JAMES RIVER

WATERSHED

INVENTORY AND ASSESSMENT

This information is based on the

James River Watershed Inventory and Assessment

prepared by

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EXECUTIVE SUMMARY

The James River Basin is a sub-basin of the White River Basin which is part of the Arkansas-White-Red drainage system. The basin is located in southwest Missouri in portions of Webster, Greene, Christian, Stone, and Barry counties. It lies mainly within the Ozark Plateau physiographic region and in portions of the Springfield and Salem plateaus. The James River flows approximately 99 miles from its headwaters in Webster County into Table Rock Lake where its lower reaches have been impounded. The major tributaries to the James River include Pearson Creek, Wilson Creek, Finley Creek, Crane Creek, and Flat Creek.

Land use is approximately 63% agricultural (mostly pasture and some row cropping), 30% forested, and 7% urban. Major cities and towns in the basin include Springfield, Ozark, Nixa, Rogersville, and Reeds Spring. Urbanization and human population are increasing.

The James River watershed totals 1,512 square miles. Streams of order 5 or greater are James River, Flat Creek, Wilson Creek, Finley Creek, Crane Creek, and Rockhouse Creek. The total mileage of streams with permanent flow is 289 miles. Intermittent streams with permanent pools add another 74 miles. Several losing stream reaches and numerous springs are also located in the basin.

Point source pollution affects many of the streams in the basin. Effluents from sewage treatment facilities enter streams at several locations. Numerous industries, subdivisions, mobile home parks, and apartment complexes also have permits to discharge treated wastes into streams. Concern has been focused on the effects of phosphorus from these sources on the productivity of the lower James River and Table Rock Lake.

Potential sources of nonpoint pollution in the basin include: dairy cattle operations, poultry husbandry, sedimentation from erosion in disturbed watersheds, sludge application from sewage treatment facilities, coal pile runoff, seepage from septic tanks, and runoff from urban areas.

The James River is part of the Ozark-White Division natural community. The streams in this community are typically found in narrow, steep-sided valleys with high bluffs and are characterized by high gradient and relief. These streams are mostly clear with gravel, rubble, and bedrock bottoms. Numerous springs influence the flow and temperature characteristics of these streams.

Seventy-one fish species have been collected in the basin. Common sportfish include smallmouth bass, largemouth bass, spotted bass, white crappie, Ozark bass, channel catfish, and rainbow trout. State or federally listed threatened and endangered species include the Ozark cavefish, Missouri bladderpod, Ozark big-eared bat, Indiana bat, and the gray bat.

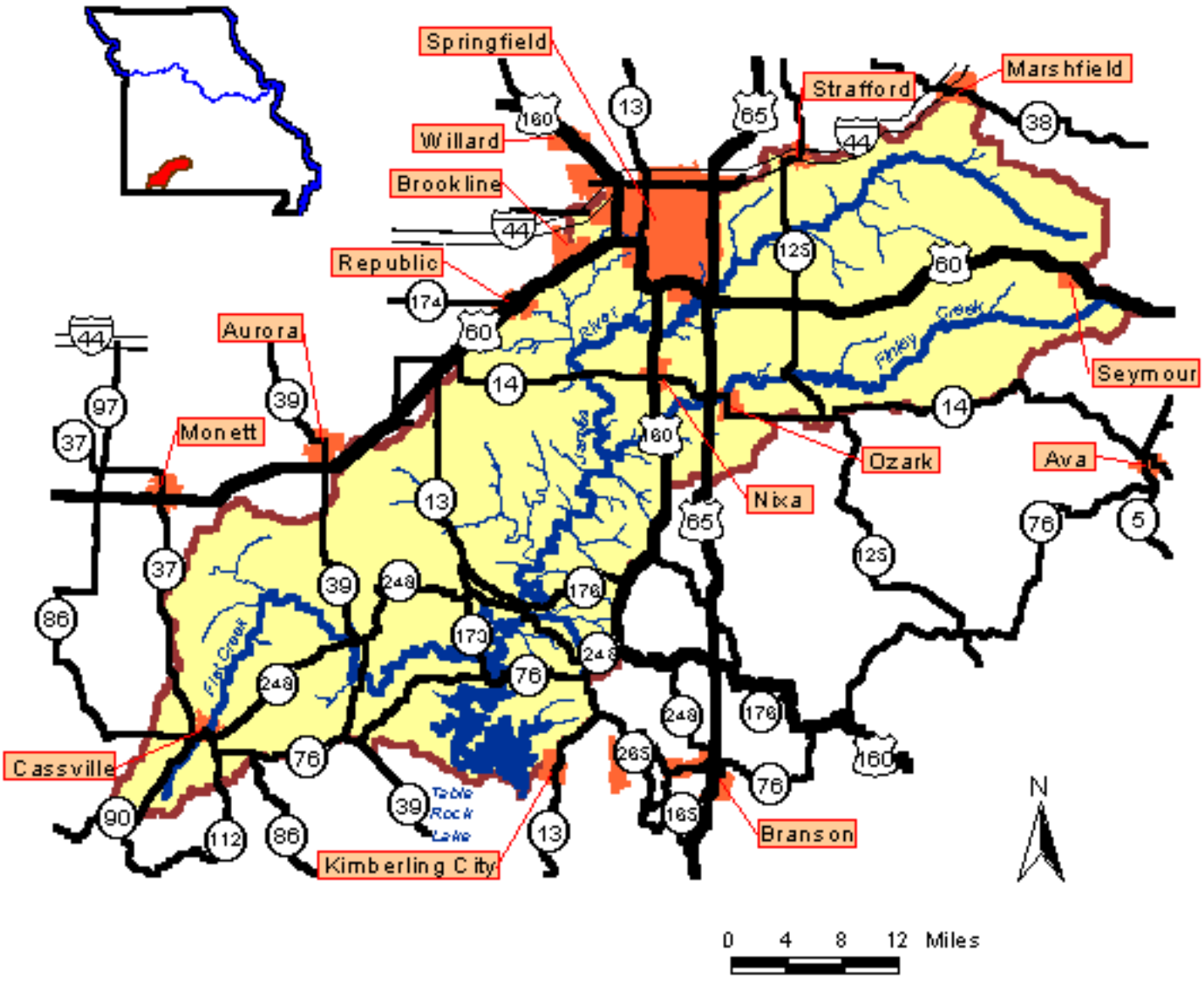
Stream habitat quality is fair to good throughout most of the basin. Some areas, including portions of the Crane Creek sub-basin, suffer from a severe lack of riparian vegetation. The lack of adequate riparian corridors, excessive nutrient loading, streambank erosion, excessive runoff and erosion, and the effects of instream activities such as gravel mining are among the problems observed in the basin. Grazing practices along many streams contribute to streambank instability, nutrient loading, and poor riparian conditions. Increased clearing and higher runoff associated with urbanization in the basin also impact stream habitat quality.

Our major goals for the basin are improved water quality, better riparian and aquatic habitat conditions, the maintenance of diverse and abundant populations of native aquatic organisms and sportfish, increased recreational use, and increased public appreciation for the stream resources. Additional fish population samples will be collected and appropriate habitat surveys will be conducted. Fishing regulations will be revised and limited stocking will be used, as needed, to maintain and improve sportfishing. Access will be improved, where needed. Cooperative efforts with other resource agencies on water quality and quantity, habitat, and watershed management issues will be critical. Enforcement of existing water quality and other stream related regulations and necessary revisions and additions to these regulations will help reduce violations and lead to further water quality improvements. Working with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions and better stream quality.

LOCATION

The James River Basin is a sub-basin of the White River Basin which is part of the Arkansas-White-Red drainage system. The basin is located in southwest Missouri in the western portion of Webster County, eastern and southern Greene County, western Christian, Stone and northeastern Barry counties (Figure 1). The basin is bordered by the Osage River Basin to the north, the Gasconade River Basin to the northeast, the Spring River Basin to the northwest, the Elk River Basin to the west, and the North Fork of the White River Basin to the east. The James River flows 99 miles southwest into Table Rock Lake. Major tributaries to the James River include Pearson Creek, Wilson Creek, Finley Creek, Crane Creek, and Flat Creek.

Figure1. Location of James River watershed.



GEOLOGY

PHYSIOGRAPHIC REGION

The basin lies mostly within the Ozark Plateau with portions in the Springfield and Salem plateaus.

GEOLOGY

The basin is dominated by limestone, shale, and sandstone. The basin's floor consists of Jefferson City-Cotter dolomite followed in an upward direction by Compton limestone, Northview shale with siltstone, Pierson limestone, Elsey limestone, and the Burlington-Keokuk limestone formation. The top layer consists of Warsaw limestone (MDNR 1995a). The Northview shale acts as an aquitard, allowing for the emergence of many springs and seeps in the basin (Table 1, Figures 2A-D).

SOIL TYPES

Six major soil complexes are found in the basin---Viraton-Wilderness, Eldon-Pembroke, Peridge-Wilderness-Goss-Pembroke, Nixa-Clarksville, Needleye-Viration-Wilderness, and Gasconade-Opequon-Clarksville (Allgood et al. 1979).

The Viraton-Wilderness complex, along with the Eldon-Pembroke and Peridge-Wilderness-Goss-Pembroke complexes, are part of the Ozark Border soils. The Ozark Border group of soils is characterized by narrow ridgetops and valleys. The native vegetation for this group of soils consists of forest with tall grasses in the open areas and glades. The Viraton-Wilderness complex is a moderately sloping complex of soils which is moderately to well drained. These soils have a fragipan and are typically found on uplands (Allgood et al. 1979).

The Eldon-Pembroke complex is comprised of deep, well drained soils. These are also upland soils with a gentle to steep slope (Allgood et al. 1979).

The Peridge-Wilderness-Goss-Pembroke complex is a deep, moderate to well drained soil complex found in upland areas. The slope of these soils can range from virtually flat to very steep (Allgood et al. 1979).

The last three complexes, Nixa-Clarksville, Needleye-Viraton-Wilderness, and Gasconade-Opequon-Clarksville, are part of the Ozark soils group. These soils are found on the narrow, limestone ridges and the steep side slopes of valleys. The vegetation of this group of soils consists of forest on the steep slopes with pastures or fields on the level upland areas. The Nixa-Clarksville complex is the first of this group of soils and is characterized by gentle to steep slopes with moderate drainage and fragipans located in upland areas (Allgood et al. 1979).

The Needleye-Viraton-Wilderness complex is characterized by moderately well drained soils with a fragipan. These soils have a level to steep slope (Allgood et al. 1979).

The Gasconade-Opequon-Clarksville complex is comprised of shallow and well drained soils. They have a gentle to steep slope and are found in upland areas (Allgood et al. 1979).

Table 1. Springs of the James River Basin.

SPRING NAME	NEAREST TOWN	COUNTY	
Barnett Spring	Hurley	Stone	26N 23W 7
Bean Factory Spring	Madry	Barry	25N 26W 25
Bell Spring*	Marshfield	Webster	29N 18W 4
Big Spring	Crane	Stone	25N 24W 28
Blue Spring*	Nixa	Christian	28N 22W 32
Bright's Spring	Purdy	Barry	24N 27W 12
Brock Spring	Cassville	Barry	23N 27W 33
Brown Spring*	Hurley	Stone	26N 24W 12
Camp Cora*	Nixa	Greene	28N 21W 30
Campground	Wilson's Creek	Greene	28N 23W 26
Carney Spring	Crane	Barry	24N 25W 3
Cave Spring	Elsey	Stone	25N 23W 19
Cave Spring	Jenkins	Barry	24N 25W 17
Cave Spring	Strafford	Webster	29N 19W 11
Crystal Spring*	Cassville	Barry	23N 27W 21
Danforth 1*	Strafford	Greene	29N 20W 5
Danforth 2*	Strafford	Greene	29N 20W 5
Double Spring	Republic	Christian	27N 23W 2
Dug Spring	Clever	Christian	27N 23w 30
Elm Spring	Marionville	Lawrence	26N 25W 12
Galena Spring	Cassville	Barry	23N 26W 17
Gum Spring	Crane	Barry	25N 25W 36
Hayes Spring	Hurley	Stone	26N 23W 34
Hilton Spring	Purdy	Barry	24N 26W 6
Hunt Spring*	Springfield	Greene	28N 21W 24
Indian Spring*	Battlefield	Greene	28N 22W 29
Jones Spring*	Springfield	Greene	29N 21W 27

Jumbo Spring	Clever	Christian	27N 23W 35
Lane Spring	Hurley	Stone	26N 23W 33
Lanetown Spring	Hurley	Stone	26N 23W 19
Lee Spring	Cassville	Barry	23N 27W 33
McCormack Spring	Seymour	Webster	29N 18W 11
McElwain Spring	Seymour	Webster	29N 18W 1
McMurty Spring*	Cassville	Barry	22N 27W 6
Melton Spring	Ozark	Christian	27N 21W 27
Monroe Spring*	Springfield	Greene	29N 21W 27
Montague Spring*	Highlandville	Christian	26N 22W 27
Mountaindale*	Seymour	Webster	29N 17W 23
Mount Sinai*	Clever	Christian	27N 23W 24
Old Still House	Hurley	Stone	26N 23W 35
Ollie Lasley*	Rogersville	Christian	28N 19W 31
Otto Lasley	Rogersville	Christian	27N 19W 7
Patterson Spring	Sparta	Christian	27N 19W 17
Pruitt Spring*	Republic	Greene	28N 23W 27
Rader Spring*	Springfield	Greene	28N 22W 18
Reed's Spring*	Reeds Spring	Stone	24N 23W 25
Rickman Spring	Hurley	Stone	26N 24W 24

Source: Vineyard (1982) and USGS 1:100,000 series topographic maps.

***More information on these springs, including rate of flow and temperature, can be found in Vineyard (1982).**

Note: T,R,S is a geographical reference referring to township(T), range(R), and section(S).

Table 1 continued.

SPRING NAME	NEAREST TOWN	COUNTY	
Roaring Spring	Madry	Barry	25N 26W 26
Roundtree*	Springfield	Greene	28N 22W 8
Rumfelt Spring*	Seymour	Webster	29N 17W 23
Sequiota Spring*	Springfield	Greene	28N 21W 9
Sherrod Spring*	Springfield	Greene	29N 22W 33
Siloam Spring	Shell Knob	Barry	23N 25W 26
Spout Spring*	Cassville	Barry	23N 27W 1
Spout Spring	Nixa	Christian	27N 21W 18
Steele Spring	Hurley	Stone	26N 24W 13
Stutzman Spring*	Springfield	Greene	28N 22W 25
Tawsemtha*	Springfield	Greene	29N 21W 13
Terrapin Spring	Hurley	Stone	26N 24W 36
Todd Spring*	Fordland	Christian	28N 18W 33
Twin Spring	Butterfield	Barry	23N 27W 4
Upshaw Spring	Madry	Barry	25N 25W 20
Walnut Spring	Cassville	Barry	23N 27W 28
Ward Spring*	Springfield	Greene	28N 22W 14
Wasson Spring*	Nixa	Christian	27N 22W 25
Welch Spring*	Springfield	Greene	28N 22W 14
Winoka Spring*	Galloway	Greene	28N 21W 22
Wise Spring	Crane	Barry	25N 25W 4
Worley	Jenkins	Barry	24N 26W 27
Young Spring*	Nixa	Christian	27N 22W 20
Unnamed	Cassville	Barry	22N 27W 4
Unnamed	Cassville	Barry	23N 27W 30
Unnamed	Cassville	Barry	23N 27W 20

Unnamed	Cassville	Barry	23N 27W 21
Unnamed	Cassville	Barry	23N 27W 21
Unnamed	Cassville	Barry	23N 27W 3
Unnamed	Cassville	Barry	23N 27W 10
Unnamed	Cassville	Barry	23N 27W 12
Unnamed	Cassville	Barry	24N 27W 34
Unnamed	Cassville	Barry	23N 27W 36
Unnamed	Cassville	Barry	23N 26W 9
Unnamed	Cassville	Barry	23N 26W 10
Unnamed	Cassville	Barry	23N 26W 17
Unnamed	Crane	Barry	25N 25W 12
Unnamed	Jenkins	Barry	24N 26W 22
Unnamed	Jenkins	Barry	24N 26W 27
Unnamed	Jenkins	Barry	24N 26W 26
Unnamed	Jenkins	Barry	24N 25W 27
Unnamed	Leann	Barry	24N 26W 1
Unnamed	Leann	Barry	24N 26W 10
Unnamed	Leann	Barry	24N 26W 8
Unnamed	Leann	Barry	24N 26W 12
Unnamed	Lohmer	Barry	23N 26W 26

Source: Vineyard (1982) and USGS 1:100,000 series topographic maps.

***More information on these springs, including rate of flow and temperature, can be found in Vineyard (1982).**

Note: T,R,S is a geographical reference referring to township(T), range(R), and section(S).

Table 1 continued.

SPRING NAME	NEAREST TOWN	COUNTY	
Unnamed	Lohmer	Barry	23N 26W 27
Unnamed	Lohmer	Barry	23N 26W 28
Unnamed	Lohmer	Barry	23N 26W 29
Unnamed	Madry	Barry	25N 25W 20
Unnamed	Madry	Barry	25N 25W 17
Unnamed	McDowell	Barry	24N 27W 12
Unnamed	McDowell	Barry	25N 26W 27
Unnamed	McDowell	Barry	25N 26W 27
Unnamed	Purdy	Barry	24N 27W 9
Unnamed	Purdy	Barry	25N 26W 16
Unnamed	Purdy	Barry	25N 26W 17
Unnamed	Star City	Barry	24N 26W 30
Unnamed	Star City	Barry	24N 26W 31
Unnamed	Star City	Barry	24N 27W 23
Unnamed	Wheelerville	Barry	24N 25W 3
Unnamed	Wheelerville	Barry	24N 25W 14
Unnamed	Wheelerville	Barry	24N 25W 15
Unnamed	Battlefield	Christian	27N 23W 1
Unnamed	Billings	Christian	27N 24W 36
Unnamed	Highlandville	Christian	26N 22W 15
Unnamed	Highlandville	Christian	26N 22W 16
Unnamed	Montague	Christian	26N 22W 27
Unnamed	Sparta	Christian	27N 19W 6
Unnamed	Sparta	Christian	27N 19W 12
Unnamed	Sparta	Christian	27N 19W 14
Unnamed	Sparta	Christian	27N 18W 21

Unnamed	Sparta	Christian	27N 19W 7
Unnamed	Sparta	Christian	27N 19W 11
Unnamed	Seymour	Douglas	27N 18W 20
Unnamed	Fordland	Greene	28N 19W 13
Unnamed*	Springfield	Greene	29N 20W 14
Unnamed	Springfield	Greene	29N 20W 33
Unnamed	Marionville	Lawrence	26N 25W 12
Unnamed	Clever	Stone	27N 24W 26
Unnamed	Clever	Stone	27N 23W 33
Unnamed	Crane	Stone	25N 24W 1
Unnamed	Crane	Stone	25N 24W 2
Unnamed	Crane	Stone	25N 24W 2
Unnamed	Crane	Stone	25N 24W 12
Unnamed	Crane	Stone	25N 24W 12
Unnamed	Crane	Stone	25N 24W 8
Unnamed	Crane	Stone	25N 24W 8
Unnamed	Crane	Stone	25N 24W 16
Unnamed	Crane	Stone	25N 24W 17
Unnamed	Crane	Stone	25N 24W 19
Unnamed	Elsey	Stone	25N 23W 18

Source: Vineyard (1982) and USGS 1:100,000 series topographic maps.

***More information on these springs, including rate of flow and temperature, can be found in Vineyard (1982).**

Note: T,R,S is a geographical reference referring to township(T), range(R), and section(S).

Table 1 continued.

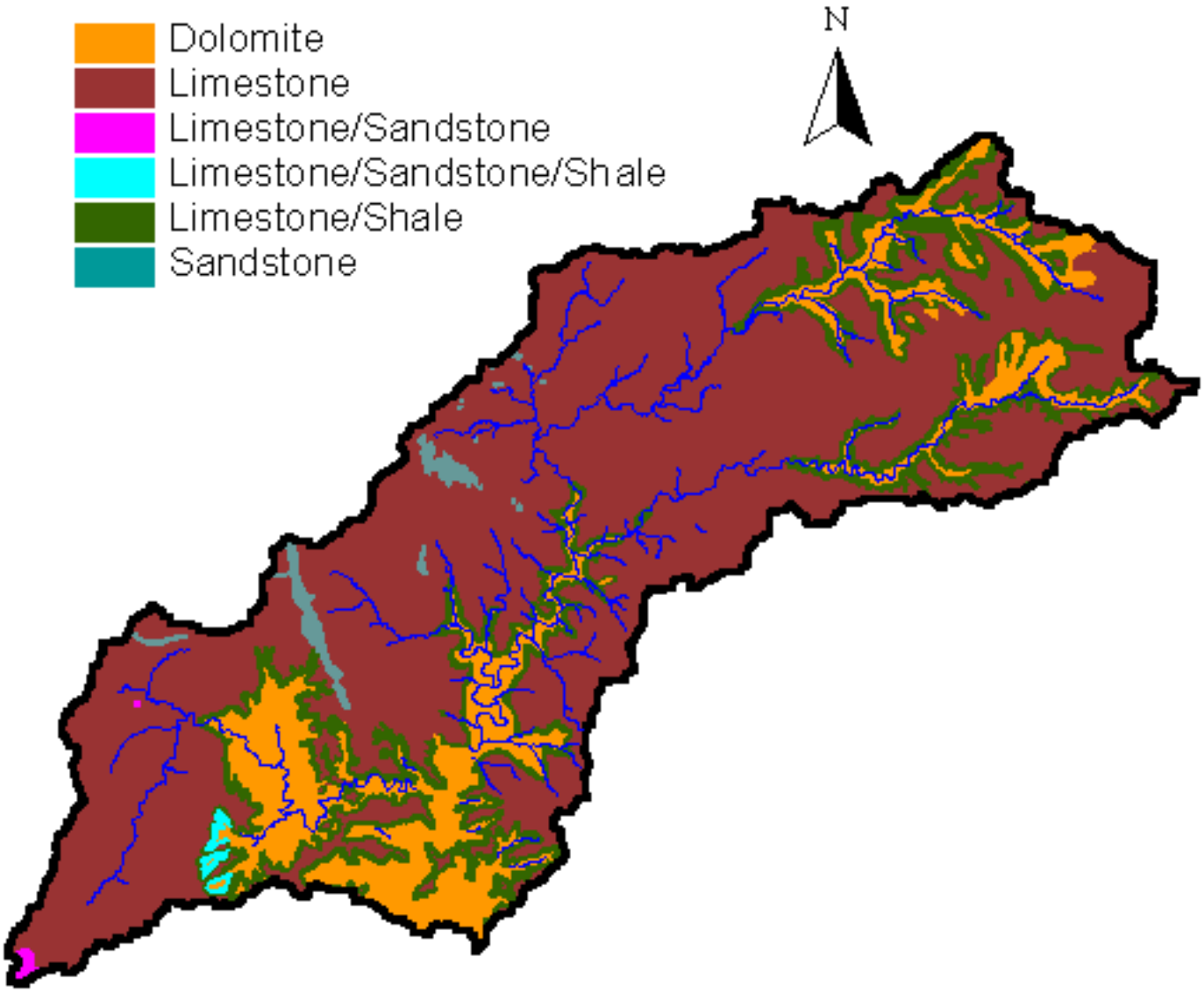
SPRING NAME	NEAREST TOWN	COUNTY	T R S
Unnamed	Elsey	Stone	24N 24W 5
Unnamed	Galena	Stone	25N 23W 29
Unnamed	Galena	Stone	25N 24W 25
Unnamed	Galena	Stone	25N 24W 28
Unnamed	Galena	Stone	25N 24W 33
Unnamed	Galena	Stone	25N 23W 31
Unnamed	Galena	Stone	24N 24W 3
Unnamed	Galena	Stone	24N 24W 17
Unnamed	Galena	Stone	24N 24W 20
Unnamed	Galena	Stone	24N 24W 22
Unnamed	Hurley	Stone	26N 24W 12
Unnamed	Hurley	Stone	26N 24W 12
Unnamed	Hurley	Stone	26N 24W 24
Unnamed	Hurley	Stone	26N 24W 23
Unnamed	White City	Stone	25N 22W 18
Unnamed	Fordland	Webster	29N 18W 9
Unnamed	Fordland	Webster	29N 18W 34
Unnamed	Fordland	Webster	28N 18W 20
Unnamed	Fordland	Webster	28N 18W 18
Unnamed	Seymour	Webster	28N 16W 19
Unnamed	Seymour	Webster	28N 16W 20
Unnamed	Seymour	Webster	28N 17W 30
Unnamed	Seymour	Webster	28N 17W 22
Unnamed	Strafford	Webster	29N 19W 11

Source: Vineyard (1982) and USGS 1:100,000 series topographic maps.

***More information on these springs, including rate of flow and temperature, can be found in Vineyard (1982).**

Note: T,R,S is a geographical reference referring to township(T), range(R), and section(S).

Geology of the James River watershed.



Soil erosion ranges from 18 to 24 tons/acre/year for tilled land, 2.5 to 5 tons/acre/year for permanent pasture, and 0.25 to 0.5 tons/acre/year for non-grazed forest. Gully erosion is slight (0 to 100 tons/square mile). Approximately 1.1 to 2 tons/acre/year of sediments reach impoundments or streams in the area. Of this total 89% is due to sheet and rill erosion, 3% is attributed to streambank erosion, and 7% comes from erosion due to sediments in urban and built-up areas (Anderson 1980).

STREAM ORDER

The James River is a seventh order stream which originates in Webster County. The major streams of the basin (fourth order and above), with their lengths and orders, are listed in Table 2.

WATERSHED AREA

The James River watershed is 1,512 square miles. The basin has been divided into four major sub-basins (Upper James River, Lower James River, Finley Creek, and Flat Creek; Figures 3A-D). The watershed areas of the streams with orders of 5 or greater are listed in Table 3.

CHANNEL GRADIENT

Channel gradients were calculated from U.S. Geological Survey (USGS) 7.5 minute topographic maps. Gradient plots for third order streams and above are available from MDC's Southwest Regional office in springfield MO.

The average channel gradients for the James River are:

Headwaters to Highway 125----15.2 ft/mi;

Highway 125 to Highway 65----4.04 ft/mi;

Lake Springfield Dam to Highway 14----5.4 ft/mi; and

Highway 14 to Galena----4.3 ft/mi.

