# *Eleven Point River*

## *WATERSHED*

## *INVENTORY AND ASSESSMENT*

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### EXECUTIVE SUMMARY

The Eleven Point River originates near the town of Willow Springs, located in northeastern Howell County. The river flows southeasterly across northern Howell and Oregon Counties and then south, crossing the Arkansas state line about 2.5 miles west of the southeast corner of Oregon County. From there it flows generally south through Randolph County, Arkansas, joining the Spring River approximately 3.7 miles above the Spring River/Black River Confluence near Black Rock, Arkansas. The Black River is a tributary of the White River. Major tributaries of the Eleven Point River include Middle Fork, Spring Creek, Hurricane Creek, and Fredrick Creek. Greer Spring also contributes significantly to the flow of the Eleven Point River, turning the river into a cold water stream. The Eleven Point Watershed, which lies in the Salem Plateau Subdivision of the Ozark Plateau Physiographic Region, drains approximately 1,024 square miles in portions of five counties within Missouri. These include Howell, Oregon, Ripley, Carter, and Shannon. The watersheds bordering the Eleven Point Watershed include the Jacks Fork to the north, the Current and Fourche to the east, and the North Fork of the White River and Spring River to the west. Many caves, springs, and losing streams are present within

the watershed. This is due to the highly karst nature of its topography.

Land use/land cover within the Eleven Point Watershed is largely forest/woodland at 64.9%, while grassland/cropland comprises 34.4% of the watershed. Urban areas make up a very small percentage of land use at 0.4% of the watershed. The watershed has two urban areas with a population of over 1,000 persons. These are Mountain View, Missouri (population 2,036) and Willow Springs, Missouri (population 8,152). The population density of the watershed is approximately 14 persons per square mile. Approximately 22% of the watershed is in public ownership with the majority of this land managed as part of the Mark Twain National Forest.

Water quality within the Eleven Point Watershed is relatively good; however, high fecal coliform levels, nutrient loading, and sediment and gravel deposition are the most severe threats to water quality. Poor land use practices, gravel dredging, and increasing cattle populations are the primary causes of the water quality problems. Lead prospecting has occurred throughout the watershed. Lead prospecting and lead mining are potential threats to water quality in the watershed. There are three municipal waste water discharges within the watershed. Four additional National Pollution Elimination System discharges are also located within the watershed.

Condition of stream habitat within the Eleven Point Watershed is relatively good in most areas. Analysis of quantified Stream Habitat Assessment Device (SHAD) results from 16 sites within the watershed indicates that habitat at these sites range from ‘fair’ to ‘excellent’. Riparian corridor land cover/land use within the watershed consists of more forest/woodland (65.0%) than grassland/cropland (33.7%). The Eleven Point River between Thomasville and Highway 142 has been designated as a National Scenic River Area. There have been no significant channel alterations anywhere within Missouri portion the Eleven Point Watershed. Small channelization projects have probably occurred on private and municipal property and also during road and bridge construction.

The biotic community of the Eleven Point Watershed is diverse. Sixty-six species of fish, 10 species of mussels, and 6 species of crayfish have been collected within the watershed. Several species of sport fish occur within the watershed including shadow bass, smallmouth bass, largemouth bass, chain pickerel, rainbow trout, warmouth, sauger, black crappie and walleye. In addition, a total of 76 "species of conservation concern" are known to occur within the watershed. This includes four species of fish, one species of amphibian, three species of mussel, and two species of crayfish.

The management goals, objectives, and strategies for the Eleven Point Watershed were developed using information collected from the Eleven Point Watershed Assessment and Inventory (WAI) and direction provided by the MDC Strategic Plan, and the Fisheries Division Five Year Strategic Plan (1995-2000). Objectives and strategies were written for instream and riparian habitat, water quality, aquatic biota, and recreational use. All goals are of equal importance. These goals include: (1) Improve riparian and aquatic habitats in the Eleven Point Watershed, (2) Improve surface and subsurface water quality in the Eleven Point Watershed, (3) Maintain the abundance, diversity, and distribution of aquatic biota at or above current levels while improving the quality of the sport fishery in the Eleven Point Watershed, (4) Increase public awareness and promote wise use of aquatic resources in the Eleven Point Watershed. The attainment of these goals will require cooperation with private landowners, other divisions within the Missouri Department of Conservation, as well as other state and federal agencies.

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# LOCATION

The Eleven Point River originates near the town of Willow Springs, located in northeastern Howell County (Figure Bk01 and Bk02). The river flows southeasterly across northern Howell and Oregon Counties and then south, crossing the Arkansas state line about 2.5 miles west of the southeast corner of Oregon County. From there it flows generally south through Randolph County, Arkansas, joining the Spring River approximately 3.7 miles above the Spring River/Black River Confluence near Black Rock, Arkansas. The Black River is a tributary of the White River. The Eleven Point Watershed (http://www.epa.gov/surf2/hucs/11010011/) occupies approximately 1,024 square miles in portions of five counties within Missouri. These include Howell, Oregon, Ripley, Carter, and Shannon. The watersheds bordering the Eleven Point Watershed include the Jacks Fork to the north, the Current and Fourche to the east, and the North Fork of the White River and Spring River Tributaries to the west.

Unless otherwise noted, the information presented in this document refers only to the Eleven Point Watershed in Missouri.

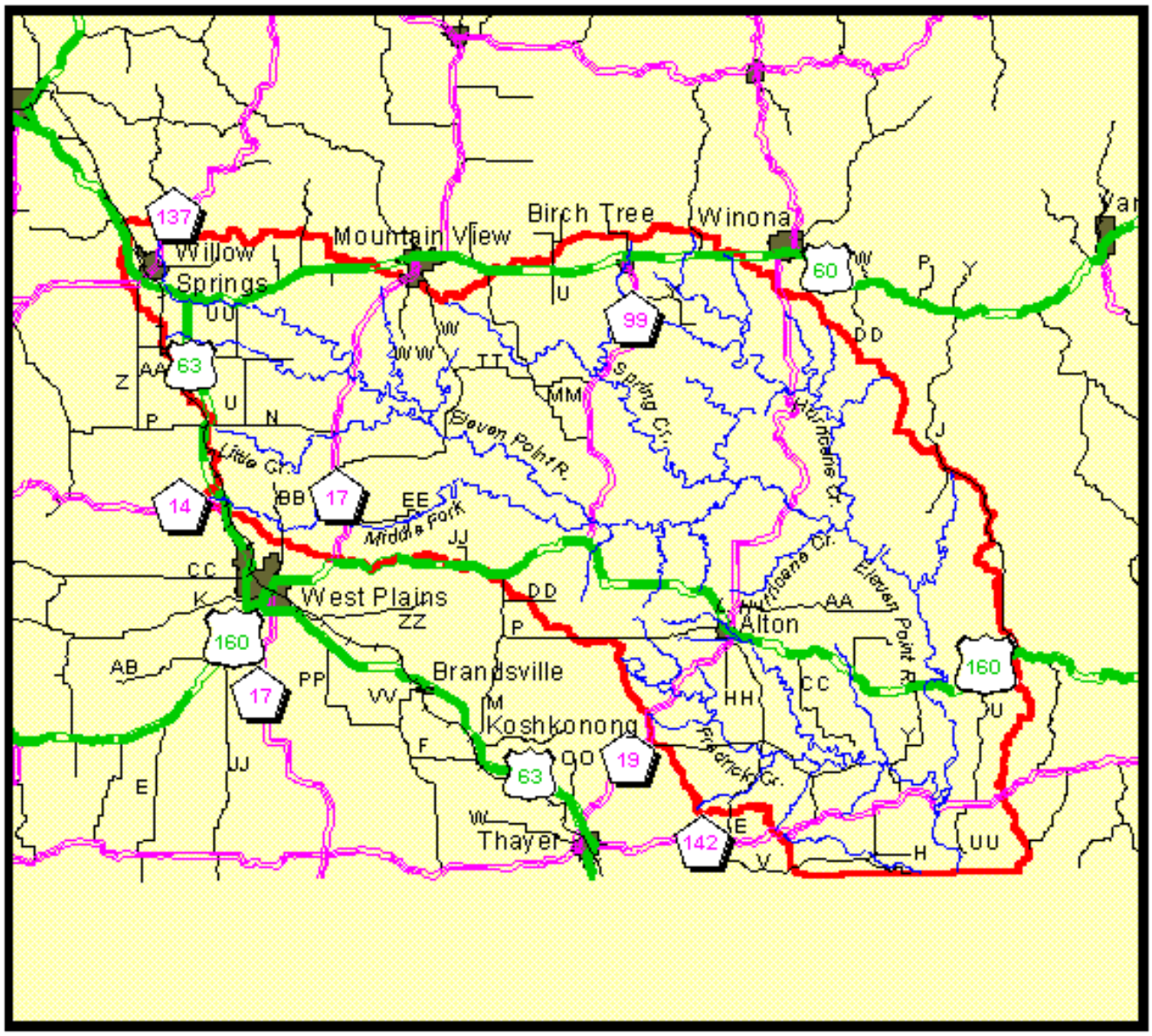
Figure Bk01.

# Eleven Point Watershed
## Location

Figure Bk02.

# Eleven Point Watershed

## Infrastructure




5 0 5 10 Miles

**Legend**

- Rail Road
- U.S. Highway
- State Primary Road
- State Secondary Road
- Watershed Boundary

N

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LO03

# *GEOLOGY*

## Physiographic Region

The Eleven Point Watershed lies within the Salem Plateau Subdivision of the Ozark Plateau. The Salem Plateau is a heavily dissected plateau with upland elevations of between 1,000 and 1,400 feet (MDNR 1986). Local relief on the uplands is between 100 to 200 feet. In areas of deeply intrenched valleys, local relief ranges between 200 to 500 feet (MDNR 1986). Elevations within the Eleven Point Watershed range between 1,500 feet above mean sea level (msl) in the uplands to less than 340 feet above msl in the lower portions of the watershed within Missouri, specifically the Eleven Point River near the state line. Karst features are prominent throughout this area (MDNR 1986 and Fenneman 1938).

## Geology

Geologically, most of the Eleven Point Watershed is underlain by Ordovician age dolomites and sandstone/dolomites (Figure Ge01)(MSDIS 1998). Isolated areas of Mississippian age limestone and limestone/sandstone are also present. Most of the prominent bluffs and steep rugged hillsides along the Eleven Point River were formed in the predominantly light brownish-gray, cherty dolomite of the Gasconade Formation (Nigh 1988). These are capped by a thick layer of Roubidoux Sandstone on the ridges and upper slopes (MDC 1997). The Jefferson City-Cotter Formation, a cherty dolomite occurring along ridge tops, is a common Ordovician age formation in the uplands of the watershed (Nigh 1988 and MDC 1997).

## Soils

The Eleven Point Watershed occurs within the Ozark Soils Region. Allgood and Persinger (1979) describe the Ozark Soils Region as "cherty limestone ridges that break sharply to steep side slopes of narrow valleys. Loess occurs in a thin mantle or is absent. Soils formed in the residuum from cherty limestone or dolomite range from deep to shallow and contain a high percentage of chert in most places. Some of the soils formed in a thin mantle of loess are on the ridges and have fragipans, which restrict root penetration. Soil mostly formed under forest vegetation with native, mid-tall and tall grasses common in open or glade area."

***The following is a list of soil associations found in the Eleven Point Watershed in Missouri:***

**Captina-Macedonia-Doniphan-Poynor**

**Captina-Macedonia-Clarksville**

**Captina-Clarksville-Doniphan**

**Wilderness-Clarksville-Coulstone**

**Hartville-Ashton-Cedargap-Nolin (alluvial)**

**(Allgood and Persinger 1979)**

## Stream Mileage, Order and Permanency, Springs

Using United States Geological Survey (USGS) 7.5 minute topographic maps, a total of 139 third order

and larger streams were identified. Of the 139 third order and larger tributaries to the Eleven Point River, 106 are third order, 27 are fourth order, 4 are fifth order, and 1 is sixth order. The Eleven Point River is seventh order when it reaches the Arkansas state line (Table Ge01 and Figures Ge02, 03, and 04).

The Eleven Point Watershed is exceptional for the number and length of losing streams in the upper and middle portions of the watershed (Table Ge02)(MDNR 1994). Nearly all streams, with the exception of the lower two miles of Hurricane Creek and the Eleven Point River below Thomasville, lose substantial amounts of surface flow to the groundwater system (MDNR 1994). The losing streams, sink holes, and other karst features recharge many springs within the watershed as well as others outside the watershed (MDNR 1996; Vineyard and Feder 1974). Based on the United States Geological Survey Geographic Names Information System Data as well as Vineyard and Feder (1974), it has been determined that there are a total of 64 named springs within the watershed. Seventeen springs with records of discharge are listed by Vineyard and Feder (1974) (Table Ge03 and Figure Ge05). All the major springs in the watershed emerge on, or near, the Eleven Point River. Twelve of the major springs, including Greer Spring, emerge from the Gasconade Formation (Vineyard and Feder 1974; MDNR 1994). Greer Spring is the second largest spring in the state with an average flow of 289 cubic feet per second (cfs). Four other springs emerge from the Roubidoux Formation near the confluence of Frederick Creek and the Eleven Point River (also known as the Narrows) and have a combined flow of 110 cfs (MDNR 1994). These springs assist in maintaining base flows in the middle and lower portions of the Eleven Point River, while streams in the headwaters of the watershed, which lack significant spring input, are frequently dry (MDNR 1994).

Dye tracings have indicated that some surface water recharges Greer Spring and other springs within the Eleven Point Watershed, however, much of the flow from the Upper Eleven Point, Spring Creek, and Hurricane Creek is lost to ground water system which travels in an East-Northeast direction and emerges at Big Spring on the Current River (MDNR 1994; Adamski, Peterson, Freiwald, and Davis 1995; MDNR 1995, 1996). A positive dye trace indicated at least 2/3 of the watershed of Hurricane Creek is in the recharge area of Big Spring. This provides an excellent demonstration that ground water divisions must be determined before water management plans are made in karst topographies. Figure Ge06 displays the results of successful dye traces completed by various state and federal natural resource agencies (USDA-FS 1997 and MDNR 1995,1996).

Using United States Geographical Survey (USGS) 7.5 minute topographical maps permanence of stream flow was determined for third order and larger streams. The USGS identifies streams having water 12 months of the year during years of normal precipitation with a solid blue line. Intermittent streams were identified by a broken blue line and were defined as streams carrying water less than 12 months of a year. Approximately 9% (92.2miles) of the fourth order and larger streams have permanent flow (Table Ge04 and Figures Ge02, 03, and 04). This includes 53% (51.5 miles) of the Eleven Point River; 34% (12.0miles) of Frederick Creek; 16% (5.2 miles) of Spring Creek; and 14% (4.5miles) Hurricane Creek.

## Drainage Area

Drainage areas were determined from digital raster graphic (drg) versions of USGS 1:100,000 and 1:24,000 scale topographic maps. The drainage area of the Eleven Point Watershed in Missouri is 655,802 acres or 1024.7 square miles. The Eleven Point Watershed was divided into six subwatersheds (not to be confused with the 14 digit hydrologic units or the drainage sections which are used in this document for analysis and display purposes) based on drainage areas accounting for $\geq$ 5% of the total

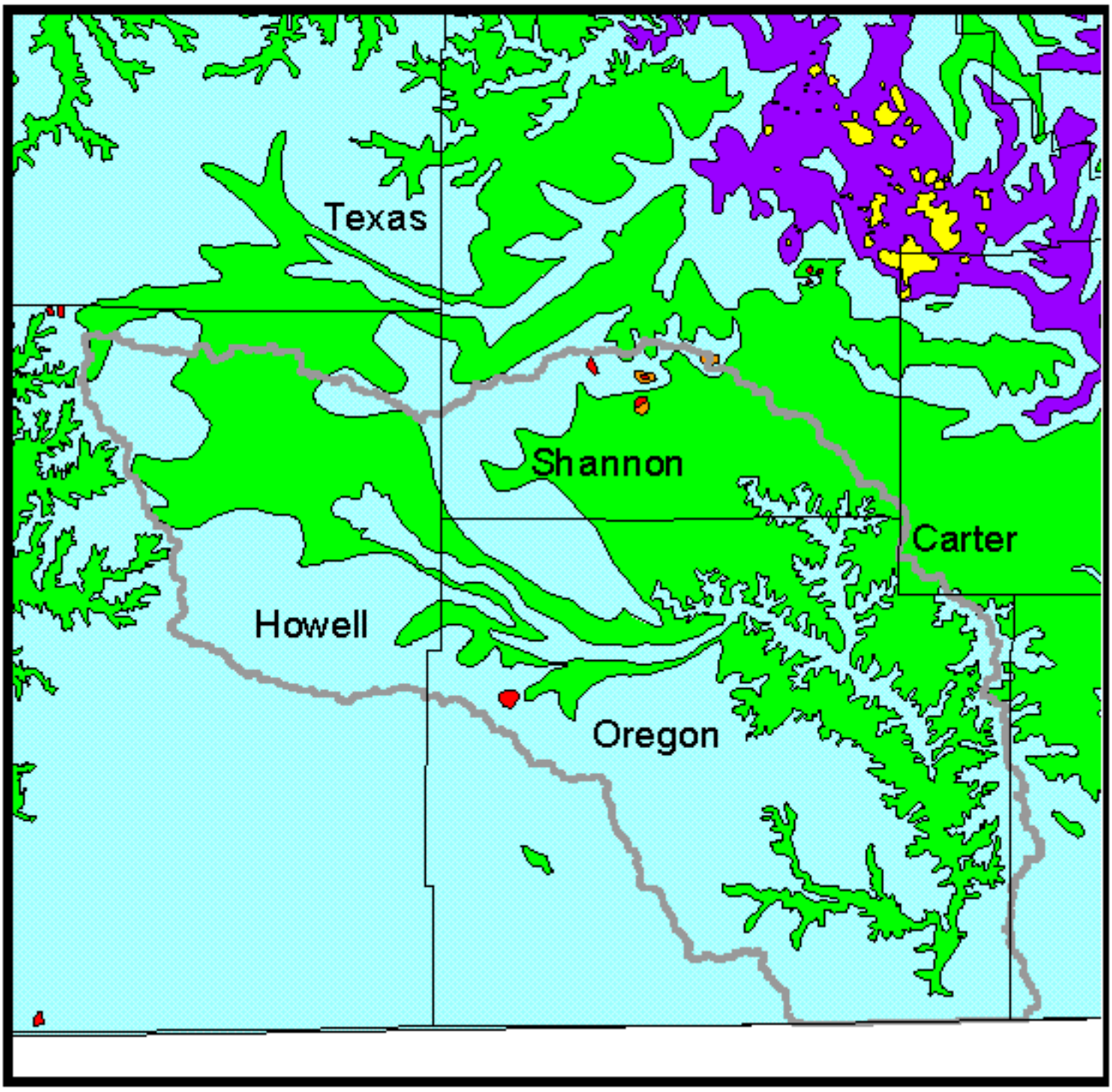
drainage area of the Eleven Point Watershed (Figure GE 07 and Table Ge04). In karst regions such as the Eleven Point River Watershed, it is of equal importance to understand the ground water divisions. As discussed earlier, much of the water produced by the Eleven Point Watershed emerges from springs within other watersheds. It is likely that springs within the Eleven Point Watershed contain ground water from other watersheds.

## Channel Gradient

Gradient information for fourth-order-and-larger streams was obtained from USGS 1:24,000 scale topographical maps. Composite gradient plots were prepared for fifth order and larger stream channels. The Eleven Point River is a high gradient stream, averaging 11.2 feet per mile. The gradient of the Eleven Point River ranges from 5.8 feet per mile at Missouri/Arkansas State line to 98.0 feet per mile at its headwaters (Table Ge05). In general, gradients of the major tributaries to the South and West of the Eleven Point River (Middle Fork; Barren Fork, Fredrick Creek) are lower than those tributaries to the North (Spring Creek; Hurricane Creek). Drainages South and West of the Eleven Point River are characterized by high, relatively flat plains with local relief of 100 to 150 feet occurring near drainages. Long gentle slopes are separated by broad, rounded ridges and wide, flat valleys. Drainages north of the Eleven Point River are characterized by highly dissected hills with narrow ridges and steep side slopes. Local relief ranges from 250 to 500 feet.

Figure Ge01.

# Eleven Point Watershed
## Geology



## Legend

Watershed Boundary

**Geology***

- Cambrian Dolomite
- Ordovician Dolomite
- Missippippian Limestone/Sandstone
- Mississippian Limestone
- Ordovician Sandstone/Dolomite
- Precambrian Igneous

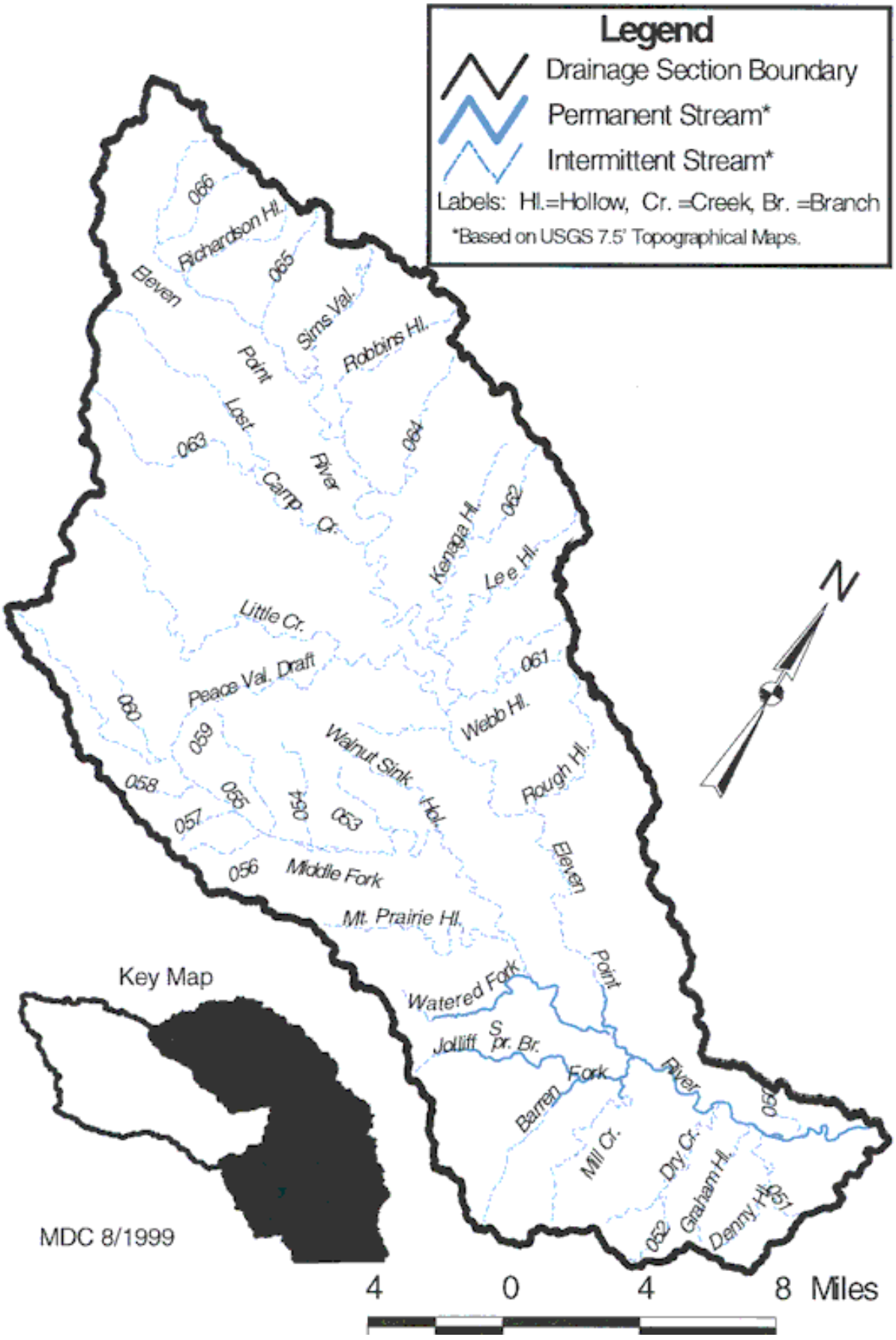
*Based on digitized version of 1979 1:500,000 scale state geologic map (Missouri Spatial Data Information Service-MSDIS 1998).


MDC 5/1999

Figure Ge02

# Upper Eleven Point Drainage Section

## Third Order and Larger Streams

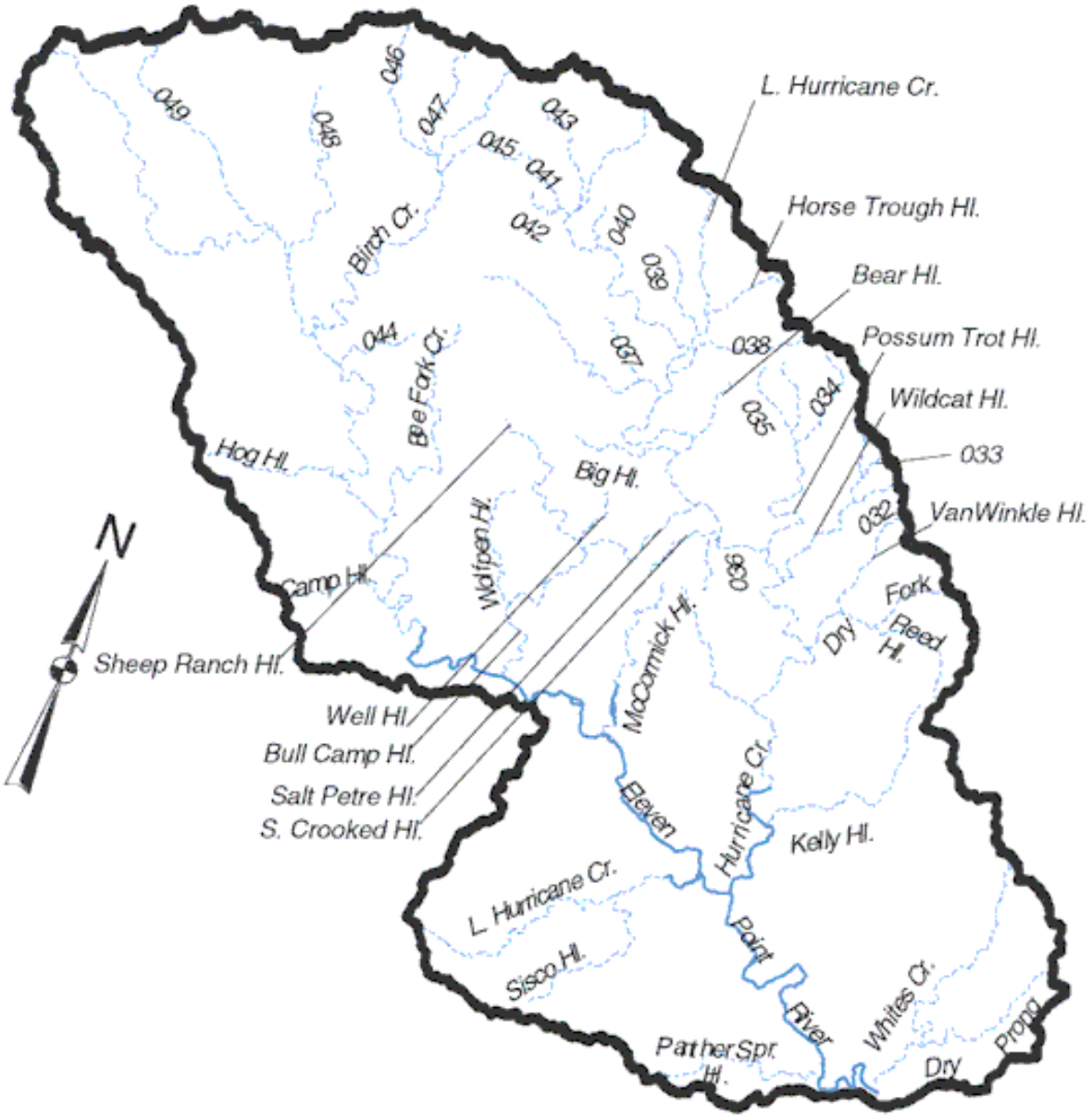



GE06

Figure Ge03

# Middle Eleven Point Drainage Section

## Third Order and Larger Streams




Key Map

3 0 3 6 Miles

## Legend

Drainage Section Boundary

Permanent Stream*

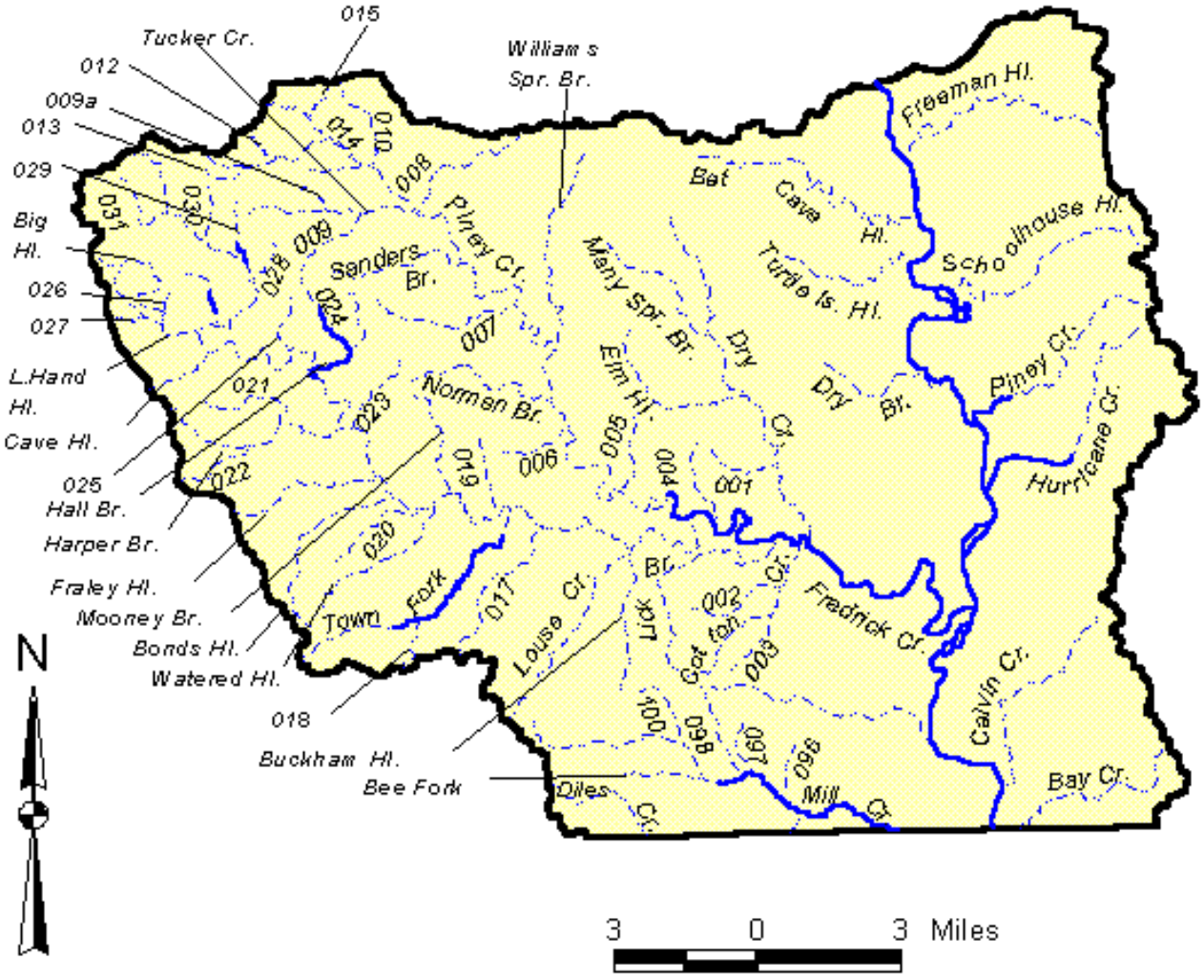
Intermittent Stream*

Labels: Hl.=Hollow, Cr. =Creek, Br. =Branch

*Based on USGS 7.5' Topographical Maps.

Figure Ge04.

# Lower Eleven Point Drainage Section
## Third Order and Larger Streams




## Legend

Drainage Section Boundary

Permanent Stream*

Intermittent Stream*

Labels: Hl.=Hollow, Cr. =Creek, Br. =Branch

*Based on USGS 7.5' Topographical Maps.

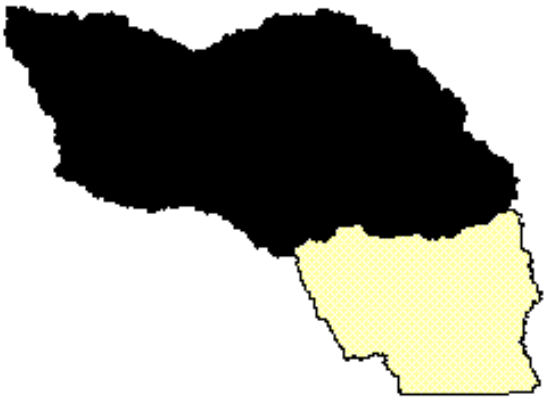


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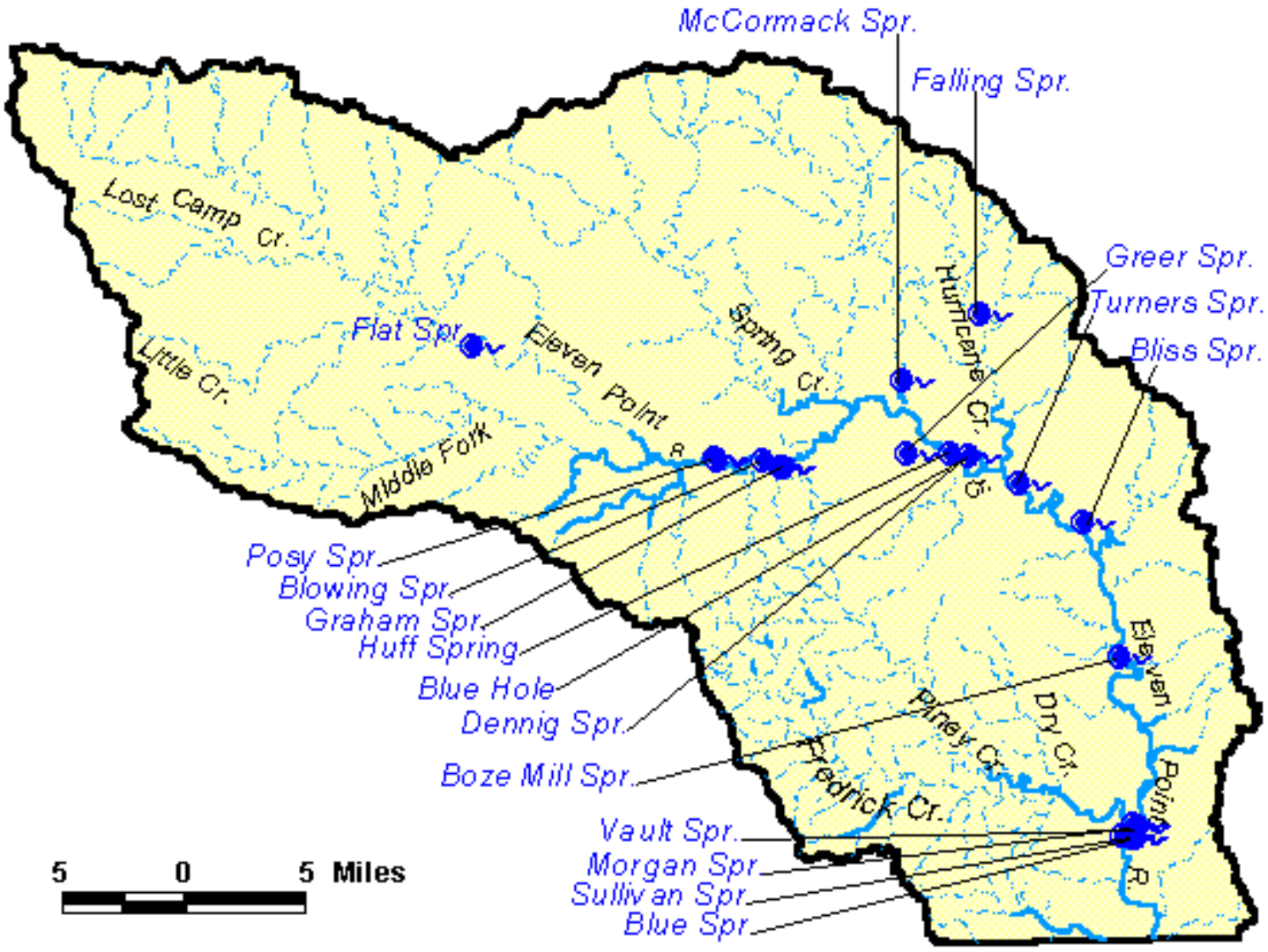
Figure Ge05.

# Eleven Point Watershed
## Springs




**Legend**

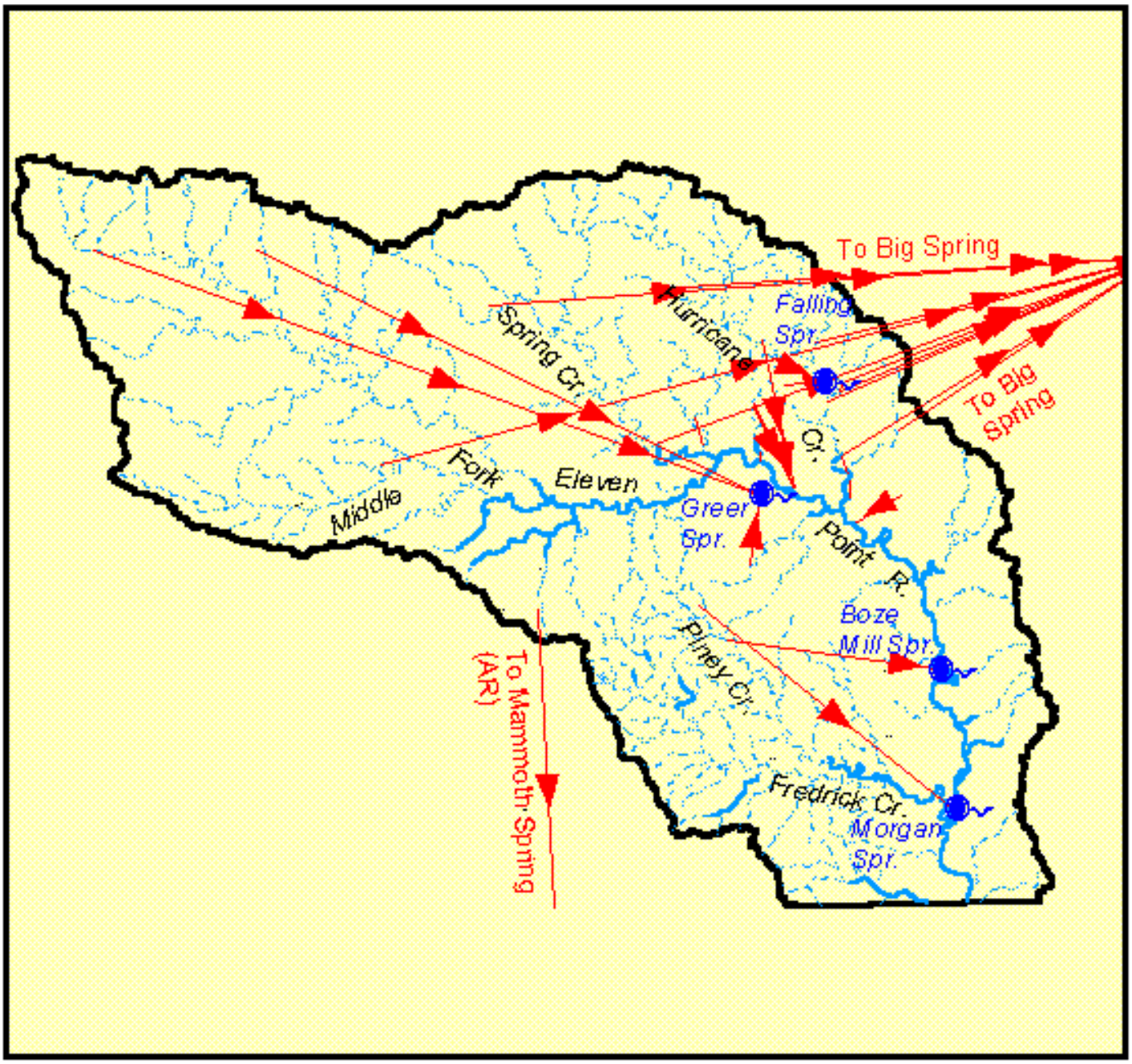
Spring

Only springs listed by Vineyard and Feder (1974) are displayed.

MDC 5/1999

Figure Ge06.

