1.4 ACKNOWLEDGEMENTS

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1.5 INTRODUCTION

Texas contains a wide variety of natural resources, climates and ecosystems that are as diverse, broad and complex as the people who call Texas home. The 11 natural regions of Texas reflect the wide range of climatic conditions, geology, flora, and fauna found in the state. In the 23 river basins of Texas are over 191,000 miles of streams and rivers that vary from the clear spring-fed streams of the Hill Country to the saline creeks and rivers of the Panhandle to the sluggish bayous of southeast Texas. Due to the climatic variability in the state, and the geographic expanse of Texas, there can be large differences between streams in the upper and lower part of a river basin, and among streams in different river basins. Texas' rivers and streams provide habitat for 247 total species of fishes (Hubbs et al. 1991), as well as a variety and diversity of aquatic plants and animals. In addition to supplying water to riparian areas, bottomland-hardwoods, and other wetland ecosystems, the natural flow conditions of rivers and streams also provide freshwater inflows to the state's bays and estuaries.

Texas is a state of extremes. While the southeastern part of the state receives as much as 60 inches of rain annually, portions of West Texas average only 8 inches of rain per year (Ramos 1999). This contributes to greater biodiversity in east Texas, and west Texas having higher levels of endemism and more threatened and endangered species. This climatic pattern has resulted in the majority of water development projects occurring in the eastern part of the state, while west Texas relies primarily upon groundwater (TWDB 1997).

Perhaps no natural resource has influenced the development of the state as distinctively as water. Modifications to natural stream systems to provide water for municipal, agricultural, industrial and other needs and to control flooding have been commonplace for the past 150 years. Such modifications have altered the hydrology of many streams in the state, with a concomitant change in the biotic communities of many of these systems. Diminished flows can cause losses in habitat diversity, reduce stream productivity, and degrade water quality. Reservoirs also directly impact physical and water quality characteristics of the impounded stream and may cause significant changes in downstream biological community structure.

In 1913, the state had only eight major reservoirs with a storage capacity of 5,000 acre-feet or larger and a total storage capacity of 376,000 acre-feet (Ramos 1999). Currently, Texas has 214 major reservoirs with a total storage capacity of approximately 41 million acre-feet (TWDB 2001). This boom in water development was in part the result of an increase in population that has seen the state's population grow to over 20 million people. Considering that the population is expected to reach about 40 million people by the year 2050, protecting environmental resources while allowing for water development is more important than ever.

As a result of the passage of Senate Bill 1 in 1997, water planning in Texas became the province of regional planning groups rather than the Texas Water Development Board (TWDB). Senate Bill 1 directed the TWDB to designate regional water planning areas, taking into consideration such factors as river basin and aquifer delineations, water utility development patterns, socioeconomic characteristics, existing regional water planning areas, political subdivision boundaries, public comment, and other factors that the TWDB deemed relevant. One of the other relevant factors considered by the TWDB was the delineation of climatic zones. From this process, the TWDB identified 16 water planning regions. The water planning regions are represented by regional water planning groups that are charged with planning for regional water demands for the next 50 years. The Region I (East Texas) Regional Water Planning Area consists of all or a portion of 20 counties located in the Neches, Sabine, and Trinity River basins, and Neches-Trinity Coastal Basin, including the counties of Anderson, Angelina, Cherokee, Hardin, Henderson, Houston, Jasper, Jefferson, Nacogdoches, Newton, Orange, Panola, Polk, Rusk, Sabine, San Augustine, Shelby, Smith, Trinity, and Tyler (Figure 1).

As part of the planning process, the regional planning groups were given the option to identify stream segments for designation as ecologically unique according to a process outlined in Texas Administrative Code (TAC) Section 357 and Texas Water Code (TWC) Section 16.051. The criteria to be used in evaluating a stream segment's ecological importance are based on factors related to biological function, hydrologic function, presence of riparian conservation areas, high water quality/exceptional aquatic life/high aesthetic value, and threatened or endangered species/unique communities (Appendix A).

Using the criteria set forth in 31 TAC § 357.8, the TPWD compiled a cursory list of ecologically significant stream segments in each region. TPWD used readily available studies, existing data, and in-house expertise to identify stream segments that met at least one of the criteria for designation as ecologically unique.

