Ecologically Significant River and Stream Segments of Region L (South Central) Regional Water Planning Area

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West Nueces River northwest of Uvalde, June 2001

COASTAL FISHERIES DIVISION:
WATER RESOURCES BRANCH

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Abbreviation List

CIR	- Color Infrared
CTC	- Central Texas Coast
DOQ	- Digital Orthophoto Quadrangle
E	- Endangered
Fed.	- Federal
GBRA	- Guadalupe-Blanco River Authority
GTCBT	- Great Texas Coastal Birding Trail
NHP	- National Historic Park
NPS	- National Park Service
NWI	- National Wetlands Inventory
NWR	- National Wildlife Refuge
RWPG	- Regional Water Planning Group
SHP	- State Historical Park
SNA	- State Natural Area
SOC	- Species of Concern
SP	- State Park
St.	- State
T	- Threatened
TAC	- Texas Administrative Code
TCEQ	- Texas Commission on Environmental Quality
TPWD	- Texas Parks & Wildlife Department
TNRCC	- Texas Natural Resources Conservation Commission
TWDB	- Texas Water Development Board
TxDOT	- Texas Department of Transportation
USFWS	- United States Fish and Wildlife Service
WMA	- Wildlife Management Area

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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).

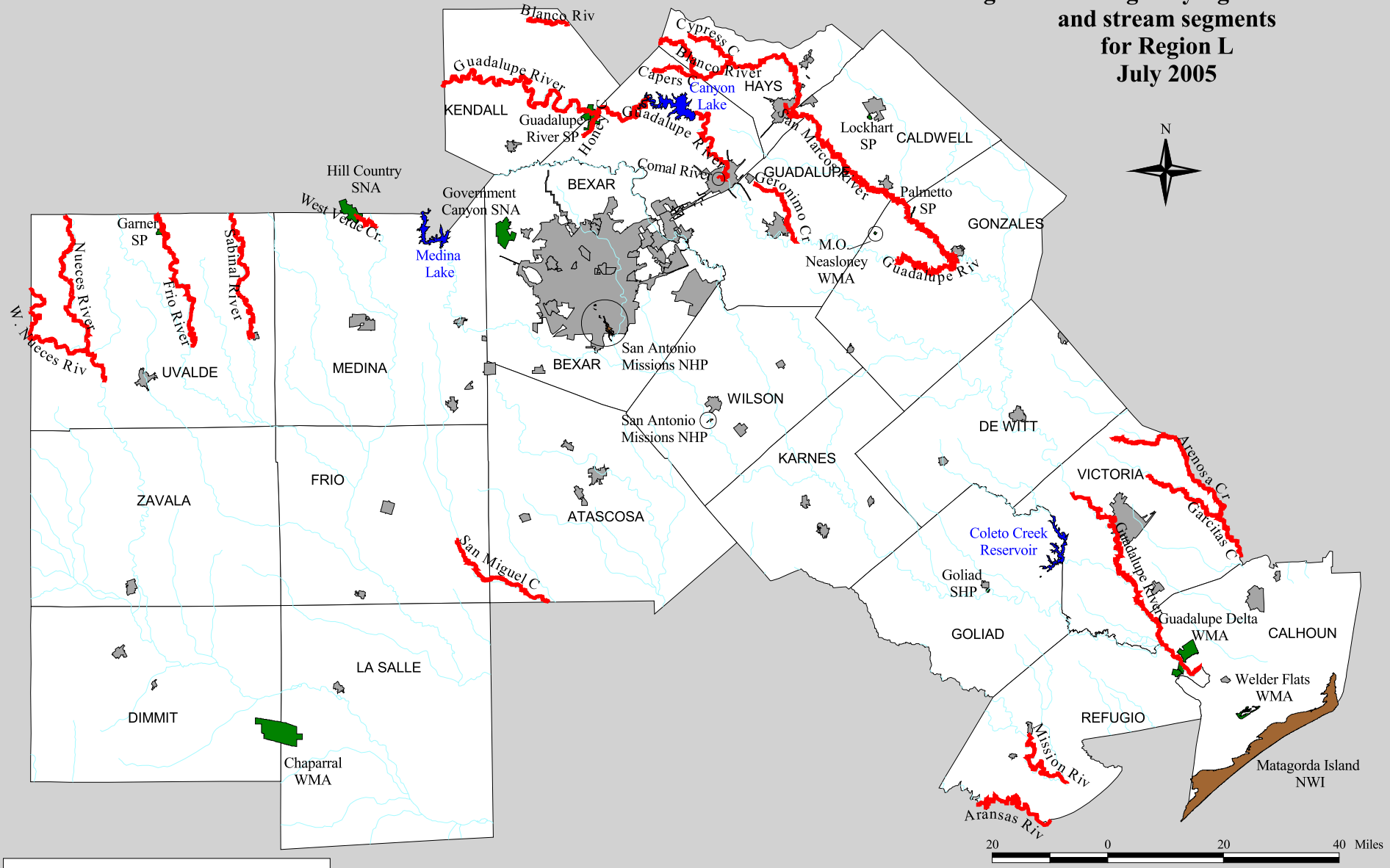
Perhaps no natural resource has influenced the development of the state as distinctively as water. Modifications to natural stream systems to provide water for municipal, agricultural, industrial and other needs and to control flooding have been commonplace for the past 150 years. Such modifications 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 L (South Central) Regional Water Planning Area consists of the counties of Atascosa, Bexar, Caldwell, Calhoun, Comal, De Witt, Dimmit, Frio, Goliad, Gonzales, Guadalupe, Hays (Guadalupe River Basin portion), Karnes, Kendall, La Salle, Medina, Refugio, Uvalde, Victoria, Wilson, and Zavala (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

Figure 1. Ecologically significant river and stream segments for Region L July 2005



Map compiled by the Water Resources Branch, TPWD. No claims are made as to the accuracy of the data or to the suitability of that data to a particular use.

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.

In the Region L Water Planning Area, TPWD identified 21 river and stream segments as meeting the criteria for designation as ecologically significant (Table 1) that should be considered for inclusion in the regional water plan. 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 their watershed, no point sources of pollution, no channelization, and no atypical non-point sources of pollution. These ecoregion reference streams serve as examples of what the physical habitat, physiochemical character, and biological attributes for other streams within their respective ecoregions could likely attain under the right set of circumstances.

Region L is arguably the most ecologically diverse of the Regional Water Planning Areas as it contains five of the ten natural subregions that comprise our state. The natural subregions included in Region L are as follows: Edwards Plateau, Oak Woods and Prairies, Blackland Prairie, Gulf Coast Prairies and Marshes, and South Texas Brush Country. Region L contains an array of streams ranging from spring-fed Hill Country streams to sluggish coastal creeks, many of which provide habitat for rare and endemic species (Table 2 and Figure 2). Several of the streams within Region L also provide the public with ample opportunities for outdoor recreation, wildlife viewing, and other forms of nature tourism; the fastest growing segment of the travel industry.

The State Water Plan, which will be based on the regional water plans, will identify river and stream segments of unique ecological value that the TWDB recommends for protection. Designation of a stream segment as “ecologically unique” can afford the segment and its natural resources a certain degree of protection from activities (such as reservoir construction) that may distract from its uniqueness. The TWDB has agreed to coordinate with the TPWD and the TCEQ in identifying any river, stream segment, or site that warrants protection because of its unique ecological value in the State Water Plan.

Table 1. Ecologically significant stream segments in Region L Regional Water Planning Area

River or Stream Segment	Biological Function	Hydrologic Function	Riparian Conservation Area	High Water Quality/ Aesthetic Value	Endangered Species/ Unique Communities
Aransas River	X	X			X
Arenosa Creek				X	
Blanco River		X	X	X	X
Carpers Creek				X	
Comal River	X	X		X	X
Cypress Creek		X		X	
Frio River	X	X	X	X	X
Garcitas Creek	X			X	X
Geronimo Creek				X	
Upper Guadalupe River		X	X	X	X
Middle Guadalupe River					X
Lower Guadalupe River	X		X	X	X
Honey Creek	X	X	X		X
Mission River	X	X			
Nueces River	X	X		X	X
Sabinal River	X	X		X	X
Upper San Marcos River	X	X		X	X
Lower San Marcos River			X		X
San Miguel Creek				X	
West Nueces River		X			X
West Verde Creek		X	X		X

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 L 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.

METHODS

Aerial photographs, maps, and the Gazetteer of Streams and Rivers of Texas (TPWD 1998) were used to identify the boundaries of the Region L 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 L 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, as well as maps of recharge zones of the Edwards Aquifer.

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 TNRCC’s State Water Quality Inventory (1996) and personal communication with government agencies and universities. 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 that documented known occurrences (Table 2 and Figure 2). 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

Table 2. Selected species of special soncern in the Region L Regional Water Planning Area (Texas Parks and Wildlife Department 2005).

Map code*	Common name	Scientific name	Fed. Status	State Status
	AMPHIBIANS			
1	Black-spotted Newt	*Notophthalmus meridionalis*		T
2	Blanco Blind Salamander	*Eurycea robusta*		T
3	Blanco River Springs Salamander	*Eurycea pterophila*		SOC
4	Cascade Caverns Salamander	*Eurycea latitans*		T
5	Comal Blind Salamander	*Eurycea tridentifera*		T
6	Comal Springs Salamander	*Eurycea sp.8*		SOC
7	Edwards Plateau Spring Salamander	*Eurycea sp.7*		SOC
8	Mexican Treefrog	*Smilisca baudini*		T
9	San Marcos Salamander	*Eurycea nana*	LT	T
10	Sheep Frog	*Hypopachus variolosus*		T
11	South Texas Siren (large form)	*Siren sp. 1*		T
12	Texas Blind Salamander	*Eurycea rathbuni*	LE	E
13	Texas Salamander	*Eurycea neotenes*		SOC
14	Valdina Farms Sinkhole Salamander	*Eurycea troglodytes* complex		SOC
	BIRDS			
15	Arctic Peregrine Falcon	*Falco peregrinus tundrius*	DL	T
16	Bald Eagle	*Haliaeetus leucocephalus*	LT-PDL	T
17	Brown Pelican	*Pelcanus occidentalis*	LE	E
18	Eskimo Curlew	*Numenius borealis*	LE	E
19	Golden-Cheeked Warbler	*Dendroica chrysoparia*	LE	E
20	Henslow's Sparrow	*Ammodramus henslowii*		SOC
21	Interior Least Tern	*Sterna antillarum athalassos*	LE	E
22	Piping Plover	*Charadrius melodus*	LT	T
23	Reddish Egret	*Egretta rufescens*		T
24	Snowy Plover	*Charadrius alexandrinus*		SOC
25	White-faced Ibis	*Plegadis chihi*		T
26	Whooping Crane	*Grus americana*	LE	E
27	Wood Stork	*Mycteria americana*		T
28	Zone-tailed Hawk	*Buteo albonotatus*		T
	CRUSTACEANS			
29	Balcones Cave Amphipod	*Stygobromus balcones*		SOC
30	Ezell's Cave Amphipod	*Stygobromus flagellatus*		SOC
31	Long-legged Amphipod	*Stygobromus longipes*		SOC
32	Nueces Crayfish	*Procambarus nueces*		SOC
33	Peck's Cave Amphipod	*Stygobromus pecki*	LE	SOC
34	Texas Cave Shrimp	*Palaemonetes antrorum*		SOC

Table 2 (Continued). Selected species of special concern in the Region L Regional Water Planning Area (Texas Parks and Wildlife Department 2005).

Map Code *	Common name	Scientific name	Fed. Status	State Status
	FISHES			
35	American Eel	*Anguilla rostrata*		SOC
36	Blue Sucker	*Cycleptus elongatus*		T
37	Fountain Darter	*Etheostoma fonticola*	LE	E
38	Guadalupe Bass	*Micropterus treculi*		SOC
39	Guadalupe Darter	*Percina sciera apristis*		SOC
40	Headwater Catfish	*Ictalurus lupus*		SOC
41	Nueces River Shiner	*Cyprinella sp.2*		SOC
42	Nueces Roundnose Minnow	*Dionda serena*		SOC
43	Opossum Pipefish	*Microphis brachyurus*		T
44	Plateau shiner	*Cyprinella lepida*		SOC
45	San Marcos Gambusia	*Gambusia georgei*	LE	E
46	Toothless Blindcat	*Trogloglanis pattersoni*		T
47	Widemouth Blindcat	*Satan eurystomus*		T
	INSECTS			
48	Comal Springs Diving Beetle	*Comaldressus comalensis*		SOC
49	Comal Springs Dryopid Beetle	*Stygoparnus comalensis*	LE	SOC
50	Comal Springs Riffle Beetle	*Heterelmis comalensis*	LE	SOC
51	Edwards Aquifer Diving Beetle	*Haideoporus texanus*		SOC
52	Flint's Net-spinning Caddisfly	*Cheumatopsyche flinti*		SOC
53	San Marcos Saddle-case Caddisfly	*Protoptila arca*		SOC
54	Texas Asaphomyian Tabanid Fly	*Asaphomyia texanus*		SOC
	MAMMALS			
55	Black Bear	*Ursus americanus*	T/SA	T
56	Carrizo Springs Pocket Gopher	*Geomys personatus streckeri*		SOC
	MOLLUSKS			
57	Creeper (Squawfoot)	*Strophitus undulates*		SOC
58	False Spike Mussel	*Quincuncina mitchelli*		SOC
59	Golden Orb	*Quadrula aurea*		SOC
60	Horseshoe Liptooth	*Polygyra hippocrepis*		SOC
61	Mimic Cavesnail	*Phreatodrobia imitata*		SOC
62	Palmetto Pill Snail	*Euchemotrema cheatumi*		SOC

Table 2 (Continued). Selected species of special concern in the Region L Regional Water Planning Area (Texas Parks and Wildlife Department 2005).