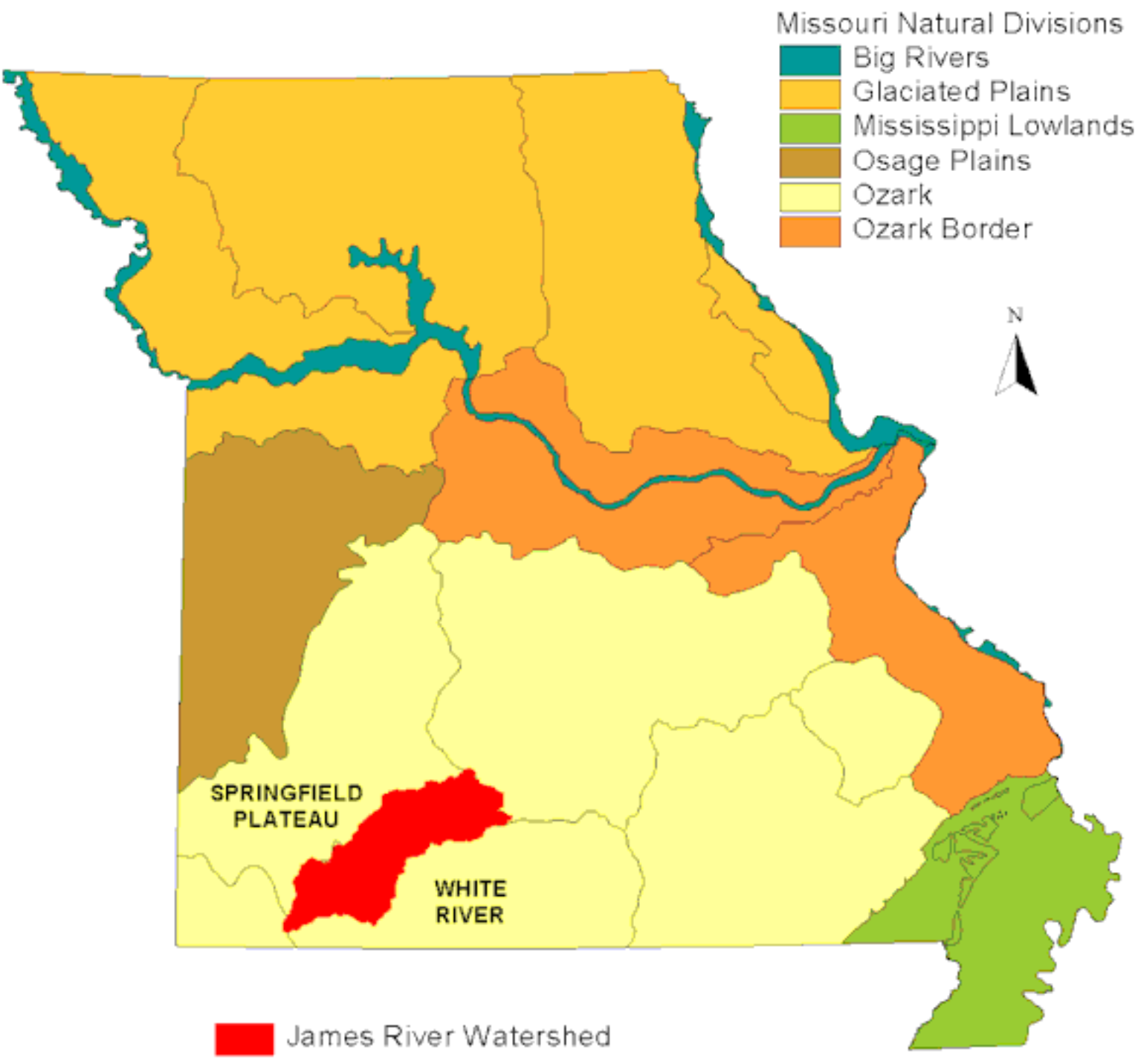
Table 2. Major streams in the James River Basin.

STREAM NAME	ORDER (MAXIMUM)	LENGTH OF MAX ORDER (mi)
Flat Creek	6	59.53
Crane Creek	5	25.00
Finley Creek	5	52.84
Rockhouse Creek	5	10.30
Wilson Creek	5	15.57
Bearden Hollow	4	3.39
Dry Crane Creek	4	13.18
Dry Creek	4	10.05
Dry Creek	4	7.14
Elk Valley	4	7.55
Fortune Branch	4	4.15
Goff Creek	4	7.46
Green Valley Creek	4	6.36
Hilton Hollow	4	4.14
Hog Creek	4	5.86
Jenkins Creek	4	7.54
Little Crane Creek	4	8.45
Little Flat Creek	4	11.06
McCullah Hollow	4	7.48
N. Carolina Creek	4	4.80
Panther Creek	4	11.89
Parched Corn Hollow	4	5.51
Pedelo Creek	4	10.00
Spring Creek	4	10.80
Terrell Creek	4	10.13
Tory Creek	4	5.46
Turnbo Creek	4	8.77

Table 3. Fifth order and larger streams in the James River Basin.

STREAM NAME	ORDER	WATERSHED AREA (mi^2)
James River	7	1,512
Flat Creek	6	314
Wilson Creek	5	84
Finley Creek	5	277
Crane Creek	5	160
Rockhouse Creek	5	32

Missouri Natural Divisions Map.



LAND USE

HISTORIC AND RECENT LAND USE

The current land cover of the James River Basin is 30% hardwood forest, 63% agriculture (mostly pasture with some row cropping), and 7% urban (industrial, commerical, and residential areas) (MDNR 1995a).

The hardwood forest consists of second growth oaks. The oak/hickory association is common on ridges, uplands, and uphill slopes on drier, more acidic soils. Some of the other trees associated with the oak/hickory complex include blackjack oak, black oak, white oak, post oak, black hickory, and shagbark hickory (EPA 1981).

Miles (1990) designates eastern red cedar forest in Barry, Christian, Webster, and Stone counties as covering 10.4, 2.7, 11.4, and 11.2 thousand acres, respectively. These counties also have 16.1, 10.0, 0.0, and 16.4 thousand acres of cedar/hardwood mixed forest, respectively. The remainder of the 201.7, 143.5, 118.4, and 125.1 thousand acres, respectively, consists of hardwood forest stands (oak/hickory). As mentioned previously, these data are for entire counties, whereas, the James River Basin lies in only a portion of each of these counties. However, trends in the watershed can be inferred from these data.

Historically, the James River Basin consisted of oak/hickory forest dominated by oaks, as well as tall grass prairie (Rafferty 1970). The prairie consisted primarily of big blue stem and other prairie grasses as well as herbs such as dittany oats grass, pussy toes, lespedeza, and cinquefoil (EPA 1981). Eastern red cedar was also found on limestone glades (Rafferty 1970). When the settlers arrived in the area, the forest was located on the slopes of stream valleys and hills, while prairie habitat was found on the level uplands (Rafferty 1970).

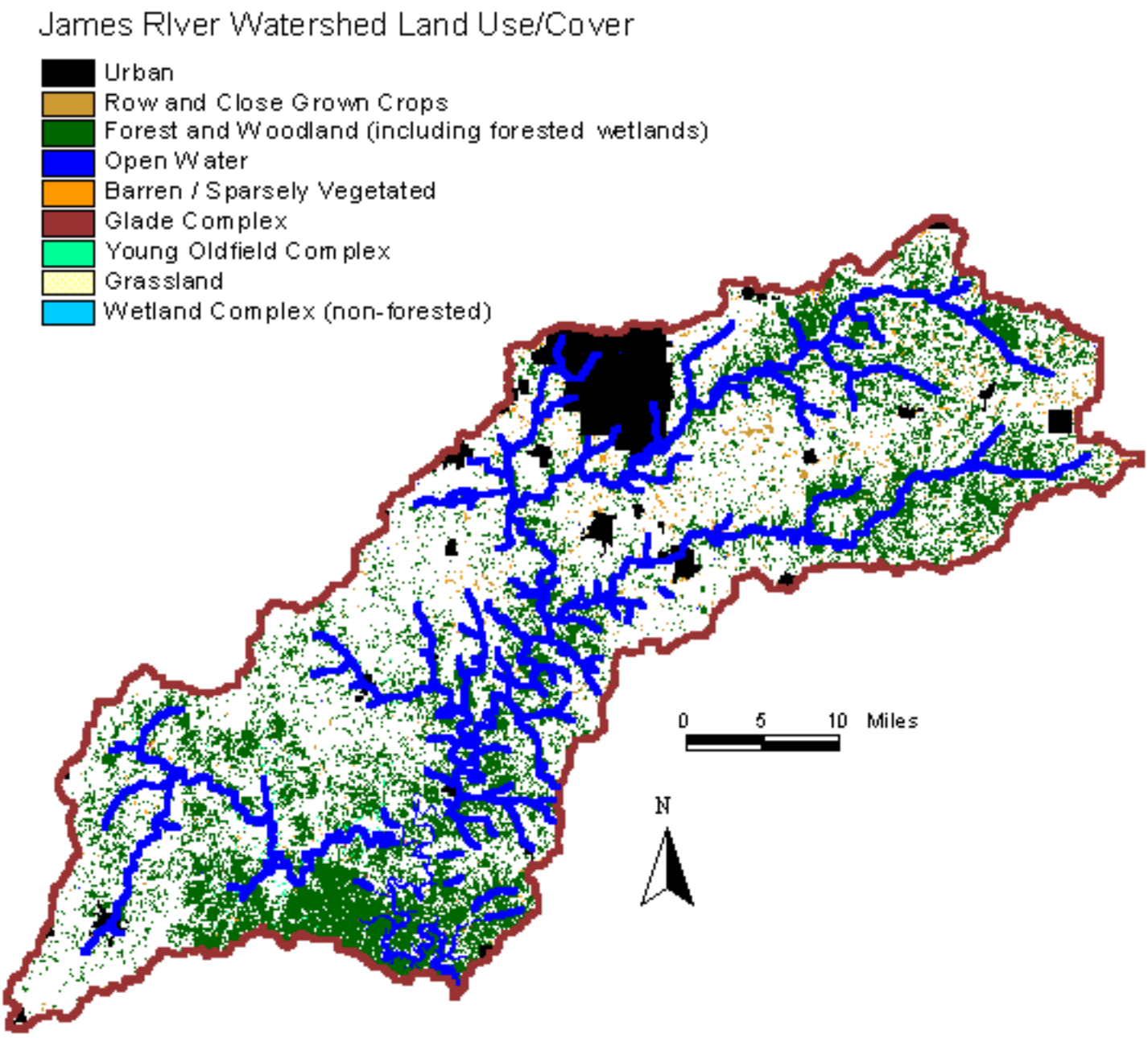
There are several reasons for the reduction in the original forest. First, as the population of the area began to increase, lumber was needed to construct homes and other buildings. Timber in the valley bottoms and on the lower slopes was harvested to support the growth in population. The development of the railroad also led to an increasing demand for lumber for railroad ties (Rafferty 1970).

Timber in the basin was also cut to clear pasture and crop land when the demand for more than subsistence farming increased (Rafferty 1970). Most of the timber that the settlers left unharvested was located on the steep slopes and in the riparian corridors because of the difficulty and relative inaccessibility of these areas to harvest (Rafferty 1970).

The prairie habitat of the region has almost disappeared due to the increase in population and related land use changes over the years. Prairie grasses have been replaced with other forage such as fescue for livestock grazing. The prairie was also plowed in order to plant rowcrops and to keep up with the increasing agricultural demand brought on by an increasing population (Rafferty 1970).

Limestone glade habitat was common in the area's early history. However, the glades were also cleared and used for livestock grazing when the settlers arrived. Orchards (mostly apples and peaches) also became more prevalent in the early 1900's. This was also brought about by the increasing population and growing demand for food (Rafferty 1970).

Land use and cover of the James River watershed.



The area now has cleared glades and fewer orchards. The remaining forest lies along riparian areas and in small stands. The virgin oak/hickory forest is almost gone. Most of the prairie has been lost to cattle grazing and agriculture (Rafferty 1970).

SOIL CONSERVATION PROJECTS

Goff Creek (Christian County) and Dry Crane Creek (Stone County) have active Special Area Land Treatment (SALT) projects.

PUBLIC AREAS

The Missouri Department of Conservation (MDC) access points (Figures 3A-D) are:

Joe Crighton Access (James River)---3 miles southeast of Springfield off Highway D in Greene County.

Southwood Access (James River, Lake Springfield)---West of Highway 65 bridge, Greene County.

Clay Henshaw Memorial Access (James River, Lake Springfield)---Evans Road off Highway 65 south of Springfield, Greene County.

Tailwaters Access (James River)---Evans Road off Highway 65 south of Springfield below Lake Springfield Dam, Greene County.

Delaware Town Access (James River)---5 miles west of Nixa off Highway 14, Christian County.

Shelvin Rock Access (James River)---5 miles southwest of Nixa off Highway M, Christian County.

Hooten Town Access (James River)---6 miles east of Hurley off Highway U, Stone County.

H. L. Kerr Access (James River)---2 miles northeast of Galena off Highway 176, Stone County.

Ralph Cox Memorial Access (James River)---Highway 13 bridge near Galena, Stone County.

Lower Flat Creek Access (Flat Creek)---3 miles east of Highway 39 and Highway EE junction, Barry County.

Stubblefield Access (Flat Creek)---5 miles northwest of Highway 39 and Highway 248 junction, Barry County.

The Department also manages (Figures 3A-D) the Springfield Conservation Nature Center located at Business Loop 65 in southeast Springfield, Wire Road Conservation Area located northwest of Crane, Compton Hollow Conservation Area south of Northview, Holland Conservation Area located north of Ponce de Leon, Jenkins Towersite south of Aurora, Seymour Towersite north of Seymour, and Jessie Hollow Conservation Area west of Reeds Spring (MDC 1995a).

The National Park Service owns Wilson's Creek National Battlefield located southwest of Springfield near Battlefield, Missouri.

A small portion of the Mark Twain National Forest lies within the basin and is located in the east central portion of Barry County, north of Highway 76.

CORPS OF ENGINEERS JURISDICTION

The entire James River Basin is under the jurisdiction of the Little Rock District of the U.S. Army Corps of Engineers (COE). Permits issued under Section 404 of the federal Clean Water Act are required to conduct many instream activities. Applications for Section 404 permits should be directed to the Little Rock office:

Little Rock District Phone: (501)324-5295

Corps of Engineers

P.O. Box 867

Little Rock, AR 72203-0867

Current listings of Section 404 permits are available from the Little Rock District office.

HYDROLOGY

PRECIPITATION

The average annual precipitation is 40 inches, and average annual runoff is 12 inches.

GAGING STATIONS

Several United States Geological Survey (USGS) gaging stations have been operated throughout the basin (Figures 3A-D). Water quality monitoring has also been conducted by USGS at sites throughout the basin. The following list includes the gaging stations found in the basin with location and period of record listed (MDNR 1986; Castillon 1994; USGS 1987, 1989, 1994). Only numbers 2 (James River near Springfield), 4 (James River near Boaz), 5 (James River near Galena), and 7 (Wilson Creek near Brookline) are currently operating.

Gage sites:

1) James River at lat. 37 12'11", long. 93 04'47", in SW¼NW¼NW¼ Sec. 24, T29N, R20W, at Greene County Highway YY bridge 4 miles south of Strafford and 1 mile downstream from Davis Creek. Period of record, 1973 to 1986.

2) James River at lat. 37 09'00", long. 93 12'12", in SW¼SE¼SW¼ Sec. 2, T28N, R21W, at a Greene County bridge (Kinser Bridge) 2.5 miles southeast of Springfield and 1.1 miles downstream from Pearson Creek. Period of record, 1955 to current year. Prior to 1955, a non-recording gage was located at this site.

3) James River at lat. 37 04'35", long. 93 22'15", in SW¼NW¼ Sec. 5, T27N, R22W, at Christian County road bridge (Nelson Mill Bridge) 2.5 miles southeast of Wilson Creek and 2 miles upstream from Wilson Creek. Period of record, August 1967 to September 1982; November 1983 to June 1987.

4) James River at lat. 37 00'25", long. 93 21'50", in NE¼NE¼NW¼ Sec. 32, T27N, R22W, at Christian County road bridge (Frazier Bridge) 2 miles southeast of Boaz and 0.2 miles upstream of Turkey Hollow. Period of record, August 1967 to September 1982; November 1983 to June 1987; November 1992 to present.

5) James River at lat. 36 48'19", long. 93 27'41", in SW¼SE¼SW¼ Sec. 6, T24N, R23W, in Stone County at State Highways 13 and 248 bridge in Galena, 0.7 miles from Railey Creek and 42.3 miles above mouth. Period of record, 1921 to current year. Prior to 1939, a non-recording gage was located at the site.

6) Wilson Creek at lat. 37 11'35", long. 93 20'20", in NW¼SE¼ Sec. 28, T29N, R22W, 0.75 miles downstream from Jordan Creek and 2 miles southwest of Springfield. Period of record, 1932 to 1938.

7) Wilson Creek near Brookline at lat. 37 9'7", long. 93 22'18", in NE¼SW¼SE¼ Sec. 7, T28N, R22W, in Greene County. Period of record, November 1993 to present year.

8) Wilson Creek near Battlefield at lat. 37 07'2", long. 93 24'14", in SW¼NW¼ Sec. 24, T28N, R23W, in Greene County. Period of record, 1972 to 1982.

9) Wilson Creek near Springfield at lat. 37 10'6", long. 93 22'14", in NE¼NE¼ Sec. 6, T28N, R22W, in Greene County. Period of record, 1972 to 1982.

10) Wilson Creek below Springfield at lat. 37 09'2", long. 93 22'12", in SE¼NE¼NE¼ Sec. 7, T28N, R22W, in Greene County. Period of record, 1967 to 1970; 1970 to 1972.

11) Tributary to James River at lat. 37 04'20", long. 93 13'05", in SW¼NE¼ Sec. 3, T27N, R21W, in Christian County on the left bank just upstream from a culvert under the old state Highway 65 bridge, 3.4 miles north of Ozark. Period of record, 1957 to 1965.

12) James River at lat. 37 05'30", long. 93 21'25", in NE¼ Sec. 32, T28N, R22W, in Greene County at Blue Spring highway bridge, 1.6 miles southwest of Battlefield and 3 miles upstream from Wilson Creek. Period of record, 1926 to 1932.

13) Finley Creek at Sec. 9, T27N, R20W, in Christian County at Highway 125, Lindenlure Dam. Period of record, 1969 to 1970; 1972.

14) Finley Creek at Sec. 23, T27N, R21W, in Christian County, Ozark Dam. Period of record, 1946 to 1967; 1952; 1962 to 1967.

Water Quality Stations:

15) James River near Nixa at lat. 37 06'13", long. 93 15'49", in SE¼NE¼ Sec. 30, T28N, R21W, in Greene County. Period of record, 1962 to 1963; 1965 to 1967.

16) James River near Wilson Creek at lat. 37 04'35", long. 93 22'15", in SE¼NW¼ Sec. 5, T27N, R22W, in Christian County. Period of record, 1967 to 1982; 1983 to 1987.

17) Wilson Creek near Battlefield at lat. 37 07'2", long. 93 24'14", in SW¼NW¼ Sec. 24, T28N, R23W, in Greene County. Period of record, 1972 to 1982.

18) Wilson Creek near Springfield at lat. 37 10'6", long. 93 22'14", in NE¼NE¼ Sec. 6, T28N, R22W, in Greene County. Period of record, 1972 to 1982.

19) Wilson Creek below Springfield at lat. 37 09'2", long. 93 22'12", in SE¼NE¼NE¼ Sec. 7, T28N, R22W, in Greene County. Period of record, 1967 to 1970; 1970 to 1972.

20) Finley Creek at Riverdale at lat. 36 59'10", long. 93 17'40", in Christian County. Period of record, 1967 to 1975.

STREAM FLOW

The peak discharges for gages located on the James River at Springfield and Galena occur in May (USGS 1993). The annual mean discharge for the Springfield gage is 237 cfs. The highest annual mean (465 cfs) occurred in 1985, and the lowest (52.8 cfs) was recorded in 1956 (USGS 1993). The annual mean discharge at the Galena gage is 981 cfs. The highest annual mean (2,499 cfs) occurred in 1927, and the lowest occurred in 1954 with a value of 119 cfs (USGS 1993).

The 7-day Q2 and Q10 values describe the low flow conditions and reflect the relative permanence of streams throughout the basin. The 7-day Q2 and Q10 values for various locations are listed in Table 4.

Table 4. Seven-day low flow discharges (cfs) in the James River Basin with recurrence intervals of two years (Q2) and ten years (Q10).

STREAM	LOCATION	PERIOD OF RECORD	7-DAY Q2	7-DAY Q10
Crane Creek	Galena	1968-1972	24.0	
Finley Creek	Linden	1969-1972	7.6	5.2
Finley Creek	Ozark	1943-1967	16.0	5.2
Flat Creek	Cassville	1944-1967	4.0	1.4
Flat Creek	Cape Fair	1969-1974	32.0	11.0
Flat Creek	Jenkins	1942-1967	27.0	10.0
James River	Galena	1921-1993	100.0	38.0
James River	Northview	1968-1972	1.5	
James River	Near Springfield	1955-1993	11.0	1.0
Sequiota Spring	Springfield	1936-1972	1.2	

Source: Missouri Department of Natural Resources (1995a), and Castillon (1994).

PERMANENT/INTERMITTENT STREAMS

There are several streams in the basin which have intermittent status for all or portions of their length. The total mileage for intermittent streams with permanent pools is 74 miles. The length of streams with permanent flow in the basin is 289 miles (Funk 1968). Mileages for intermittent streams with permanent pools are included in Table 5. Losing stream reaches are listed in Table 6 and shown in Figures 4A-D.

DAMS AND HYDROPOWER INFLUENCES

Lake Springfield is the only large dam on the James River (Figure 1). It creates Lake Springfield (318 acres), a cooling water supply lake for a Springfield City Utilities coal-fired power plant. Table Rock Dam, on the White River near Branson, has also impounded a portion of the James River below Galena. These dams have altered flows of the James and White river systems. The influences of these dams include water temperature changes and limitations on fish migration.

There are also several smaller, privately owned, low dams in the basin which were used in the past for power production or to run grain mills. These dams include: Lindenlure Dam on Finley Creek at Missouri Highway 125, Ozark Dam on Finley Creek at Ozark, Riverdale Dam one mile east of Missouri Highway 160 on Finley Creek, Hurley Dam on Spring Creek in Hurley, Calton Mill Dam on Little Flat Creek east of Purdy, and McDowell Mill Dam on Flat Creek east of Purdy (Castillon 1994 and Castillon unpublished).

Table 5. Intermittent streams with permanent pools in the James River Basin.

STREAM NAME	COUNTY	TOTAL MILES INTERMITTENT POOLS
Dry Creek	Barry-Stone	5.0
Fortune Branch	Barry	2.0
Galena Hollow	Barry	3.0
Gunter Creek	Barry	6.0
Jenkins Creek	Barry	2.5
Lateral to Flat Creek	Barry	2.0
Lateral to Little Flat Cr	Barry	5.0
Lateral to Little Flat Cr	Barry	3.5
Lateral to Rock House Creek	Barry	1.0
Lateral to Rock House Creek	Barry	2.5
Lateral to Rock House Creek	Barry	2.5
Little Crane Creek	Barry-Stone	4.5
Little Flat Creek	Barry	1.0
Roark Hollow	Barry	0.5
Rock House Creek	Barry	5.0
Sugar Camp Hollow	Barry	2.0
Willow Branch	Barry	3.0
Lateral to Finley Creek	Christian	0.5
Lateral to Finley Creek	Christian	1.0
Stewart Creek	Christian	1.0
Terrell Creek	Christian	1.0
Lateral to James River	Greene	0.5
Lateral to James River	Greene	0.5
Lateral to James River	Greene	2.0
Lateral to James River	Stone	4.5
Lateral to Pearson Creek	Greene	0.5
Horse Creek	Stone	1.5
Railey Creek	Stone	6.5
Silver Lake Branch	Stone	1.0
Wilson Run	Stone	2.0

Source: Funk (1968).

Table 6. Losing stream reaches in the James River Basin.