Sources of information that the TPWD used in this analysis included state-conducted studies on ecoregion streams (Bayer et. al 1992), the Nationwide Rivers Inventory (Appendix B) (NPS 1995), the State of Texas Water Quality Inventory (TNRCC 1996, TCEQ 2004), data on threatened and endangered species (Campbell 1995, TPWD 2005), a variety of TPWD reports and studies (Bauer et. al 1991, Howells et. al 1996, Linam and Kleinsasser 1998, Linam et al. 2002), and personal communications with TPWD biologists. In addition, graphic information in the form of USGS topographic maps, digital ortho-quads, and national wetland inventory maps were consulted. It was important that ecologically significant stream segments be objectively identified based upon the best available information.

TPWD's analysis identified 228 stream segments throughout the state that met at least one of the criteria listed for identifying ecologically unique stream segments. In producing its list of ecologically significant stream segments, TPWD did not consider other important factors such as recreation. The analysis was not definitive or exhaustive, but based on existing and readily available information. The regional water planning groups in their considerations of ecologically unique river and stream segments can use the stream segment list compiled by the TPWD as a starting point. The act of officially designating a stream segment as ecologically unique is a combined effort of the regional water planning groups, the TWDB, and the Texas legislature. Designation of a stream segment as ecologically unique does not impart protection from degradation, but solely means that a state agency or political subdivision of the state may not finance the actual construction of a reservoir in a specific river or stream segment designated by the legislature under § 16.051 (f) of the Texas Water Code. Designation also recognizes the importance of protecting the ecological legacy of Texas' rivers and streams by affording the

segment and its natural resources a certain degree of protection from activities (such as reservoir construction) that may distract from its uniqueness.

