

**Biology**

**Rare Plants**  
TPWD performs plant surveys and has identified 19 rare plant species that are found in the six county Pedernales River watershed. They are listed below.

**Rare Plants in Pedernales River Watershed**

Common Name	Scientific Name
Tobusch fishhook cactus	<i>Scleroctactus breviamatus subsp. tobuschii</i>
Hill Country wild-mecury	<i>Anythamnia aphoroides</i>
Basin bellflower	<i>Campanula reveschii</i>
Big red sage	<i>Salvia pentstemonoides</i>
Boerne bean	<i>Phaseolus texensis</i>
Bracted twist flower	<i>Streptanthus bracteatus</i>
Canyon rattlesnake-root	<i>Prenanthes bracteatus</i>
Correll's false dragon-head	<i>Physostegia correllii</i>
Granite spiderwort	<i>Tradescantia pedicularis</i>
Llano butterweed	<i>Packera texensis</i>
Warmock's coral-root	<i>Hexaletris warmockii</i>
Broadfoot rustacea	<i>Promisera leucocarpa</i>
California satiniell	<i>Impatiens brevifolia Vasey</i>
Edwards Plateau comsald	<i>Valerianella texana</i>
Longstalk heisma	<i>Nesaea longstamii</i>
Rock quillwort	<i>Isotles lithophilus</i>
Mexican oak leaf	<i>Shinneria rivularis</i>
Small-headed pipewort	<i>Eriocaulon kernickianum</i>
Texabama croton	<i>Croton alabamensis var. texensis</i>



**River Biological Monitoring**

LCRA has performed biological monitoring at two sites on the Pedernales River. Biological information and water chemistry data when combined provide a good snapshot of water quality. The biological indicators point to excellent water quality in the Pedernales River. Biological monitoring includes collection of:

- Fish
- Macroinvertebrates such as aquatic insects and mussels

Habitat measurements such as bank slope and the degree of siltation  
The river has wide variety of fish species, a list of the 34 species collected is presented below. There are a large number of sunfish species. Some of the fish are intolerant to pollution and few captured fish were diseased or had anomalies. These are indicators of good water quality. Guadalupe bass, the official state fish of Texas, is also found in the Pedernales River. In other river systems there has been hybridization between Guadalupe bass and smallmouth bass which dilutes the Guadalupe bass characteristics. So far, this is not an issue in the Pedernales River as LCRA has yet to collect smallmouth bass. So it seems that the Guadalupe bass in the Pedernales River are a genetically pure strain.

**Fish Found in the Pedernales River**

Common Name	Scientific Name	Common Name	Scientific Name
Speckled gar	<i>Lepisosteus oculatus</i>	Red-earr sunfish	<i>Channa argus</i>
Longnose gar	<i>Lepisosteus osseus</i>	Freshwater drum	<i>Aplodinotus grunniens</i>
Gizzard shad	<i>Dorosoma cepedianum</i>	Perch	<i>Perca americana</i>
Common carp	<i>Cyprinus carpio</i>	Emmelia	<i>Emmelia nigrilabris</i>
Reis shiner	<i>Cyprinella lutrensis</i>	Guadalupe bass	<i>Micropterus dolomieu</i>
Blacktail shiner	<i>Cyprinella venusta</i>	Largemouth bass	<i>Micropterus salmoides</i>
Mimic shiner	<i>Moxostoma valenciennesi</i>	Redbreast sunfish	<i>Lepomis gibbosus</i>
Bullhead minnow	<i>Pimephales vixatrix</i>	Green sunfish	<i>Lepomis cyanellus</i>
Centrarchus stoneroller	<i>Centrarchus tomentosus</i>	Warmouth	<i>Lepomis gibbosus</i>
Smallmouth buffalo	<i>Ictalurus bubalus</i>	Orange-spotted sunfish	<i>Lepomis humilis</i>
River carpucker	<i>Carpodacus carpio</i>	Bluegill	<i>Lepomis macrochirus</i>
Gray redhorse	<i>Moxostoma valenciennesi</i>	Longear sunfish	<i>Lepomis megalotis</i>
Dusky garter	<i>Percina sciera</i>	White bass	<i>Morone chrysops</i>
Channel catfish	<i>Ictalurus punctatus</i>	Texas shiner	<i>Notropis armabilis</i>
Flathead catfish	<i>Pylodictis olivaris</i>	Yellow bullhead	<i>Ameiurus natalis</i>
Mosquitofish	<i>Gambusia affinis</i>	Greenhead darter	<i>Etheostoma lepidum</i>
Inland silverside	<i>Menidia beryllina</i>	Redear sunfish	<i>Lepomis microlophus</i>

The state fish of Texas, Guadalupe bass (*Micropterus treculi*) is found in clear Hill Country streams such as the Pedernales River.

