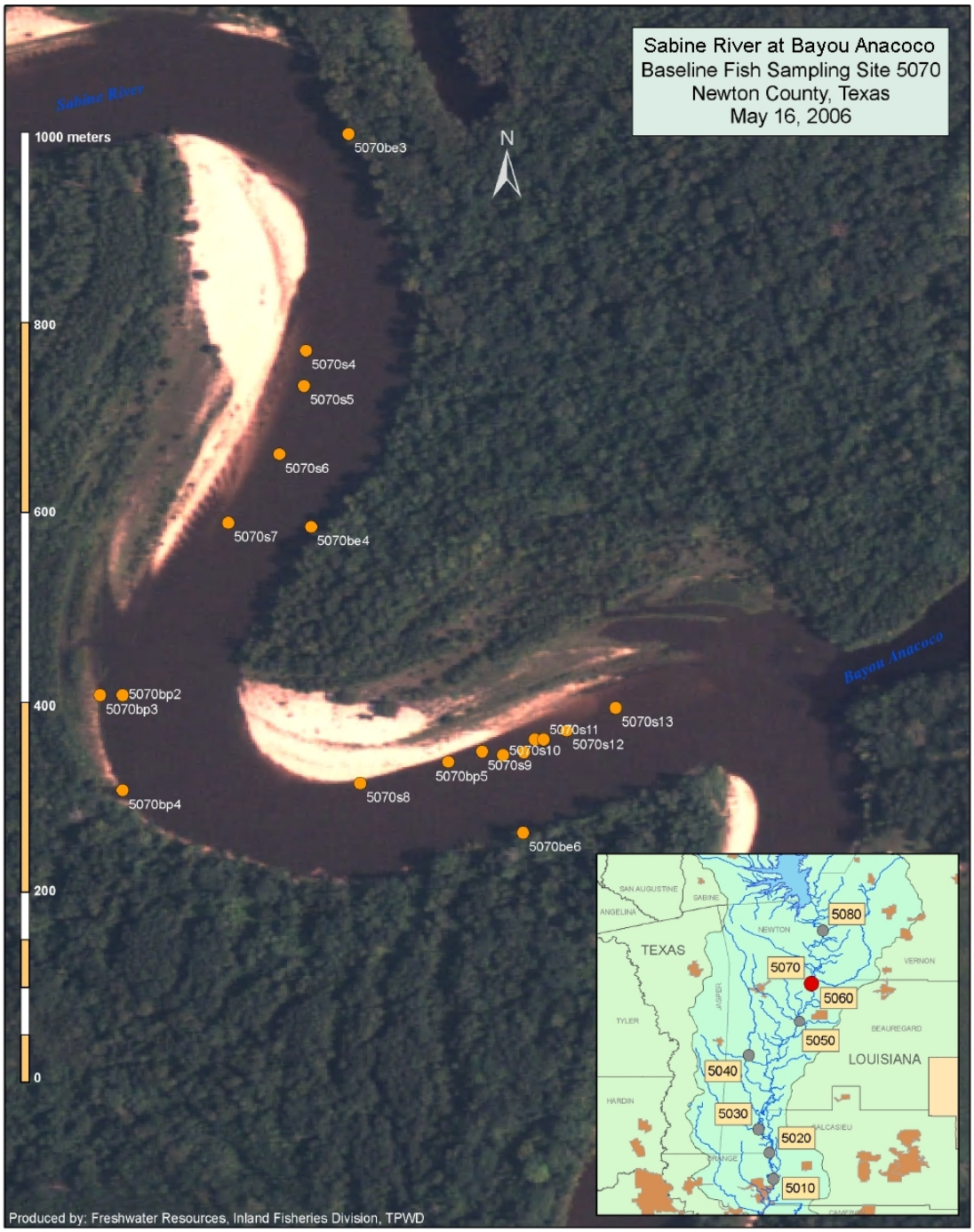

Figure 8. Site 5070, Sabine River at Bayou Anacoco

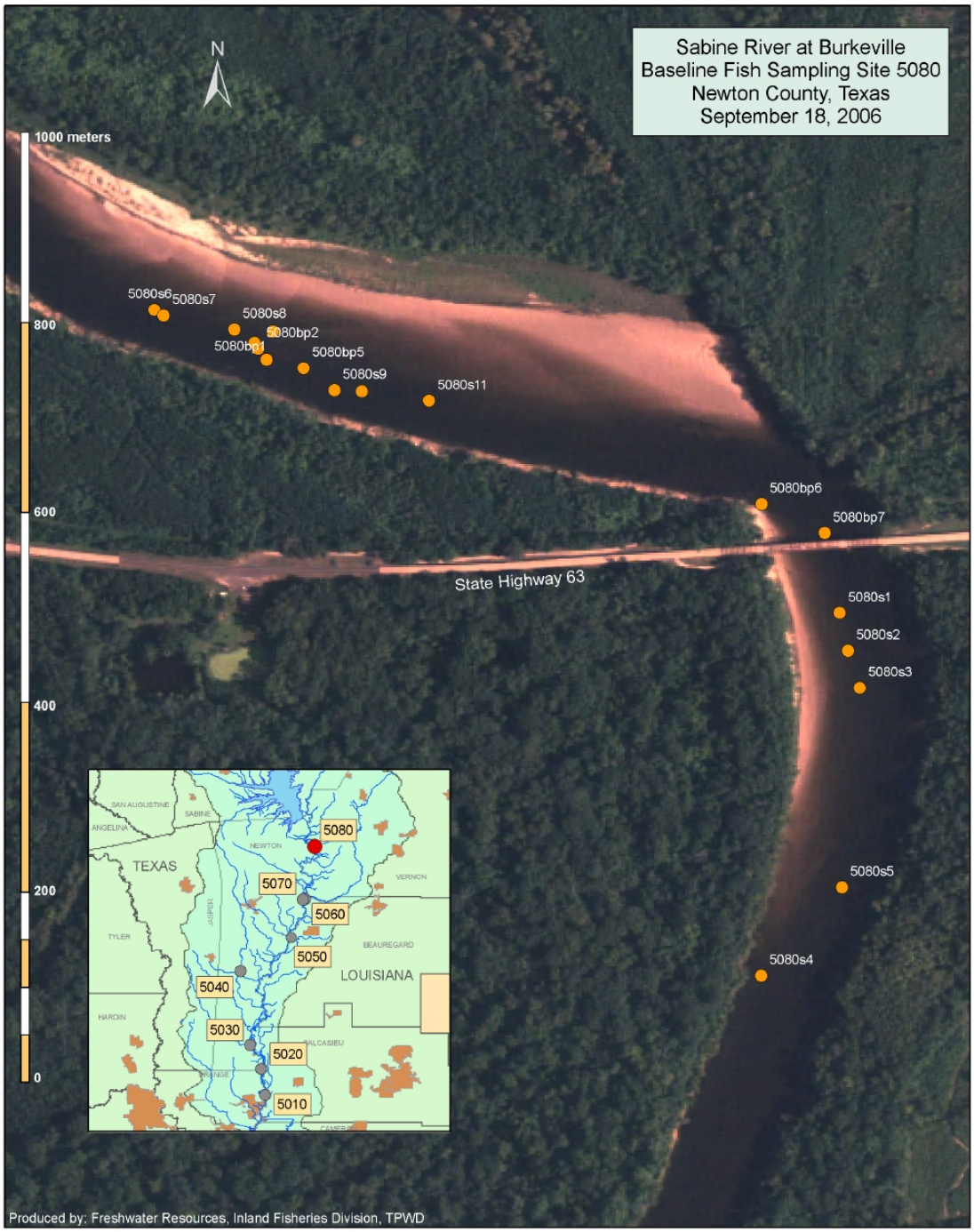

Figure 9. Site 5080, Sabine River at Burkeville, Texas

Appendix C DVD Contents

DVD contains:

- Photographs -- habitat photos from sampling events
- Microsoft Excel Spreadsheets
  - Sabine_baseline_fish_data_021207.xls -- fish data from sites 5010 through 5080
  - Sabine_baseline_study_sites_121806.xls -- site location descriptions
  - Sabine_baseline_habitat_121306.xls -- habitat data for each sampling event from all sites
- GIS project files -- tables of location, habitat and fish data
- This report in Adobe PDF format

Appendix D TWDB Comments on *Draft* Final Report

Attachment I
Baseline Fish Collections,
Lower Sabine River Priority Instream Flow Study
Draft Report Comments: 0604830567

The report, as submitted, does not appear to satisfy the Scope of Work as required per contractual agreement. Only minor modifications and additions are needed to satisfy the reporting requirements stated in the Scope of Work.

Task 1: Appears to have been completed.
Objective 1-A: This objective was met. The report provides a table showing the location of the eight sampling sites, as well as a description of why these sites were deemed appropriate.
Objective 1-B: The report indicates that this objective has been met. The sampling procedure is described adequately in the report.
Objective 1-C: The report indicates that this objective has been met. The collection of additional information is described adequately in the report.

Task 2: Appears to be **incomplete**.
Objective 2-A: This objective was only partially met. Fish are identified for only four of the eight study sites.
Objective 2-B: This objective has been met. Habitat information is provided for the eight study sites.
Objective 2-C: This objective has been met. Photographs were submitted on an accompanying DVD.