STREAM NAME	FIRST COUNTY	SECOND COUNTY	LENGTH (mi)	LEGAL START (T R S)	LEGAL END (T R S)
Flat Creek	Barry	Barry	3.0	NW,NE,NW 22N 28W 23	SE,SE,NW 22N 27W 6
Little Flat Creek	Barry	Barry	2.0	NW,NW,NW 25N 27W 35	SE,SE,NE 25N 27W 36
Little Flat Creek	Barry	Barry	3.0	SE,NE,SE 24N 28W 11	NE,NE,NE 25N 27W 33
Unnamed Trib to Flat Creek	Barry	Barry	1.5	NW,NE,SE 22N 27W 9	SE,SE,NE 22N 27W 5
Unnamed Trib to Flat Creek	Barry	Barry	1.0	NW,NW,SE 23N 27W 22	NE,SW,SE 23N 27W 21
Big Hollow	Christian	Christian	1.5	NE,NW,NW 28N 20W 36	SW,SE,SE 28N 20W 35
Carter Hollow	Christian	Christian	2.0	SE,NE,SW 27N 20W 26	NE,NE,NW 27N 20W 22
Dry Crane Creek	Christian	Christian	1.0	NE,SW,NE 27N 23W 32	Co. Line 27N 23W 33
Elk Valley	Christian	Christian	9.0	NW,SW,NE 27N 20W 32	NW,NW,NE 27N 21W 31
Finley Creek	Christian	Christian	2.5	NW,NW,SE 27N 19W 18	SW,NE,NW 27N 20W 14
Finley Creek	Christian	Christian	1.0	SE,NW,SW 27N 20W 18	SE,SW,NW 27N 21W 13
Green Valley Creek	Christian	Christian	5.0	NW,SW,SE 27N 23W 28	NE,SW,SW 27N 23W 12
Hog Creek	Christian	Christian	0.1	SE,SE,NW 26N 22W 1	NE,SE,NW 26N 22W 1
Hog Creek	Christian	Christian	5.5	NE,NW,NW 26N 21W 23	SE,NW,SW 26N 21W 6
Johnson Hollow	Christian	Christian	2.2	NW,NW,NW 27N 19W 29	NE,SW,SW 27N 20W 13
McCafferty Hollow	Christian	Christian	3.0	NE,SE,NW 27N 22W 26	NW,SW,SW 27N 22W 33
Saunders Valley	Christian	Christian	1.5	NE,NW,NE 27N 22W 9	SW,SW,NW 28N 22W 33
Spout Spring Hollow	Christian	Christian	1.2	SW,SW,SE 27N 21W 18	NE,NW,NW 27N 21W 29
Spring Creek	Christian	Christian	0.7	SW,NW,SE 27N 24W 14	NW,NE,NE 27N 24W 26
Spring Creek	Christian	Christian	1.7	NE,SE,NE 27N 24W 26	Co. Line 27N 24W 36
Terrell Creek	Christian	Christian	8.0	NE,NW,SW 27N 24W 15	NW,NW,NW 27N 23W 2
Tory Creek	Christian	Stone	4.8	SW,SE,SE 26N 22W 36	NW,SE,NE 26N 22W 20
Unnamed Trib to Big Hollow	Christian	Christian	1.5	NW,NE,SW 28N 20W 35	NW,NE,SE 27N 20W 2
Unnamed Trib to Carter Hollow	Christian	Christian	1.0	NE,SE,NE 27N 20W 28	NE,SW,SE 27N 20W 22
Unnamed Trib to Carter Hollow	Christian	Christian	1.0	NE,SE,NW 27N 20W 26	SE,NW,SE 27N 20W 22
Unnamed Trib to Elk Valley	Christian	Christian	2.5	NW,SE,NW 26N 20W 7	NE,NW,NE 26N 21W 2
Unnamed Trib to Elk Valley	Christian	Christian	0.5	SE,NE,SW 26N 21W 2	NE,SE,NE 26N 21W 3
Unnamed Trib to Elk Valley	Christian	Christian	2.5	SE,NE,SE 26N 21W 13	SE,SE,SE 26N 21W 3

Unnamed Trib to Elk Valley	Christian	Christian	1.5	SE,NE,SE 26N 21W 10	SE,SW,NE 26N 21W 3
Unnamed Trib to Finley Creek	Christian	Christian	1.7	NE,NE,SE 27N 22W 26	SE,NW,NE 26N 22W 2
Unnamed Trib to Finley Creek	Christian	Christian	1.0	SE,SE,SW 27N 21W 26	NW,NW,NW 27N 21W 26
Unnamed Trib to Finley Creek	Christian	Christian	1.0	SE,SW,NW 27N 21W 21	NE,SW,NE 27N 21W 28
Unnamed Trib to Finley Creek	Christian	Christian	2.5	NW,NW,SW 27N 22W 13	NE,SE,NW 27N 21W 30
Unnamed Trib to Finley Creek	Christian	Christian	2.0	SW,SE,SW 27N 19W 4	NE,NE,SW 27N 19W 17
Unnamed Trib to Finley Creek	Christian	Christian	2.0	SE,NE,SE 27N 19W 4	NE,NW,SE 27N 19W 16
Unnamed Trib to Finley Creek	Christian	Christian	3.0	NW,NE,NW 28N 20W 31	SE,SE,SW 27N 20W 7
Unnamed Trib to Finley Creek	Christian	Christian	2.0	NW,NE,NE 28N 20W 32	NW,SE,SE 27N 20W 5
Unnamed Trib to Finley Creek	Christian	Christian	3.5	NW,NE,NW 28N 20W 34	NE,NE,SE 27N 20W 7
Unnamed Trib to Finley Creek	Christian	Christian	2.0	NE,NE,SE 28N 20W 34	NW,SE,NW 27N 20W 4
Unnamed Trib to Finley Creek	Christian	Christian	1.5	SE,NE,SW 27N 20W 20	SW,SW,NE 27N 20W 17
Unnamed Trib to Finley Creek	Christian	Christian	1.5	NW,SE,SW 27N 20W 21	SE,SE,NE 27N 20W 17
Unnamed Trib to Finley Creek	Christian	Christian	1.8	NW,NE,SE 27N 22W 26	SE,NW,NE 26N 22W 2
Unnamed Trib to Finley Creek	Christian	Christian	2.5	NW,NW,SE 27N 21W 9	SE,SE,SE 27N 21W 20
Unnamed Trib to Finley Creek	Christian	Christian	1.5	SE,NW,SE 27N 21W 9	NE,NE,NE 27N 21W 20
Unnamed Trib to Finley Creek	Christian	Christian	2.2	NE,NE,NE 27N 21W 16	SW,NE,NE 27N 21W 28
Unnamed Trib to Finley Creek	Christian	Christian	1.0	NW,NE,SW 27N 21W 1	NW,NW,NW 27N 21W 12
Unnamed Trib to Finley Creek	Christian	Christian	0.8	SE,SW,NE 27N 21W 1	NW,NW,NE 27N 21W 12
Unnamed Trib to Finley Creek	Christian	Christian	0.5	SW,SE,SE 27N 21W 24	NW,NE,NW 27N 21W 25
Unnamed Trib to Finley Creek	Christian	Christian	0.7	SE,NE,SE 27N 21W 23	NE,SE,NW 27N 21W 23
Unnamed Trib to Finley Creek	Christian	Christian	0.3	SW,SE,NE 27N 20W 30	SW,NW,SE 27N 21W 14

Table 6 continued.

STREAM NAME	FIRST COUNTY	SECOND COUNTY	LENGTH (mi)	LEGAL START (T R S)	LEGAL END (T R S)
Unnamed Trib to Terrell Creek	Christian	Christian	0.4	SW,SE,NW 27N 24W 14	SW,NW,NW 27N 24W 14
Unnamed Trib to Terrell Creek	Christian	Christian	1.2	SW,SE,SE 27N 24W 11	SW,SW,SW 27N 24W 1
Unnamed Trib to Terrell Creek	Christian	Christian	0.8	SE,NE,NE 27N 24W 2	NW,NW,SE 27N 24W 1
Unnamed Trib to Terrell Creek	Christian	Christian	1.5	NE,NE,SE 28N 24W 36	SE,SW,NW 27N 23W 5
Unnamed Trib to Terrell Creek	Christian	Christian	0.8	CENTER 27N 23W 9	NE,NW,SE 27N 23W 4
Unnamed Trib to Terrell Creek	Christian	Christian	1.0	NW,NW,SW 27N 23W 17	NE,NW,NW 27N 23W 16
Unnamed Trib to Terrell Creek	Christian	Christian	0.2	NW,SW,NW 27N 23W 16	NE,NW,NW 27N 23W 16
Unnamed Trib to Terrell Creek	Christian	Christian	1.0	SE,SW,SW 27N 23W 16	NE,NW,NW 27N 23W 16
Unnamed Trib to Tory Creek	Christian	Christian	1.5	NW,SW,NE 26N 22W 23	SW,SE,SW 26N 22W 22
Unnamed Trib to Tory Creek	Christian	Christian	1.5	SW,NW,SE 26N 22W 23	NW,NE,NW 26N 22W 27
Unnamed Trib to Tory Creek	Christian	Christian	2.0	NE,NW,SW 26N 22W 24	NW,SE,SE 26N 22W 27
Unnamed Trib to Tory Creek	Christian	Christian	1.0	NE,NE,SW 26N 22W 25	SE,SW,NE 26N 22W 26
Unnamed Trib to Tory Creek	Christian	Christian	3.0	NE,SW,NW 25N 22W 12	NW,SW,SW 26N 22W 26
Unnamed Trib to Tory Creek	Christian	Christian	1.0	NW,SE,NE 25N 22W 3	SE,SW,NW 26N 22W 35
Unnamed Trib to Tory Creek	Christian	Christian	1.0	SE,NW,NW 25N 22W 11	SE,NW,NE 25N 22W 2
Unnamed Trib to sinkhole	Christian	Christian	0.7	NE,SE,SW 27N 22W 2	SE,SE,NE 27N 22W 11
Unnamed Trib to sinkhole	Christian	Christian	1.2	SW,NE,NW 27N 22W 11	NE,SE,NW 27N 22W 14
Broad Creek	Greene	Greene	2.0	SE,NE,SW 29N 20W 3	NE,SE,NW 29N 20W 15
James River	Greene	Greene	0.5	SW,NW,SE 28N 21W 30	SW,SW,SW 28N 21W 30
Pearson Creek	Greene	Greene	1.0	SW,SE,NW 29N 21W 26	SE,SW,NE 29N 21W 35
Shulyer Creek	Greene	Greene	2.5	SW,NE,NW 28N 23W 28	NW,SE,SW 28N 23W 26
Turner Creek	Greene	Greene	1.5	NE,SW,NW 28N 20W 3	NE,SW,NW 29N 20W 33
Unnamed Trib to James River	Greene	Greene	1.2	NE,NE,SW 28N 22W 20	NE,NW,SE 28N 22W 29
Unnamed Trib to James River	Greene	Greene	1.0	NE,SE,NW 29N 20W 12	SE,NW,NE 29N 20W 13
Unnamed Trib to James River	Greene	Greene	5.5	NE,NE,SE 28N 21W 24	SW,NW,SE 28N 21W 30
Unnamed Trib to Pearson Creek	Greene	Greene	1.0	NW,SW,NE 29N 21W 34	NE,SW,NE 29N 21W 35
Unnamed Trib to Ward Branch	Greene	Greene	1.0	NE,SW,NE 28N 22W 21	SE,NW,NW 28N 22W 27

Unnamed Trib to Wilson Creek	Greene	Greene	3.0	SW,SE,SE 28N 22W 3	SE,NE,NE 28N 22W 7
Unnamed Trib to Wilson Creek	Greene	Greene	1.0	SW,NE,NE 29N 22W 20	NW,NW,NW 29N 22W 28
Ward Branch	Greene	Greene	2.5	NE,SE,SE 28N 22W 14	SE,NW,NW 28N 22W 27
Wilson Creek	Greene	Greene	4.3	NE,NW,NE 29N 22W 29	NW,SW,SE 28N 22W 7
Unnamed Trib to Wilson Run	Stone	Stone	0.9	NW,SW,SE 24N 23W 35	NW,SW,SW 24N 23W 25
Unnamed Trib to Wilson Run	Stone	Stone	1.7	SW,SW,SW 24N 23W 35	SW,SE,NE 24N 23W 26
Burks Hollow	Webster	Webster	2.8	SE,SE,SE 29N 19W 36	SW,NW,SW 29N 19W 23
Davis Branch	Webster	Webster	3.7	SW,SW,SW 29N 18W 36	SW,NE,NE 28N 18W 11
Davis Branch	Webster	Webster	0.4	NE,SW,SE 28N 18W 21	SW,SE,NE 28N 18W 21
Peck Hollow	Webster	Christian	2.3	SW,SW,NW 28N 19W 21	SE,NW,SW 28N 19W 32
Pedelo Creek	Webster	Christian	5.3	NE,NW,SW 28N 19W 22	NE,NW,SE 27N 19W 6
Sawyer Creek	Webster	Webster	1.7	NE,NW,SW 28N 19W 17	NE,SW,NW 28N 19W 7
Terrel Branch	Webster	Webster	2.0	NE,SW,NE 28N 18W 8	NW,SW,NE 28N 18W 20
Unnamed Trib to Finley Creek	Webster	Webster	3.1	NE,NE,SE 28N 17W 2	CENTER 28N 17W 23
Unnamed Trib to James River	Webster	Webster	3.4	NW,SW,SW 29N 19W 30	SW,NE,SW 29N 19W 17
Unnamed Trib to James River	Webster	Webster	3.1	SE,NW,SW 29N 18W 25	SE,SE,SW 29N 17W 7
Unnamed Trib to Sawyer Creek	Webster	Webster	0.5	NW,NW,SW 28N 19W 17	NE,NW,NE 28N 19W 18
White Oak Creek	Webster	Webster	1.7	NW,NW,NW 28N 19W 16	NE,NW,NE 28N 19W 18

Source: Duchrow (1991).

WATER QUALITY

BENEFICIAL USE ATTAINMENT

The basin has streams which are classified for all beneficial uses listed by the Missouri Department of Natural Resources (MDNR 1994) (Table 7). The basin also has one Metropolitan No-Discharge Stream, the entire length of Pearson Creek.

Under this designation, no water contaminant except uncontaminated cooling water, permitted stormwater discharges in compliance with permit conditions, and excess wet-weather discharges not interfering with beneficial uses, shall be discharged to Pearson Creek (Moriarty 1994).

In addition to the streams, Sequiota Park Lake (Class L3) has been classified for livestock watering and aquatic life use, and Lake Springfield (Class L3) has been classified for livestock watering, aquatic life, industrial, and boating and canoeing. Table Rock Lake, at the foot of the basin, has use designations for livestock watering, aquatic life, whole body contact recreation, and boating and canoeing.

CHEMICAL QUALITY, CONTAMINATION, AND FISH KILLS

Several streams have had health advisories listed on selected fish species. In 1991, Level I and III health advisories were issued on fishes in the James River Basin.

A level I advisory is issued for a species or area if contaminant levels are elevated but lower than the level of concern. If this advisory is issued, consumption of the fish species should be limited. A level I advisory was issued due to chlordane for all fish species in the James River from Wilson Creek to Piney Creek in 1991.

A level III advisory is issued for a species or area if most of the fish which are tested have contaminant concentrations above levels of concern. Under this advisory, the specified fish should not be eaten. This level of advisory was implemented due to chlordane contamination in paddlefish and their eggs found in the James River and Table Rock Lake. This level was also issued for carp and channel catfish species found in Wilson Creek.

The level I advisory was lifted for all species except paddlefish in 1993. The level III advisories were also lifted for all species in 1993. The level I advisory for paddlefish was lifted in 1995. No advisories are currently in effect.

Chemical water quality data have been collected throughout the basin. Collections have been taken by USGS at gages on the James River and Wilson Creek. Other groups have sampled water quality at various localities in the Crane Creek, Finley Creek, and Flat Creek sub-basins. All samples for each particular site were averaged, and the site high and low values were recorded in Table 8. Parameters considered were water temperature, pH, dissolved oxygen, nitrate, fecal coliform, and fecal strep. In some cases other water quality parameters were tested, and this information may be found in Castillon (1994), Castillon (unpublished), and USGS (1989, 1993, and 1994).

According to the water quality standards set forth by the Missouri Department of Natural Resources and the Clean Water Commission (1996) pH should range from 6-9, fecal coliform levels should not exceed

Table 7. Stream use classifications for the James River Basin.

C or P---Class

Class C---Streams which may cease flow in periods of drought but which maintain permanent pools with aquatic life.

Class P---Streams which maintain permanent flow even in drought periods.

Use designation

IRR----Irrigation

LWW----Livestock and Wildlife Watering

AQL----Protection of Warm Water Aquatic Life and Human Health- Fish Consumption

CLF----Cool Water Fishery

CDF----Cold Water Fishery

WBC----Whole Body Contact Recreation

BTG----Boating and Canoeing

DWS----Drinking Water Supply

STREAM NAME	COUNTY	C	MI	FROM	TO	BENEFICIAL USE
CALTON CREEK	BARRY	C	5.0	MOUTH	25N 26W 16	LWW, AQL
CARNEY CREEK	BARRY	C	4.0	MOUTH	24N 25W 3	LWW, AQL
CRANE CREEK	STONE	P	4.5	MOUTH	25N 23W 8	LWW, AQL, WBC,BTG
CRANE CREEK	STONE	P	13.5	25N 23W 8	LAWRENCE CO LINE	LWW,AQL,CDF,WBC,BTG
DAVIS CREEK	GREENE	P	1.0	MOUTH	29N 20W 12	LWW, AQL
DAVIS CREEK	GREENE	C	3.0	29N 20W 12	29N 20W 2	LWW, AQL
TRIB TO DAVIS CREEK	GREENE	C	1.0	MOUTH	29N 20W 1	LWW, AQL
DAVIS BRANCH	WEBSTER	C	4.0	MOUTH	28N 18W 2	LWW, AQL
DRY CREEK	STONE, BARRY	C	5.0	MOUTH	24N 25W 12	LWW, AQL
FASSNIGHT CREEK	GREENE	C	1.2	29N 22W 30	29N 22W 30	LWW, AQL
FINLEY CREEK	STONE, WEBSTER	P	44.0	MOUTH	28N 16W 19	LWW,AQL,CLF,WBC,BTG
FLAT CREEK	STONE, BARRY	P	39.0	24N 24W 28	23N 27W 9	LWW,AQL,CLF,WBC,BTG
FLAT CREEK	BARRY	P	3.0	23N 27W 9	23N 27W 21	IRR,LWW,AQL,CDF,BTG,WBC
FLAT CREEK	BARRY	P	7.5	23N 27W 21	22N 28W 23	LWW,AQL,CLF,WBC,BTG
TRIB TO FLAT CREEK	BARRY	C	3.0	MOUTH	24N 26W 28	LWW, AQL
TRIB TO FLAT CREEK	BARRY	C	2.0	MOUTH	22N 28W 26	LWW, AQL
FORTUNE BRANCH	BARRY	C	2.5	MOUTH	23N 26W 9	LWW, AQL
GALENA HOLLOW	BARRY	C	2.5	MOUTH	23N 26W 20	LWW, AQL
GALLOWAY CREEK	GREENE	P	3.2	28N 21W 16	28N 21W 4	LWW, AQL
GUNTER CREEK	BARRY	C	6.0	MOUTH	24N 27W 29	LWW, AQL
HORSE CREEK	STONE	C	2.0	MOUTH	25N 23W 26	LWW, AQL
HUNT BRANCH	GREENE	P	0.5	28N 21W 22	28N 21W 22	LWW, AQL
HUNT BRANCH	GREENE	P	1.0	28N 21W 23	28N 21W 24	LWW, AQL
JAMES RIVER	STONE	P	28.0	24N 22W 10	26N 22W 8	IRR,LWW,AQL,CLF,WBC,BTG
JAMES RIVER	STONE, GREENE	P	26.0	26N 22W 8	LAKE SPFLD DAM	IRR,LWW,AQL,CLF,WBC,BTG
JAMES RIVER	GREENE, WEBSTER	P	35.0	HWY 65	29N 17W 24	LWW,AQL,CLF,WBC,BTG,DWS
JENKINS CREEK	BARRY	C	2.5	MOUTH	24N 26W 1	LWW, AQL
JOHNSON HOLLOW	CHRISTIAN	P	1.0	MOUTH	27N 20W 13	LWW, AQL
JORDAN CREEK	GREENE	P	3.8	29N 22W 29	29N 22W 13	LWW, AQL

LITTLE CRANE CREEK	STONE, BARRY	C	6.0	MOUTH	25N 25W 4	LWW, AQL
LITTLE FINLEY CREEK	WEBSTER	P	5.0	MOUTH	28N 17W 5	LWW, AQL
TRIB TO LITTLE FINLEY CREEK	WEBSTER	P	2.0	MOUTH	28N 17W 7	LWW, AQL
LITTLE FLAT CREEK	BARRY	P	3.5	MOUTH	25N 27W 25	LWW,AQL,CDF,WBC,BTG
LITTLE FLAT CREEK	BARRY	C	2.0	25N 27W 25	25N 27W 34	LWW, AQL
MASH HOLLOW	STONE	C	1.0	MOUTH	24N 24W 33	LWW, AQL
PANTHER CREEK	WEBSTER	P	8.5	MOUTH	29N 18W 29	LWW, AQL
PEARSON CREEK	GREENE	P	8.0	MOUTH	29N 20W 5	LWW, AQL, WBC
PEDELO CREEK	CHRISTIAN	P	0.5	MOUTH	27N 19W 7	LWW, AQL
PEDELO CREEK	CHRISTIAN	C	1.0	27N 19W 7	27N 19W 6	LWW, AQL
PINE RUN	STONE	C	4.0	MOUTH	25N 24W 26	LWW, AQL
PINEY CREEK	STONE, BARRY	C	3.0	MOUTH	23N 25W 22	LWW, AQL
PRAIRIE RUN HOLLOW	BARRY	C	1.0	MOUTH	25N 27W 25	LWW, AQL
RAILEY CREEK	STONE	C	6.5	MOUTH	HWY 13	LWW, AQL
ROCKHOUSE CREEK	BARRY	P	2.0	MOUTH	23N 26W 14	LWW, AQL
ROCKHOUSE CREEK	BARRY	C	4.0	23N 26W 14	23N 26W 28	LWW, AQL
TRIB TO ROCKHOUSE CREEK	BARRY	C	2.5	MOUTH	23N 26W 34	LWW, AQL
SAWYER CREEK	GREENE	P	5.0	MOUTH	28N 20W 12	LWW, AQL
SCHULER CREEK	GREENE	P	3.2	28N 23W 26	28N 23W 28	LWW, AQL
SILVER LAKE BRANCH	STONE	C	1.5	MOUTH	26N 23W 13	LWW, AQL
SOUTH CREEK	GREENE	P	3.8	28N 22W 7	29N 22W 34	LWW, AQL
SPRING BRANCH	GREENE	P	1.5	MOUTH	29N 22W 4	LWW, AQL
SPRING CREEK	STONE	P	5.5	MOUTH	26N 24W 12	LWW, AQL, CDF
TRIB TO SPRING CREEK	STONE	P	1.0	MOUTH	26N 23W 18	LWW, AQL
STEWART CREEK	CHRISTIAN	P	1.0	MOUTH	27N 19W 12	LWW, AQL
STEWART CREEK	CHRISTIAN	C	3.0	27N 19W 12	27N 18W 17	LWW, AQL
SUGARCAMP HOLLOW	BARRY	C	2.5	MOUTH	23N 26W 17	LWW, AQL
TERRELL BRANCH	WEBSTER	P	2.0	MOUTH	28N 18W 17	LWW, AQL
TERRELL CREEK	CHRISTIAN	P	1.0	MOUTH	27N 23W 2	LWW, AQL, WBC
TERRELL CREEK	CHRISTIAN	P	4.0	27N 23W 2	27N 23W 5	LWW, AQL
TERRELL CREEK	CHRISTIAN	C	1.0	27N 23W 5	27N 23W 6	LWW, AQL
TERRELL CREEK	CHRISTIAN	P	1.0	27N 23W 6	27N 24W 1	LWW, AQL
TORY CREEK	STONE, CHRISTIAN	P	2.5	MOUTH	26N 22W 27	LWW, AQL, CDF
TURNBO CREEK	WEBSTER	P	6.5	MOUTH	30N 18W 16	LWW, AQL
TURNER CREEK	GREENE	P	4.0	MOUTH	29N 20W 33	LWW, AQL
WARD BRANCH	GREENE	P	3.3	MOUTH	28N 22W 13	LWW, AQL
WILSON CREEK	CHRISTIAN, GREENE	P	18.0	MOUTH	29N 22W 16	LWW, AQL
WILSON CREEK	GREENE	C	1.3	29N 22W 16	29N 22W 10	LWW, AQL
WILSON RUN	STONE	C	2.5	MOUTH	24N 23W 17	LWW, AQL
WOOLLY CREEK	STONE	C	1.5	MOUTH	23N 24W 7	LWW, AQL
WORKMAN BRANCH	GREENE	C	1.0	28N 22W 22	28N 22W 15	LWW, AQL

Source: Missouri Department of Natural Resources (1994).

C or P---Class

Class C---Streams which may cease flow in periods of drought but which maintain permanent pools with aquatic life.

Class P---Streams which maintain permanent flow even in drought periods.

Use designation

IRR----Irrigation

LWW----Livestock and Wildlife Watering

AQL----Protection of Warm Water Aquatic Life and Human Health- Fish Consumption

CLF----Cool Water Fishery

CDF----Cold Water Fishery

WBC----Whole Body Contact Recreation

BTG----Boating and Canoeing

DWS----Drinking Water Supply

Table 8. Water quality averages for the James River Basin

Stream Site and Collector: DO = Dissolved Oxygen
F = Finley Creek Collections F coli = Fecal coliform
J = James River Collections F strep = Fecal streptococcus
C = Crane Creek Collections N/A = information not available
Fl = Flat Creek Collections TNTC = colonies too numerous to count
a = Castillon 1994
b = Castillon unpublished
c = Castillon unpublished
d = Berkas and USGS

STREAM SITE	DATE	WATER TEMP(ºF) AVG HI LO	pH AVG HI LO	DO AVG HI LO	NITRATE AVG HI LO	F COLI AVG HI LO	F STREP AVG HI LO
F1a	1993	43.5 44.5 43.6	8.2 8.3 8.0	6.0 6.0 6.0	0.94 1.3 0.59	36 42 30	86.5 120 53
F2a	1993	52 52 52	8.1 8.1 8.1	6.0 6.0 6.0	0.14 0.14 0.14	4 4 4	N/A
F3a	1993	43 46 40	8.0 8.3 8.7	7.0 7.0 7.0	0.57 0.68 0.45	20 31 9	65.5 70 61
F4a	1993	N/A	7.7 7.7 7.7	6.0 6.0 6.0	0.3 0.3 0.3	91 91 91	82 82 82
F5a	1993	45 45 45	7.7 7.7 7.7	5.0 5.0 5.0	0.88 0.88 0.88	76 76 76	112 112 112
F6a	1993	48 48 48	7.3 7.3 7.3	6.0 6.0 6.0	1.5 1.5 1.5	52 52 52	159 159 159
F7a	1993	45 45 45	8.7 8.7 8.7	7.0 7.0 7.0	0.2 0.2 0.2	72 72 72	114 114 114
F8a	1993	42 42 42	8.0 8.0 8.0	N/A	0.55 0.55 0.55	3 3 3	13 13 13
F9a	1993	46 46 46	8.7 8.7 8.7	N/A	0.9 0.9 0.9	8 8 8	84 84 84
F10a	1993	50 50 50	7.5 7.5 7.5	11.6 11.6 11.6	0.31 0.31 0.31	45 45 45	33 33 33
F11a	1993	55 55 55	7.8 7.8 7.8	10.8 10.8 10.8	0.71 0.71 0.71	235 235 235	22 22 22
F12a	1993	47 47 47	7.4 7.4 7.4	5.8 5.8 5.8	0.35 0.35 0.35	10 10 10	10 10 10
F13a	1993	50 50 50	8.2 8.2 8.2	5.8 5.8 5.8	0.40 0.40 0.40	N/A	19 19 19
F14a	1993	46 46 46	7.5 7.5 7.5	5.6 5.6 5.6	0.30 0.30 0.30	N/A	9 9 9
F15a	1993	46 46 46	7.5 7.5 7.5	5.5 5.5 5.5	0.32 0.32 0.32	N/A	24 24 24
F16a	1993	46 46 46	7.75 8.0 7.5	7.0 9.0 5.0	2.82 3.26 2.38	5 7 3	26 50 2
F17a	1993	52 52 52	7.2 7.3 7.1	8.0 10.0 6.0	3.96 4.22 3.7	23 45 1	68.5 114 23
F18a	1993	42 42 42	7.9 8.0 7.8	8.0 9.0 7.0	2.36 2.86 1.85	52 98 6	70 106 34
F19a	1993	43 43 43	7.85 8.0 7.7	8.5 9.0 8.0	2.73 3.17 2.29	24.5 40 9	39.5 42 37
F20a	1993	52 52 52	7.5 7.8 7.2	8.0 8.0 8.0	4.4 4.4 4.4	9 13 5	30 43 17
F21a	1993	44 44 44	8.1 8.2 8.0	8.0 9.0 7.0	2.14 2.42 1.85	48.5 86 11	51.5 53 50
F22a	1993	46 46 46	8.0 8.0 8.0	8.5 9.0 8.0	3.58 4.05 3.12	41 75 7	49 82 16
F23a	1993	N/A	8.0 8.0 8.0	9.0 9.0 9.0	2.77 2.77 2.77	7 7 7	51 51 51

F24a	1993	N/A	8.0 8.0 8.0	4.0 4.0 4.0	4.4 4.4 4.4	3 3 3	N/A
F25a	1993	55.6 55.6 55.6	7.5 7.5 7.5	5.0 5.0 5.0	4.4 4.4 4.4	10 10 10	92 92 92
F26a	1993	48.2 48.2 48.2	7.5 7.5 7.5	4.0 4.0 4.0	4.14 4.14 4.14	11 11 11	3 3 3
F27a	1993	51.4 51.4 51.4	8.0 8.0 8.0	9.0 9.0 9.0	4.18 4.18 4.18	71 71 71	91 91 91
F28a	1993	47.5 47.5 47.5	8.0 8.0 8.0	5.0 5.0 5.0	2.64 2.64 2.64	13 13 13	34 34 34
F29a	1993	53.6 53.6 53.6	8.0 8.0 8.0	6.0 6.0 6.0	4.4 4.4 4.4	2 2 2	13 13 13
F30a	1993	52.2 52.2 52.2	7.5 7.5 7.5	3.0 3.0 3.0	4.4 4.4 4.4	7 7 7	8 8 8
F31a	1993	48.9 48.9 48.9	8.0 8.0 8.0	10.0 10.0 10.0	3.26 3.26 3.26	4 4 4	13 13 13
F32a	1993	46.9 46.9 46.9	7.5 7.5 7.5	8.0 8.0 8.0	2.46 2.46 2.46	114 114 114	97 97 97
F33a	1993	46.8 46.8 46.8	8.0 8.0 8.0	4.0 4.0 4.0	2.55 2.55 2.55	339 339 339	61 61 61
F34a	1992	56.5 72.5 43.7	7.7 8.2 7.2	10.2 13.0 6.75	1.0 3.8 0.33	88.9 34 0	42.9 185 10
F35a	1992	56.3 72.3 43.7	7.57 8.0 7.1	10.2 12.6 6.9	0.55 1.4 0.14	38.4 26 0	43.9 144 2
F36a	1992	56.9 77.1 43.5	7.68 8.0 7.3	10.5 15.4 7.0	0.57 1.8 0.18	65.9 264 0	36.4 201 5
F37a	1992	57.4 74.5 42.8	7.7 8.0 7.3	10.3 15.8 7.2	0.48 1.1 0.09	44.3 192 0	37.6 166 1
F38a	1992	56.8 68.2 44.6	7.4 8.0 7.0	10.1 15.0 6.5	0.72 2.1 0.16	54.7 371 0	41.7 166 10
F39a	1992	56.8 73.9 43.0	7.77 8.0 7.2	10.97 13.0 7.8	0.96 5.8 0.31	36.6 195 0	30.0 108 5
F40a	1992	57.6 73.9 43.0	7.7 8.1 7.4	10.1 13.2 7.2	1.04 3.5 0.35	111.0 422 0	48.1 142 12

Source: Castillon (unpublished), Castillon (1994), Berkas (1982), Berkas (1980), USGS (1986, 1988, 1989, 1991, 1993, and 1994).