63	Pistolgrip	*Tritogonia verrucosa*		SOC
64	Rock-pocketbook	*Arcidens confragosus*		SOC
65	Texas Famucket	*Lampsilis bracteata*		SOC
66	Texas Pimpleback	*Quadrula petrina*		SOC
	REPTILES			
67	Cagle's Map Turtle	*Graptemys caglei*	C	T
68	Indigo Snake	*Drymarchon corais*		T
69	Reticulate Collared Lizard	*Crotaphytus reticulates*		T
70	Texas Diamondback Terrapin	*Malaclemys terrapin littoralis*		SOC
71	Texas Garter Snake	*Thamnophis sirtalis annectens*		SOC
72	Texas Scarlet Snake	*Cemophora coccinea lineri*		T

T-Threatened, E-Endangered, SOC-Species of Concern, LT-Listed Threatened, LE-Listed Endangered, DL- Delisted, PDL- Proposed to be delisted, C1- Candidate species, T/SA - . Threatened by Similarity of Appearance.

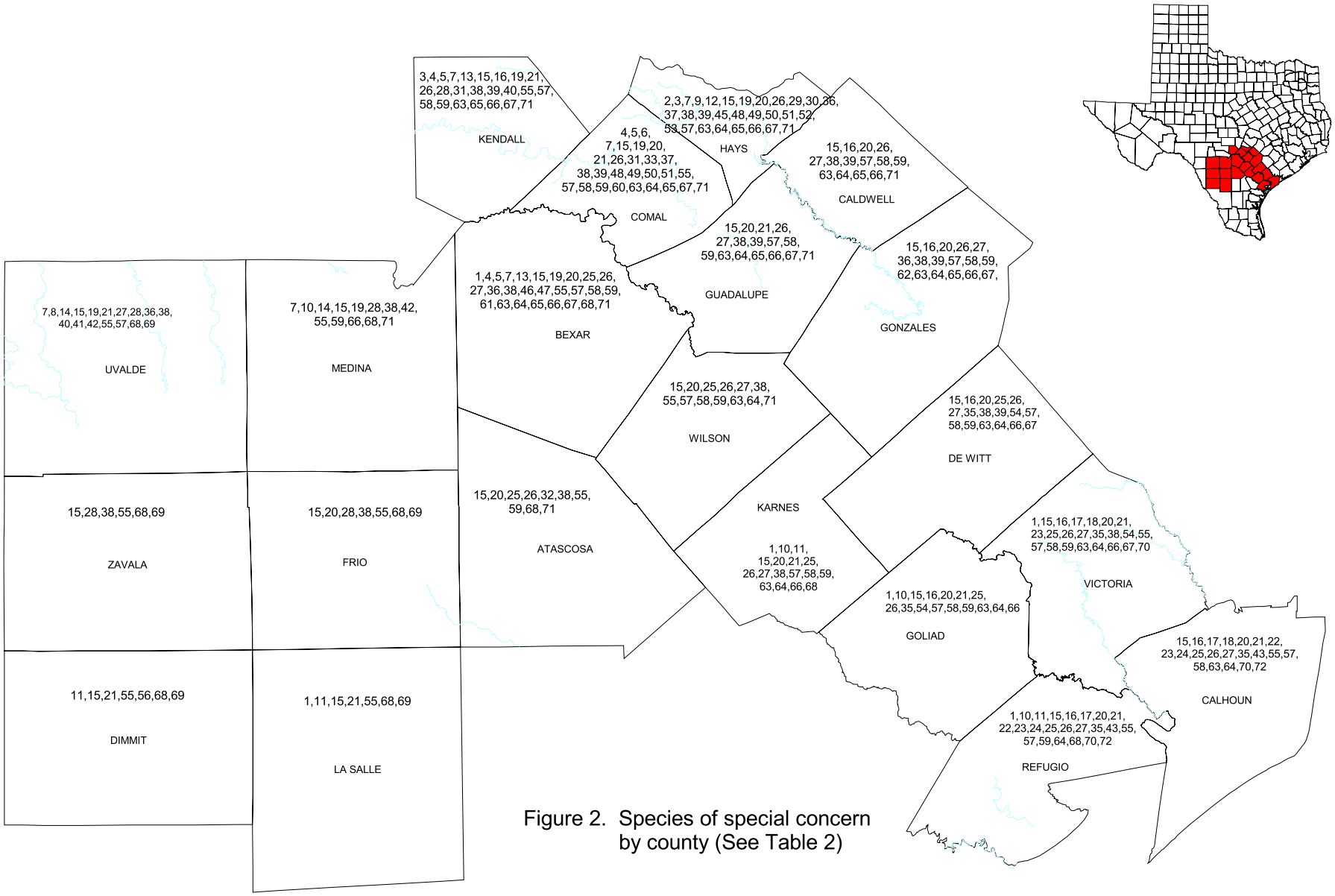


Figure 2. Species of special concern by county (See Table 2)

30 0 30 60 Miles

Produced by TPWD Water Resources Branch, April 2005. No claims are made as to the accuracy of the data or its suitability for a particular use.

with the county list of occurrences made it possible to identify rivers or streams that may currently support these species or are likely to provide habitat for these species at some point in the future.

After identifying all of the river and stream segments meeting the criteria, a preliminary list consisting of those segments thought to be "significant" was compiled (Table 1). The list consists of those segments that are thought to best fit the criteria and does not attempt to rank the river or stream segments in order of importance or significance.

RESULTS

In the Region L RWPG, twenty-one river or stream segments were identified as meeting at least one of the outlined criteria (Table 1). Ten 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 met by 13 streams, which “perform valuable hydrologic function relating to water quality, flood attenuation, flow stabilization, or groundwater recharge and discharge.” Seven streams met the riparian conservation area criteria. Fourteen 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 fifteen streams.

Ecologically significant river and stream segment descriptions

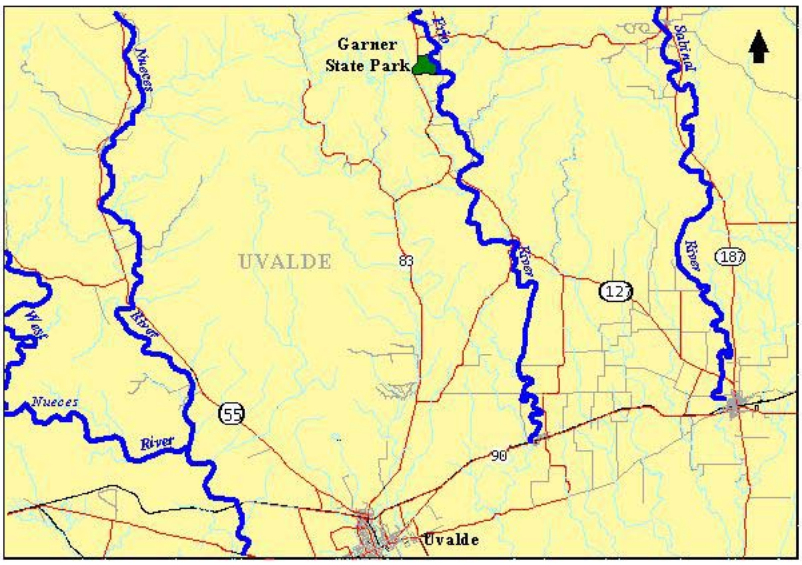


Figure 3. Ecologically significant stream segments of Frio, Nueces, Sabinal, and West Nueces rivers (TxDOT 2000)

Frio River

The Frio River begins in northeast Real County and flows southeast for about 250 miles traversing Uvalde, Medina, Frio, La Salle, McMullen, and Live Oak counties (TPWD 1998). Springs that form the Frio River issue from a 3,000-acre ranch north of Leakey, while numerous spring-fed tributaries contribute to flow (Brune 1981). The river crosses the Edwards Aquifer recharge zone in northern Uvalde County and disappears into alluvial cobbles and gravels downstream, only to reappear at frequent intervals as springs (Brune 1981). The stream passes through limestone formed canyons lined with mesquite (*Prosopis glandulosa*), Texas red bud (*Cercis canadensis*), Ashe juniper (*Juniperus ashei*), lacey oak (*Quercus laceyi*), Texas madrone (*Arbutus xalapensis*), and cedar elm (*Ulmus crassifolia*) and banks lined with bald cypress (*Taxodium distichum*), pecan (*Carya illinoensis*), sycamore (*Platanus occidentalis*), willow (*Salix nigra*), and Spanish oak (*Quercus buckleyi*) (Belisle and Josselet 1974). The upper section of the river is one of the most scenic sections of any river in the state (NPS 1995). As such, the river is very popular for recreational activities such as canoeing, tubing, fishing, and wildlife viewing. Many shallow rapids exist in the narrow upper section of the river, however water levels generally support recreational activities throughout much of its course (Belisle and Josselet 1974). This segment is important to TPWD stocking experiments involving Guadalupe bass (*Micropterus treculi*) as it is downstream of areas where pure strain Guadalupe bass were stocked in large numbers in an attempt to purify existing hybrid populations (G. Garrett 1999, pers. comm.). The Frio River ultimately empties into the Nueces River, and therefore contributes freshwater inflow to Nueces and Corpus Christi bays, one of the state's major estuaries. The aquatic and riparian habitats (Figure 4) associated with the stream support an exceptionally diverse assemblage of invertebrates,

fish, birds, and plants characteristic of the Edwards Plateau. The riparian woodlands also provide important nesting, migration, and wintering habitat for a variety of birds. The ecologically significant stream segment is from a point 110 yards upstream of US 90 in Uvalde County upstream to the Uvalde/Real County line (within TCEQ classified stream segment 2113) (Figure 3). The ecological significance of this segment is based upon the following criteria:

- Biological Function- Texas Natural Rivers System nominee for outstandingly remarkable wildlife values (Appendix B) (NPS 1995).

- Hydrologic Function- numerous springs along the Frio River provide valuable hydrologic function relating to discharge of the Edwards Plateau Aquifer and flow within the river provides recharge as it crosses the outcrop portion of the Edwards Aquifer (Brune 1981).

- Riparian Conservation Area- fringed by 1,419.8-acre Garner State Park (TPWD 2005b).

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value- high water quality and exceptional aquatic life use (TNRCC 1996); exceptional aesthetic value (NPS 1995).

- Threatened or Endangered Species/Unique Communities- significant due to presence of the Nueces roundnose minnow (*Dionda serena*) (SOC), Nueces River shiner (*Cyprinella* sp. 2) (SOC), Guadalupe bass (*Micropterus treculi*) (SOC) (G. Garrett 1999, pers. comm.) and numerous springs along the Frio River and its tributaries which provide habitat for an undescribed species of salamander that belongs to the *Eurycea troglodytes* complex (Norris, unpublished data).

Figure 4. Frio River south of CR 101 in Uvalde County (5/9/01).

Nueces River

The Nueces River begins in northwestern Real County and flows southeastward, where it joins its West Fork to form the Nueces River northwest of Uvalde in Uvalde County (TPWD 1998). From this confluence the river flows approximately 280 miles where it provides freshwater inflow to Nueces Bay and ultimately Corpus Christi Bay (TPWD 1998). The upper section of the Nueces River is one of the more aesthetically pleasing stream segments in the state (Belisle and Josselet 1974). The East Fork of the Nueces River rises from springs in the Edwards Plateau, and its clear water flows through scenic limestone canyons (Brune 1981). Historically, many springs could be found along the banks of the Nueces River. However, now springs are only found in the bottom of the channel (Brune 1981). Several spring-fed tributaries, most importantly the Frio River, help to ensure that some flow is present in the Nueces River although it is often shallow (Belisle and Josselet 1974). Water in the Nueces River sinks into gravels in the river bottom as it crosses the Balcones Fault Zone and reappears through several springs in other local creeks and rivers such as Spring Creek and the Leona River (Brune 1981). The Edwards Plateau portion of the Nueces River has banks lined with characteristic pecan (*Carya illinoensis*), oak (*Quercus* sp.), and cedar-elm (*Ulmus crassifolia*), which give way to sagebrush (*Artimesia* sp.), mesquite (*Prosopis glandulosa*), and cacti as the river enters the South Texas Brush Country. The aquatic and riparian habitats (Figures 5-6) associated with the stream support a diverse assemblage of invertebrates, fish, birds, and plants characteristic of the Edwards Plateau. The riparian woodlands also provide important nesting, migration, and wintering habitat for a variety of birds. The ecologically significant stream segment is from the US 90 crossing in Uvalde County upstream to the Uvalde/Real/Edwards County line (within TCEQ classified stream segment 2112) (Figure 3). The ecological significance of this segment is based upon the following criteria:

- Biological Function- Texas Natural Rivers System nominee for outstandingly remarkable fish and wildlife values (Appendix B) (NPS 1995).

