LAND USE

Human Population

Indian occupation and European settlement of the Niangua Watershed are described in The Big Niangua River by Glenn "Boone" Skinner (1979). The first native Americans that French and Spanish explorers, traders, and trappers encountered in the watershed were the Osage (Circa 1780). Skinner reported that many Osage villages were strategically placed throughout the watershed, often where tributaries joined the main stem. The Osage were forced from Missouri to Oklahoma and relinquished their homeland by treaty in 1808. Soon Algonquin tribes, who were fleeing settlers to the east, moved into the area until they were evicted by treaty in 1820. Skinner related that the first permanent European settlers in the watershed established their home at the mouth of the Niangua River sometime between 1827 and 1833. Only poor roads existed so subsequent settlers poled rafts upriver to settle upstream sites in the watershed. The Buffalo area was settled in 1837 and Marshfield between 1834 and 1838. Early settlers located their homes close to the river because that was the main mode of transportation. They also sought locations near springs and forests for domestic water and building materials. Later immigrants settled on ridgetops where major roads were constructed. An Indian trail in Laclede and Webster Counties became Wire Road, which later became Route 66.

The 1994 estimated human population of the watershed was 34,679 based on U.S. Bureau of Census and Rand McNally data for each county and various communities. Population estimates by decade for counties that include the Niangua Watershed are shown in Table 4. Low-density and fairly stable populations were evident between 1930 and 1970. Since then populations of all five counties have increased, with Camden County more than doubling. The estimated population growth of Dallas County was the fourth greatest in the state between 1990 and 1994, and Camden County was ninth greatest.

Land Cover and Use

Land cover in the Niangua Watershed before settlement was a mosaic of prairie, savanna, and forest. The undissected uplands were dominated by patches of prairie and savanna with high grasses and large post oaks (Schroeder, 1983). Large patches of prairie were confined to the Buffalo Head Prairie which included the southwestern portion of the watershed in the upper reaches of the LNR and NR (McCarty, 1995). Areas of greater relief and narrow ridgetops were dominated by oak-hickory forest with occasional patches of prairie in the bottomland (Schroeder, 1983). Savannas were believed to be common in the Springfield Plateau which includes the Niangua Watershed (Nelson, 1985). They depended on fires started by lightning or native Indians every five to ten years to prevent encroachment by less fire-tolerant trees (Nelson, 1985). Drastic changes in land cover have occurred since European settlement. Prairies have been destroyed by plowing, overgrazing, and fire control, and are now primarily replaced by pasture (Schroeder,1983). Savannas have been similarly altered and good examples are only found in Ha Ha Tonka and Bennett Springs state parks (Leach and Ross, 1995).

Approximately 50% of the original forest in the state was converted to pasture by 1947 (MDC, 1980). Conversion to pasture is most prevalent in areas with low relief, such as headwater reaches and wide valleys. In the five counties that include the Niangua Watershed, forested acres declined 24% between 1947 and 1972, while forested acres in the entire Ozark Region declined by 13% (MDC, 1980). These

Table 4. Human populations of counties that include the Niangua Watershed.

County	1930	1940	1950	1960	1970	1980	1990	1994 (estimate)	Growth Rank[1]
Camden	9,142	8,971	7,861	9,116	13,315	20,017	27,495	30,594	9
Dallas	10,541	11,523	10,392	9,314	10,054	12,096	12,646	14,233	4
Hickory	6,430	6,506	5,387	4,516	4,481	6,367	7,335	8,044	12
Laclede	16,320	18,718	19,010	18,991	19,944	24,323	27,158	28,682	34
Webster	16,148	17,226	15,072	13,753	15,562	20,414	23,753	25,965	14
Totals	58,581	62,944	57,772	55,690	63,356	90,909	98,387	107,278	

[1] State rank in estimated population growth between 1990 and 1994.

1930 thru 1990 data are from U.S. Census Bureau.