# Eleven Point Watershed
## Ground Water Movement




5 0 5 10 Miles

**Legend**

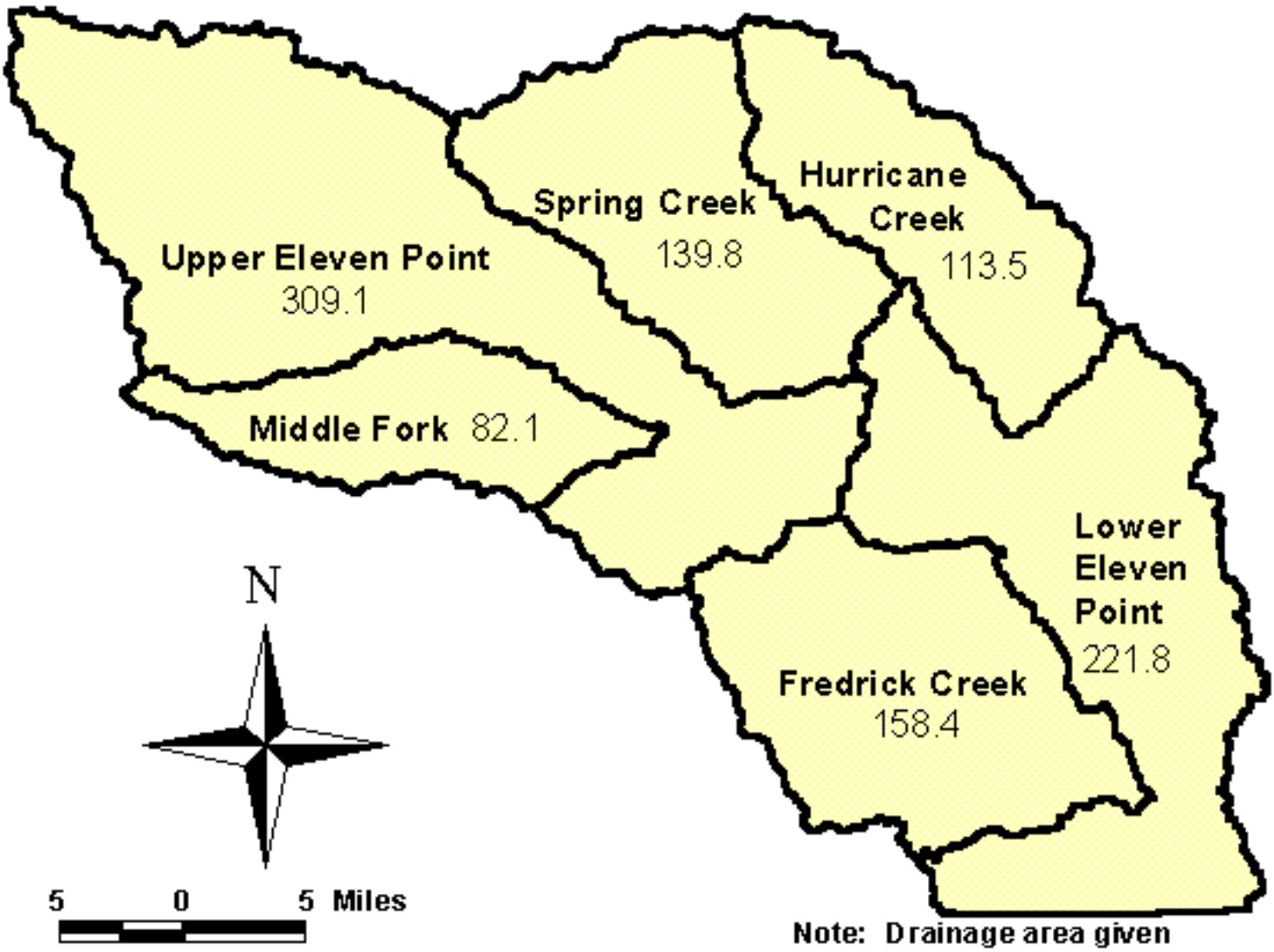
Dye Trace

Watershed Boundary

N

Figure Ge07.

# Eleven Point Watershed
## Subwatersheds




Note: Drainage area given in square miles.

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Figure Ge08. Gradient Plot for Upper Eleven Point and Major tributaries.

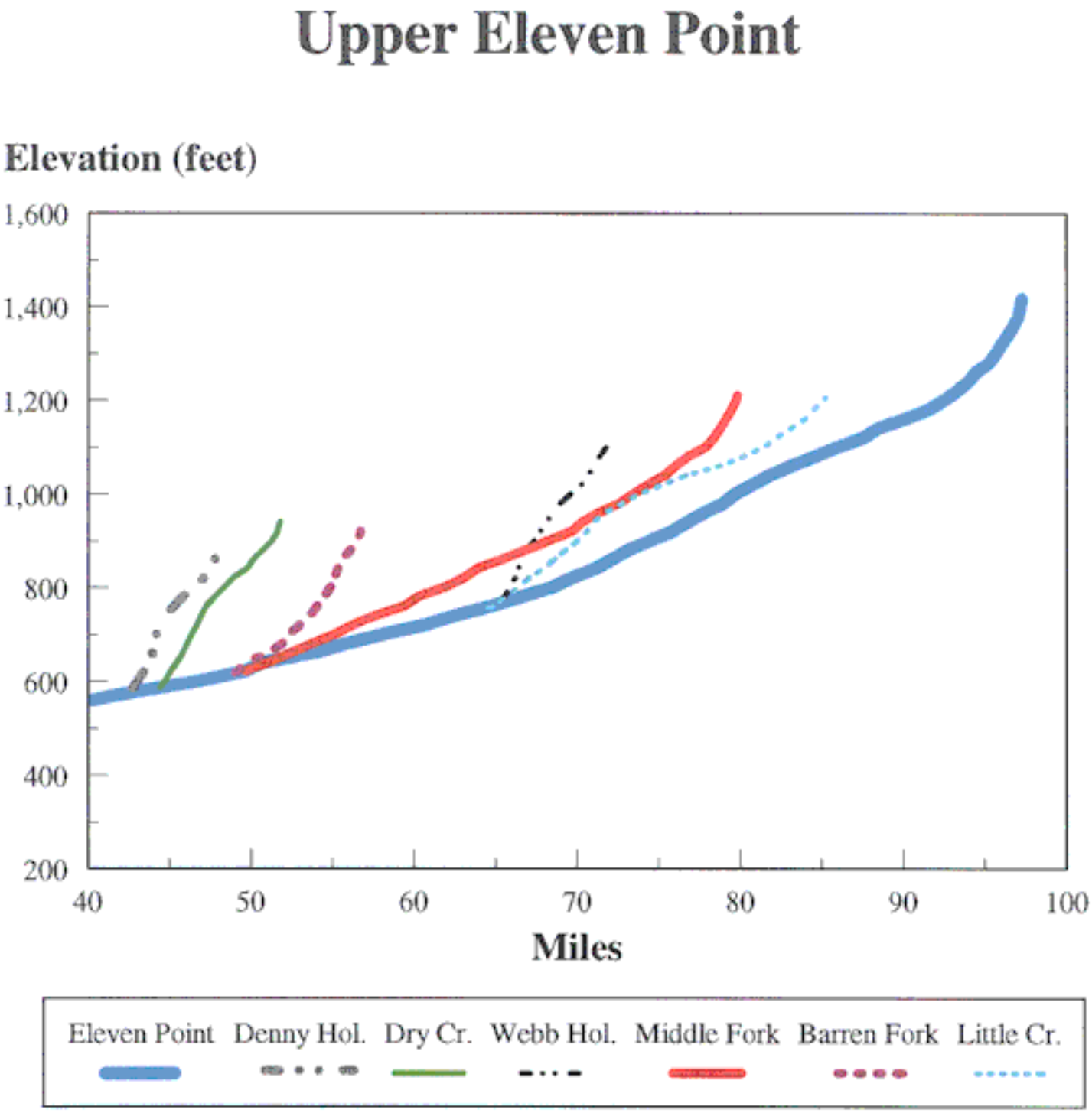


Figure Ge09. Gradient Plot for Middle Eleven Point and Major tributaries.

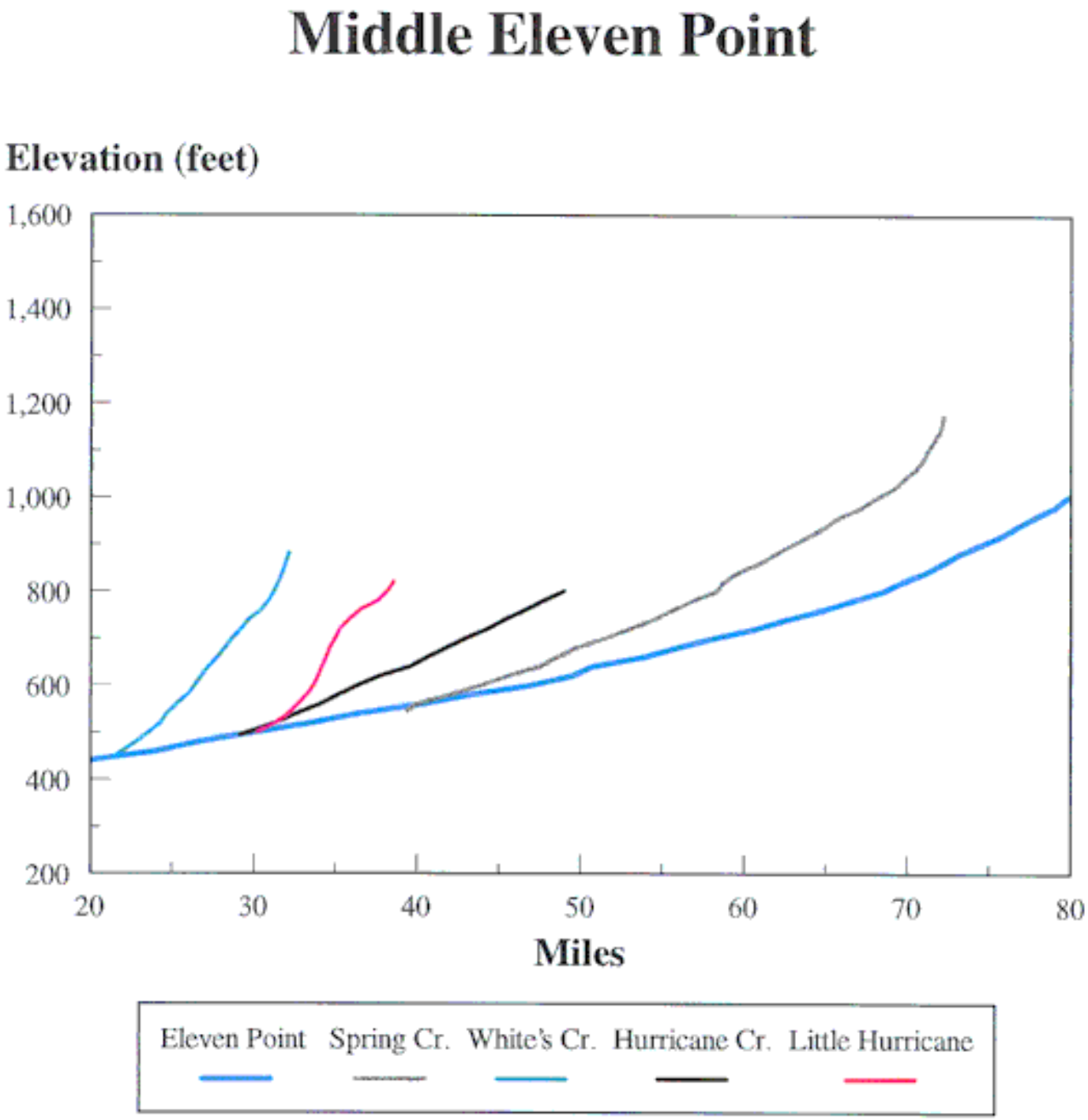


Figure Ge10. Gradient Plot for Lower Eleven Point and major tributaries.

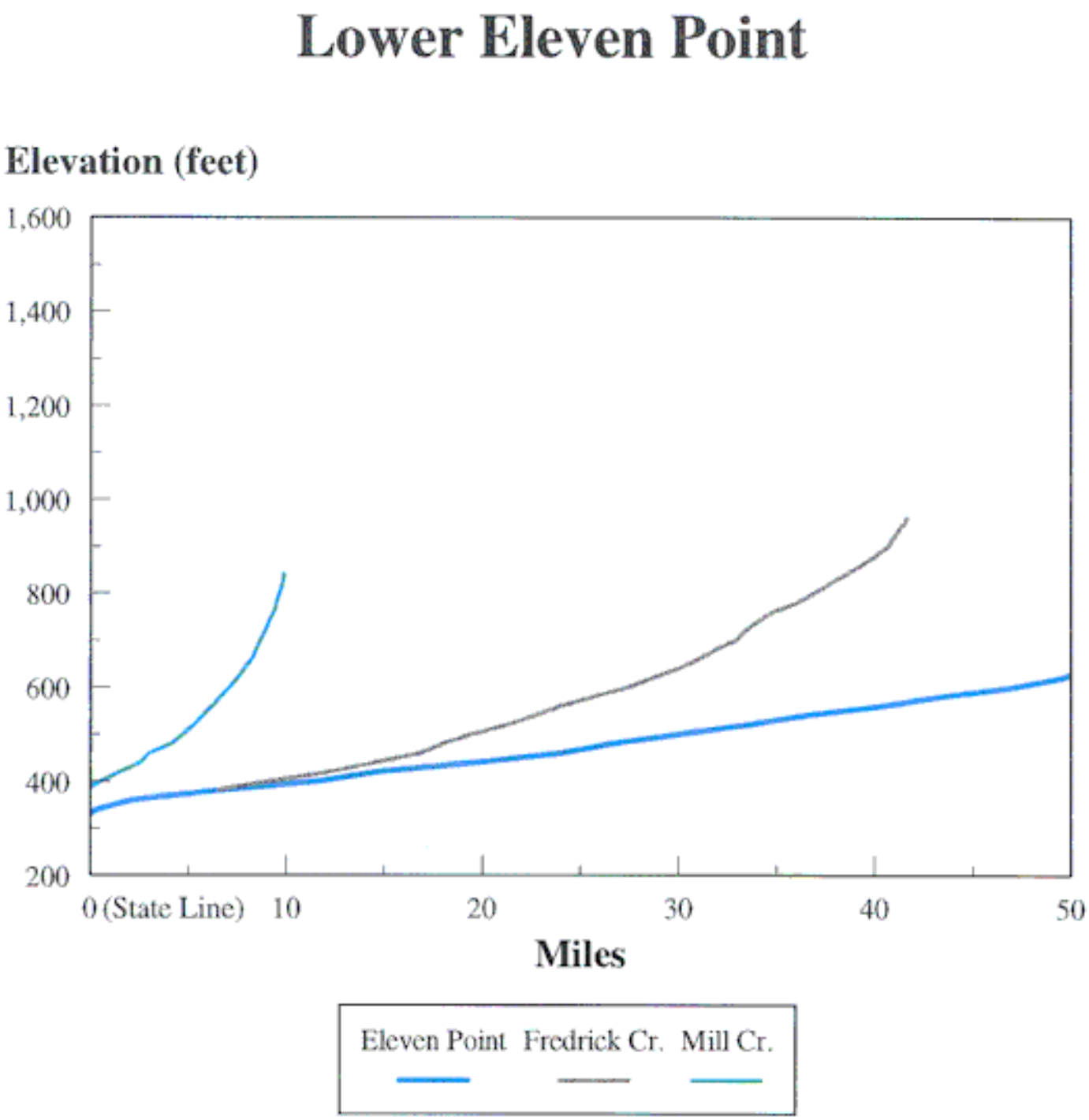


Figure Ge11. Gradient Plot for Fredrick Creek and major tributaries.

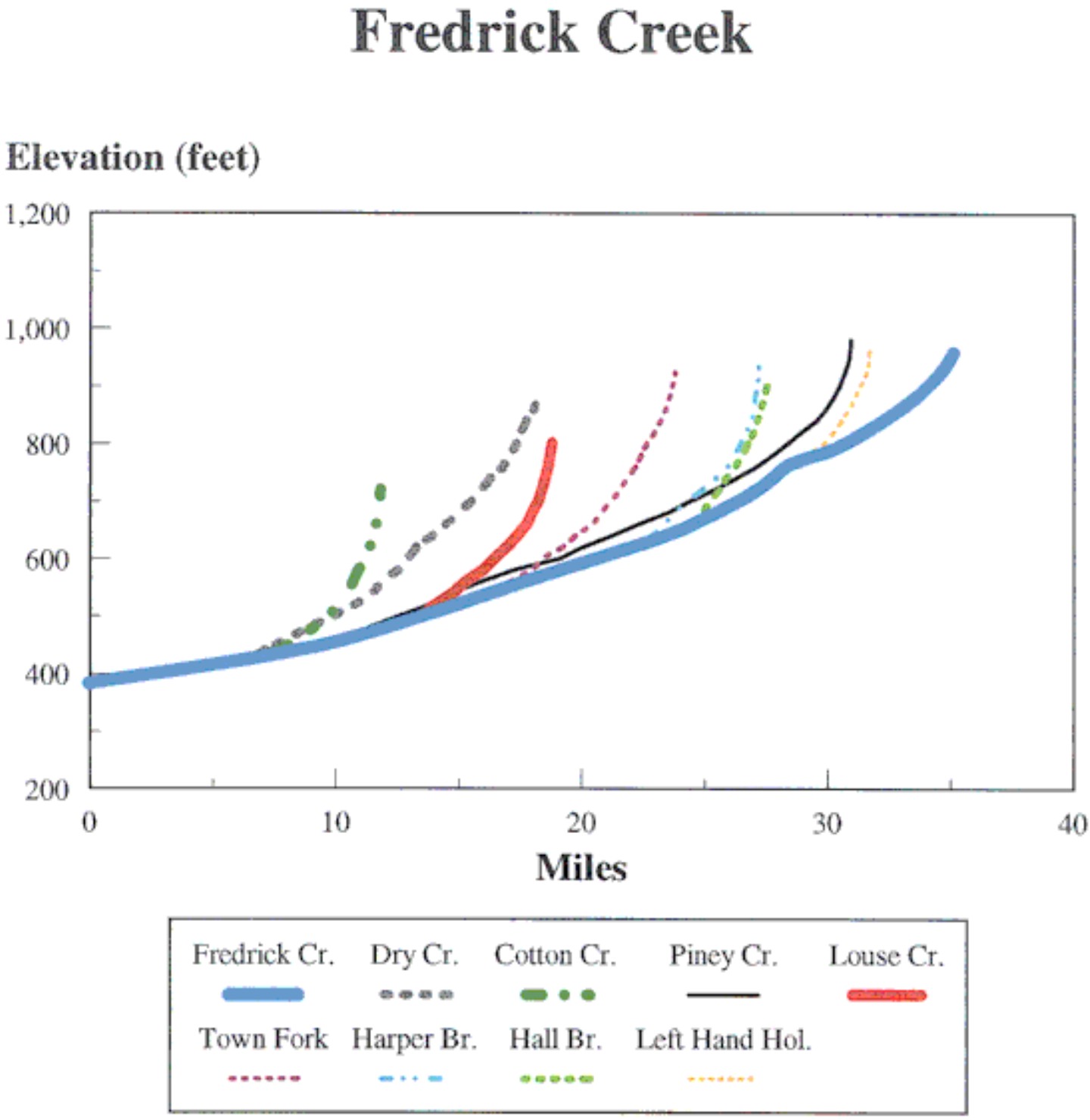


Figure Ge12. Gradient Plot for Left Hand Hollow and major tributary.

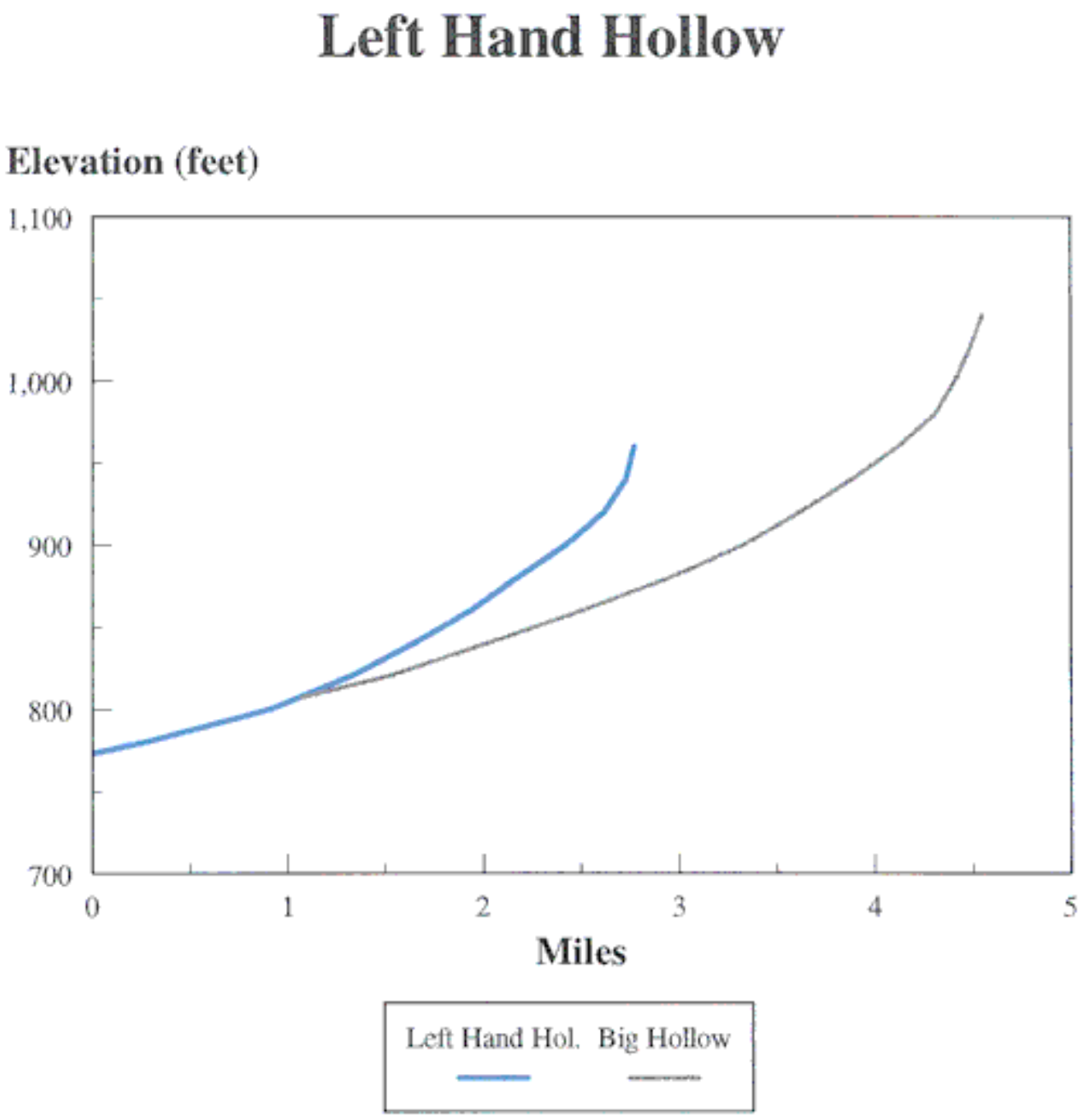


Figure Ge13. Gradient Plot for Piney and major tributary.

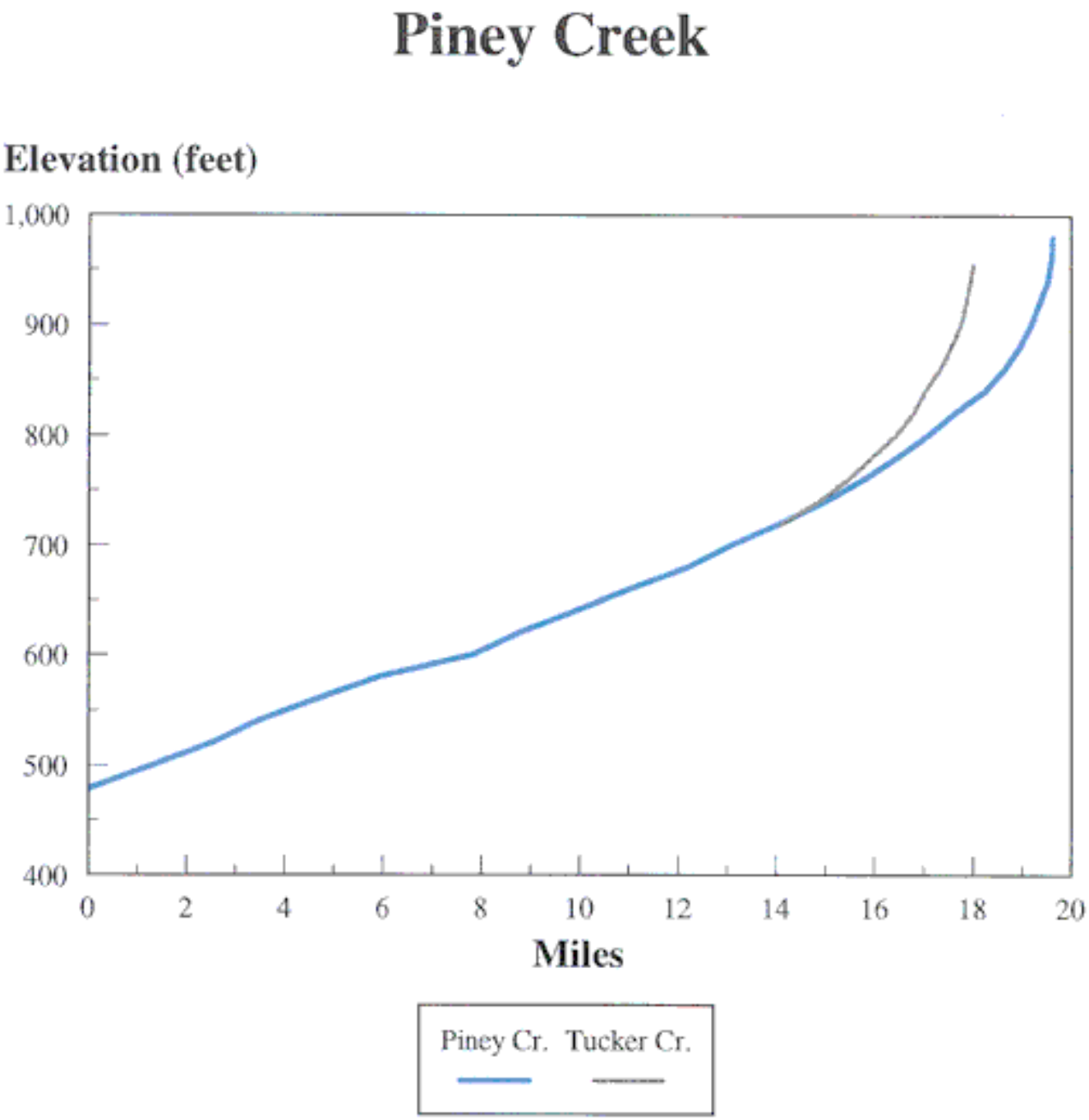


Figure Ge14. Gradient Plot for Hurricane Creek and major tributaries.

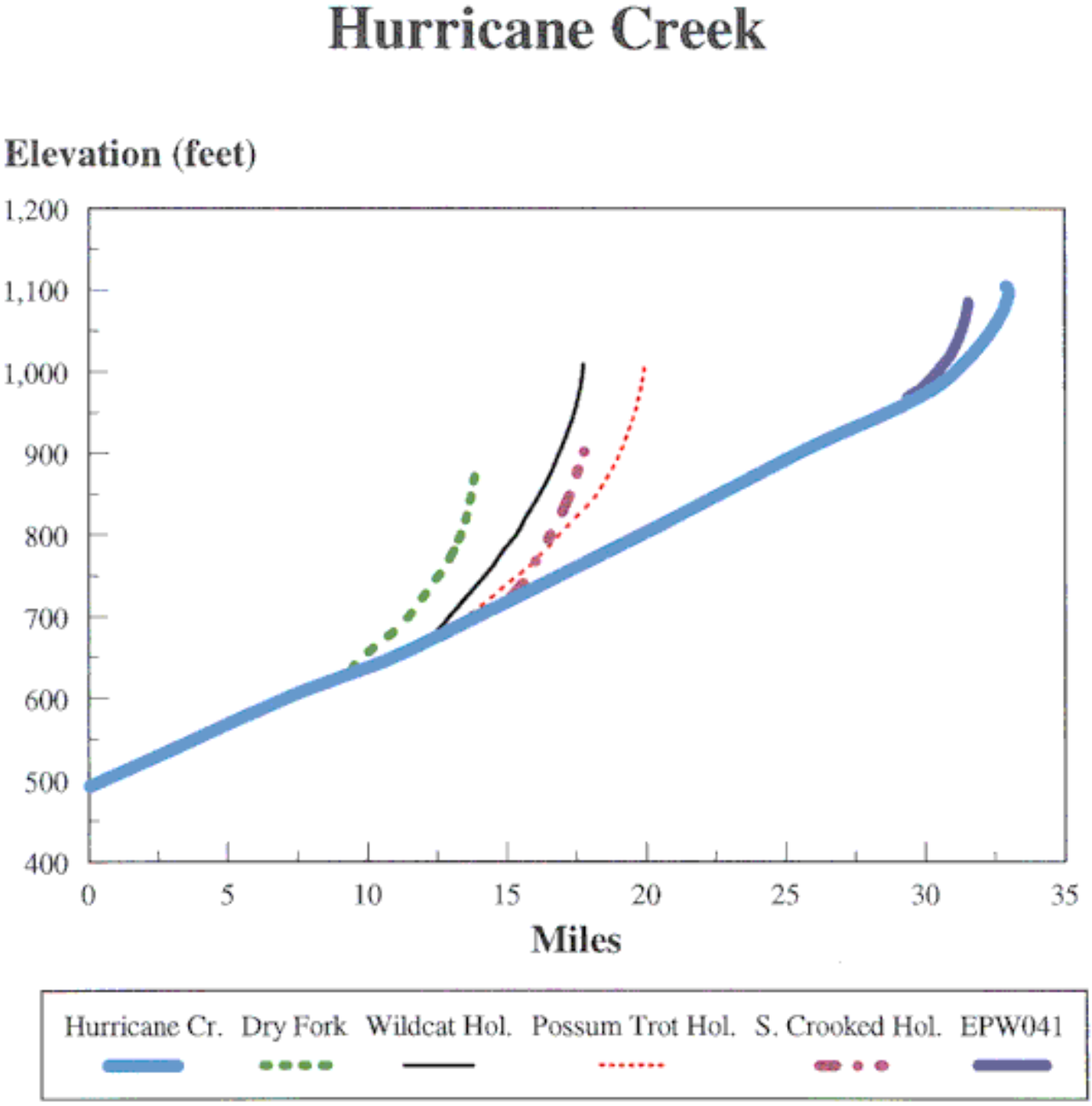


Figure Ge15. Gradient Plot for Spring Creek and major tributaries.

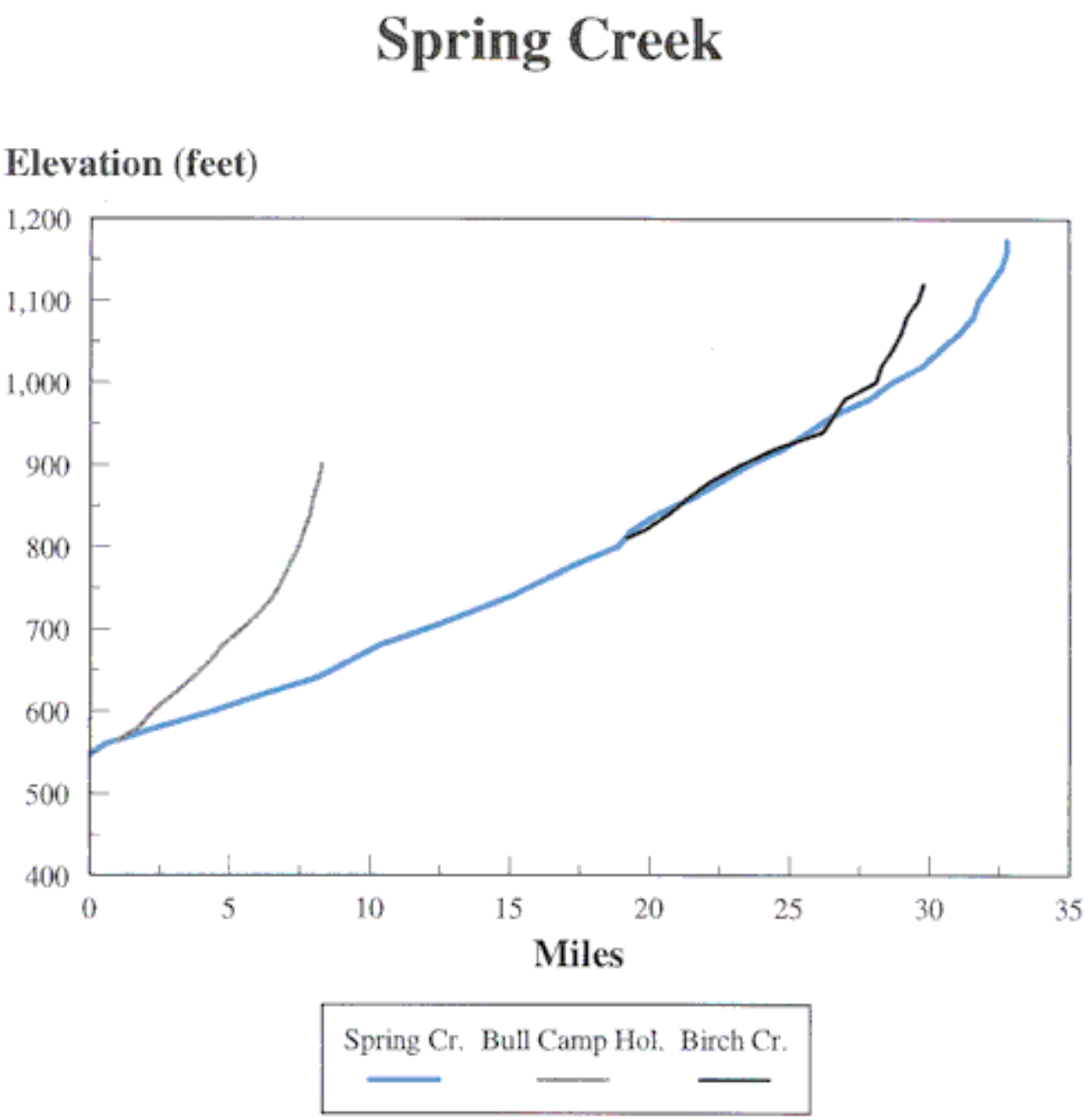


**Table Ge01. Third order and larger streams of the Eleven Point Watershed.**

| Stream Name | Order | USGS 7.5' Quad at Stream Mouth | Name and Order Downstream Link |
|---|---|---|---|
| Bay Creek | 3* | Dalton AR | Eleven Point R. AR |
| Mill Creek | 4* | Dalton AR | Eleven Point R. AR |
| EPW095 | 3 | Billmore | Mill Cr. 4 |
| EPW096 | 3 | Billmore | Mill Cr. 4 |
| EPW097 | 3 | Billmore | Mill Cr. 4 |
| EPW098 | 3 | Myrtle | Mill Cr. |
| Bee Fork | 3 | Myrtle | Mill Cr. 4 |
| Eleven Point River | 7 | Billmore | Spring R. AR |
| Diles Creek | 3* | Dalton AR | Eleven Point R. AR |
| Calvin Creek | 3 | Billmore | Eleven Point R. 7 |
| Spring Valley Cr. | 3 | Billmore | Eleven Point R. 7 |
| Fredrick Creek | 6 | Billmore | Eleven Point R. 7 |
| Dry Creek | 4 | Billmore | Fredrick Cr. 6 |

| | | | |
|---|---|---|---|
| **EPW001** | **3** | **Myrtle** | **Dry Cr. 4** |
| **Elm Hollow** | **3** | **Many Springs** | **Dry Cr. 4** |
| **Many Springs Br.** | **3** | **Many Springs** | **Dry Cr. 4** |
| **Cotton Creek** | **4** | **Billmore** | **Fredrick Cr. 6** |
| **EPW002** | **3** | **Myrtle** | **Cotton Cr. 4** |
| **EPW003** | **3** | **Myrtle** | **Cotton Cr. 4** |
| **Lick Branch** | **3** | **Myrtle** | **Fredrick Cr.6** |
| **EPW004** | **3** | **Myrtle** | **Fredrick Cr. 6** |
| **Piney Creek** | **5** | **Myrtle** | **Fredrick Cr. 6** |
| **EPW006** | **3** | **Myrtle** | **Piney Cr. 5** |
| **EPW005** | **3** | **Myrtle** | **Piney Cr. 5** |

| Stream Name | Order | USGS 7.5' Quad at Stream Mouth | Name and Order Downstream Link |
|---|---|---|---|
| **Norman Branch** | **3** | **Many Springs** | **Piney Cr. 5** |
| **Williams Spring Br.** | **3** | **Many Springs** | **Piney Cr. 5** |

| | | | |
|---|---|---|---|
| **EPW007** | **3** | **Many Springs** | **Piney Cr. 5** |
| **Sanders Branch** | **3** | **Many Springs** | **Piney Cr. 5** |
| **EPW008** | **3** | **Alton** | **Piney Cr. 5** |
| **Tucker Creek** | **4** | **Alton** | **Piney Cr. 5** |
| **EPW009** | **3** | **Alton** | **Tucker Cr. 4** |
| **EPW0009a** | **3** | **Alton** | **Tucker Cr. 4** |
| **EPW010** | **3** | **Alton** | **Piney Cr. 5** |
| **EPW011** | **3** | **Alton** | **Piney Cr. 5** |
| **EPW012** | **3** | **Alton** | **Piney Cr. 4** |
| **EPW013** | **3** | **Alton** | **Piney Cr. 4** |
| **EPW014** | **4** | **Alton** | **Piney Cr. 5** |
| **EPW015** | **3** | **Alton** | **EPW014, 4** |
| **EPW016** | **3** | **Alton** | **Piney Cr. 4** |
| **Louse Creek** | **4** | **Myrtle** | **Fredrick Cr. 5** |
| **Buckham Hollow** | **3** | **Myrtle** | **Louse Cr. 4** |

| | | | |
|---|---|---|---|
| EPW017 | 3 | Myrtle | Fredrick Cr. 5 |
| Town Fork | 4 | Myrtle | Fredrick Cr. 5 |
| EPW018 | 3 | Couch | Town Fork 4 |
| EPW019 | 3 | Myrtle | Fredrick Cr. 5 |
| Mooney Branch | 3 | Myrtle | Fredrick Cr. 3 |
| Watered Hollow | 3 | Couch | Fredrick Cr. 5 |

| Stream Name | Order | USGS 7.5' Quad at Stream Mouth | Name and Order Downstream Link |
|---|---|---|---|
| Bonds Hollow | 3 | Couch | Fredrick Cr. 5 |
| EPW023 | 3 | Couch | Fredrick Cr. 5 |
| Harper Branch | 4 | Couch | Fredrick Cr. 5 |
| EPW021 | 3 | Couch | Harper Br. 4 |
| EPW022 | 3 | Couch | Harper Br. 4 |
| Hall Branch | 4 | Alton | Fredrick Cr. 5 |
| EPW024 | 3 | Alton | Hall Br. 4 |

| | | | |
|---|---|---|---|
| **EPW025** | **3** | **Alton** | **Fredrick Cr. 5** |
| **Cave Hollow** | **3** | **Alton** | **Fredrick Cr. 5** |
| **Left Hand Hollow** | **5** | **Alton** | **Fredrick Cr. 4** |
| **Big Hollow** | **4** | **Alton** | **Left Hand Hol. 5** |
| **EPW026** | **3** | **Alton** | **Big Hol. 4** |
| **EPW027** | **3** | **Alton** | **Left Hand Hol. 5** |
| **Cow Hollow** | **3** | **Alton** | **Fredrick Cr. 4** |
| **EPW028** | **3** | **Alton** | **Fredrick Cr. 4** |
| **EPW029** | **3** | **Alton** | **Fredrick Cr. 4** |
| **EPW030** | **3** | **Alton** | **Fredrick Cr. 4** |
| **EPW031** | **3** | **Alton** | **Fredrick Cr. 4** |
| **Hurricane Creek** | **3** | **Billmore** | **Eleven Point R. 6** |
| **Piney Creek** | **3** | **Billmore** | **Eleven Point R. 6** |
| **Dry Branch** | **3** | **Riverton** | **Eleven Point R. 6** |
| **Schoolhouse Hol.** | **3** | **Riverton** | **Eleven Point R. 6** |

| Stream Name | Order | USGS 7.5' Quad at Stream Mouth | Name and Order Downstream Link |
|---|---|---|---|
| Freeman Hollow | 3 | Riverton | Eleven Point R. 6 |
| Whites Creek | 4 | Riverton | Eleven Point R. 6 |
| Dry Prong | 3 | Wilderness | Whites Cr. 4 |
| Panther Spr. Hol. | 3 | Riverton | Eleven Point R. 6 |
| Hurricane Creek | 5 | Greer | Eleven Point R. 6 |
| Kelly Hollow | 3 | Greer | Hurrican Cr. 5 |
| Cook Hollow | 3 | Greer | Hurricane Cr. 5 |
| Dry Fork | 4 | Greer | Hurricane Cr. 5 |
| Van Winkle Hol. | 3 | Low Wassie | Dry Fork 4 |
| Reed Hollow | 3 | Low Wassie | Dry Fork 4 |
| Wildcat Hollow | 4 | Low Wassie | Hurricane Cr. 5 |
| EPW032 | 3 | Low Wassie | Wildcat Hol. 4 |
| EPW033 | 3 | Low Wassie | Wildcat Hol. 4 |
| Possum Trot Hol. | 4 | Low Wassie | Hurricane Cr. 5 |