- Hydrologic Function- numerous springs along and within the Nueces River provide valuable hydrologic functions relating to discharge of the Edwards Plateau Aquifer and flow within the river provides recharge as it crosses the outcrop portion of the Edwards Aquifer (Brune 1981).

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value- entire reach offers exceptional aesthetic value and East Nueces headwaters region was included in the Top 100 Texas Natural Areas list (Appendix A) (NPS 1995).

- Threatened or Endangered Species/Unique Communities- significant due to presence of the Plateau shiner (*Cyprinella lepida*) (SOC), Nueces roundnose minnow (*Dionda serena*) (SOC), Nueces River shiner (*Cyprinella* sp. 2) (SOC), Guadalupe bass (*Micropterus treculi*) (SOC) (G. Garrett 1999, pers. comm., TPWD 2005a) and numerous springs along the Nueces River and its tributaries which provide habitat for an undescribed species of salamander that belongs to the *Eurycea troglodytes* complex (Norris, unpublished data).

Figure 5. Nueces River south of CR 405 in Uvalde County (5/9/01).

Figure 6. Nueces River north of CR 405 in Uvalde County (5/9/01).

Sabinal River

The Sabinal River begins near Vanderpool in western Bandera County and flows south for approximately 58 miles into Uvalde County where it joins the Frio River in the southeastern part of the county (TPWD 1998). The Frio River then flows into the Nueces River that provides freshwater inflow to Nueces and Corpus Christi bays, one of the state's major estuaries. The upper portion of the Sabinal River rises from the Edwards Plateau and flows through Hill Country canyons with walls up to 300 feet tall before entering the South Texas Brush Country (Belisle and Josselet 1974). Large bald cypress (*Taxodium distichum*) are interspersed along the banks with green ash (*Fraxinus pennsylvanica*), black willow (*Salix nigra*), pecan (*Carya illinoensis*), and sycamore (*Platanus occidentalis*). The aquatic and riparian habitats (Figures 7-8) associated with the stream support a diverse assemblage of invertebrates, fish, birds, and plants characteristic of the Edwards Plateau and South Texas Brush Country. The Sabinal River crosses the Edwards Aquifer recharge zone in northeastern Uvalde County and, like the Nueces River, the Sabinal River and other streams to the northwest lose water as they cross the Balcones Fault Zone (Brune 1981). Some of the water that is lost reappears in the Sabinal River at Sabinal Springs west of the city of Sabinal (Brune 1981). The Sabinal River was nominated for inclusion in the proposed Texas Natural Rivers System for scenery, recreation, geology, wildlife, and other values (Appendix A) (NPS 1995). This segment is important to TPWD stocking experiments involving Guadalupe bass (*Micropterus treculi*) as it is downstream of areas where pure strain Guadalupe bass were stocked in large numbers in an attempt to purify existing hybrid populations (G. Garrett 1999, pers. comm.). The ecologically significant stream segment is from the US 90 crossing in Uvalde County near the city of Sabinal upstream to the Uvalde/Bandera County line (within TCEQ classified stream segments 2110 and 2111) (Figure 3). The ecological significance of this segment is based upon the following criteria:

- Biological Function- Texas Natural Rivers System nominee for outstandingly remarkable wildlife values (Appendix B) (NPS 1995).

- Hydrologic Function- numerous springs along and within the Sabinal River provide valuable hydrologic function relating to discharge of the Edwards Plateau Aquifer and flow within the river provides valuable recharge as it crosses the outcrop portion of the Edwards Aquifer (Brune 1981).

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value- high aesthetic value (NPS 1995).

- Threatened or Endangered Species/Unique Communities- significant due to presence of the Nueces roundnose minnow (*Dionda serena*) (SOC), Nueces River shiner (*Cyprinella* sp. 2) (SOC), Guadalupe bass (SOC) (G. Garrett 1999, pers. comm., TPWD 2005a) and numerous springs along the Sabinal River and its tributaries which provide habitat for an undescribed species of salamander that belongs to the *Eurycea troglodytes* complex (Norris, unpublished data).

Figure 7. Sabinal River north of State Highway 127 in Uvalde County (5/9/01).

Figure 8. Sabinal River at US 90 in Uvalde County (5/9/01).

West Nueces River

The West Nueces River rises five miles north of US Hwy 377 west of Rocksprings in Edwards County and flows south into Kinney County, where it turns southeast and flows into Uvalde County (TPWD 1998). In Uvalde County, the West Nueces River joins the Nueces River ten miles northwest of the City of Uvalde. Like other large streams in the area, the West Nueces River disappears into gravel and cobbles only to reappear downstream at frequent intervals as springs. This segment crosses the Edwards Aquifer recharge zone for much of its length. The floodplain is flat and is surfaced by clay and sandy loam that supports water-tolerant hardwoods, conifers, and grasses (Belisle and Josselet 1974). Bald cypress (*Taxodium distichum*), sycamore (*Platanus occidentalis*), pecan (*Carya illinoensis*), and willows (*Salix nigra*) dominate the riparian areas, while canyon slopes are dominated by live oak (*Quercus virginiana*) and Ashe juniper (*Juniperus ashei*). The aquatic and riparian habitats (Figures 9-10) associated with the stream support a diverse assemblage of invertebrates, fish, birds, and plants characteristic of the Edwards Plateau and South Texas Brush Country. This segment is important to TPWD stocking experiments involving Guadalupe bass (*Micropterus treculi*) as it is downstream of areas where pure strain Guadalupe bass were stocked in large numbers in an attempt to purify existing hybrid populations (G. Garrett 1999, pers. comm.). The ecologically significant stream segment is from the confluence with the Nueces River in Uvalde County upstream to the Uvalde/Kinney County line (Figure 3). The ecological significance of this segment is based upon the following criteria:

- Hydrologic Function- numerous springs along the West Nueces River provide valuable hydrologic function relating to discharge of the Edwards Plateau Aquifer and flow within the river provides recharge as it crosses the outcrop portion of the Edwards Aquifer (Brune 1981).

- Threatened or Endangered Species/Unique Communities- significant due to presence of the Nueces roundnose minnow (*Dionda serena*) (SOC), Nueces River shiner (*Cyprinella* sp. 2) (SOC), Guadalupe bass (*Micropterus treculi*) (SOC) (G. Garrett 1999, pers. comm., TPWD 2005a) and numerous springs along the West Nueces River and its tributaries which provide habitat for an undescribed species of salamander that belongs to the *Eurycea troglodytes* complex (Norris, unpublished data).

Figure 9. West Nueces River adjacent to FM 334 in Uvalde County (5/9/01).

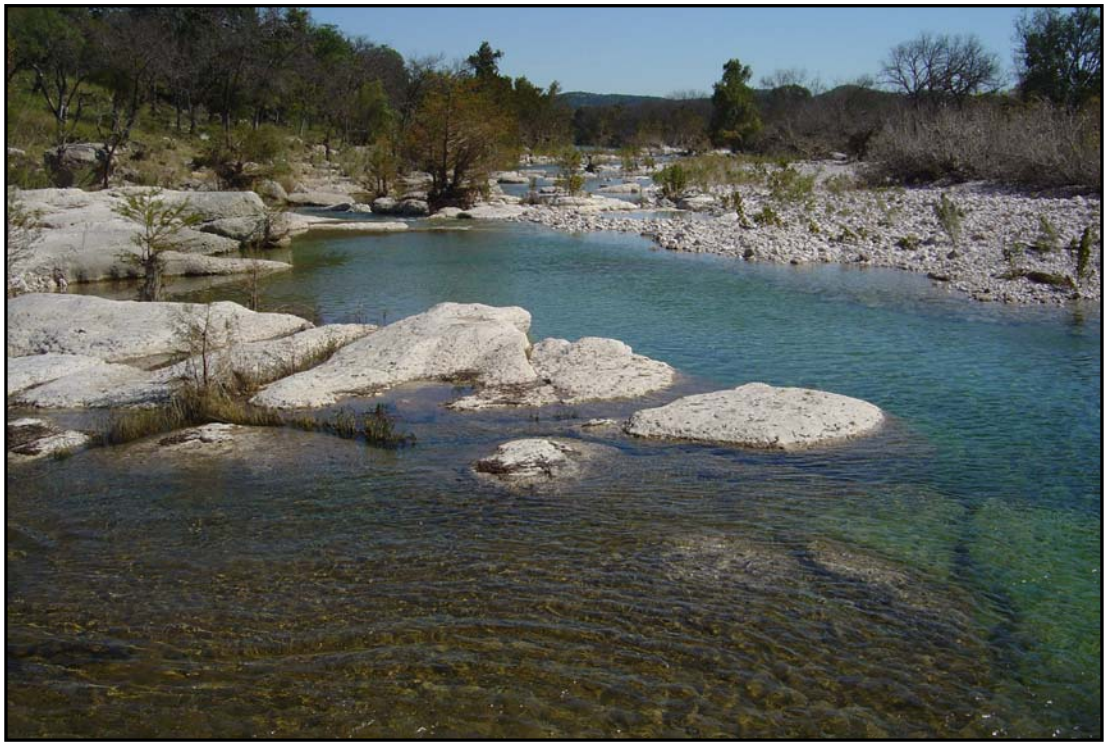


Figure 10. West Nueces River at a private ranch in Edwards County (11/13/03).

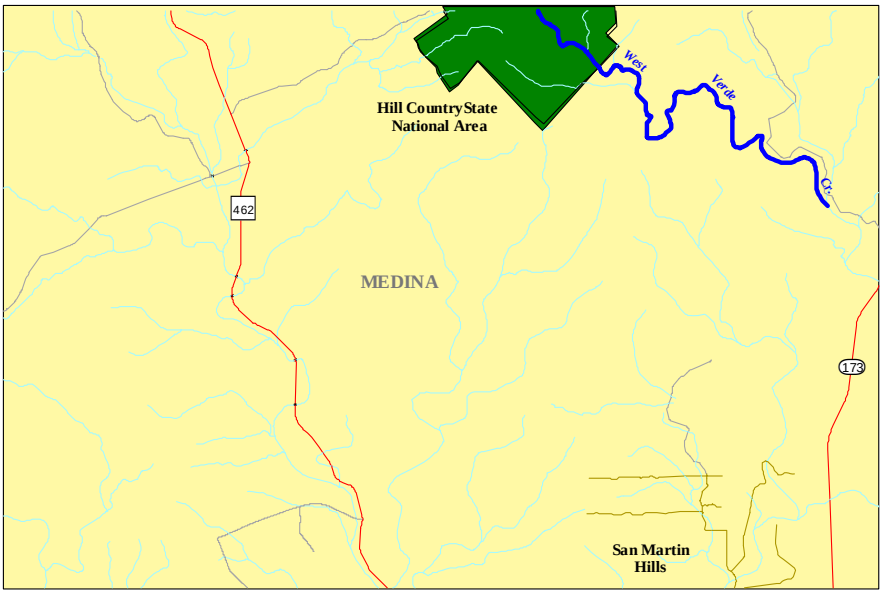


Figure 11. Ecologically significant stream segment of West Verde Creek (TxDOT 2000).

West Verde Creek

West Verde Creek begins in southern Bandera County and flows south into Medina County where it joins Middle Verde Creek and ultimately Verde Creek (TPWD 1998). The substrate of the creek is primarily composed of bedrock and the banks are lined with green ash (*Fraxinus pennsylvanica*), willow (*Salix nigra*), pecan (*Carya illinoensis*), sycamore (*Platanus occidentalis*), and live oak (*Quercus virginiana*) trees. Like other creeks in the area, the flow of West Verde Creek disappears as it crosses the Edwards Aquifer recharge zone in northern Medina County. Water that reappears downstream of the recharge zone flows into the Frio River through Verde Creek and Hondo Creek, thus providing freshwater inflow to Nueces and Corpus Christi bays. Fish collected by the TPWD Water Resources Branch on September 25, 2003 included the sand shiner (*Notropis stramineus*), channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropterus salmoides*), green sunfish (*Lepomis cyanellus*), longear sunfish (*Lepomis megalotis*), Mexican tetra (*Astyanax mexicanus*), and the endemic Plateau shiner (*Cyprinella lepida*). The ecologically significant stream segment is from the confluence with Middle Verde Creek upstream to the Medina County line (Figure 11). The ecological significance of this segment is based upon the following criteria:

- Hydrologic Function- numerous springs along the headwaters perform valuable hydrologic function relating to discharge of the Edwards Plateau Aquifer and flow within the creek provides valuable recharge as it crosses the outcrop portion of the Edwards Aquifer (Brune 1981).

- Riparian Conservation Area- fringed by the 5,369.8-acre Hill Country State Natural Area (TPWD 2005b).

- Threatened or Endangered Species/Unique Communities- significant due to presence of the Plateau shiner (*Cyprinella lepida*) (SOC) (Norris, unpublished data, TPWD 2005a). Numerous springs along the headwaters of West Verde Creek provide habitat for an undescribed species of salamander that belongs to the *Eurycea troglodytes* complex (Norris, unpublished data).