Stream Site and Collector: DO = Dissolved Oxygen
F = Finley Creek Collections F coli = Fecal coliform
J = James River Collections F strep = Fecal streptococcus
C = Crane Creek Collections N/A = information not available
Fl = Flat Creek Collections TNTC = colonies too numerous to count
a = Castillon 1994
b = Castillon unpublished
c = Castillon unpublished
d = Berkas and USGS

Table 8 continued.

STREAM SITE	DATE	WATER TEMP (ºF) AVG HI LO	pH AVG HI LO	DO AVG HI LO	NITRATE AVG HI LO	F COLI AVG HI LO	F STREP AVG HI LO
F41a	1993	57.6 59.9 43.0	7.5 7.5 7.5	11.5 12.0 10.0	N/A	2 5 0	47.0 81 21
F42a	1993	51.6 59.9 43.0	7.9 8.0 7.5	11.75 12.0 11.0	N/A	4.8 9 0	28 73 9
F43a	1993	51.3 59.0 43.0	7.7 8.0 7.5	12.0 13.0 11.0	N/A	1.5 5 0	29.6 56 15
J1d	1984, 87	58.8 77.0 43.7	7.85 8.6 7.2	9.5 12.9 7.0	1.5 5.1 0.6	327.3 2300 2	N/A
J1d	1964-77	60.8 89.6 32.9	7.9 8.3 7.3	8.6 13.3 5.0	1.3 3.2 0	758 N/A N/A	N/A
J1d	1977-79	59.4 82.4 36.5	7.7 8.2 7.5	8.57 12.6 6.0	1.63 6.5 0.5	897 N/A N/A	N/A
J2d	1985, 87 93,94	59.5 77.0 41.9	7.9 8.9 7.2	9.6 19.3 5.4	2.8 5.5 1.4	1489.3 13000 11	1745.2 12000 10
J2d	1964 -77	59.9 84.2 32.9	7.7 8.5 7.2	6.9 13.3 1.0	2.4 7.7 0	1790 N/A N/A	N/A
J2d	1977 -79	58.5 80.6 33.8	7.7 8.3 7.4	8.51 14.6 4.2	3.09 6.5 0.1	3900 N/A N/A	N/A
C1b	1995	54.0 58.8 49.1	8.2 8.5 7.9	9.9 11.3 6.6	5.6 8.8 0.92	52 TNTC 52	13.5 TNTC 8
C2b	1995	52.9 55.2 49.8	7.9 8.0 7.7	11.0 11.9 10.0	0.65 0.81 0.48	114 179 75	37.2 44 37
C3b	1995	54.0 54.0 54.0	8.0 8.0 8.0	9.5 9.5 9.5	N/A	41 41 41	5 5 5
C4b	1995	55.2 57.0 53.6	7.4 7.5 7.3	9.9 10.2 9.7	0.28 0.53 0.04	45.6 98 9	23.3 39 15
C5b	1995	59.4 59.7 59.0	8.15 8.3 8.0	11.3 13.4 9.1	0.52 0.84 0.19	85 120 50	19 24 4
C6b	1995	56.7 56.7 56.7	7.8 7.8 7.8	13.4 13.4 13.4	0.087 0.087 0.08	194 194 194	46 46 46
C7b	1995	60.3 60.3 60.3	8.0 8.0 8.0	10.7 10.7 10.7	0.44 0.44 0.44	TNTC	TNTC
C8b	1995	54.1 54.1 54.1	7.3 7.3 7.3	8.4 8.4 8.4	0.792 0.792 0.79	390 390 390	99 99 99
C9b	1995	60.8 60.8 60.8	8.0 8.0 8.0	7.5 8.0 7.0	0.33 0.352 0.31	222.5 260 185	37.5 40 35
C10b	1995	56.5 68.0 45.0	8.0 8.0 8.0	11.0 14.0 8.0	0.161 0.322 0	58.5 61 56	216 408 24
C11b	1995	59.0 59.0 59.0	8.0 8.0 8.0	8.0 8.0 8.0	0.286 0.286 0.28	290 290 290	7 7 7
C12b	1995	54.5 54.5 54.5	7.5 7.5 7.5	9.0 9.0 9.0	0 0 0	118 118 118	18 18 18
C13b	1995	55.4 55.4 55.4	8.5 8.5 8.5	12.0 12.0 12.0	0 0 0	230 230 230	625 625 625
C14b	1995	55.6 55.9 55.4	6.0 6.0 6.0	8.5 9.0 8.0	5.5 7.04 3.96	48 50 46	112.5 145 80
C15b	1995	45.5 48.9 42.0	6.5 6.5 6.5	10.0 11.0 9.0	3.74 7.04 0.44	154 162 146	64 100 28
C16b	1995	50.4 55.9 44.6	7.5 8.0 7.0	7.0 8.0 6.0	6.6 7.48 5.72	53.5 66 41	22 41 13
C17b	1995	45.0 45.0 45.0	6.5 6.5 6.5	9.0 9.0 9.0	0 0 0	72 72 72	43 43 43
C18b	1995	52.0 52.0 52.0	8.0 8.0 8.0	10.0 10.0 10.0	7.92 7.92 7.92	26 26 26	26 26 26
C19b	1995	55.9 55.9 55.9	7.0 7.0 7.0	5.0 5.0 5.0	N/A	N/A	N/A
C20b	1995	53.6 53.6 53.6	6.0 6.0 6.0	9.0 9.0 9.0	0 0 0	N/A	138 138 138
C21b	1995	54.0 56.3 51.8	6.75 8.0 7.5	12.7 13.2 12.2	2.9 3.4 2.4	221 336 106	587 1020 154

C22b	1995	60.3 55.8 51.4	7.58 7.75 7.5	12.3 14.4 10.4	0.6 5.4 2.2	63 114 33	109.3 170 65
C23b	1995	57.3 59.9 55.9	7.08 7.5 6.5	9.8 10.5 9.3	2.26 3.6 1.4	233 570 39	211 435 17
C24b	1995	57.6 58.3 56.3	7.83 8.0 7.5	10.1 10.5 9.9	4.78 6.16 3.52	149.7 246 96	144.7 349 29
C25b	1995	55.8 56.3 55.4	7.83 8.0 7.5	9.93 10.1 9.8	8.43 9.9 7.04	135 310 22	25.7 58 7
C26b	1995	57.8 59.0 55.6	8.1 8.3 7.7	9.76 10.5 9.4	6.68 9.24 2.0	392.3 1093 35	34.3 79 10
C27b	1995	53.7 57.7 47.8	7.9 7.9 7.9	13.4 14.0 12.2	7.92 11.0 4.84	93.5 TNTC 12	752 2208 10
C28b	1995	52.9 56.5 47.8	7.26 7.4 7.0	11.36 14.0 10.0	8.65 15.84 6.6	594.7 1400 120	1417 4128 21
C29b	1995	50.9 56.8 41.9	7.93 8.0 7.9	13.06 14.0 11.9	3.37 4.84 2.64	369 960 44	344.7 864 46

Source: Castillon (unpublished), Castillon (1994), Berkas (1982), Berkas (1980), USGS (1986, 1988, 1989, 1991, 1993, and 1994).

Stream Site and Collector: DO = Dissolved Oxygen
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Table 8 continued.

STREAM SITE	DATE	WATER TEMP (°F) AVG HI LO	pH AVG HI LO	DO AVG HI LO	NITRATE AVG HI LO	F COLI AVG HI LO	F STREP AVG HI LO
C30b	1995	50.1 56.1 52.5	7.73 7.9 7.6	10.96 14.9 8.0	8.07 9.24 6.16	64 149 0	37.3 85 2
C31b	1995	54.0 54.0 54.0	7.6 7.6 7.6	9.5 9.5 9.5	1.0 1.0 1.0	0 0 0	3 3 3
C32b	1995	54.0 54.0 54.0	7.5 7.5 7.5	9.8 9.8 9.8	1.6 1.6 1.6	72 72 72	43 43 43
C33b	1995	53.0 53.0 53.0	7.5 7.5 7.5	10.0 10.0 10.0	2.2 2.2 2.2	10 10 10	12 12 12
C34b	1995	58.1 58.1 58.1	7.9 7.9 7.9	10.5 10.5 10.5	1.5 1.5 1.5	7 7 7	124 124 124
C35b	1995	58.5 64.0 51.1	7.9 8.2 7.7	12.6 13.4 11.4	1.5 2.8 0.6	98.5 126 71	27.6 59 7
C36b	1995	54.5 55.4 53.6	8.0 8.0 8.0	10.0 10.0 10.0	0.271 0.374 0.44	744 1531 258	111.3 221 49
C37b	1995	56.3 58.1 55.4	8.0 8.0 8.0	9.0 12.0 5.0	0.22 0.264 0.17	400 668 132	81.0 219 7
C38b	1995	55.4 55.4 55.4	8.0 8.0 8.0	10.5 11.0 10.0	0.66 0.968 0.35	196 196 196	34 40 28
Fl1c	1996	48.6 51.6 45.7	7.5 7.5 7.5	11.0 11.0 11.0	12.8 13.2 12.4	0 0 0	18 24 12
Fl2c	1996	55.0 58.2 51.4	7.4 7.5 7.2	10.0 10.0 10.0	22.1 30.8 13.4	0 0 0	66.7 120 44
Fl3c	1996	53.6 55.9 52.0	7.8 8.0 7.3	11.0 11.0 11.0	11.7 17.6 4.4	0.67 2 0	27.3 38 18
Fl4c	1996	58.2 61.5 56.5	7.3 7.3 7.2	10.0 10.0 10.0	12.2 13.2 11.2	2.7 6 0	416 778 54
Fl5c	1996	54.9 58.6 52.0	7.5 7.6 7.5	N/A	14.4 17.6 12.4	0 0 0	10.7 26 2
Fl6c	1996	56.3 57.6 55.6	7.1 7.2 7.1	N/A	12.1 13.2 11.0	0 0 0	17.3 28 8
Fl7c	1996	54.7 56.1 52.5	7.8 7.8 7.7	N/A	9.1 9.4 8.8	2 6 0	46.7 54 38
Fl8c	1996	54.5 56.3 51.4	7.5 7.7 7.3	N/A	7.3 8.8 4.4	0 0 0	32.7 42 18
Fl9c	1996	54.0 55.8 52.0	7.6 7.7 7.5	N/A	9.5 13.2 7.7	5.3 16 0	50.7 60 38
Fl10c	1996	55.3 55.4 55.2	7.9 8.0 7.75	11.4 11.6 11.3	0.8 1.5 0.7	8 8 8	18 24 12
Fl11c	1996	54.7 54.7 54.7	7.75 7.75 7.75	9.78 9.78 9.78	0.97 0.97 0.97	4 4 4	2 2 2
Fl12c	1996	52.3 52.3 52.3	7.75 7.75 7.75	10.2 10.2 10.2	0.35 0.35 0.35	14 14 14	92 92 92
Fl13c	1996	51.7 54.0 49.5	7.5 7.5 7.5	8.6 8.7 8.43	0.59 1.14 0.04	1 2 0	7 8 6
Fl14c	1996	51.1 51.1 51.1	7.5 7.5 7.5	10.63 10.63 10.63	0.26 0.26 0.26	2 2 2	26 26 26
Fl15c	1996	52.3 52.3 52.3	7.5 7.5 7.5	8.02 8.02 8.02	0.26 0.26 0.26	2 2 2	38 38 38

Fl16c	1996	57.8 57.8 57.8	8.0 8.0 8.0	10.38 10.38 10.38	0.44 0.44 0.44	0 0 0	8 8 8
Fl17c	1996	50.63 50.63 50.63	7.5 7.5 7.5	9.9 9.9 9.9	0 0 0	0 0 0	6 6 6
Fl18c	1996	52.9 52.9 52.9	7.5 7.5 7.5	8.96 8.96 8.96	0.35 0.35 0.35	0 0 0	6 6 6
Fl19c	1996	60.8 60.8 60.8	8.0 8.0 8.0	7.82 7.82 7.82	0.01 0.01 0.01	0 0 0	61 61 61
Fl20c	1996	53.6 53.6 53.6	7.5 7.5 7.5	11.04 11.04 11.04	0.02 0.02 0.02	1 1 1	20 20 20
Fl21c	1996	60.8 60.8 60.8	7.5 7.5 7.5	11.63 11.63 11.63	0.02 0.02 0.02	0 0 0	19 19 19
Fl22c	1996	53.0 53.0 53.0	8.0 8.0 8.0	9.08 9.08 9.08	0.18 0.18 0.18	0 0 0	59 59 59
Fl23c	1996	51.8 51.8 51.8	8.0 8.0 8.0	12.02 12.02 12.02	0 0 0	0 0 0	48 48 48
Fl24c	1996	59.0 59.0 59.0	7.1 7.1 7.1	10.0 10.0 10.0	0.47 0.47 0.47	0 0 0	184 184 184
Fl25c	1996	59.0 59.0 59.0	7.4 7.4 7.4	12.0 12.0 12.0	0.26 0.26 0.26	0 0 0	44 44 44
Fl26c	1996	51.8 51.8 51.8	7.6 7.6 7.6	13.0 13.0 13.0	0.26 0.26 0.26	0 0 0	73 73 73
Fl27c	1996	50.9 50.9 50.9	7.4 7.4 7.4	13.0 13.0 13.0	0.04 0.04 0.04	0 0 0	99 99 99
Fl28c	1996	50.0 50.0 50.0	7.8 7.8 7.8	12.0 12.0 12.0	0.09 0.09 0.09	0 0 0	TNTC
Fl29c	1996	50.0 50.0 50.0	7.4 7.4 7.4	12.0 12.0 12.0	0.44 0.44 0.44	0 0 0	TNTC
F130c	1996	50.9 50.9 50.9	7.7 7.7 7.7	12.0 12.0 12.0	0.44 0.44 0.44	0 0 0	9 9 9
F131c	1996	55.8 55.8 55.8	7.6 7.6 7.6	11.0 11.0 11.0	0 0 0	0 0 0	41 41 41
F132c	1996	56.1 56.1 56.1	7.5 7.5 7.5	10.0 10.0 10.0	1.32 1.32 1.32	0 0 0	89 89 89
F133c	1996	57.9 57.9 57.9	8.3 8.3 8.3	11.0 11.0 11.0	0 0 0	0 0 0	24 24 24
F134c	1996	53.1 53.1 53.1	8.0 8.0 8.0	11.0 11.0 11.0	0.22 0.22 0.22	0 0 0	67 67 67
Fl35c	1996	59.5 59.5 59.5	8.3 8.3 8.3	12.0 12.0 12.0	0 0 0	0 0 0	91 91 91
Fl36c	1996	49.9 60.8 41.0	7.5 7.95 6.94	N/A	1.6 1.6 1.6	9.3 20 4	49.7 110 14
Fl37c	1996	50.9 60.8 42.8	8.1 8.25 8.06	N/A	2.2 2.5 1.8	1.3 2 1	3 4 2
Fl38c	1996	55.4 55.4 55.4	7.26 7.26 7.26	N/A	0.39 0.39 0.39	1 1 1	13 13 13
Fl39c	1996	59.0 59.0 59.0	7.31 7.31 7.31	N/A	2.7 2.7 2.7	2 2 2	4 4 4
Fl40c	1996	48.0 48.0 48.0	8.1 8.1 8.1	N/A	3.1 3.1 3.1	36 36 36	1 1 1
Fl41c	1996	45.0 45.0 45.0	8.17 8.17 8.17	N/A	1.4 1.4 1.4	48 48 48	29 29 29

Fl42c	1996	62.6 62.6 62.6	7.89 7.89 7.89	N/A	2.9 2.9 2.9	2 2 2	51 51 51
Fl43c	1996	55.4 55.4 55.4	7.71 7.71 7.71	N/A	3.3 3.3 3.3	16 16 16	8 8 8
Fl44c	1996	60.8 60.8 60.8	7.87 7.87 7.87	N/A	2.9 2.9 2.9	170 170 170	70 70 70

Source: Castillon (unpublished), Castillon (1994), Berkas (1982), Berkas (1980), USGS (1986, 1988, 1989, 1991, 1993, and 1994).

Stream Site and Collector: DO = Dissolved Oxygen
F = Finley Creek Collections F coli = Fecal coliform
J = James River Collections F strep = Fecal streptococcus
C = Crane Creek Collections N/A = information not available
Fl = Flat Creek Collections TNTC = colonies too numerous to count
a = Castillon 1994
b = Castillon unpublished
c = Castillon unpublished
d = Berkas and USGS

1,000 colonies per milliliter per day, temperature for cold water fisheries should not exceed 68 degrees Farenheit, and the temperature for cool water fisheries should not exceed 84 degrees. Nitrate levels of 10 mg/L or less are the standard criteria for drinking water supply. Dissolved oxygen levels for cool and warm water fisheries should be no lower than 5ppm and no lower than 6ppm for cold water fisheries.

Review of the water quality data collected in the basin indicate that pH levels were never reported outside the ranges recommended by the water quality standards. Fecal coliform levels were exceeded on the James River near Wilson Creek and Boaz. Fecal coliform levels were also exceeded in the Crane Creek drainage, on Crane Creek, Spring Creek, and Hayes Spring. Temperatures for cool water fisheries were exceeded once on the James River. Dissolved oxygen levels fell below the standard levels at three locations on Finley Creek. Nitrate levels were exceeded in the Crane Creek and Flat Creek drainages, but these streams are not designated for drinking water supplies.

Fish kills have been investigated throughout the basin since the 1970's. Forty-one fish kills have been investigated since 1980 (Table 9), and of these, 13 were from Jordan Creek, 5 were from Wilson Creek, and 5 from the James River in Greene County. All but 5 fish kill locations were in Greene County. Sewage discharge is the most common problem cited in the investigation of fish kills in this region.

WATER USE

Most of the municipalities in the basin use wells for their municipal water-supply facilities (Table 10). Springfield, however, receives its water-supply from both groundwater sources (outside the basin) and reservoirs.

In 1988 there were two public water-supply surface withdrawals in the basin. One was located on Lake Springfield (28N, 21W, 20). The other was located on the James River at 29N, 21W, 35. In 1994, the James River site was the only surface withdrawal in the basin (MDNR 1994). At present, daily withdrawals at this site average 16.7 million gallons per day.

POINT SOURCE POLLUTION

Point source pollution affects many of the streams in the basin including the James River itself. Sewage treatment facilities in Clever, Crane, Fordland, Rogersville, Seymour, Sparta, Reeds Spring, Nixa, Ozark, Springfield, Galena, Purdy, Washburn, and Exeter discharge effluents to streams. Numerous industries, subdivisions, mobile home parks, and apartment complexes also have permits to discharge into streams. The streams which seem to be the most affected include: Jordan Creek, Wilson Creek, Terrell Branch in Webster County, Finley Creek, and the James River in Christian County and again in the James River arm of Table Rock Lake in Stone County. Most discharges effect less than 0.1 mile of the receiving stream. However, five miles of Wilson Creek are believed to be affected by discharge from the Springfield Southwest Treatment Plant, and about 1 mile of Railey Creek in Stone County is believed to be affected by the Reeds Spring wastewater treatment plant (MDNR 1995a). Concern has been expressed repeatedly over the effects of phosphorus from these sources on the productivity of the lower James River and Table Rock Lake. A list of all the permitted point sources in the basin is included in Table 11a. In addition to the NDPES permits, there are also several permitted stormwater discharges (Table 11b) . To report pollution incidents contact the Department of Natural Resources.

NONPOINT SOURCE POLLUTION

Table 9. Fish kill summary for the James River Basin from 1980- 1995.

DATE	STREAM	COUNTY	NUMBER KILLED	ESTIMATED VALUE	CAUSE/SOURCE
5-13-94	Lake Springfield	Greene	N/A	N/A	parasite
8- 1-94	South Creek	Greene	1,887	$ 258.95	unknown
9- 9-94	James River	Greene	300+	N/A	nitrogen fertilizer
9-13-94	Crane Creek	Stone	N/A	N/A	municipal:sewage
12-10-94	Lake Springfield	Greene	2,000	$ 160.50	unknown
12-13-94	Lake Springfield	Greene	200	N/A	high ammonia
1-22-93	James River	Greene	N/A	N/A	diesel fuel
1-29-93	Flat Creek	Barry	1,436	$ 126.40	unknown
3- 2-93	Jordan Creek	Greene	N/A	N/A	diesel fuel
5-14-93	Galloway Creek	Greene	N/A	N/A	sewage
5-17-93	Jordan Creek	Greene	21,164	$2,151.91	sour milk
10-28-93	Sawyer Creek	Greene	N/A	N/A	cattle manure
2-27-92	Jordan Creek	Greene	N/A	N/A	turkey blood
6-30-92	Wilson Creek/James River	Greene	N/A	N/A	treated sewage effluent without disinfection
7-31-92	Jordan Creek	Greene	N/A	N/A	unused concrete
7-31-92	Jordan Creek	Greene	22,511	$2,241.01	unknown
12-16-92	Ward Branch	Greene	N/A	N/A	raw sewage
2-28-91	Jordan Creek	Greene	N/A	N/A	phosphoric acid
6- 8-91	Schuyler Creek	Greene	4,909	$ 394.91	sewage
6-18-91	South Creek	Greene	184	$ 114.45	unknown
6-20-91	Jordan Creek	Greene	N/A	N/A	elemental mercury
12-12-91	Flat Creek	Barry	N/A	N/A	unknown
1- 8-90	Jordan Creek	Greene	4,162	$ 373.34	industrial
7- 2-89	Pine Run Creek	Stone	35	$ 19.60	petrolem
1-25-88	Jordan Creek	Greene	10,675	$ 800.46	unknown
3- 6-87	Jordan Creek	Greene	3,273	$ 225.08	unknown
9-23-87	Wilson Creek	Greene	N/A	N/A	sewage
10-14-86	Wilson Creek	Greene	5,539	$ 604.65	sewage
3-30-85	Wilson Creek	Greene	N/A	N/A	sewage
1-27-84	Unnamed Trib to Finley Creek	Webster	N/A	N/A	fuel oil

4-10-84	Jordan Creek	Greene	N/A	N/A	sewage
7-16-84	James River	Greene	283	$ 187.43	powerplant effluent
8- 7-84	Ward Branch	Greene	1,048	$ 77.87	sewage
8-11-84	James River	Greene	200	N/A	unknown
8-12-84	Jordan Creek	Greene	19,604	$1,340.41	unknown
8-17-84	James River	Greene	312	$ 129.90	unknown
12-17-84	Jordan Creek	Greene	300	$ 18.00	sewage
3- 1-83	Wilson Creek	Greene	N/A	N/A	sludge
5-18-83	Turner Creek	Greene	2,388	$ 331.36	manure
6- 2-82	Unnamed Trib to South Creek	Greene	N/A	N/A	oil spill
5-16-81	South Creek	Greene	60	N/A	unknown

Source: Missouri Department of Conservation Fish Kill Summary (1996)

Table 10. Municipalities in the James River Basin with wells* for water-supply facilities.**

MUNICIPALITY	COUNTY	LOCATION T R S
Billings	Christian	27N 24W 10
Butterfield	Barry	24N 28W 36
Clever	Christian	27N 23W 20
Crane	Stone	25N 24W 4
Diggins	Webster	29N 18W 25
Exeter	Barry	23N 28N 34
Fordland	Webster	28N 18W 6
Galena	Stone	24N 23W 7
Marshfield	Webster	30N 18W 10
Nixa	Christian	27N 22W 14
Ozark	Christian	27N 21W 26
Purdy	Stone	24N 28W 2
Reeds Spring	Stone	24N 23W 26
Republic	Greene	28N 23W 30
Rogersville	Webster	28N 19W 19
Sparta	Christian	27N 20W 25
Strafford	Greene	29N 20W 4
Washburn	Barry	22N 28W 28

Source: Missouri Department of Natural Resources (1995a).

***Exact locations as well as sites for wells used by subdivisions and trailer parks can be found in MDNR (1995b).**

****Springfield also uses wells for a part of its water supply. These wells are located outside the basin.**

Table 11a. Permitted point sources in the James River Basin.