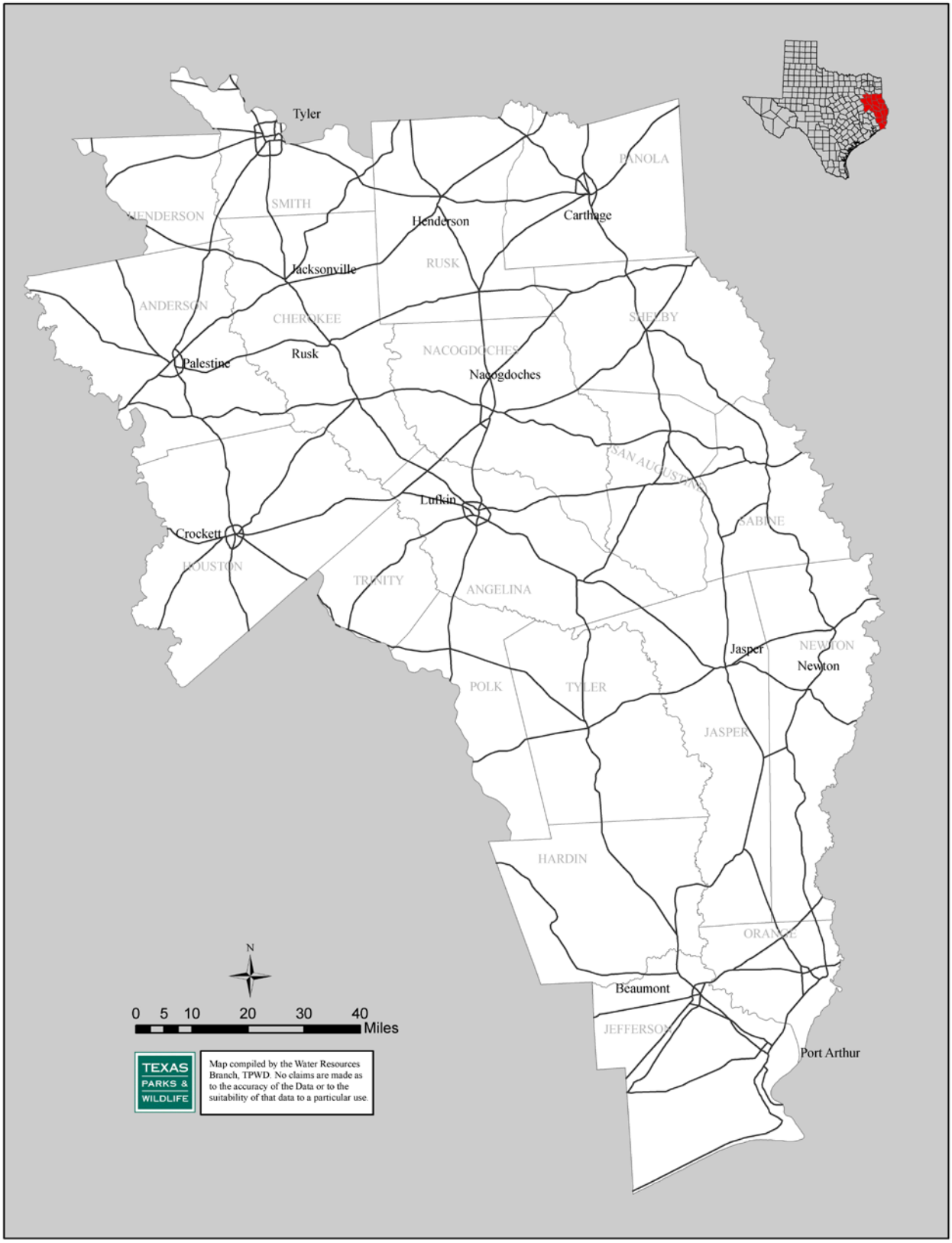

Figure 1. Map of Region I with Cities

Region I contains three of the ten natural subregions that comprise our state including the East Central Texas Plains, Western Gulf Coast Plains, and the South Central Plains. The South Central Plains ecoregion, locally termed the "piney woods", covers the majority of Region I. Prior to European settlement, this area of Texas supported longleaf pine, shortleaf pine, loblolly pine, and oak-hickory forests. Today the region is composed of fragmented pine and pine-hardwood forests with some cropland and pastureland (TPWD 2005). The majority of national forests and other forestland located in Texas are found in this region, including the Big Thicket National Preserve, Davy Crockett National Forest, Angelina National Forest, and Sabine National Forest. Swamps, bogs, man-made lakes, and an array of streams ranging from spring-fed blackwater streams to sluggish coastal creeks extend through the region, which has the state's highest rainfall with annual precipitation of 32 to 56 inches (NCDC 2005). Many of these streams provide habitat for rare and endemic species (Table 1) and provide the public with ample opportunities for outdoor recreation, wildlife viewing, and other forms of nature tourism; a fast growing segment of the travel industry.

1.6 OBJECTIVE

The purpose of this report is to identify and document those river and stream segments that meet the outlined criteria established by 31 TAC 357.8(b) as having significant ecological value. The report is intended to provide the Region I RWPG with the technical information necessary to prepare a recommendation package of ecologically unique river and stream segments under 31 TAC 357.8(a), which may be included in the regional water plan.

1.7 METHODS

Aerial photographs, maps, and the Gazetteer of Streams and Rivers of Texas (TPWD 1998) were used to identify the boundaries of the Region I Regional Water Planning Area and the major water courses contained within. Each of the criteria listed in 31 TAC §357.8 (b) was then addressed individually in an effort to identify all rivers or streams that met the criteria. The majority of the research performed in the preparation of this report is secondary in nature, largely due to the amount of time and staff power that would be necessary to do primary research. Because the outlined criteria has specific requirements and the fact that few rivers or streams in the state have been studied to such an extensive degree to cover all of the criteria, it was often difficult to address some of the criteria for certain stream segments.

State and federal agencies and universities were contacted to solicit river and stream segment information along with supporting data and documentation for inclusion in the final report. Those contacted include the TCEQ, TPWD, USFWS, U.S. Forest Service, Texas A&M University, and the University of Texas. Information was received in the form of personal communication, reports, and studies, all of which are documented in the References section. This information proved to be most helpful in identifying streams that met the biological function criteria.

National Wetland Inventory Maps and USFWS documents and resources were used to identify river or stream segments bordered by wetlands displaying "significant overall habitat value" (31 TAC §357.8 (b) (1)), thus meeting the biological function criteria. Significant wetland habitat within Region I was determined to include any freshwater or estuarine wetlands of considerable size that offer valuable habitat. Forested wetlands and riparian zones of significant size were determined to be the most important of these habitat types.

National Wetland Inventory Maps were also used to identify those river or stream segments that "perform valuable hydrologic functions relating to water quality and flood attenuation" (31 TAC §357.8 (b) (2)). A river or stream was considered to perform these functions if it was bordered by significant wetlands or acreage that would help filter excess nutrients, sediment, and contaminants from runoff and prevent or minimize flooding of downstream cities or urban areas. Rivers or streams that "perform valuable hydrologic functions relating to groundwater recharge and discharge" (31 TAC §357.8 (b) (2)) were identified through the use of TWDB reports and Gunnar Brune's (1981) Springs of Texas: Volume 1.