Figure 12. Falls on West Verde Creek at Hill Country State Natural Area (8/21/03).

Figure 13. Pool on West Verde Creek at Hill Country State Natural Area (8/21/03).

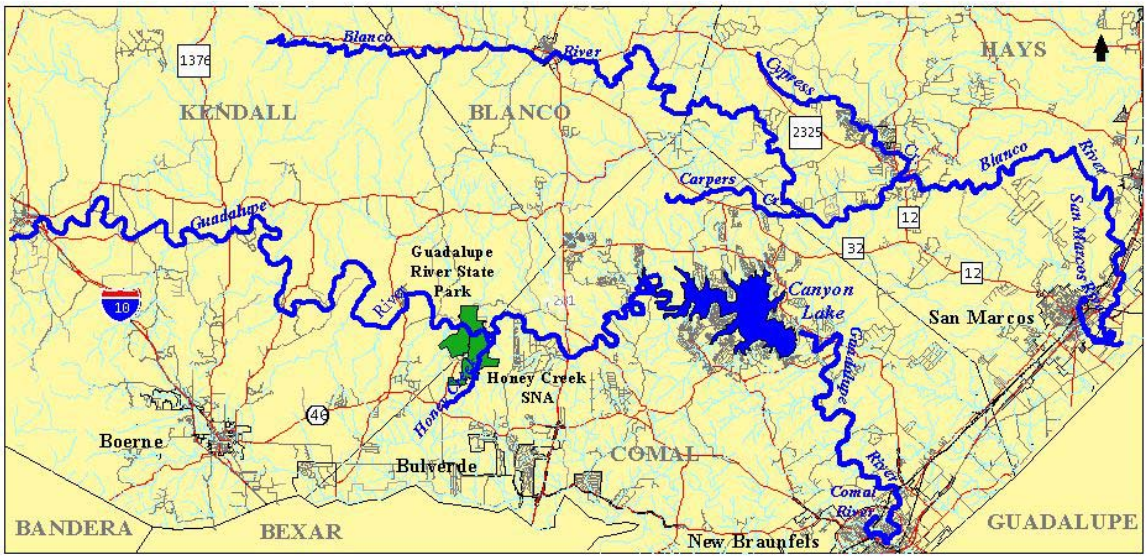


Figure 14. Ecologically significant stream segments of the Blanco River, Carpers Creek, Comal River, Cypress Creek, Upper Guadalupe River, Honey Creek, and Upper San Marcos River (TxDOT 2000).

Blanco River

The Blanco River rises in northeastern Kendall County and flows approximately 87 miles through Blanco and Hays counties before joining the San Marcos River two miles southeast of San Marcos (TPWD 1998). The river is within the Edwards Plateau and contains vegetation typical of the Live Oak-Ashe Juniper Parks and Live Oak-Ashe Juniper Woods associations (McMahan et al. 1984). The river receives flow from numerous springs within the riverbed and the watershed as a whole that provide it with clear, high quality water (Brune 1975, 1981). The upper section of the river in Kendall and Blanco counties is narrow and shallow for most of its length as it flows over a limestone bottom and between banks lined with bald cypress (*Taxodium distichum*) and limestone bluffs (Belisle and Josselet 1974). This segment is important to TPWD stocking experiments involving Guadalupe bass (*Micropterus treculi*) as it is downstream of areas where pure strain Guadalupe bass are being stocked in large numbers in an attempt to purify existing hybrid populations (G. Garrett 1999, pers. comm.). The lower section of the Blanco River in Hays County continues to flow over a bed of limestone between banks lined with bald cypress (*Taxodium distichum*), pecan (*Carya illinoensis*), willow (*Salix nigra*), and sycamore (*Platanus occidentalis*). During periods of normal flow the river is essentially divided into shallow stretches of flowing water interspersed with occasional deep pools, many as the result of low water dams and road crossings. Bellisle and Josselet (1974) considered this section of the Blanco as "some of the most interesting scenery in Central Texas." The river generally increases in size downstream of the community of Wimberley in Hays County as a result of increased inflows from

springs (i.e. Fern Bank Springs, Wimberley Springs, and others) and creeks (Belisle and Josselet 1974, Brune 1981). Tributaries to this section of the Blanco River include Cypress Creek, Carpers Creek, and Lone Man Creek among others. The ecologically significant stream segment is from a point 0.2 mile upstream of Limekiln Road in Hays County to the confluence of Meier Creek in Kendall County (TCEQ classified stream segment 1813) (Figure 14). The ecological significance of this segment is based upon the following criteria:

- Hydrologic Function- valuable hydrologic function relating to groundwater discharge of the Edwards and Trinity aquifers (Brune 1975, 1981).

- Riparian Conservation Area- fringed by the 104.6-acre Blanco State Park (TPWD 2005b).

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value- high water quality and exceptional aquatic life use (TCEQ 1996); exceptional aesthetic value (Belisle and Josselet 1974).

- Threatened or Endangered Species/Unique Communities- significant due to presence of the Blanco blind salamander (*Eurycea robusta*) (St. T), the Blanco River Springs salamander (*Eurycea pterophila*) (SOC), and the Guadalupe bass (*Micropterus treculi*) (TPWD 2005a).

Figure 15. Blanco River north of Old San Marcos-Wimberley Road in Hays County (6/11/01).

Carpers Creek

Carpers Creek rises in the northern part of Comal County and flows east for approximately six miles through Comal and Hays counties where it empties into the Blanco River. The creek is within the Guadalupe River Basin and has a drainage basin area of approximately 15 square miles (TPWD 1998). The watershed is within the Live Oak-Ashe Juniper Parks association, and the creek provides habitat for an exemplary natural aquatic community representative of the Edwards Plateau ecoregion (Bayer et al. 1992). The creek displays high bend development with numerous riffles containing gravel, cobble, and boulders and some deep pools with silt deposits (Bayer et al. 1992). The upper reach of Carpers Creek is intermittent and is characterized by shallow water flowing over a deeply-fissured limestone bed and pools formed at low water crossings and depressions in the stream bed. Large boulders and limestone bluffs about 40 feet high encompass Blue Hole, a spring-fed limestone sinkhole about 80 feet wide containing about 30 feet of water, which provides perennial flow in the lower section of Carpers Creek. The John Knox Ranch Camp and Conference Center fringe the lower section of Carpers Creek, including the Blue Hole, until its confluence with the Blanco River. The ecologically significant stream segment is from the confluence with the Blanco River in Hays County upstream to its headwaters in the northern part of Comal County (Figure 14). The ecological significance of this segment is based upon the following criteria:

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value- ecoregion stream; diverse benthic macroinvertebrate community (Bayer et al. 1992).

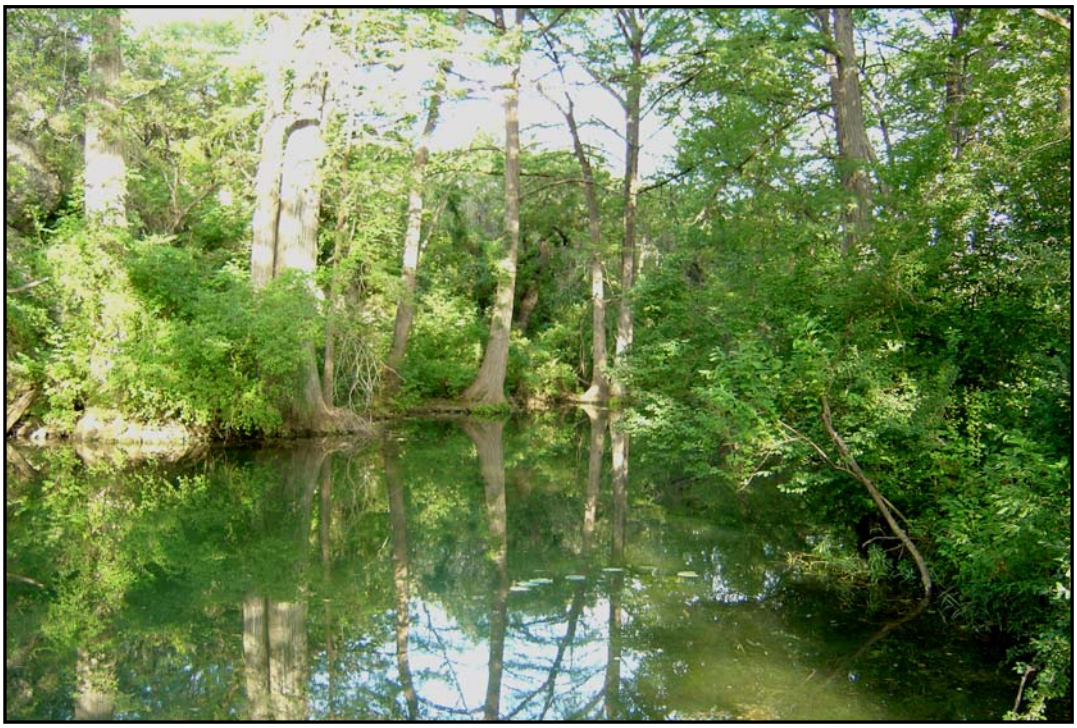


Figure 16. Carpers Creek at John Knox Ranch in Hays County (7/29/03)

Figure 17. Blue Hole on the John Knox Ranch in Hays County (07/29/03).

Comal River

The Comal River is formed by the largest spring system in Texas about one mile northwest of New Braunfels and flows southeast into the Guadalupe River (Brune 1975). It is the shortest river in Texas, at only two and one half miles, and the shortest river in the U.S. carrying an equivalent amount of water (Belisle and Josselet 1974). In addition to providing agricultural and municipal water supply, the Comal River supports a regional recreation and tourism industry and provides critical habitat for four federally endangered species. Spring waters that flow up from the Edwards Aquifer create a thermally constant environment that supports one of the greatest known diversities of organisms of any aquatic ecosystem in the southwestern United States (USFWS 1996). Because many of the plants and animals within this community depend upon the springs, most of this flora and fauna would disappear if the springs fail. The U.S. Fish and Wildlife Service has determined that flows of less than 150 cfs from Comal Springs will place these endangered species in jeopardy (USFWS 1996). San Marcos and Comal springs collectively account for over 30% of the flow of the Guadalupe River at it's mouth and 70% or more of baseflows during periods of drought (GBRA 1988), thus their contribution of freshwater inflow to San Antonio Bay, one of the state's major estuaries, is significant. The ecologically significant stream segment is from the confluence of the Guadalupe River in Comal County upstream to Landa Lake in New Braunfels (contains TCEQ classified stream segment 1811) (Figure 14). The ecological significance of this segment is based upon the following criteria:

- Biological Function- displays significant overall habitat value in both quantity and quality considering the degree of biodiversity and uniqueness observed in the aquatic habitat (USFWS 1996).

- Hydrologic Function- provides valuable hydrologic function relating to groundwater discharge of the Edwards Aquifer, as it is the largest spring system in the state (Brune 1975).

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value- presence of unique habitat dependent on or associated with high water quality (USFWS 1996); high water quality and exceptional aquatic life use (TNRCC 1996, TCEQ 2004).

- Threatened or Endangered Species/Unique Communities- significant due to presence of the fountain darter (*Etheostoma fonticola*) (Fed.E/St.E), Comal Springs riffle beetle (*Heterelmis comalensis*) (Fed.E/SOC), Comal Springs dryopid beetle (*Stygoparnus comalensis*) (Fed.E/SOC), Comal Springs diving beetle (*Comaldessus stygius*) (SOC) Peck's Cave amphipod (*Stygobromus pecki*) (Fed.E/St.E), Comal blind salamander (*Eurycea tridentifera*) (St.T), Comal Springs salamander (*Eurycea* sp. 8) (SOC), and Edwards Aquifer diving beetle (*Haideoporus texanus*) (SOC) (USFWS 1996, TPWD 2005a).

Figure 18. Comal River upstream of railroad trestle at Prince Solms Park (4/6/01).

Figure 19. Spring run #1 of Comal Springs in Landa Park in New Braunfels (4/6/01).

Cypress Creek

Cypress Creek begins in western Hays County and flows southeasterly through the communities of Woodcreek and Wimberley into the Blanco River. The creek lies within the Edwards Plateau and is one of the main tributaries to the lower Blanco River in the Guadalupe River Basin. The primary source of water for Cypress Creek is springs that issue through Jacobs Well west of the community of Woodcreek (Brune 1975). These springs have dissolved out a hole approximately 3-feet in diameter and 120-feet deep and provide perennial flow to Cypress Creek (Brune 1981). However, in the summer of 2000 the springs ceased to flow for the first time in recorded history. The watershed contains vegetation characteristic of the Live Oak-Ashe Juniper Parks association and bald cypress (*Taxodium distichum*) and sycamore (*Platanus occidentalis*) trees dominate the banks of the creek (McMahan et al. 1984). The substrate of the creek is primarily composed of bedrock overlaid by cobble and gravel. Filamentous algae, woody debris, boulders, and aquatic vegetation provide abundant instream cover for aquatic species. Fish collected from Cypress Creek by the TPWD Water Resources Branch in October 2003 included greenthroat darters (*Etheostoma lepidum*), orangethroat darters (*Etheostoma spectabile*), spotted sunfish (*Lepomis punctatus*), redear sunfish (*Lepomis microlophus*), roundnose minnows (*Dionda episcopa*), Texas shiners (*Notropis amabilis*), and largemouth bass (*Micropterus salmoides*). The ecologically significant stream segment is from the confluence with the Blanco River in Hays County upstream to a point four miles upstream of the most upstream unnamed county road crossing in Hays County (TCEQ classified stream segment 1815) (Figure 14). The ecological significance of this segment is based upon the following criteria:

- Hydrologic Function- provides valuable hydrologic function relating to groundwater discharge of the Trinity Aquifer (Brune 1975, 1981).