1994 estimates are from the Missouri Office of Administration.

declines were attributed to high cattle prices in the 1960s that prompted farmers, who owned over 50% of the commercial forest in Missouri, to convert forest to pasture (MDC, 1980). Further declines were not documented in these counties between 1972 and 1989, although differences in reporting methods "make comparison uncertain" (Smith, 1990). In areas of high relief, such as the LNR and lower NR, slopes tend to be maintained in woodland and valleys are cleared (Harvey et al., 1983).

Agriculture and tourism are major industries throughout the watershed. Primary agricultural activities include dairy and beef cattle production. A limited amount of hog and poultry production also occurs. Important tourist activities include fishing, canoeing, and boating. A major challenge in managing the watershed is to allow these industries to co-exist without adversely impacting each other or the environment.

Land use on farms in several categories is shown in Table 5. These data were obtained from Agri-Facts for each county (MDA, 1995) and from USDA (1992). In 1992 approximately 51% of the watershed was used for cropland. This consisted mostly of hay fields of which more than half was also used for pasture. Woodland pasture and other pasture occupied 39% of the watershed and ungrazed woodland occupied less than 9%. Grazed and ungrazed woodland included approximately 27% of the watershed. Notable changes evident in Table 5 between 1929 and 1992 include a decrease in harvested cropland (40%), a decrease in pastured woodland (55%), and an increase in other pasture (126%). The total amount of pasture has remained fairly constant. Most woodland was grazed, and ungrazed woodland was a small percentage (9%-10%) of the watershed between 1978 and 1992.

Soil Conservation Projects

The U.S. Department of Agriculture, through the Natural Resources Conservation Service (NRCS), began the Upper Niangua Animal Waste Project (UNAWP) in 1991 as part of its nationwide Water Quality Initiative (Smale et al, 1995). The UNAWP supports a number of activities with the common goal of minimizing the undesirable effects of agriculture on water quality in the Upper Niangua Watershed. Some of the project activities, such as outreach programs conducted through the local University Agricultural Extension offices and the completion of Farmstead Assessment Systems, are educational or information gathering in nature and difficult to quantify in terms of their effects on water quality. Other activities, including the monitoring of wells and capping of abandoned wells, are directed at preventing groundwater pollution. The main emphasis of the project has been the design and construction of a number of animal waste treatment facilities throughout the watershed.

The treatment facilities are designed to intercept and process manure and prevent nutrients from contaminating the NR and its tributaries. Manure is retained in the facilities so that it can be broken down by natural decomposition and applied to farmland. Smale et al (1995) estimated the nutrients saved in 1995 by processing this manure were valued at over $49,000 and could be expected to produce over 3,800 tons of hay. As of October 1996 there were 29 completed facilities and seven more under design. The agencies involved with the UNAWP have educated landowners about nutrient enrichment and the need for such facilities, and provided technical assistance and cost-share funds for their construction. Inspection and certification of the facilities is conducted by the Missouri Department of Natural Resources (MDNR). To evaluate the effectiveness of this project, the U.S. Geological Survey (USGS) was contracted to monitor water quality throughout the Upper Niangua River watershed. In addition, the Missouri Cooperative Fish and Wildlife Research Unit at the University of Missouri monitored fish and invertebrate communities and evaluated habitat conditions.

Table 5. Land use in acres within the Niangua Watershed between 1929 and 1992.

	Cropland			Woodland[4]		Other Pasture[5]	All Other Land[6]
Year	Harvested[1]	Other[2]	Pastured[3]	Pastured	Not Pastured		
1929	133,684	13,986	87,605	162,591	--	32,721	12,156
1934	104,550	26,789	98,473	--	--	--	49,037
1939	104,102	10,756	106,563	--	--	--	57,306
1944	111,948	4,425	28,513	158,802	--	160,069	14,577
1949	96,672	12,002	80,669	156,695	--	81,419	17,218
1954	77,072	9,054	82,451	183,133	--	79,176	12,318
1959	67,215	16,111	85,857	162,729	--	66,515	13,307
1964	61,691	21,984	81,644	--	--	--	12,633
1969	51,778	16,345	126,954	--	--	--	8,934
1974	61,072	7,261	118,570	--	--	--	9,672
1978	67,686	7,457	130,449	83,062	32,083	58,228	15,045
1982	70,964	6,044	112,070	78,426	34,275	62,155	14,993
1987	72,754	8,401	108,303	83,062	31,614	76,265	13,043
1992	80,064	6,150	110,285	71,903	32,891	74,969	12,005