| | | | |
|---|---|---|---|
| EPW034 | 3 | Low Wassie | Possum Trot Hol. 4 |
| EPW035 | 3 | Low Wassie | Possum Trot Hol. 4 |
| S. Crooked Hollow | 4 | Low Wassie | Hurricane Cr. 5 |
| EPW036 | 3 | Low Wassie | S. Crooked Hol. 4 |
| Salt Petre Hollow | 3 | Low Wassie | Hurricane Cr. 5 |
| Big Hollow | 3 | Low Wassie | Hurricane Cr. 5 |
| Bear Hollow | 3 | Low Wassie | Hurricane Cr. 5 |
| S. Fork Hurricane Cr. | 4 | Birch Tree | Hurricane Cr. 5 |
| EPW037 | 3 | Birch Tree | S.F. Hurricane Cr. |
| Little Hurricane Creek | 4 | Birch Tree | Hurricane Cr. 5 |

| Stream Name | Order | USGS 7.5' Quad at Stream Mouth | Name and Order Downstream Link |
|---|---|---|---|
| EPW038 | 3 | Low Wassie | L. Hurricane C.r 4 |
| EPW039 | 3 | Low Wassie | L. Hurricane Cr. 4 |
| Horse Trough Hollow | 3 | Low Wassie | L. Hurricane Cr. 4 |

| | | | |
|---|---|---|---|
| **EPW040** | **3** | **Birch Tree** | **Hurricane Cr. 5** |
| **EPW041** | **4** | **Birch Tree** | **Hurrcane Cr. 5** |
| **EPW042** | **3** | **Birch Tree** | **EPW041, 4** |
| **EPW043** | **3** | **Birch Tree** | **Hurricane Cr. 4** |
| **Little Hurricane Cr.** | **4** | **Greer** | **Eleven Point R. 6** |
| **Sisco Hollow** | **3** | **Greer** | **L. Hurricane Cr. 4** |
| **McCormack Hollow** | **3** | **Greer** | **Eleven Point R. 6** |
| **Spring Creek** | **5** | **Piedmont Hollow** | **Eleven Point R. 6** |
| **Bull Camp Hollow** | **4** | **Piedmont Hollow** | **Spring Cr. 5** |
| **Sheep Ranch Hollow** | **4** | **Piedmont Hollow** | **Bull Camp Hol. 4** |
| **Well Hollow** | **3** | **Piedmont Hollow** | **Sheep Ranch Hol. 4** |
| **Wolfpen Hollow** | **3** | **Piedmont Hollow** | **Bull Camp Hol. 4** |
| **Camp Hollow** | **3** | **Piedmont Hollow** | **Spring Cr. 5** |
| **Bee Fork Creek** | **3** | **Piedmont Hollow** | **Spring Cr. 5** |
| **Hog Hollow** | **3** | **Piedmont Hollow** | **Spring Cr. 5** |

| | | | |
|---|---|---|---|
| EPW044 | 3 | Montier | Spring Cr. 5 |
| Birch Creek | 4 | Montier | Spring Cr 5 |
| EPW045 | 3 | Birch Tree | Birch Cr. 4 |
| EPW046 | 3 | Montier | Birch Cr. 4 |
| EPW047 | 3 | Montier | Birch Cr. 4 |
| EPW048 | 3 | Montier | Spring Cr. 4 |

| Stream Name | Order | USGS 7.5' Quad at Stream Mouth | Name and Order Downstream Link |
|---|---|---|---|
| EPW049 | 3 | Montier | Spring Cr. 4 |
| EPW050 | 3 | Piedmont Hollow | Eleven Point R. 5 |
| Denny Hollow | 4 | Piedmont Hollow | Eleven Point R. 5 |
| EPW051 | 3 | Piedmont Hollow | Denny Hol. 4 |
| Graham Hollow | 3 | Piedmont Hollow | Eleven Point R. 5 |
| Dry Creek | 4 | Piedmont Hollow | Eleven Point R. 5 |
| EPW052 | 3 | Alton | Dry Cr. 4 |

| | | | |
|---|---|---|---|
| **Barren Fork** | **4** | **Thomasville** | **Eleven Point R. 5** |
| **Jolliff Spring Br.** | **3** | **Thomasville** | **Barren Fork 4** |
| **Thayer Hollow** | **3** | **Rover** | **Barren Fork 4** |
| **Mill Creek** | **3** | **Thomasville** | **Barren Fork 4** |
| **Middle Fork** | **4** | **Thomasville** | **Eleven Point R. 5** |
| **Watered Fork** | **3** | **Thomasville** | **Middle Fork 4** |
| **Mt. Prarie Hollow** | **3** | **Thomasville** | **Middle Fork 4** |
| **Walnut Sink Hol.** | **3** | **Peace Valley** | **Middle Fork 4** |
| **EPW053** | **3** | **Peace Valley** | **Middle Fork 4** |
| **EPW 054** | **3** | **Peace Valley** | **Middle Fork 4** |
| **EPW055** | **3** | **Peace Valley** | **Middle Fork 4** |
| **EPW056** | **3** | **Peace Valley** | **Middle Fork 4** |
| **EPW057** | **3** | **White Church** | **Middle Fork 4** |
| **EPW058** | **3** | **White Church** | **Middle Fork 4** |
| **EPW059** | **3** | **White Church** | **Middle Fork 4** |

| | | | |
|---|---|---|---|
| EPW060 | 3 | White Church | Middle Fork 4 |
| Rough Hollow | 3 | Thomasville | Eleven Point R. 5 |

| Stream Name | Order | USGS 7.5' Quad at Stream Mouth | Name and Order Downstream Link |
|---|---|---|---|
| County Hollow | 3 | Peace Valley | Eleven Point R. 5 |
| Little Creek | 4 | Peace Valley | Eleven Point R. 5 |
| Peace Valley Draft | 3 | White Church | Little Cr. 4 |
| Webb Hollow | 4 | Mountain View | Eleven Point |
| EPW061 | 3 | Mountain View | Webb Hol. 4 |
| Lee Hollow | 3 | Mountain View | Eleven Point R. 5 |
| Kenaga Hollow | 4 | Mountain View | Eleven Point R. 5 |
| EPW062 | 3 | Mountain View | Kenaga Hol. 4 |
| Lost Camp Creek | 4 | Trask | Eleven Point R. 5 |
| EPW063 | 3 | Trask | Lost Camp Cr. 4 |
| EPW064 | 3 | Trask | Eleven Point R. 4 |

| | | | |
|---|---|---|---|
| **Robbins Hollow** | **3** | **Trask** | **Eleven Point R. 4** |
| **Sims Valley** | **3** | **Trask** | **Eleven Point R. 4** |
| **EPW065** | **3** | **Willow Springs S.** | **Eleven Point R. 4** |
| **Richardson Hollow** | **3** | **Willow Springs S.** | **Eleven Point R. 4** |
| **EPW066** | **3** | **Willow Springs S.** | **Eleven Point R. 4** |

**Table Ge02. Eleven Point Watershed stream reaches designated as losing in Table J Rules of Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality. Code of State Regulations (MDNR 1996).**

| Stream | Miles | From | To |
|---|---|---|---|
| Trib to Little Cr. | 2.0 | nw,ne,04,25n,08w | sw,ne,ne,10,25n,08w |
| Lee Hollow | 6.0 | sw,se,nw,35,27n,07w | nw,sw,nw,34,26n,07w |
| Kenaga Hollow | 8.0 | ne,se,nw,28,27n,07w | se,nw,ne,33,26n,07w |
| Middle Fork | 10.0 | nw,nw,sw,35,25n,07w | nw,nw,ne,05,24n,05w |
| Lost Camp Cr. | 12.0 | sw,sw,se,08,26n,09w | se,nw,se,24,26n,08w |
| Trib. to Lost Camp Cr. | 6.0 | nw,ne,nw,28,26n,09w | ne,nw,se,20,26n,08w |
| Eleven Point R. | 32.0 | nw,se,sw,29,27n,09w | sw,se,se,31,25n,05w |
| Trib to Eleven Point R. | 2.5 | se,sw,sw,36,27n,08w | se,nw,nw,13,26n,08w |
| Gunters Valley | 8.0 | sw,sw,nw,03,24n,08w | ne,ne,se,34,25n,07w |
| Little Cr. | 9.0 | nw,sw,sw,16,25n,08w | se,nw,sw,02,25n,07w |
| Trib to Lost Camp Cr. | 12.8 | sw,sw,se,27,26n,09w | se,sw,sw,19,26n,07w |
| Fredrick Cr. | 6.5 | ne,sw,sw,02,22n,03w | sw,nw,nw,15,22n,02w |
| Fredrick Cr. | 20.0 | se,ne,sw,26,24n,05w | ne,sw,sw,02,22n,03w |
| Dry Cr. | 9.0 | sw,sw,nw,28,24n,03w | se,sw,se,01,22n,03w |
| School House Hollow | 3.0 | sw,se,se,36,24n,02w | sw,sw,sw,10,23n,02w |
| Greenbriar Hollow | 4.0 | se,nw,ne,36,24n,02w | ne,se,se,32,24n,02w |
| Freeman Hollow | 3.0 | sw,nw,ne,14,24n,02w | ne,nw,ne,32,24n,02w |
| Unnamed Trib. | 1.5 | se,nw,se,14,24n,02w | nw,sw,sw,22,24n,02w |
| Sitton Valley | 4.0 | ne,sw,ne,17,25n,02w | sw,ne,se,04,24n,02w |
| Dry Prong | 2.0 | se,ne,nw,02,24n,02w | sw,ne,se,09,24n,02w |

| | | | |
|---|---|---|---|
| Whites Cr. | 7.0 | ne,se,ne,21,25n,02w | ne,sw,nw,20,24n,02w |
| Watered Fork | 4.0 | se,se,nw,16,24n,06w | sw,se,sw,35,25n,06w |
| L. Hurricane Cr. | 4.5 | sw,sw,ne,22,24n,04w | se,se,nw,07,24n,03w |

| Stream | Miles | From | To |
|---|---|---|---|
| Piney Cr. | 15.0 | nw,sw,sw,20,24n,04w | se,sw,nw,03,22n,03w |
| Birch Creek | 7.0 | se,se,21,27n,05w | sw,ne,sw,20,26n,05w |
| Birch Creek | 6.0 | nw,ne,sw,32,27n,05w | sw,ne,sw,20,26n,05w |
| Unnamed Trib. | 3.0 | nw,se,se,31,27n,05w | nw,sw,nw,18,26n,05w |
| Unnamed Trib. | 4.0 | ne,nw,nw,34,27n,06w | ne,se,nw,12,26n,06w |
| Spring Cr. | 18.0 | ne,se,nw,08,26n,06w | ne,nw,nw,27,25n,04w |
| L. Hurricane Cr. | 4.5 | se,nw,nw,21,27n,04w | sw,nw,se,10,26n,04w |
| Hurricane Cr. | 15.0 | sw,nw,se,10,26n,04w | ne,ne,sw,34,25n,03w |
| Bee Fork Cr. | 7.0 | sw,sw,sw,11,26n,05w | se,se,nw,11,25n,05w |
| Total | 249.3 | - | - |

**Note: This table is not a final authority. Data subject to change.**

**Table Ge03. Location and discharge of selected springs in the Eleven Point Watershed (Vineyard and Feder 1974).**

| - | - | - | - | - | Flow Rate |
|---|---|---|---|---|---|
| - | - | - | Quad | UTM | (cfs) |
| No. | Spring | County | Name | Cordinates | Date Rec. |
| 1 | | | | | |
| 2 | Blowing | Howell | Peace | 617420 | .98Valley40796206-6-66 |
| 3 | Blue | Oregon | Billmore | 662140 | 72.040470201925-66 |
| 4 | Blue Hole | Oregon | Greer | 651300 | 8.84407220010-18-46 |
| 5 | Boze Mill | Oregon | Riverton | 661400 | 23.040587001925-66 |
| 6 | Dennig | Oregon | Greer | 651320 | 7.38(lower)407218010-18-46 |
| 7 | Dennig | Oregon | Greer | 651320 | 3.06(upper)407220010-18-46 |
| 8 | Falling | Oregon | Greer | 652000 | 0.1440813009-8-44 |
| 9 | Flat | Howell | Peace | 619000 | 0.31Valley40792806-6-66 |
| 10 | Graham | Oregon | Piedmont | 639180 | 0.30Hollow40712308-15-25 |
| 11 | Greer | Oregon | Greer | 647465 | 344.040722701921-95 |
| 12 | Huff | Oregon | Greer | 650160 | 0.78407230010-18-46 |

| - | - | - | | | Flow Rate |
|---|---|---|---|---|---|
| - | - | - | Quad | UTM | (cfs) |
| No. | Spring | County | Name | Cordinates | Date Rec. |
| 13 | McCormack | Oregon | Greer | 647970 | .16407792510-12-65 |
| 14 | Morgan | Oregon | Billmore | 662600 | 32.040476801925-66 |
| 15 | Posy | Oregon | Piedmont | 634825 | 1.89Hollow40717101950-63 |

| | | | | | |
|---|---|---|---|---|---|
| 16 | Sullivan | Oregon | Billmore | 662480 | 5.23404704011-6-63 |
| 17 | Turner Mill | Oregon | Greer | 654470 | 2.3040702501924-65 |
| 18 | Vault | Oregon | Billmore | 662150 | 0.4040478458-11-25 |

**Table Ge04. Total length and length of permanent stream of third order and larger (1 of 7) streams as well as drainage area of streams draining ≥ 5% of the Eleven Point Watershed.**

| Stream Name | Length (Miles) | Miles Permanent | Drainage Area ($mi^2$) |
|---|---|---|---|
| Bay Creek | 4.5 | 0 | - |
| Mill Creek | 9.6 | 5.1 | - |
| EPW095 | 0.6 | 0 | - |
| EPW096 | 1.4 | 0 | - |
| EPW097 | 1.4 | 0 | - |
| EPW098 | 2.3 | 0 | - |
| Bee Fork | 1.8 | 0 | - |
| Eleven Point River | 97.3 | 51.5 | 1014.4 |
| Diles Creek | 2.8 | 0 | - |
| Calvin Creek | 5.23 | 0 | - |
| Spring Valley Cr. | 5.47 | 0 | - |
| Fredrick Creek | 35.1 | 12 | 158.4 |
| Dry Creek | 11.6 | 0 | - |

| | | | |
|---|---|---|---|
| **EPW001** | **1.7** | **0** | **-** |
| **Elm Hollow** | **3.8** | **0** | **-** |
| **Many Springs Br.** | **3.5** | **0** | **-** |
| **Cotton Creek** | **4.6** | **0** | **-** |
| **EPW002** | **2.2** | **0** | **-** |
| **EPW003** | **1.5** | **0** | **-** |
| **Lick Branch** | **5.6** | **0** | **-** |
| **EPW004** | **2.0** | **0** | **-** |
| **Piney Creek** | **19.6** | **0** | **-** |
| **EPW005** | **1.9** | **0** | **-** |

| Stream Name | Length (Miles) | Miles Permanent | Drainage Area ($mi^2$) |
|---|---|---|---|
| **Norman Branch** | **3.7** | **0** | **-** |
| **Williams Spring Br.** | **5.1** | **0** | **-** |
| **EPW007** | **3.4** | **0** | **-** |

| | | | |
|---|---|---|---|
| **Sanders Branch** | **3.1** | **0** | **-** |
| **EPW008** | **3.5** | **0** | **-** |
| **Tucker Creek** | **3.9** | **0** | **-** |
| **EPW009** | **1.9** | **0** | **-** |
| **EPW0009a** | **0.9** | **0** | **-** |
| **EPW010** | **2.2** | **0** | **-** |
| **EPW011** | **1.1** | **0** | **-** |
| **EPW012** | **0.9** | **0** | **-** |
| **EPW013** | **1.2** | **0** | **-** |
| **EPW014** | **2.2** | **0** | **-** |
| **EPW015** | **0.9** | **0** | **-** |
| **Louse Creek** | **5.0** | **0** | **-** |
| **Buckham Hollow** | **3.1** | **0** | **-** |
| **EPW017** | **3.7** | **0** | **-** |
| **Town Fork** | **6.8** | **3** | **-** |

| | | | |
|---|---|---|---|
| **EPW018** | **1.3** | **0** | **-** |
| **EPW019** | **1.8** | **0** | **-** |
| **Mooney Branch** | **2.5** | **0** | **-** |
| **Watered Hollow** | **3.5** | **0** | **-** |

| Stream Name | Length (Miles) | Miles Permanent | Drainage Area ($mi^2$) |
|---|---|---|---|
| **Fraley Hollow** | **3.5** | **0** | **-** |
| **EPW023** | **1.9** | **0** | **-** |
| **Harper Branch** | **4.6** | **0** | **-** |
| **EPW021** | **2.7** | **0** | **-** |
| **EPW022** | **1.8** | **0** | **-** |
| **Hall Branch** | **3.2** | **1** | **-** |
| **EPW024** | **1.5** | **0** | **-** |
| **EPW025** | **1.4** | **0** | **-** |
| **Cave Hollow** | **1.6** | **0** | **-** |

| | | | |
|---|---|---|---|
| **Left Hand Hollow** | **2.8** | **0** | **-** |
| **Big Hollow** | **3.4** | **0** | **-** |
| **EPW026** | **0.7** | **0** | **-** |
| **EPW027** | **0.7** | **0** | **-** |
| **Cow Hollow** | **1.8** | **0.4** | **-** |
| **EPW028** | **1.1** | **0** | **-** |
| **EPW029** | **1.5** | **.01** | **-** |
| **EPW030** | **1.4** | **0** | **-** |
| **EPW031** | **2.03** | **0** | **-** |
| **Hurricane Creek** | **4.0** | **2.6** | **113.5** |
| **Piney Creek** | **0.8** | **0.8** | **-** |
| **Dry Branch** | **3.5** | **0** | **-** |

| | | | |
|---|---|---|---|
| **Freeman Hollow** | **6.1** | **0** | **-** |

| | | | |
|---|---|---|---|
| **Whites Creek** | **10.8** | **2.6** | **-** |
| **Dry Prong** | **4.3** | **0** | **-** |
| **Panther Spr. Hol.** | **5.3** | **0** | **-** |
| **Hurricane Creek** | **32.9** | **4.5** | **-** |
| **Kelly Hollow** | **6.1** | **0** | **-** |
| **Cook Hollow** | **3.9** | **0** | **-** |
| **Dry Fork** | **4.6** | **0** | **-** |
| **Van Winkle Hol.** | **3.1** | **0** | **-** |
| **Reed Hollow** | **3.0** | **0** | **-** |
| **Wildcat Hollow** | **5.1** | **0** | **-** |
| **EPW032** | **1.3** | **0** | **-** |
| **EPW033** | **1.1** | **0** | **-** |
| **Possum Trot Hol.** | **6.6** | **0** | **-** |
| **EPW034** | **3.1** | **0** | **-** |
| **EPW035** | **1.9** | **0** | **-** |

| | | | |
|---|---|---|---|
| S. Crooked Hollow | 2.9 | 0 | - |
| EPW036 | 1.5 | 0 | - |
| Salt Petre Hollow | 1.9 | 0 | - |
| Big Hollow | 3.0 | 0 | - |

| Stream Name | | | |
|---|---|---|---|
| EPW038 | 2.9 | 0 | - |
| EPW039 | 2.5 | 0 | - |
| Horse Trough Hollow | 2.2 | 0 | - |
| EPW040 | 1.15 | 0 | - |
| EPW041 | 2.0 | 0 | - |
| EPW042 | 1.1 | 0 | - |
| EPW043 | 3.1 | 0 | - |
| Little Hurricane Cr. | 9.3 | 1.3 | - |
| Sisco Hollow | 5.1 | 0 | - |

| | | | |
|---|---|---|---|
| **McCormack Hollow** | **5.4** | **0.6** | **-** |
| **Spring Creek** | **32.8** | **5.2** | **139.8** |
| **Bull Camp Hollow** | **7.3** | **0** | **-** |
| **Sheep Ranch Hollow** | **5.2** | **0** | **-** |
| **Well Hollow** | **1.5** | **0** | **-** |
| **Wolfpen Hollow** | **3.8** | **0** | **-** |
| **Camp Hollow** | **3.1** | **0** | **-** |
| **Bee Fork Creek** | **7.3** | **0** | **-** |
| **Hog Hollow** | **3.9** | **0** | **-** |
| **EPW044** | **2.3** | **0** | **-** |

| | | | |
|---|---|---|---|
| **Birch Creek** | **10.7** | **0** | **-** |
| **EPW045** | **2.4** | **0** | **-** |
| **EPW046** | **4.1** | **0** | **-** |
| **EPW047** | **3.4** | **0** | **-** |
| **EPW048** | **3.4** | **0** | **-** |

| Stream Name | Length (Miles) | Miles Permanent | Drainage Area ($mi^2$) |
|---|---|---|---|
| EPW049 | 6.7 | 4.8 | - |
| EPW050 | 2.5 | 0 | - |
| Denny Hollow | 5.8 | 0 | - |
| EPW051 | 1.5 | 0 | - |
| Graham Hollow | 4.5 | 0 | - |
| Dry Creek | 7.4 | 0 | - |
| EPW052 | 2.9 | 0 | - |
| Barren Fork | 8.4 | 3.5 | - |
| Jolliff Spring Br. | 6.0 | 5.1 | - |
| Thayer Hollow | 2.8 | 0 | - |
| Mill Creek | 7.16 | 2.13 | - |
| Middle Fork | 30.1 | 4.0 | 82.1 |
| Watered Fork | 5.3 | 3.9 | - |

| | | | |
|---|---|---|---|
| **Mt. Prarie Hollow** | **8.7** | **5.1** | **-** |
| **Walnut Sink Hol.** | **4.9** | **0** | **-** |
| **EPW053** | **3.0** | **0** | **-** |
| **EPW054** | **3.7** | **0** | **-** |
| **EPW055** | **4.9** | **0** | **-** |

| **Stream Name** | | | |
|---|---|---|---|
| **County Hollow** | **3.3** | **0** | **-** |
| **Little Creek** | **20.9** | **14.6** | **-** |
| **Peace Valley Draft** | **4.8** | **0** | **-** |
| **Webb Hollow** | **6.6** | **0** | **-** |
| **EPW061** | **1.8** | **0** | **-** |
| **Lee Hollow** | **7.8** | **5.3** | **-** |
| **Kenaga Hollow** | **9.5** | **6.2** | **-** |
| **EPW062** | **4.5** | **1.7** | **-** |

| | | | |
|---|---|---|---|
| **Lost Camp Creek** | **13.6** | **8.1** | **-** |
| **EPW063** | **7.6** | **2.8** | **-** |
| **EPW064** | **6.1** | **0** | **-** |
| **Robbins Hollow** | **6.6** | **4.5** | **-** |
| **Sims Valley** | **7.0** | **4.7** | **-** |
| **EPW065** | **4.2** | **0** | **-** |
| **Richardson Hollow** | **4.5** | **0** | **-** |
| **EPW066** | **4.0** | **0** | **-** |

**Table Ge05. Stream gradient for order as well as average gradient for entire stream for fifth order and larger streams within the Eleven Point Watershed.**

| Stream Name | Gradient for Order (ft/mi) | | | | | | | Average Gradient (ft/mi) |
|---|---|---|---|---|---|---|---|---|
| - | 7 | 6 | 5 | 4 | 3 | 2 | 1 | - |
| Left Hand Hol. | - | - | 32.0 | 46.3 | 56.9 | 89.2 | 300.7 | 63.5 |
| Eleven Point R. | 7.4 | 5.1 | 10.2 | 16.8 | 20.7 | 61.5 | 98.0 | 11.2 |
| Fredrick Cr. | - | 9.5 | 17.1 | 20.0 | 33.3 | 25.0 | 66.7 | 16.3 |
| Hurricane Cr. | - | - | 16.1 | 10.0 | 28.6 | 25.0 | 77.8 | 18.4 |
| Piney Cr. | - | - | 1.1 | 31.8 | 56.3 | 50.0 | 225.0 | 25.7 |
| Spring Cr. | - | - | 14.1 | 18.5 | 35.3 | 43.3 | 30.9 | 19.0 |

# LANDUSE

## Historical Land Cover/Land Use

Many historical accounts describe the land cover of the rugged hills of the Eleven Point River, as well as other rivers in the area such as the Jack's Fork and Current, as consisting primarily of forest (Nigh 1988). These forests were described as being primarily open, with little woody undergrowth and a dense herbaceous ground flora composed of bluestem (Andropogon sp.) and other wild grasses and non-woody species. Ridges with sandy, flint covered soils were covered with stands of shortleaf pine (Pinus echinata). White oak (Quercus alba) and black oak (Quercus velutina) were often mixed with the pines on the ridges, and along with northern red oak (Quercus rubra), black walnut (Juglans nigra) and shagbark hickory (Carya ovata) formed the dominant canopy of the side slopes. Along isolated stream valleys in this watershed, prairie openings were also observed. This is reflected in the names of places such as Mt. Prairie Hollow.

In the uplands portion of the Eleven Point Watershed, where the topography is less dissected, a more barren or savanna land cover is believed to have existed (Nigh 1988). This consisted of "impoverished" open stands of post oak, black oak, and black jack oak with a ground story of grass.

The earliest inhabitants of the Ozarks, the Native American Indian, are thought to have existed in the Ozarks as semi-nomadic tribes living in small, transient camps and subsisting on hunting and foraging during much of the archaic period (7000-1000 B.C.)(Jacobson and Primm 1994). Late in the Archaic period, tribes on the fringes of the Ozarks became less nomadic, existing in larger villages and increasingly depending on plants for food, while tribes in the interior retained their hunter-gatherer characteristics. Tribes within the interior began to construct more elaborate villages as well as incorporate more agriculture into their subsistence during the early Mississippian Period (A.D. 900-1200). By A.D. 1500 this culture had disappeared as large villages based on agriculture began to grow along the eastern fringe of the Ozarks and the Mississippi River. During this period the interior of the Ozarks was used as a seasonal hunting ground as well as a source for flint and chalcedony for making tools. It is believed that a climatic shift to cooler, drier summers and the resulting failure of maize crops, on which early agriculture was based, may have caused an abrupt abandonment of these larger villages This is believed to have been the case of Cahokia Mounds in Illinois. Remnants of these villages and tribes reassembled to form the Osage Tribe which existed throughout much of the Ozarks and was present as European settlement of the area began to occur in the late 1700s and early 1800s (Jacobson and Primm 1994). Native American use of fire is believed to have been a large factor in the types of vegetation found by Schoolcraft and others as exploration of the Ozarks interior began to occur after the Louisiana Purchase of 1803 (Schoolcraft 1821, Jacobson and Primm 1994). Fires, set for many reasons from harassment of enemies to aiding in hunting, also stimulated warm-season grasses such as bluestem and eliminated woody undergrowth thus creating open woodlands or savannas (Jacobson and Primm 1994). European settlement of the Ozark fringe began in the early 1700s under French and, later, Spanish political control. After the Louisiana Purchase of 1803, Americans began settling the same areas earlier occupied by the Spanish and French. Settlement of the Ozarks interior increased after the War of 1812 (Jacobson and Primm 1994). Many of the early settlers came from the Appalachian States such as Tennessee, Kentucky, and Virginia where they had learned the skills necessary for survival in land similar to the rugged Ozark wilderness (Nigh 1988). In addition to hunting and fishing, early settlers

survived by using the valley bottom land for gardens and row crops, and the wooded side slopes and natural grass of the uplands for grazing cattle, hogs, horses, and other livestock. This region remained isolated and only sparsely settled until the late 1800's. As the timber resource of the eastern states dwindled and an increasing number of settlers migrated onto the western plains, the demand for the timber of the Ozarks increased (Cunningham and Hauser 1989). Undoubtedly, the cheap price of land having uncut timber was also very attractive to eastern speculators. Uncut timber land often sold for a $1.00 an acre (Cunningham and Hauser 1989). The coming of the railroad to the Ozarks interior during this time not only provided a means of transportation for lumber products, but also was a great consumer of this resource for railroad ties. With the extension of the railroads into the Ozarks came the large-scale exploitation of the timber resource (Rafferty 1983).

The many different products produced from the timber of the Ozarks resulted in a wide range of species and sizes harvested. Larger shortleaf pine trees were harvested for lumber, while a variety of sizes of hardwood trees were harvested for products such as railroad ties, charcoal, barrel staves, and flooring (Rafferty 1983, Cunningham and Hauser 1989).

Nigh (1988) states that "little attention was paid to regeneration of the forest and by the 1930s the timber cutting boom was over." Many of the settlers associated with the timber industry were forced to turn to subsistence farming as a means of survival (Nigh 1988, Cunningham and Hauser 1989 , Jacobson and Primm 1994). "After the removal of the pine and larger hardwood trees, a dense growth of young oak timber sprang up and the wild grasses diminished in abundance, greatly reducing the value of the range for pasture" (Krusekopf 1921). Grasses were annually burned and hogs and cattle roamed free. Continual burning, grazing and the cultivation of marginal uplands caused further damage to the already degraded land ( Nigh 1988, Jacobson and Primm 1994). Rivers and streams filled with gravel and water quality declined as soils, especially those on the steep rocky hillsides, suffered from severe erosion (Nigh 1988).

Attempts to farm the rugged country bordering the rivers in the Ozarks, including the Eleven Point, achieved limited success (Nigh 1988). Much of the population had left this area by the 1940s in order to find a better means of survival. Maintenance of the pasture land was more viable in the gentle uplands away from the rivers, where clearing of the land for grazing has continued up to the present. Jacobson and Primm (1994) indicate that although a significant portion of the watershed was purchased by the state and federal governments during the late 1930s, more intensive logging and agricultural practices on private land have countered the results of conservation practices employed on public lands.

An evaluation of present (1993) conditions of Ozark streams, pre-settlement period historical descriptions, stratigraphic observations, and accounts of oral-history responses on river changes during the last 90 years, led Jacobson and Primm (1994) to the conclusion that Ozark streams are disturbed from their natural conditions (Tables Lu01 and Lu02). Jacobson and Primm (1994) state that this "disturbance has been characterized by accelerated aggradation of gravel, especially in formerly deep pools, accelerated channel migration and avulsion, and growth of gravel point bars". Jacobson and Primm (1994) also suggest that "land use changes have disturbed parts of the hydrologic or sediment budgets or both".

Although detailed data from the Eleven Point Watershed has not been compiled, Jacobson and Primm (1994) summarized the land use changes from pre-settlement conditions to the 1970's in the Jack’s Fork Watershed, which borders the Eleven Point River Watershed to the North (Table Lu03).

Jacobson and Primm (1994) state that: "Different types of land use have taken place on different parts of the landscape, and at different times, resulting in a complex series of potential disturbances. Uplands have been subjected to suppression of a natural regime of wildfire, followed by logging, annual burning to support open range, patchy and transient attempts at cropping, a second wave of timber cutting, and most recently, increased grazing intensity. Valley side slopes have been subjected to logging, annual burning, and a second wave of logging. Valley bottoms were the first areas to be settled, cleared, and farmed; removal of riparian vegetation decreased the erosional resistance of the bottom lands. More recently, some areas of bottomland have been allowed to grow back into forest. The net effects of this complex series of land-use changes are difficult to determine and separate from natural variability."

Jacobson and Primm (1994) offer the following observations which summarize the probable, qualitative changes to runoff, soil erosion, and riparian erosional resistance on parts of the Ozarks landscape relative to man's impact:

**1.** Initial settlement of the Ozarks may have initiated moderate channel disturbance because of decreased erosional resistance of cleared bottom lands. This trend would have been countered by decreased annual runoff and storm runoff that accompanied fire suppression in the uplands.

**2.** Because of low-impact skidding methods and selective cutting during initial logging for pine during the Timber-boom period, logging would have had minimal effects on runoff and soil erosion. Low-impact methods and selective cutting continued to be the norm in timber harvesting of hardwoods until the late 1940's, when mechanization and diversified markets for wood products promoted more intensive cutting. Locally, log and tie jams, tie slides, and logging debris may have added to channel instability by diverting flow, but because aggradation and instability also occurred on streams not used for floating timber, these factors were not necessary to create channel disturbance.

**3.** Significant channel disturbance probably began in the Timber-boom period because of continued clearing of bottomland forests and road building in the riparian zone. This hypothesis is supported by evidence that significant stream disturbance began before the peak of upland destabilization in the post-timber-boom period. Extreme floods during 1895 to 1915 may have combined with lowered erosional thresholds on bottom lands to produce the initial channel disturbance.

**4.** The regional practice of annual burning to maintain open range had the most potential to increase annual and storm runoff and soil erosion because of its considerable areal extent and repeated occurrence. Burning would have been most effective in increasing runoff and erosion on the steep slopes that had been recently cut over during the timber boom. Generally, accelerated soil erosion was not observed after burning, and relict gullies presently (1993) are not apparent on valley-side slopes and uplands. These observations support the hypothesis that burning did not produce substantial quantities of sediment.

**5.** The greatest potential for soil erosion on valley slopes and upland areas occurred during the post-timber-boom period when marginal upland areas were cultivated for crops. Accelerated erosion of plowed fields was observed and noted by oral-history respondents and by soil scientists working in the Ozarks during the post-timber-boom period.

**6.** Valley bottoms have the longest history of disturbance from their natural condition because they were the first to be settled, cleared, and farmed. The lowered resistance to stream erosion that results from removing or thinning riparian woodland would have been a significant factor, especially on small to

medium sized streams for which bank stability and roughness provided by trees are not overwhelmed by discharge. Disturbance of bottomland riparian forest increased as free-range grazing, crop production, and use of valley bottoms for transportation expanded and reached a peak in the post-timber-boom period. Headward extension of the channel network because of loss of riparian vegetation may have increased conveyance of the channel network (and hence flood peaks downstream) and removed gravel from storage in first and second order valleys at accelerated rates. This hypothesis is supported by a lack of other source areas for gravel and by observations that gravel came from small stream valleys, not off the slopes.

**7.** During present (1993) conditions, channel instability seems somewhat decreased in areas where the riparian woodland has recovered, but stability is hampered by high sedimentation rates because of large quantities of gravel already in transport and effects of instability in upstream reaches that lack a riparian corridor.

**8.** Land use statistics indicate that the present trend in the rural Ozarks is toward increased populations of cattle and increased grazing density (MDA and USDA 1994). This trend has the potential to continue the historical stream-channel disturbance by increasing storm runoff and sediment supply with consequent remobilization of sediment already in transit."

## Land Type Associations

Land type associations (LTAs) are units of land which are relatively similar in landform and in patterns of geologic parent material, aspect, soils and potential natural vegetation. Within the Eleven Point River Watershed, 9 LTAs have been identified. Each has a characteristic pattern of landform geology, soil and vegetation. Figure Lu01 indicates the distribution of these LTAs. Table Lu04 gives descriptions of LTAs within the watershed. LTAs could prove to be a useful tool for planning and implementing management activities (ie. water quality and aquatic biodiversity)

## Current Land Use

The Missouri Resource Assessment Partnership (MoRAP) Phase 1 Land Cover Classification (1997) is currently the most recent compiled land use data available. This data, as analyzed by Caldwell (1998), indicates estimated forest/woodland cover within the watershed at 64.9% while grassland/cropland comprises 34.4% of the total land cover. Urban land use accounts for only 0.4% (Table Lu05, Figure Lu02, Lu03, and Lu04). The population density of the watershed is approximately 14 persons per square mile (Blodgett J. and CIESIN 1996). While forest/woodland is the most dominant cover type within the all three major drainage sections (Upper Eleven Point, Middle Eleven Point, and Lower Eleven Point), the Middle Eleven Point Drainage Section contains the highest combined percentage of forest/woodland cover at 79.2 percent. This is due, in large part, to the fact that much of this drainage is in public ownership as part of the Mark Twain National Forest (Figure Lu05). The Little Creek 14 Digit Hydrologic Unit (10003) has the lowest percentage of forest/woodland cover at 37.6 percent. The Middle Hurricane Creek 14 Digit Hydrologic Unit (30004) has the highest percentage of forest/woodland cover at 91.9 percent. This hydrologic unit primarily consists of public land (Figure Lu04 and Lu05).

Common trees within the Eleven Point Watershed include white oak (Quercus alba), black oak (Quercus velutina), northern red oak (Quercus rubra), scarlet oak (Quercus coccinea), post oak (Quercus stallata), chinkapin oak (Quercus muehlenbergii), black walnut (Juglans nigra), and shortleaf pine (pinus echinata). Less common species are silver maple (Acer saccharinum), american elm (Ulnus americana),

american basswood (Tilia americana), green ash (Fraxinus pennsylvanica), eastern cottonwood (Populus deltoides), and black locust (Robinia pseudoacacia).

The Natural Resource Conservation Service (NRCS) rates sheet erosion as low at 2.5-5 tons per acre annually, which is considered an acceptable rate of soil loss. Gully erosion is only a slight problem at 0-0.16 tons per acre annually (MDNR 1994).

## Soil Conservation Projects

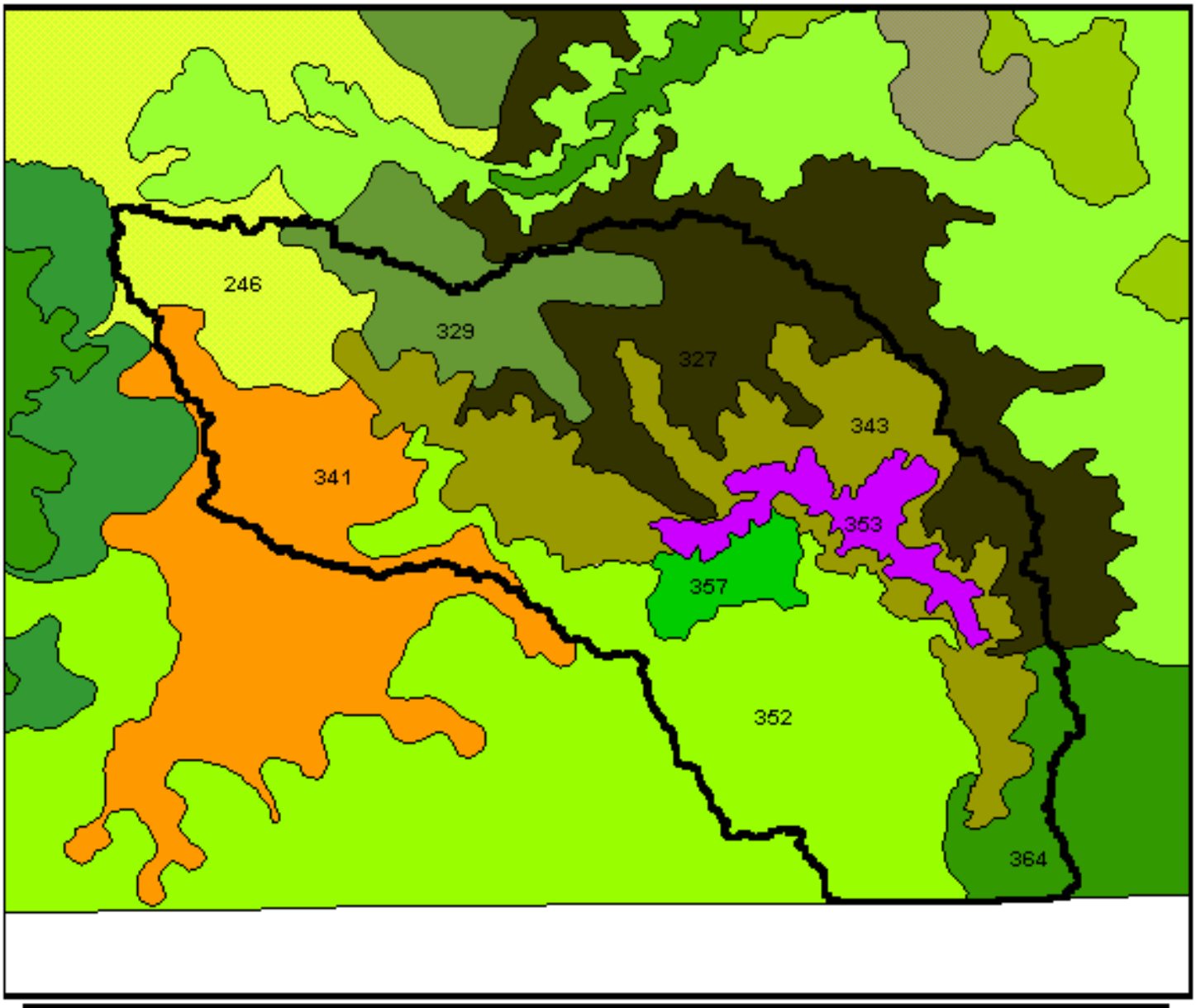
At the time of this writing (1999),the Eleven Point Watershed has no completed, ongoing or planned Public Law 566 (PL-566) watershed projects or Special Area Land Treatment (SALT) projects within the watershed (Robbins, personal communication). The proposed Fredrick Creek and Piney Creek PL-566 projects were terminated.