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value- high water quality and exceptional aquatic life use (TNRCC 1996).

Figure 20. Jacobs Well at the headwaters of Cypress Creek in Hays County (9/16/03).

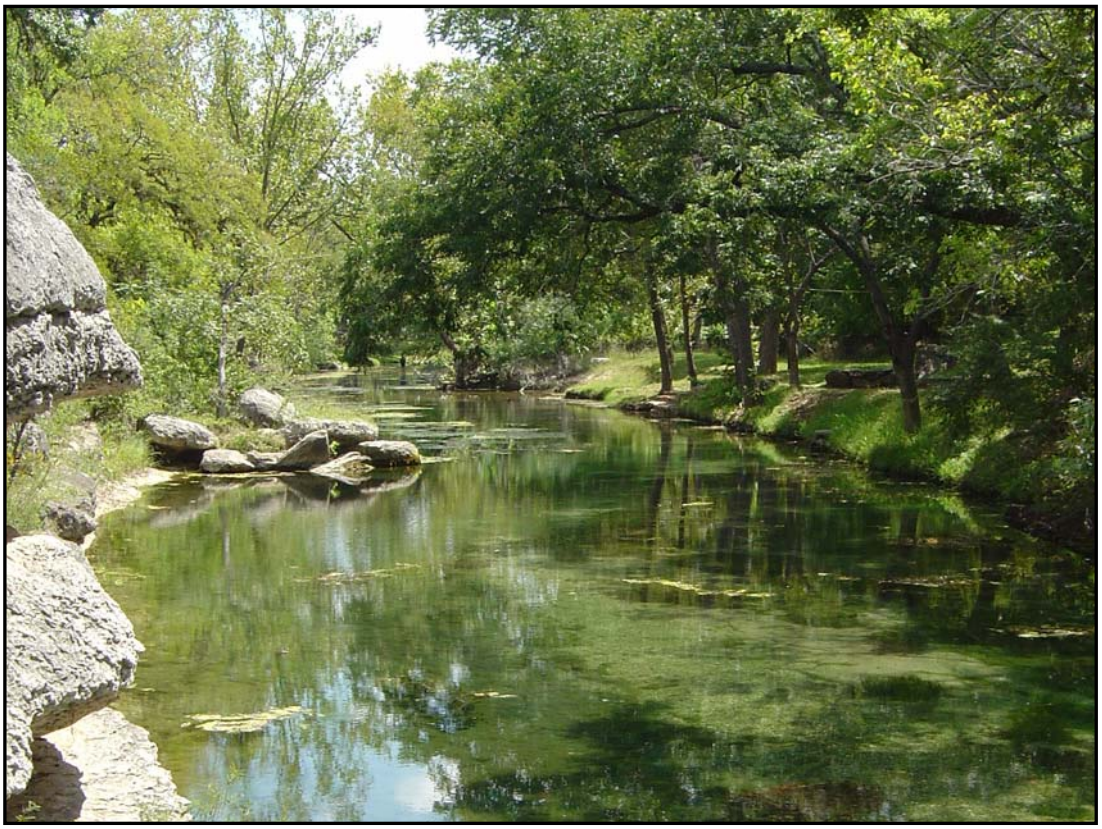


Figure 21. Cypress Creek downstream of Jacobs Well in Hays County (9/16/03).

Upper Guadalupe River

The Guadalupe River is formed in western Kerr County at the confluence of its north and south forks and flows southeasterly approximately 225 miles traversing Kerr, Kendall, Comal, Guadalupe, Gonzales, DeWitt, Victoria, Calhoun, and Refugio counties before emptying into San Antonio Bay (TPWD 1998). The river is spring-fed and is narrow and shallow in its upper reaches (Belisle and Josselet 1974). The Upper Guadalupe River meanders through limestone bluffs and banks lined with sycamore (*Platanus occidentalis*), basswood (*Tilia* sp.), elm (*Ulmus* sp.), pecan (*Carya illinoensis*), walnut (*Juglans* sp.), persimmon (*Diospyros* sp.), willow (*Salix nigra*), hackberry (*Celtis* sp.), and bald cypress (*Taxodium distichum*). Numerous rapids and falls exist on the Upper Guadalupe River. The aquatic and riparian habitats (Figures 22-23) associated with the river support an exceptionally diverse assemblage of invertebrates, fish, birds, mammals, and plants characteristic of the Edwards Plateau (Kutac and Caran 1994). Tributaries to this section of the Guadalupe River include Big Joshua Creek, Elm Creek, Honey Creek, Curry Creek and Spring Branch Creek as well as several smaller spring-fed streams. The Upper Guadalupe River is also important to TPWD stocking experiments involving Guadalupe bass (*Micropterus treculi*), a state species of special concern. It is downstream of areas where pure-strain Guadalupe bass are being stocked in large numbers in an attempt to purify existing hybrid populations (G. Garrett 1999, pers. comm.). The ecologically significant stream segment is from the confluence of the Comal River in Comal County upstream to the Kendall/Kerr County line, excluding Canyon Reservoir (TCEQ classified stream segment 1812 and part of 1806) (Figure 14). The ecological significance of this segment is based upon the following criteria:

- Hydrologic Function- performs valuable hydrologic function relating to discharge of the Edwards Plateau Aquifer (Brune 1975).

- Riparian Conservation Area- fringed by the 1,938.7-acre Guadalupe River State Park (TPWD 2005b).

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value- high water quality and exceptional aquatic life use (TNRCC 1996, TCEQ 2004); high aesthetic value as it was rated the number two scenic river in the state of Texas (Appendix B) (NPS 1995).

- Threatened or Endangered Species/Unique Communities- significant due to presence of the Plateau shiner (*Cyprinella lepida*) (SOC), Guadalupe darter (*Percina sciera apristis*) (SOC), and headwater catfish (*Ictalurus lupus*) (SOC) (TPWD 2005a).

Figure 22. Guadalupe River west of FM 3160 in Kendall County (5/9/01).

Figure 23. Guadalupe River upstream of River Road in New Braunfels (4/6/01).

Honey Creek

Honey Creek begins north of the Oak Cliff Acres subdivision in the northwestern part of Comal County and flows for approximately three miles where it joins the Guadalupe River (TPWD 1998). The creek is a small spring-fed stream that cuts through an area of high biological diversity with nine different soil types (TPWD 2005b). The uplands of the Honey Creek Natural Area adjacent to the creek contain a mix of native trees and grasses, while the canyon formed by the creek is lined with cedar elm (*Ulmus crassifolia*), old-growth junipers (*Juniperus ashei*), Spanish oak (*Quercus buckleyi*), pecan (*Carya illinoensis*), walnut (*Juglans* sp.), and Mexican buckeye (*Ungnadia speciosa*). Dominant species in the floodplain include sycamore (*Platanus occidentalis*) and bald cypress (*Taxodium distichum*), and the banks are lined with dwarf palmetto (*Sabal minor*), ferns, columbine, and an array of emergent vegetation. The fauna of the area includes typical Edwards Plateau species, such as white-tailed deer (*Odocoileus virginianus*), jackrabbits (*Lepus* sp.), Rio Grande turkeys (*Meleagris gallopavo intermedia*), and ringtails (*Bassariscus astutus*), but also includes many endemic species with limited ranges (Kutac and Caran 1994, TPWD 2005a). The ecologically significant stream segment is from the confluence with the Guadalupe River upstream to the headwaters in northwestern Comal County (Figure 14). The ecological significance of this segment is based upon the following criteria:

- Biological Function- significant overall habitat value considering the degree of biodiversity and uniqueness observed in the terrestrial and aquatic habitats (Kutac and Caran 1994, TPWD 2005a).

- Hydrologic Function- valuable hydrologic function relating to groundwater discharge and recharge (Brune 1981, Veni 1997).

- Riparian Conservation Area- fringed by the 2,293.7-acre Honey Creek State Natural Area (TPWD 2005b).

- Threatened or Endangered Species/Unique Communities- significant due to presence of Guadalupe bass (*Micropterus treculi*) (SOC), Cagle's map turtle (*Graptemys caglei*) (SOC), Comal blind salamander (*Eurycea tridentifera*) (SOC), green kingfisher (*Chloroceryle americana*) (SOC), and four-lined skink (*Eumeces tetragrammus*) (SOC) (TPWD 2005a, 2005b).

Figure 24. Honey Creek at Honey Creek State Natural Area in Comal County (5/18/01).

Figure 25. Honey Creek at Honey Creek State Natural Area in Comal County (5/18/01).

Upper San Marcos River

The San Marcos River is formed by several major springs in the City of San Marcos and flows for approximately 80 miles before joining the Guadalupe River southwest of Gonzales. San Marcos Springs is the second largest spring system in Texas and has historically exhibited the greatest dependability and stability of any spring system in the southwestern Unites States (Brune 1981, USFWS 1996). An estimated 200 springs issue from 3 large fissures and numerous smaller openings in the bottom of Spring Lake at the head of the San Marcos River (Brune 1981). The springs receive local recharge where the Blanco River, Guadalupe River, Sink Creek, Purgatory Creek, York Creek, and Alligator Creek cross the Balcones Fault Zone, but the majority of flow comes from the Edwards Aquifer to the west-southwest (Brune 1981). The Upper San Marcos River contains many shallow riffles with gravel and gravel/sand substrate that alternate with deep pools containing silt substrates. Like the Comal River system, the upper San Marcos River has one of the greatest known diversities of aquatic organisms in the southwestern United States (USFWS 1996). The unique habitats and relatively constant thermal environment provided by these spring systems support many endemic species. It is the only known location of several species, such as the San Marcos salamander (*Eurycea nana*) and Texas wild rice (*Zizania texana*) (USFWS 1996, TPWD 2005a). This segment also eventually provides freshwater inflow to San Antonio Bay, one of the state's major estuaries. The ecologically significant stream segment is from a point 0.7 miles downstream of IH 35 in Hays County to a point 0.4 mile upstream of Loop 82 in San Marcos (TCEQ classified stream segment 1814) (Figure 14). The ecological significance of this segment is based upon the following criteria:

- Biological Function- significant overall habitat value regarding the degree of biodiversity, age, and uniqueness observed in the aquatic habitat (USFWS 1996).

- Hydrologic Function- provides valuable hydrologic functions relating to groundwater discharge of the Edwards Aquifer (Brune 1981).

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value- high water quality and exceptional aquatic life use (TNRCC 1996, TCEQ 2004).

- Threatened or Endangered Species/Unique Communities- significant due to presence of the American eel (*Anguilla rostrata*) (SOC), fountain darter (*Etheostoma fonticola*) (Fed.E/St.E), Texas blind salamander (*Eurycea rathbuni*) (Fed.E/St.E), San Marcos salamander (*Eurycea nana*) (Fed.T/St.T), and Texas wild rice (*Zizania texana*) (Fed.E/St.E) (USFWS 1996, Kelsey 1997, TPWD 2005a). Recently, the Comal Springs riffle beetle (*Heterelmis comalensis*) (Fed.E/SOC), once thought to only inhabit Comal Springs, was collected from spring orifices on the banks of Spring Lake.

Figure 26. San Marcos River south of Cheatham Street in San Marcos, TX (4/18/01).

Figure 27. San Marcos River north of Loop 82 at the outfall of Spring Lake (4/18/01).