FACILITY NAME	RECEIVING STREAM	LOCATION T R S)	COUNTY
CASSVILLE WWTF	FLAT CREEK	NE NE 23N 27W 21	BARRY
EXETER WWTF	TRIB TO FLAT CREEK	NE SE 23N 28W 35	BARRY
PRUDY E WWTF	LITTLE FLAT CREEK	SW NE 24N 28W 1	BARRY
WASHBURN WWTF	FLAT CREEK	NE SE 22N 28W 28	BARRY
CEDARVIEW APARTMENTS	TRIB TO JAMES RIVER	NW SE 28N 21W 32	CHRISTIAN
CLEVER WWTF	TRIB TO SPRING CREEK	SW SW 27N 23W 20	CHRISTIAN
DIVERSIFIED PLASTICS	TRIB TO JAMES RIVER	NE NE 27N 22W 2	CHRISTIAN
ENGLISH VILLAGE MHP	TRIB TO JAMES RIVER	SWSENE28N 22W 35	CHRISTIAN
FASCO INDUSTRIES	FINLEY CREEK	NWSESW27N 21W 22	CHRISTIAN
FREMONT HILLS WWTF	TRIB TO JAMES RIVER	SE NW 27N 21W 5	CHRISTIAN
INTERGRATED INGREDIENTS	TRIB TO FINLEY CREEK	NENWSW27N 22W 13	CHRISTIAN
NIXA WWTF	FINLEY CREEK	SW SE 27N 22W 24	CHRISTIAN
OZARK WWTF	FINLEY CREEK	NW NE 27N 21W 28	CHRISTIAN
RIVERDOWNS W SUBDIVISION	TRIB TO JAMES RIVER	NW NW 28N 22W 34	CHRISTIAN
SOUTH OAKS MOBLIE HOME PARK	TRIB TO FINLEY CREEK	SWSENE27N 22W 35	CHRISTIAN
SPARTA WWTF	CARTER HOLLOW	NW SE 27N 20W 26	CHRISTIAN
ASH GROVE CEMENT CO, INC	SEQUIOTA CREEK	NW SE 28N 21W 8	GREENE
BURLINGTON NORTHERN WEST	WILSON CREEK	SE SE 29N 22W 9	GREENE
CONCRETE CO OF SPRINGFIELD	JORDAN CREEK	SW SE 29N 22W 13	GREENE
DAYCO PRODUCTS INC	SOUTH CREEK	W NW 28N 22W 3	GREENE

DRURY HPER GYM AND POOL	N BRANCH JORDAN CR	NW SE 29N 22W 13	GREENE
GE, MOTOR MFG DEPARTMENT	TRIB TO GALLOWAY BR	SE SE 29N 21W 29	GREENE
GEN COUNCIL/ASSEMBLY OF GOD	TRIB TO JORDAN CREEK	NW SE 29N 22W 13	GREENE
HEATHERWOODS STP	JAMES RIVER	NW NE 28N 21W 11	GREENE
HICKORY HILLS COUNTRY CLUB	COOPER CREEK	NW NE 29N 21W 22	GREENE
JAMES VALLEY FARM SUBDIV	JAMES RIVER	SENENE29N 21W 36	GREENE
KRAFT GENERAL FOODS	FASSNIGHT CREEK	SE NW 29N 21W 29	GREENE
MID-AMERICA DAIRYMEN INC	JORDAN CREEK	SW SE 29N 22W 14	GREENE
PAUL MUELLER COMPANY	JORDAN CREEK	SE SE 29N 22W 15	GREENE
PRAIRIE VIEW HEIGHTS SUBDIV	TRIB TO WILSON CREEK	SE NE 28N 22W 17	GREENE
SOUTHWEST REG STOCKYARDS	TRIB TO WILSON CREEK	SW SW 29N 22W 11	GREENE
SPRINGFIELD, BLACKMAN WTP	TRIB TO JAMES RIVER	SW SW 29N 21W 34	GREENE
SPRINGFIELD, JAMES RIVER	LAKE SPRINGFIELD	SW SW 28N 21W 20	GREENE
SPRINGFIELD, JAMES RIVER	JAMES RIVER	NE NE 28N 21W 30	GREENE
SPRINGFIELD READY-MIX CO	JORDAN CREEK	NE NW 29N 22W 23	GREENE
SPRINGFIELD SW WWTP	WILSON CREEK	NE NE 28N 22W 7	GREENE
SPRINGFIELD SOUTHWEST PS	TRIB TO WILSON CREEK	SESWNE28N 23W 12	GREENE
SPRINGFIELD SOUTHWEST PS	TRIB TO WILSON CREEK	SESWNW28N 22W 7	GREENE
SPRINGFIELD SOUTHWEST PS	WILSON CREEK	NWNESW28N 22W 7	GREENE
SWEETHEART CUP COMPANY	TRIB TO JORDAN CREEK	SW NW 29N 21W 17	GREENE
SYNTEX AGRIBUSINESS INC	JORDAN CREEK	NE SW 29N 22W 27	GREENE

TIMBERCREST MOBLE HOME PARK	THOMPSON BRANCH	NWSENE28N 21W 17	GREENE
US MED CENTER FED PRISONERS	SOUTH CREEK	SW SE 29N 22W 34	GREENE
VILLAGE ADD. TO BATTLEFIELD	WILSON CREEK	SE SE 28N 22W 18	GREENE
WILSON CREEK NATL BATTLEFLD	MCELHANEY BRANCH	NE SW 28N 23W 23	GREENE
CRANE WWTP	CRANE CREEK	NW SE 25N 24W 4	STONE
EDGEWATER VILLA RESORT	TABLE ROCK LAKE	SW SE 23N 23W 30	STONE
FLAT CREEK RESORT	TABLE ROCK LAKE	NE SW 24N 24W 27	STONE
GALENA WWTP	PINE RUN	NW SW 24N 23W 6	STONE
HIDDEN VALLEY ESTATES	JAMES RIVER	SW NE 26N 22W 5	STONE
LAKE COUNTRY VILLAGE	TABLE ROCK LAKE	SW NE 23N 24W 11	STONE
PIONEER POINT WWTP	TRIB TO JAMES R ARM	SE NE 23N 24W 36	STONE
REEDS SPRING WWTF	RAILEY CREEK	SW NE 24N 23W 26	STONE
ROCKYTOP MOBILE HOME PARK	TRIB TO RAILEY CREEK	SW SE 24N 23W 35	STONE
RUSTIC GATE MOTOR INN	TRIB TO S AUNTS CR	SW SW 23N 23W 5	STONE
SHADRACK RESORT	TRIB TO TABLE ROCK	SE SE 23N 24W 4	STONE
USCOE, CAPE FAIR PARK	TABLE ROCK LAKE	SE SW 23N 24W 4	STONE
WHITE EAGLE WOODS SUBDIV	ANCE CR/TABLE ROCK	NWSESE23N 23W 30	STONE
FORDLAND WWTP	TERRELL BRANCH	SW NW 28N 18W 5	WEBSTER
MDOC, OZARK CORRECTIONS	TRIB TO FINLEY CREEK	NE SW 28N 18W 2	WEBSTER
ROGERSVILLE WWTF	SAWYER CREEK	NW NE 28N 19W 18	WEBSTER
SEYMOUR INN, INC	TRIB TO FINLEY CREEK	NWNWSW28N 17W 1	WEBSTER

SEYMOUR WWTP	TRIB TO FINLEY CREEK	NW NE 28N 17W 11	WEBSTER

Source: MDNR (1995a).

Table 11b. Permitted stormwater discharges in the James River Basin.

FACILITY NAME	RECEIVING STREAM	LOCATION (T R S)	COUNTY
HUTCHENS, PURDY QUARRY	LITTLE FLAT CREEK	NE NE 25N 27W 34	BARRY
LJ, CHRISTIAN CO STONE	LUCE BR. TERRELL CREEK	NE NE 27N 23W 9	CHRISTIAN
LJ, MCCRACKEN QUARRY	TRIB TO FINLEY CREEK	NW SW 27N 20W 20	CHRISTIAN
LJ, OZARK QUARRY	FARMER'S BRANCH	NW NW 28N 21W 34	CHRISTIAN
SAFTEY KLEEN-SPRINGFIELD	WILSON'S CREEK	NW SW 29N 22W 16	GREENE
SOLID STATE CIRCUITS	TRIB TO WILSON'S CREEK	SE SE 28N 22W 4	GREENE
3M CO, TAPE MANUFACTURING	TRIB TO JORDAN CREEK	SE 29N 21W 16	GREENE
BRANSON CO-COMPOSTING FAC	TRIB TO SOUTH ANCE CREEK	SW SE 23N 23W 11	STONE
LJ, REED'S SPRING	RAILEY CREEK	NE SW 24N 23W 23	STONE
RENFRO'S SANI AND DEMO LDFL	TRIB TO SOUTH ANCE CREEK	W SE 23N 23N 11	STONE
TABLE ROCK ASPHALT #3	TRIB LITTLE AUNTS CREEK	SW SW 23N 23W 22	STONE
HUTCHENS, STEEL PROCESSOR	TRIB TO FINLEY CREEK	NWNWNE28N 17W 2	WEBSTER
WEBSTER CO LANDFILL	TRIB TO JAMES RIVER	NE SW 30N 18W 32	WEBSTER

Source: MDNR (1995a).

There are several potential sources for nonpoint pollution in the watershed. The nonpoint sources include dairy cattle operations, poultry or turkey husbandry, sedimentation from erosion in disturbed watersheds, sludge application from sewage treatment facilities, coal pile runoff from the power plant in southwest Greene County, and some dioxin and volatile organics in the groundwater from Syntex Agribusiness (MDNR 1995a). Seepage from septic systems throughout the basin is another unquantified source of nonpoint pollutants.

Several large dairy cattle farms are a significant source of nonpoint pollution. Poultry barn operations and related land application of wastes are also potential and increasing sources of nonpoint source pollution. In 1988, the MDNR also recognized the Webster County landfill as a potential source of nonpoint pollution in the James River Basin due to leachate discharge into streams and severe soil erosion. Several farming operations have been given site descriptions by the MDNR as potential nonpoint sources of pollution (Table 12).

Table 12. Nonpoint source operations in the James River Basin.

FACILITY NAME	TYPE OF FACILITY	LOCATION T R S	COUNTY
HALL, GARY	POULTRY OR TURKEYS	SE NE 23N 27W 25	BARRY
HUDSON FARMS- H AND H	POULTRY OR TURKEYS	E NE 24N 28W 36	BARRY
HUDSON FARMS-SMITH FARM	POULTRY OR TURKEYS	SE NW 22N 28W 25	BARRY
HUTCHENS, CAROL	POULTRY OR TURKEYS	NE SW 22N 28W 14	BARRY
HUTCHENS, TOM	POULTRY OR TURKEYS	SE SW 25N 27W 24	BARRY
MADISON, BUD	POULTRY OR TURKEYS	NW SE 23N 27W 12	BARRY
MCDONALD, VIRGIL	DAIRY CALVES, MILKING, FEEDING	NE SW 25N 25W 25	BARRY
WILLIAMSON POULTRY	POULTRY OR TURKEYS	NW NE 22N 27W 11	BARRY
BARNHART, PHIL	DAIRY CALVES, MILKING, FEEDING	NW SW 26N 22W 35	CHRISTIAN
H AND H DAIRY	DAIRY CALVES, MILKING, FEEDING	NE SW 26N 20W 6	CHRISTIAN
SCHUPBACH, JAMES	POULTRY OR TURKEYS	SW SW 27N 23W 34	CHRISTIAN
COX-DAVIS DAIRY FARM	DAIRY CALVES, MILKING, FEEDING	SE NE 28N 23W 30	GREENE
DAVIS BROS. DAIRY	DAIRY CALVES, MILKING, FEEDING	NW NW 28N 20W 3	GREENE
DAVIS BROS. DAIRY	DAIRY CALVES, MILKING, FEEDING	W SW 29N 20W 27	GREENE
JACOBSON, ALLEN	DAIRY CALVES, MILKING, FEEDING	SE SW 29N 21W 1	GREENE
METCALF, RAYMOND	DAIRY CALVES, MILKING, FEEDING	SW NE 25N 24W 8	GREENE
SYNTEX AGRIBUSINESS	DIOXIN, VOLATILE ORGANICS	NWSWNE29N 22W 27	GREENE
THOMPSON, ROBERT	DAIRY CALVES, MILKING, FEEDING	NW NE 29N 21W 11	GREENE
HORSE CREEK RANCH	POULTRY OR TURKEYS	S SW 25N 23W 27	STONE
STOCKSTILL, BILLY	DAIRY CALVES, MILKING, FEEDING	NW NE 25N 24W 27	STONE
ANDREATTA, FRANK	DAIRY CALVES, MILKING, FEEDING	NW SW 30N 18W 21	WEBSTER
ATKINSON, JOHN AND DAN	DAIRY CALVES, MILKING, FEEDING	NW SW 29N 19W 21	WEBSTER
RATLIFF, BOB	DAIRY CALVES, MILKING, FEEDING	SW NE 29N 17W 17	WEBSTER

Source: MDNR (1995a).

HABITAT CONDITIONS

AQUATIC COMMUNITY CLASSIFICATIONS

Pflieger (1989) includes the basin in the Ozark-White Division community. Streams in this classification are found in narrow, steep-sided valleys with high bluffs and are characterized by high gradient and relief (usually between 300 and 600 feet). Streams in this region are clear with a substrate of mostly gravel and rubble with some boulders and bedrock. Channels of these streams also have clear, well-defined riffles and pools. There are numerous springs in the area due to the karst topography. This makes some streams of the region ideal for cool or cold water fisheries.

CHANNEL ALTERATIONS

Channel alterations in the basin include modifications to urban stream courses, channelization associated with road and bridge construction, several small impoundments on streams such as Finley Creek, small channel modifications related to gravel removal and efforts by individual landowners to control streambank erosion and similar problems, and the impoundment of major portions of the original James River and some of its tributaries by Table Rock Dam and Lake Springfield Dam. Approximately 44 miles of the James River have been impounded. Instream gravel mining operations are typically small, few in number, and scattered. With the exception of channel alterations on small streams in the Springfield urban area, channelization in the basin is limited.

Streams flowing through urban portions of Springfield have been straightened, lined with materials such as concrete and riprap, cleared of riparian vegetation, and in some cases, re-routed through underground channels. Channel alterations of this kind are common on Jordan Creek, South Creek, and their tributaries.

Portions of Crane Creek on the Wire Road Conservation Area were channelized prior to MDC taking ownership. The channelized sections now appear relatively stable. Consideration had been given to re-routing streamflows into the original channel at one location. However, plans were dropped due to the potential for channel de-stabilization.

UNIQUE TERRESTRIAL HABITATS

The state's terrestrial natural resources have been classified into six major categories---Forest, Savanna, Prairie, Primary, Wetland, and Cave communities. These communities have been divided based on characteristic features such as topography, size, distribution, and characteristic plants (Nelson 1985).

The Missouri Department of Conservation's Natural Heritage Program has identified natural communities in three of these major types in the James River Basin; Forest, Primary and Wetland (Table 13).

The James River Basin contains both upland and bottomland forest. The upland forest habitats include Dry-Mesic Limestone/Dolomite, Mesic Limestone/Dolomite, and Dry Chert Forest. The bottomland forest habitat type is the Mesic Bottomland Forest (Nelson 1985).

The Primary category type found in the basin includes both Limestone and Dolomite Glade habitats, as

Table 13. Unique community types found in the James River Basin.

COMMUNITY TYPE	AREA NAME	LOCATION (T R S)	SIZE (AC)	OWNERSHIP
Dolomite Glade	Crane Hollow Glade	23N 23W 21	6.0	USFS-Cassville/Private
Dolomite Glade	Piney Creek Wilderness	23N 25W 24	8.0	USFS-Cassville
Dolomite Glade	Piney Creek Wilderness	23N 25W 22	11.0	USFS-Cassville
Dolomite Glade	Piney Creek Wilderness	23N 25W 23	17.5	USFS-Cassville
Dolomite Glade	South Ance Creek Glade	23N 23W 22	6.0	USFS-Cassville/Private
Dry Chert Forest	Justus Forest	25N 25W 30	40.0	Private
Dry Limestone/Dolomite Cliff	Oswalt Bluff	22N 24W 2		USCOE/Private
Dry Limestone/Dolomite Cliff	Virgin Bluff	23N 24W 15		USCOE/Private
Dry-Mesic Limestone/Dolomite Forest	Finley Creek Forest	28N 18W 30	13.0	Private
Dry-Mesic Limestone/Dolomite Forest	Moon Tract	29N 20W 23	16.0	Private
Limestone Glade	Hailey Bald	23N 26W 13		USFS-Cassville
Mesic Bottomland Forest	James River Bottomland Forest	29N 21W 1	13.0	Private
Mesic Limestone/Dolomite Forest	James River Forest	25N 23W 33	30.0	Private
Pond Shrub Swamp	Murphy Pond	27N 19W 24	10.0	Private

Source: Missouri Department of Conservation (1995b)

well as the Limestone/Dolomite Cliff habitat (Nelson 1985).

There is one Wetland community type identified, the Pond Shrub Swamp community (Nelson 1985).

IMPROVEMENT PROJECTS

As in most basins, there have been a variety of attempts by private landowners to stabilize streambanks. These attempts include channelization and bank armoring using a variety of materials including rock, gravel, and construction debris.

MDC personnel have installed seven improvement projects since 1989 (Table 14), three on MDC property, one on property owned by the City of Cassville, and three on private property.

STREAM HABITAT ASSESSMENT

Stream habitat assessments (SHAD) were completed at 105 sites between 1993 and 1995 by Fisheries District 9 staff (Table 15, Figures 5A-D). SHAD sites were selected in all four of the major sub-basins using the guidelines of Bovee (1982).

SHAD assessments are summarized in Table 16 and the written SHAD summaries by sub-basin and by stream are included in Appendix B. Data on streambank erosion and protection, stream corridor, corridor vegetation quality, land use, channel condition, instream cover, and streambed condition are summarized.

Stream habitat quality throughout most of the basin is fair to good. Portions of the Crane Creek sub-basin as well as a few other areas suffer from a severe lack of riparian vegetation. Problem areas observed include lack of adequate riparian corridors, nutrient loading, streambank erosion, and instream activities such as gravel mining. Increased urbanization and related runoff also impact stream habitat quality.

Table 14. Missouri Department of Conservation streambank restoration and habitat improvement projects in the James River Basin.

STREAM	COUNTY	PRACTICE	LOCATION (T R S)	OWNER	INSTALLATION DATE
Crane Creek *	Stone	Revetments	25N,24W,10	MDC	1994
Dry Crane Creek	Stone	Revetments	26N,23W,27	Private	1995
Flat Creek *	Barry	Revetment	24N,26W,15	MDC	1989
Flat Creek	Barry	Revetment	24N,25W,31	Private	1992
Flat Creek	Barry	Riprap	24N,26W,15	MDC	1995
Flat Creek	Barry	Riprap	23N,27W,28	Cassville	1997
James River	Greene	Revetment	29N,20W,28	Private	1991

*** Project failed. No repairs are planned. Unless otherwise noted, all projects are functioning as planned.**

Table 15. List of Stream Habitat Assessment Device (SHAD) sites completed in the James River Basin by the Missouri Department of Conservation.

STREAM	SITE	ORDER	LOCATION	STREAM MILE	TOPOGRAPHIC MAP	SURVEY DATE
James River	A1	5	T28N R21W S 2	60.54	Galloway	8-18-94
James River	A2	5	T29N R19W S 3	78.40	Strafford	7-12-95
James River	A3	5	T29N R20W S31	97.80	Galloway	8-18-94
James River	A4	5	T29N R18W S 6	115.20	Marshfield	10-15-93
James River	A5	4	T29N R18W S 4	117.80	Marshfield	8-18-94
James River	A6	4	T29N R17W S 7	122.90	Seymour	10-13-93
James River	A7	3	T29N R17W S22	127.00	Seymour	10-13-93
Dry Fork	A8	3	T29N R19W S28	0.90	Oak Grove Heights	12-10-93
Dry Creek	A9	4	T29N R18W S 6	0.30	Marshfield	10-15-93
Dry Creek	A10	3	T29N R18W S 4	3.00	Fordland	10-15-93
North Carolina Creek	A11	4	T29N R19W S 4	0.90	Oak Grove Heights	12-10-94
Panther Creek	A12	4	T29N R18W S21	2.80	Oak Grove Heights	12-10-93
Panther Creek	A13	3	T29N R18W S29	8.10	Fordland	10-15-93
Pearson Creek	A14	3	T29N R20W S26	0.60	Galloway	6- 6-94
Sawyer Creek	A17	3	T29N R20W S26	1.10	Oak Grove Heights	6- 6-94
Turnbo Creek	A15	4	T30N R19W S35	0.30	Marshfield	12-10-93
Turnbo Creek	A16	3	T30N R18W S20	5.00	Marshfield	12-10-93
James River	B1	6	T24N R23W S 6	7.75	Galena	7-18-95
James River	B2	6	T26N R22W S19	29.17	Hurley	7-18-95
James River	B3	6	T27N R22W S32	36.10	Nixa	7-18-95
James River	B4	6	T27N R23W S13	40.42	Brookline	7-19-95
James River	B5	5	T28N R22W S27	49.26	Nixa	7-14-95
Green Valley Creek	B15	4	T27N R23W S12	0.20	Brookline	1-11-94
Green Valley Creek	B16	3	T27N R23W S24	1.90	Brookline	1-11-94
Goff Creek	B7	4	T25N R23W S13	1.20	Hurley	7- 7-95
Silver Lake Branch	B12	3	T26N R23W S13	1.00	Hurley	8-16-94
Terrell Creek	B10	4	T28N R23W S35	0.90	Brookline	1-11-94
Terrell Creek	B11	3	T28N R23W S33	3.80	Brookline	1-11-94
Tory Creek	B13	4	T26N R22W S27	2.50	Highlandville	3- 4-94
Tory Creek	B14	3	T26N R22W S34	2.90	Highlandville	3- 4-94
West Prong Goff Creek	B6	3	T25N R22W S19	1.32	Galena	7- 7-95
Wilson Creek	B8	5	T28N R23W S36	0.90	Republic	1-11-94
Wilson Creek	B9	3	T28N R22W S18	5.30	Brookline	1-11-94
Crane Creek	C2	5	T25N R23W S16	2.00	Elsey	7-31-95
Crane Creek	C3	5	T25N R23W S 5	8.12	Hurley	6-30-95

Crane Creek	C4	5	T25N R24W S10	12.80	Crane	7- 7-94
Crane Creek	C5	4	T26N R25W S24	20.00	Aurora	7- 5-95
Crane Creek	C6	3	T26N R25W S23	20.35	Aurora	7- 5-95
Dry Crane Creek	C7	4	T25N R23W S 9	0.25	Hurley	6-30-95
Dry Crane Creek	C8	4	T26N R23W S33	2.90	Hurley	6-30-95
Dry Crane Creek	C9	4	T26N R23W S22	6.60	Hurley	3- 4-94
Dry Crane Creek	C10	3	T26N R23W S 4	9.50	Hurley	3- 4-94
Dry Creek	C17	4	T24N R24W S17	1.00	Elsey	7-25-95
Dry Creek	C18	3	T25N R24W S34	4.00	Elsey	7-31-95
Little Crane Creek	C11	4	T26N R25W S35	2.90	Aurora	7- 5-95
Little Crane Creek	C12	3	T25N R25W S 4	6.32	Aurora	7- 5-95
Mc Cullah Hollow	C15	4	T26N R23W S19	0.50	Crane	8-16-94
Mc Cullah Hollow	C16	4	T26N R24W S11	2.70	Crane	8-16-94
McCord Branch	C1	3	T26N R24W S34	3.11	Crane	7- 5-95
Spring Creek	C13	4	T26N R23W S31	1.10	Hurley	6-30-95
Spring Creek	C14	3	T26N R23W S18	4.00	Hurley	8-16-94
Davis Branch	F16	3	T28N R18W S15	1.30	Bruner	6-10-93
Elk Valley	F27	4	T26N R22W S33	1.80	Selmore	7- 2-93
Elk Valley	F28	4	T26N R21W S 3	3.30	Selmore	8-25-93
Elk Valley	F29	3	T26N R21W S 2	4.60	Selmore	8- 4-93
Finley Creek	F1	5	T26N R22W S10	2.80	Highlandville	10-28-93
Finley Creek	F2	5	T27N R22W S 1	4.80	Highlandville	10-28-93
Finley Creek	F15	5	T26N R22W S 1	4.95	Highlandville	7-19-95
Finley Creek	F3	5	T27N R21W S14	13.60	Ozark	10-28-93
Finley Creek	F14	5	T27N R21W S23	11.93	Ozark	7-19-95
Finley Creek	F4	5	T27N R20W S18	15.40	Ozark	8-25-93
Finley Creek	F5	5	T27N R20W S16	17.90	Ozark	6- 6-94
Finley Creek	F6	5	T27N R20W S14	23.40	Rogersville	8-25-93
Finley Creek	F7	4	T27N R19W S16	28.50	Rogersville	9- 2-93
Finley Creek	F8	4	T27N R19W S11	30.50	Bruner	8- 3-93
Finley Creek	F9	4	T27N R19W S 1	32.90	Bruner	8- 3-93
Finley Creek	F10	4	T28N R18W S29	37.90	Bruner	8-26-93
Finley Creek	F11	4	T28N R18W S23	41.70	Dogwood	8-26-93
Finley Creek	F12	3	T28N R17W S19	43.50	Dogwood	7- 1-93
Finley Creek	F13	3	T28N R17W S23	49.00	Dogwood	6-10-93
Hog Creek	F21	3	T26N R21W S 6	1.30	Highlandville	7- 2-93
Hog Creek	F22	3	T26N R21W S 8	3.10	Selmore	7- 2-93
Johnson Hollow	F20	3	T27N R20W S13	1.00	Rogersville	8- 4-93
Little Finley Creek	F30	3	T28N R18W S13	1.40	Dogwood	8-26-93
Martins Branch	F19	3	T27N R18W S31	0.30	Bruner	8- 3-93

Parched Corn Hollow	F23	4	T27N R20W S 7	0.70	Ozark	8- 4-93
Parched Corn Hollow	F24	3	T27N R20W S 5	3.50	Ozark	8- 4-93
Pedelo Creek	F25	4	T27N R19W S 6	2.40	Rogersville	7- 1-93
Pedelo Creek	F26	3	T28N R19W S32	3.80	Rogersville	8- 3-93
Stewart Creek	F18	3	T27N R19W S12	1.70	Bruner	8- 3-93
Terrell Branch	F17	3	T28N R18W S20	0.90	Bruner	7- 1-93
East Fork Jenkins Creek	D3	3	T25N R25W S28	1.50	Jenkins	7-25-95
Flat Creek	D7	6	T24N R24W S30	8.50	Elsey	7-25-95
Flat Creek	D8	6	T24N R25W S34	14.20	Elsey	7-12-95
Flat Creek	D9	6	T23N R25W S 6	20.60	Shell Knob	7-12-95
Flat Creek	D10	5	T24N R26W S24	26.30	Jenkins	7-14-95
Flat Creek	D11	5	T24N R26W S 9	30.64	Jenkins	7-14-95
Flat Creek	D12	5	T24N R26W S 6	35.20	McDowell	7-17-95
Flat Creek	D14	4	T23N R27W S 3	43.90	Cassville	6-16-94
Flat Creek	D15	3	T22N R28W S13	55.13	Seligman	7-17-95
Flat Creek	D13	3	T22N R28W S22	57.20	Seligman	7-17-95
Fortune Branch	D16	3	T23N R26W S10	1.80	Shell Knob	7-10-95
Gunter Creek	D17	3	T24N R27W S12	0.90	Jenkins	7-25-95
Gunter Creek	D18	3	T24N R27W S 9	3.50	Jenkins	7-17-95
Jenkins Creek	D1	4	T24N R26W S24	0.30	Jenkins	7-14-95
Jenkins Creek	D2	4	T24N R26W S 1	3.00	Jenkins	7-25-95
Little Flat Creek	D4	4	T24N R27W S 1	0.50	McDowell	7-17-95
Little Flat Creek	D5	4	T25N R27W S25	3.86	McDowell	7-17-95
Little Flat Creek	D6	3	T25N R27W S26	5.70	McDowell	7-17-95
North Railey Creek	D22	3	T24N R23W S11	0.90	Galena	7- 7-95
Railey Creek	D23	4	T24N R23W S 9	2.80	Galena	7- 7-95
Railey Creek	D24	3	T24N R23W S10	3.80	Galena	7- 7-95
Rockhouse Creek	D19	5	T23N R26W S12	2.70	Shell Knob	7-10-95
Rockhouse Creek	D20	4	T23N R26W S14	4.00	Shell Knob	7-10-95
Rockhouse Creek	D21	3	T23N R26W S22	4.48	Shell Knob	7-10-95

BIOTIC COMMUNITIES

AQUATIC COMMUNITY DATA

The White River region is the most diverse region in Missouri as far as number of fish species is concerned. Fifty-six species or subspecies have a localized distribution in this basin or have a limited distribution elsewhere in the state. A localized distribution is one in which organisms are found in great abundance in an area, but may also be found in limited or reduced abundance in other areas of their range. Species or subspecies which are restricted to the White River region include: the Ozark bass, duskystripe shiner, White River or Arkansas saddled darter, and the yoke darter. Each of these species has been collected in the James River Basin. Four races or subspecies in the basin are found elsewhere in the state, but have a morphological distinction in the White River region. These species are the longear sunfish, rainbow darter, fantail darter, and the orangethroat darter (Pflieger 1989).