All data from 7/95 Camden, Dallas, Hickory, Laclede, Webster County Agri-facts, and from 1992 Census of Agriculture, Missouri State and County Data, U.S. Department of Commerce Economics and Statistics Administration, Bureau of the Census.

[1] - All land from which crops were harvested or hay was cut, and all land in orchards, citrus groves, vineyards, and nursery and greenhouse crops.

[2] - Cropland used for cover crops, legumes, and soil-improvement grasses, but NOT harvested and Not pastured; cropland on which all crops failed; cropland in cultivated summer fallow; and/or cropland idle.

[3] - Rotation pasture and grazing land that could have been used for crops without additional improvements.

[4] - Woodlots and timber tracts and cutover and deforested land with young timber growth.

[5] - Pastureland and rangeland other than cropland and woodland pastured.

[6] - Land in house lots, ponds, roads, wasteland, etc.

-- Data not available.

Public Lands

All public use areas are listed in Table 6 and mapped in Figure 5. Both state parks, a multi-purpose lake access, three large MDC frontage tracts with stream access, six other MDC stream accesses, and three access points near Tunnel Dam provide water-oriented recreational opportunities. Recreational use on the NR, LOZ, and at Bennett Spring State Park is very high. At least ten outfitters provide canoes, rafts, kayaks, and tubes; and shuttle customers between the public access sites and other sites on the NR. MDC agents have reported a significant increase in the number of boaters and associated violations in recent years, especially between Bennett Spring State Park and Prosperine Access (John Hoskins (MDC), pers. comm.). They estimate that over 1,000 canoes use that section on a typical busy summer day. Campground owners and canoe outfitters have also complained about littering, noise, and alcohol/drug abuse by boaters in recent years.

Bennett Spring State Park is located in Laclede and Dallas Counties at the confluence of Bennett Spring Branch and the NR (Appendix D). The 3,095 acre park is operated by the MDNR, but includes a cold-water hatchery operated by the MDC. It features a put-and-take trout fishery as well as camping and cabin facilities. Bennett Spring CA is a MDC access on the NR adjacent to the park. The Stream Management Plan for the park was prepared by the Bennett Spring Trout Park Task Force Committee in March, 1990 and revised in February, 1992 (BSTPTFC, 1992). The Trout Park Task Force is comprised of two representatives from the MDNR and two representatives from the MDC. The plan outlines concerns and activities related to Bennett Spring Branch, and its stream corridors and watershed. Several described stream improvement projects have been completed. These include rock jetties to decrease gravel deposition in the main channel; bank stabilization with strategic cedar tree revetments and corridor revegetation; and boulder habitat structures. Structures to improve bank fishing access such as walkways on rock jetties and stream banks with wheelchair access have also been completed. A rock wall for bank stabilization on the NR at the mouth of Bennett Spring Branch was recently constructed, and tree plantings to reduce flood-plain erosion have been completed in most of the planned locations (Craig Fuller (MDC), pers. comm).

Lead Mine CA is located in Dallas County on the NR (SM 41.5) (Appendix D). The area includes 7,743 acres and is 90 percent forested. It contains the lower 3.6 miles of Jakes Creek to its confluence with the NR, and approximately 3.0 miles of Niangua River frontage. The area plan, which is currently being revised, was completed in June, 1984. In addition to area plans, a Riparian Management Zone Plan for Lead Mine State Forest - Jakes Creek, and a Bank Stabilization Project Plan for Lead Mine State Forest - Jakes Creek were both approved in December, 1990 (see Habitat Conditions section).