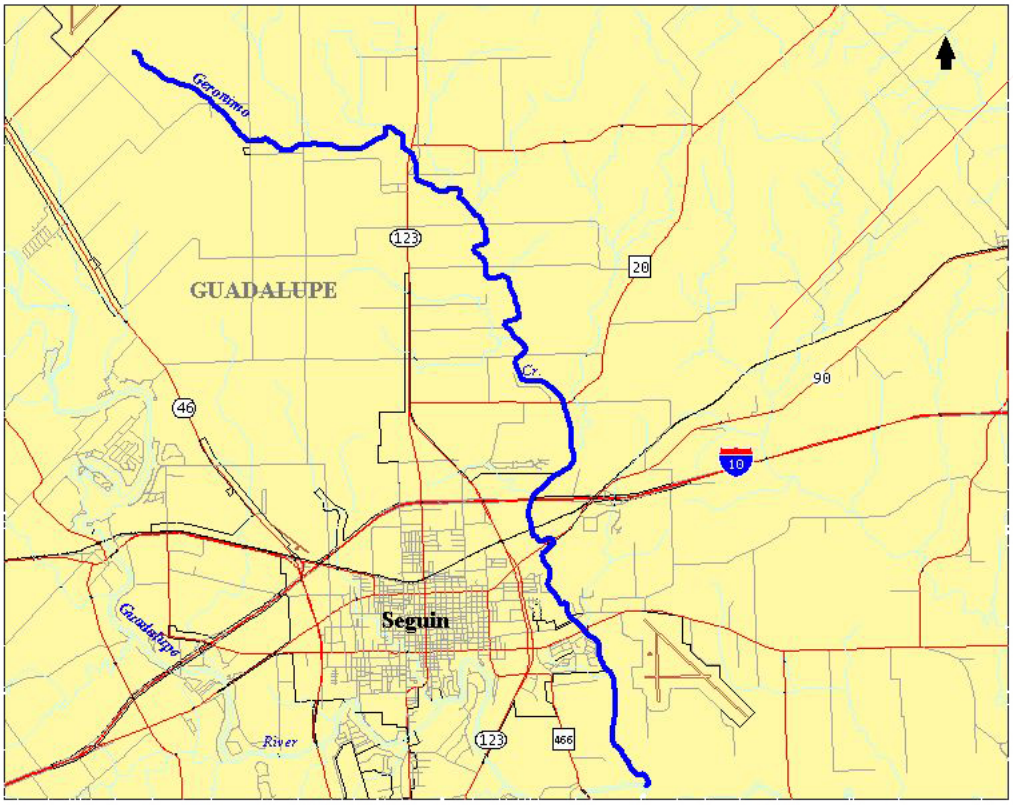


Figure 28. Ecologically significant stream segment of Geronimo Creek (TxDOT 2000).

Geronimo Creek

Geronimo Creek begins in northwestern Guadalupe County and flows southeast 15 miles into the Guadalupe River about four miles southeast of Seguin in central Guadalupe County (TPWD 1998). The creek has a drainage basin area of approximately 24 square miles (Bayer et al. 1992) and the surrounding vegetation is dominated by croplands (McMahan et al. 1984). The head of the creek is fed by Geronimo Springs, which Brune (1981) classified as a medium-sized spring (1 to 10 cfs). In addition, numerous unnamed springs and seeps contribute to streamflow according to local landowners (Bayer et al. 1992). The stream has moderate bend development and occasional riffles and runs that separate long, deep pools (Bayer et al. 1992). Geronimo Creek contains a natural aquatic community representative of the Texas Blackland Prairie ecoregion (Bayer et al. 1992; Linam et al. 2002). Fish species collected during the Texas Aquatic Ecoregion Project in June 1988 included the mimic shiner (*Notropus volucellus*), Guadalupe bass (*Micropterus treculi*), and Texas logperch (*Percina carbonaria*) (Bayer et al. 1992). The presence of these intolerant species reflects the relatively undisturbed nature of Geronimo Creek (Linam and Kleinsasser 1998, Linam et al. 2002). The ecologically significant stream segment is from the confluence with the Guadalupe River upstream to its headwaters northwest of Geronimo in Guadalupe County (Figure 28). The ecological significance of this segment is based upon the following criteria:

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value- ecoregion stream; high water quality, diverse benthic macroinvertebrate community (Bayer et al. 1992).

Figure 29. Geronimo Creek north of Laubach Road in Guadalupe County (5/18/01).

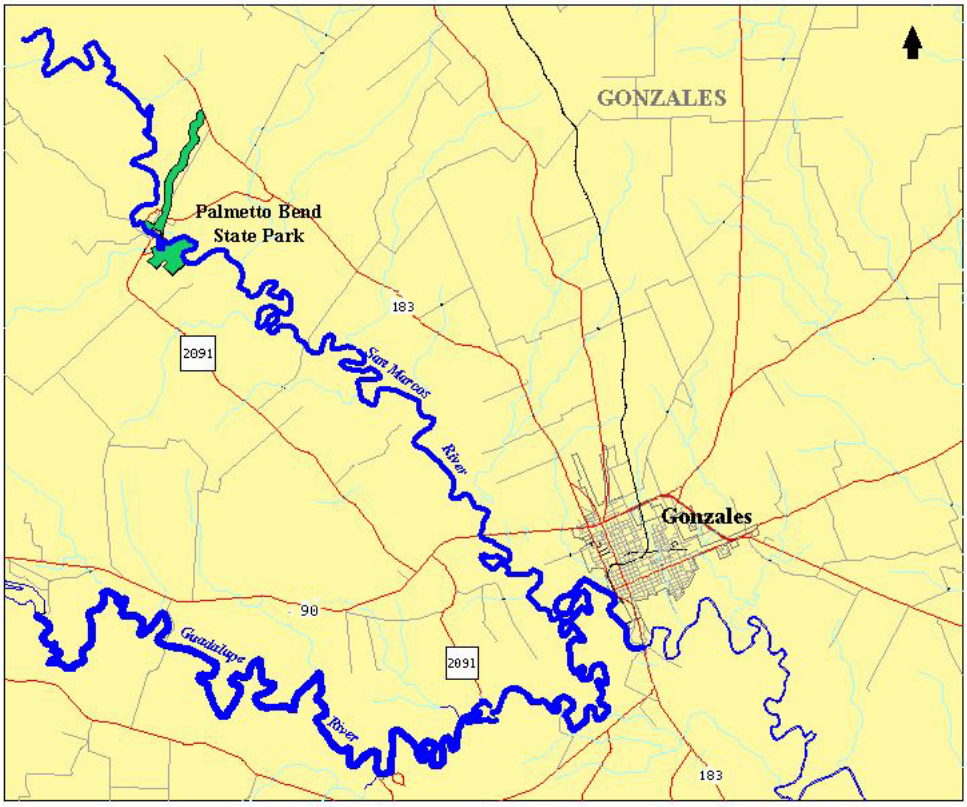


Figure 30. Ecologically significant stream segments of the Middle Guadalupe and Lower San Marcos rivers (TxDOT 2000).

Middle Guadalupe River

This section of the Guadalupe River is slower moving than the upper reaches of the river due to a decreased gradient as it leaves the Edwards Plateau and enters the relatively flat coastal plains. Water clarity in this section of the river is greatly decreased due to increased sediment loads and numerous sandbars are present along its banks (Belisle and Josselet 1974). The major tributary to this section of the Guadalupe River is the San Marcos River. The riparian habitats associated with the river function to improve the quality of runoff and groundwater discharge into the river, attenuate peak flood flows, and to some extent, stabilize base flows. The ecologically significant stream segment is from US 183 in Gonzales County upstream to Lake Gonzales Dam in Gonzales County (within TCEQ classified stream segments 1803 and 1804) (Figure 30). The ecological significance of this segment is based upon the following criteria:

- Threatened or Endangered Species/Unique Communities- contains two of only four known remaining populations of the golden orb (*Quadrula aurea*) (SOC), an endemic freshwater mussel (Howells et al. 1996, Howells 1997).

Figure 31. Guadalupe River at Independence Park in Gonzales County (5/8/01).

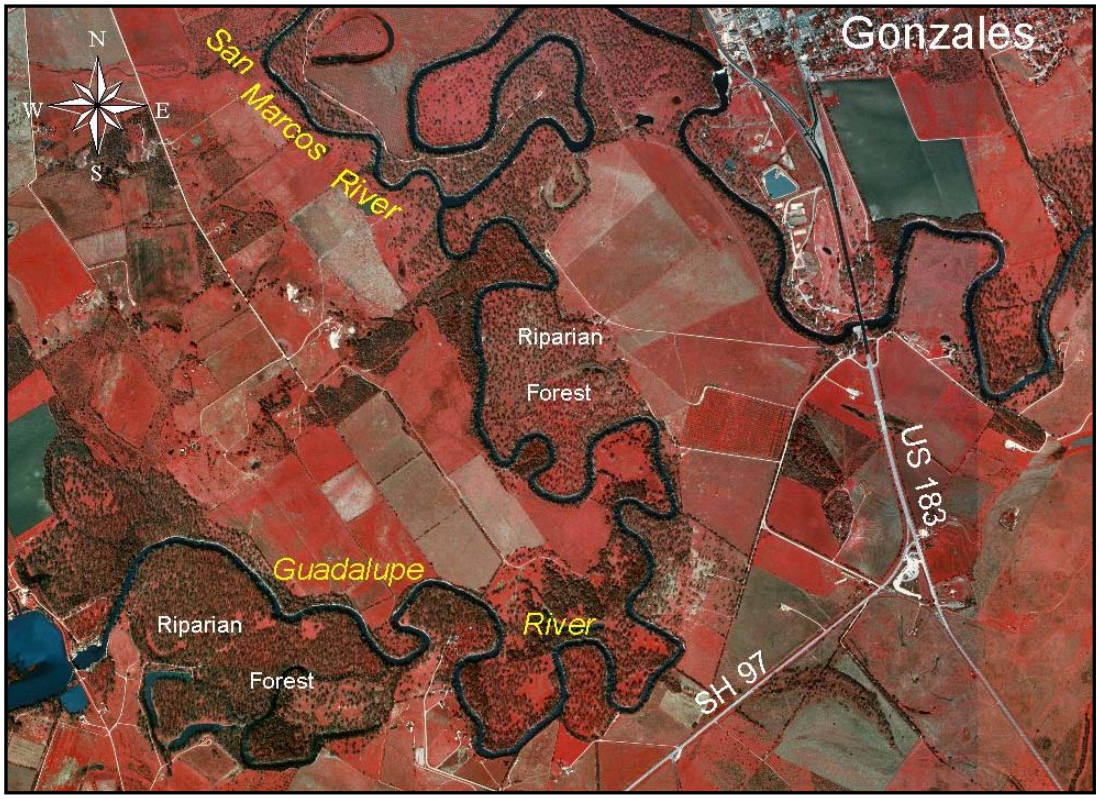


Figure 32. Guadalupe and San Marcos Rivers at Gonzales. Source: Gonzales South DOQ, 1995, 1m CIR (TNRIS, 1995-1997).

Lower San Marcos River

This section of the San Marcos River is within the Oak Woods and Prairie ecoregion of the State; however, the area surrounding the river near the City of Ottine offers a diversity of plant and animal life that is more tropical in appearance than most of Central Texas. A large stand of dwarf palmettos (*Sabal minor*) found in Palmetto State Park marks the western and northernmost distribution of comparable stands of the palmetto (Kutac and Caran 1994). This section of the San Marcos River is predominantly wide and deep, although some swift runs and shallow riffles exist. The banks of the river are largely steep and muddy and the relatively dense vegetation that lines the banks provides abundant woody debris. Palmetto State Park, which fringes this segment of the San Marcos River, is part of the Great Texas Coastal Birding Trail. Numerous bird species have been observed in the area, including the prothonotary warbler (*Protonotaria citrea*), northern parula (*Parula americana*), painted bunting (*Passerina ciris*), and red-shouldered hawk (*Buteo lineatus*) (TPWD and TxDOT 1999). The ecologically significant stream segment is from the confluence with the Guadalupe River upstream to the Caldwell/Gonzales County line (within TCEQ classified stream segment 1808) (Figure 30). The ecological significance of this segment is based upon the following criteria:

- Riparian Conservation Area- fringed by 270.3-acre Palmetto State Park (TPWD 2005b).

- Threatened or Endangered Species/Unique Communities- significant due to presence of the American eel (*Anguilla rostrata*) (SOC) and the golden orb (*Quadrula aurea*) (SOC), an endemic freshwater mussel (L.A. Linam 2001, pers. comm., TPWD 2005a).

Figure 33. San Marcos River east of CR 250 in Gonzales County (5/8/01).

Figure 34. San Marcos River at Palmetto State Park in Gonzales County (5/8/01).

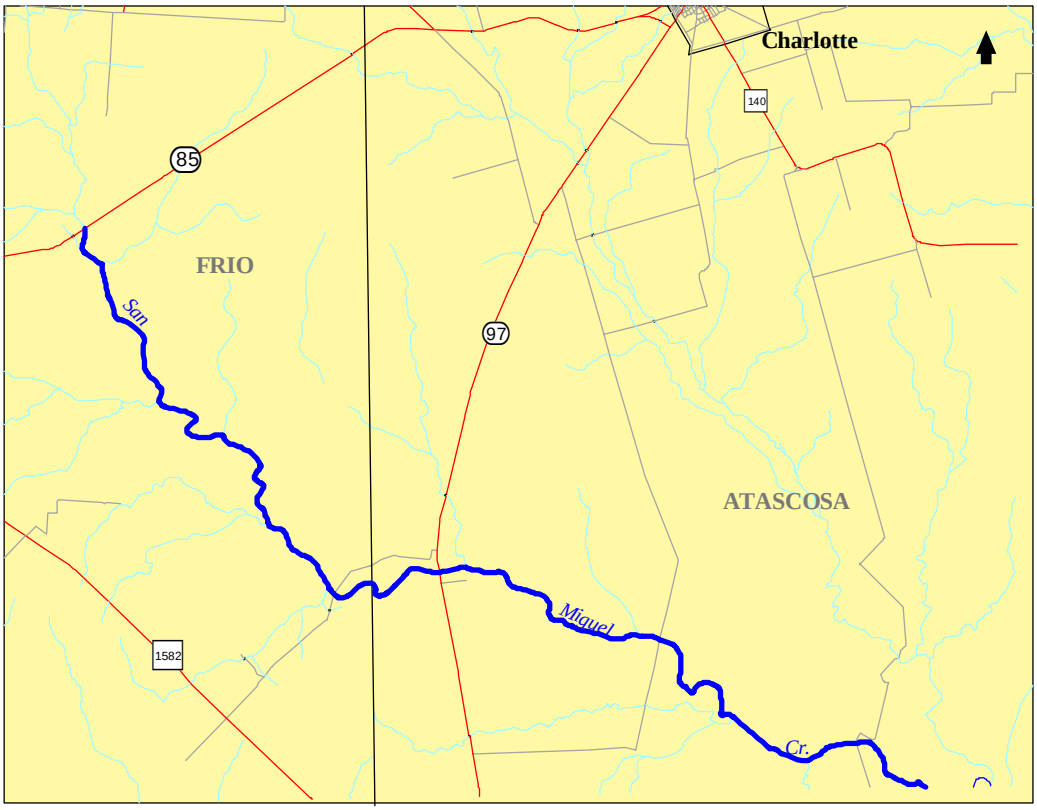


Figure 35. Ecologically significant stream segment of San Miguel Creek (TxDOT 2000).