## Public Areas

Approximately 143,778 acres, or 22 % of the Eleven Point Watershed is in public ownership (Table Lu06 and Figure Lu05). Approximately 86% (137,442 acres) of the public land is part of the Mark Twain National Forest maintained by the United States Forest Service (USFS). In the upper reaches of the watershed are two Missouri Department of Conservation (MDC) sites: Simms Valley Community Lake near Mountain View and Dean Davis Conservation Area about halfway between Willow Springs and West Plains (MDC 1995). The MDC maintains 2 additional conservation areas (CA): Cover Memorial CA, and Birch Creek CA. Cover Memorial CA is located five miles west of Alton on Highway P. Birch Creek CA is part of the Kerr-McGee lands and is located 3 miles south of Birch Tree on Highway 99. In addition, the MDC has 3 tower sites within the Watershed. The MDC also maintains one access site (Myrtle access) located on the Eleven Point River, 15 miles East of Thayer. Myrtle access is 26 acres with a concrete boat launch. The USFS maintains 8 stream access sites and 8 float camp sites along the Eleven Point River within the National Scenic River Area (USFS 1995). A detailed map identifying access sites and float camp locations is available from the United States Forest Service in Rolla, Missouri (573) 364-4621.

Figure Lu01.

# Eleven Point Watershed
## Land Type Associations




### Legend

Watershed Boundary

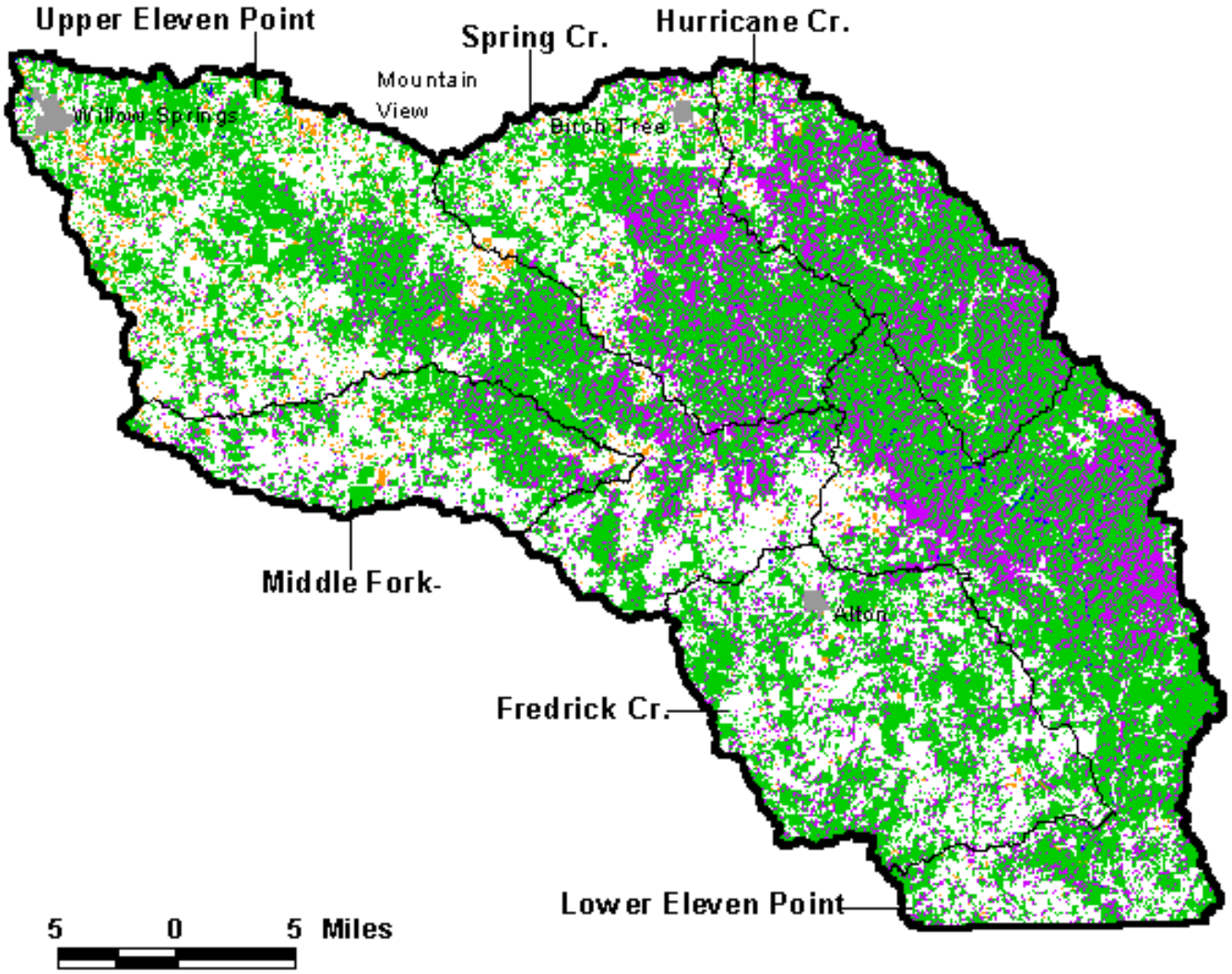
**Land Type Association**

- Alton Oak Savanna/Woodland Plain (357)
- Current-Eleven Point Pine-Oak Woodland Dissected Plain (327)
- Eleven Point Oak-Pine Forest Breaks (353)
- Eleven Point River Oak-Pine Woodland/Forest Hills (343)
- Howell-Oregon Counties Oak Woodland Dissected Plain (352)


Mt. View Oak Savanna/Woodland Plain (329)
Ripley County Oak Woodland Dissected Plain (364)
Upper Gasconade Oak Woodland Dissected Plain (246)
West Plains Oak Savanna/Woodland Plain (341)
Current River Oak Forest Breaks
Current River Oak-Pine Woodland/Forest Hills
Eminence Igneous Glade/Oak Forest Knobs
Jacks Fork River Oak-Pine Forest Breaks
North Fork Pine-Oak Woodland Dissected Plain
Summersville Oak Savanna/Woodland Plain
MDC 5/1999

Figure Lu02.

# Eleven Point Watershed
## Land Cover/Land Use




## Legend

- Subwatershed Boundary
- Deciduous Forest and Woodland
- Evergreen & Mixed Forest & Woodland
- Grassland
- Cropland
- Urban
- Water

Missouri Resource Assessment Partnership (MoRAP)
Phase 1 Land Cover Map
December, 1997

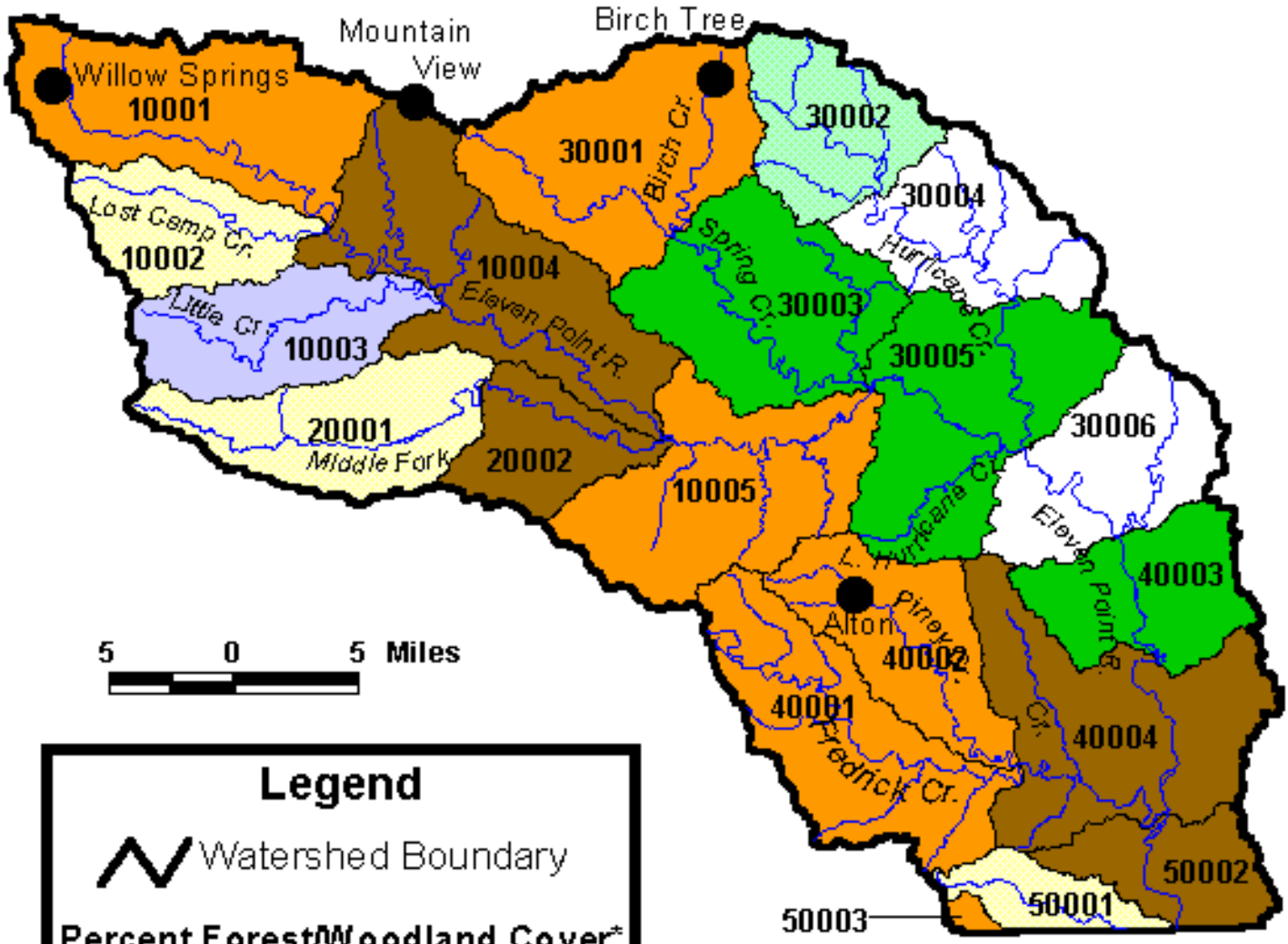
N

MDC 5/1999

Figure Lu03.

# Eleven Point Watershed

## 14 Digit Hydrologic Unit Forest/Woodland Cover




### Legend

Watershed Boundary

**Percent Forest/Woodland Cover***

- 30 - 39
- 40 - 49
- 50 - 59
- 60 - 69
- 70 - 79
- 80 - 89
- 90 - 99

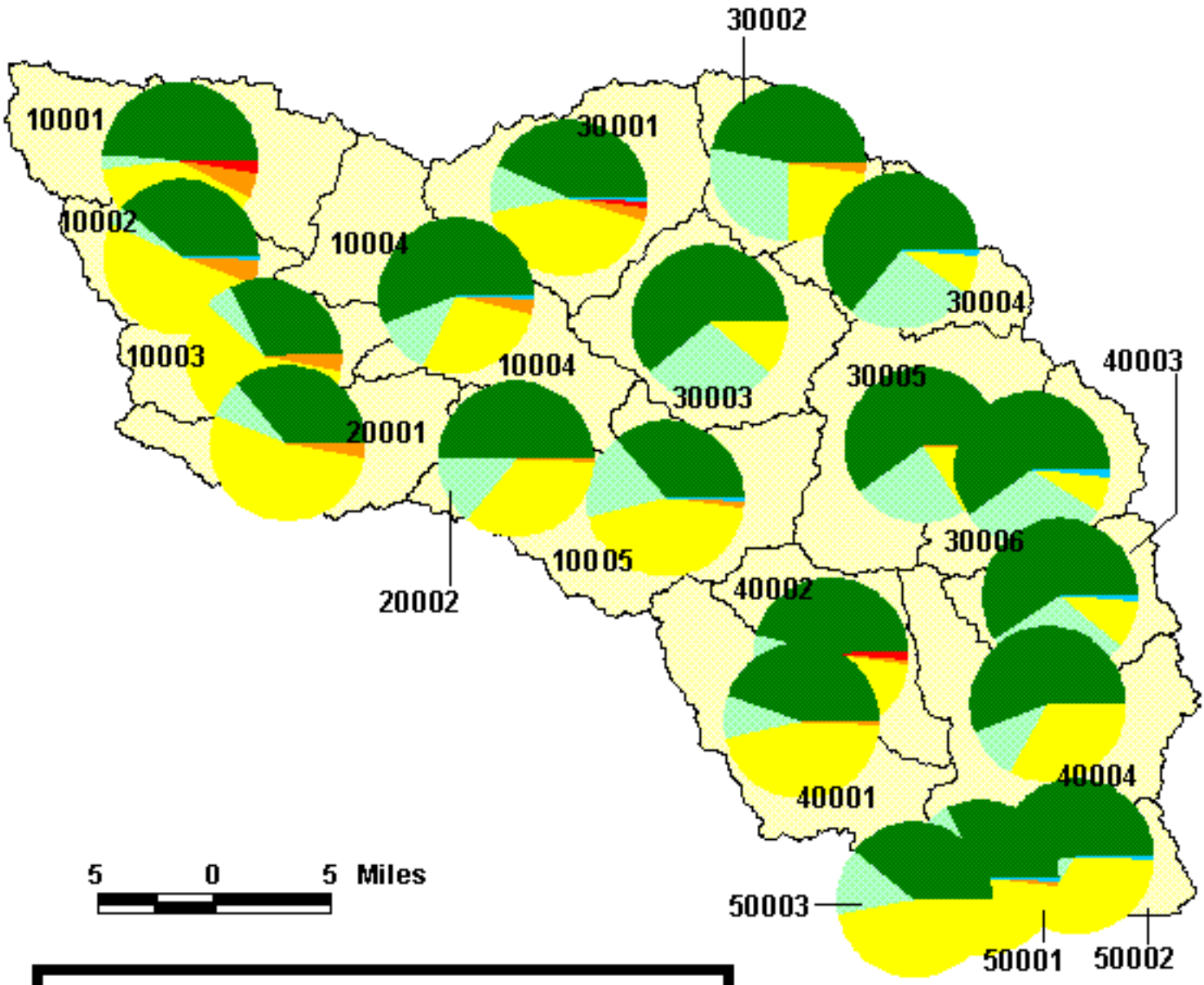
*Based on Missouri Resource Assessment Partnership (MoRAP) Phase 1 Land Cover Map December, 1997

MDC 5/1999

Figure Lu04.

# Eleven Point Watershed

## 14 Digit Hydrologic Unit Land Cover /Land Use




## Legend

**Percent Land Cover/Land Use***

| | |
|---|---|
| Forest | Cropland |
| Woodland | Urban |
| Grassland | Water |

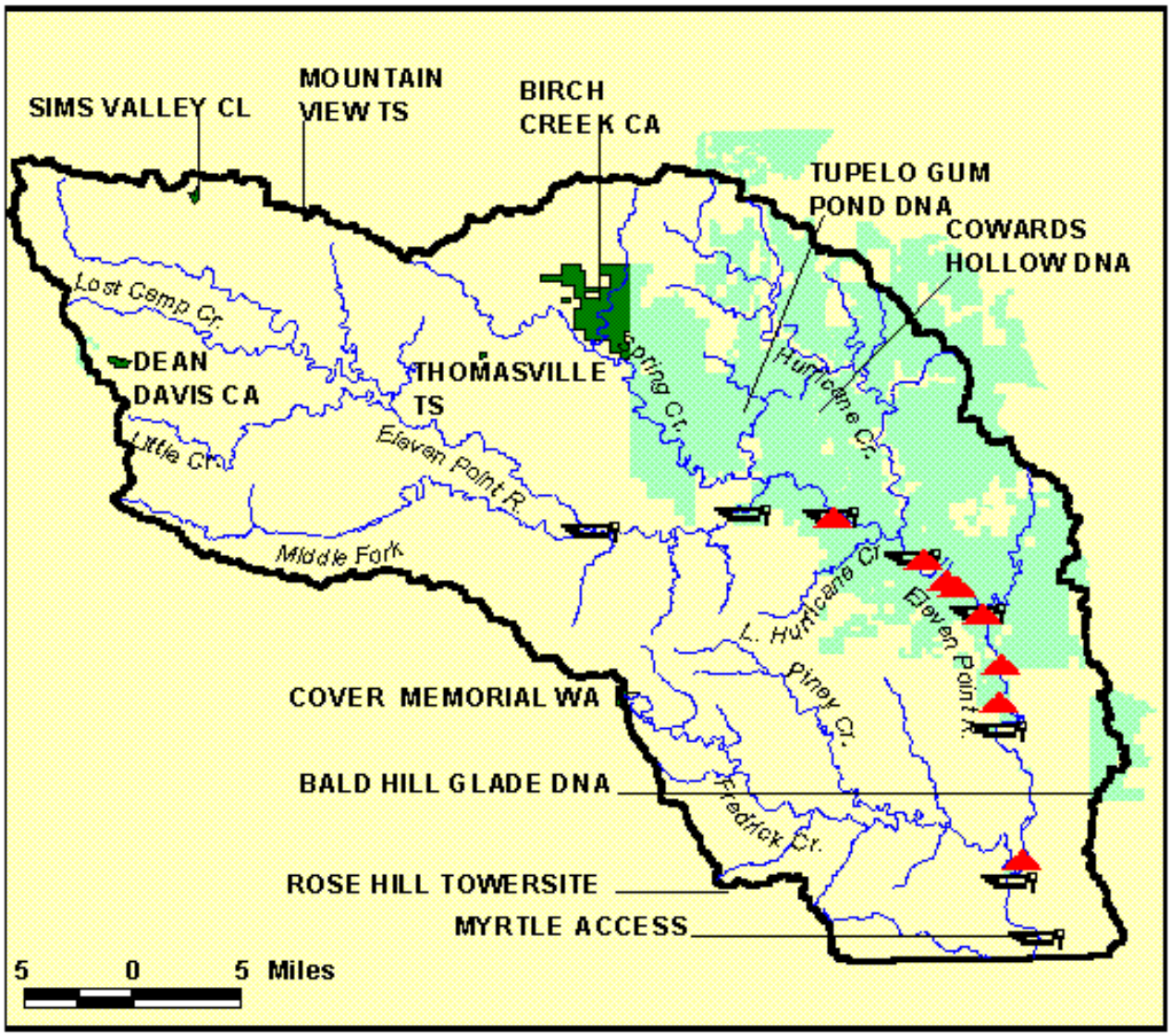
*Based on analysis by Caldwell (1999) of Missouri Resource Assessment Partnership (MoRAP) Phase 1 Land Cover Map
December 1997

N

MDC 5/1999

Figure Lu05.

# Eleven Point Watershed
## Public Land




## Legend

- Watershed Boundary
- Missouri Department of Conservation*
- United States Forest Service*
- Access*
- Float Camp*

CA=Conservation Area
DNA=Designated Natural Area
WA=Wildlife Area
TS=Tower Site
CL=Community Lake

*This figure is not a final authority.
Data subject to change.

N

MDC 5/1999

**Table Lu01. Summary of probable qualitative changes to runoff, soil erosion, and riparian erosional resistance on parts of the Ozarks landscape relative to pre-settlement period conditions. Copied in whole from Jacobson and Primm (1994).**

| Period | Uplands | Valley Slopes | Valley Bottoms |
|---|---|---|---|
| Pre-settlement | Baseline | Baseline | Baseline |
| Early Settlement | - | - | - |
| Annual Runoff | Decrease | Slight Increase | N/A |
| Storm Runoff | Decrease | Slight Increase | N/A |
| Upland Sediment Yield | Decrease | Slight Increase | N/A |
| Riparian Erosional Resistance | N/A | N/A | Moderate Decrease |
| Timber-Boom | - | - | - |
| Annual Runoff | Slight Increase | Slight Increase | N/A |
| Storm Runoff | Slight Increase | Moderate Increase | N/A |
| Upland Sediment Yield | Slight Increase | Moderate Increase | N/A |
| Riparian Erosional Resistance | N/A | N/A | Decrease |
| Post-Timber-Boom | - | - | - |

| | | | |
|---|---|---|---|
| **Annual Runoff** | **Moderate Increase** | **Increase** | **N/A** |
| **Storm Runoff** | **Moderate Increase** | **Increase** | **N/A** |
| **Upland Sediment Yield** | **Moderate Increase** | **Increase** | **N/A** |
| **Riparian Erosional Resistance** | **N/A** | **N/A** | **Substantial Decrease** |
| **Recent** | - | - | - |
| **Annual Runoff** | **Slight Increase** | **Slight Increase** | **N/A** |
| **Storm Runoff** | **Slight Increase** | **Moderate Increase** | **N/A** |
| **Upland Sediment Yield** | **Slight Increase** | **Slight Increase** | **N/A** |
| **Riparian Erosional Resistance** | **N/A** | **N/A** | **Decrease** |

**Table Lu02. Sequence of land-use changes on parts of the rural Ozarks landscape. Data is for the following Missouri counties: Butler, Carter, Crawford, Dent, Howell, Iron, Laclede, Oregon, Pulaski, Phelps, Reynolds, Shannon, Texas, Wright (Jacobson and Primm 1994).**

| Period | Uplands | Valley Slopes | Valley Bottoms |
|---|---|---|---|
| Pre-settlement before 1800 | Patchy prarie and oak savannah | Thick oak-hickory and yellow pine | Thick deciduous forest |
| Early-settlement 1800-1880 | Patchy prarie, used for grazing and minor row crops | Thick oak-hickory with minor cutting | Cleared for pasture and row crops |
| Timber-boom 1880-1920 | Cutover, fire supression | Cut over | Cleared for pasture and row crops |
| Post-timber-boom 1920-1960 | Increasing pasture, row crops | Woodland grazing, seasonal burning | Cleared for pasture and row crops, open-range grazing |
| Recent 1960-present (1993) | Increased grazing and row crops | Woodland grazing, managed timber little burning | Cleared for pasture and row crops with some reversion to forest |

**Table Lu03. Land cover/ land use change from pre-settlement period conditions (1820's) to the 1970's in the Jack's Fork Watershed, Missouri (Jacobson and Primm 1994).**

| 1820's | | 1970's | | |
|---|---|---|---|---|
| Category | Area sq. miles | Category | Area sq. miles | % |
| Shrub and brush rangeland | 55.4 | Urban/developed | 1.6 | 3 |
| | | Pasture/cropland | 26.5 | 48 |
| | | Deciduous forest | 27.3 | 49 |
| Deciduous forest | 242.0 | Pasture/cropland | 59.9 | 25 |
| | | Deciduous forest | 178.6 | 75 |
| Evergreen forest | 3.5 | Deciduous forest | 3.5 | 100 |
| Mixed forest | 323.1 | Pasture/cropland | 34.5 | 11 |
| | | Deciduous forest | 281.6 | 87 |
| | | Mixed forest | 7.0 | 2 |
| Barrens | 29.2 | Pasture/cropland | 15.5 | 53 |
| | | Deciduous forest | 13.7 | 47 |

**Table Lu04. Descriptions of land type association (LTAs) groups as well as a condensed (1 of 5) description of LTAs within the Eleven Point Watershed. Descriptions are quoted in part or whole from MDC (1997).**

| Oak Woodland Dissected Plains and Hills Group |
|---|
| **Landform: Distinguished by rolling to moderately dissected topography. Local relief is 75-150 feet. Very broad, flat ridges give way to gentle side slopes and broad stream valleys. Karst plains with frequent shallow sinkhole depressions are common. Broad stream valleys most often occupied by losing streams, however occasional seeps do occur and can spread across substantial portions of a valley.** |
| **Geology: Commonly underlain by Jefferson City-Cotter dolomites with a common loess cap. Some minor areas underlain by Roubidoux sandstones.** |
| **Soils: Soils are variable, ranging from shallow to bedrock and fragipan soils, to deep, cherty and well-drained loams. Tree root growth is often restricted by bedrock, pans or clay mineralogy, especially high in the landscape.** |
| **HistoricVegetation: Open woodlands with occasional prairie and savanna openings was the principal vegetation type. Post oak and black oak were the principal woodland tree species. Historic fire likely played an important role in maintaining an open canopy, sparse understory and a dense herbaceous ground flora. More dissected lands likely contained mixed oak woodland and forest. Unique sinkhole ponds, wet prairies and seeps were scattered in the broad valleys and depressions.** |
| **Current Conditions: Currently a mosaic of fescue pasture (35-65% cover) and dense, often grazed oak forest. The transition from open grassland to closed forest is abrupt and the patch work blocky. Very few native grasslands or savannas are known, and the dense second growth woodlands have very little ground flora. Most sinkholes, wet prairies and seeps have been drained and heavily grazed. Many roads, towns, cities and businesses are located in these LTAs.** |
| **Howell-Oregon Oak Woodland Dissected Plain: Dissected Plain in southern Howell and Oregon Counties. More dissection, better soils, and more existing timber than most other LTAs in this group.**<br>**Ripley County Oak Woodland Dissected Plain: Very dissected plain between lower Eleven Point and Current Rivers. Contains an unusual cluster of dolomite knobs on east side of Eleven Point.**<br>**Upper Gasconade Oak Woodland Dissected Plain: Broad divide encompassing the headwaters of the Big Piney and Gasconade River Watersheds.** |

| Oak Savanna/Woodland Plains Group |
|---|
| |

**Landform**: **Very broad flat uplands slope gently to very broad flat drains or solution (karst) depressions. Local relief is less than 75 feet.**

**Geology**: **Underlain mainly by Jefferson City-Cotter dolomites with a common loess cap. Minor areas of the Roubidoux formation occur. Headwater streams are nearly all losing.**

**Soils: Fragipan soils or soils with shallow restrictive clays or bedrock are common, inhibiting tree root growth.**

**HistoricVegetation: Oak savannas and woodlands with common prairie openings were the predominant historic vegetation. While few prairies were named by original land surveyors, early descriptions portray an open, "oak prairie" landscape. Fire likely played a principal role in maintaining a grassland-open woodland structure. Some sinkhole depressions would have had unique ponds and seeps.**

**Current Conditions: The largest blocks and greatest acres of grassland (45-65% cover) are currently associated with these LTAs; grasslands are mainly fescue pasture. Less than 40% of these LTAs are timbered, mainly in dense, second growth oak forest (post and black oaks) with common grazing pressure. Very few quality native prairies, savannas, woodlands, sinkhole ponds or seeps are known. Many of the regions roads, towns, and businesses are associated with these LTAs.**

**Alton Oak Savanna/Woodland Plain: Small flat area on south flank of Eleven Point River above Greer.**

**Mtn. View Oak Savanna/Woodland Plain: Broad, flat divide between upper Jack's Fork and Eleven Point Rivers.**

**West Plains Oak Savanna/Woodland Plain: Very extensive, flat upland in the center of Howell County.**

## Oak-Pine Woodland Forest Hills Group

**Landform: Mainly broad ridges, moderately sloping (<25%) side slopes, and relatively broad entrenched valleys with local relief between 150-250 feet. Steeper, more dissected areas occur locally near larger stream valleys. Sinkhole depressions are common on broader ridges. Stream valleys vary somewhat from broad and rather shallow, to more deeply entrenched, narrow, and meandering. Many losing streams occur in valleys distant from the main rivers. Cliffs, caves and springs are commonly associated with larger, perennial stream valleys.**

**Geology: Roubidoux cherty sandstones and dolomites occupy most ridges and upper side slopes, while lower side slopes, especially near major streams are in cherty upper Gasconade dolomite materials.**

**Soils:** Soils are mainly deep, highly weathered and very cherty silt loams with clays at varying depth. Broad ridges may have a loess cap with occasional fragipans, and shallow soils with dolomite bedrock near the surface occur frequently on steeper, exposed slopes.

**Historic Vegetation:** Pine and mixed oak-pine woodland originally dominated the more gently sloping upland surface associated with the Roubidoux Formation. Early descriptions portray an open, grassy and shrubby understory in these woodlands, a condition related to the prevalence of fire in the historic landscape. Oak and oak-pine forest occupied lower slopes and more dissected, hilly parts of these landscapes, as well as the wider and more well-drained bottom. Bottoms with richer alluvial soils and more abundant water likely were forested in mixed hardwood timber. Dolomite glade and open savanna/woodland complexes were common on exposed slopes with shallow soils. Sinkhole ponds and fens were dotted occasionally throughout.

**Current Conditions:** Mainly forested in second growth oak and oak-pine forests; forest cover ranges from sixty to over 80%. Most forests are rather dense, near even-age second growth, with very little woodland ground flora. The occurrence of shortleaf pine in these forests has diminished from its original extent, today having only 20-30% of the forest cover containing a substantial component (>25%) of pine. Even age stands dominated by scarlet, black, and white oak are common, oak die back is a common problem. Much of the existing timber land is associated with public land ownership. Cleared pasture lands occupy many of the broad stream valleys and highest, flattest ridges. Many glades and woodlands suffer from woody encroachment, and sinkhole ponds and fens have been drained or severely overgrazed. An exceptional proportion of state-listed species sites are associated with the streams, springs, caves, cliffs, fens, and sinkhole ponds in this group.

**Current River Oak-Pine Woodland Forest Hills:** Hills associated with the Current and Jacks Fork Rivers, excluding steep breaks.

**Eleven Point River Oak-Pine Woodland Forest Hills**: Hills associated with Eleven Point River, mainly north of the river; excludes breaks.

## Pine-Oak Woodland Dissected Plains

**Landform:** Broad, flat to gently rolling plains which give way to moderately dissected and sloping lands associated with the headwaters of major drainages. Valleys are broad and local relief 100-150 feet. Clusters of karst sinkholes are common. Streams are mainly headwater streams with flashy, intermittent flow.

**Geology:** Underlain by cherty sandstone and dolomite of the Roubidoux Formation with frequent loess deposits on the flatter uplands.

**Soils:** Soils are formed principally in cherty sandstone and dolomite residuum from the Roubidoux Formation. Soils are mainly deep, cherty, and highly weathered, low base soils. However occasional fragipans and shallow to bedrock soils do occur. Most soils are extremely well drained and droughty.

**HistoricVegetation:** Originally covered in woodlands of shortleaf pine and mixed pine oak with an open understory of dense grass and shrub ground cover. Post oak woodlands occupied occasional loess covered flats and unique sinkhole ponds dotted the landscape.

**Current Conditions:** Over 75% of this group are currently forested in dense, even-age oak and oak-pine forest. Only 20% of these forests have a strong pine component. However, the proportion of forests containing shortleaf pine is the highest in this group. Dense stands of near even age scarlet, black, and post oak occur in the place of pine. Understories are dense, woodland ground flora sparse, and oak die-back common. A substantial component of these forested lands are publicly owned. Approximately 20% of this group is currently pasture, which often occupies the broad valley bottoms or karst plains. Most sinkhole ponds have been drained, dozed or severely overgrazed. Headwater streams are subject to grazing and bank erosion.

**Current-Eleven Point Pine-Oak Woodland Dissected Plain:** High, flat to rolling divide between Current and Eleven Point Rivers; most extensive acreage of this group.

## Oak and Oak-Pine Forest Breaks

**Landform:** Distinguished by local relief over 300 feet, narrow ridges, steep side slopes and mainly narrow sinuous valleys. Cliffs, caves, and springs are common.

**Geology:** Thick caps of Roubidoux Sandstone on ridges and upper slopes streams cut into the Lower Gasconade Dolomite.

**Soils:** Soils formed from Roubidoux and Upper Gasconade materials.

**HistoricVegetation:** Originally forested in oak pine, oak and mixed hardwood forest types. Scattered glades and open woodlands would have occurred on exposed slopes and ridges, especially in areas of shallow soil. Relatively small fen openings occasionally filled narrow tributary valleys.

**Current Conditions:** **A high percentage of public land (45%) is associated with this group. Because of the large amount of public land, as well as the steep topography, this group is still mostly forested(88%) in second growth oak, oak-pine and mixed hardwood timber. Open areas are confined to valleys, so bottomland forest is less than originally. Dolomite glades are largely overgrown with eastern red cedar, and many fens have been drained or heavily grazed. Numerous rare or endangered species, some restricted to this group, are associated with the streams, springs, caves, cliffs, and fens in these landscapes. The rivers have been recognized as national treasures and are an important recreational resource in the region.**

**Eleven Point River Oak-Pine Forest Breaks:** **Abrupt and somewhat wide sinuous valley with outstanding cliff communities, some harboring unique flora. Well developed alluvial bottoms and somewhat deep river.**

**Table Lu05. Percent land cover/land use for 14 digit hydrologic units within the Spring River Tributaries Watershed. Data is based on MoRAP Phase 1 Land Cover (1997) as analyzed by Caldwell (1998).**

| Hydrologic Unit | FOR | WDL | GRS | CRP | URB | WAT |
|---|---|---|---|---|---|---|
| 10001 | 49.4 | 3.1 | 39.7 | 4.8 | 2.8 | 0.3 |
| 10002 | 39.4 | 3.5 | 51.4 | 5.5 | 0 | <0.1 |
| 10003 | 31.7 | 5.9 | 58.5 | 3.7 | 0 | 0.1 |
| 10004 | 56.4 | 12.1 | 28.1 | 2.7 | 0.5 | 0.3 |
| 10005 | 36.5 | 17.7 | 44.0 | 1.4 | 0 | 0.4 |
| 20001 | 35.5 | 8.4 | 52.8 | 3.2 | <0.1 | <0.1 |
| 20002 | 49.9 | 13.7 | 34.9 | 1.5 | 0 | <0.1 |
| Upper Eleven Point | 43.7 | 9.5 | 42.7 | 3.2 | 0.6 | 0.2 |
| 30001 | 42.8 | 10.4 | 42.5 | 3.2 | 1.0 | <0.1 |
| 30002 | 46.6 | 28.1 | 23.2 | 2.1 | 0 | <0.1 |
| 30003 | 61.1 | 27.5 | 10.7 | 0.5 | 0 | 0.2 |
| 30004 | 64.4 | 27.5 | 7.7 | 0.3 | 0 | 0.1 |
| 30005 | 59.6 | 23.9 | 15.0 | 0.9 | 0 | 0.6 |
| 30006 | 60.1 | 31.2 | 7.5 | 0.4 | 0 | 0.8 |
| Middle Eleven Point | 55.5 | 23.7 | 18.9 | 1.3 | 0.2 | 0.3 |
| 40001 | 45.4 | 9.5 | 44.5 | 0.6 | 0 | <0.1 |
| 40002 | 45.6 | 9.7 | 42.1 | 0.7 | 1.9 | <0.1 |
| 40003 | 59.1 | 30.2 | 10.4 | <0.1 | 0 | 0.2 |
| 40004 | 55.7 | 10.5 | 33.2 | 0.4 | 0 | 0.1 |
| 50001 | 32.2 | 10.2 | 56.4 | 1.1 | 0 | <0.1 |
| 50002 | 52.8 | 13.4 | 33.1 | 0.4 | 0 | 0.4 |
| 50003 | 38.9 | 13.6 | 47.3 | <0.1 | 0 | <0.1 |
| Lower Eleven Point | 50.2 | 13.3 | 35.6 | 0.4 | 0.3 | 0.1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Eleven Point Watershed** | **49.5** | **15.4** | **32.6** | **1.8** | **0.4** | **0.2** |

**FOR =Forest, WDL=Woodland, GRS=Grassland, CRP=Cropland, URB=Urban, WAT=Water**

# *HYDROLOGY*

## Precipitation

A National Weather Service Station in Willow Springs, measuring precipitation since 1924, indicates an average annual precipitation of 45 inches, with very little change throughout the period of record (Figure Hy01)(USDC 1995; Owenby and Ezell 1992). The Eleven Point Watershed is situated in one of the wetter parts of the state. The greatest amount of precipitation occurs during the spring months of March, April, and May. Precipitation is lowest in the winter months of December, January, and February.

## USGS Gage Stations

The United States Geological Survey (USGS) has two active gage stations within the Eleven Point Watershed (USGS 1996 and USGS 1998). Station #07071000 is located at Greer Spring, 300 feet from the lower outlet spring, and 1 mile upstream from the Eleven Point River. It has been recording water stage data from August 1904 to the present and water quality data periodically from 1968 to the present. Gage station #07071500 (http://mo.water.usgs.gov/rt-cgi/gen_stn_pg?station=07071500) is located 7.0 miles southwest of Bardley in Oregon county, at the Highway 160 Bridge. Water stage data has been recorded from October 1921 to the present. Water quality data was recorded periodically at this station from 1968 to the present (USGS 1996). Historical water stage records exist from ten other gaging stations positioned throughout the Eleven Point Watershed (Table Hy01 and Figure Hy02).

## Average Daily and Peak Discharge

Long-term flow data exists for three locations throughout the Eleven Point Watershed, the two operational gage stations discussed earlier and the Eleven Point River near Thomasville. The mean daily discharge at gage station #07070500 on the Eleven Point River near Thomasville from 1951-1976 was 101 cubic feet per second (cfs) (USGS 1995). The average daily discharge at the Greer Spring Branch Gage for the last 73 years was 342 cfs. The average daily discharge at the gage station near Bardley for the last 73 years was 781 cfs. Stream flow at all stations was lowest during the months of August, September, and October and highest during April and May (Figures Hy03,Hy04, and Hy05). Table Hy02 lists the highest and lowest instantaneous flow rates that have occurred at each of the above sites during the period of gaging record.

## 7-day Q2, Q10, and Q20 Low Flow and Slope Indices

Seven day low flow statistics were computed for the three areas that had long term gaging station records (Table Hy03). The Eleven Point River near Thomasville has seven day Q2, Q10, and Q20 low flow values of 7.2, 4.1, and 3.4 cubic feet per second (cfs), respectively. These are extremely low flow rates when one considers that this site drains 361 square miles (36% of the watershed), yet another indicator of the number of losing stream reaches in this portion of the watershed.

Slope indices (SI, ratio of the seven day Q2 to Q20) were calculated for the Eleven Point River near Thomasville and also for the Eleven Point River near Bardley. The SI were 2.1 near Thomasville and 1.5 near Bardley. The slope index near Bardley is slightly lower than that at Thomasville. One possible reason for such a low slope index near Bardley would be the influence of springs on maintaining stable low flows. Both stations had extremely low slope indices, an indication of low variability in annual low flows.

## Duration of Daily Flows and Mean Annual Discharge

Flow duration curves are useful for inter/intra watershed comparisons of discharges. Daily flow duration data was compared to determine if the Eleven Point River has become more or less susceptible to flooding and or drying in recent years. Figures Hy06 and Hy07 illustrate the duration of flows from 1922 through 1958 and 1959 through 1994 for the Eleven Point River near Bardley and Greer Spring Branch respectively. The flow duration curves from the latter time period have made an upward shift to higher discharges. The upward shift of the flow duration curve reflects, in part, an overall increase in discharge in the latter time period. The changes in the flow duration curve and discharge rates are an indication of possible changes in precipitation, land use, and/or spring output.

Changes in the amount, intensity, seasonal timing, and/or duration of precipitation could impact discharge. Although the amount and seasonal timing of precipitation (at least at Willow Springs and Alton) have remained relatively stable since 1922, data on intensity and duration of precipitation is unavailable; however, it is unlikely that the change in discharge on Greer Spring Branch is linked to precipitation.

Land use practices can significantly alter flow duration and discharge. A change in land use from pasture or clear-cut to timber can slow the rate of surface runoff, alter the ratio of surface to subsurface flow, and reduce over bank flow velocities. Land use practices have changed considerably over the two time periods mentioned. As described in preceeding sections, the earlier time period was characterized by massive clearcutting, row crop conversion to pasture, and burning. A large portion of this disrupted land has returned to timber (Jacobson and Primm 1994) This would decrease the flashiness of the river as noted by the extended durations at any particular flow rate.

In the Eleven Point Watershed, ground water contributes significantly to the overall river water supply. Table Ge03 lists the names, locations, and measured discharges of springs referenced in Springs of Missouri (Vineyard and Feder 1974). The Eleven Point River Watershed is characterized by karst topography and a complex aquifer system. Alterations in the aquifer and subsequent changes in the supply of ground water could significantly change stream discharge and flow duration. Although Figure Hy07 shows an increase in discharge from Greer Spring Branch in recent years, at present, we have no way of determining whether this increase has been caused by a change in land use (i.e. surface/subsurface water flow) or a possible alteration in the aquifer system (i.e. collapse).

## 10:90 Ratio

The 10:90 ratio refers to the ratio of the flow rate equaled or exceeded 10% of the time to the flow rate equaled or exceeded 90% of the time. The 10:90 ratio for the Eleven Point River near Thomasville and Bardley is 31:1 and 5:1 respectively. The Eleven Point River near Thomasville has a high 10:90 ratio, an indication of highly variable flows. A high 10:90 ratio would be expected at Thomasville since much of the watershed at this point is in pasture and stream channels are composed of intermittent and losing stream reaches. In addition, the flow of the river near Thomasville is influenced to a great extent by precipitation and to a lesser extent by spring flow. In contrast to the Eleven Point River near Thomasville, near Bardley the Eleven Point River has a low 10:90 ratio, indicative of low variable flows. Flow of the river near Bardley is highly regulated by spring flow. As a result, the river near Bardley maintains a relatively stable flow rate throughout the year.

## Flood Frequency

Table Hy04 shows the frequency and magnitude of flooding at two locations (Thomasville and Bardley) on the Eleven Point River. Flooding magnitude for the Eleven Point Watershed is comparable to other Ozark watersheds of similar size.

Figure Hy01. Mean monthly precipitation at Willow Springs for two time periods.