Barclay Springs CA (389 acres) was acquired on the Niangua River in 1997 (Appendix D). The tract is located 6 mile north of Bennett Spring. Water resources include 1.7 mile of Niangua River frontage designated as trout management waters, a large spring, and 0.4 mile of spring branch. The tract has 55 acres of open bottomland, 58 acres of upland fields (hay and pasture), 269 acres of timber, and 5 acres of river, and buildings sites. The site is suitable for access development, riparian corridor improvements, protection of the spring and spring branch, and fisheries habitat improvements.

Mule Shoe CA encompasses 2,390 acres in three separate areas in Hickory County, including 9.2 miles of stream frontage (Appendix D). The most significant stream on the property is 2.9 miles of the Little Niangua River which is critical habitat for the Niangua darter. Other waterways on the area include Starks Creek and two unnamed tributaries. A 200-foot riparian zone will be created and maintained on

Figure 5. Public use areas within the Niangua River Watershed.

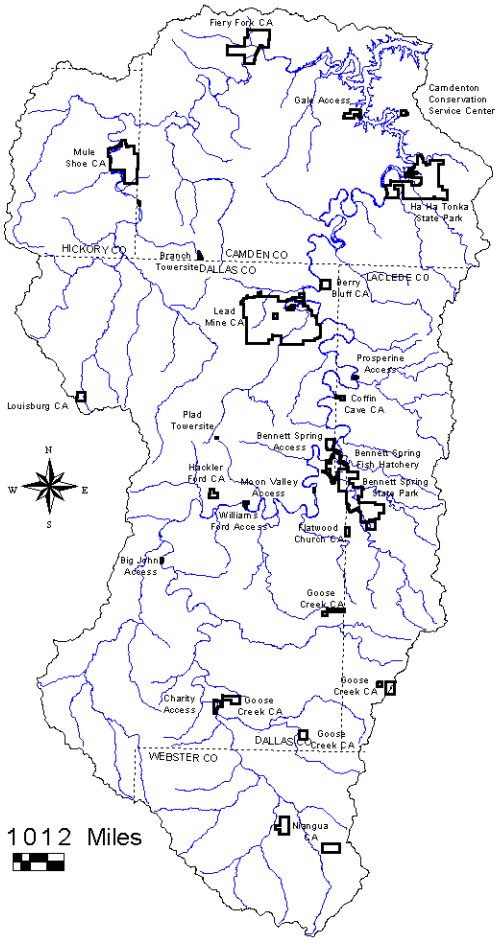

Table 6. Public use areas with size, stream, and type of boat access within the Niangua Watershed.

Area (Ownership[1])	Acres	Frontage (mi)	Major Streams	Boat Access	Topographic Map
Barclay CA	389	1.7 0.4	Niangua River Barclay Spring Branch	Planned No	Eldridge West
Bennett Springs Access	178	0.5	Niangua River	Yes	Bennett Springs
Bennett Springs State Park (MDC, MDNR)	40	1.5	Bennett Sprg Br	Yes	Bennett Springs
Berry Bluff CA[2]	159	0.0	Niangua River	No	Eldridge West
Big John Access	16	0.3	Niangua River	Yes	Buffalo
Branch Towersite	40	0	None	No	Branch
Camdenton CSC[3]	46	0	None	No	Green Bay Terrace
Charity Access	163	0.2	Niangua River	Yes	Long Lane
Coffin Cave CA	60	0	None	No	Bennett Springs
Fiery Fork CA	1,606	1.5	Little Niangua River	Yes	Barnumton
Flatwood Church CA	71	0	None	No	Bennett Springs
Goose Creek SF	1,040	0.0	None	No	Long Lane, Phillipsburg
Ha Ha Tonka State Park (MDNR)	2,953	1.3	Niangua Arm (LOZ)	Yes	Hahatonka
Lake Niangua Accesses (SME)[4]	1	0.1	Lake Niangua	Yes	Hahatonka