San Miguel Creek

San Miguel Creek begins in northeastern Frio County at the union of San Francisco Perez Creek and Chacon Creek. The creek flows southeast for approximately 46 miles through Frio, Atascosa, and McMullen counties and is within the Frio River watershed (TPWD 1998). All three counties are representative of the South Texas Brush Country, which is characterized by hickory (*Carya* sp.), oak (*Quercus* sp.), huisache (*Acacia farnesiana*), prickly pear (*Opuntia* sp.), brush, and grasses (McMahan et al. 1984). Banks of the creek are lined with green ash (*Fraxinus pennsylvanica*), willow (*Salix nigra*), cedar elm (*Ulmus crassifolia*), pecan (*Carya illinoensis*), and live oak (*Quercus virginiana*), as well as numerous emergent plant species. Common wildlife seen in the area includes javelina (*Peccary angulatus*), bobcats (*Felis rufus*), ringtails (*Bassariscus astutus flavus*), beaver (*Castor canadensis*), badgers (*Taxidea taxus*), and Rio Grande turkeys (*Meleagris gallopavo intermedia*) (Kutac and Caran 1994). Fish collected from San Miguel Creek by the TPWD River Studies Program in July 1990 included the bullhead minnow (*Pimephales vigilax*), warmouth (*Lepomis gulosis*), orangespotted sunfish (*Lepomis humilis*), white crappie (*Pomoxis annularis*), and largemouth bass (*Micropterus salmoides*) (Bayer et al. 1992). The ecologically significant stream segment is from the Atascosa/McMullen County line upstream to the SH 85 crossing in eastern Frio County (Figure 35). The ecological significance of this segment is based upon the following criteria:

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value- ecoregion stream; high water quality, diverse fish community (Bayer et al., 1992; Linam et al., 2002).

Figure 36. San Miguel Creek north of CR 204 in Frio County (5/9/01).

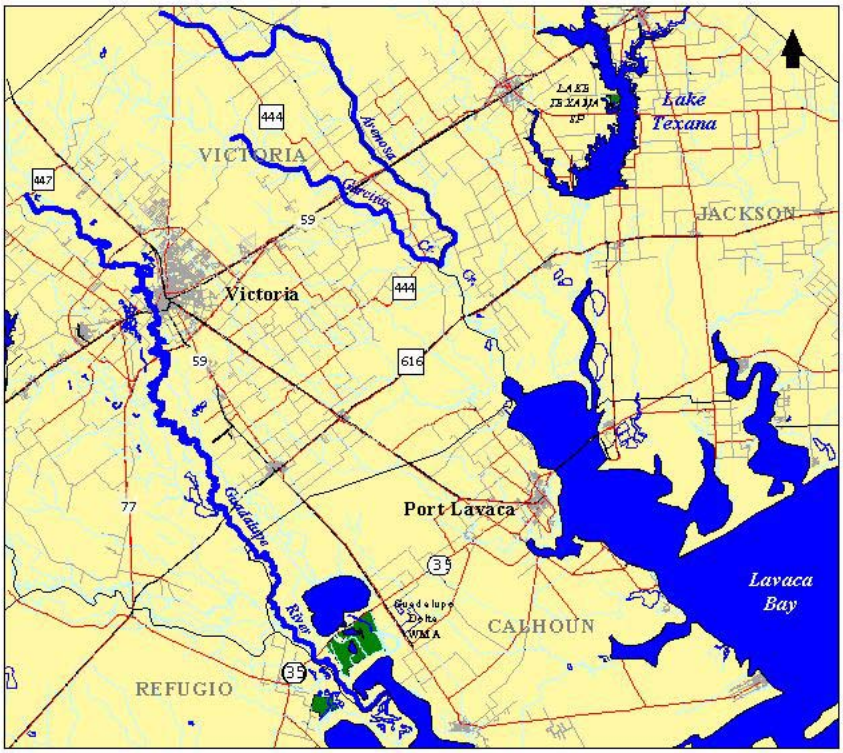


Figure 37. Ecologically significant stream segments of Arenosa Creek, Garcitas Creek, and Lower Guadalupe River (TxDot 2000).

Arenosa Creek

Arenosa Creek rises in northern Victoria County and flows southeast for approximately 28 miles, forming the boundary of Jackson and Victoria Counties much of the way before joining Garcitas Creek (Belisle and Josselet 1974). The creek is within the Lavaca-Guadalupe River Basin and has a drainage basin area of approximately 91 square miles (TPWD 1998). It ultimately discharges into the Gulf of Mexico after emptying into Lavaca and Matagorda bays through Garcitas Creek. The portion of the watershed upstream of U.S. Hwy 59 is within the Bluestem Grassland association, while the lower portion is dominated by cropland. The creek displays moderate bend development and contains numerous short riffles with gravel substrate that separates long deep pools containing sandy substrate (Bayer et al. 1992). The habitat provided by the creek contains a natural aquatic community representative of the Gulf Coast Prairies and Marshes ecoregion (Bayer et al. 1992, Linam et al. 2002). Fish collected by the TPWD River Studies Program in September 1988 included spotted gar (*Lepisosteus oculatus*), American eel (*Anguilla rostrata*), red shiner (*Cyprinella lutrensis*), bluegill (*Lepomis macrochirus*), longear sunfish (*Lepomis megalotis*), and largemouth bass (*Micropterus salmoides*) (Bayer et al. 1992). The ecologically significant stream segment is from the confluence with Garcitas Creek upstream to its headwaters in northern Victoria County (Figure 37). The ecological significance of this segment is based upon the following criteria:

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value- ecoregion stream; diverse benthic macroinvertebrate community (Bayer et al. 1992).

Figure 38. Arenosa Creek north of US 59 in Victoria County (5/8/01).

Garcitas Creek

Garcitas Creek begins in northeast DeWitt County and flows southeast through Victoria County where it joins Arenosa Creek and empties into Lavaca Bay. The creek is within the Lavaca-Guadalupe River Basin and has a drainage basin area of approximately 62 square miles (TPWD 1998). The upper portion of the watershed is within the Bluestem-Grassland association and the lower portion is dominated by croplands (McMahan et al. 1984). Estuarine wetlands that provide valuable habitat and hydrologic functions surround the creek downstream of the confluence with Arenosa Creek as it nears Lavaca Bay (USFWS 2001). The creek has some well-developed bends with a moderate amount of riffles that separate long, narrow pools and the substrate is predominantly fine sand with gravel occupying the riffle areas (Bayer et al. 1992). The creek contains a natural biotic community representative of the Gulf Coast Prairies and Marshes ecoregion (Bayer et al. 1992, Linam et al. 2002). The ecologically significant stream segment is from the confluence with Lavaca Bay in Victoria/Jackson/Calhoun County upstream to FM 1315 in Victoria County (Figure 37). The ecological significance of this segment is based upon the following criteria:

- Biological Function- estuarine wetland habitats display significant overall habitat value (USFWS 2001).

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value- ecoregion stream; high water quality, diverse benthic macroinvertebrate community (Bayer et al. 1992).

- Threatened or Endangered Species/Unique Communities- one of only a few locales where Texas palmetto occurs naturally; diamondback terrapin (St. SOC) (B. Ortego 1999, pers. comm.).

Figure 39. Garcitas Creek north of FM 444 in Victoria County (5/8/01).

Figure 40. Freshwater marsh east of Garcitas Creek at FM 616 in Victoria County (5/8/01).

Lower Guadalupe River

The Lower Guadalupe River is typically slow-moving as it meanders its way through Victoria and Calhoun counties toward the coast and into Guadalupe Bay. Major tributaries to this section of the Guadalupe River include the San Antonio River and Coleto Creek. The freshwater and estuarine wetlands associated with the river perform valuable hydrologic functions relating to water quality and flood attenuation. The river and associated wetlands also offer ample opportunity for birdwatching, as evidenced by a site on the Great Texas Coastal Birding Trail. The federal and state listed endangered whooping crane (*Grus americana*) spends time from November to March in this area (Bauer et al. 1991, TPWD and TxDOT 1999). The ecologically significant stream segment is from the confluence with Guadalupe Bay in Calhoun/Refugio County upstream to FM 447 in northwest Victoria County (TCEQ classified stream segment 1801) (Figure 37). The ecological significance of this segment is based upon the following criteria:

- Biological Function- extensive freshwater and estuarine wetlands display significant overall habitat value (Bauer et al. 1991, USFWS 2001).

- Riparian Conservation Area- fringed by Guadalupe Delta Wildlife Management Area, which is one of the largest wetland reserve projects in the United States at almost 6,000-acres (B. Ortego, 1999, pers. comm., TPWD 2005c).

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value- high water quality and exceptional aquatic life use (TNRCC 1996, TCEQ 2004).

- Threatened or Endangered Species/Unique Communities- whooping crane (Fed.E/St.E); unique and extensive marsh communities (Bauer et al. 1991, TPWD 2005a).

Figure 41. Guadalupe River upstream of River Road on Calhoun/Refugio County line (5/8/01).

Figure 42. Guadalupe River north of FM 447 in Victoria County (5/8/01).

Figure 43. Ecologically significant stream segments of the Aransas and Mission rivers (TxDot 2000).

Aransas River

The Aransas River begins at the confluence of Olmos, Aransas, and Poesta creeks in south central Bee County and is within the San Antonio-Nueces River Basin. It flows southeast for approximately 40 miles where it forms the boundary between San Patricio and Refugio counties before emptying into Copano Bay in Aransas County (Belisle and Josselet 1974). In its upper reaches the river transects the South Texas Brush Country before entering the Gulf Coast Prairies and Marshes in Refugio County. The tidal segment of the Aransas River runs from a point about 3.3 miles upstream from the confluence with Chiltipin Creek downstream to its confluence with Copano Bay (TNRCC 1996). This area provides habitat for raptors, pelicans, herons, egrets, waterfowl, and shorebirds such as the state listed threatened reddish egret (*Egretta rufescens*) (TPWD and TxDOT 1999). The stream segment and its associated wetlands display significant overall habitat value by providing nursery habitat and freshwater inflows that support economically valuable commercial and recreational fisheries and wildlife resources. Two sites on the Great Texas Coastal Birding Trail, Black Point and Egery Flats, are associated with this segment of the Aransas River. The ecologically significant stream segment is from Copano Bay upstream to US Highway 77 in Refugio County (TCEQ classified stream segment 2003 and part of 2004) (Figure 43). The ecological significance of this segment is based upon the following criteria:

- Biological Function- extensive estuarine wetlands in the Aransas River Delta display significant overall habitat value (USFWS 2001).

- Hydrologic Function- estuarine and freshwater wetlands perform valuable hydrologic function relating to water quality and flood attenuation by filtering excess nutrients, sediment, and contaminants from runoff entering the river and Copano Bay, which it provides with freshwater inflow (USFWS 2001).

- Threatened or Endangered Species/Unique Communities- significant due to presence of reddish egret (*Egretta rufescens*) (SOC/St.T), piping plover (Fed.T/St.T), snowy plover (SOC), white-faced ibis (SOC/St.T), wood stork (SOC/St.T), brown pelican (Fed.E/St.E) (TPWD 2005a).

Figure 44. Shorebirds in estuarine habitat at Egery Flats off FM 136.