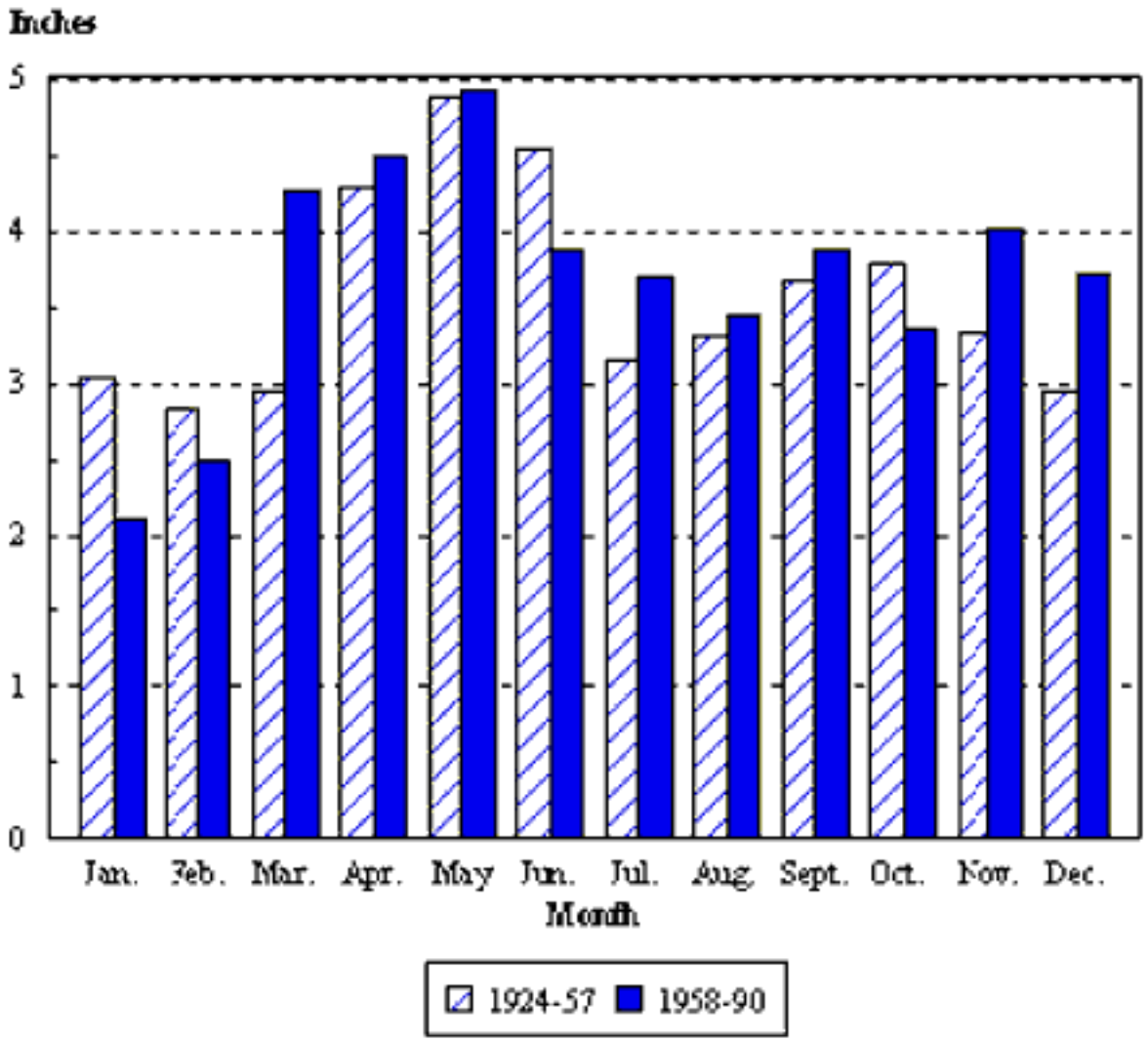


Figure Hy02.

# Eleven Point Watershed
## Surface Water Gage Stations

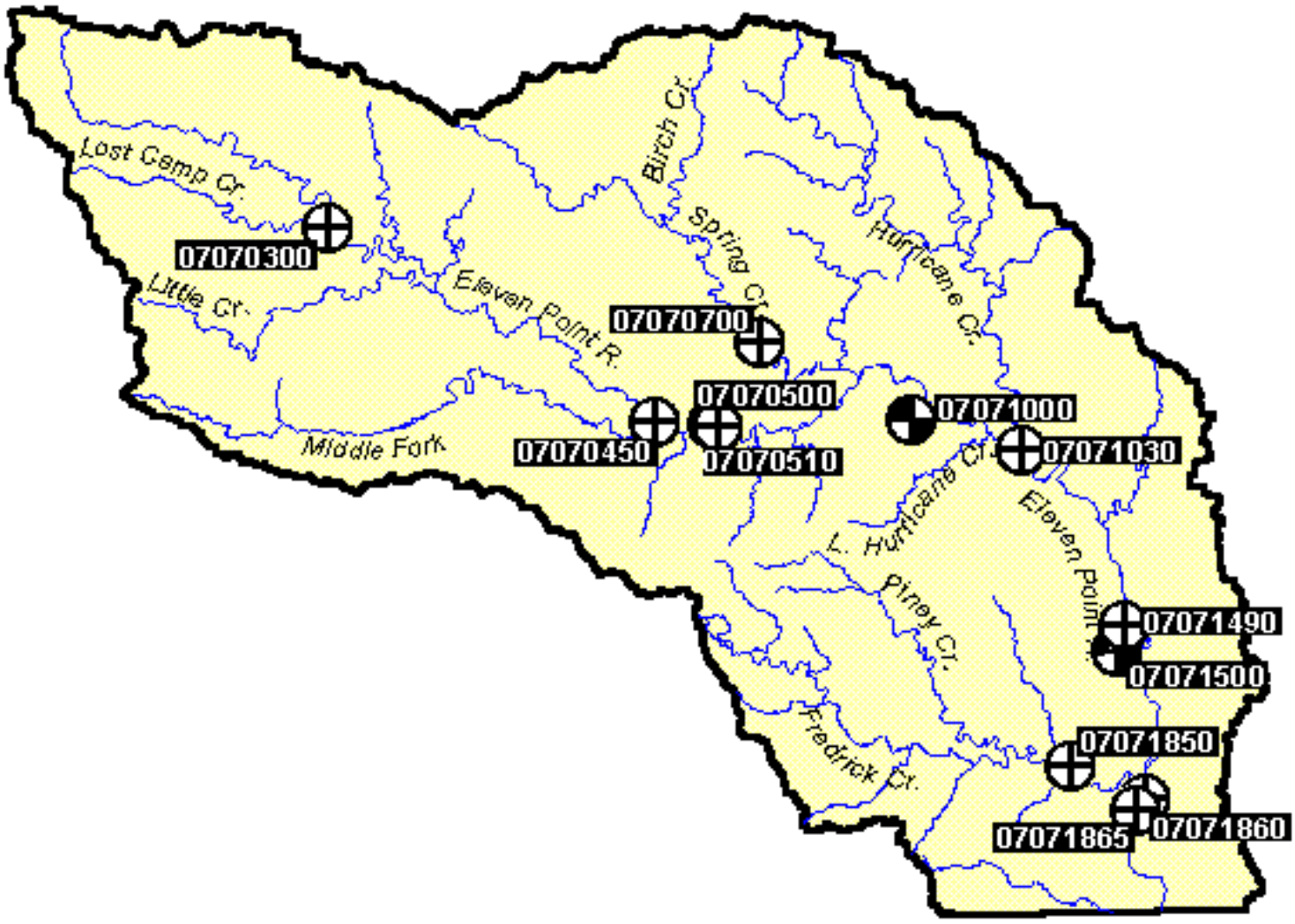


Figure Hy03. Monthly maximum, minimum, and mean flows for station 07071000-Greer Spring Branch at Greer, MO 1922-1994 (USGS 1995).

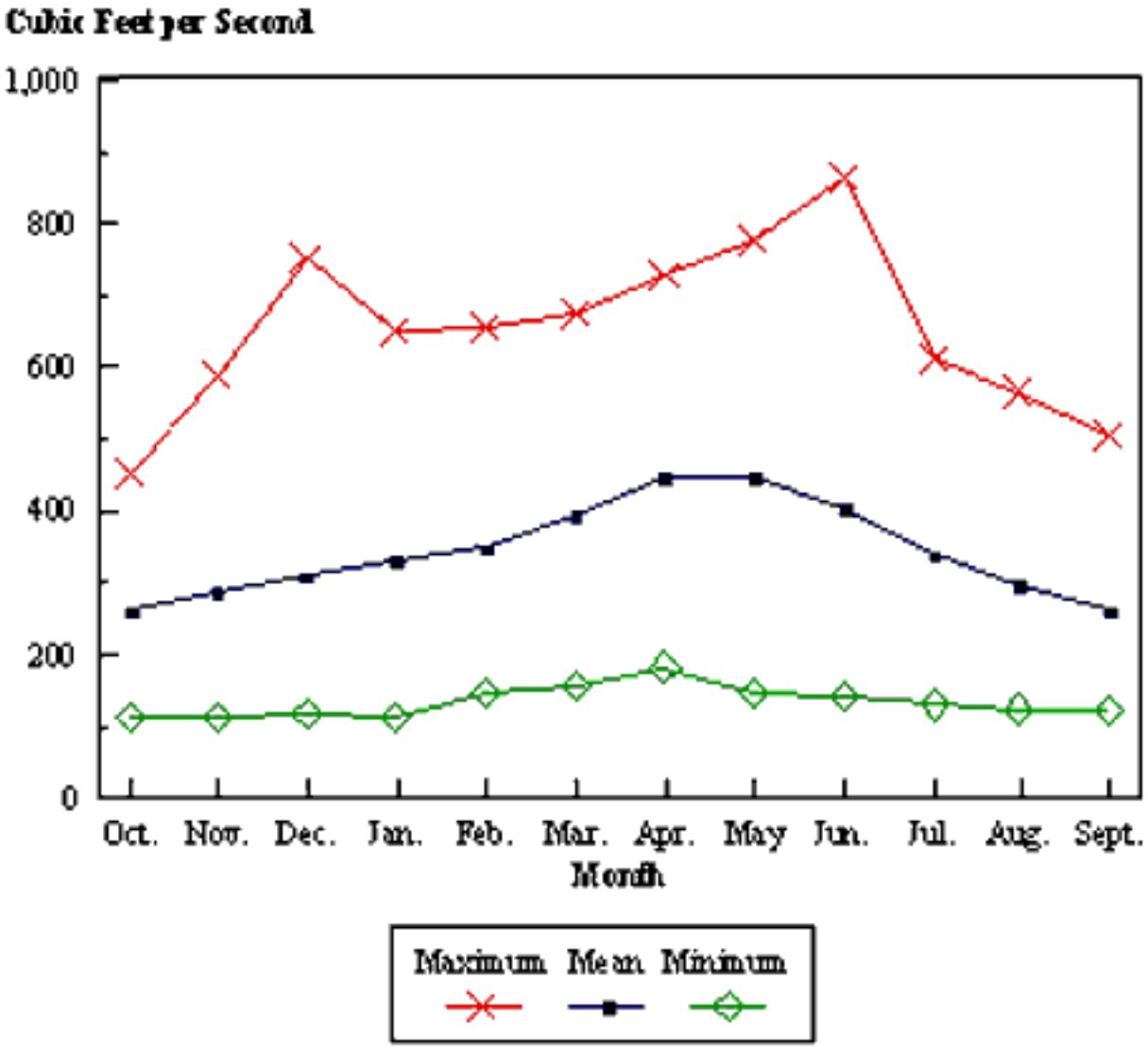


Figure Hy04. Monthly maximum, minimum, and mean flows for station 07071500-Eleven Point River near Bardley 1922-1994 (USGS 1995).

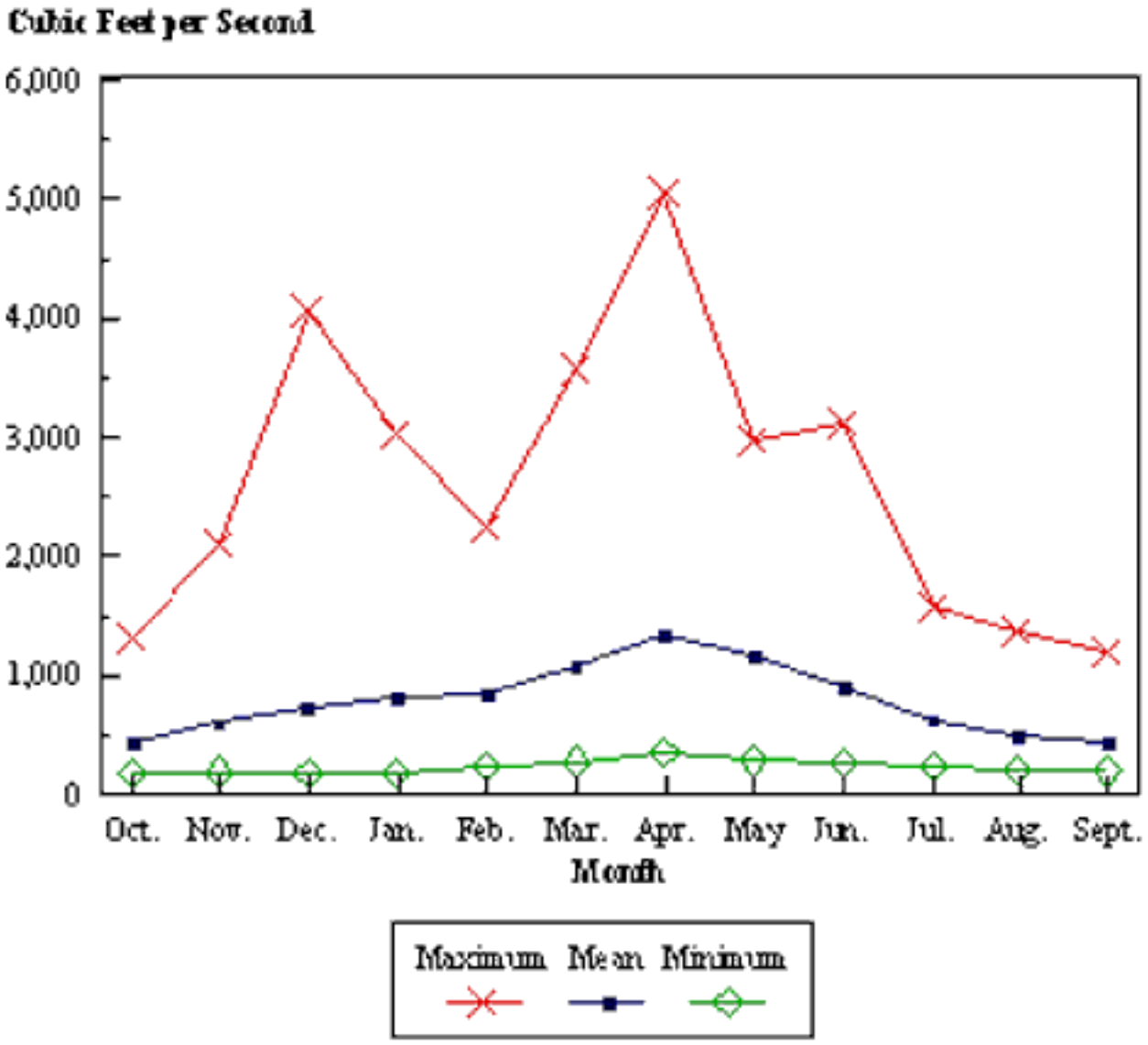


Figure Hy05. Monthly maximum, minimum, and mean flows for station 07070500-Eleven Point River near Thomasville 1951-1977 (USGS 1996).

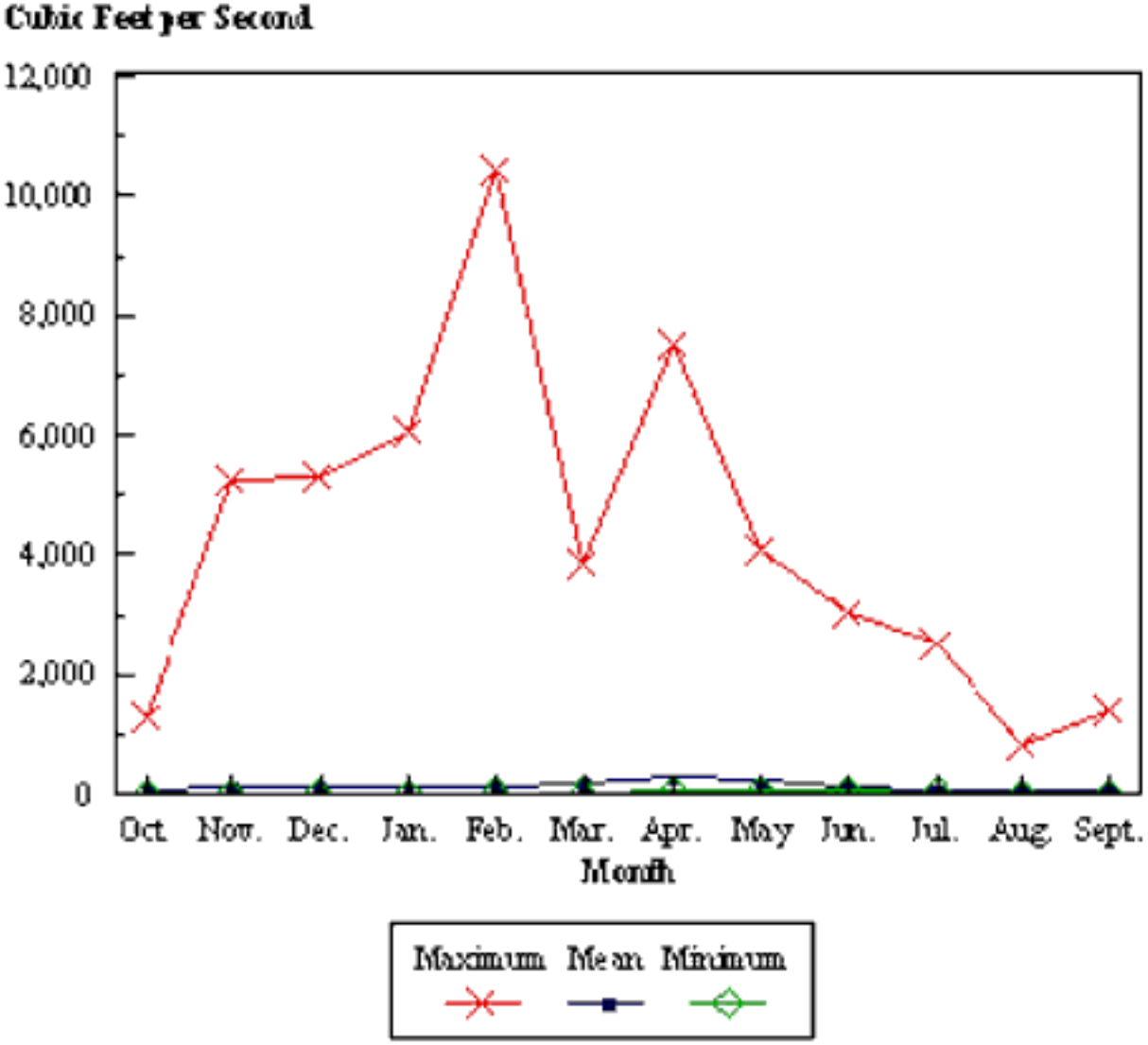


Figure Hy06. Flow duration changes between two time periods for the Eleven Point River near Bardley (USGS 1995).

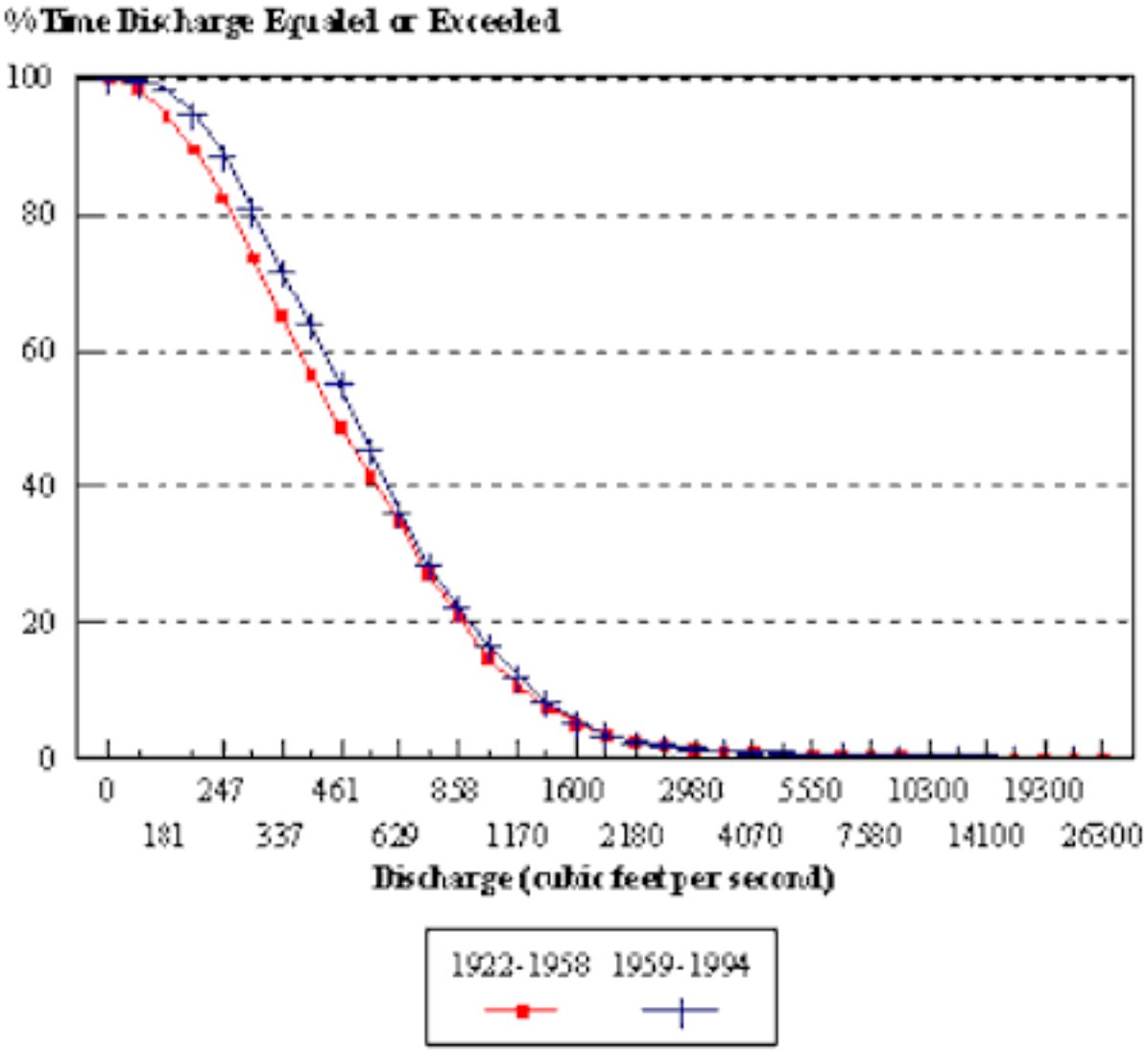


Figure Hy07. Flow duration changes between two time periods for the Greer Spring (USGS 1995).

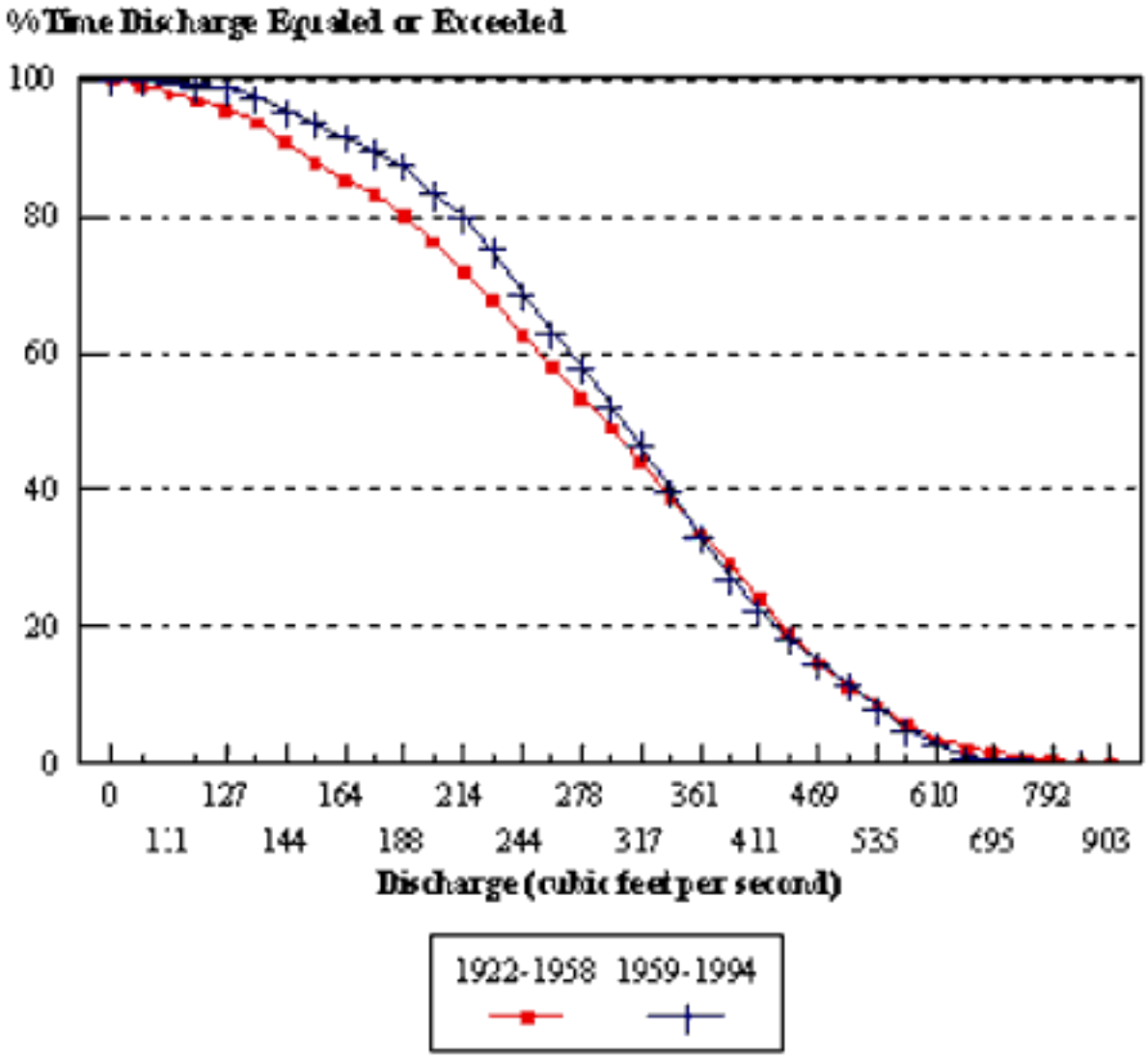


**Table Hy01. Gage stations in the Eleven Point Watershed (MDNR 1984, USGS 1994 and 1997).**

| Station Number | Station Name | Location | Period of Record |
|---|---|---|---|
| 07070300 | Eleven Point River near Mountain View | Howell County NE,NE,Sec.25,T26N,R8W | 1964-1966 |
| 07070450 | Eleven Point River at Thomasville | Oregon County SW,Sec.32,T25N,R5W | 1942-1943 1945-1946 1951 1962-1967 |
| 07070500 | Eleven Point River near Thomasville | Oregon County NE,NE,Sec.3,T24N,R5W | 1951-1972 |
| 07070510 | Posey Spring near Thomasville | Oregon County NE,NE,Sec.3,T24N,R5W | 1950-1956 1958-1959 1961-1963 |
| 07070700 | Spring Creek near Thomasville | Oregon County SW,Sec.13,T25N,R5W | 1969-1970 |
| 07071000 | Greer Spring<br>at Greer | Oregon County<br>SE,SW,Sec.36,T25N,R4W | 1904<br>1921-1997 |
| 07071030 | Turner Mill Spring near Alton | Oregon County NE,SE,Sec.3,T24N,R3W | 1924-1925 1932-1936 1966-1967 |
| 07071490 | Boze Mill Spring near Bardley | Oregon County SE,SE,Sec.9,T23N,R2W | 1925 1931-1934 1936-1964 1966-1967 |
| 07071500 | Eleven Point River near Bardley | Oregon County NE,SE,Sec.17,T23N,R2W | 1922-1997 |
| 07071850 | Fredrick Creek near Myrtle | OregonCountyNE, Sec.12,T22N,R3W | 1969-1971 |

| | | | |
|---|---|---|---|
| **07071860** | **Thomasson Mill (Morgan) Spring near Alton** | **Oregon County NW,Sec.16,T22N,R2W** | **1925-1926 1932-1936 1963-1967** |
| **07071865** | **Blue Spring near Alton** | **Oregon County SE,Sec.16,T22N,R2W** | **1925 1932-1936 1942-1964 1966-1967 1971** |

**Table Hy02. Highest and lowest instantaneous discharges and date of occurrence at three gage stations within the Eleven Point Watershed (USGS 1995).**

| Station Number | Station Name | Period of Record | Highest Instantaneous Flow and Date of Occurrence | Lowest Instantaneous Flow and Date of Occurrence |
|---|---|---|---|---|
| 07070500 | Eleven Point R near Thomasville | 1951-1976 | 10,400 cfs February, 1966 | 3.0 cfs Sept. 1954 |
| 07071000 | Greer Spring near Greer | 1921-1994 | 1,770 cfs December, 1982 | 104 cfs Nov.1956 |
| 07071500 | Eleven Point R. near Bardley | 1921-1994 | 49,800 cfs December, 1982 | 152 cfs Jan. 1956 |

**Table Hy03. Seven-day low-flow discharges for 2, 10, and 20 year recurrence intervals, as well as (Q2/Q20) slope indices for the Eleven Point River (USGS 1995).**

| Station Number | Station Name | Period of Record | Q2 (cfs) | Q10 (cfs) | Q20 (cfs) | Slope Index (Q2/Q20) |
|---|---|---|---|---|---|---|
| 07070500 | Eleven Point R. near Thomasville | 1951-1976 | 7.2 | 4.1 | 3.4 | 2.1 |
| 07071000 | Greer Spring near Greer | 1921-1994 | 184 | 122 | 119 | 1.5 |
| 07071500 | Eleven Point R. near Bardley | 1921-1994 | 270 | 185 | 178 | 1.5 |

**Table Hy04. Two-500 year flood discharges at two United States Geological Survey (USGS) Stations within the Eleven Point Watershed (Alexander and Wilson 1995).**

| Station | Recurrence Interval | | | | | | |
|---|---|---|---|---|---|---|---|
| - | 2 | 5 | 10 | 25 | 50 | 100 | 500 |
| Eleven Point Near Thomasville | 6,070 | 10,900 | 14,700 | 19,800 | 23,800 | 28,100 | 38,600 |
| Eleven Point Near Bardley | 9,250 | 20,000 | 28,600 | 40,300 | 49,500 | 58,800 | 80,600 |

# *WATER QUALITY*

The United States Geological Survey and United States Forest Service have periodically measured chemical and physical water quality conditions at locations throughout the Eleven Point Watershed since 1968 (Table Wq01)(USGS 1969; Aley 1971; Tryon 1978; and USGS 1995). Many different aspects of water quality have been measured, and data on one or more of the items listed in Table Wq02 are available at each station.

Long term and current water quality data exist for the Eleven Point River near Bardley (Station 07071500) and at Greer Spring (Station 07071000). Water samples taken throughout the period of record indicate water discharged from Greer Spring maintains a water temperature of 55 to 57 degrees Fahrenheit (deg. F.) dissolved oxygen between 3.9 and 11.2 mg/l. The water is hard (108 to 209mg/l CaCO3), low in total phosphorus (0.020 to 0.030 mg/l), with periodically high fecal coliform (1 to 173 cols./100ml) and fecal streptococci (29 to 94 cols./100ml) levels, coinciding with periods of high precipitation (USGS 1996).

Water quality readings taken on the Eleven Point River near Bardley suggest the river has hard water (60 to 210 mg/l CaCO3), that is low in total phosphorus (0.008 to 0.15 mg/l), and has periodically high fecal coliform (2 to 2300 cols./100ml) and fecal streptococci (6 to 1300 cols./100ml) once again, the elevated values coincide with periods of high precipitation. Water temperatures at this station have ranged from 43 to 73 deg. F. and dissolved oxygen readings have ranged between 6.0 and 13.2 mg/l (USGS 1996).

Two years, 1971 and 1993, were arbitrarily selected to compare water quality values between the 1970's and 1990's at Bardley (Table Wq03). Most water quality parameters were similar except total phosphorus, manganese, and iron. Phosphorus, manganese, and iron values were all higher during 1971. Fecal coliform levels appear to be much lower in 1971. However, high fecal coliform levels have occurred throughout the entire period of record, and have often exceeded state standards for drinking water (0 cols./100ml) and whole-body-contact recreation (200 cols./100ml) (USGS 1972; USGS 1994; and MDNR 1994A). State water quality standards for fecal streptococci have not been established .

From 1990 to 1993 the USGS in cooperation with the Missouri Department of Conservation (MDC) performed an extensive evaluation of ground and surface water quality, ground water levels, and ground water flow in and adjacent to the lead prospecting area. Prior to this study, insufficient information existed to adequately analyze the potential effects of lead mining in the area. Water quality was evaluated at 6 stream sites, 7 springs, and 29 wells . Various water quality parameters were evaluated once a year between 1990 and 1993 (Table Wq04)(Kleeschulte and Sutley 1995). The data from this study is on file at the MDC Ozark Fisheries Regional Office, West Plains. All water quality parameters were within normal levels. Figure Ge04 displays historical records of some successful groundwater dye tracings in the Eleven Point Watershed. This study showed positive dye traces inconsistent with previous dye traces, giving testimony to the dynamics of groundwater movement (Legler, personal communication). A multi-agency database of dye tracings is available through the MDNR, Division of Geology and Land Survey.

Duchrow (1977) conducted the most comprehensive macroinvertebrate study within the watershed. He collected a total of 129 taxa of aquatic invertebrates from the Eleven Point River and its tributaries during a water quality/aquatic invertebrate study in 1974. Water quality was evaluated by comparing calculated species diversity index values to established standards for Missouri streams(Tables Wq05,

Wq06, and Figure Bc04). Many pollution sensitive invertebrates were collected. Water quality parameter values met established criteria for unpolluted Missouri streams. According to Duchrow, intensive recreational use has not degraded the water quality of the Eleven Point River. However, he also noted that the conversion of forest land to pasture land and the introduction of treated sewage effluent represent major, potential threats to the water quality of the Eleven Point River Watershed, adding that these activities had apparently contributed additional nutrients to the Eleven Point River as witnessed by excessive algal growth. Duchrow (1977) stated, "to date, the increased productivity has not caused serious problems; however, if the nutrient introduction is allowed to increase, future water quality degradation could occur."

Since 1974, benthic macroinvertebrates have been spot sampled periodically. Seasonal records do not exist for any of the post 1974 collections, which precludes using this data to compare with the 1974 study performed by Duchrow.

## Water Use

Data obtained from the United States Geological Survey National Water Use Database (1999) indicate that total water withdrawn within the Eleven Point Watershed in 1995 was 4.08 million gallons per day (mgd) (Table Wq07)(USGS 1999). Nearly all of the water withdrawn in the watershed was from the groundwater system. Groundwater withdrawn within the watershed was 3.21 million gallons per day (mgd) while surface water withdrawn was 0.87 mgd. All surface water withdrawn was for livestock or irrigation use.

Domestic water use was the most prevalent use within the Eleven Point Watershed (USGS 1999). Domestic deliveries from public water supplies in 1995 equaled 0.56 million gallons per day (mgd). Self-supplied water withdrawn in 1995 for domestic use equaled 0.52 mgd. Livestock use was a close second at 1 mgd (Table Wq07).

The amount of water withdrawn in the watershed is likely to continue to rise in the upper portion of the watershed with a projected increase in the population of Howell County. Projections of population increase of Missouri counties have been calculated by the Missouri Office of Administration (MOA), Division of Budget and Planning for three different projection scenarios in a report entitled "Projections of the Population of Missouri Counties By Age, Gender, and Race: 1990 to 2020" (http://www.oa.state.mo.us/bp/popproj/index.htm)(MOA 1994). The combined population for Howell and Oregon Counties is expected to increase 6% to 27% by the year 2020.

The Missouri Department of Natural Resources (MDNR) maintains records of "major" users of surface and ground water (those facilities capable of withdrawing 100,000 gallons/day) throughout the state. Recent records (1993) indicate that although there are no major surface water users, four major ground water users exist within the Eleven Point Watershed. The major ground water users include the cities of Willow Springs, Alton, and Birch Tree, as well as Oregon County Public Water Supply District #2 (PWSD #2). Annual water withdrawals (million gallons/year) for Willow Springs, Alton, Birch Tree, and PWSD #2 are 161.0, 60.4, 36.7, and 2.1 respectively (MDNR 1993).

The Missouri Department of Natural Resources (MDNR) has designated 20 miles of the Eleven Point River from Greer Spring (Section 17, 23N, 2W) to Highway 160 (Section 36, 25N, 4W) in Oregon County as a Cold-Water Sport Fishery (Figure Hc03). The Eleven Point River from its headwaters near Willow Springs to Highway 142 has also been designated as an outstanding National Water Resource.

Section 23, 25N, 6W (Thomasville) to the state line is designated by the MDNR for whole body contact recreation as well as boating and canoeing (MDNR 1994A). Within the National Scenic River boundary, United States Forest Service has established regulations prohibiting the use of air boats and outboard motors larger than 25 HP at the propeller shaft.

The Eleven Point River is not designated for use as a drinking water supply. The streams of this watershed have no public surface water withdrawals. Additionally, there are no dam or hydropower influences at this time. Additional use designations for the Eleven Point River and its tributaries are included in Table Wq08.

Section 303d of the federal Clean Water Law requires that states identify those waters for which current pollution control measures are inadequate. This is accomplished by comparing data from those waters with water quality criteria established for designated beneficial uses of those waters (MDNR 1999b). Those waters are then included in the 303(d) list. The state must then conduct Total Maximum Daily Load (TMDL) studies on those waters in order to determine what pollution control measures are required and then insure those measures are implemented (MDNR 1999a). The Final 1998 303(d) list for Missouri includes 0.4 miles of the Eleven Point River and 0.1 miles of Piney Creek (MDNR 1999c). The pollutant at both sites is chlorine associated with the Willow Springs and Alton waste water treatment plants. The Clean Water Act requires that the list be updated every 2 years thus the next 303(d) list should be available in the year 2000 (MDNR 1999b).

## Recreational Angling and Boating

Annual angler mail surveys were conducted for the Missouri portion of the Eleven Point River between 1983 to 1986 (Wiethman 1991). Annually, 12,873 total days were spent angling on that reach of river. Rainbow trout (Oncorhynchus mykiss) were the most preferred species even though only 1/2 of the stream is considered cold water. A total of 3,969 (31%) days were spent fishing for rainbow trout, 2298 (18%) days for black bass, 2210 (17%) days for shadow bass (Ambloplites ariommus), and 442 (3%) days for sucker sp.. Non-game fish and no preference angling made up the remaining 31% of the time.

A probability type angler survey was conducted for the Eleven Point River between Thomasville Access and Greer Access from May through October in 1990 and 1991, and May through August of 1992 (Mayers 1994). During this two year angler survey, approximately 1,123 anglers were contacted. They were mostly local anglers with 73% from Oregon, Shannon, and Howell counties, and 94% from Missouri. Angling pressure was similar in 1990 and 1991 at 12,882 and 9,083 estimated total hours respectively. However, angling pressure dropped considerably in 1992 to 3,887 estimated total hours. Several factors were ruled out as contributors to this decline including weather, water levels, and a regulation change which affected the lower mile of the angler survey area; thus reasons for the decline remain undetermined. While rainbow trout provided 7,798 estimated total angling hours, 78% (13,774 total hours) of the angling effort was directed toward shadow bass, largemouth bass (Micropterus salmoides), and smallmouth bass (Micropterus dolomieui). The remaining effort was expended fishing for sunfish species (4.8%), sucker species (0.4%), chain pickerel (Esox niger) (1.3%), channel catfish (Ictalurus punctatus) (1.0%), and anything (14.6%).

The mainstem of the Eleven Point River from Thomasville to Riverton receives a tremendous amount of recreational boating use. In 1982 The Missouri Department of Conservation evaluated the recreational

value of Missouri's major watersheds. The Eleven Point River ranked 3rd, behind the Gasconade and Current River, which were 2nd and 1st respectively (Bachant, Witter, and Martindale 1982). Based on data collected by permitted outfitters on the Eleven Point River, the United States Forest Service estimates the number of client days spent on the Eleven Point River to be 10,785 in the year 1996.