Lead Mine CA	**6,473**	**2.3**	**Niangua River**	**Yes**	**Lead Mine**
Moon Valley Access	**3**	**0.2**	**Niangua River**	**Yes**	**Windyville**
Mule Shoe CA	**1,850** **540**	**2.2** **0.8**	**Little Niangua River** **Starks Creek**	**Yes** **No**	**Branch** **Climax Springs**
Gale CA	**194**	**0.2**	**Niangua Arm (LOZ)**	**Yes**	**Green Bay Terrace**
Niangua CA	**837**	**0.4**	**Trib. East Fork Niangua River**	**No**	**Beach, Niangua**
Plad Towersite	**2**	**0**	**None**	**No**	**Windyville**
Prosperine Access	**8**	**0.1**	**Niangua River**	**Yes**	**Eldridge West**
Williams Ford Access	**40**	**0.2**	**Niangua River**	**Yes**	**Windyville**

[1] MDC = Missouri Department of Conservation, unless otherwise indicated; MDNR = Missouri Department of Natural Resources; SME = Sho-Me Power Corporation.

[2] CA = Conservation Area.

[3] CSC = Conservation Service Center.

[4] Three separate accesses on Lake Niangua: Niangua River below Lake Niangua dam; Niangua River at SME powerhouse; and Lake Niangua above dam.

the LNR by 2003 and a 100-foot riparian zone will protect the tributaries. Nearly 80% of the area is forested. The area is managed by MDC personnel from the West Central Forestry Region in cooperation with the West Central Fisheries Region. A major reason for acquisition of the area was to protect habitat for the Niangua darter.

Charity CA is the most upstream access on the NR (SM 112) (Appendix D). It is approximately 18 miles upstream from Big John CA (SM 94). Charity CA currently includes 320 acres. Four significant springs upstream from the access and a spring within one-half mile to the east of the access combine to produce cold-water conditions in the NR in the vicinity of the access. The aquatic resources of the area will be managed for the benefit of the native fish and fauna.

Fiery Fork CA in Camden County includes 1,606 acres on the LNR (SM 12.5) (Appendix D). The area contains 1.5 miles of the LNR, and the lower 0.9 miles of Fiery Fork Creek, and 1.0 miles of Toby Hollow Creek. Five springs and numerous permanent ponds (mostly fishless) provide water for wildlife and essential breeding habitat for amphibians. The LNR access is popular with fishermen, floaters, and swimmers (Brown and Ronk, 1983). Fiery Fork is managed primarily for recreational values and as a model in forest management and wildfire suppression (Brown and Ronk, 1983). The area includes 1,401 acres (87% of total area) of forest (oak-hickory), glade, and savanna; 184 acres (11%) of crop/old field; 11 acres (1%) of water/stream bed; and 10 acres (1%) of campgrounds/roads (Jones et al., under review). In addition to the area plan, a Riparian Zone Plan for Fiery Fork CA was completed in July of 1992. This plan resulted in curtailed cultivation and haying operations in 1992 and placed a high priority on expanding riparian corridors to 200 feet on all streams by 1998 (Stoner, 1992).

Corps of Engineers Jurisdiction

Waters of the Niangua Watershed are under the regulatory jurisdiction of the Kansas City District of the U.S. Army Corps of Engineers (COE). The district assumes responsibility for all streams which appear on county highway maps prepared by the Missouri Highway and Transportation Department (MHTD). Portions of the watershed impounded by LOZ are listed as navigable waters of the United States pursuant to Section 10 of the Clean Water Act, while all other streams are regulated under Section 404. Nationwide permits are normally issued for qualifying Section 404 activities upstream of the point where the median annual flow of any stream is less than 5 cfs. Proposed activities within Niangua darter range before 1995 were usually reviewed by the MDC and USFWS, and normally not authorized by nationwide permits. In December 1995, a general permit, MKP-GP34M, was enacted for sand and gravel excavation in Missouri streams. This permit includes conditions formulated by the MDC, MDNR, U.S. Fish and Wildlife Service (USFWS), and COE to minimize environmental impacts. In stream activities are prohibited during spring and/or fall seasons on designated segments of some streams (Table 7, Figure 6). The COE automatically includes the prohibitions on general permits within these segments. Prior to 1997, most Section 404 activities involving sand and gravel removal were authorized by this permit unless unusual conditions required individual permits, or a nationwide permit could be applied.