River and stream segments fringed by significant riparian conservation areas were mainly identified using maps and webpages (TPWD 2005a), but also through personal communication with staff of government agencies. Only those stream segments fringed by federal or state owned conservation areas were deemed as meeting the riparian conservation area criteria. River and stream segments deemed significant due to "unique or critical habitats and exceptional aquatic life uses dependent on or associated with high water quality" (31 TAC §357.8 (b) (4)) were identified through the TCEQ's State Water Quality Inventory (1996) and personal communication with government agencies and universities. Among the segments included are those that the TPWD in cooperation with the TCEQ identified as ecoregion reference streams. Ecoregions, as delineated by Omernik (1987), are based upon land surface form, land use, soils, and potential natural vegetation. The joint project identified streams within each of the respective ecoregions that were minimally or only slightly disturbed in order to develop a potential list of reference stations that could be used to evaluate the conditions of other streams within the ecoregion. The criteria for becoming an ecoregion reference stream included the lack of urban development in the watershed, no point sources of pollution, no channelization, and no atypical non-point sources of pollution. Ecoregion reference streams serve as examples of the physical habitat, physiochemical character, and biological attributes that other streams within the respective ecoregions could likely attain under the right set of circumstances.

Unique communities and "sites along streams where water development projects would have significant detrimental effects on state or federally listed threatened and endangered species" (31 TAC §357.8 (b) (5)) were identified through personal communication with TPWD and USFWS staff. Habitats that support threatened, endangered, and rare species were identified using county lists of rare species prepared by the TPWD Wildlife Diversity Program, personal communication, and reports of documented occurrences (Table 1). Because of the low population numbers of most of these species and their transient nature, it was often difficult to pinpoint exact locations or streams for many of the species. However, the specific habitat requirements of many of the species along with the county list of occurrences made it possible to identify rivers or streams that may currently support these species or may provide habitat for these species at some point in the future.

Table 1. Endangered Species of Region I (Texas Parks and Wildlife Department 2007/2008)

Scientific name	Common name	Fed. Status	State Status
AMPHIBIANS			
Plethodon serratus	Southern Redback Salamander		SOC
Rana grylio	Pig Frog		SOC
BIRDS			
Aimophila aestivalis	Bachman's Sparrow		T
Ammodramus henslowii	Henslow's Sparrow		SOC
Charadrius alexandrinus	Snowy Plover		SOC
Charadrius melodus	Piping Plover	LE	E
Egretta rufescens	Reddish Egret		T
Elanoides forficatus	Swallow-tailed Kite		T
Falco peregrinus anatum	American Peregrine Falcon		E
Falco peregrinus tundrius	Arctic Peregrine Falcon		T
Grus americana	Whooping Crane	LE	E
Haliaeetus leucocephalus	Bald Eagle	DL	T
Laterallus jamaicensis	Black Rail		SOC
Mycteria americana	Wood Stork		T
Pelcanus occidentalis	Brown Pelican	LE-PDL	E
Picoides borealis	Red-cockaded Woodpecker	LE	E
Plegadis chihi	White-faced Ibis		T
Sterna antillarum athalassos	Interior Least Tern	LE	E
Sterna fuscata	Sooty Tern		T
CRUSTACEANS			
Fallicambarus devastator	Texas prairie crayfish		SOC
Procambarus nechesae	A crayfish		SOC
FISHES			
Ammocrypta clara	Western Sand Darter		SOC
Anguilla rostrata	American eel		SOC
Cycleptus elongatus	Blue Sucker		T
Erimyzon oblongus	Creek Chubsucker		T
Etheostoma radiosum	Orangebelly darter		SOC
Notropis chalybaeus	Ironcolor shiner		SOC
Polyodon spathula	Paddlefish		T
INSECTS			
Cheumatopsyche morsei	Morse’s Net-spinning Caddisfly		SOC
Chimarra holzenthali	Holzenthal’s Philopotamid Caddisfly		SOC
Euphyes bayensis	Bay skipper		SOC
Gomphus modestus	Gulf Coast clubtail		SOC
Hydroptila ouachita	A Purse Casemaker Caddisfly		SOC
Phylocentropus harrisi	(no common name)		SOC
Plauditus gloveri	A mayfly		SOC
Somatochlora margarita	Big Thicket Emerald Drangonfly		SOC