## Point Source Pollution/Nonpoint Source Pollution

Table Wq09 lists National Pollution Discharge Elimination System (NPDES) sites within the Eleven Point Watershed. The towns of Alton, Birch Tree, and Willow Springs are the only permitted (by MDNR) municipal wastewater discharges in the watershed. These discharges are to losing streams and exhibit some water quality problems until all stream flow is lost to ground- water system, which usually occurs within 0.5 miles of the discharge point. As with other permitted discharges to losing streams in Missouri, these wastewater facilities must have a higher degree of treatment and disinfection of wastewaters in order to help protect ground water. Despite this added treatment however, these wastewaters are a constant source of contamination to the groundwater system (MDNR 1984, MDNR 1994A, MDNR 1994B, MDNR 1994C). In addition to the municipal wastewater discharges, 4 other NPDES discharges exist within the watershed.(Table Wq09 and Figure Wq01). Other threats to water quality include turbidity and sediment deposition from gravel dredging operations as well as poor land use practices. Figure Wq01 shows locations of recent (1998) gravel mining acitivity within the watershed.

The Missouri Department of Natural Resources, Division of Geology and Land Survey has identified 15 active and 133 historical mining operations within the Eleven Point Watershed (MDNR 1994D). Of the 15 active mines, 13 are gravel mines and 2 are limestone mines.

Since 1963, a total of 217 lead prospecting holes have been drilled on United States Forest Service (USFS) lands. Prospecting activity on USFS lands has ceased, with the last 3 holes drilled in 1993. No public record is available to determine numbers or locations of lead prospecting on private lands within the watershed. Data on the location and number of drill holes completed on USFS lands is available at the Missouri Department of Conservation Ozark Region Fisheries Office in West Plains or the United States Forest Service Eleven Point/Doniphan Ranger District Office in Winona.

Land disruption from road and bridge construction and maintenance often results in increased sediment loads to receiving water systems. Bridge construction also results in stream channel modification, which affects stream flow both up and downstream from the bridge. The Missouri Department of Transportation 2000-2004 Road and Bridge Construction Schedule lists six projects involving bridge construction within the Eleven Point Watershed. These sites include Highway 60 (2 projects), Highway 63 (2 projects), Highway 99 (Eleven Point River), and Highway 99 (Middle Fork) (MDT 1999).

## Nonpoint Source Pollution

Perhaps one of the more difficult challenges to address within any watershed is nonpoint source pollution. Whereas point source pollution can usually be traced to a single discharge point or area such as a waste water treatment plant discharge, non point source pollution, such as sheet erosion of topsoil, runoff of nutrients from pastures, or pesticide or fertilizer runoff from a fields, is much more difficult to detect as well as remedy. It takes the cooperation of the landowners within a watershed to minimize nonpoint source pollution and its impacts.

Livestock waste is a large source of nonpoint pollution and constitutes a major percentage of the Eleven

Point Watershed's total organic waste, contributing to the BOD, suspended solids, fecal coliform, and fecal streptococci loads (MDNR 1984). In 1984, the number of cattle and hogs within the watershed was estimated to be equal to 1,124,985 PE (human population equivalents) (MDNR 1984). A large number of cattle in the watershed are on pasture and many spend a large portion of their time in or near stream channels. This results in increased organics and bacterial loading, turbidity, and high concentrations of algae. In many cases the negative impacts are more apparent than upstream point source discharges (MDNR 1984). Negative impacts to aquatic ecosystems also occur when "no discharge" lagoons associated with confined animal feeding operations discharge to streams. In 1984, there were 19 of these facilities in the Eleven Point River Watershed (MDNR 1984).

Another source of nonpoint pollution is the failure of private septic systems. This can occur when septic systems are not constructed properly and/or are not properly maintained.

It is difficult to estimate what impact private septic systems have on water quality within the Eleven Point Watershed. However the potential for contamination by septic systems has been shown by Aley (1972 and 1974) to be increased in areas of soluble bedrock (MDNR 1984).

The primary emphasis of watershed management in the Ozarks should be on maintaining or enhancing water quality. Gravel dredging and poor land use practices such as indiscriminate land clearing and allowing livestock in riparian areas for long periods of time cause significant soil erosion, sediment deposition, and degradation of in-stream habitat. In addition, the careless use of pesticides can also be detrimental to water quality. Efforts should be focused toward improving land use practices and reducing the negative impacts of gravel dredging. The use of "best management practices" during logging and road maintenance/construction activities are important in reducing sediment loss to streams. Emphasis should also be placed on spring flow and groundwater systems. As stated previously, private septic sytem failure can pose a significant risk to groundwater systems. Additional public education on proper septic system construction and maintenance is important. Areas where water enters groundwater systems ,such as sinkholes and losing streams, are especially sensitive areas needing immediate management emphasis. Good land management can insure that only good quality water enters groundwater through these routes.

## Fish Contamination and Fish Kills Investigations

Contaminant levels within fish of the Eleven Point River have been evaluated annually since 1989 (Buchanan 1995; MDC 1989-1995). Various fish and invertebrate species from above and below potential lead mining areas were collected each year (Table Wq10). Fish contaminant samples were collected from Cane Bluff in 1989, 1990, 1991, 1993, 1994, and 1996. Fish contaminant samples were collected from Turner Mill in 1990, 1991, 1993, 1994, 1995, and 1996. Samples from Cane Bluff and Turner Mill access have included black redhorse (Moxostoma duquesnei), common carp (Cyprinus carpio), bass sp., and sucker sp.. Asian Clam (Corbicula fulminea), Britt's shell (Lampsilis reeviana brittsi), and other mussels were collected from Spring Creek and Hurricane Creek in 1996. Contaminant analysis revealed low levels of lead, cadmium, and chlordane in fish samples for all years. However, mussel samples taken in 1996 from Spring Creek and Hurricane Creek revealed high concentrations of lead and cadmium.

Mercury levels in fish rose suddenly in 1993. In 1993, mercury levels in sucker sp. rose to 200 parts per billion (ppb) in Cane Bluff samples and 150ppb in Turner Mill samples. In 1994 mercury levels were at 175ppb and 200ppb in redhorse and bass from Cane Bluff and 171ppb and 426ppb in redhorse and bass from Turner Mill. In 1995 mercury levels in suckers at Turner Mill dropped to 122ppb. In 1996 mercury

levels in black redhorse and northern hogsucker were 290ppb and 210ppb at Cane Bluff and 215ppb and 232ppb at Turner Mill respectively. Prior to 1993, the highest mercury level recorded for suckers was 17ppb at Turner Mill in 1990. Although mercury levels rose considerably, these levels are well below state health advisory levels of 1,000ppb. Mussel sp. and Asian Clams collected from Spring Creek in 1996 contained lead concentrations of 270ppb and 87ppb and cadmium concentrations of 400ppb and 430ppb respectively. Britt's shell collected from Hurricane Creek in 1996 contained lead concentrations of 48ppb and cadmium concentrations of 170ppb. In addition to the annual fish contaminant sample sites at Cain Bluff and Turner Mill, the MDC Ozark Fisheries Region plans to continue sampling mussels from the Eleven Point River at Spring Creek and Hurricane Creek. The high concentrations of lead and cadmium found in the 1996 mussel samples, justify expansion of mussel sample sites. Future expansion of mussel contaminant sampling to include the Eleven Point River near Thomasville, Cane Bluff, and Turner Mill is planned. The Missouri Health Department presently (January 1999) has no warnings of fish consumption in the entire Eleven Point Watershed (Robert Legler, Personal Communication).

The Missouri Department of Health releases its Fish Advisory

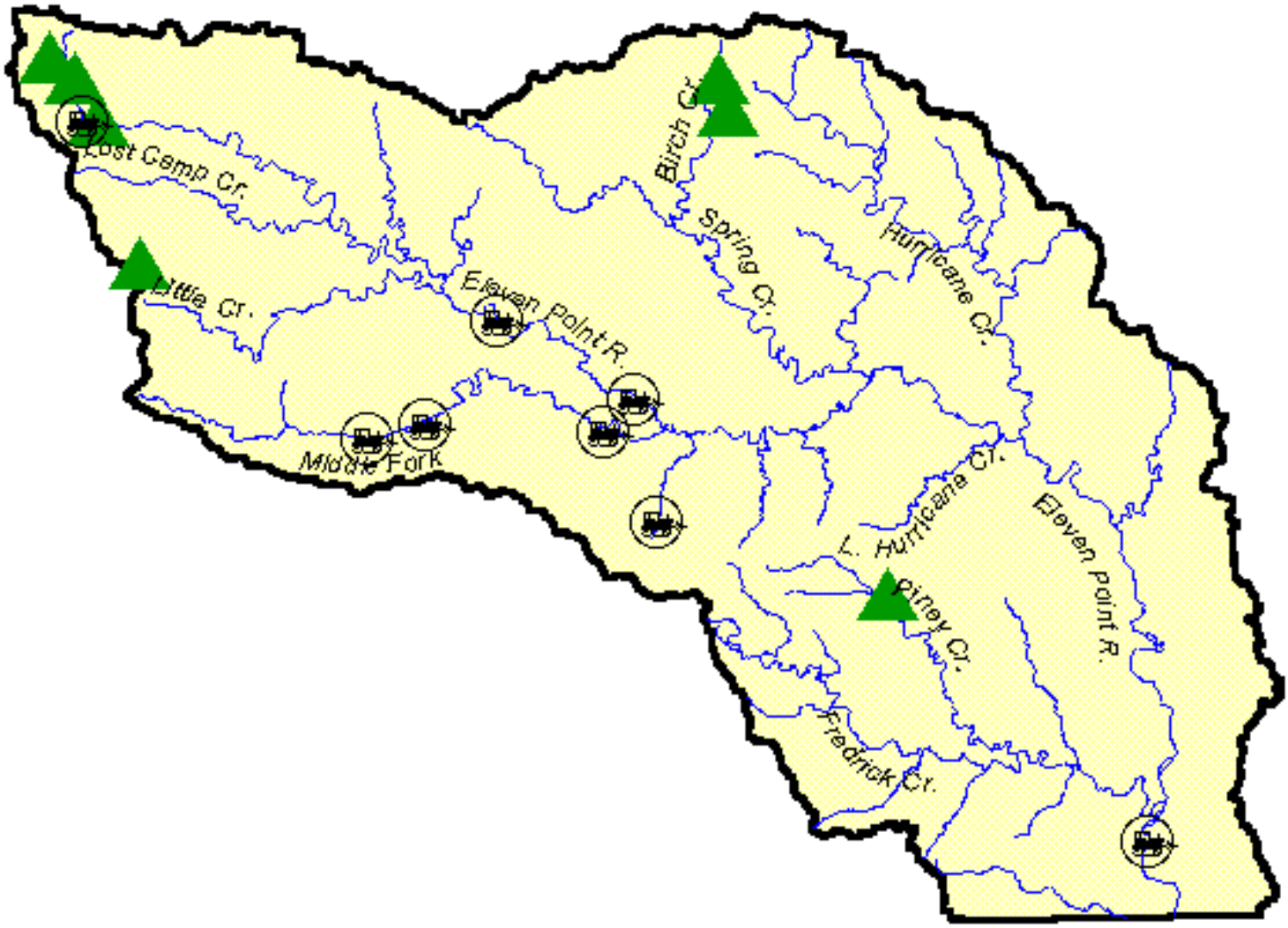
(http://www.health.state.mo.us/NewsReleases/99ADVSRYpr.html) on an annual basis. The advisory indicates the amount of different types of fish that the department believes can be safely consumed by people.

No fish kills have been reported in the Eleven Point Watershed since 1970 (MDC 1981, 1983A, 1983B, 84-85, 86-97, and 99).

Figure Wq01.

# Eleven Point Watershed

## National Pollution Discharge Elimination System (NPDES) & Gravel Mining Sites




5 0 5 Miles

N

**Legend**

- NPDES Permit Site (1998)
- Permitted Gravel Mining Site (1998)

Note: Data subject to change.

**Table Wq01. Water quality stations within the Eleven Point Watershed (USGS 1969, Aley 1971, Tryon 1978, and USGS 1995).**

| Location | USFS Period of Record | USGS Period of Record |
|---|---|---|
| Eleven Point River at Thomasville | 1968-1974 | - |
| Middle Fork at Highway 99 | - | 1968-1974 |
| Eleven Point River 2.9 miles below Thomasville | 1968-1974 | - |
| Eleven Point River above Greer Spring | 1968-1974 | - |
| Greer Spring | 1968-1974 | 1993-1995 |
| Hurrican Creek at Forest Service Weir | 1968-1974 | - |
| Boze Mill Spring | 1968-1974 | - |
| Eleven Point River near Bardley | 1968-1974 | 1968-1995 |
| Thomasson Mill (Morgan) Spring | 1968-1974 | - |
| Blue Spring | - | 1968-1974 |

**Table Wq02. Selected water quality indicators measured within the Eleven Point Watershed (USGS 1969, Aley 1971, Tryon 1978, and USGS 1995).**

| Flow | Total Nitrogen |
|---|---|
| Air Temperature | Ortho-phosphate |
| Water Temperature | Total phosphate |
| Turbidity | Sodium |
| Apparent Color | Potassium |
| pH | Chloride |
| Dissolved Oxygen | Fluoride |
| Free carbon dioxide | Sulfate |
| Specific conductance | Silica |
| Total dissolved solids | Calcium |
| Carbonate | Magnesium |
| Bicarbonate | Copper |
| Calcium-magnesium hardness | Iron |
| Total alkalinity | Lead |

| | |
|---|---|
| **Organic nitrogen** | **Manganese** |
| **Ammonium nitrogen** | **Zinc** |
| **Nitrate nitrogen** | **Aluminum** |
| **Kjeldahl nitrogen** | **Fecal/Streptococci** |
| **Nitrate + nitrite** | **Benthic macroinvertebrate** |

**Table Wq03. Selected water quality data for the Eleven Point River near Bardley at gage station #07071500, water years 1972 and 1993 (USGS 1972, USGS 1993, MDNR 1994).**

| - | State Standard | - | - | - | Water Year | - |
|---|---|---|---|---|---|---|
| **Parameter** | **I** | **III** | **VI** | **VII** | **1972** | **1993** |
| Temperature (ºF) | 68.0Max | - | - | - | 48.2-65.3 | 48.2-65.3 |
| Specific Conductance (us/cm[3]) | - | - | - | - | 268-395 | 191-349 |
| pH | ----------6.5-9.0---------- | | | | 7.7-7.9 | 7.2-8.2 |
| Oxygen, dissolved (mg/L) | 5.0 | - | - | - | 7.3-9.7 | 8.4-11.6 |
| Coliform, fecal (colonies / 100 ml) | - | - | 200 | - | 14-62 | 2-2300 |
| Streptococci, fecal (colonies / 100 ml) | - | - | - | - | 32-430 | 30-k1300[5] |
| Alkalinity[1] (mg/L as CaCO3) | - | - | - | - | 128-190 | 94-174 |
| Nitrogen, Total Ammonia (mg/L as N) | 1.17-1.75[2] | - | - | - | 0.01-0.07 | 0.01-0.05 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Phosophorus, Total[3] (mg/L as P)** | - | - | - | - | 0.01-0.29 | 0.02-0.07 |
| **Manganese, dissolved (ug/L as Mn)** | - | 50 | - | 50 | 30-40 | 2-8 |
| **Fluoride, dissolved (mg/L as F)** | - | 4 | - | 4 | 0.10 | 0.10 |
| **Iron, dissolved (ug/L as Fe)** | 1000 | 300 | - | 300 | 20-110 | 3-10 |

**I Protection of aquatic life**

**III Drinking water supply**

**V Livestock and Wildlife Watering**

**VI Whole-body-contact recreation**

**VII Groundwater**

**k Non-ideal count of colonies (too large a sample, colonies merged)**

**[1] State standard for alkalinity currently unavailable. The Environmental Protection Agency currently recommends a minimum of 20.0 mg/L (USEPA 1999)·**

**[2] Based on minimum chronic and acute standards for limited warm-water fishery. Levels are pH and temperature dependent. For specific criteria at varying pH and temperatures consult Table B of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality.**

**[3] State standard for phosphorus is currently unavailable. The Environmental Protection Agency currently recommends a maximum of 0.1mg/L for rivers (Christensen and Pope 1997).**

**Table Wq04. Water quality parameters measured by the USGS and the MDC during 1990-1993 at various stream, spring, and well locations throughout the Fristoe Unit of the Mark Twain National Forest (Kleeschulte and Sutley 1995).**

| | |
|---|---|
| **Instantaneous Discharge** | **Dissolved Arsenic** |
| **Specific Conductance** | **Dissolved Barium** |
| **pH** | **Dissolved Beryllium** |
| **Temperature** | **Dissolved Cadmium** |
| **Dissolved Oxygen** | **Dissolved Chromium** |
| **Dissolved Calcium** | **Dissolved Cobalt** |
| **Dissolved Magnesium** | **Dissolved Copper** |
| **Dissolved Sodium** | **Dissolved Iron** |
| **Dissolved Potassium** | **Dissolved Lead** |
| **Bicarbonate** | **Dissolved Lithium** |
| **Carbonate** | **Dissolved Manganese** |
| **Alkalinity (Calcium Carbonate)** | **Dissolved Mercury** |
| **Dissolved Sulfate** | **Dissolved Molybdenum** |
| **Dissolved Chloride** | **Dissolved Nickel** |

| | |
|---|---|
| **Dissolved Flouride** | **Dissolved Selenium** |
| **Dissolved Silica** | **Dissolved Silver** |
| **Dissolved Solids** | **Dissolved Strontium** |
| **Dissolved Nitrite** | **Dissolved Vanadium** |
| **Dissolved Nitrite+Nitrate** | **Dissolved Zinc** |
| **Dissolved Ammonia** | **Total Organic Carbon** |
| **Dissolved Ammonia +Organic Nitrogen** | **Suspended Sediment** |
| **Dissolved Phosphorous** | **Dissolved Aluminum** |
| **Dissolved Orthophosphate** | - |

**Table Wq05. Summary of Duchrow's 1974 water quality parameter values for stations within the Eleven Point Watershed (Duchrow 1977).**

| Station | Location | [1]Species Diversity Index Value | Number of Mayfly and Stonefly Taxa |
|---|---|---|---|
| EP-45 | Eleven Point @ Hwy. 142 Bridge | 5.9 | 19 |
| EP-54 | Eleven Point @ Hwy. 160 Bridge | 5.7 | 20 |
| EP-73 | Eleven Point @ Hwy. 19 Bridge | 5.6 | 19 |
| EP-76 | Eleven Point above Greer Spring Branch | 6.8 | 21 |
| EP-88 | Eleven Point @ Hwy. 99 Bridge | 6.8 | 20 |
| EP-86 | Eleven Point below Barren Fork | 7.4 | 25 |
| EPF-1 | Fredrick Creek @ the Narrows | 8.5 | 30 |
| EPH-1 | Hurricane Creek @ County Rd. 19-154 | 5.8 | 19 |
| GS-0 | Greer Spring Branch | 4.3 | 14 |
| EPS-0 | Spring Creek @ mouth | 5.6 | 14 |
| EPBF-2 | Barren Fork @ Hwy. 160 Bridge | 7.0 | 24 |
| EPMF-0 | Middle Fork @ Hwy. 99 Bridge | 7.2 | 24 |

**[1]Species Diversity Index Value = D = (s-1)/($log_e$N);where s" equals**

**the number of taxa and "N" is the total number of organisms in the sample.**

**Table Wq06. Water quality designations based on invertebrate insect population data for Missouri streams as used by Duchrow (1977).**

| | Seasonal | | Annual | | |
|---|---|---|---|---|---|
| Water Quality Designation | Species Diversity Index Value[1] | # of Mayfly & Stonefly Taxa | Species Diversity Index Value[1] | # of Mayfly & Stonefly Taxa | Total Taxa |
| Unpolluted | >3.9 | >9 | >6.9 | >21 | >56 |
| Moderately Polluted | 2.2-3.9 | 5-9 | 3.8-6.9 | 10-21 | 31-56 |
| Polluted | <2.2 | <5 | <3.8 | <10 | <31 |

[1]Species Diversity Index Value=D= (s-1)/($\log_e$N); where "s" equals the number of taxa and "N" is the total number of organisms in the sample.

**Table Wq07. Water use within the Eleven Point Watershed in 1995 based on withdrawals in millions of gallons per day (USGS 1999).**

| Use | Ground Water | Surface Water | Total |
|---|---|---|---|
| Public Supply (Total) | 1.94 | 0 | 1.94 |
| Domestic (delivered) | - | - | 0.56 |
| Commercial (delivered) | - | - | 0.12 |
| Industrial (delivered) | - | - | 0.08 |
| Self Supplied (Total) | 1.27 | 0.87 | 2.14 |
| Domestic | 0.52 | 0 | 0.52 |
| Commercial | 0.07 | 0 | 0.07 |
| Livestock | 0.25 | 0.75 | 1.00 |
| Irrigation | 0.43 | 0.12 | 0.55 |
| Total | 3.21 | 0.87 | 4.08 |

**Table Wq08. Missouri Department of Natural Resources use designations for selected streams within the Eleven Point Watershed (MDNR 1996). Locations are given in section, township, range format.**

| Stream Name | Class[1] | Miles | From | To | Designated Use* |
|---|---|---|---|---|---|
| Eleven Point R. | P | 21.0 | State Line | 18,24n,02w | irr,lww,aql,clf,wbc,btg |
| Eleven Point R. | P | 10.0 | 18,24n,02w | 36,25n,04w | lww,aql,cdf,wbc,btg |
| Eleven Point R. | P | 19.0 | 36,25n,04w | 23,25n,06w | lww,aql,clf,wbc,btg |
| Eleven Point R. | C | 34.0 | 23,25n,06w | 33,27n,09w | lww,aql,clf |
| Fredrick Cr. | P | 3.0 | Mouth | 08,22n,02w | lww,aql,wbc,btg |
| Fredrick Cr. | C | 10.0 | 08,22n,02w | 02,22n,04w | lww,aql,btg |
| Greenbriar Cr. | C | 1.5 | Mouth | 33,24n,02w | lww,aql |
| Greer Spring Br. | P | 1.0 | Mouth | 36,25n,04w | lww,aql,cdf |
| Hurricane Cr. | P | 4.0 | Mouth | 28,25n,03w | lww,aql,wbc,btg |
| Hurricane Cr. | C | 5.0 | 28,25n,03w | 04,25n,03w | lww,aql |
| Kelley Hollow | P | 0.5 | Mouth | 27,25n,03w | lww,aql |
| L. Hurricane Cr. | C | 3.0 | Mouth | 07,24n,03w | lww,aql |
| Lee Hollow | C | 1.0 | Mouth | 27,26n,07w | lww,aql |
| Little Cr. | C | 8.0 | Mouth | 01,25n,08w | lww,aql |
| Lost Camp Cr. | C | 5.0 | Mouth | 20,26n,08w | lww,aql |
| Middle Fork | P | 5.5 | Mouth | 28,25n,06w | lww,aql,wbc,btg |
| Middle Fork | C | 12.0 | 28,25n,06w | 04,24n,07w | lww,aql |
| Piney Cr. | C | 10.5 | Mouth | Hwy. 160 | lww,aql |
| Spring Cr. | P | 6.0 | Mouth | 24,25n,05w | lww,aql |
| Spring Cr. | C | 6.0 | 24,25n,05w | 03,25n,05w | lww,aql |

| | | | | | |
|---|---|---|---|---|---|
| **White Cr.** | **P** | **2.5** | **Mouth** | **09,24n,02w** | **lww,aql** |
| **White Cr.** | **C** | **2.0** | **09,24n,02w** | **04,24n,02w** | **lww,aql** |

***irr**-irrigation clf-cool water fishery

**lww**-livestock & wildlife watering cdf-cold water fishery

**aql**-protection of warm water aquatic life wbc-whole body contact recreation and human health-fish consumption.btg-boating & canoeing

**dws**-drinking water supply ind-industrial

**[1]P**-Streams that maintain permanent flow even in drought periods.

**C**-Streams that may cease flow in dry periods but maintain permanent pools which support aquatic life.

**Table Wq09. National Pollution Discharge Elimination System (NPDES) permit sites within the Eleven Point Watershed (MDNR 1998).**

| Facility Name | Recieving Stream | Facility Class | County |
|---|---|---|---|
| Mfa Oil Co. Willow Springs | Trib. Eleven Point R. | Petroleum Storage | Howell |
| Pomona Mobile Home Park | Trib. Lost Camp Cr. | Mobile Home Park | Howell |
| Bryan Pump & Plumbing | Trib. Eleven Point R. | Sludge Disposal\Haulers | Howell |
| Willow Springs WWTF | Eleven Point R. | City Waste Water Treatment Plant | Howell |
| V & V Processing | Trib. Birch Cr. | Meat Locker/Processing | Shannon |
| Birch Tree Municipal WWTP | Trib. Birch Cr. | City Waste Water Treatment Plant | Shannon |
| Alton WWTP | Piney Cr. | City Waste Water Treatment Plant | Oregon |

**Note: This table is not a final authority. Data subject to change.**

**Table Wq10 . Summary of fish contaminant results for sites within the Eleven Point Watershed (1989-1995). No data available for 1992.**

| Cane Bluff | | | | | | |
|---|---|---|---|---|---|---|
| Year | Species | Chlor | PCB | Hg | Cd | Pb |
| 1989 | Black Redhorse | 20 | - | - | - | - |
| - | Carp | 68 | - | - | - | - |
| - | Carp | 54 | - | - | - | - |
| 1991 | Black Redhorse | <20 | <50 | - | - | - |
| - | Carp | 43 | <50 | - | - | - |
| 1993 | Sucker sp. | - | - | 200 | 2 | <10 |
| 1994 | Redhorse sp. | - | - | 175 | 9.1 | 10 |
| - | Bass sp. | - | - | 200 | 4.5 | 10 |
| 1996 | Black Redhorse | 29 | - | 290 | 2 | <10 |
| - | N. Hogsucker | <20 | - | 210 | 2.4 | <10 |
| Turner Access | | | | | | |
| Year | Species | Chlor | PCB | Hg | Cd | Pb |
| 1990 | N. Hogsucker | <20 | <50 | 17 | 3 | <20 |
| - | Black Redhorse | <20 | <50 | 16 | 3 | <20 |
| 1991 | N. Hogsucker | <20 | <50 | - | - | - |
| - | Black Redhorse | <20 | <50 | - | - | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1993 | Sucker sp. | - | - | 150 | 4 | <9 |
| 1994 | Redhorse sp. | - | - | 171 | 4.6 | <10 |
| | Bass sp. | - | - | 426 | 1.6 | <10 |
| | Sucker sp. | 21 | <50 | 122 | 3.9 | <10 |
| | Redhorse sp. | <20 | - | 215 | 4.3 | <10 |
| - | N. Hogsucker | <20 | - | 232 | 8.2 | <10 |

| Year | Species | Chlor | PCB | Hg | Cd | Pb |
|---|---|---|---|---|---|---|
| 1996 | Mussel sp. | - | - | 48 | 400 | 270 |
| - | Asiatic Clam | - | - | 19 | 430 | 87 |

**Hurricane Creek**

| Year | Species | Chlor | PCB | Hg | Cd | Pb |
|---|---|---|---|---|---|---|
| 1996 | Britt shell | - | - | 44 | 170 | 48 |

# *HABITAT CONDITIONS*

## Channel Alterations

There have been no significant channel alterations anywhere throughout the Eleven Point Watershed. Small channelization projects have probably occurred on private property and also from road and bridge construction. These activities are currently not considered to be a major threat to the river system. However, there are currently (1998) 8 permitted gravel removal operations within the watershed (Figure Wq01) (USACOE 1998). The negative impacts of gravel mining have been shown to include channel deepening, sedimentation of downstream habitats, accelerated bank erosion, the formation of a wider and shallower channel, the lowering of the floodplain water table, and channel shift (Roell 1999).

## National Scenic River

Congress passed legislation which established the National Wild and Scenic Rivers System in 1968. Forty four miles of the Eleven Point River, which was free of impoundments with its shoreline and watershed still largely undeveloped, qualified as a National Scenic River (USFS 1995). Thus the portion of the Eleven Point River between Thomasville and Highway 142 Bridge became one of the 8 initial units of the National Wild and Scenic River Systems.

Approximately half of the lands within the Eleven Point National Scenic River Area are privately owned (USFS 1995). The remainder of the area is owned and managed by the United States Forest Service. To assure the continued natural appearance of this area, private lands along the river are protected by scenic easements, acquired from landowners within the National Scenic River Area.

## Natural Features

In the late 1980s and early 1990s the Missouri Department of Conservation inventoried counties within the Eleven Point River Watershed for unique natural features (Nigh 1988; Ryan and Smith 1991). The inventories recognized seven categories of natural features: examples of undisturbed natural communities, habitat of rare or endangered species, habitat of relict species, outstanding geological formations, areas for nature studies, other unique features, and special aquatic areas having good water quality, flora and fauna. These studies identified 134 potential natural features in the Eleven Point River Watershed. Of the 134 sites, 35 had exceptional or highly significant natural features. The Eleven Point River was recognized as an outstanding natural feature. Blue Spring was recognized as the most exceptional spring site in the state and the surrounding area was identified as containing an outstanding aquatic community. The corridor of the Eleven Point River near Greer contained an exceptional example of a mesic dolomite forest. Unique and outstanding dolomite bluffs, glades, and dry music chert forests are common throughout the watershed. Other types of exceptional or highly significant features found in the watershed include: pond swamp and marsh, dry chert forest, mesic dolomite forest, pond marsh/shrub swamp, effluent cave, deep phreatic spring, marsh (fen), fen, dry-mesic bottomland forest, flatwoods, pond shrub swamp, pin oak flatwoods/pond marsh and forested acid seep (Nigh 1988; Ryan and Smith 1991).

## Improvement Projects

Currently there are no Missouri Department of Conservation stream habitat improvement projects in the Eleven Point Watershed.

## Stream Habitat Assessment

Stream and riparian habitat quality were evaluated at 16 sites throughout the Eleven Point Watershed in 1992 and 1995 by Missouri Department of Conservation and United States Forest Service personnel (Figure Hc01). Habitat quality was assessed using the Missouri Department of Conservation Stream Habitat Assessment Device (SHAD II). SHAD survey sites were selected independently of historic fish collection sites. SHAD surveys helped identify common problems throughout the watershed and provided a standardized description of habitat condition at specific locations. For purposes of evaluation, the SHADS were grouped according to their location in the watershed. Any particular SHAD was assigned to one of three major drainage sections: the Upper Eleven Point Section (above Spring Creek), Middle Eleven Point Section (between Spring Creek and Fredrick Creek), or the Lower Eleven Point Section (below Fredrick Creek). This grouping proved to be appropriate for evaluating general physical habitat characteristics since many of the habitat conditions at the sites within each drainage section were similar. However, because of the small number of SHAD sites and the subjective, general nature of the SHADs and this grouping, this evaluation can not be considered a thorough and accurate representation of the entire Eleven Point Watershed.

The upper Eleven Point Drainage Section consisted of eight survey locations. Seven surveys were conducted on the Eleven Point River and one on the Middle Fork. Streams in the upper section rated lowest in habitat quality. Timbered stream corridor width at all but one site, had at least a portion of one of the stream banks with less than 100 feet of timbered corridor. Stream banks ranged from stable to severely eroded. Silt and organic debris composed 15% to 45% of the stream substrate on all of the streams in the upper section except the Middle Fork, where substrate was composed primarily of cobble and gravel. Additional habitat concerns included a lack of instream cover and a significant amount of algal growth, indicating a high nutrient influx.

Habitat conditions in the Middle Drainage Section of the Eleven Point were the best (This portion of the watershed is almost entirely within United States Forest Service boundaries). Timbered stream corridor width was >100 feet and bank erosion is minimal at all three survey locations. In-stream cover was sparse, primarily consisting of boulders. Substrate was primarily composed of cobble and gravel.

Four SHAD surveys were completed in the Lower Eleven Point Drainage Section. Habitat quality in this portion of the watershed was impacted by farming operations. Most of the stream corridor contained <100 feet of timber. Instream cover was very sparse, consisting primarily of small patches of water willow (< 2% of wetted area). Silt and organic debris were prevalent. Algal growth was significant at all sites, indicating a high nutrient influx. Cattle had direct access to the stream at three of the four survey sites; Piney Creek (River Mile 3); Fredrick Creek (River Mile 9); Eleven Point River (River Mile 2-3).

Selected SHAD data was entered into a geographic information system (GIS) database based on a numerical system which enabled more efficient analysis of data. Sites were evaluated based on the following SHAD categories: "stream bank erosion", stream bank erosion protection", "percent timbered stream corridor", and "narrowest width of timbered corridor".

Numerical values associated with different levels of condition for each category were then assigned to left and right streambanks and corridors of each riffle and pool evaluated with 1 being extremely poor and 5 being excellent. These values were then averaged to give an overall grade for the site (Figure Hc01). The lowest grade within the Eleven Point Watershed was a 3 (fair). Three sites received this

rating; all of which are located in the Upper Eleven Point Drainage Section. Three sites were rated as 5 (excellent) one of which was a dry site located on the Upper Eleven Point River. It was felt that data from this site was still pertinent to determining erosion and scour susceptibility of this site during a flood event. The remaining 10 sites were rated as 4 (good).

An aerial survey of the Eleven Point Watershed was made during February, 1995. The survey flight covered the entire length of the Eleven Point River within Missouri and many of the major tributaries. A video tape of the reconnaissance flight was used to identify areas of significant channel and bank disturbance(Tables Hc01, Hc02, and Figure Hc01) .

Perhaps one of the more difficult attributes of a watershed to attempt to quantify is stream habitat. This is due to the fact that there are several dynamic characteristics which make up stream habitat. To evaluate all of these characteristics individually and accurately for an entire watershed is a monumental task. Thus, the next best thing is to evaluate a characteristic that has the most impact on all aspects of stream habitat. This is, arguably, riparian corridor land cover/land use. Riparian corridor land cover effects many aspects of stream habitat. These include, but are not limited to water temperature, turbidity, nutrient loading, sand/gravel deposition, in-stream cover, flow, channel width, and channel stability. These in turn have effects on still other characteristics of stream habitat such as food availability, dissolved oxygen, cover, spawning areas, etc.

Evaluation of riparian corridor land cover/land use within the Eleven Point Watershed was accomplished using Missouri Resource Assessment Partnership Phase 1 Land Cover Data. A buffer zone 3 pixels (90 meters) wide was created which corresponded to a 1:100,000 hydrography coverage for the watershed. This was split into segments no longer than 0.25 miles long (Caldwell, personal communication). Percent land use for each segment was then calculated. Land cover/land use categories included forest, woodland, grassland, cropland, urban, and water. Percentages of these categories were then calculated for riparian corridors within each of the 20 fourteen digit hydrologic units, the three main drainage sections within the watershed, as well as the whole watershed.

Results for the entire watershed indicate that corridor land use consists of more forest/woodland (65.0%) than grassland/cropland (33.7%). Combined percentages for the remaining categories are less than 4% of the total riparian corridor land cover/land use in the watershed. Of the three major drainage sections within the watershed, the Middle Eleven Point Section has the highest combined percentage of forest/woodland corridor land cover/land use at 77.8%. It also has the lowest combined percentage of grassland/cropland corridor land use at 20.5%. This is due in large part to the fact that much of this section is part of the Mark Twain National Forest. Table Hc03 gives riparian corridor land cover/land use percentages for all fourteen digit hydrologic units within the watershed as well as percentages for the three major drainage sections of the watershed and the total watershed. Figure Hc02 presents a graphic representation of riparian corridor land cover/land use for all fourteen digit hydrologic units within the watershed.

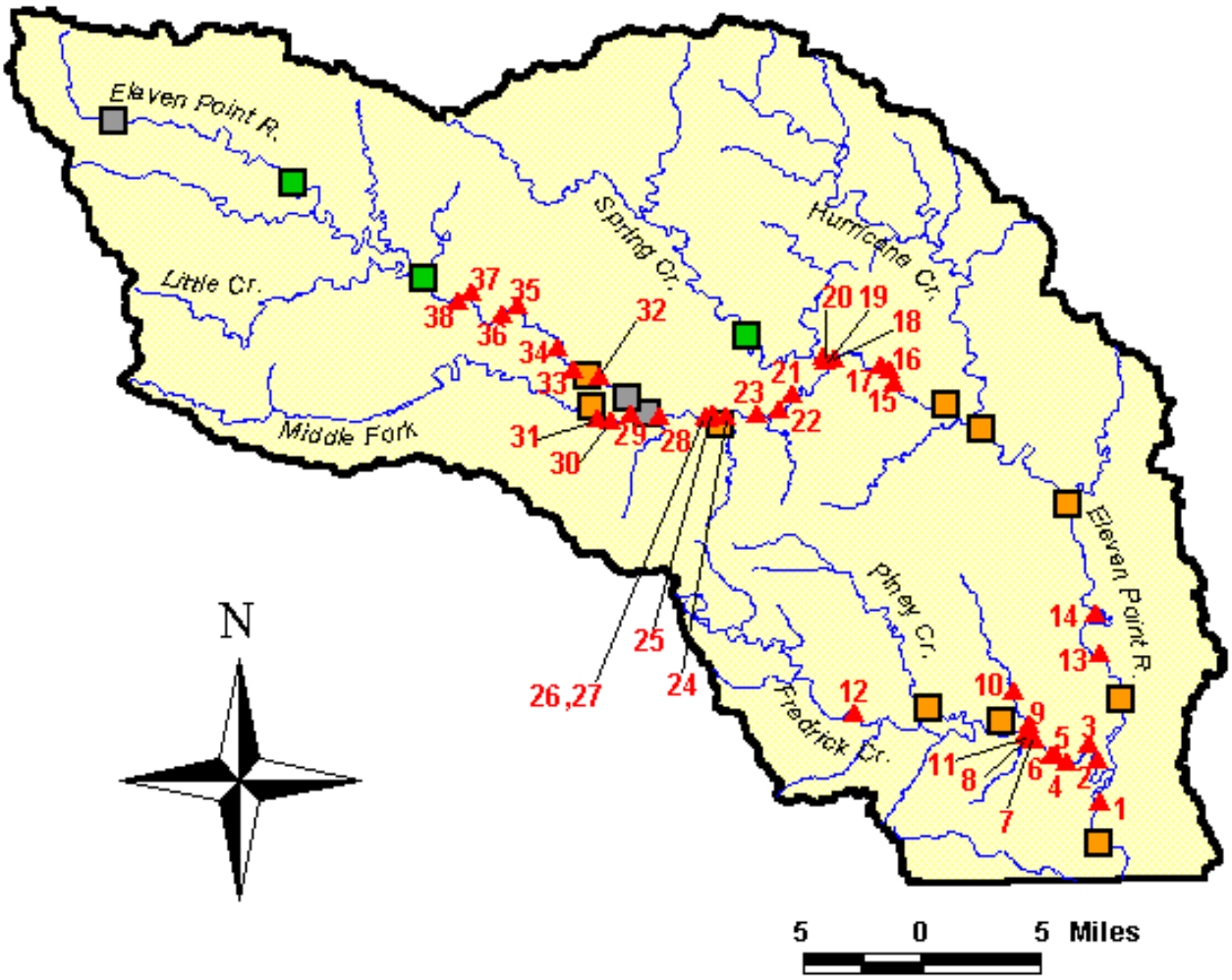
Approximately 21 miles of stream within the Eleven Point Watershed are designated for cold-water sport fishery (MDNR 1994). Twenty miles of the Eleven Point River are designated for cold-water sport fishery from the mouth of Greer Spring Branch to approximately Highway 160 at Riverton. The remaining 1 mile is Greer Spring Branch (Figure Hc03).

As part of an effort to further quantify cold water resources throughout the Eleven Point Watershed, long-term temperature recorders were deployed in July and retrieved in September of 1995. In addition to

the eight temperature recorders deployed throughout the Eleven Point River, a single unit was deployed on Greer Spring Branch and two were deployed on Hurricane Creek (Figure Hc03). Figure Hc04 shows the maximum 3 hour consecutive water temperatures from the Eleven Point River and Greer Spring Branch during the months of July, August, and September of 1995. Greer Spring Branch reached a maximum temperature of 64.4 degrees Fahrenheit (deg. F.). The confluence of Greer Spring Branch just below river mile 34, strongly influences the temperature of the Eleven Point River, as witnessed by the 10 deg. F. drop in temperature from river mile 34 to river mile 28. Temperature recorders were deployed at river miles 1 and 4 on Hurricane Creek. A maximum temperature of 74 deg. F. was reached at both locations on Hurricane Creek.

Figure Hc01.