In January, 1997 a federal court reversed a 1993 ruling that was the basis for COE authority to regulate in stream sand and gravel excavation. In 1993, the Tulloch Rule found that "incidental fallback", small amounts of material that inevitably fall back in the stream when sand and gravel are excavated, was "fill" as regulated under Section 404 of the Clean Water Act. Several months after the 1997 ruling, the court issued a stay, pending appeal that reinstated COE authority over "incidental fallback", so the COE began issuing permits and enforcing its authority. However, the court again removed COE authority in July

Figure 6. Stream segments protected by spring and fall spawning prohibitions within the Niangua Watershed.

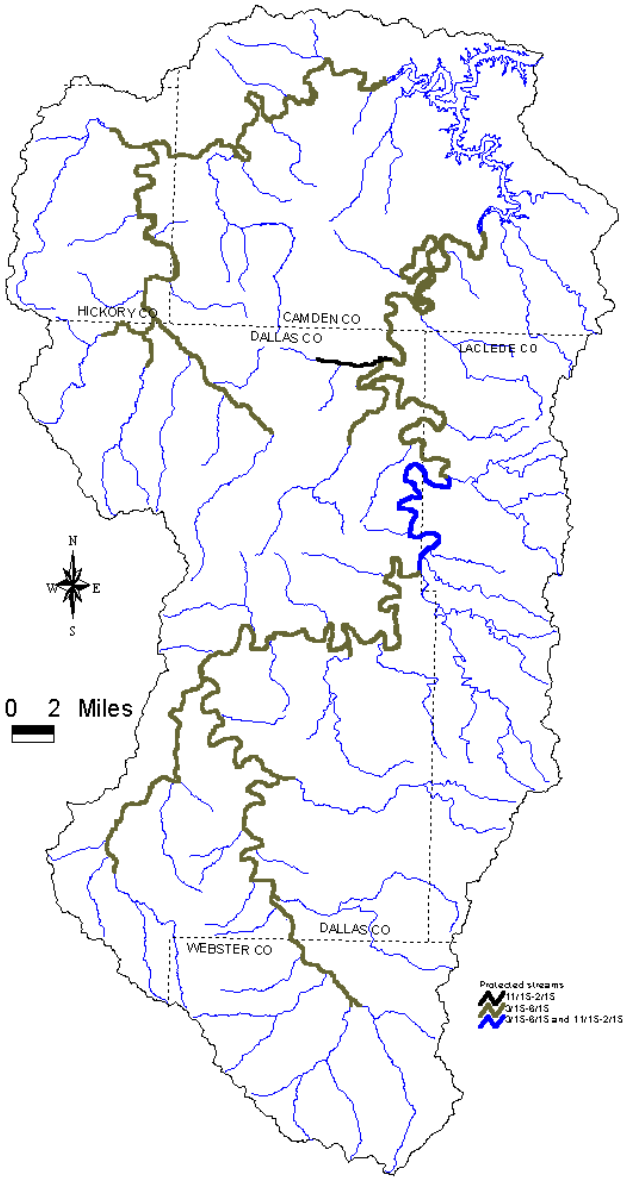

Table 7. Stream segments where Section 404 instream activities are prohibited during Spring and Fall Periods within the Niangua Watershed.