MAMMALS			
Corynorhinus rafinesquii	Rafinesque's big-eared bat		T
Myotis austroriparius	Southeastern myotis bat		SOC
Spilogale putorius interrupta	Plains spotted skunk		SOC
Ursus americanus	Black bear	T/SA;NL	T
Ursus americanus luteolus	Louisiana black bear	LT	T
REPTILES			
Cemophora coccinea copei	Northern Scarlet snake		T
Chelonia mydas	Green sea turtle	LT	T
Crotalus horridus	Timber/Canebrake rattlesnake		T
Dermochelys coriacea	Leatherback sea turtle	LE	E
Eretmochelys imbricata	Atlantic hawksbill sea turtle	LE	E
Graptemys ouachitensis sabinensis	Sabine map turtle		SOC
Lepidochelys kempii	Kemp's Ridley sea turtle	LE	E
Macrochelys temminckii	Alligator Snapping Turtle		T
Malaclemys terrapin littoralis	Texas Diamondback Terrapin		SOC
Nerodia clarkii	Gulf Saltmarsh Snake		SOC
Pitbuophis ruthveni	Louisiana Pine Snake	C	T
PLANTS			
Galinis navasotensis	Navasota false foxglove		
Bartonia texana	Texas screwstem		SOC
Clematis carrizoensis	Carrizo leather flower		
Eriocaulon koernickianum	Small-headed pipewort		SOC
Gaillardia aestivalis var winkleri	White firewheel		SOC
Geocarpon minimum	Earth fruit (Tinytim)	LT	T
Helianthus occidentalis ssp plantagineus	Shinner's sunflower		SOC
Hibiscus dasycalys	Neches River rose-mallow	C	SOC
Hymenopappus carrizoanus	Sandhill woolywhite		SOC
Leavenworthia texana	Texas golden glade cress	C	SOC
Phlox nivalis ssp texensis	Texas trailing phlox	LE	E
Physaria pallida	White bladderpod	LE	E
Physostegia longisepala	Long-sepaled false dragonhead		SOC
Platanthera chapmanii	Chapman's orchid		SOC
Quercus boyntonii	Boynton's oak		SOC
Spiranthes parksii	Navasota ladies'-tresses	LE	E
Symphyotrichum puniceum var scabricaule	Rough-stem aster		SOC
Trillium texanum	Texas trillium		SOC
Xyris chapmanii	Chapman's yellow-eyed grass		SOC
Yucca cernua	Nodding yucca		SOC

Status Code: LE, LT – Federally Listed Endangered/Threatened; E/SA – Federally Endangered by Similarity of Appearance; E, T – State Endangered/Threatened; PT – Federally Proposed Threatened; C – Federal Candidate, Category 1, information supports proposing to list as endangered/threatened; SOC – Species of Concern.

After identifying river and stream segments meeting the criteria, a preliminary list consisting of the ecologically significant segments was compiled (Table 2). The list consists of the segments that best fit the criteria and does not rank the river or stream segments in order of importance or significance.

1.8 RESULTS

In the Region I RWPG, 41 river or stream segments were identified as meeting at least one of the outlined criteria (Table 2). Seven of the streams identified were found to meet the biological function criteria. These streams "displayed significant overall habitat value…considering the degree of biodiversity, age, and uniqueness." The hydrologic function criterion was not met by any streams perhaps because insufficient data on groundwater-surfacewater interactions is available. Thirty-three streams met the riparian conservation area criteria, which primarily included those in the Davy Crockett National Forest and the Big Thicket National Preserve. Twelve streams met the high water quality/exceptional aquatic life/high aesthetic value criteria, while the threatened or endangered species/unique communities criteria was met by 18 streams.

Table 2. Ecologically significant stream segments in the Region I (East Texas) Regional Water Planning Area

River or Stream Segment	Biological Function	Hydrologic Function	Riparian Conservation Area	High Water Quality/Aesthetic Value	Endangered Species/Unique Communities	Total # of criteria met
Alabama Creek			x			1
Alazan Bayou	x		x		x	3
Upper Angelina River	x		x		x	3
Lower Angelina River	x		x		x	3
Attoyac Bayou					x	1
Austin Branch			x			1
Beech Creek			x	x		2
Big Cypress Creek				x		1
Big Hill Bayou	x		x			2
Big Sandy Creek	x		x	x	x	4
Bowles Creek			x			1
Camp Creek			x		x	2
Catfish Creek			x	x	x	3
Cochino Bayou			x			1
Hackberry Creek			x		x	2
Hager Creek			x			1
Hickory Creek			x			1
Hillebrandt Bayou			x			1
Irons Bayou				x		1
Little Pine Island Bayou			x			1
Lynch Creek			x		x	2
Menard Creek			x			1
Mud Creek	x				x	2
Upper Neches River	x		x	x	x	4
Lower Neches River	x		x	x	x	4
Pine Island Bayou			x			1
Piney Creek			x	x	x	3
Upper Sabine River	x			x	x	3
Middle Sabine River	x			x		2
Lower Sabine River	x		x			2
Salt Bayou	x		x			2
San Pedro Creek			x			1
Sandy Creek (Trinity Co)			x		x	2
Sandy Creek (Shelby Co)					x	1
Taylor Bayou			x			2
Texas Bayou			x			1
Trinity River	x		x		x	3
Trout Creek			x			1
Turkey Creek			x			1
Village Creek	x		x	x	x	4
White Oak Creek				x		1