Many insects and other organisms have a stage in life in which they live in water. These nymphs or larvae are called benthic macroinvertebrates because they live along the stream bottom and do not have backbones. In the Pedernales River, benthic macroinvertebrates scores show high or exceptional variety of species. These organisms are good indicators of water quality because they live in the river, some their entire life. Many of the organisms found in the river are sensitive to pollution so the fact that they are present indicates good water quality. The rare freshwater mussel-Texas fatmucket (*Lampsilis bracteata*) is also found in the Pedernales.

The Pedernales River provides good habitat for the organism that live there. The habitat is typical of a Hill Country stream with clear water and good diversity of habitat including sand, gravel, cobble and boulders. There is usually a good mix of riffles (shallow, aerated areas), runs (moderate depth and velocity) and pools (deep and slow-moving). The river demonstrates sinuosity or natural curves and bends. Generally, the riparian area is well vegetated. A well-vegetated riparian area acts as a sponge to hold back water and sustain flows over time. A riparian area also helps to trap sediments and attenuate nutrients. The sediment trapping keeps sediment out of the river.

# Pedernales River Watershed

**Water Quality**

**Monitoring**

Three entities monitor the water quality of the Pedernales River. The sites they monitor are shown in the table below. Texas Commission on Environmental Quality (TCEQ) currently monitors two sites in the watershed, Colorado River Watch Network (CRWN) volunteers monitor the Pedernales or its tributaries at 14 locations. The Lower Colorado River Authority (LCRA) has been monitoring some Pedernales River sites for more than 28 years. The water quality is generally very good. LCRA performed a trend analysis to answer the often-asked question-Is the water quality getting better or worse?

Entity	Site Description	Station Id.
CRWN	Live Oak Creek at RR 2093	184
CRWN	Barons Creek at Frantz Park, Fredericksburg	303
CRWN	Barons Creek at U.S. Highway 290	397
CRWN	Pedernales River at LBJ National Historic Park, Hodges Dam-RR 1623	173
CRWN	Pedernales River at LBJ National Historic Park	170
CRWN	Williams Creek at the Pedernales River confluence	348
CRWN	Town Creek at Johnson Settlement	325
CRWN	Pedernales River at Pedernales Falls State Park	294
CRWN	Pedernales River at Hammett's Crossing	3
CRWN	Cypress Creek at Hammett's Crossing	368
CRWN	Hamilton Pool	368
CRWN	Reimers Ranch Park at Climbers Canyon	383
CRWN	Pogue Springs	382
CRWN	Pedernales River at Buffalo Crossing	292
LCRA	Pedernales River near Hammett's Crossing	12369
LCRA	Pedernales River near Bradford	12372
LCRA	Pedernales River at RR 1320	12375
LCRA	Pedernales River at U.S. Highway 67	17472
TCEQ	Pedernales River at Goshman Lane	12377
TCEQ	Cypress Creek at FM 962	12258

**Treated Wastewater**

Two municipalities, Fredericksburg and Johnson City, discharge treated wastewater (effluent) into the Pedernales River. Both facilities are permitted, regulated and subject to inspection by the TCEQ.

Wastewater treatment involves the processing of waste through filtration, settling and microbial action to break down the waste. The final step in the treatment process is disinfection, which is usually accomplished through chlorination. The chlorine kills potentially harmful bacteria prior to the effluent being discharged off site. The Fredericksburg wastewater treatment plant must also remove the chlorine prior to discharging so that the chlorine will not harm the river's aquatic ecosystem.