Closed March 15 Through June 15					
Waterbody	**Miles**	**From**	**To**	**Counties**	**Criteria[1]**
Niangua River	59.0	Lake of the Ozarks (9,37N,17W)	Hwy K (8,34N,18W)	Camden, Dallas, Laclede	3,5,6,7
Niangua River	40.0	Hwy K (8,34N,18W)	Conf. Of E. and W. Forks (33,32N,18W)	Dallas, Webster	1
East Fork Niangua River	0.5	Conf. of Niangua River (33,32N,18W)	T32 - T31 Line (33,32N,18W)	Webster	1
West Fork Niangua River	0.3	Conf. of Niangua River (33,32N,18W)	T32 - T31 Line (33,32N,18w)	Webster	1
Greasy Creek	12.9	Conf. with Niangua River (17,34N,19W)	South Section Line (34,33N,20W)	Dallas	2
Jakes Creek	4.5	Conf. with Niangua River (15,36N,18W)	First Co. Rd. Crossing (33,36N,18W)	Dallas	6
Dousinbury Creek	0.7	Conf. with Niangua River (11,33N,19W)	First Co. Rd. Crossing (12,33N,19W)	Dallas	2
Jones Creek	0.4	Conf. with Niangua River (2,32N,19W)	First Co. Rd. Crossing (11,32N,19W)	Dallas	2
Fourmile Creek	0.7	Conf. with Niangua River (4,34N,18W)	Hwy P (9,34N,18W)	Dallas	2
Little Niangua River	18.5	Lake of the Ozarks (3,38N,18W)	East Section Line (33,38N,20W)	Camden, Hickory	3,5,6,7

Little Niangua River	**22.5**	**East Section Line (33,38N,20W)**	**East Section Line (26,36N,19W)**	**Camden, Dallas, Hickory**	**1**
Starks Creek	**2.0**	**Conf. with Little Niangua River (23,38N,20W)**	**North Section Line (22,38N,20W)**	**Hickory**	**2,3**
Thomas Creek	**2.7**	**Conf. with Little Niangua River (36,37N,20W)**	**South Section line (12,36N,20W)**	**Dallas, Hickory**	**2,3**
Cahoochie Creek	**2.5**	**Conf. with Thomas Creek (2,36N,20W)**	**West Section Line (3,36N,20W)**	**Dallas**	**2,3**
Closed November 15 through February 15					
Mill Creek	**3.5**	**Conf. With Niangua River (10,36N,18W)**	**West Section Line (8,36N,18W)**	**Dallas**	**6**
Niangua River	**12.0**	**Bennett Spring (25,35N,18W)**	**Prosperine Access (5,35N,17W)**	**Laclede, Dallas**	**6**

[1] Criteria for justifying spawning season prohibition are as follows:

1. Critical habitat for Niangua darter.

2. Area considered critical to the maintenance or recovery of one or more of the following sensitive species; Niangua darter, bluestripe darter, blacknose shiner, topeka shiner, eastern hellbender, pink mucket, southern brook lamprey, blue sucker, and pallid sturgeon.

3. Stream reach which supports seasonal concentrations of spawning, incubating or rearing fishes of management interest including one or more of the following; walleye, sauger, white bass, rock bass, smallmouth bass, suckers, trout, and the above mentioned sensitive species.

4. Remnant example of historic habitat in which the surrounding streams or stream reaches have been severely degraded by human activities.

5. Designated Outstanding National or State Resource Water (or candidate for such designations) which supports a biological resource subject to damage from sand and gravel removal during periods of spawning, incubation, or rearing.

6. Agency management area (special trout or black bass management area), candidate for special management, or agency owned area.

7. Area containing a unique fish community or unexpectedly high biodiversity due to the presence of species considered atypical to the area.

1998. Currently, the COE does not regulate sand and gravel removal that results in "incidental fallback". However, COE permits are required for activities that include grading or pushing gravel in the stream channel; stockpiling, sorting, or crushing gravel in the stream channel or on gravel bars; access roads through the stream; and disposal of oversized material within the stream channel.

Any commercial sand and gravel removal within stream channels or flood plains requires a permit from the MDNR Land Reclamation Program. Environmental conditions imposed on these permits are usually much less restrictive than those in the General Permit (MKP-GP34M), and the lack of adequate personnel in the Land Reclamation Program limits enforcement. Non-commercial operations, such as those by individuals for personal use, or city, county, and state governments are exempt from Land Reclamation permitting requirements. The MDNR is in the process of developing guidelines similar to those in the General Permit (MKP-GP34M) which may be included in Land Reclamation permits in the future.