# Eleven Point Watershed
## Habitat




## Legend

▲ Aerial Inventory Site (Tables Hc2 and Hc3)

S.H.A.D. Site (1995)*

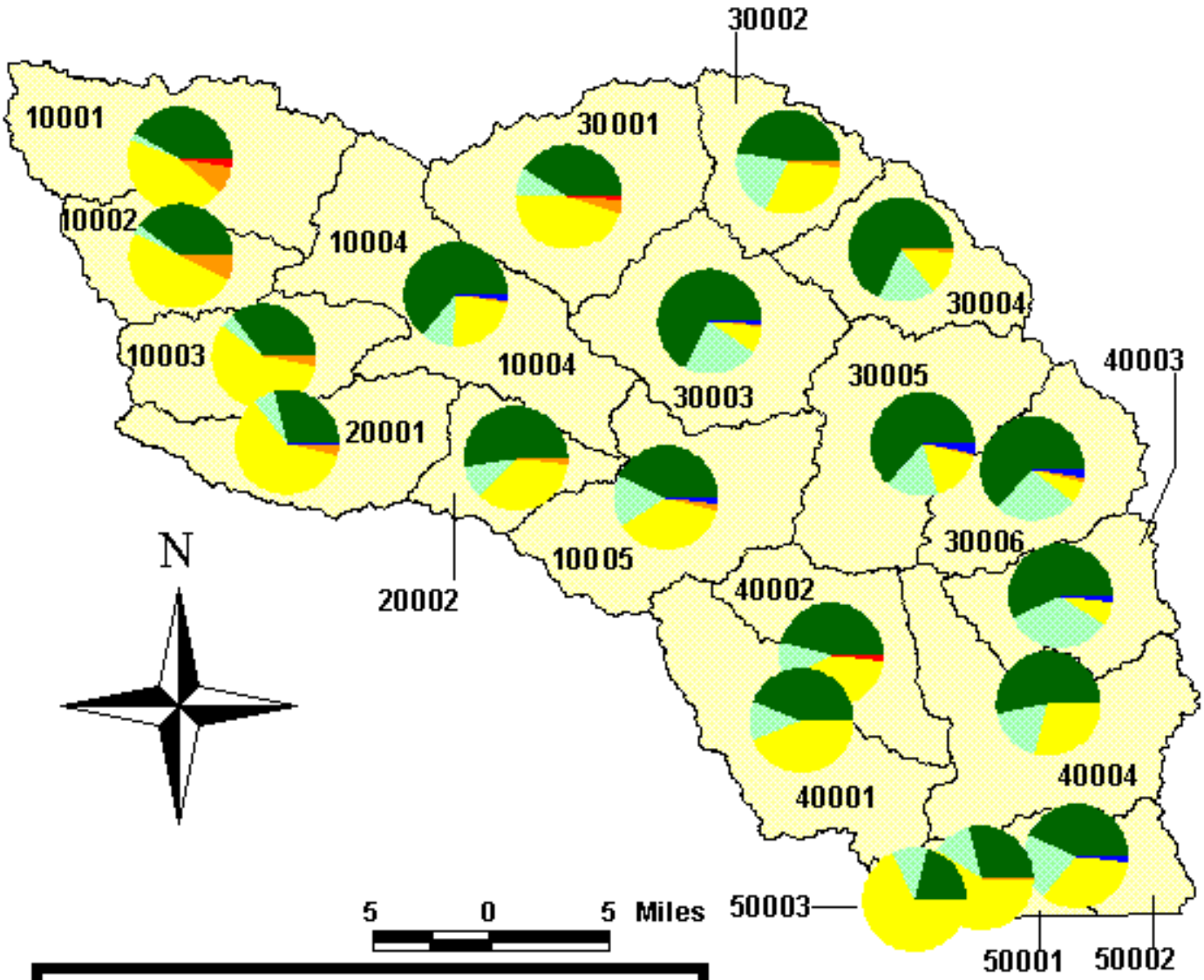
- Fair
- Good
- Excellent

*Stream Habitat Assessment Device (S.H.A.D.) ratings based only on the following catagories: "streambank erosion", "streambank erosion protection","percent of timbered stream corridor >or= 100ft", and "narrowest width of timbered corridor".

Figure Hc02.

# Eleven Point Watershed

## Riparian Corridor Land Cover /Land Use




### Legend

**Percent Land Cover/Land Use***

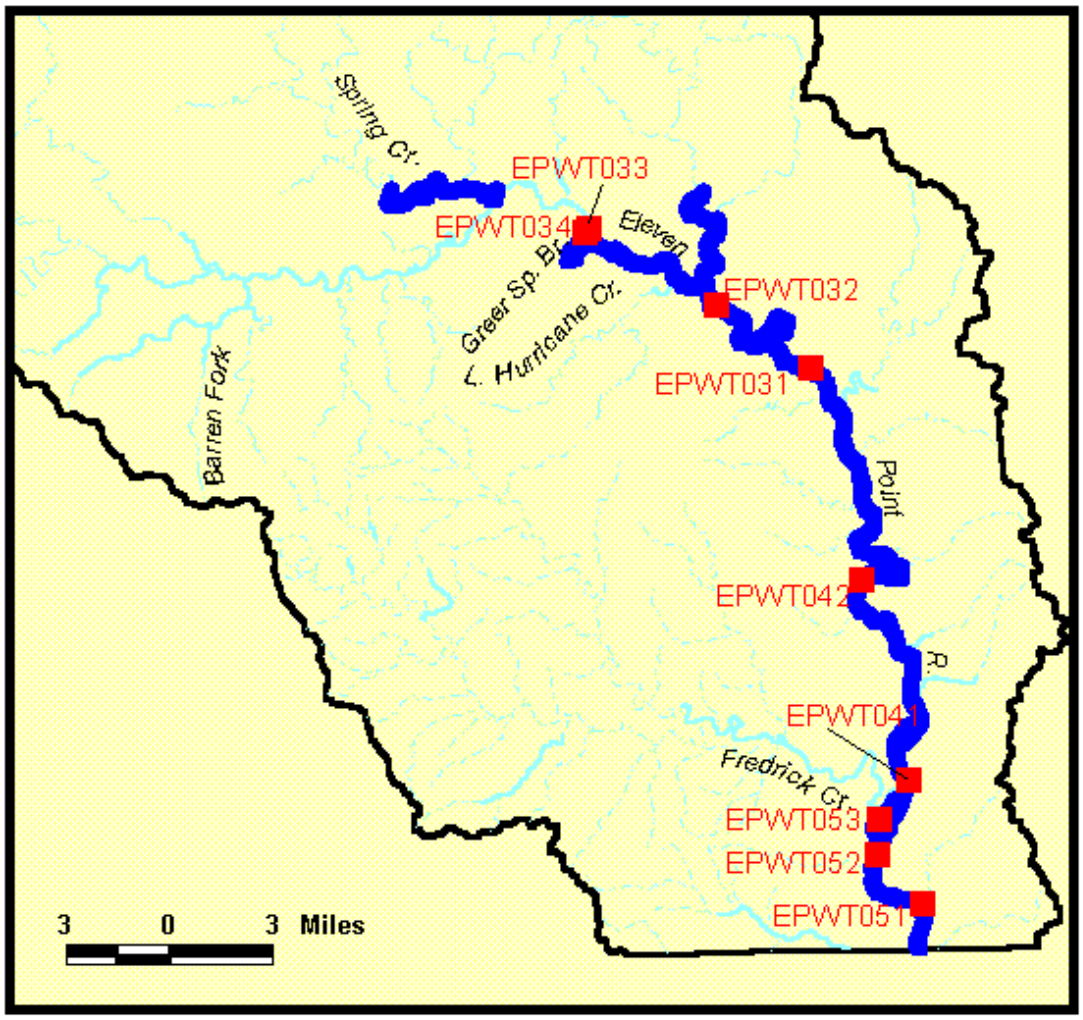
| | |
|---|---|
| Forest | Cropland |
| Woodland | Urban |
| Grassland | Water |

*Based on Missouri Resource Assessment Partnership (MoRAP) Phase 1 Land Cover Map December, 1997

MDC 5/1999

Figure Hc03.

# Eleven Point Watershed
## Cold Water




**Legend**

- Temperature Monitoring Site
- Cold Water Stream*

* "Streams designated for cold-water sport fishery" in the Missouri Dept. of Natural Resources Clean Water Commission regulations 1996 (10 CSR 20.7, Table C)

N

MDC 5/1999

Figure Hc04. Maximum three hour consecutive temperatures for selected sites on the Eleven Point River as well as one site on Greer Spring Branch..

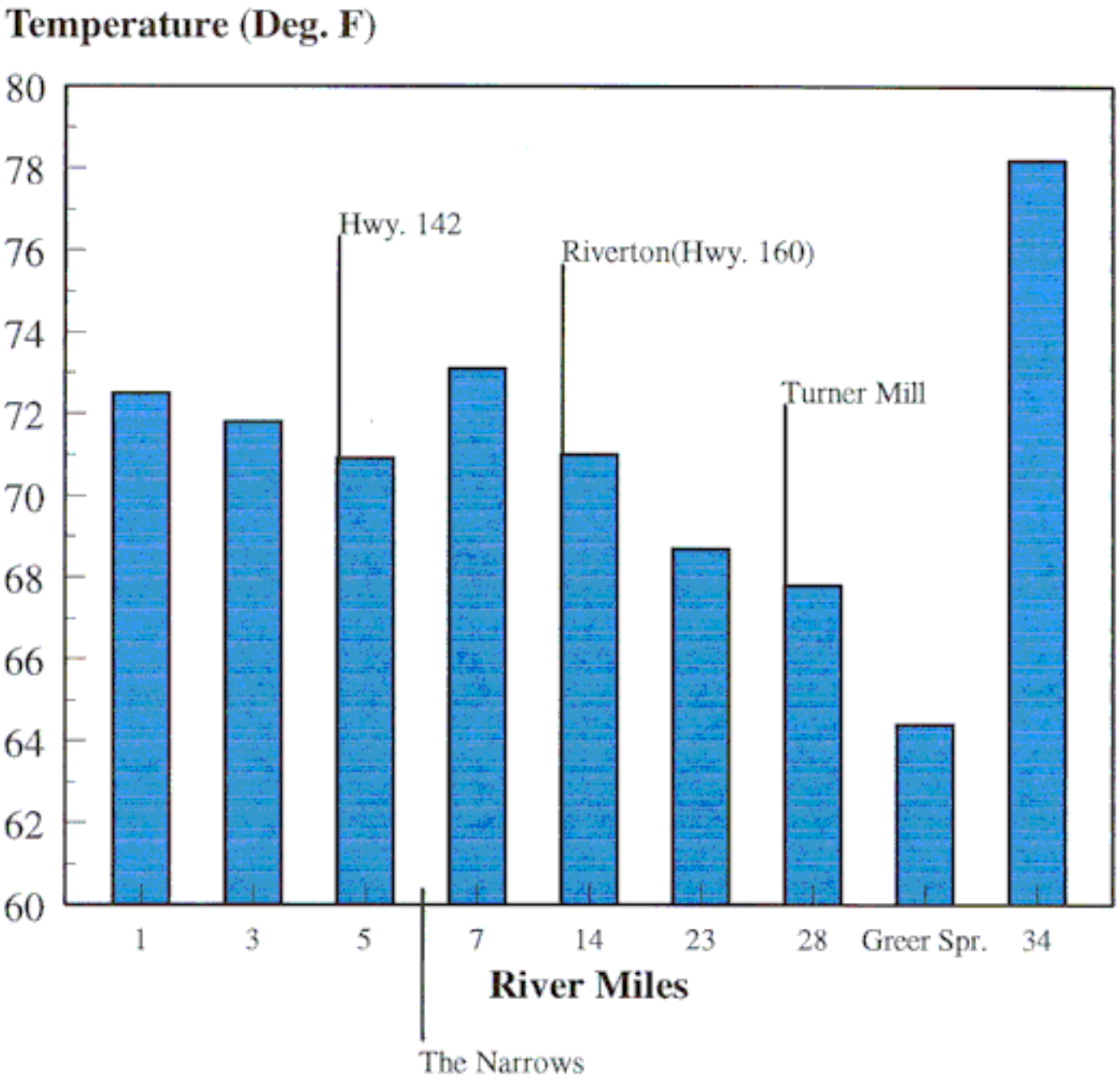


**Table Hc01. Qualitative observations of stream channel condition and use of selected sites within the Eleven Point Watershed based on aerial video (1995).**

| Site* | Stream Name | Left Bank Condition/Land Use | Right Bank Condition/Land Use |
|---|---|---|---|
| 1 | Eleven Point River | Erosion/Pasture | Stable/Timber |
| 2 | Fredrick Creek | Erosion/Pasture | Deposition/Pasture |
| 3 | Fredrick Creek | Erosion/Timber | Deposition/Timber |
| 4 | Fredrick Creek | Erosion/Pasture | Stable/Timber |
| 5 | Fredrick Creek | Erosion | Deposition |
| 6 | Fredrick Creek | Erosion | Deposition/Pasture |
| 7 | Fredrick Creek | Headcutting | Headcutting |
| 8 | Fredrick Creek | Erosion | Deposition/Pasture |
| 9 | Dry Creek | Erosion/Pasture | Stable /Pasture |
| 10 | Dry Creek | Erosion/Pasture | Stable /Pasture |
| 11 | Fredrick Creek | Stable/Timber | Erosion/Pasture |
| 12 | Fredrick Creek | Erosion | Cattle in Stream/Pasture |
| 13 | Eleven Point River | Erosion | Deposition/Pasture |

| | | | |
|---|---|---|---|
| 14 | Eleven Point River | Erosion/Timber | Stable/Timber |
| 15 | Eleven Point River | Erosion | Deposition/Timber |
| 16 | Eleven Point River | Stable/Timber | Erosion/Timber |
| 17 | Eleven Point River | Stable/Timber | Erosion/Timber |
| 18 | Eleven Point River | Stable/Timber | Erosion/Sparse Timber |
| 19 | Spring Creek | Erosion/Timber | Erosion/Timber |
| 20 | Spring Creek | Timber | Grassland |
| 21 | Eleven Point River | Erosion | Deposition |
| 22 | Eleven Point River | Erosion/Pasture | Deposition/Timber |
| 23 | Eleven Point River | Stable/Timber | Erosion/Pasture |

| Site* | Stream Name | Left Bank Condition/Land Use | Right Bank Condition/Land Use |
|---|---|---|---|
| 24 | Eleven Point River | Open Grassland | Open Grassland |
| 25 | Eleven Point River | Stable /Pasture | Erosion/Pasture |
| 26 | Eleven Point River | Erosion/Pasture | Stable/Timber |

| | | | |
|---|---|---|---|
| **27** | **Eleven Point River** | **Erosion** | **Deposition/Pasture** |
| **28** | **Eleven Point River** | **Erosion/Pasture** | **Timber** |
| **29** | **Middle Fork** | **Erosion** | **Channel Widening/Gravel Mining** |
| **30** | **Middle Fork** | **Erosion** | **Channel Widening/Gravel Mining** |
| **31** | **Middle Fork** | **Erosion** | **Channel Widening/Gravel Mining** |
| **32** | **Eleven Point River** | **Erosion** | **Stream Widening/Gravel Mining** |

**Table Hc02. Qualitatve observations of timbered stream corridor at selected points within the Eleven Point Watershed based on aerial video (1995).**

| Site* | Left Timbered Corridor Width | | | Right Timbered Corridor Width | | |
|---|---|---|---|---|---|---|
| | %>100ft | %50-100ft | %<10ft | %>100ft | %50-100ft | %<10ft |
| 1 | 0 | 0 | 100 | 100 | 0 | 0 |
| 2 | 50 | 0 | 50 | 0 | 0 | 100 |
| 3 | 0 | 30 | 70 | 0 | 0 | 100 |
| 4 | 0 | 40 | 60 | 100 | 0 | 0 |
| 5 | 0 | 0 | 100 | 0 | 0 | 100 |
| 6 | 0 | 0 | 100 | 0 | 0 | 100 |
| 7 | 50 | 0 | 50 | 0 | 0 | 100 |
| 8 | 0 | 0 | 100 | 0 | 0 | 100 |
| 9 | 0 | 0 | 100 | 0 | 0 | 100 |
| 10 | 0 | 0 | 100 | 0 | 0 | 100 |
| 11 | 100 | 0 | 0 | 0 | 0 | 100 |
| 12 | 0 | 0 | 100 | 0 | 0 | 100 |
| 13 | 50 | 0 | 50 | 50 | 0 | 50 |
| 14 | 100 | 0 | 0 | 100 | 0 | 0 |
| 15 | 100 | 0 | 0 | 100 | 0 | 0 |
| 16 | 100 | 0 | 0 | 100 | 0 | 0 |
| 17 | 100 | 0 | 0 | 100 | 0 | 0 |
| 18 | 100 | 0 | 0 | 100 | 0 | 0 |
| 19 | 0 | 0 | 100 | 0 | 100 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 20 | 0 | 50 | 50 | 0 | 0 | 100 |
| 21 | 0 | 0 | 100 | 0 | 0 | 100 |
| 22 | 0 | 0 | 100 | 50 | 0 | 50 |

| | %>100ft | | | | | |
|---|---|---|---|---|---|---|
| 23 | 100 | 0 | 0 | 0 | 0 | 100 |
| 24 | 0 | 0 | 100 | 0 | 0 | 100 |
| 25 | 0 | 0 | 100 | 0 | 0 | 100 |
| 26 | 0 | 0 | 100 | 100 | 0 | 0 |
| 27 | 0 | 0 | 100 | 0 | 0 | 100 |
| 28 | 0 | 50 | 50 | 0 | 30 | 70 |
| 29 | 0 | 0 | 100 | 0 | 0 | 100 |
| 30 | 0 | 0 | 100 | 0 | 0 | 100 |
| 31 | 0 | 0 | 100 | 0 | 0 | 100 |
| 32 | 0 | 0 | 100 | 0 | 0 | 100 |
| 33 | 0 | 0 | 100 | 100 | 0 | 0 |
| 34 | 0 | 0 | 100 | 0 | 0 | 100 |
| 35 | 50 | 0 | 50 | 50 | 0 | 50 |
| 36 | 0 | 0 | 100 | 0 | 0 | 100 |
| 37 | 0 | 0 | 100 | 0 | 0 | 100 |
| 38 | 0 | 0 | 100 | 0 | 100 | 0 |

*** Site number corresponds to Table Hc01 and Figure Hc01.**

**Table Hc03. Percent riparian corridor land use for 14 digit hydrologic units within the Spring River Tributaries Watershed (Figure Hc02). Data is based on MoRAP Phase 1 Land Cover (1997).**

| Subwatershed | FOR | WDL | GRS | CRP | URB | WAT |
|---|---|---|---|---|---|---|
| 10001 | 41.7 | 2.4 | 44.6 | 7.7 | 3.2 | 0.2 |
| 10002 | 40.3 | 3.2 | 49.5 | 6.7 | 0 | 0.2 |
| 10003 | 35.2 | 5.1 | 56.7 | 2.5 | 0 | 0.5 |
| 10004 | 64.1 | 9.5 | 23.4 | 1.4 | <0.1 | 1.5 |
| 10005 | 43.3 | 16.0 | 37.3 | 1.5 | 0 | 1.9 |
| 20001 | 29.2 | 7.1 | 60.4 | 3.0 | 0 | 0.2 |
| 20002 | 53.1 | 10.4 | 34.5 | 1.6 | 0 | 0.4 |
| Upper Eleven Point | 45.1 | 8.1 | 41.8 | 3.4 | 0.6 | 0.9 |
| 30001 | 41.0 | 7.8 | 45.8 | 3.5 | 1.8 | 0.1 |
| 30002 | 46.9 | 20.6 | 30.5 | 1.9 | 0 | 0.5 |
| 30003 | 66.9 | 23.4 | 8.3 | 0.5 | 0 | 0.8 |
| 30004 | 68.2 | 17.9 | 12.6 | 0.6 | 0 | 0.7 |
| 30005 | 63.4 | 16.6 | 16.2 | 1.2 | 0 | 2.6 |
| 30006 | 63.4 | 25.8 | 6.9 | 0.5 | 0 | 3.3 |
| Middle Eleven Point | 59.2 | 18.6 | 19.2 | 1.3 | 0.3 | 1.4 |
| 40001 | 43.7 | 12.1 | 43.8 | 0.3 | 0 | <0.1 |
| 40002 | 46.0 | 11.5 | 40.3 | 0.2 | 2.0 | <0.1 |
| 40003 | 56.9 | 34.3 | 7.4 | <0.1 | 0 | 1.3 |
| 40004 | 52.6 | 17.5 | 28.9 | 0.2 | 0 | 0.7 |
| 50001 | 28.9 | 12.2 | 57.8 | 1.0 | 0 | <0.1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **50002** | **42.7** | **20.6** | **33.9** | **0.2** | **0** | **2.5** |
| **50003** | **21.0** | **10.6** | **68.4** | **0** | **0** | **0** |
| **Lower Eleven Point** | **47.3** | **17.5** | **34.0** | **0.3** | **0.3** | **0.6** |
| **Eleven Point Watershed** | **50.5** | **14.5** | **31.9** | **1.8** | **0.4** | **1.0** |

**FOR =Forest, WDL=Woodland, GRS=Grassland, CRP=Cropland, URB=Urban, WAT=Water**

# *BIOTIC COMMUNITIES*

## Stream Fish Distribution and Abundance

Sixty-six fish species representing 16 families have been collected (including sport fish sample observations) in the Eleven Point Watershed since 1930 (Table Bc01)(MDC 1998a and Pflieger 1975). Figure Bc01 shows recent as well as historical fish community sampling sites within the Eleven Point Watershed.

In 1996, fish were collected at nine locations throughout the watershed, including one site at each of four major tributaries to the Eleven Point River (Middle Fork, Spring Creek, Hurricane Creek, and Frederick Creek). Collection sites on the four major tributaries were located within three miles of the tributary mouths. Since 1930, fish have been collected from 30 sites throughout the watershed.

The stream fish fauna of the Eleven Point River Watershed is dominated by Ozark species (Table Bc01). Since 1980, fifty-six fish species have been collected (including sport fish sample observations), 51 of which have been collected at one or more locations on the mainstem of the Eleven Point River. According to the faunal region classification of species as developed by Pflieger (1989), they could be described as 60% Ozark, 9% Ozark-Prairie, 11% Ozark-lowland, 4% Ozark-Big River, 2% Prairie, and 14% widely distributed.

Two fish species, checkered madtom and spotted sucker appear to have very limited distributions in the watershed. Checkered madtom were collected from only two sites; both of which were on the Eleven Point River. A single spotted sucker was collected during the 1989, Eleven Point River sport fish sample (Mayers 1994). The fish was collected somewhere between Thomasville and Greer Spring Branch. Several spotted suckers were observed during the 1996 sample of the Wild Trout Management Area, just below Greer Spring. These observations of a spotted sucker from the Eleven Point River, represent new distributions for the species. The historical range of the spotted sucker extended east and north from the Current River Watershed and did not include the Eleven Point River Watershed (Pflieger 1997). To further quantify the distribution of the spotted sucker and checkered madtom, additional sampling effort on the Eleven Point River is required.

Eight fish species collected from the Eleven Point River Watershed prior to 1980, were not found in post 1980 samples. These fish include black buffalo, channel catfish, spotted bass, , freshwater drum, mooneye, gilt darter, ozark shiner, and johnny darter.

None of the previously mentioned species have ever been collected in great numbers or in many samples within the watershed. Out of these collections, the maximum number of individuals collected were 7 spotted bass from a single site in 1964 while the maximum number of collections an individual species occurred in was 2. This in addition to the fact that most of the previously mentioned species are commonly found in other areas of the state is why their absence in recent collections is not necessarily a concern. Exceptions to this which raise an immediate management concern, however, include the gilt darter, mooneye, and Ozark Shiner.

The gilt darter, although it remains common in the Current, Black, and Gasconade River systems, has experienced a decline in its range since the construction of dams within the White River Basin (Pflieger 1997). Within the Eleven Point Watershed, only one individual from from one site has been collected since 1930. It appears that this species has never been common within the watershed; however, due to the

decline of its already small range, additional effort should be expended toward determining the present status of this species within the watershed.

The mooneye is currently listed as a species of conservation concern (MDC 1999). Only 4 individuals from 2 samples have been collected within the Eleven Point Watershed. Pflieger (1997) states that "the mooneye has never been common in Missouri collections and may be declining". It is possible this species no longer exists within the watershed. Additional sampling will be necessary in order to determine the status of this species in the watershed.

The Ozark Shiner has only been collected in two samples within the watershed. A total of three individuals were collected in these samples (MDC 1998). Because of state wide reductions in the range of the Ozark Shiner and virtual extirpation from areas such as the Eleven Point Watershed, the Ozark Shiner has been placed on the "Species of Conservation Concern" List (MDC 1999a). Future monitoring will need to be performed in order to determine the status of this species within the watershed.

One fish species, the Ozark Chub, was collected in fish community samples after 1980, but had not appeared within the watersheds in previous collections. The Ozark Chub occurs within neighboring watersheds; thus its appearance within the Eleven Point Watershed is should be of little surprise.

Four species have been observed in sport fish samples which have not been collected in historical fish community samples within the watershed. These include the black crappie, fathead minnow, sauger, and spotted sucker. Both the **black crappie**, sauger, spotted sucker have been collected in fish community samples within neighboring watersheds. The fathead minnow, however, does not occur in any watersheds bordering the Eleven Point. This species has been recommended as a supplemental forage species for game fish in new fishing ponds and lakes (MDC 1992). In addition, it is said to be one of the most commonly used bait minnows in North America. For these reasons it is quite possible that additional populations exist within the Eleven Point, as well as other watersheds.

## Sport Fish

Sport fish species (as defined as game fish in MDC 1999b) occurring within the Eleven Point Watershed include black crappie, chain pickerel, largemouth bass, and rainbow trout, shadow bass, sauger, smallmouth bass, walleye, and warmouth,(Mayers 1994, MDC 1998a, and Ozark Region Sport Fish Collection Files).

The Eleven Point River from Thomasville to Greer Spring Branch is characterized as a warm water stream (Mayers 1994). Discharge from Greer Spring doubles the flow of the Eleven Point River. The cold water influence from Greer Spring transforms the river into a coldwater fishery for approximately the next 20 miles to Highway 160. From Highway 160 to the state line the Eleven Point is primarily a warm water fishery, although the springs near the mouth of Fredrick Creek affect year round temperatures for a few miles downstream.

Sport fish populations in the Eleven Point River from Thomasville to Greer Spring Branch were sampled in 1989 and 1990 (Mayers 1994). In addition to longear sunfish, shadow bass, and smallmouth bass, which dominate the fishery; largemouth bass, northern hog sucker , chain pickerel, and rainbow trout were also collected during these samples. Tables Bc02, Bc03, Bc04 summarize the electrofishing catch, estimated abundance and size distribution of shadow bass, smallmouth bass, and largemouth bass.

The twenty miles of cold water are primarily managed for rainbow trout. Greer Spring Branch to Turner

Mill has been designated a Wild Trout Management Area (MDC 1999c). The Eleven Point River is designated as a Trout Management Area from Turner Mill to 14.2 miles downstream of Tuner Mill. In addition to rainbow trout, the cold water areas support sizable populations of smallmouth bass, shadow bass, longear sunfish and several species of suckers. Chain pickerel also contribute to this sport fishery, although their numbers have never been estimated.

Similar to the warmwater sport fishery in the head waters, the lower reaches of the Eleven Point River support good populations of chain pickerel, largemouth bass, shadow bass, smallmouth bass and walleye. In addition to these species, the Eleven Point River near the Arkansas state line supports a limited sauger population.

In addition to the previously mentioned sport fish, streams within the Eleven Point Watershed support populations of bluegill, black redhorse, golden redhorse, green sunfish, longear sunfish, northern hogsucker, redear, redspotted sunfish, shorthead redhorse, spotted sucker, white sucker, and yellow bullhead.

## Fish Stocking

Grass carp (Ctenopharyngodon idella), bluegill, largemouth bass, and channel catfish are routinely stocked in lakes and ponds throughout the Eleven Point Watershed. There are only two public lakes within the watershed. Stocking records for these lakes date back to 1964. Simms Valley Lake is 38 acres and was constructed in 1963. Within the first few years after construction, Simms Valley Lake was stocked with bluegill, largemouth bass, redear sunfish, and channel catfish. While other fish populations have sustained themselves, channel catfish stocking has continued on an annual basis (Table Bc05). McCormack Lake is 11 acres and was constructed in the 1930's and has remained under United States Forest Service ownership since that time. Original stocking records of McCormack Lake are not available, however, present day fish populations suggest that in addition to channel catfish; bluegill, largemouth bass, smallmouth bass, and grass carp were all stocked at some point in time. Periodic stocking of channel catfish into McCormack Lake has continued since 1977 (Table Bc06). The potential exists for these fish to enter streams during periods of high precipitation. Blue catfish (Ictalurus furcatus), also stocked into lakes and ponds, have been captured from the Eleven Point Watershed (Legler, personal communication). Bait bucket releases also occur in streams throughout the watershed.

Available records indicate the first state authorized stocking of trout into the Eleven Point River occurred in 1962 with the release of 5000 rainbow trout. Stocking of rainbow trout has continued at a near-annual occurrence (Table Bc07). Between 12,000 and 16,000 rainbow trout per year have been released into the Eleven Point River since 1991. These trout support areas managed by minimum length limits as well as put-and-take fisheries.

## Mussels

A total of 23 mussle species have been collected from the Eleven Point Watershed (Table Bc08 and Figure Bc02)(Oesch 1995, MDC 1998b, and Turgeon et al. 1998). Of these, 3 species are listed as species of conservation concern (MDC 1999a). These include the black sandshell,

Ouachita Kidneyshell, and the purple lilliput. Both the Ouchita Kidneyshell and puple lilliput are former category 2 federal candidates. While the Missouri Department of Conservation continues to distinguish these former category 2 species for information and planning purposes. The United States Fish and Wildlife Service (USFWS) discontinued the practice of maintaining a list of species regarded as

"category-2 candidates" in 1996 (MDC 1999a).

**Crayfish**

Six species of crayfish Hubbsi' Crayfish (Cambarus hubbsi), coldwater crayfish(Orconectes eupunctus), OzarkCrayfish(Orconectes ozarkae), Salem Cave Crayfish (Cambarus hubrichti), devil crayfish(Cambarus diogenes),and spothanded crayfish (Orconectes punctimanus) have been collected from the Eleven Point Watershed (Table Bc09 and Figure Bc03)(MDC 1988; Pflieger 1996; and MDC 1998c). The Hubbs', coldwater, Ozark and spothanded crayfish are primarily aquatic, while the devil crayfish lives primarily on land, in burrows extending down to the water table. Both the coldwater crayfish and the Salem Cave Crayfish are listed as species of conservation concern (MDC 1999a). The coldwater crayfish occurs only in the Eleven Point River and Spring River (Pflieger 1996). The Salem Cave Crayfish has been found only in Missouri and is believed to occur throughout the eastern Ozarks from Camden to Crawford Counties, southward to Oregon and Ripley Counties.

## Aquatic Insects

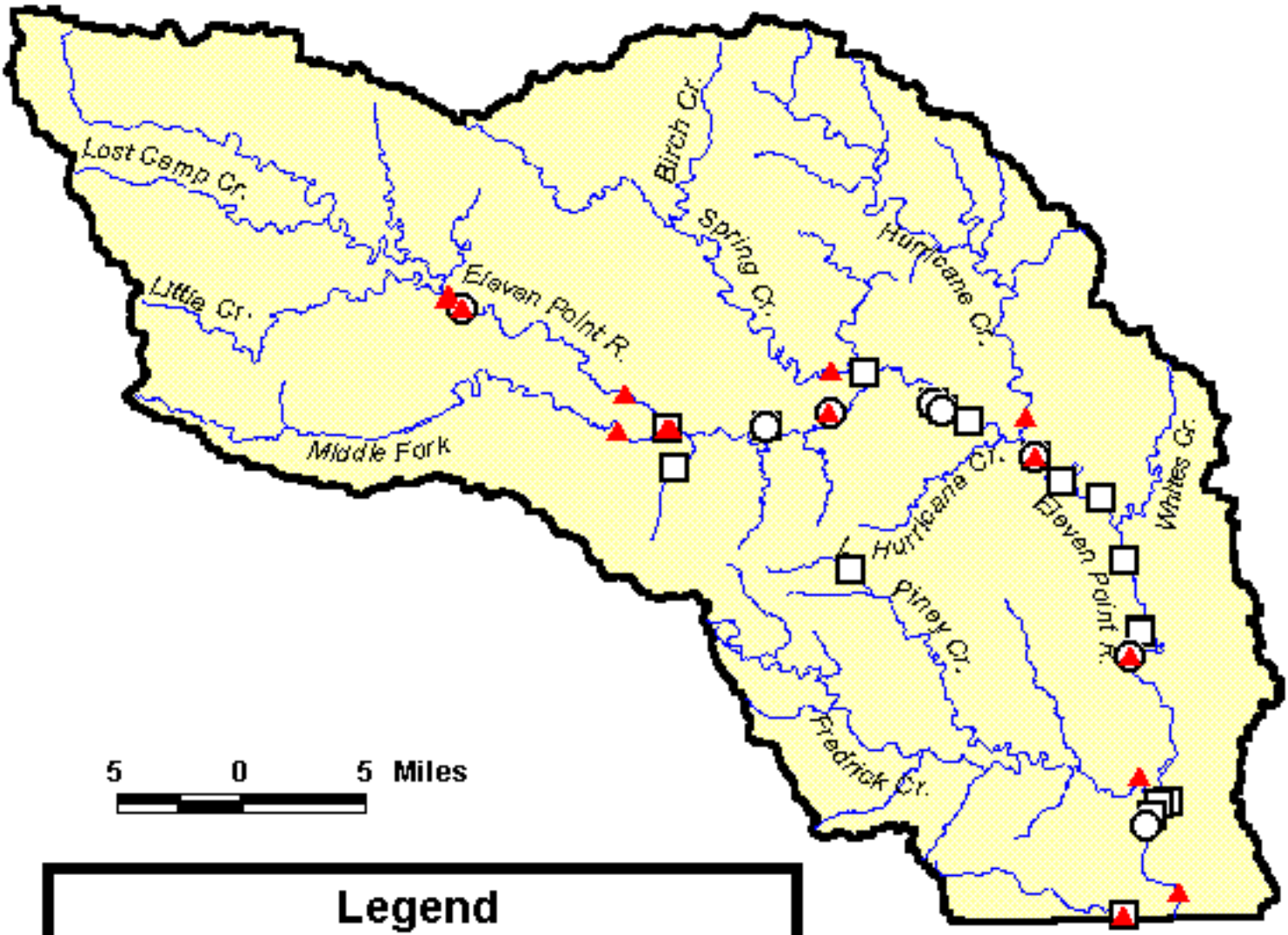
Benthic macro-invertebrates have been periodically sampled throughout the Eleven Point Watershed by Missouri Department of Conservation employees since 1974. A total of 78 collections have been made from 20 sites throughout the watershed including Spring Creek, Barren Fork, Middle Fork, Fredrick Creek, Hurricane Creek, and the main stem of the Eleven Point River (Table Bc10 and Figure Bc04) (MDC 1995b and MDC 1998d). A comparison was made between two samples taken from the same site and same month, but in different years (Table Bc11). Although the amount of effort expended in 1985 (8 $ft^2$) is only 75% of the 1974 effort (12 $ft^2$), eight additional taxa were collected in 1985. With few exceptions, the numbers of organisms per taxa, per square feet were greater in the 1985 collection. Much of the increase occurred within the family Ephemoptera, which could be an indication of improved water quality.

## Species of Conservation Concern

A total of 76 species of conservation concern are known to occur in the Eleven Point Watershed (Table Bc12)(MDC 1999a and MDC 1999c). This includes four species of fish (mooneye, Ozark Shiner, checkered madtom, and southern cavefish), one species of amphibian (Ozark Hellbender), three species of mussel (black sandshell, Ouachita Kidneyshell, and purple lilliput), and two species of crayfish (Salem Cave Crayfish and cold water crayfish). Terrestrial oriented species include two species with state and federal endangered status: the gray bat (Myotis grisescens) and the Indiana Bat (Myotis sodalis). In addition three other species are state endangered. These include the Bachman’s Sparrow (Aimophila aestivalis), Swainson’s Warbler (Limnothlypis swainsonii), and the bald eagle (Haliaeetus leucocephalus). The bald eagle also has federal threatened status. Several heron rookeries have also been identified throughout the watershed.

Figure Bc01.

# Eleven Point Watershed
## Fish Community Sampling Sites




**Legend**

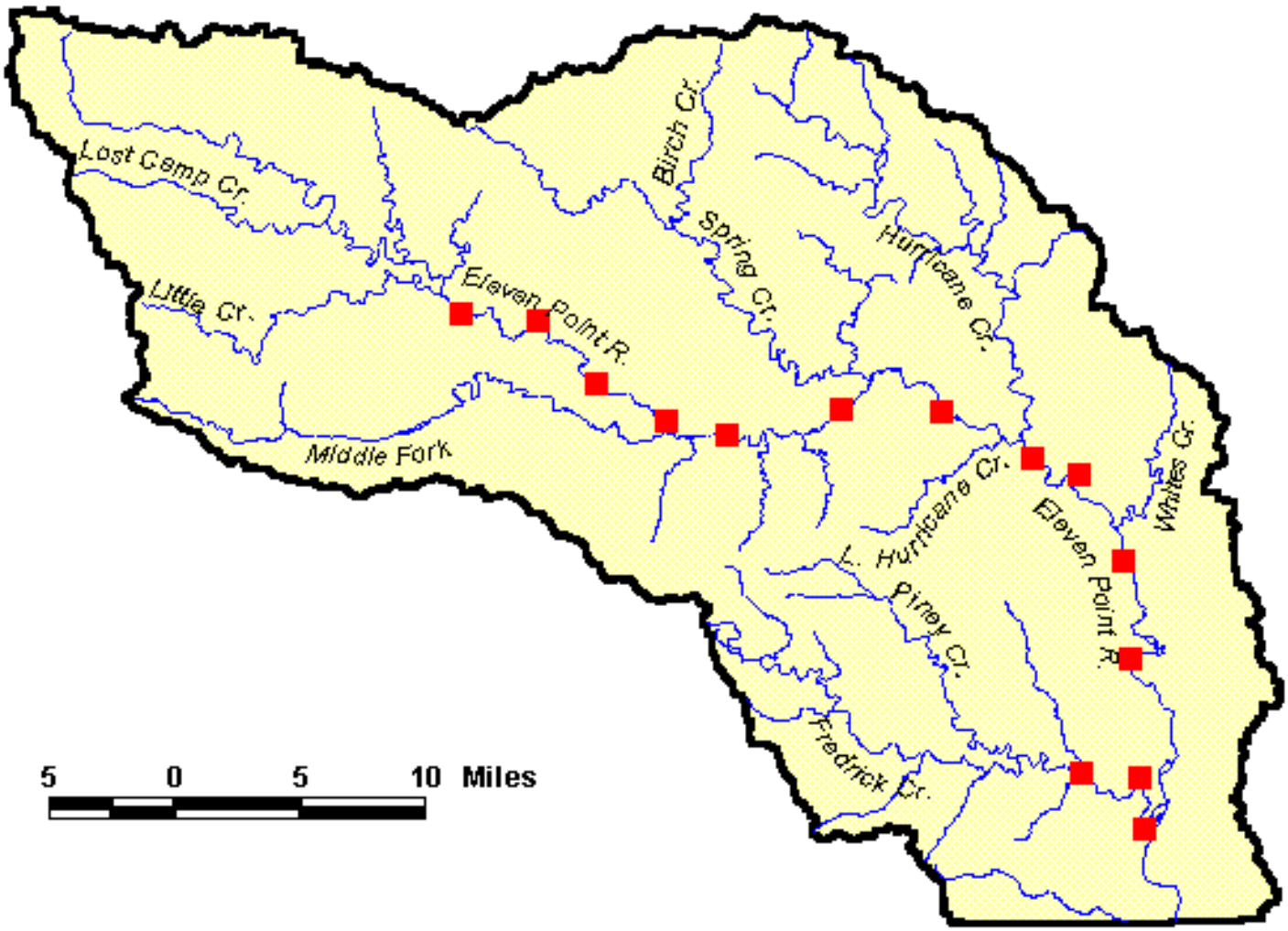
- ▲ 1980-1999
- ○ 1960-1979
- □ 1930-1959

Dates are for collections within MDC fish collection database (1998a) as well as collections performed by MDC Ozark Region Fisheries personnel.

MDC 5/1999

Figure Bc02.