The City of Fredericksburg is permitted to discharge up to 2.5 million gallons per day of effluent to Barons Creek, a tributary of the Pedernales River. The City also has TCEQ authorization to apply the treated effluent to land for beneficial irrigation with the added benefit of reducing the discharge of treated wastewater to Barons Creek. Recently the City has made significant strides to reduce the amount of nutrients discharged to Barons Creek from the wastewater treatment plant. This effort is directly beneficial to the health of Barons Creek and helps protect water quality of the Pedernales River, a tributary to a major drinking water source, Lake Travis.

The City of Johnson City has a permit to discharge 0.303 million gallons per day into Town Creek, a tributary to the Pedernales River. The maximum TCEQ permit limits for both municipalities are shown below.

Municipality	Permit #	CBOD5	TSS	Ammonia-N	Dissolved Oxygen
Fredericksburg	WQ0014969001	10	15	2	6
Johnson City	WQ0010198001	10	15	3	5

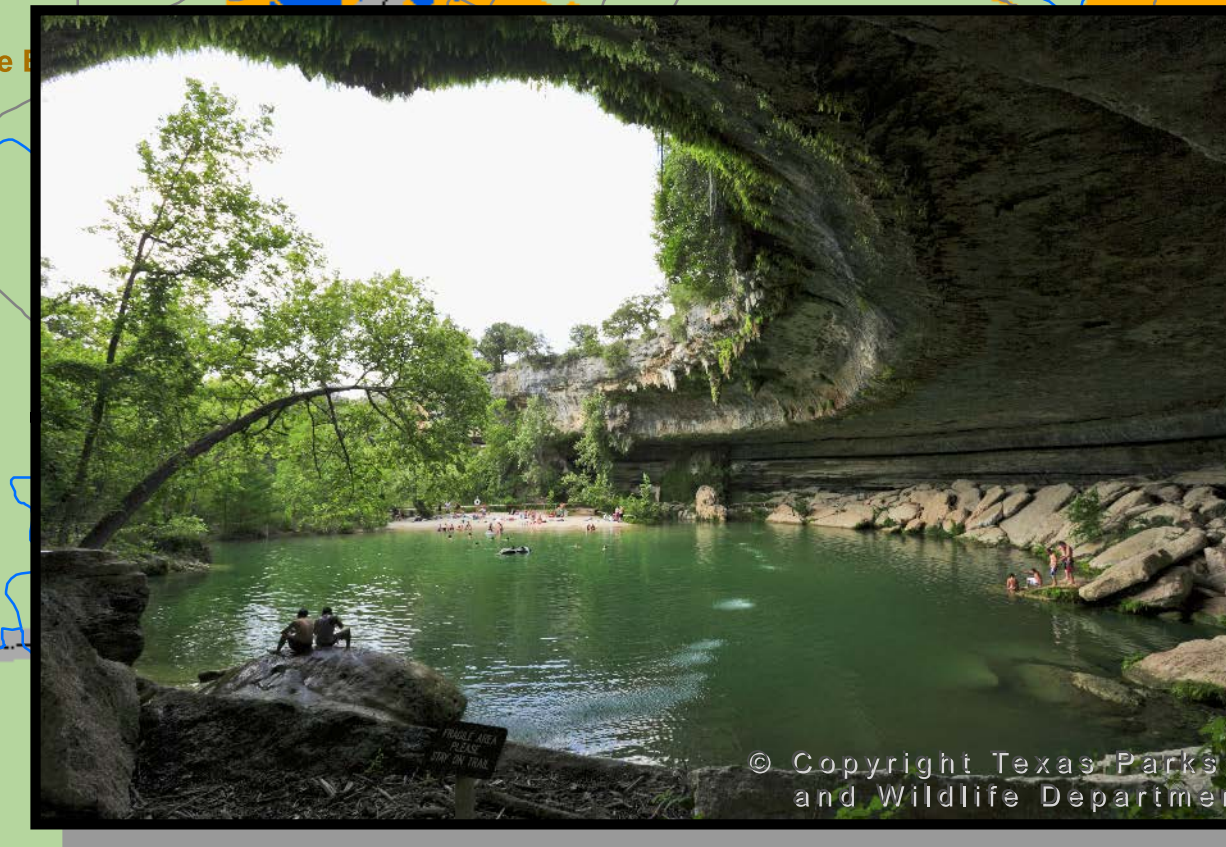
All permit values are expressed in milligrams per liter (essentially parts per million).  
CBOD5- carbonaceous biochemical oxygen demand, 5 days- a measure of the water's organic strength.  
TSS- total suspended solids- particulates in the water.  
Ammonia-nitrogen in high concentrations can be toxic to stream organisms or can increase algae growth.  
Dissolved oxygen is a minimum concentration that effluent must meet or exceed.