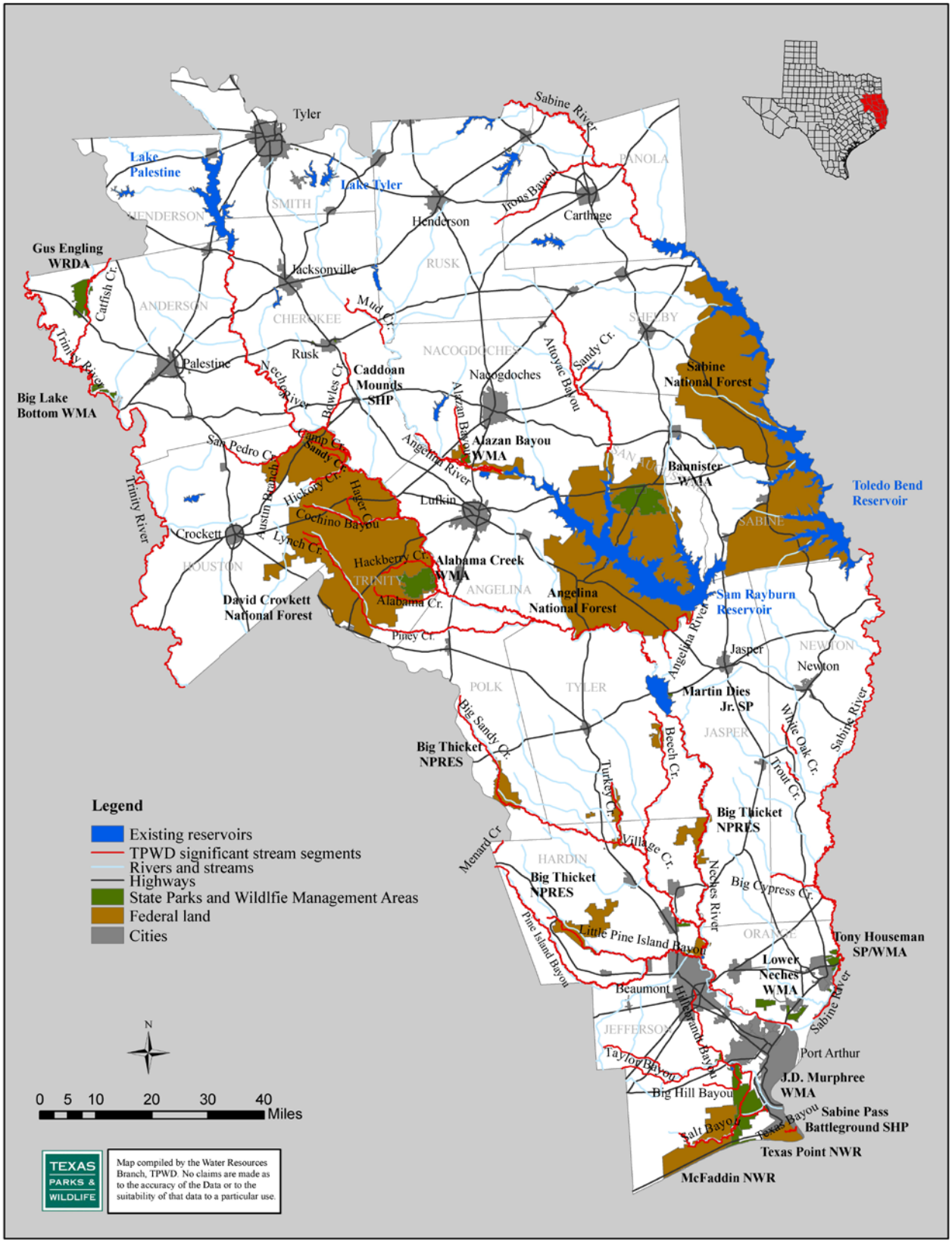

Figure 2. Ecologically Significant Stream Segments of Region I