This region also has several unique or limited-distribution crayfish species (Table 17; Pflieger 1987 and 1989). Several amphibians and reptiles which have a localized distribution in the James River Basin are listed in Table 18.

The mussels in the James River Basin were sampled by Oesch in 1967-1974 and Buchanan in 1982. The objectives of Buchanan's study were to determine the presence of the Curtis Pearly Mussel (*Epioblasma florentina curtisi*) and the distribution and abundance of the basin's other naiad species. Buchanan found 24 species, but no Curtis Pearly Mussels. He also found that sewage effluent from the Springfield area had an impact on the naiad fauna in 20 miles of the James River downstream from the mouth of Wilson Creek. The naiad fauna has yet to recover. Information on abundance, composition, and species profiles can be found in Buchanan (1982). The mussels found in the James River Basin are listed in Table 19.

FISH COMMUNITY DATA

Fish collections have been made throughout the basin since the early 1930s (Table 20). There are 71 fish species which have been collected since that time (Table 21). In 1995, fish were collected by Fisheries District 9 staff from William Pflieger's historic collection sites, as well as additional sites located throughout the basin (Table 22, Figures 6A-D). Fish species distributions by stream are listed in Table 23. In addition to the collections by Department staff, fish have also been sampled from the James River at Highway 125 Bridge and the Old Bridge at Highway D east of Springfield in 1994 and 1995 by Dan Beckman, Ph.D., at Southwest Missouri State University (Table 24).

Several species were collected historically by Pflieger, but have been absent from the recent collections made by Beckman and District 9 staff. These species are:

Highfin carpsucker (*Carpiodes velifer*)

Quillback (*Carpiodes cyprinus*)

Black bullhead (*Ameirus melas*)

Yellow bullhead (*Ameirus natalis*)

Table 17. Crayfish species found in the James River Basin.

COMMON NAME	SPECIES NAME
Ozark Crayfish	*Orconectes ozarkae*
(No common name given)	*Cambarus maculatus*
Bristley Cave Crayfish	*Cambarus setosus*
Ringed Crayfish	*Orconectes neglectus*
Longpincered Crayfish	*Orconectes longidigitus*
Williams' Crayfish or White River Midget Crayfish	*Orconectes williamsi*
(No common name given)	*Orconectes menae*
(No common name given)	*Orconectes naias*
Woodland Crayfish	*Orconectes hylas*
Spothanded Crayfish	*Orconectes punctimanus*
Golden Crayfish	*Orconectes luteus* **
Coldwater Crayfish	*Orconectes eupunctus*
Mammoth Spring Crayfish	*Orconectes marchandi* **
Dwarf Crayfish	*Cambarellus pueur* **
Meek's Crayfish	*Orconectes meekii*
Hubb's Crayfish	*Cambaras hubbsi*

Source: Pflieger (1987 and 1989) and the Missouri Benthic Database, available through MDC.

****Unconfirmed locations due to possible misidentification.**

Redear sunfish (*Lepomis microlophus*)

White bass (*Morone chrysops*)

Freshwater drum (*Aplodinotus grunniens*)

Wedgespot shiner (*Notropis greenei*)

Ozark shiner (*Notropis ozarcanus*)

Fathead minnow (*Pimephales promelas*)

Golden shiner (*Notemigonus crysoleucas*)

Creek chubsucker (*Erimyzon oblongus*)

Bigeye chub (*Hybopsis dissimilis*)

White River saddled darter (*Etheostoma e. euzonum*)

Fantail darter (*Etheostoma flabellare*)

Speckled darter (*Etheostoma stigmaeum*)

Gilt darter (*Percina evides*)

Mottled sculpin (*Cottus bairdi*)

Checkered madtom (*Noturus flavater*)

Ozark cavefish (*Amblyopsis rosae*)

Inadequate sampling methods or effort could explain the absence of all of these species from the collections of Beckman and Fisheries District 9 staff. Inadequate sampling methods are probably the best explanation for the absence of the highfin carpsucker, quillback, bullheads, white bass, and freshwater drum. These species are large fish, and most of the sampling was conducted with seines. Net avoidance and the inability of the researchers to sample the deeper preferred habitats of these species could lead to their absence in recent collections. Samples were collected in August and September. Therefore, white bass is probably absent from recent collections because it usually occurs in streams only during the spring spawning run. The golden shiner and creek chubsucker may also be missing from collections for no other reason than inadequate sampling effort.

In some instances, however, there could be other reasons for the absence of a particular species. For instance, the redear sunfish has not been collected from streams in the basin since the early 1970s. This species occupies some of the same stream habitats as other sunfish species represented in the collections. It is unlikely that sampling bias is the reason for the absence of this species in recent collections.

The wedgespot shiner lives in close association with the rosyface, telescope, and striped shiners which were all collected in abundance. The absence of wedgespot shiners is not likely due to sampling inadequacies. The checkered madtom is another example of this type of association. This species is

Table 18. Amphibians and reptiles with localized distributions in the James River Basin.

COMMON NAME	SPECIES NAME
Ringed Salamander	*Ambystoma annulatum*
Spotted Salamander	*Ambystoma maculatum*
Graybelly Salamander	*Eurycea multiplicata griseogaster*
Oklahoma Salamander	*Eurycea tynerensis*
Ozark Zigzag Salamander	*Plethodon dorsalis angusticlavius*
Wood Frog	*Rana sylvatica*
Ground Snake	*Sonora semiannulata*
Western Pygmy Rattlesnake	*Sistrurus miliarius streckeri*

Source: Johnson (1987).

commonly found with the Ozark madtom which was collected in the basin.

The Ozark shiner and gilt darter have not been collected in the basin since before 1946. These species have very localized distributions in the Ozarks and may no longer occur in the basin. The fantail and White River (or Arkansas) saddled darters also have localized distributions in the basin and have not been collected since the early 1970s. This suggests that they no longer occur in the basin. The bigeye chub may also be extirpated from the basin.

Fathead minnows are most common in prairie region streams. When they are found in Ozark streams, it is probably the result of bait or hatchery releases. This could be the explanation for the absence of this species from the collections made by Beckman and Fisheries District 9 staff.

Threadfin shad (*Dorosoma petenense*), which had not appeared in historic collections, were collected by Fisheries District 9 staff on Flat Creek at the junction of Table Rock Lake. This species was introduced to Table Rock Lake.

One of the fish species collected historically is now on the Rare and Endangered Species Checklist of Missouri (MDC 1995b), the Ozark cavefish (*Amblyopsis rosae*). This species was not collected by Fisheries District 9 staff in 1995. There are three active Ozark cavefish sites in the basin.

Black bass populations were sampled by electrofishing in the James River in 1994 and 1995. Data for largemouth bass, spotted bass, smallmouth bass, Ozark bass, and longear sunfish are available at the Fisheries District 9 office in Springfield.

RARE, THREATENED, AND ENDANGERED SPECIES

The James River Basin is part of a region with a very diverse aquatic and terrestrial flora and fauna. This unique assemblage includes several state and federally listed threatened and endangered species. The federally listed endangered species occurring in the basin are the Missouri bladder-pod (*Lesquerella filiformis*), the Ozark big-eared bat (*Corynorhinus townsendii*), the Indiana bat (*Myotis sodalis*), and the gray bat (*Myotis grisescens*). The Ozark cavefish (*Amblyopsis rosae*) is federally listed as threatened.

The state listed endangered species (four of which are also classified federally) occurring in the James River Basin are Swainson's hawk (*Buteo swainsoni*), black-tailed jackrabbit (*Lepus californicus*), parsley haw (*Crataegus marshallii*), tansey mustard (*Descurainia pinnata pinnata*), a liprocarpha (*Liprocarpha durmmondii*), Ozark cavefish, Missouri bladder-pod, Indiana bat, and the gray bat. The federally endangered Ozark big-eared bat is thought to be extirpated in the basin. Indian physic (*Gillenia trifoliata*) is also believed to be extirpated in the basin.

Species in the basin that are listed by the state as rare or threatened are:

An Isopod (no common name) (*Caecidotea dimorpha*)

White River midget crayfish (*Orconectes williamsi*)

Marine vine (*Cissus incisa*)

Low prickly pear (*Opuntia macrorhiza*)

Stenosiphon (*Stenosiphon linifolius*)

Ozark wake robin (*Trillium pusillum var ozarkanum*)

Ozark corn salad (*Valerianella ozarkana*)

Texas horned lizard (*Phynosoma cornutum*)

Ozark spiderwort (*Tradescantia ozarkana*)

Highfin carpsucker (*Carpiodes velifer*)

There are also several species in the basin which are included on the state watch list. These are:

Grotto salamander (*Typhlotriton spelaeus*)

Bristly cave crayfish (*Cambarus setosus*)

Ozark cave amphiod (*Stygobromus ozarkensis*)

Ostrich fern (*Matteuccia struthiopteris var pensylvanca*)

Purple false foxglove (*Agalinis purpurea*)

Broadwing sedge (*Carex alata*)

Yellow wood (*Cladrastis kentukea*)

Wood stonecrop (*Sedum ternatum*)

Royal catchfly (*Silene regia*)

Purple lilliput (*Toxolasma lividus*)

Eastern collared lizard (*Crotaphytus collaris*)

Northern river otter (*Lutra canadensis*)

False foxglove (*Agalinis skinneriana*)

Whitlow grass (*Draba aprica*)

Soapberry (*Sapindus drummondii*)

Ringed salamander (*Ambystoma annulatum*)

Checkered madtom (*Noturus flavater*)

Net spinning caddisfly (*Hydropsyche piatrix*)

ANGLER SURVEY DATA

Angler survey data have been collected on Table Rock Lake, at the foot of the basin. Summaries of these data can be found in various annual reports in the Southwest Regional Office in Springfield.

FISH INTRODUCTIONS

Documented stocking records are limited. The earliest releases of trout and salmon were probably around

Table 19. Mussel species found in the James River Basin.

COMMON NAME	SPECIES NAME
Paper Floater	*Anodonta imbecilis*
Giant Floater	*Anodonta grandis grandis*
Squaw Foot	*Strophitus undulatus undulatus*
Elk Toe	*Alasmidonta marginata*
Slipper Shell	*Alasmidonta viridis*
Fluted Shell	*Lasmigona costata*
Pistol-Grip	*Tritogonia verrucosa*
Three-Ridge	*Amblema plicata*
Wabash Pig-Toe	*Fusconaia flava*
Ozark Shell	*Fusconaia ozarkensis*
Purple Pimpleback	*Cyclonaias tuberculata*
Round Pig-Toe	*Pleurobema sintoxia*
Lady-Finger	*Elliptio dilatata*
Kidney Shell	*Ptychobranchus occidentalis*
Mucket	*Actinonaias ligamentina caunata*
Western Fan-Shell	*Cyprogenia aberti*
Ellipse	*Venustaconcha e. ellipsiformis*
Plea's Mussel	*Venustaconcha e. pleasi*
Fragile Paper Shell	*Leptodea fragilis*
Liliput Shell	*Toxolasma parvus*
Little Purple	*Toxolasma lividus glans*
Pond Mussel	*Ligumia subrostrata*
Rainbow Shell	*Villosa iris iris*
Little Spectacle Case	*Villosa lienosa lienosa*
Pink Mucket	*Lampsilis orbiculata*

Fat Mucket	***Lampsilis radiata luteola***
Neosho Mucket	***Lampsilis rafinesqueana***
Pocketbook	***Lampsilis ventricosa***
Broken Rays	***Lampsilis reeviana brevicula***
Pimple-Back	***Quadrula pustulosa pustulosa***
Purple Shell	***Potamilus purpuratus***
Asiatic Clam	***Corbicula fluminea***

Source: Oesch (1984) and Buchanan (1982).

Table 20. Historic fish collection summary for the James River Basin by location, date, and method of capture.

Sample Type--
- **Kick---Kickseining**
- **Drag---Drag seining**
- **Elec---Electroshocking**
- **Trap---Trapnetting**
- **Tox----Toxicant**

Number of Species--
- **L---Large fish species**
- **N---Nektonic fish species**
- **B---Benthic fish species**
- **T---Total fish species**
- **H---Hybrid fish species**

LOCATION NUMBER	STREAM NAME	MILE	LOCATION (T R S)	DATE	SAMPLE TYPE K D E T I R L T R C A E O A K G C X P	NUMBER OF SPECIES L N B T H
1614A	JAMES RIVER S6	128	29N 18W 2	21 AUG 40	? X	6 14 7 27 0
1614B	JAMES RIVER S6	128	29N 18W 2	02 MAY 63	X X	8 15 10 33 0
1614C	JAMES RIVER S6	128	29N 18W 2	16 SEP 92	X X	3 10 7 20 0
1615A	JAMES RIVER S5	108	29N 20W 21	01 AUG 40	X X	2 14 6 22 0
1616A	JAMES RIVER S5	106	29N 20W 30	42 TO 46	? X	6 11 3 20 0
1616B	JAMES RIVER S5	106	29N 20W 30	46 TO 57	X X X	16 17 11 44 1
				11 MAY 63	X X	
1616C	JAMES RIVER S5	106	29N 20W 30	16 SEP 92	X X	4 9 8 21 0
1617A	PEARSON CREEK	1	29N 21W 26	31 JUL 40	? X	1 8 5 14 0
1618A	JAMES RIVER S4	86	28N 22W 26	09 JUL 42	? X	3 8 4 15 0
1618C	JAMES RIVER S4	86	28N 22W 26	17 SEP 92	X X	5 12 6 23 0
1619A	FINLEY CREEK S2	28	27N 19W 16	01 AUG 40	? X	6 11 7 24 0
1620A	FINLEY CREEK S1	20	27N 20W 14	14 JUL 42	? X	5 8 5 18 0
1620C	FINLEY CREEK S1	20	27N 20W 14	18 SEP 92	X X	3 10 7 20 0
1621A	FINLEY CREEK S1	11	27N 21W 22	01 AUG 40	X X	9 11 3 23 0
1622A	FINLEY CREEK S1	6	27N 22W 36	17 JUL 42	? X	4 6 5 15 1
1622B	FINLEY CREEK S1	6	27N 22W 36	16 JUN 64	X X	10 11 5 26 1
1622C	FINLEY CREEK S1	6	27N 22W 36	17 SEP 92	X X	4 13 7 24 0
1623A	CRANE CREEK	2	25N 23W 16	13 JUL 42	? X	4 8 3 15 0
1623C	CRANE CREEK	2	25N 23W 16	17 SEP 92	X X	3 10 4 17 0
1629A	UNNAMED SPRING	1	25N 23W 29	06 AUG 40	? X	0 5 3 8 0

1630A	JAMES RIVER S2	42	24N 23W 6	06 AUG 40	? X	7 12 7 26 0
				10 JUL 42	X X	
1630B	JAMES RIVER S2	42	24N 23W 6	17 JUN 64	X X	11 11 7 29 0
				21 JUL 64	X X	
1630C	JAMES RIVER S2	42	24N 23W 4	17 SEP 92	X X	8 12 2 22 0
1631B	UNNAMED	1	29N 17W 17	16 JUN 64	X X	0 4 4 8 0
1632B	JAMES RIVER S6	119	29N 19W 3	01 MAY 63	X X	3 13 9 25 0
1632C	JAMES RIVER S6	119	29N 19W 3	16 SEP 92	X X	4 12 8 24 0
1633B	JAMES RIVER S4	95	28N 21W 2	02 MAY 63	X X	1 10 8 19 0
1634A	JAMES RIVER S4	92	28N 21W 21	22 AUG 30	? X	3 11 7 21 0
1635B	JAMES RIVER S4	81	28N 22W 32	20 JUL 64	X X	8 7 6 21 0
1636B	JAMES RIVER S4	79	27N 22W 5	26 JUL 66	X X X	14 9 7 30 0
1637B	JAMES RIVER S4	78	27N 22W 6	17 JUN 64	X	11 11 4 26 0
1638B	JAMES RIVER S4	75	27N 23W 18	25 JUL 66	X X	11 5 0 16 0
1639B	FINLEY CREEK S2	33	27N 19W 1	16 JUN 64	X X	4 11 6 21 0
1640B	FINLEY CREEK S1	5	26N 22W 1	20 JUL 64	X X	8 13 7 28 1
1641B	JAMES RIVER S3	67	26N 22W 8	16 JUN 64	X X	10 12 7 29 0
				21 JUL 64	X X	
1642B	SILVER LAKE BRANCH	1	26N 22W 19	21 JUL 64	X X	0 4 5 9 0
1643B	JAMES RIVER S3	63	26N 22W 19	27 JUL 66	X X X	23 15 9 47 1
				52 TO 57	X X X	
1644B	CRANE CREEK	15	26N 24W 4	05 JUL 62	X X	2 7 4 13 1
				07 MAY 60	X X	
1645B	FLAT CREEK S2	44	23N 27W 9	9 SEP 64	X X	6 9 3 18 0
1749A	FLAT CREEK S1	34	24N 26W 6	08 AUG 40	? X	6 12 7 25 0
1749B	FLAT CREEK S1	34	24N 26W 6	09 SEP 64	X X	4 11 4 19 0
1749C	FLAT CREEK S1	34	24N 26W 6	30 SEP 92	X X	5 11 7 23 1
1750A	FLAT CREEK S1	20	25N 25W 6	06 AUG 40	? X	4 14 6 24 0
1750C	FLAT CREEK S1	20	25N 25W 6	30 SEP 92	X X	6 8 6 20 1
1751A	FLAT CREEK S1	14	24N 25W 34	13 JUL 42	? X	3 7 6 16 0
1751B	FLAT CREEK S1	14	24N 25W 34	10 SEP 64	X X	4 12 7 23 1
1751C	FLAT CREEK S1	14	24N 25W 34	30 SEP 92	X X	5 7 8 20 0
1752A	FLAT CREEK S1	2	24N 24W 27	06 AUG 40	? X	4 15 7 26 0

1753B	JAMES RIVER S1	21	24N 23W 16	52 TO 56	X X X	24 15 9 48 0
1843C	CRANE CREEK	18	26N 24W 30	21 APR 79	X X	6 5 4 15 0

Source: MDC Fish Collection Database Records and Summary dated 1991.

Sample Type--

Kick---Kickseining
Drag---Drag seining
Elec---Electroshocking
Trap---Trapnetting
Tox----Toxicant

Number of Species--

L---Large fish species
N---Nektonic fish species
B---Benthic fish species
T---Total fish species
H---Hybrid fish species

Table 21. Fish species list for the James River Basin.

Source: MDC Fish Collection Database Records and Summary dated 1991 and 1995 collections by Fisheries District 9 staff.

Status:

A---Collected before 1946

B---Collected between 1947 and 1973

C---Collected from 1974 to 1990

D---Collected in 1995 by Fisheries District 9

COMMON NAME	SCIENTIFIC NAME	STATUS
Longnose gar	*Lepisosteus osseus*	A, B, D
Threadfin shad	*Dorosoma petenense*	D
Gizzard shad	*Dorosoma cepedianum*	B, C, D
Rainbow trout	*Oncorhynchus mykiss*	B, C, D
Common carp	*Cyprinus carpio*	B D
Highfin carpsucker	*Carpiodes velifer*	B
Quillback	*Carpiodes cyprinus*	B
White sucker	*Catostomus commersoni*	A, B, C, D
Northern hog sucker	*Hypentelium nigricans*	A, B, C, D
River redhorse	*Moxostoma carinatum*	B D
Black redhorse	*Moxostoma duquesnei*	A, B, C, D
Golden redhorse	*Moxostoma erythrurum*	A, B, C, D
Black bullhead	*Ictalurus melas*	A, B, C
Yellow bullhead	*Ictalurus natalis*	A, B, C
Channel catfish	*Ictalurus punctatus*	B D
Flathead catfish	*Pylodictis olivaris*	B D
Ozark bass	*Ambloplites constellatus*	A, B, C, D
Green sunfish	*Lepomis cyanellus*	A, B, C, D
Bluegill	*Lepomis macrochirus*	A, B, C, D
Longear sunfish	*Lepomis megalotis*	A, B, C, D
Redear sunfish	*Lepomis microlophus*	B

Smallmouth bass	***Micropterus dolomieui***	**A, B, C, D**
Spotted bass	***Micropterus punctulatus***	**B, C, D**
Largemouth bass	***Micropterus salmoides***	**A, B, C, D**
White crappie	***Pomoxis annularis***	**A, B D**
Black crappie	***Pomoxis nigromaculatus***	**B D**
White bass	***Morone chrysops***	**B**
Freshwater drum	***Aplodinotus grunniens***	**B**
Central stoneroller	***Campostoma anomalum***	**A, B, C, D**
Largescale stoneroller	***Campostoma oligolepis***	**A, B, C, D**
Hornyhead chub	***Nocomis biguttatus***	**A, B, C, D**
Bigeye shiner	***Notropis boops***	**A, B, C, D**
Striped shiner	***Notropis chrysocephalus***	**A, B, C, D**
Whitetail shiner	***Notropis galacturus***	**A, B, C, D**
Wedgespot shiner	***Notropis greenei***	**A, B**
Ozark minnow	***Notropis nubilus***	**A, B, C, D**
Duskystripe shiner	***Notropis pilsbryi***	**A, B, C, D**
Rosyface shiner	***Notropis rubellus***	**A, B, C, D**
Telescope shiner	***Notropis telescopus***	**A, B, C, D**
Ozark shiner	***Notropis ozarcanus***	**A**
Bluntnose minnow	***Pimephales notatus***	**A, B, C, D**
Fathead minnow	***Pimephales promelas***	**B**
Southern redbelly dace	***Phoxinus erythrogaster***	**A, B, C, D**
Golden shiner	***Notemigonus crysoleucas***	**B, C**
Creek chubsucker	***Erimyzon oblongus***	**A, B, C**
Creek chub	***Semotilus atromaculatus***	**A, B, C, D**
Streamline chub	***Hybopsis dissimilis***	**A, B D**
Bigeye chub	***Hybopsis amblops***	**A, B**
Grass pickerel	***Esox americanus***	**A, B, C, D**
Northern studfish	***Fundulus catenatus***	**A, B, C, D**

Blackspotted topminnow	*Fundulus olivaceus*	A, B, C, D
Mosquitofish	*Gambusia affinis*	C, D
Brook silverside	*Labidesthes sicculus*	A, B, C, D
Rainbow darter	*Etheostoma caeruleum*	A, B, C, D
White River saddled darter	*Etheostoma e. euzonum*	B
Yoke darter	*Etheostoma juliae*	A, B, C, D
Orangethroat darter	*Etheostoma spectabile*	A, B, C, D
Banded darter	*Etheostoma zonale*	A, B, C, D
Greensided darter	*Etheostoma blennioides*	A, B, C, D
Stippled darter	*Etheostoma punctulatum*	A, B, C, D
Golden fantail darter	*Etheostoma flabellare*	B
Speckled darter	*Etheostoma stigmaeum*	A, B, C
Gilt darter	*Percina evides*	A
Ohio logperch	*Percina c. caprodes*	A, B, C, D
Banded sculpin	*Cottus carolinae*	A, B, C, D
Ozark sculpin	*Cottus hypselurus*	A, B, C, D
Mottled sculpin	*Cottus bairdi*	B
Slender madtom	*Noturus exilis*	A, B, C, D
Ozark madtom	*Noturus albater*	A, B, C, D
Checkered madtom	*Noturus flavater*	A, B
Ozark cavefish	*Amblyopsis rosae*	B

Source: MDC Fish Collection Database Records and Summary dated 1991 and 1995 collections by Fisheries District 9 staff.
Status:
A---Collected before 1946
B---Collected between 1947 and 1973
C---Collected from 1974 to 1990
D---Collected in 1995 by Fisheries District 9

Table 22. Fish collection summary for the James River Basin by location and method of capture for 1995 Fisheries District 9 sampling.