**Trend Analysis**

A trend analysis was performed on five monitoring sites from which sufficient data is available. Field measurements and water chemistry were evaluated. Field measurements include water temperature, specific conductivity, dissolved oxygen and pH while water chemistry trend evaluation consisted of nitrate/nitrite nitrogen, total phosphorus and chloride concentrations.

Two of five sites showed an increasing trend in total phosphorus. No other water chemistry trend was detected. So with respect to phosphorus, the water quality is degrading. Phosphorus is often associated with particulates in rainfall runoff and wastewater effluent. No trends were found in the field measurements. Sites demonstrating observable trends are shown in the table below.

Pedernales River Site	Station Id.	Trend
At U.S. Highway 87	17472	Increasing total phosphorus
At Goshman Lane	12377	No trends
At Flano Road 1320	12375	Increasing total phosphorus
Near Bradford	12372	No trends
Near Hammett's Crossing	12369	No trends



**Watershed Facts**

The Pedernales River watershed is an area of land that water flows across, through or under on its way to Lake Travis, a primary source of drinking water for Central Texas. The Pedernales River, hydrologically a third order stream, flows for approximately 106 miles from its source in Kimble County to Lake Travis. The watershed is located in Kimble, Kerr, Gillespie, Blanco, Hays and Travis counties and has an area of 1,280 square miles. Major tributaries include- Wolf Creek, Live Oak Creek, Barons Creek, Miller Creek, Fall Creek and Hamilton Creek. Watershed slopes range from one to 50 percent.

Generally shallow soils are found within the watershed. The dominant soil series in the Pedernales River watershed are Tarrant, Brackett, Doss, Hensley, and Purves. These five soil series represent about 56 percent of the watershed area and are generally well-drained soils. These are moderately slowly permeable soils that are formed in marls and limestone. The word pedernales is Spanish for flint. This material is very common in the watershed and often forms the river channel.

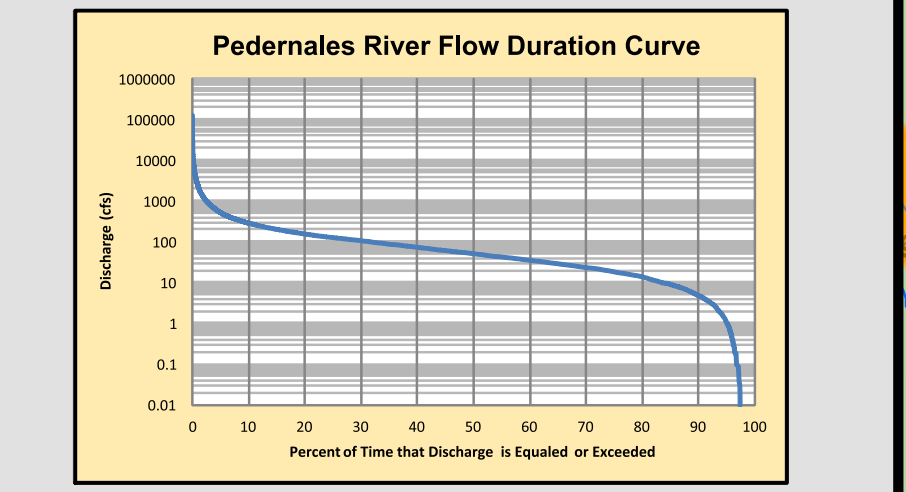
The land use is predominantly rangeland. Arable soils for crop production occur along streams and are largely oriented to livestock feed (e.g. hay, oats and sorghum). Heavy to moderate brush are found in the watershed with oak and ash juniper being very common - The vegetation supports diverse wildlife populations and some managed exotic species can be found.