Mission River

The Mission River is formed at the confluence of Medio and Blanco creeks west of Refugio in Refugio County. The river is within the Coastal Bend region of Texas and is one of two major rivers that provide freshwater to the Mission-Aransas Estuary. Major tributaries to this section of the Mission River include Sous and Melon creeks, which also contribute valuable freshwater inflow to Mission and Copano bays. Hunting, fishing, and birdwatching opportunities are abundant in the area as its wide array of habitats supports a diverse blend of wildlife. The 4,000-acre Fennessey Ranch occupies nine miles of river frontage along this section of the Mission River (Moulton and Jacob 2001). Over 400 species of birds have been counted on the ranch, including the black-bellied whistling duck (*Dendrocygna autumnalis*), mottled duck (*Anas fulvigula*), masked duck (*Nomonyx dominicus*), least bittern (*Ixobrychus exilis*), purple gallinule (*Porphyrula martinica*), common moorhen (*Gallinula chloropus*), marsh wren (*Cistothorus palustris*), sandhill crane (*Grus canadensis*), Sprague's pipit (*Anthus spragueii*), sparrows, and numerous other avian species (TPWD and TxDOT 1999). The river is fringed by three sites on the Central Texas Coast portion of the Great Texas Coastal Birding Trail: Lion's/Shelley Park, Fennessey Ranch, and Mission River Flats (TPWD and TxDOT 1999). The ecologically significant stream segment is from the confluence with Mission Bay in Refugio County upstream to the U.S. Highway 77 crossing in Refugio County (TCEQ classified stream segment 2001 and part of 2002) (Figure 43). The ecological significance of this segment is based upon the following criteria:

- Biological Function- extensive freshwater and estuarine wetland habitat displays significant overall habitat value (Bauer et al. 1991).

- Hydrologic Function- estuarine and freshwater wetlands perform valuable hydrologic function relating to water quality and flood attenuation by filtering excess nutrients, sediment, and contaminants from runoff entering the river and Copano Bay, which it provides with freshwater inflow (USFWS 2001) (Figure 47).

Figure 45. Mission River west of FM 2678 in Refugio County (5/8/01).

Figure 46. Estuarine wetlands adjacent to Mission River east of FM 2678 in Refugio County (5/8/01).

Figure 47. Mission River at FM 2678 in Refugio County. Note extensive estuarine wetlands surrounding the river. Source: Mission Bay DOQ, 1995, 1m CIR (TNRIS 1995-1997).

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Appendix A: 31 TAC § 357.8 Ecologically Unique River and Stream Segments

(a) Regional water planning groups may include in adopted regional water plans recommendations for all or parts of river and stream segments of unique ecological value located within the regional water planning area by preparing a recommendation package consisting of a physical description giving the location of the stream segment, maps, and photographs of the stream segment and a site characterization of the stream segment documented by supporting literature and data. The recommendation package shall address each of the criteria for designation of river and stream segments of ecological value found in subsection (b) of this section. The regional water planning group shall forward the recommendation package to the Texas Parks and Wildlife Department and allow the Texas Parks and Wildlife Department 30 days for its written evaluation of the recommendation. The adopted regional water plan shall include, if available, Texas Parks and Wildlife Department's written evaluation of each river and stream segment recommended as a river or stream segment of unique ecological value.
(b) A regional water planning group may recommend a river or stream segment as being of unique ecological value based upon the following criteria:

(1) ***biological function****--stream segments which display significant overall habitat value including both quantity and quality considering the degree of biodiversity, age, and uniqueness observed and including terrestrial, wetland, aquatic, or estuarine habitats;*

(2) ***hydrologic function****--stream segments which are fringed by habitats that perform valuable hydrologic functions relating to water quality, flood attenuation, flow stabilization, or groundwater recharge and discharge;*

(3) ***riparian conservation areas****--stream segments which are fringed by significant areas in public ownership including state and federal refuges, wildlife management areas, preserves, parks, mitigation areas, or other areas held by governmental organizations for conservation purposes, or stream segments which are fringed by other areas managed for conservation purposes under a governmentally approved conservation plan;*

(4) ***high water quality/exceptional aquatic life/high aesthetic value****-- stream segments and spring resources that are significant due to unique or critical habitats and exceptional aquatic life uses dependent on or associated with high water quality; or*

(5) ***threatened or endangered species/unique communities****--sites along streams where water development projects would have significant detrimental effects on state or federally listed threatened and endangered species, and sites along streams significant due to the presence of unique, exemplary, or unusually extensive natural communities.*

Appendix B:
Nationwide Rivers Inventory Summary

In 1968 Congress passed the Wild and Scenic Rivers Act, which called for the identification of potential wild, scenic, and recreational river areas of the nation. The Act declared that the established national policy of dams and other construction on appropriate sections of river should be complimented by a policy to preserve other sections of rivers in their free-flowing condition to "protect water quality and to fulfill other vital national conservation purposes." Designation as a Wild and Scenic River does not halt development and use of a river, but is meant to preserve the character of a river. Thus, uses compatible with the management goals of a particular river are allowed as long as it does not curtail its free-flowing nature or damage the outstanding natural resources upon which its designation was based. Section 5 (d) of the Wild and Scenic Rivers Act calls for the creation of a list of potential national wild, scenic, and recreational river areas for use in future water planning and development.

The Nationwide Rivers Inventory (NRI), in partial fulfillment of section 5 (d), is maintained by the National Park Service (NPS) as a national listing of river segments potentially eligible for protection under the Wild and Scenic Rivers Act of 1968. The NRI is a listing of free-flowing river segments in the United States that are believed to possess one or more "outstandingly remarkable" natural or cultural values. It provides the location of free-flowing, relatively undisturbed stream segments as well as a description of the "outstandingly remarkable" features associated with its designation. These values are thought to be of more than local or regional significance, thus affording these river segments a certain amount of protection from federal actions that would adversely affect one or more of the NRI segments. For groups concerned with ecosystem management or river assessments, the NRI serves as a source of information on nearby naturally-functioning river systems for reference while performing monitoring or restoration activities.

A river segment must be free-flowing and possess one or more Outstandingly Remarkable Value (ORV) to be listed on the NRI. In order to be deemed outstandingly remarkable, the value must be a unique, rare, or exemplary feature that is significant at a comparative scale. The scale for comparison may be regional or national and the range

of resources considered should be directly river-related. Evaluating a river for inclusion on the NRI consists of an examination of the rivers hydrology, man-made alterations, and an inventory of its natural, cultural, and recreational resources. The criteria for evaluation may be modified to serve as a meaningful basis for comparison within the state, physiographic province, ecoregion, or other defined area. The following criteria for assessing ORVs was offered to aid federal agencies in assessing river segments:

1. **Scenery (S):** The landscape elements of landform, vegetation, water, color, and related factors result in notable or exemplary visual features and/or attractions. When analyzing scenic values, additional factors -- such as seasonal variations in vegetation, scale of cultural modifications, and the length of time negative intrusions are viewed -- may be considered. Scenery and visual attractions may be highly diverse over the majority of the river or river segment.
2. **Recreation (R):** Recreational opportunities are, or have the potential to be, popular enough to attract visitors from throughout or beyond the region of comparison or are unique or rare within the region. Visitors are willing to travel long distances to use the river resources for recreational purposes. River-related opportunities could include, but are not limited to, sightseeing, wildlife observation, camping, photography, hiking, fishing and boating.
    - Interpretive opportunities may be exceptional and attract, or have the potential to attract, visitors from outside the region of comparison.
    - The river may provide, or have the potential to provide, settings for national or regional usage or competitive events.
3. **Geology (G):** The river, or the area within the river corridor, contains one or more example of a geologic feature, process or phenomenon that is unique or rare within the region of comparison. The feature(s) may be in an unusually active stage of development, represent a "textbook" example, and/or represent a unique or rare combination of geologic features (erosional, volcanic, glacial, or other geologic structures).
4. **Fish (F):** Fish values may be judged on the relative merits of either fish populations, habitat, or a combination of these river-related conditions.
    - *Populations:* The river is nationally or regionally an important producer of resident and/or anadromous fish species. Of particular significance is the presence of wild stocks and/or federal or state listed (or candidate) threatened, endangered or sensitive species. Diversity of species is an important consideration and could, in itself, lead to a determination of "outstandingly remarkable."

- *Habitat:* The river provides exceptionally high quality habitat for fish species indigenous to the region of comparison. Of particular significance is habitat for wild stocks and/or federal or state listed (or candidate) threatened, endangered or sensitive species. Diversity of habitats is an important consideration and could, in itself, lead to a determination of "outstandingly remarkable."

5. **Wildlife (W):** Wildlife values may be judged on the relative merits of either terrestrial or aquatic wildlife populations or habitat or a combination of these conditions.

    - *Populations:* The river, or area within the river corridor, contains nationally or regionally important populations of indigenous wildlife species. Of particular significance are species considered to be unique, and/or populations of federal or state listed (or candidate) threatened, endangered or sensitive species. Diversity of species is an important consideration and could, in itself, lead to a determination of "outstandingly remarkable."

    - *Habitat:* The river, or area within the river corridor, provides exceptionally high quality habitat for wildlife of national or regional significance, and/or may provide unique habitat or a critical link in habitat conditions for federal or state listed (or candidate) threatened, endangered or sensitive species. Contiguous habitat conditions are such that the biological needs of the species are met. Diversity of habitats is an important consideration and could, in itself, lead to a determination of "outstandingly remarkable."

6. **Prehistory (P):** The river, or area within the river corridor, contains a site(s) where there is evidence of occupation or use by Native Americans. Sites must have unique or rare characteristics or exceptional human interest value(s). Sites may have national or regional importance for interpreting prehistory; may be rare and represent an area where a culture or cultural period was first identified and described; may have been used concurrently by two or more cultural groups; and/or may have been used by cultural groups for rare sacred purposes. Many such sites are listed on the National Register of Historic Places, which is administered by the NPS.

7. **History (H):** The river or area within the river corridor contains a site(s) or feature(s) associated with a significant event, an important person, or a cultural activity of the past that was rare or one-of-a-kind in the region. Many such sites are listed on the National Register of Historic Places. A historic site(s) and/or features(s) is 50 years old or older in most cases.

8. **Other Values (O):** While no specific national evaluation guidelines have been developed for the "other similar values" category, assessments of additional river-related values consistent with the foregoing guidance may be developed -- including, but not limited to, hydrology, paleontology and botany resources.

Twenty river or stream segments in Texas were included on the final Nationwide Rivers Inventory in August of 1982. Of these, four are included within the Region L Regional Water Planning Area. Stream segments within the Region L Regional Water Planning Area included on the NRI are listed below:

1) **Frio River**- A forty mile section from Concan upstream to the headwaters within Uvalde and Real counties was listed on the NRI in 1982 for outstanding Scenic, Recreation, Wildlife and Historic values. The following description was offered by the NPS: Frio Cave, potential National Natural Landmark, is in vicinity. Recommended for inclusion in proposed Texas Natural Rivers System. One of top 10 rivers in the state- very popular recreational river for canoeing and tubing. Most recreational use based at Garner State Park. It is a clear, spring-fed river. The banks are lined with bald-cypress, pecans and oaks, with limestone outcroppings and bluffs. Springs which form the Frio River issue from a 3,000 acre ranch north of Leakey. Black phoebes nest in canyons- deer and other mammals present. Old wagon tracks are visible in the rock of river bed.

2) **Guadalupe River**- An 81-mile section from the headwaters of Canyon Lake upstream to headwaters near Kerrville was listed on the NRI in 1982 for outstanding Scenic, Recreation, Geologic and Other values. The following description was offered by the NPS: Rated as #1 recreational river in the state, and #2 scenic river. A segment of the river was previously recommended as a Scenic Waterway. It is heavily used by canoeists, kayakers and tubers. At Edge Falls (on Curry Creek tributary), existence of extremely rare Styrax plantnifolia (silverbell tree) has been noted. Many Spring fed streams supply the river with a constant flow of good quality water. There are two major waterfalls and numerous rapids. Limestone bluffs line the river. Interesting limestone formations occur, such as travertine and flowstone/dripstone.

3) **Nueces River**- A 54-mile section from the southernmost SH 55 crossing upstream to the headwaters was listed on the NRI in 1982 for outstanding Scenic, Recreation, Geologic, Fish, and Wildlife values. The following description was offered by the NPS: Devil's Sinkhole, a designated National Natural Landmark, occurs near headwaters. Montell Creek and Indian Creek Cave, potential National Natural Landmarks, are also in the vicinity. Recommended for inclusion in proposed Texas Natural Rivers System. Referred to as "purest, cleanest stretch of stream this size in Texas". Canoeable in all seasons. The river is springfed, has numerous rapids, and the banks are lined with oaks and pecans. Included in the top 100 natural areas in the state. Geologic oddities, such as "pin-ball rapids", occur. Banks are lined with ferns, sedges, switch grass, cardinal lobelia, frog fruit, and water cress. Green herons, spotted sandpipers, green kingfishers, turkey vultures and others live in river corridor.

4) **Sabinal River**- A 37-mile section from US 90 crossing in Sabinal upstream to the headwaters was listed on the NRI in 1982 for outstanding Scenic, Recreation, Geologic, Wildlife and Other values. The following description was offered by the NPS: Within

habitat of Tobusch Fishook Cactus, a federally listed endangered species. Lost Maples State Natural Area, a designated National Natural Landmark is near headwaters. Recommended for inclusion in proposed Texas Natural Rivers System. Hiking trail in Lost Maples Natural Area recommended for inclusion in proposed Texas Trails System. Sabinal Canyon is a wooded canyon with the only good stand of Big Tooth Maples in central Texas Hill Country. Many canyon wrens and other birds. Scenic limestone canyon walls (to 300 feet). River is spring-fed. Gorgeous fall colors. New National Champion Texas Ash and Escarpment Black Cherry north of Vanderpool.