Sample Type--
- **Kick---Kickseining**
- **Drag---Drag seining**
- **Elec---Electroshocking**
- **Trap---Trapnetting**
- **Tox----Toxicant**

Number of Species--
- **L---Large fish species**
- **N---Nektonic fish species**
- **B---Benthic fish species**
- **T---Total fish species**
- **H---Hybrid fish species**

LOCATION NUMBER	STREAM NAME	LOCATION (T R S)	DATE	SAMPLE TYPE							NUMBER OF SPECIES			
				K I X	D R	E L K	T R G	T O C	C	A P	E	A	L	N	B	T
	Wild Cat Creek	29N 17W 17	7-26-95	X	X								2	10	5	17
1614F	James River	29N 18W 2	7-26-95	X	X								4	9	5	18
	Jenkins Creek	24N 26W 24	8-1-95	X	X								4	10	4	18
1751F	Flat Creek	24N 25W 34	8-1-95	X	X								4	7	6	17
1645F	Flat Creek	23N 27W 9	8-7-95	X	X								4	7	2	13
1843C	Crane Creek	26N 24W 30	8-7-95	X	X								3	2	2	7
	Finley Creek	28N 17W 20	8-9-95	X	X								0	4	4	8
	Little Finley Creek	28N 18W 13	8-9-95	X	X								4	8	2	14
1749F	Flat Creek	24N 26W 6	8-10-95	X	X								5	11	5	21
1750F	Flat Creek	23N 25W 6	8-10-95	X	X								7	10	6	23
1642F	Silver Lake Branch	26N 23W 13	8-14-95	X	X								1	3	2	6
1644F	Crane Creek	25N 24W 4	8-14-95	X	X								2	2	1	5
	Spring Creek	26N 23W 19	8-14-95	X	X								1	1	3	5
1639B(move)*	Finley Creek	27N 19W 11	8-15-95	X	X								3	9	4	16
1619F	Finley Creek	27N 19W 16	8-15-95	X	X								7	10	5	22
1631F	James River Unnamed	29N 17W 17	8-16-95	X	X								2	8	3	13
1632F	James River	29N 19W 3	8-16-95	X	X								6	9	2	17
	Finley Creek	28N 18W 8	8-16-95	X	X								2	11	5	18
1615F	James River	29N 20W 21	8-17-95	X	X								5	8	6	19
1617A(move)*	Pearson Creek	29N 21W 35	8-17-95	X	X								2	6	3	11
1636B-1637B	James River	27N 22W 5/6	8-17-95	X	X								4	9	3	16
1641B	James River	26N 22W 8	8-30-95	X	X								3	9	7	19
1643F	James River	26N 22W 19	8-31-95	X	X								4	6	6	16
	Finley Creek	26N 22W 8	8-31-95	X	X								4	6	3	13
1641F	James River	26N 22W 8	8-31-95	X	X								2	3	2	7
	Wilson Creek	28N 23W 36	11-15-95	X	X											

1621F	Finley Creek	27N 21W 22	11-15-95	X	X		0	8	6	14
1618F	James River	28N 22W 36	8-24-95	X	X		3	7	5	15
1638F	James River	27N 22W 18	8-24-95	X	X		2	6	5	13
1752A	Flat Creek	24N 24W 27	9-6-95			X	14	1		15
1630A,B	James River	24N 23W 6	9-14-95			X	15	3	1	19
	James River	25N 23W 34	9-14-95			X	11	1	3	15
1640F	Finley Creek	26N 22W 1	8-24-95	X	X		6	8	7	21

***(move)= The sample site was moved one section downstream due to access constraints.**

Sample Type--
Kick---Kickseining
Drag---Drag seining
Elec---Electroshocking
Trap---Trapnetting
Tox----Toxicant

Number of Species--
L---Large fish species
N---Nektonic fish species
B---Benthic fish species
T---Total fish species
H---Hybrid fish species

Table 23. Fish species list by stream in the James River Basin.

Species	James River	Finley Creek	Flat Creek	Crane Creek	Spring Creek	Wilson Creek	Little Finley Creek	Pearson Creek	Wild Cat Creek	Jenkin's Creek	Silver Lake Branch
Lepisosteus osseus	X	-	X	-	-	-	-	-	-	-	-
Dorosoma petenense	-	-	X	-	-	-	-	-	-	-	-
Dorosoma cepedianum	X	X	X	-	-	-	-	X	-	-	-
Oncorhynchus mykiss	X	-	-	X	X	-	-	-	-	-	-
Cyprinus carpio	X	-	X	-	-	-	-	-	-	-	-
Carpiodes velifer	X	-	-	-	-	-	-	-	-	-	-
Carpiodes cyprinus	X	-	-	-	-	-	-	-	-	-	-
Catostomus commersoni	X	-	X	X	-	-	-	-	-	-	-
Hypentelium nigricans	X	X	X	-	-	-	X	-	-	X	-
Moxostoma carinatum	X	-	-	-	-	-	-	-	-	-	-
Moxostoma duquesnei	X	X	X	-	-	-	-	-	-	X	-
Moxostoma erythrurum	X	X	X	-	-	-	-	-	-	-	-
Ictalurus melas	X	X	-	X	-	-	-	-	-	-	-
Ictalurus natalis	X	X	X	X	-	-	-	-	-	-	-

Ictalurus punctatus	X	-	X	-	-	-	-	-	-	-	-
Pylodictis olivaris	X	-	-	-	-	-	-	-	-	-	-
Ambloplites constellatus	X	X	X	X	-	-	-	-	-	-	-
Lepomis cyanellus	X	X	X	X	-	-	-	-	-	-	-
Lepomis macrochirus	X	X	X	X	-	-	X	-	X	-	X
Lepomis megalotis	X	X	X	X	-	-	-	X	-	-	-
Lepomis microlophus	-	-	-	-	-	-	-	-	-	-	-
Micropterus dolomieui	X	X	X	-	-	-	-	-	-	X	-
Micropterus punctulatus	X	X	X	-	-	-	-	X	X	-	-
Micropterus salmoides	X	X	X	-	-	-	-	-	-	-	-
Species											
Pomoxis annularis	X	X	X	-	-	-	-	-	-	-	-
Pomoxis nigromaculatus	X	-	-	-	-	-	-	-	-	-	-
Morone chrysops	-	-	-	-	-	-	-	-	-	-	-
Aplodinotus grunniens	X	-	-	-	-	-	-	-	-	-	-

Campostoma anomalum	X	X	X	X	-	-	X	X	X	X	-
Campostoma oligolepis	X	X	X	-	-	-	-	-	-	-	X
Nocomis biguttatus	X	X	X	X	-	-	X	X	X	X	-
Notropis boops	X	-	-	-	-	-	X	-	-	-	-
Notropis chrysocephalus	X	X	X	X	-	-	-	X	X	X	-
Notropis galacturus	X	X	X	-	-	-	-	-	-	-	-
Notropis greenei	X	-	X	-	-	-	-	-	-	-	-
Notropis nubilus	X	X	X	-	-	-	X	X	X	X	-
Notropis pilsbryi	X	X	X	X	-	-	X	X	X	X	X
Notropis rubellus	X	X	X	X	-	-	X	X	-	X	-
Notropis telescopus	X	X	X	X	-	-	-	-	-	X	-
Notropis ozarcanus	-	-	X	-	-	-	-	-	-	-	-
Pimephales notatus	X	X	X	-	-	-	-	X	X	-	-
Pimephales promelas	X	-	-	-	-	-	-	-	-	-	-
Phoxinus erythrogaster	X	X	X	X	X	-	X	X	X	X	X
Notemigonus crysoleucas	-	-	-	X	-	-	-	-	-	-	-
Erimyzon oblongus	X	X	X	X	-	-	-	-	-	-	-

Semotilus atromaculatus	X	-	X	-	-	-	-	-	X	X	X
Hybopsis dissimilis	X	X	X	-	-	-	-	-	-	-	-
Species											**Silver Lake Branch**
Hybopsis amblops	X	-	X	-	-	-	-	-	-	-	-
Esox americanus	X	X	X	X	-	-	-	-	-	-	-
Fundulus catenatus	X	X	X	X	-	-	-	X	-	X	-
Fundulus olivaceus	X	X	X	X	-	-	-	X	-	X	-
Gambusia affinis	X	X	-	-	-	-	-	-	-	-	-
Labidesthes sicculus	X	X	X	-	-	-	-	-	-	-	-
Etheostoma caeruleum	X	X	X	X	-	-	X	X	X	X	X
Etheostoma e. euzonum	X	-	-	-	-	-	-	-	-	-	-
Etheostoma juliae	X	X	X	-	-	-	-	-	-	-	-
Etheostoma spectabile	X	X	X	X	X	-	X	X	X	X	X
Etheostoma zonale	X	X	X	-	-	-	-	-	-	-	-
Etheostoma blennioides	X	X	X	X	-	-	-	-	-	-	-
Etheostoma punctulatum	X	X	-	-	-	-	-	X	X	-	X
Etheostoma flabellare	X	X	-	-	-	-	-	-	X	X	-
Etheostoma stigmaeum	X	-	-	-	-	-	-	-	-	-	-

Percina evides	X	-	-	-	-	-	-	-	-	-	-
Percina c. caprodes	X	X	X	-	-	-	-	-	-	-	-
Cottus carolinae	X	X	X	X	X	-	-	X	X	X	X
Cottus hypselurus	X	X	X	X	X	-	-	X	-	-	X
Cottus bairdi	-	-	-	-	-	-	-	-	-	-	-
Noturus exilis	X	X	X	-	-	-	-	-	X	-	-
Noturus albater	X	X	X	-	-	-	-	-	-	-	-
Noturus flavater	X	X	X	X	-	-	-	-	-	-	-
Amblyopsis rosae	-	-	-	-	-	-	-	-	-	-	-

Table 23. Fish species list by stream in the James River Basin.

Species	James River	Finley Creek	Flat Creek	Crane Creek	Spring Creek	Wilson Creek	Little Finley Creek	Pearson Creek	Wild Cat Creek	Jenkin's Creek	Silver Lake Branch
Lepisosteus osseus	X	-	X	-	-	-	-	-	-	-	-
Dorosoma petenense	-	-	X	-	-	-	-	-	-	-	-
Dorosoma cepedianum	X	X	X	-	-	-	-	X	-	-	-
Oncorhynchus mykiss	X	-	-	X	X	-	-	-	-	-	-
Cyprinus carpio	X	-	X	-	-	-	-	-	-	-	-
Carpiodes velifer	X	-	-	-	-	-	-	-	-	-	-
Carpiodes cyprinus	X	-	-	-	-	-	-	-	-	-	-
Catostomus commersoni	X	-	X	X	-	-	-	-	-	-	-
Hypentelium nigricans	X	X	X	-	-	-	X	-	-	X	-
Moxostoma carinatum	X	-	-	-	-	-	-	-	-	-	-
Moxostoma duquesnei	X	X	X	-	-	-	-	-	-	X	-
Moxostoma erythrurum	X	X	X	-	-	-	-	-	-	-	-
Ictalurus melas	X	X	-	X	-	-	-	-	-	-	-
Ictalurus natalis	X	X	X	X	-	-	-	-	-	-	-

Ictalurus punctatus	X	-	X	-	-	-	-	-	-	-	-
Pylodictis olivaris	X	-	-	-	-	-	-	-	-	-	-
Ambloplites constellatus	X	X	X	X	-	-	-	-	-	-	-
Lepomis cyanellus	X	X	X	X	-	-	-	-	-	-	-
Lepomis macrochirus	X	X	X	X	-	-	X	-	X	-	X
Lepomis megalotis	X	X	X	X	-	-	-	X	-	-	-
Lepomis microlophus	-	-	-	-	-	-	-	-	-	-	-
Micropterus dolomieui	X	X	X	-	-	-	-	-	-	X	-
Micropterus punctulatus	X	X	X	-	-	-	-	X	X	-	-
Micropterus salmoides	X	X	X	-	-	-	-	-	-	-	-
Species	**James River**	**Finley Creek**	**Flat Creek**	**Crane Creek**	**Spring Creek**	**Wilson Creek**	**Little Finley Creek**	**Pearson Creek**	**Wild Cat Creek**	**Jenkin's Creek**	**Silver Lake Branch**
Pomoxis annularis	X	X	X	-	-	-	-	-	-	-	-
Pomoxis nigromaculatus	X	-	-	-	-	-	-	-	-	-	-
Morone chrysops	-	-	-	-	-	-	-	-	-	-	-
Aplodinotus grunniens	X	-	-	-	-	-	-	-	-	-	-

Campostoma anomalum	X	X	X	X	-	-	X	X	X	X	-
Campostoma oligolepis	X	X	X	-	-	-	-	-	-	-	X
Nocomis biguttatus	X	X	X	X	-	-	X	X	X	X	-
Notropis boops	X	-	-	-	-	-	X	-	-	-	-
Notropis chrysocephalus	X	X	X	X	-	-	-	X	X	X	-
Notropis galacturus	X	X	X	-	-	-	-	-	-	-	-
Notropis greenei	X	-	X	-	-	-	-	-	-	-	-
Notropis nubilus	X	X	X	-	-	-	X	X	X	X	-
Notropis pilsbryi	X	X	X	X	-	-	X	X	X	X	X
Notropis rubellus	X	X	X	X	-	-	X	X	-	X	-
Notropis telescopus	X	X	X	X	-	-	-	-	-	X	-
Notropis ozarcanus	-	-	X	-	-	-	-	-	-	-	-
Pimephales notatus	X	X	X	-	-	-	-	X	X	-	-
Pimephales promelas	X	-	-	-	-	-	-	-	-	-	-
Phoxinus erythrogaster	X	X	X	X	X	-	X	X	X	X	X
Notemigonus crysoleucas	-	-	-	X	-	-	-	-	-	-	-
Erimyzon oblongus	X	X	X	X	-	-	-	-	-	-	-

Species	James River	Finley Creek	Flat Creek	Crane Creek	Spring Creek	Wilson Creek	Little Finley Creek	Pearson Creek	Wild Cat Creek	Jenkin's Creek	Silver Lake Branch
Semotilus atromaculatus	X	-	X	-	-	-	-	-	X	X	X
Hybopsis dissimilis	X	X	X	-	-	-	-	-	-	-	-
Hybopsis amblops	X	-	X	-	-	-	-	-	-	-	-
Esox americanus	X	X	X	X	-	-	-	-	-	-	-
Fundulus catenatus	X	X	X	X	-	-	-	X	-	X	-
Fundulus olivaceus	X	X	X	X	-	-	-	X	-	X	-
Gambusia affinis	X	X	-	-	-	-	-	-	-	-	-
Labidesthes sicculus	X	X	X	-	-	-	-	-	-	-	-
Etheostoma caeruleum	X	X	X	X	-	-	X	X	X	X	X
Etheostoma e. euzonum	X	-	-	-	-	-	-	-	-	-	-
Etheostoma juliae	X	X	X	-	-	-	-	-	-	-	-
Etheostoma spectabile	X	X	X	X	X	-	X	X	X	X	X
Etheostoma zonale	X	X	X	-	-	-	-	-	-	-	-
Etheostoma blennioides	X	X	X	X	-	-	-	-	-	-	-
Etheostoma punctulatum	X	X	-	-	-	-	-	X	X	-	X
Etheostoma flabellare	X	X	-	-	-	-	-	-	X	X	-
Etheostoma stigmaeum	X	-	-	-	-	-	-	-	-	-	-

Percina evides	X	-	-	-	-	-	-	-	-	-	-
Percina c. caprodes	X	X	X	-	-	-	-	-	-	-	-
Cottus carolinae	X	X	X	X	X	-	-	X	X	X	X
Cottus hypselurus	X	X	X	X	X	-	-	X	-	-	X
Cottus bairdi	-	-	-	-	-	-	-	-	-	-	-
Noturus exilis	X	X	X	-	-	-	-	-	X	-	-
Noturus albater	X	X	X	-	-	-	-	-	-	-	-
Noturus flavater	X	X	X	X	-	-	-	-	-	-	-
Amblyopsis rosae	-	-	-	-	-	-	-	-	-	-	-

Table 24. Fish species collected in the James River by Beckman in 1994 and 1995.

COMMON NAME	SCIENTIFIC NAME
Bluegill	*Lepomis macrochirus*
Longear sunfish	*Lepomis megalotis*
Spotted bass	*Micropterus punctulatus*
Largemouth bass	*Micropterus salmoides*
Ozark bass	*Ambloplites constellatus*
Banded sculpin	*Cottus carolinae*
Stoneroller	*Campostoma sp.*
Striped shiner	*Luxilus chrysocephalus*
Duskystripe shiner	*Luxilus pilsbryi*
Hornyhead chub	*Nocomis biguttatus*
Bigeye shiner	*Notropis boops*
Ozark minnow	*Notropis nubilus*
Telescope shiner	*Notropis telescopus*
Bluntnose minnow	*Pimephales notatus*
Whitetail shiner	*Cyprinella galactura*
Northern studfish	*Fundulus catenatus*
Blackspotted topminnow	*Fundulus olivaceus*
Grass pickerel	*Esox americanus*
Rainbow darter	*Etheostoma caeruleum*
Orangethroat darter	*Etheostoma spectabile*
Yoke darter	*Etheostoma juliae*
Banded darter	*Etheostoma zonale*
Logperch	*Percina caprodes*
Northern hogsucker	*Hypentelium nigricans*
Golden redhorse	*Moxostoma erythrurum*
Black redhorse	*Moxostoma duquesnei*
Gizzard shad	*Dorosoma cepedianum*

1880. As early as 1893, rainbow trout were stocked in Crane Creek in Stone County. The spread of the common carp was probably hastened by purposeful stocking of area streams in the latter half of the last century. A resident paddlefish population is currently maintained in Table Rock Lake through stocking by MDC. These fish move upstream from Table Rock Lake and into the James River annually. There is currently no evidence of successful reproduction. Threadfin shad and walleye have also been stocked in Table Rock Lake.

Crane Creek and Spring Creek in Stone County support self-sustaining populations of wild rainbow trout. Stocking records indicate that Crane Creek was last stocked in the early 1900's. Limited data suggest that Crane Creek supports a strain of wild trout closely related to the original McCloud River, California strain of rainbow trout. MDC is using offspring of these fish to help establish other wild trout populations in Missouri.

Numerous ponds throughout the basin have been stocked with a variety of fish including largemouth bass, bluegill, white crappie, redear sunfish, grass carp, and channel catfish. Escapement of channel catfish stocked by MDC in Lake Springfield probably occurs, but the extent is undocumented.

FISHING REGULATIONS

Statewide fishing regulations (daily limits, size limits, methods, and seasons) apply to most of the streams in the basin. Please refer to the most recent version of the Wildlife Code of Missouri and signs posted at public accesses for specific regulations.

AQUATIC INVERTEBRATES

Aquatic invertebrates have been sampled extensively by Tracey (1979) and by Dieffenbach and Ryck (1976) (Table 25). Dieffenbach and Ryck (1976) assessed the effects of pollutants on stream water quality using the density, diversity, and composition of bottom-dwelling invertebrates as a reflection of water quality at a variety of sites.

Dieffenbach and Ryck (1976) concluded that the upper portion of the James River had invertebrate communities characteristic of unpolluted Ozark streams. There were, however, pollution related concerns on several major tributaries and the lower James River. Pearson Creek had reduced invertebrate community indices, most likely as a result of some combination of pollution and the substantial influence of spring flow on the reach sampled. Index values were depressed in Flat Creek near Cassville, but recovered in its lower reaches. In Finley Creek, indices reflected good water quality in upstream reaches, but were depressed in a seven mile reach below Ozark and Nixa. Wilson Creek was severely impacted for approximately five miles below the Southwest Wastewater Treatment Plant, and about 14 miles of the James River below Wilson Creek were moderately affected.

Youngsteadt (1995) conducted a more recent survey of the invertebrate community on Pearson Creek. He found that aquatic ecosystem health is worse in lower Pearson Creek than in its upper reaches and that it is worse in general than it was in 1965.

Table 25. Aquatic invertebrates found in the James River Basin.

CLASS	ORDER	FAMILY	SPECIES
INSECTA	EPHEMEROPTERA	Baetidae	*Baetis sp.*
			Baetis tricaudatus
			Centroptilum sp.
			Pseudocloeon sp.
			Callibaetis sp.
			Acentrella sp.
		Caenidae	*Caenis sp*
		Ephemerellidae	*Ephemerella bicolor*
			Ephemerella subvaria
			Ephemerella deficiens
			Ephemerella dorothea
			Ephemerella needhami
			Serratella sp.
			Serratella deficiens
			Dentatella sp.
			Ephemerella invaria
		Ephemeridae	*Ephemera simulans*
			Ephemera sp.
			Ephemera varia
			Ephemera guttulata
			Hexagenia limbata
		Heptageniidae	*Heptagenia sp.*
			Heptagenia maculipennis
			Rithrogena jejuna
			Rithrogena pellucida
			Stenacron interpunctatum
			Stenacron gildersleevei
			Stenonema nepotellum
			Stenonema bednariki
			Stenonema exiguum
			Stenonema femoratum

			Stenonema mediopunctatum
			Stenonema integrum
			Stenonema pulchellum
			Stenonema terminatum
			Stenonema tripunctatum
			Stenonema ares
			Stenonema bipunctatum
		Leptophlebiidae	***Choroterpes sp.***
			Choroterpes basilis
			Leptophlebia sp.
			Leptophlebia cupida
			Paraleptophlebia sp.
			Paraleptophlebia praepedita
			Paraleptophlebia moerens
		Polymitarcidae	***Ephoron album***
			Ephoron leukon
		Potamanthidae	***Potamanthus myops***
			Potamanthus sp.
		Siphlonuridae	***Isonychia sp.***
			Siphlonurus sp.
		Tricordythidae	***Tricorythodes sp.***
		Baetiscidae	***Batisca lacustris***
		Palingeniidae	***Pentagenia villegia***
	ODONATA	**Calopterygidae**	***Hetaerina americana***
		Coenagrionidae	***Argia moesta***
			Argia sp.
			Argia sedula
			Argia apicalis
			Argia plana
			Argia tibialis
			Enallagma civile
			Enallagma sp.
		Gomphidae	***Gomphus vastus***
			Stylogomphus albistylus
			Lanthus albistylus

		Agrionidae	***(no species name given)***
		Aeshnidae	***Aeshna sp.***
	PLECOPTERA	**Capniidae**	***Allocapnia vivipara***
			Allocapnia sp.
			Allocapnia mystica
			Allocapnia granulata
		Chloroperlidae	***Haploperla brevis***
			Hastaperla brevis
		Nemouridae	***Nemoura venosa***
			Amphinemura delosa
			Prostoia completa
		Perlidae	***Acroneuria evoluta***
			Acroneuria sp.
			Acroneuria arida
			Neoperla clymene
			Phasgonophora capitata
			Paragnetenia media
			Perlesta placida
			Perlinella ehyre
		Perlodidae	***Isogenoides varians***
			Diploperla duplicata
			Isoperla sp.
			Isoperla nana
			Isoperla decepta
			Isoperla bilineata
			Isoperla minuta
			Isoperla richardsoni
			Hydroperla sp.
			Hydroperla crosbyi
		Pteronarcidae	***Pteronarcys dorsata***
			Pteronarcys peictii
		Teniopterygidae	***Strophopteryx fasciata***
			Taeniopteryx maura
			Taeniopteryx sp.
			Brachyptera fasciata

Source: Tracey (1979), Ingersol and Jones (1979), and MDC Benthos Database and Summary dated 1995.

CLASS	ORDER	FAMILY	SPECIES
	COLEOPTERA	Dryopidae	*Helichus lithophilus*
			Helichus sp.
		Elmidae	*Dubiraphia sp.*
			Ancyronyx variegata
			Narpus sp.
			Optioservus sandersoni
			Stenelmis crenata
			Stenelmis exigua
			Stenelmis sp.
			Stenelmis beameri
			Stenelmis lateralis
		Gyrinidae	*Dineutus sp.*
		Psephenidae	*Ectopria nervosa*
			Psephenus herricki
		Dytiscidae	*Dytiscus sp.*
			Hydaticus piceus
		Haliplidae	*(no species name given)*
		Hydrophilidae	*Berosus sp.*
			Helophorus sp.
			Tropisternus sp.
		Ptilodactylidae	*(no species name given)*
		Chrysomelidae	*Lutrochus laticeps*
	MEGALOPTERA	Corydalidae	*Corydalus cornutus*
			Nigronia serricornis
		Sialidae	*Sialis sp.*
		Chauliodinae	*Chauliodes sp.*
	DIPTERA	Anthericidae	*Atherix variegata*
			Atherix lantha
		Ceratopogonidae	*Bezzia sp.*
		Chironomidae	*Ablabesmyia sp.*
			Cardiocladius sp.
			Chrionomus sp.

			Cricotopus sp.
			Cryptochironomus sp.
			Diamesa sp.
			Dicrotendipes sp.
			Eukiefferella sp.
			Microtendipes sp.
			Orthocladius sp.
			Polypedilum sp.
			Psectrocladius sp.
			Stenochironomus sp.
			Stictochironomus sp.
			Tanytarsus sp.
			Tribelos sp.
		Empididae	***Hemerodromia sp.***
			Hemerodromia rogatoris coquillett
		Simulidae	***Simulium sp.***
		Tabanidae	***Tabanus sp.***
			Chrysops sp.
		Tanyderidae	***Protoplasa fitchii***
		Tendipedidae	***(no species name given)***
		Tipulidae	***Antocha sp.***
			Hexatoma
			Tipula sp.
		Heleidae	***Bezzia, Probezzia sp.***
		Muscidae	***(no species name given)***
		Tanypodinae	***(no species name given)***
		Scathophagidae	***(no species name given)***
		Psychodidae	***Pericoma sp.***
		Limoniinae	***Dicranota sp.***
			Limonia sp.
	TRICHOPTERA	**Glossosomatidae**	***Agapetus sp.***
			Glossoma sp.
			Glossoma intermedium
			Protopila sp.
		Helicopsychidae	***Helicopsyche borealis***

			Helicopsyche sp.
		Hydropsychidae	***Cheumatopsyche sp.***
			Hydropsyche arinale
			Hydropsyche slossonae
			Hydropsyche venularis
			Hydropsyche aerata
			Hydropsyche piatrix
			Hydropsyche morosa
			Hydropsyche betteni
			Hydropsyche bifida
			Hydropsyche glossonae
			Hydropsyche scalaris
			Hydropsyche simulans
			Potamyia flava
			Symphitopsyche bifida
		Hydroptilidae	***Ochrotrichia sp.***
			Hydroptila sp.
			Stactobiella sp.
		Leptoceridae	***Ceraclea sp.***
		Limnephilidae	***Caborius sp.***
			Neophylax sp
			Neophylax fuscus
			Ironoquia sp.
		Odontoceridae	***Psilotreta sp.***
		Philopotamidae	***Chimarra aterrima***
			Chimarra feria
			Chimarra obscura
			Chimarra socia
		Polycentropidae	***Polycentropus cinereus***
			Polycentropus sp.
		Ptilodactylidae	***(no species name given)***
		Polycentropodidae	***Nyctiophylax moestus***
		Rhyacophilidae	***Rhacophila sp.***
		Psychomyiidae	***Psychomyia flavida***
		Hydropsychoidea	***Wormalida moesta***

	LEPIDOPTERA	Pyralidae	*Paragyrarctis sp.*

Source: Tracey (1979), Ingersol and Jones (1979), and MDC Benthos Database and Summary dated 1995.

Table 25 continued.