Several parks and recreational areas are found within the Pedernales River watershed. Some of these include: LBJ National Historic Park, Pedernales Falls State Park, Pedernales River Nature Park, Westvaco Preserve, Hamilton Pool Nature Preserve, Milton Reimers Ranch Park and various city parks. Parks include approximately 8,839 acres and are shown in the map.

The projected population growth in the area will present a challenge for the watershed. In Gillespie and Blanco counties, which constitute a large portion of the watershed, the population is expected to increase substantially. From 2010 to 2060 the population in Gillespie County is projected to increase from 24,837 to 33,000 while Blanco County's population is estimated to increase from 10,497 to 23,000.



**Hydrology**



The flow duration curve shown above illustrates the wide variety of flows seen in the Pedernales River. It shows the percentage of time that flow, measured in cubic feet per second (cfs), in the river is likely to equal or exceed a specific value. The measured flow from a USGS gauge located near Johnson City was used to produce the graph and it represents average daily flow measurements starting in May 1939 through June 2011. The drainage area to the gauge site is 901 square miles. Important points in the graph include:

- The highest flow recorded was 129,000 cfs (September 11, 1951).
- 25% of the time the flow is greater than 131 cfs. So, the 75th percentile flow is 131 cfs.
- The median (50th percentile) flow is 53 cfs. Half of the flows are greater and half are less than 53 cfs.
- 75% of the time the flow is greater than 19 cfs so the 25th percentile flow is 19 cfs.
- The river can go dry.

Springs are areas where groundwater emerges from the subsurface. An estimated 1,272 springs are found within the six county Pedernales River watershed. About 3/4 of the springs are found in Travis County. Texas Parks and Wildlife Department (TPWD) staff has mapped these springs though due to landowner requests this information is not distributed to the general public. Some springs are home to many unique species, including salamanders. A total of six species of salamanders and many other organisms can be found in these springs that ultimately contribute flow to the Pedernales River.

**Land Management**

**Conservation Easements**

A conservation easement is a flexible, negotiated tool that a landowner may use to protect his/her land. It is a legal agreement between the landowner and a land trust and it may also provide both local and federal tax relief. Benefits of conservation easements include the protection of family assets, land, wildlife and water quality and quantity. To date more than 28,000 acres are under conservation easements within the Pedernales River watershed. Of this total acreage, 38 percent are public lands, while 62 percent are privately held lands. Conservation easements are flexible agreements that:

- Protect the financial interests of landowners while preserving the land that they love.
- Allow the landowner to continue to use the land as they always have.
- Keep the land intact or protected from fragmentation.
- Allow for specific practices that benefit wildlife.
- Reduce runoff into rivers and creeks.
- Benefit those living downstream.
- Protect something that the landowner finds precious.

**LCRA Creekside Conservation Program**

LCRA began its Creekside Conservation Program in 1980 to reduce sedimentation entering the Highland Lakes. The program is administered cooperatively with the Natural Resources Conservation Service and soil and water conservation districts. By using various best management practices, willing landowners are able to reduce the sediment that is washed off their land. To date, in the Pedernales River watershed:

- 46 landowners have participated in the program.
- More than 33,000 management acres are complete.
- More than 3,900 brush management acres are complete.
- More than 71,000 linear feet of cross fence are complete to assist with grazing management.
- More than 3,900 linear feet of pipeline have been installed, resulting in two water troughs and two ponds for water development.
- Education and outreach have been conducted through newspapers, field days, workshops and seminars.
- Lasting partnerships have been formed to promote soil and water conservation, enhancing wildlife habitat through improved vegetation.

**Brush Management**

With poor grazing practices and repression of naturally occurring wildfires during the past century, invasive brush species such as mesquite and ash juniper have inundated vast areas of land that once thrived with a rich diversity of native woody plants, grasses and forbs. Consequently, much of the rainfall that would have otherwise infiltrated deep into the soil providing subsurface flow and aquifer recharge is now either caught up in the heavy brush canopy and evaporated, taken up through the roots and transpired, or it runs off the land, taking valuable soil with it. Land stewardship planning that includes selective brush management benefits soil, water and wildlife by stabilizing the soil, improving water quality, and increasing surface water and groundwater availability.