CLASS	ORDER	FAMILY	SPECIES
ARACHNIDA	ACARIFORMES	Arachnoidea	*(no species name given---water mites)*
TURBELLARIA	TRICLADIDA	Planariidae	*Dugesia*
HIRUDINEA			*(no species names given)*
BRANCHIOBDELLILDA		Branchiobdellidae	*(no species names given)*
OLIGOCHAETA			*(no species names given)*
APHASMIDA			*(no species names given)*
GORDIOIDA		Gordiidae	*(no species names given)*
GASTROPODA			*Goniobasis sp.*
			Ferrissia sp.
			Ferrissia fragilis
			Physa sp.
			Helisoma a. ancops
			Somatogyrus crassiabris
			Elimia sp.
			Elimia potosiensis plebeius
			Gyraulus sp.
			Gyraulus parvus
			Physella sp.
			Pleurocera acuta acuta
			Fossaria sp.
		Physidae	*(no species names given)*
		Planorbidae	*(no species names given)*
		Lymnaeidae	*Lymnaea sp.*
			Amnicola sp.
			Amnicola limosa parva
PELECYPODA	UNIONIDAE	Unioninae	*Actinonaias ellipsiformis*
			Sphaerium
			Psidium sp.
			Pleurobema utterbacki

			Pleurobema coccineum
			Potamilus purpuratus
			Leptodea fragilis
			Amblema plicata plicata
			Corbicula fluminea
			Alasmidonta viridis
			Lasmigona costata
			Lampsilis sp.
			Lampsilis reeviana brevicula
			Lampsilis ventricosa
			Phytobranchus occidentalis
			Lampsilis abrupta
			Lampsilis radiata luteola
			Venustaconcha pleasi
			Venustaconcha ellipsiformis
			Actinonaias ligamentina
			Lasmigona costata
			Cyclonaias tuberculata
			Strophitus undulatus undulatus
			Elliptio sp.
			Villosa iris iris
			Toxolasma lividus
			Anodonta grandis grandis
			Anodonta imbecilis
		Ambleminae	***Fusconaia ozarkensis***
		Gammaridae	***Allocrangonyx sp.***
			Allocrangonyx pellucidus
			Asellus stygius
			Synurella bifurca
			Crangonyx minor
			Gammarus pseudolimnaeus
			Gammarus fasciatus
		Talitridae	***Hyalella azteca***
	ISOPODA	**Asellidae**	***Asellus sp.***
			Caecidotea sp.

			Caecidotea stygius
			Lirceus sp.
	DECAPODA	**Cambarinae**	***Orconectes menae***
			Orconectes longidigitus
			Orconectes hylas
			Orconectes punctimanus
			Orconectes neglectus
			Orconectes naias
			Orconectes ozarkae
			Orconectes luteus
			Orconectes eupunctus
			Orconectes marchandi
		Cambarellinae	***Cambarellus pueur***

Source: Tracey (1979), Ingersol and Jones (1979), and MDC Benthos Database and Summary dated 1995.

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MANAGEMENT PROBLEMS AND OPPORTUNITIES

MANAGEMENT GOALS, OBJECTIVES, AND STRATEGIES

These management goals, objectives, and strategies were developed to address objectives in the Missouri Department of Conservation's Strategic Plan, Fisheries Division's Strategic Plan, the Stream Areas Program Strategic Plan, and the Stream Acquisition Plan. These plans address strategic areas of future resource management, public awareness, and access needs.

GOAL I: IMPROVE WATER QUALITY AND MAINTAIN OR IMPROVE WATER QUANTITY IN THE JAMES RIVER BASIN SO ALL STREAMS ARE CAPABLE OF SUPPORTING NATIVE AQUATIC COMMUNITIES.

Status: Both point and nonpoint source pollution are threats to water quality in the basin. Human population is increasing rapidly in portions of the basin, particularly in Greene, Christian, and Stone counties. This population increase has resulted in increasing urbanization in areas like Springfield, Ozark, and Nixa. Sewage treatment plant upgrades have been required, and considerable attention has been focused on the nutrient outfall from these facilities and its impacts on receiving streams and downstream reservoirs. Like much of southwest Missouri, large farming corporations have shown interest in establishing operations within the basin that have the potential to increase and concentrate livestock waste runoff.

Objective 1.1: Streams within the basin will meet state standards for water quality.

Strategy: Enforcement of existing water quality regulations and necessary revisions to these regulations will help reduce violations. Water quality problems must also be addressed through aggressive public awareness efforts and by encouraging good land use in riparian areas and throughout watersheds in the basin. Citizen activism is alive and well in the basin through STREAM TEAMs and a variety of related organizations and should be encouraged. Working with related agencies to promote public awareness and incentive programs, cooperating with citizen groups involved with water quality issues in the basin, and helping to enforce water quality laws will be among the most efficient ways to achieve this objective.

Enhance people's awareness of 1) water quality problems (i.e., point source pollution, animal waste runoff, etc.) affecting aquatic biota, 2) viable solutions to these problems, and 3) their role in implementing these solutions. Media contacts, personal contacts, special events, and literature development and distribution will be used to reach people throughout the basin.

Review NPDES, Section 404, and other permits and either recommend denial or appropriate mitigation for

those which are harmful to aquatic resources. Related activities will include cooperating with other state and federal agencies to investigate pollution events and fish kills, assisting with the enforcement of existing water quality laws, and recommending appropriate measures to protect and enhance aquatic communities.

Working with the Missouri Department of Health and MDNR, reduce contaminant levels in fish by collecting fish for contaminant analysis, advising the fishing public on the impacts of contaminant levels, and identifying and eliminating sources of contamination.

Work with MDNR to monitor water quality, improve water quality, and ensure compliance with discharge permits. With training, volunteer groups, such as STREAM TEAMs, could assist with water quality monitoring and improvement. These volunteer groups are strong advocates for good water quality throughout the basin. Further development of STREAM TEAMs should be encouraged. Related monitoring efforts should also be encouraged and directed to strategic locations.

Serve in an advisory role to organizations such as the Watershed Committee of the Ozarks, White River Watershed Coalition, James River Basin Partnership, and the Greene County/City of Springfield Water Resources Technical Advisory Committee. These efforts will help to ensure that existing and potential impacts to aquatic biota are recognized by the general public, community leaders, and local agencies and that efforts to minimize these impacts are included in local planning documents, regulations, and statutes.

Control excess nutrient loading by assisting in ongoing efforts to quantify the effects of basin-wide nutrient loading on the productivity of Table Rock Lake and assist in efforts to control significant sources of excess nutrients in the basin.

Objective 1.2: Maintain base flows in streams within the basin at or above current levels within the constraints imposed by natural seasonal variations and precipitation.

Strategy: The most efficient and effective way to address these concerns will be through existing agency programs and the legislative process.

Summarize existing data and, working with USGS, gather available flow information to create flow duration curves for streams within the basin. Using these and other appropriate data, establish flow regimes that protect or enhance fish and other aquatic life.

Working with MDNR and the U.S. Army Corps of Engineers (COE), protect or enhance stream flows through oversight and enforcement of existing water withdrawal permits.

Support development of water law and an interstate compact/agreement that will address the quantity of water in Missouri's streams.

Increase public awareness of and concern for water quantity problems, the affected aquatic biota, and potential solutions through media contacts, personal contacts, and literature development and distribution.

GOAL II: IMPROVE RIPARIAN AND AQUATIC HABITAT CONDITIONS IN THE JAMES RIVER BASIN TO MEET THE NEEDS OF NATIVE AQUATIC SPECIES WHILE ACCOMMODATING DEMANDS FOR WATER AND AGRICULTURAL PRODUCTION.

Status: Stream habitat quality is fair to good throughout most of the basin. Some areas, including portions of the Crane Creek sub-basin, suffer from a more severe lack of riparian vegetation. The lack of adequate riparian corridors, excessive nutrient loading, streambank erosion, excessive runoff and erosion, and the effects of instream activities such as gravel mining are among the problems observed. Grazing practices along many streams contribute to streambank instability, nutrient loading, and poor riparian corridor conditions. Increased clearing and higher runoff associated with urbanization also impact stream habitat quality.

Objective 2.1: Riparian landowners on third order and larger streams will understand the importance of good stream stewardship and where to obtain technical assistance for sound stream habitat improvement.

Strategy: Advertising and promoting stream programs, installing and maintaining demonstration projects, and providing educational opportunities to landowners will make them more aware of the reasons and techniques for protecting streams. Emphasizing economic aspects of stream improvement will encourage more landowners to participate.

Work with MDC's Education Division to develop stream management related materials and present related courses for elementary and secondary school teachers.

Establish and maintain stream management

demonstration sites. Initially, existing sites on Flat Creek and Dry Crane Creek will be used for demonstration purposes. Thereafter, additional sites will be developed on MDC frontage and as part of anticipated SALT projects in the Crane Creek watershed. Other sites will be located to provide demonstration opportunities to landowners throughout the basin.

Promote good stream stewardship through landowner workshops and stream demonstration site tours.

Objective 2.2: Maintain, expand, and restore riparian corridors; enhance watershed management; improve instream habitat; and reduce streambank erosion throughout the basin.

Strategy: High quality aquatic habitat is the critical factor in maintaining and improving natural stream communities. Stream habitat conditions will be improved by cooperating with and providing technical assistance to private landowners, working with other local, state, and federal agencies to manage stream frontages on their properties, and installing stream improvement and habitat enhancement projects on MDC lands within the basin. Monitoring habitat conditions and using regulatory avenues to reduce impacts from development projects should also help to identify problems and minimize impacts on the stream resource.

Monitor habitat conditions in the basin periodically by using SHAD (or similar methodologies), aerial photography, and helicopter reconnaissance. Map riparian corridors on selected third order and all fourth order and larger streams. Prepare GIS layers when the technology is available, and update as needed.

Ensure that all MDC areas are examples of good stream and watershed management by including appropriate recommendations and prescriptions in area plans, implementing these practices in a timely manner, and monitoring these practices throughout their life. These practices will include, but may not be limited to, riparian corridor re-establishment, riparian corridor management, and maintaining soil erosion levels at "T" (soil replacement level) or lower.

Provide technical recommendations to all landowners that request assistance and who are willing to reestablish and maintain an adequate riparian corridor.

Improve riparian corridor and watershed conditions by actively participating in SALT projects to

incorporate fish and wildlife values and promote sound stream stewardship. Cooperate with NRCS and SWCD boards to establish a SALT project in the Crane Creek watershed and in additional watersheds as appropriate.

Improve landowner stewardship of streams by promoting and implementing cost share programs, including MDC's watershed-based programs, that include streambank stabilization, alternative watering provisions, and establishment and maintenance of quality riparian corridors.

Objective 2.3: Critical and unique aquatic habitats will be identified and protected from degradation.

Strategy: Identification, acquisition, targeted private landowner programs, and cooperation with other agencies/organizations will result in better management of critical and unique aquatic areas.

Acquire critical and unique aquatic habitats. Priority areas will include frontage along Crane and Spring creeks, Ozark cavefish cave sites and their recharge areas, and springs and sinkholes.

Conduct additional fish population sampling to further define and delineate unique and critical habitats.

Collect additional background information from the public and resource professionals to better define critical and unique aquatic habitats.

Implement the recovery plan for the Ozark cavefish and coordinate related efforts between MDC's Natural History Division, MDC's Southwest Fisheries Management District personnel, and related agencies.

GOAL III: MAINTAIN DIVERSE AND ABUNDANT POPULATIONS OF NATIVE AQUATIC ORGANISMS WHILE ACCOMMODATING ANGLER DEMANDS FOR QUALITY FISHING.

Status: The basin has a diverse fish assemblage of 71 fish species collected since the 1930's. James River, Flat Creek, and Finley Creek have the most diverse fish communities. Crane Creek, in Stone County, is a nationally recognized cold-water fishery. Growth rates and size structure of black bass in the lower James River are very good, and the lower James River has a long-standing reputation as an excellent float-fishing stream.

The Ozark cavefish is found in selected cave systems along the western border of the basin. The Ozark cavefish is listed as endangered by MDC and threatened by the U.S. Fish and Wildlife Service. The Ozark cavefish is the only federally listed threatened or endangered fish species in the basin. State listed

rare, threatened, or watch listed fish species found in the basin are the highfin carpsucker and the checkered madtom.

A population of paddlefish is maintained in portions of the basin through stocking. This population currently serves as a source of broodstock for MDC's hatchery system. Self-sustaining populations of introduced rainbow trout are found in Spring Creek near Hurley and Crane Creek near Crane. Sufficient samples to assess the status of most sportfish populations are lacking.

Sportfishing management emphasis species are black bass (smallmouth, largemouth, and spotted bass), rainbow trout, Ozark bass, channel catfish, and paddlefish.

Some invertebrate sampling has been conducted in the basin, but a system-wide comprehensive invertebrate collection has not been made.

Objective 3.1: Evaluate and maintain sportfish populations, with primary emphasis on black bass and rainbow trout, at sufficient quality and condition to satisfy the angling public.

Strategy: Assess the quality of populations of sportfishing management emphasis species and take steps to improve their populations through public education, regulations, habitat improvement, stocking, and other methods.

Develop and implement a monitoring program to obtain trend data on sportfish populations in the James River and its major tributaries.

Identify critical habitat areas for sportfishing management emphasis species and maintain or enhance these areas as needed to improve habitat.

Using regulations, habitat improvement, and other methods, continue implementation of population improvement programs for sportfishing management emphasis species.

Conduct a survey of anglers to determine catch, harvest, species preference, and fishing pressure.

Increase angler awareness of the recreational potential of fishes other than black bass and rainbow trout, such as catfish, buffalo, carp, drum, and gar.

Objective 3.2: Maintain populations of native non-game fishes and aquatic invertebrates at or above present levels throughout the basin.

Strategy: Assess the status of fish and invertebrate communities throughout the basin. Techniques to maintain or improve non-game fishes will depend on the fish communities in decline and the causative agent. It is also assumed that improvements in other aquatic life will occur simultaneous to those occurring in fish communities.

Develop standard sampling techniques for assessing

fish and invertebrate communities, including the use of indicator species, and implement a monitoring program to track trends in species diversity and abundance.

Maintain aquatic biodiversity and protect or enhance fish species diversity and abundance using regulations, stocking, habitat improvement, and related techniques,

Objective 3.3: Populations of Ozark cavefish will be maintained at or above current levels.

Strategy: In cooperation with MDC's Natural History Division, continue efforts to assess the status of Ozark cavefish populations throughout the basin and implement the existing federal recovery plan for this species.

Continue monitoring efforts at known and historic Ozark cavefish sites and follow-up on new reports of possible cavefish populations.

Continue public awareness and habitat management efforts related to Ozark cavefish and consider additional possibilities for non-MDC funding for additional inventory work, continued public awareness efforts, and habitat management efforts.

Protect and improve Ozark cavefish habitat by encouraging stream, spring, and cave related cost share practices to be included on SWCD dockets (e.g., livestock fencing, abandoned well capping, alternative water sources, etc.).

Participate in recovery efforts including interstate conferences and recovery team meetings.

GOAL IV: IMPROVE THE PUBLIC'S APPRECIATION FOR STREAM RESOURCES AND INCREASE RECREATIONAL USE OF STREAMS IN THE JAMES RIVER BASIN.

Status: Streams in the basin are used extensively for both fishing and other recreational activities. Scenic stretches of stream are relatively common. The lower James River, Finley Creek, and Flat Creek each receive considerable use by floaters and canoeists. Eleven public stream access sites are located in the basin. Included in this total are an access site and a bank fishing area on Lake Springfield cooperatively managed by MDC and Springfield City Utilities. In addition, MDC also owns and manages frontage along Crane Creek on Wire Road Conservation Area (CA) and manages leased lands along Lake Springfield at the Springfield Conservation Nature Center.

The public's understanding of the importance of streams culturally, biologically, and historically needs improving. While landowner participation in Streams For The Future programs has been limited,

participation in the STREAM TEAM program has been good. Efforts are underway by several groups in the basin, including STREAM TEAMs, to improve public awareness of the importance of high quality streams.

Objective 4.1: Access sites, bank fishing, and trails will be developed and maintained in sufficient numbers to accommodate public use.

Strategy: The MDC Strategic Plan anticipates an increase in stream use because of an overall increase in the levels of fishing and other stream-based recreational activities. Acquisition and development projects along streams should be sufficient to meet these increasing demands.

Conduct a recreational use survey within the basin in conjunction with an angler survey to determine existing levels of use and satisfaction with recreational opportunities in the basin.

Acquire and develop public access and frontage sites (for boating and bank fishing) at strategic points, based on the Stream Areas Program Strategic Plan (McPherson 1994).

Improve bank fishing and other aquatic wildlife-based recreational opportunities on public lands.

Objective 4.2: Increase the general public's awareness of stream recreational opportunities, local stream resources, and good watershed and stream management practices.

Strategy: The public will be made aware of stream related recreational opportunities and issues through media outlets, fair exhibits, and Missouri Conservationist articles.

Increased appreciation of stream resources should follow enhanced public awareness and education. More concern about the quality and quantity of water within the basin's streams should follow, and greater citizen involvement and advocacy in related environmental issues should result. Newspaper articles, presentations, and special events highlighting streams should help foster this awareness.

Working with MDC's Education Division, use streams for aquatic education programs. Identify stream locations appropriate for educational field trips near participating schools.

Maintain a stream emphasis at public events such as the Ozark Empire Fair, Springfield Boat Show, etc.

Assist in the development of one article for the Missouri Conservationist and make suggestions for a future MDC video ("Missouri Outdoors", etc.) to highlight James River Basin recreational opportunities.

Contribute to future revisions of Missouri Ozark Waterways.

Prepare an annual fishing prospectus for selected streams.

Promote the formation of STREAM TEAMs and STREAM TEAM associations within the basin.

Distribute information through organizations such as the Watershed Committee of the Ozarks, White River Watershed Coalition, James River Basin Partnership, and the Greene County/City of Springfield Water Resources Technical Advisory Committee.

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ANGLER GUIDE

Lake Springfield (Southwest Region, in cooperation with Springfield City Utilities)
Information: 417/895-6880
Largemouth bass fishing is typically excellent. Numbers and size structure are generally good. Chances exist to catch a trophy size bass. A large area of American Lotus was treated in 1998; this has increased angling opportunities for largemouth bass. **Crappie** anglers can expect some fishing success. Quality size crappie do exist, but are limited in number. **White crappie** is the dominant crappie species present. **Bluegill** fishing should be good as overall size structure has remained constant. A good portion of the bluegill population exceeds 6 inches. **Channel catfish** are preferred by many Lake Springfield anglers and should provide continued excellent fishing. Many 10-20" channel catfish are present. Favorite baits include night crawlers, chicken livers and prepared dough baits. Anglers also have an opportunity to catch a variety of river species such as **golden redhorse suckers, bullheads, carp, rock bass and green sunfish**. The upper end of the reservoir, fed by the James River, is a popular area to gig suckers. Community Assistance Program fishing facilities are available and include a barrier free fishing jetty, disabled user fishing dock located at the dam and a boat launching ramp.

James River (Southwest Region)
Information: 417/895-6880
The James River, in southwest Missouri, features both scenic beauty and excellent fishing. **Smallmouth bass, largemouth bass** and **spotted bass** are present. Abundance and size structure are good. Excellent opportunities are also available to catch **rock bass, channel catfish** and **carp.** Anglers should remember that special regulations apply in the Black Bass Stream Management Area on the 23 miles of river between Hooten Town bridge (Stone Co. Rd. A-90) and the Highway 13 bridge at Galena. In this area, the minimum length limit on smallmouth bass and largemouth bass is 15", and the minimum length limit for spotted bass is 12". Anglers may harvest six black bass daily, of which only one may be a smallmouth bass. Below the Highway 13 bridge at Galena, Table Rock Lake regulations apply, and all black bass possessed must be at least 15". It is important for anglers to correctly identify the three species of black bass found in the James River. Signs with identification information are posted at Missouri Department of Conservation access sites in the Black Bass Stream Management Area.

GLOSSARY

Alluvial soil Soil deposits resulting directly or indirectly from the sediment transport of streams, deposited in river beds, flood plains, and lakes.

Aquifer An underground layer of porous, water-bearing rock, gravel, or sand.

Benthic Bottom-dwelling; describes organisms which reside in or on any substrate.

Benthic macroinvertebrate Bottom-dwelling (benthic) animals without backbones (invertebrate) that are visible with the naked eye (macro).

Biota The animal and plant life of a region.

Biocriteria monitoring The use of organisms to assess or monitor environmental conditions.

Channelization The mechanical alteration of a stream which includes straightening or dredging of the existing channel, or creating a new channel to which the stream is diverted.

Concentrated animal feeding operation (CAFO) Large livestock (ie.cattle, chickens, turkeys, or hogs) production facilities that are considered a point source pollution, larger operations are regulated by the MDNR. Most CAFOs confine animals in large enclosed buildings, or feedlots and store liquid waste in closed lagoons or pits, or store dry manure in sheds. In many cases manure, both wet and dry, is broadcast overland.

Confining rock layer A geologic layer through which water cannot easily move.

Chert Hard sedimentary rock composed of microcrystalline quartz, usually light in color, common in the Springfield Plateau in gravel deposits. Resistance to chemical decay enables it to survive rough treatment from streams and other erosive forces.

Cubic feet per second (cfs) A measure of the amount of water (cubic feet) traveling past a known point for a given amount of time (one second), used to determine discharge.

Discharge Volume of water flowing in a given stream at a given place and within a given period of time, usually expressed as cubic feet per second.

Disjunct Separated or disjoined populations of organisms. Populations are said to be disjunct when they are geographically isolated from their main range.

Dissolved oxygen The concentration of oxygen dissolved in water, expressed in milligrams per liter or as percent.

Dolomite A magnesium rich, carbonate, sedimentary rock consisting mainly (more than 50% by weight) of the mineral dolomite ($CaMg(CO_3)_2$).

Endangered In danger of becoming extinct.

Endemic Found only in, or limited to, a particular geographic region or locality.

Environmental Protection Agency (EPA) A Federal organization, housed under the Executive branch,

charged with protecting human health and safeguarding the natural environment — air, water, and land — upon which life depends.

Epilimnion The upper layer of water in a lake that is characterized by a temperature gradient of less than 1º Celcius per meter of depth.

Eutrophication The nutrient (nitrogen and phosphorus) enrichment of an aquatic ecosystem that promotes biological productivity.

Extirpated Exterminated on a local basis, political or geographic portion of the range.

Faunal The animals of a specified region or time.

Fecal coliform A type of bacterium occurring in the guts of mammals. The degree of its presence in a lake or stream is used as an index of contamination from human or livestock waste.

Flow duration curve A graphic representation of the number of times given quantities of flow are equaled or exceeded during a certain period of record.

Fragipans A natural subsurface soil horizon seemingly cemented when dry, but when moist showing moderate to weak brittleness, usually low in organic matter, and very slow to permeate water.

Gage stations The site on a stream or lake where hydrologic data is collected.

Gradient plots A graph representing the gradient of a specified reach of stream. Elevation is represented on the Y-axis and length of channel is represented on the X- axis.

Hydropeaking Rapid and frequent fluctuations in flow resulting from power generation by a hydroelectric dam's need to meet peak electrical demands.

Hydrologic unit (HUC) A subdivision of watersheds, generally 40,000-50,000 acres or less, created by the USGS. Hydrologic units do not represent true subwatersheds.

Hypolemnion The region of a body of water that extends from the thermocline to the bottom and is essentially removed from major surface influences during periods of thermal stratification.

Incised Deep, well defined channel with narrow width to depth ration, and limited or no lateral movement. Often newly formed, and as a result of rapid down-cutting in the substrate

Intermittent stream One that has intervals of flow interspersed with intervals of no flow. A stream that ceases to flow for a time.

Karst topography An area of limestone formations marked by sinkholes, caves, springs, and underground streams.

Loess Loamy soils deposited by wind, often quite erodible.

Low flow The lowest discharge recorded over a specified period of time.

Missouri Department of Conservation (MDC) Missouri agency charged with: protecting and managing the fish, forest, and wildlife resources of the state; serving the public and facilitating their participation in resource management activities; and providing opportunity for all citizens to use, enjoy,

and learn about fish, forest, and wildlife resources.

Missouri Department of Natural Resources (MDNR) Missouri agency charged with preserving and protecting the state's natural, cultural, and energy resources and inspiring their enjoyment and responsible use for present and future generations.

Mean monthly flow Arithmetic mean of the individual daily mean discharge of a stream for the given month.

Mean sea level (MSL) A measure of the surface of the Earth, usually represented in feet above mean sea level. MSL for conservation pool at Pomme de Terre Lake is 839 ft. MSL and Truman Lake conservation pool is 706 ft. MSL.

Necktonic Organisms that live in the open water areas (mid and upper) of waterbodies and streams.

Non-point source Source of pollution in which wastes are not released at a specific, identifiable point, but from numerous points that are spread out and difficult to identify and control, as compared to point sources.

National Pollution Discharge Elimination System (NPDES) Permits required under The Federal Clean Water Act authorizing point source discharges into waters of the United States in an effort to protect public health and the nation's waters.

Nutrification Increased inputs, viewed as a pollutant, such as phosphorous or nitrogen, that fuel abnormally high organic growth in aquatic systems.

Optimal flow Flow regime designed to maximize fishery potential.

Perennial streams Streams fed continuously by a shallow water table.

pH Numeric value that describes the intensity of the acid or basic (alkaline) conditions of a solution. The pH scale is from 0 to 14, with the neutral point at 7.0. Values lower than 7 indicate the presence of acids and greater than 7.0 the presence of alkalis (bases).

Point source Source of pollution that involves discharge of wastes from an identifiable point, such as a smokestack or sewage treatment plant.

Recurrence interval The inverse probability that a certain flow will occur. It represents a mean time interval based on the distribution of flows over a period of record. A 2-year recurrence interval means that the flow event is expected, on average, once every two years.

Residuum Unconsolidated and partially weathered mineral materials accumulated by disintegration of consolidated rock in place.

Riparian Pertaining to, situated, or dwelling on the margin of a river or other body of water.

Riparian corridor The parcel of land that includes the channel and an adjoining strip of the floodplain, generally considered to be 100 feet on each side of the channel.

7-day Q^{10} Lowest 7-day flow that occurs an average of every ten years.

7-day Q^{2} Lowest 7-day flow that occurs an average of every two years.

Solum The upper and most weathered portion of the soil profile.

Special Area Land Treatment project (SALT) Small, state funded watershed programs overseen by MDNR and administered by local Soil and Water Conservation Districts. Salt projects are implemented in an attempt to slow or stop soil erosion.

Stream Habitat Annotation Device (SHAD) Qualitative method of describing stream corridor and instream habitat using a set of selected parameters and descriptors.

Stream gradient The change of a stream in vertical elevation per unit of horizontal distance.

Stream order A hierarchial ordering of streams based on the degree of branching. A first order stream is an unbranched or unforked stream. Two first order streams flow together to make a second order stream; two second order streams combine to make a third order stream. Stream order is often determined from 7.5 minute topographic maps.

Substrate The mineral and/or organic material forming the bottom of a waterway or waterbody.

Thermocline The plane or surface of maximum rate of decrease of temperature with respect to depth in a waterbody.

Threatened A species likely to become endangered within the foreseeable future if certain conditions continue to deteriorate.

United States Army Corps of Engineers (USACE) Federal agency under control of the Army, responsible for certain regulation of water courses, some dams, wetlands, and flood control projects.

United States Geological Survey (USGS) Federal agency charged with providing reliable information to: describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect the quality of life.

Watershed The total land area that water runs over or under when draining to a stream, river, pond, or lake.

Waste water treatment facility (WWTF) Facilities that store and process municipal sewage, before release. These facilities are under the regulation of the Missouri Department of Natural Resources.

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