# Eleven Point Watershed
## Mussel Community Sampling Sites

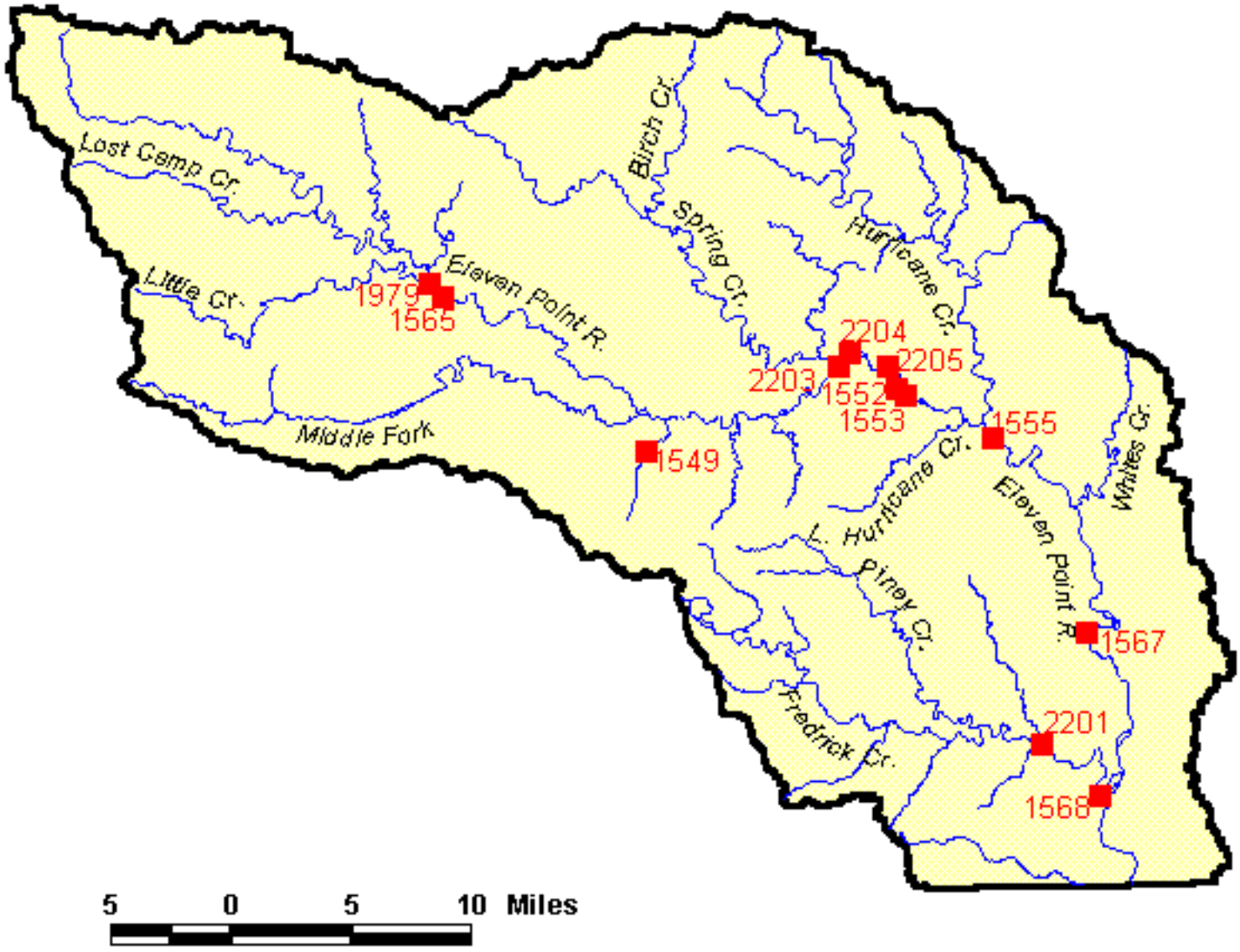



MDC 5/1999

Figure Bc03.

# Eleven Point Watershed

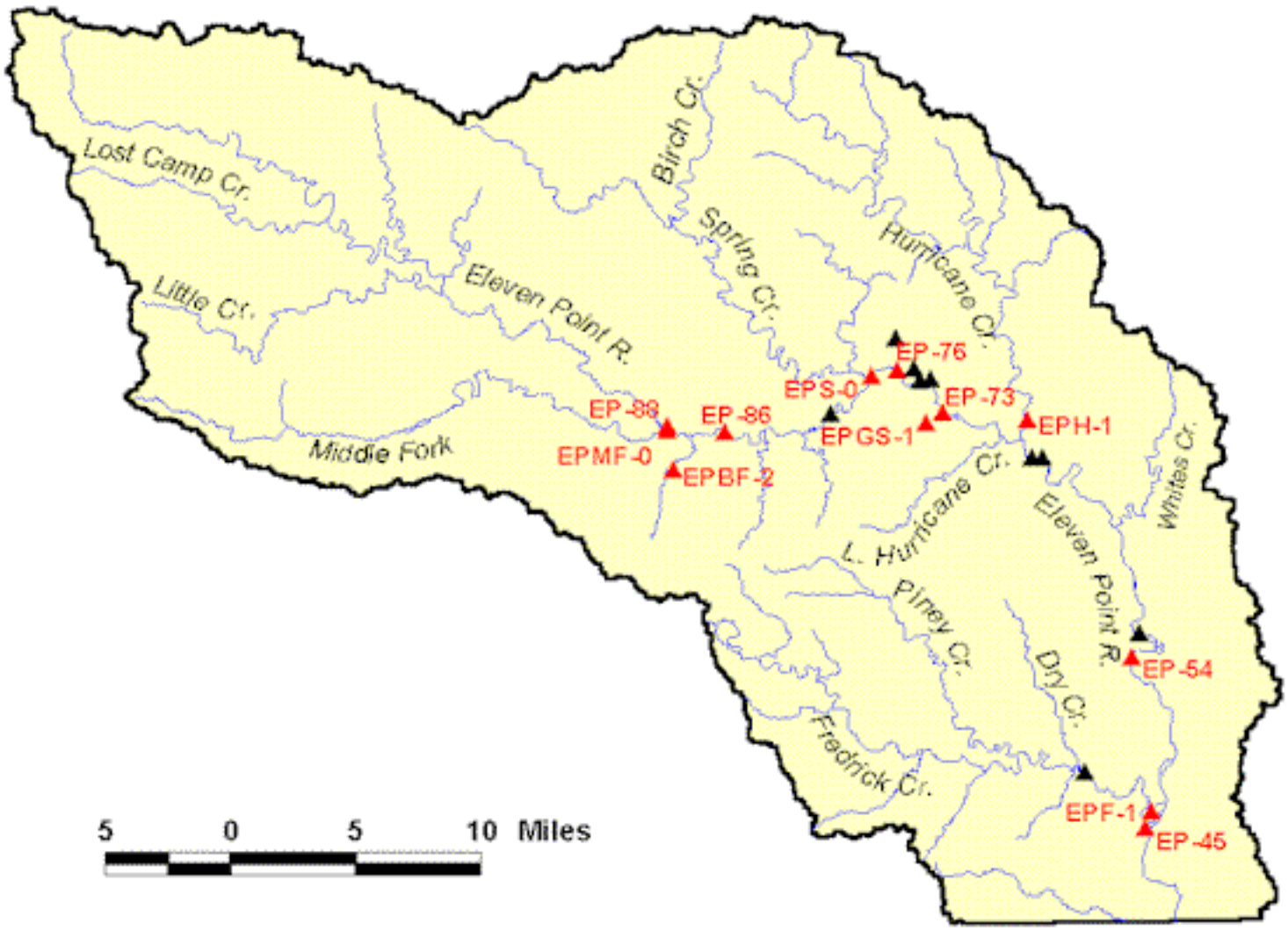
## Crayfish Community Sampling Sites



MDC 5/1999

Figure Bc04.

# Eleven Point Watershed
## Benthic Community Sampling Sites




## Legend

Benthic Community Sample Site (1998d).

- Duchrow 1974
- Other

N

**Table Bc01. Fish species of the Eleven Point Watershed. Key to Status: 1 = collected 1930 (1 of 4) to 1960; 2 = collected 1961 to 1980; 3 = collected 1981 to 1996 (Mayers, personal communication; MDC Ozark Regional Fish Collection Files; MDC 1995a; Pflieger 1975; Pflieger 1989; Pflieger and Bruenderman 1996; Pflieger 1997; Ozark Region Sport Fish Collection Files).**

| Common Name | *Scientific Name* | Trophic Guild[1] | Geo Affinity[3] | Sam. Date |
|---|---|---|---|---|
| American eel | *Anquilla rostrata* | O | O,R | 1,2,3 |
| Banded darter | *Etheostoma zonale* | P | O | 1,2,3 |
| Banded sculpin | *Cottus carolinae** | P | O | 1,2,3 |
| Bigeye chub | *Notropis amblops* | ? | O | 1,2,3 |
| Bigeye shiner | *Notropis boops** | P | O | 2,3 |
| Black buffalo | *Ictiobus niger* | O | WIDE | |
| Black Crappie | *Pomoxis nigromaculatus* | P | WIDE | # |
| Black redhorse | *Moxostoma duquesnei** | O | O | 1,2,3 |
| Blackspotted topminnow | *Fundulus olivaceus** | O | L,O | 1,2,3 |
| Bleeding shiner | *Luxilus zonatus* | P | O | 1,2,3 |
| Bluegill | *Lepomis macrochirus* | P | WIDE | 1,2,3 |
| Bluntnose minnow | *Pimepales notatus* | O | WIDE | 1,2,3 |
| Brook silverside | *Labidesthes sicculus** | P | O | 1,2,3 |
| Central stoneroller | *Campostoma pullum* | P | O,P | 1,2,3 |
| Common carp | *Cyprinus carpio* | O | WIDE | 2,3 |
| Chain pickerel | *Esox niger* | P | O | 1,2,3 |
| Channel catfish | *Ictalurus punctatus* | O | WIDE | 1,2 |
| Checkered madtom | *Noturus flavater* | P | O | 2,3 |
| Creek chub | *Semotilus atromaculatus* | P | O,P | 1,3 |

| | | | | |
|---|---|---|---|---|
| **Creek chubsucker** | ***Erimyzon oblongus*** | **P** | **O** | **1,2,3** |
| **Current River Darter** | ***Etheostoma uniporum*** | **P** | **O** | **1,2,3** |
| **Eastern redfin shiner** | ***Lythurus u. cyanocephalus*** | **P** | **L,O** | **1,2,3** |
| **Fathead minnow** | ***Pimephales promelas*** | **O** | **P** | **#** |
| **Freshwater drum** | ***Aplodinotus grunniens*** | **P** | **WIDE** | **1,2** |
| **Gilt darter** | ***Percina evides*** | **P** | **O** | **2** |
| **Gizzard shad** | ***Dorosoma cepedianum*** | **O** | **WIDE** | **2,3** |
| **Golden redhorse** | ***Moxostoma erythrurum**** | **P** | **O,P** | **1,2,3** |
| **Greenside darter** | ***Etheostoma blennioides*** | **P** | **O** | **1,2,3** |
| **Green sunfish** | ***Lepomis cyanellus*** | **P** | **WIDE** | **1,2,3** |
| **Hornyhead chub** | ***Nocomis biguttatus**** | **O** | **O** | **1,2,3** |
| **Johnny darter** | ***Etheostoma nigrum*** | **O,P** | **P** | **1** |
| **Largescale stoneroller** | ***Campostoma oligolepis**** | **H** | **O** | **1,2,3** |
| **Largemouth bass** | ***Micropterus salmoides*** | **P** | **WIDE** | **1,3** |
| **Larval lamprey** | ***Ichthyomyzon ammocoete*** | **-** | **O** | **3** |
| **Least brook lamprey** | ***Lampetra aepyptera*** | **P** | **O** | **1,2,3** |
| **Longear sunfish** | ***Lepomis megalotis*** | **P** | **L,O** | **1,2,3** |
| **Longnose gar** | ***Lepisosteus osseus*** | **P** | **WIDE** | **2,3** |
| **Mooneye** | ***Hiodon tergisus**** | **P** | **WIDE** | **2** |
| **Northern hogsucker** | ***Hypentelium nigricans**** | **H** | **O** | **1,2,3** |
| **Northern studfish** | ***Fundulus catenatus*** | **P** | **O** | **1,2,3** |
| **Ohio logperch** | ***Percina c. caprodes*** | | **O** | **1,2,3** |

| | | | | |
|---|---|---|---|---|
| **Ozark chub** | ***Erimystax harryi*** | **ND** | **O** | **3** |
| **Ozark madtom** | ***Noturus albater*** | **P** | **O** | **1,2,3** |
| **Ozark minnow** | ***Notropis nubilus*** | **H** | **O** | **1,2,3** |
| **Ozark sculpin** | ***Cottus hypselurus*** | **P** | **O** | **1,2,3** |
| **Ozark shiner** | ***Notropis ozarcanus*** | **O** | **O** | **1,2** |
| **Rainbow darter** | ***Etheostoma caeruleum*** | **P** | **O** | **1,2,3** |
| **Rainbow trout** | ***Oncorynchus mykiss*** | **P** | **O** | **2,3** |
| **Redspotted sunfish** | ***Lepomis miniatus*** | **O** | **L,O** | **1,2,3** |
| **Rosyface shiner** | ***Notropis rubellus**** | **O** | **O** | **1,2,3** |
| **Sauger** | **Stizostedion canadense** | **P** | **R** | **#** |
| **Shadow bass** | ***Ambloplites ariommus*** | **P** | **O** | **1,2,3** |
| **Shorthead redhorse** | ***Moxostoma macrolepidotum*** | **O** | **WIDE** | **2,3** |
| **Slender madtom** | ***Noturus exilis**** | **P** | **O** | **1,2,3** |
| **Smallmouth bass** | ***Micropterus dolomieui**** | **P** | **O** | **1,2,3** |
| **Southern redbelly dace** | ***Phoxinus erythrogaster**** | **H** | **O** | **1,3** |
| **Spotted Bass** | ***Micropterus punctulatus*** | **P** | **O,L** | **2** |
| **Spotted sucker** | ***Minytrema melanops*** | **P** | **L,O** | **3** |
| **Striped fantail darter** | ***Etheostoma f. lineolatum*** | **P** | **O** | **2,3** |
| **Striped shiner** | ***Luxilus chrysocephalus**** | **O** | **O** | **1,2,3** |
| **Telescope shiner** | ***Notropis telescopus*** | **O** | **O** | **1,2,3** |
| **Walleye** | ***Stizostedion vitreum*** | **P** | **O,R** | **2,3** |
| **Warmouth** | ***Lepomis gulosus*** | **P** | **L** | **1,2,3** |

| | | | | |
|---|---|---|---|---|
| **White sucker** | ***Catostomus commersoni*** | **P** | **O,P** | **1,2,3** |
| **Whitetail shiner** | ***Cyprinella galactura*** | **P** | **O** | **1,3** |
| **Yellow bullhead** | ***Ameirus natalis*** | **O** | **O,P** | **1,2,3** |

**# All records based on observations associated with sport fish samples.**

*** = intolerant species**

**Trophic Guild: H = Herbivore, P = Predator, O = Omnivore**

**Geographic Affinity: L = Lowland, O = Ozark, P = Prairie, R = Big River**

**WIDE=Statewide Distribution**

**Table Bc02. Modified Petersen abundance estimates (number/mi.) of various sizes of shadow bass, smallmouth bass, and largemouth bass from 1989-1990 and 1991 Upper Eleven Point River Samples 1991 figures are modified Schnabel abundance estimates collected by Roell (1994) (Mayers 1994).**

| Species | Size group (in) | Mean 1989-1990 | 1991 |
|---|---|---|---|
| Shadow Bass | All | 348 | -- |
| - | >4 | 341 | 346 |
| - | >7 | 195 | 184 |
| - | >9 | 21 | -- |
| Smallmouth Bass | All | 234 | -- |
| - | >5 | 227 | 176 |
| - | >9 | 147 | 124 |
| - | >12 | 47 | -- |
| - | >15 | 16 | -- |

| | | | |
|---|---|---|---|
| **Largemouth Bass** | **All** | **59** | **--** |
| **-** | **>5** | **59** | **62** |
| **-** | **>12** | **16** | **33** |
| **-** | **>15** | **3** | **--** |

**Table Bc03. Size distribution of shadow bass, smallmouth bass, and largemouth bass captured in electrofishing samples from the Eleven Point River from 1989 to1991 (Mayers 1994). Number in parenthesis is sample size.**

| | | Percent Total | | | |
|---|---|---|---|---|---|
| Species | Size Group (in) | 1989 | 1990 | 1990[a] | 1991[b] |
| | <4.0 | 0 | 2 | 3 | 10 |
| - | 4.0-6.9 | 45 | 45 | 39 | 39 |
| | | | | | |
| - | ≥9.0 | 7 | 6 | 5 | 7 |
| - | - | (111) | (186) | (191) | (474) |
| Smallmouth Bass | <7.0 | 8 | 5 | 29 | 20 |
| - | 7.0-11.9 | 69 | 77 | 55 | 60 |
| - | 12.0-14.9 | 14 | 14 | 12 | 16 |
| - | ≥15.0 | 9 | 4 | 4 | 4 |
| - | - | (127) | (152) | (78) | (302) |
| Largemouth Bass | <7.0 | 0 | 0 | 13 | 11 |
| - | 7.0-11.9 | 67 | 72 | 40 | 29 |
| - | 12.0-14.9 | 29 | 22 | 43 | 56 |

| | | | | | |
|---|---|---|---|---|---|
| - | **≥15.0** | **4** | **6** | **4** | **4** |
| - | - | **(66)** | **(50)** | **(55)** | **(144)** |

**[a]September sample**

**[b]Roell 1994**

**Table Bc04. Percent species composition of electrofishing catch from the Eleven Point River in 1963, 1964, 1978, 1985,1989,and 1990. Number in parentheses is sample size. (Mayers 1994)**

| Species | 1963 | 1964 | 1978 | 1985 | 1989 | 1990 |
|---|---|---|---|---|---|---|
| Rainbow Trout | 0 | 0 | 0 | 0 | 3(1) | 0 |
| Gizzard Shad | 9(49) | 2(22) | 30(173) | 15(107) | 21(275) | * |
| Northern Hog Sucker | 2(12) | 6(52) | <1(3) | 3(22) | 6(83) | * |
| Spotted Sucker | 0 | 0 | 0 | 0 | <1(1) | * |
| Black Redhorse | 12(67) | 18(162) | 22(124) | 6(41) | 16(213) | * |
| Golden Redhorse | 6(31) | 8(74) | 5(30) | 16(116) | 4(60) | * |
| Shorthead Redhorse Redhorse | 0 | 0 | 0 | 0 | <1(1) | * |
| Yellow Bullhead | <1(3) | <1(4) | <1(2) | <1(2) | 1(14) | 1(12) |
| Chain Pickerel | <1(3) | <1(4) | 1(4) | 1(8) | <1(6) | 2(18) |
| Smallmouth Bass | 4(12) | 6(50) | 15(84) | 4(32) | 10(127) | 18(152) |
| Largemouth Bass | 1(6) | 2(14) | 1(8) | 4(27) | 5(66) | 6(50) |
| Warmouth | <1(2) | <1(3) | <1(1) | <1(1) | <1(5) | 0 |
| Green Sunfish | 9(49) | 7(65) | 2(12) | 1(9) | 1(13) | 2(13) |
| Spotted Sunfish | 1(5) | <1(4) | 0 | <1(3) | <1(2) | 0 |
| Longear Sunfish | 34(184) | 33(290) | 16(90) | 39(275) | 23(296) | 47(404) |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Bluegill** | **1(6)** | **2(14)** | **1(6)** | **1(7)** | **1(13)** | **1(9)** |
| **Shadow Bass** | **5(25)** | **8(72)** | **3(19)** | **6(44)** | **9(111)** | **22(186)** |
| **Hybrid Sunfish** | **<1(2)** | **<1(1)** | **0** | **0** | **<1(3)** | **1(10)** |
| **Carp** | **12(61)** | **5(46)** | **3(15)** | **0** | ***** | ***** |
| **American Eel** | **1(5)** | **1(9)** | **0** | **<1(3)** | ***** | ***** |

***Species were not collected.**

**Table Bc05. Channel Catfish Stocking Records for Sims Valley Lake (MDC Fish Stocking Records).**

| Year | Total Number Stocked | Number/Acre | Size(in.) |
|---|---|---|---|
| 1964 | 4000 | 105 | 2-5 |
| 1967 | 1200 | 32 | N/A |
| 1968 | 1500 | 39 | N/A |
| 1974 | 1000 | 26 | N/A |
| 1975 | 1903 | 50 | 9-12 |
| 1976 | 2000 | 53 | 9 |
| 1977 | 2000 | 53 | 9 |
| 1978 | 1000 | 26 | 8-10 |
| 1979 | 2000 | 53 | 10 |
| 1980 | 2000 | 53 | 9 |
| 1981 | 2000 | 53 | 8-10 |
| 1982 | 2000 | 53 | 8-10 |
| 1983 | 2000 | 53 | 8-10 |

| | | | |
|---|---|---|---|
| **1984** | **750** | **20** | **8-10** |
| **1985** | **788** | **21** | **8-10** |
| **1986** | **800** | **21** | **8-10** |
| **1987** | **600** | **16** | **10-12** |
| **1988** | **600** | **16** | **8-10** |
| **1989** | **600** | **16** | **8-10** |
| **1990** | **600** | **16** | **8-10** |
| **1991** | **400** | **11** | **10-12** |
| **1992** | **500** | **13** | **8-10** |
| **1993** | **500** | **13** | **10-12** |
| **1994** | **500** | **13** | **8-10** |
| **1995** | **500** | **13** | **8-10** |
| **1996** | **500** | **13** | **8-10** |
| **1997** | **500** | **13** | **8-10** |
| **1998** | **185** | **5** | **8-10** |

**Table Bc06. Channel catfish stocking records for McCormack Lake (MDC Fish Stocking Records).**

| Year | Total Number Stocked | Number/Acre | Size (in.) |
|---|---|---|---|
| 1977 | 1000 | 91 | 9 |
| 1978 | 250 | 23 | 8-10 |
| 1979 | 500 | 45 | 10 |
| 1982 | 400 | 36 | 8-10 |
| 1983 | 400 | 36 | 8-10 |
| 1984 | 400 | 36 | 8-10 |
| 1985 | 248 | 22 | 8-10 |
| 1986 | 209 | 19 | 8-10 |
| 1987 | 150 | 14 | 10-12 |
| 1988 | 150 | 14 | 8-10 |
| 1990 | 275 | 25 | 8-10 |
| 1991 | 200 | 18 | 10-12 |
| 1993 | 275 | 25 | 10-12 |

| | | | |
|---|---|---|---|
| **1995** | **200** | **18** | **8-10** |
| **1997** | **200** | **18** | **8-10** |

**Table Bc07. Rainbow Trout Stocking Records for the Eleven Point River (MDC Fish Stocking Records).**

| Trout Management Area | | |
|---|---|---|
| Year | Number of Fish | Pounds of Fish |
| 1962 | 5000 | 2500 |
| 1963 | 5000 | 3260 |
| 1964 | 50500 | 13200 |
| 1965 | 6000 | 2176 |
| 1966 | 52000 | 3920 |
| 1967 | 7000 | 4550 |
| 1968 | 8000 | 5089 |
| 1969 | 10800 | 7081 |
| 1971 | 8000 | 6552 |
| 1972 | 8000 | 5218 |
| 1973 | 12200 | 8588 |
| 1974 | 15200 | 9749 |
| 1975 | 9600 | 6783 |
| 1976 | 8800 | 6561 |
| 1977 | 8800 | 5542 |
| 1978 | 8800 | 5260 |
| 1979 | 8800 | 5351 |
| 1980 | 8800 | 4568 |
| 1981 | 8800 | 5175 |
| 1982 | 10200 | 6742 |
| 1983 | 8800 | 5620 |
| 1984 | 8800 | 5090 |
| 1985 | 8800 | 5090 |
| 1986 | 8800 | 5397 |

| | | |
|---|---|---|
| **1987** | **12000** | **7252** |
| **1988** | **12000** | **7658** |
| **1989** | **16000** | **10356** |
| **1990** | **12000** | **8971** |
| **1991** | **12000** | **9089** |
| **1992** | **12300** | **10811** |
| **1993** | **13000** | **8579** |
| **1994** | **12000** | **6329** |
| **1995** | **12000** | **11247** |
| **1996** | **12000** | **N/A** |
| **1997** | **12000** | **N/A** |
| **1998** | **16000** | **N/A** |

| | | |
|---|---|---|
| **1992** | **2000** | **N/A** |
| **1993** | **1525** | **N/A** |
| **1998** | **2000** | **N/A** |

**Table Bc08. Mussels collected from the Eleven Point Watershed (Oesch 1995, MDC 1998b, and Turgeon et al. 1998).**

| Scientific Name | Common Name | Federal Status | State Status |
|---|---|---|---|
| Corbicula fluminea | Asian Clam | - | - |
| Cyclonaias tuberculata | Purple Wartyback | - | - |
| Elliptio dilatata | Spike | - | - |
| Fusconaia flava | Wabash Pigtoe | - | - |
| Fusconaia ozarkensis | Ozark Pigtoe | - | - |
| Lampsilis cardium | Plain Pocketbook | - | - |
| Lampsilis r. brittsi | Northern Broken-ray | - | - |
| Lampsilis r. brevicula | Ozark Brokenray | - | - |
| Lampsilis siliquoidea | Fatmucket | - | - |
| Lasmigona costata | Fluted Shell | - | - |
| Ligumia recta* | Black Sandshell | - | - |
| Ligumia subrostrata | Pondmussel | - | - |
| Pleurobema sintoxia | Round Pigtoe | - | - |

| | | | |
|---|---|---|---|
| **Ptychobranchus occidentalis*** | **Ouachita Kidneyshell** | # | - |
| **Pyganodon grandis** | **Giant Floater** | - | - |
| **Quadrula pustulosa pustulosa** | **Pimpleback** | - | - |
| **Strophitus undulatus** | **Creeper** | - | - |
| **Toxolasma lividus*** | **Purple Lilliput** | # | - |
| **Toxolasma parvus** | **Lilliput** | - | - |
| **Utterbackia imbecillis** | **Paper Pondshell** | - | - |
| **Venustaconcha pleasi** | **Bleedingtooth Mussel** | - | - |
| **Villosa iris** | **Rainbow** | - | - |
| **Villosa lienosa** | **Little Spectaclecase** | - | - |

*** Species of Conservation Concern (MDC 1999a)**

**# Former category-2 candidate (In December of 1996, the USFWS discontinued the practice of maintaining a list of species regarded as "category-2 candidates". MDC continues to distinguish these species for information and planning purposes.)**

**Table Bc09. Summary of crayfish collections within the Eleven Point Watershed (MDC 1988).**

| Stream | Locality | *Cambarushubrichti* | *Cambarushubbsi* | *Orconecteseupunctus* |
|---|---|---|---|---|
| Eleven Pt S117 Aug 87 | 1568C | - | 7 | 5 |
| Eleven Pt S217 Sep 84 | 1567C | - | 7 | 62 |
| Eleven Pt S217 Jul 85 | 1567D | - | - | 54 |
| Eleven Pt S317 Jan 86 | 1555C | - | 7 | 83 |
| Eleven Pt S413 May 86 | 2205C | - | - | 73 |
| Eleven Pt S417 Jan 86 | 2204C | - | - | 31 |
| Eleven Pt S628 Jun 82 | 1565C | - | - | - |
| Eleven Pt S623 Mar 84 | 1565D | - | - | - |
| Eleven Pt S628 Jun 82 | 1979C | - | - | - |
| Greer Spr Br7 Jun 78 | 1552C | - | 12 | 7 |
| Greer Spr Br13 Nov 85 | 1552D | - | 74 | 32 |
| Barren Fork2 Apr 87 | 1549C | - | - | - |
| Frederick Cr27 Mar 85 | 2201C | - | - | - |
| Unnamed Spr17 Jan 86 | 2203C | - | - | - |
| BASIN TOTALS | - | -- | 107 | 347 |
| BASIN % COMP. | - | - | 9.5% | 31.1% |

| | | | | |
|---|---|---|---|---|
| Eleven Pt S1 17 Aug 87 | 1568C | 10 | 5 | - |
| Eleven Pt S1 17 Sep 84 | 1567C | 25 | 19 | - |

| | | | | |
|---|---|---|---|---|
| Eleven Pt S2 17 Jul 85 | 1567D | - | 5 | - |
| Eleven Pt S3 17 Jan 86 | 1555C | - | - | - |
| Eleven Pt S4 13 May 86 | 2205C | 67 | 3 | - |
| Eleven Pt S4 17 Jan 86 | 2204C | 23 | 1 | - |
| Eleven Pt S6 28 Jun 82 | 1565C | 60 | 16 | - |
| Eleven Pt S6 23 Mar 84 | 1565D | 289 | 19 | - |
| Eleven Pt S6 28 Jun 82 | 1979C | 27 | 15 | - |
| Greer Spr Br 7 Jun 78 | 1552C | - | 2 | - |
| Greer Spr Br 13 Nov 85 | 1552D | 1 | 2 | - |
| Barren Fork 2 Apr 87 | 1549C | 15 | 2 | |
| Frederick Cr 27 Mar 85 | 2201C | 41 | 15 | |
| Unnamed Spr 17 Jan 86 | 2203C | - | 2 | 1 |
| BASIN TOTALS | | 558 | 106 | 1 |
| BASIN % COMP. | | 49.9% | 9.4% | .1% |

**Table Bc10. Summary of riffle habitat benthic invertebrate collections from the (1 of 13) Eleven Point Watershed; Numbers beside taxa indicate total number collected with the average number/ft$^2$ in parentheses. (*) indicates none found (MDC 1995b).**

| - | 11pt River Mile 5 1974 | Frederick Mile 7 1983 | Frederick Mile 1 1974 |
|---|---|---|---|
| No. Samples | 4 | 1 | 4 |
| Total No. Organisms | 8042 | 921 | 7664 |
| Avg. Number Organisms/ft$^2$ | 136 | 154 | 213 |
| Trichoptera | 2119 (36.5) | 349 (58.1) | 1060 (29.5) |
| Ephemeroptera | 1302 (22.4) | 432 (72.0) | 3686 (102.4) |
| Odonata | 6 (<1.0) | 1 (<1.0) | 13 (<1.0) |
| Plecoptera | 10 (<1.0) | 1 (<1.0) | 296 (8.2) |
| Lepidoptera | 2 (<1.0) | * | 10 (<1.0) |
| Coleoptera | 1251 (21.6) | 95 (15.8) | 490 (13.6) |
| Diptera | 273 (4.7) | 12 (2) | 1689 (46.9) |
| Arachnoidea | 7 (<1.0) | * | 2 (<1.0) |
| Gastropoda | 2567 (44.3) | * | 37 (1.03) |
| Annelida | 227 (3.9) | * | 128 (3.6) |
| Isopoda | 28 (<1.0) | 5 (<1.0) | 17 (1.0) |
| Amphipoda | 231 (3.9) | * | * |
| Decapoda | 6 (<1.0) | * | 3 (<1.0) |

| | | | |
|---|---|---|---|
| Platyhelminthes | 10 (<1.0) | 3 (<1.0) | 71 (1.9) |
| Megaloptera | * | 23 (3.8) | 22 (<1.0) |
| Nemato | * | * | 4 (<1.0) |
| Hemiptera | * | * | 1 (<1.0) |
| Pelecypoda | * | * | 130 (3.6) |
| Nematomorpha | * | * | * |

| - | 11pt River Mile 14 1974 | 11pt River Mile 14 1979 | 11pt River Mile 14 1981 |
|---|---|---|---|
| No. Samples | 4 | 1 | 2 |
| Total No. Organisms | 15,810 | 6776 | 5874 |
| Avg. Number Organisms/ft | 256 | 565 | 196 |
| Trichoptera | 5432 (87.6) | 2698 (224.8) | 842 (28.1) |
| Ephemeroptera | 4623 (74.6) | 1441 (120) | 2071 (69.0) |
| Odonata | 1 (<1.0) | * | 5 (<1.0) |
| Plecoptera | 18 (<1.0) | 8 (<1.0) | 2 (<1.0) |
| Lepidoptera | 10 (<1.0) | 8 (<1.0) | 5 (<1.0) |
| Coleoptera | 3018 (48.7) | 1141 (18.4) | 1670 (55.7) |
| Diptera | 1093 (17.6) | 352 (29.3) | 116 (3.9) |
| Arachnoidea | 28 (<1.0) | 14 (1.2) | 7 (<1.0) |
| Gastropoda | 1191 (19.2) | 755 (62.9) | 781 (26.0) |

| | | | |
|---|---|---|---|
| **Annelida** | **94 (1.5)** | **233 (19.4)** | **213 (7.1)** |
| **Isopoda** | **7 (<1.0)** | * | **2 (<1.0)** |
| **Amphipoda** | **63 (1.0)** | **15 (1.3)** | **69 (2.3)** |
| **Decapoda** | **7 (<1.0)** | **2 (<1.0)** | **25 (<1.0)** |
| **Platyhelminthes** | **213 (3.4)** | **101 (8.4)** | **55 (<1.8)** |
| **Megaloptera** | **7 (<1.0)** | **2 (<1.0)** | * |
| **Nematoda** | **5 (<1.0)** | **5 (<1.0)** | * |
| **Hemiptera** | * | * | * |
| **Pelecypoda** | * | **1 (<1.0)** | **3 (<1.0)** |
| **Nematomorpha** | * | * | * |

| - | **11pt River Mile 14 1983** | **Boze Mill Mile 1 1979** | **Boze Mill Mile 1 1981** |
|---|---|---|---|
| **No. Samples** | **1** | **1** | **1** |
| **Total No. Organisms** | **1192** | **931** | **1745** |
| **Avg. Number Organisms/ft** | **119** | **116** | **175** |
| **Trichoptera** | **430 (43)** | **14 (1.8)** | **27 (2.7)** |
| **Ephemeroptera** | **378 (37.8)** | **197 (24.6)** | **282 (28.2)** |
| **Odonata** | * | * | * |
| **Plecoptera** | * | **2 (<1.0)** | * |

| | | | |
|---|---|---|---|
| Lepidoptera | * | * | * |
| Coleoptera | 317 (31.7) | 5 (<1.0) | 4 (<1.0) |
| Diptera | 22 (2.2) | 59 (7.4) | 62 (6.2) |
| Arachnoidea | * | 16 (2.0) | 1 (<1.0) |
| Gastropoda | * | 428 (53.5) | 1078 (107.8) |
| Annelida | 2 (<1.0) | 8 (1.0) | 17 (1.7) |
| Isopoda | 1 (<1.0) | 154 (19.3) | 9 (<1.0) |
| Amphipoda | 4 (<1.0) | 41 (5.1) | 111 (11.1) |
| Decapoda | 9 (<1.0) | 2 (<1.0) | 3 (<1.0) |
| Platyhelminthes | 26 (2.6) | 5 (<1.0) | 151 (15.1) |
| Megaloptera | 8 (<1.0) | * | * |
| Nematoda | * | * | * |
| Hemiptera | * | * | * |
| Pelecypoda | * | * | * |
| Nematomorpha | * | * | * |

| - | Boze Mill Mile 1 1983 | 11pt River Mile 28 1981 | 11pt River Mile 28 1985 |
|---|---|---|---|
| No. Samples | 1 | 2 | 1 |
| Total No. Organisms | 427 | 2917 | 2406 |

| | | | |
|---|---|---|---|
| **Avg. Number Organisms/ft** | **71** | **365** | **301** |
| **Trichoptera** | **65 (10.8)** | **439 (54.9)** | **896 (112)** |
| **Ephemeroptera** | **18 (3.0)** | **1009 (126.0)** | **1194 (149.3)** |
| **Odonata** | * | * | * |
| **Plecoptera** | * | * | * |
| **Lepidoptera** | * | **18 (2.3)** | * |
| **Coleoptera** | * | **731 (91.4)** | * |
| **Diptera** | **6 (1.0)** | **169 (21.1)** | **180 (22.5)** |
| **Arachnoidea** | * | **2 (<1.0)** | **46 (5.8)** |
| **Gastropoda** | * | **94 (11.8)** | **1 (<1.0)** |
| **Annelida** | **12 (2.0)** | **90 (11.3)** | **23 (2.9)** |
| **Isopoda** | **118 (19.7)** | * | **52 (6.5)** |
| **Amphipoda** | **141 (23.5)** | **243 (30.4)** | * |
| **Decapoda** | * | **6 (<1.0)** | * |
| **Platyhelminthes** | **67 (11.2)** | **108 (13.5)** | **9 (1.1)** |
| **Megaloptera** | * | * | **2 (<1.0)** |
| **Nematoda** | * | **1 (<1.0)** | **2 (<1.0)** |
| **Hemiptera** | * | * | **1 (<1.0)** |
| **Pelecypoda** | * | * | * |
| **Nematomorpha** | * | * | * |

| - | Turner Mill Mile 0 1981 | Turner Mill Mile 0 1983 | 11pt River Mile 33 1974 |
|---|---|---|---|
| No. Samples | 1 | 1 | 4 |
| Total No. Organisms | 1439 | 434 | 14,389 |
| Avg. Number Organisms/ft | 192 | 72 | 313 |
| Trichoptera | 402 (50.3) | 113 (18.8) | 4976 (108.2) |
| Ephemeroptera | 41 (5.1) | * | 4710 (102.4) |
| Odonata | * | * | 1 (<1.0) |
| Plecoptera | * | * | 232 (5.1) |
| Lepidoptera | * | * | 9 (<1.0) |
| Coleoptera | 8 (1.0) | 1 (<1.0) | 1579 (34.3) |
| Diptera | 152 (19.0) | 1 (<1.0) | 2151 (46.8) |
| Arachnoidea | * | * | 26 (<1.0) |
| Gastropoda | 472 (59.0) | * | 113 (2.5) |
| Annelida | 89 (11.1) | 6 (1.0) | 141 (3.1) |
| Isopoda | 1 (<1.0) | * | 46 (1.0) |
| Amphipoda | 165 (20.6) | 279 (46.5) | * |
| Decapoda | 4 (<1.0) | 9 (1.5) | 8 (<1.0) |
| Platyhelminthes | 101 (12.6) | 25 (4.2) | 359 (7.8) |
| Megaloptera | 4 (<1.0) | * | 17 (<1.0) |

| | | | |
|---|---|---|---|
| Nematoda | * | * | 2 (<1.0) |
| Hemiptera | * | * | * |
| Pelecypoda | * | * | * |
| Nematomorpha | * | * | * |

| - | 11pt River Mile 33 1981 | 11pt River Mile 33 1983 | 11pt River Mile 33 1985 |
|---|---|---|---|
| No. Samples | 2 | 1 | 1 |
| Total No.Organisms | 7462 | 3838 | 3989 |
| Avg. Number Organisms/ft | 249 | 384 | 499 |
| Trichoptera | 4292 (143.1) | 2178 (217.8) | 1733 (216.6) |
| Ephemeroptera | 1534 (51.1) | 774 (77.4) | 1848 (231.0) |
| Odonata | 1 (<1.0) | * | * |
| Plecoptera | 27 (<1.0) | 14 (1.4) | 10 (1.3) |
| Lepidoptera | 22 (<1.0) | * | 2 (<1.0) |
| Coleoptera | 685 (22.8) | 103 (10.3) | 75 (9.4) |
| Diptera | 159 (5.3) | 173 (17.3) | 66 (8.3) |
| Arachnoidea | * | * | 4 (<1.0) |
| Gastropoda | 92 (3.1) | * | 23 (2.9) |
| Annelida | 93 (3.1) | 2 (<1.0) | 8 (1.0) |

| | | | |
|---|---|---|---|
| Isopoda | 167 (5.6) | 331 (33.1) | 100 (12.5) |
| Amphipoda | 7 (<1.0) | * | 9 (1.1) |
| Decapoda | 35 (1.2) | 3 (<1.0) | 11 (1.4) |
| Platyhelminthes | 336 (11.2) | 259 (25.9) | 97 (12.1) |
| Megaloptera | 10 (<1.0) | 1 (<1.0) | 3 (<1.0) |
| Nematoda | 2 (<1.0) | * | * |
| Hemiptera | * | * | * |
| Pelecypoda | * | * | * |
| Nematomorpha | * | * | * |

| - | 11pt River Mile 34 1985 | 11pt River Mile 36 1974 | 11pt River Mile 36 1983 |
|---|---|---|---|
| No. Samples | 1 | 4 | 1 |
| Total No.Organisms | 1977 | 5568 | 1927 |
| Avg. Number Organisms/ft | 247 | 139 | 193 |
| Trichoptera | 916 (114.5) | 1440 (36.0) | 811 (81.1) |
| Ephemeroptera | 761 (95.1) | 2475 (61.9) | 876 (87.6) |
| Odonata | * | 3 (<1.0) | * |
| Plecoptera | 10 (1.3) | 27 (<1.0) | 2 (<1.0) |
| Lepidoptera | 6 (<1.0) | 4 (<1.0) | * |

| | | | |
|---|---|---|---|
| Coleoptera | 97 (12.1) | 718 (18.0) | 164 (16.4) |
| Diptera | 62 (7.2) | 585 (14.6) | 28 (2.8) |
| Arachnoidea | 1 (<1.0) | 12 (<1.0) | * |
| Gastropoda | 46 (5.8) | 85 (3.2) | * |
| Annelida | 46 (5.8) | 160 (4.0) | * |
| Isopoda | * | * | * |
| Amphipoda | * | * | * |
| Decapoda | 9 (1.1) | 14 (<1.0) | 10 (1.0) |
| Platyhelminthes | * | 7 (<1.0) | 2 (<1.0) |
| Megaloptera | 18 (2.3) | 26 (<1.0) | 34 (3.4) |
| Nematoda | * | * | * |
| Hemiptera | * | * | * |
| Pelecypoda | 5 (<1.0) | 9 (<1.0) | * |
| Nematomorpha | * | * | * |

| - | Hurricane Mile 1 1974 | Hurricane Mile 1 1981 | Hurricane Mile 1 1983 |
|---|---|---|---|
| No. Samples | 4 | 1 | 1 |
| Total No. Organisms | 8312 | 1449 | 2070 |
| Avg. Number Organisms/ft | 260 | 145 | 345 |

| | | | |
|---|---|---|---|
| **Trichoptera** | **3532 (110.4)** | **67 (6.7)** | **941 (156.8)** |
| **Ephemeroptera** | **3038 (94.9)** | **247 (24.7)** | **910 (151.7)** |
| **Odonata** | **21 (<1.0)** | * | **1 (<1.0)** |
| **Plecoptera** | **151 (4.7)** | **73 (7.3)** | **1 (<1.0)** |
| **Lepidoptera** | **26 (<1.0)** | * | * |
| **Coleoptera** | **338 (10.6)** | **48 (4.8)** | **71 (11.8)** |
| **Diptera** | **635 (19.8)** | **982 (98.2)** | **55 (9.2)** |
| **Arachnoidea** | **26 (<1.0)** | * | * |
| **Gastropoda** | **277 (<1.0)** | **3 (<1.0)** | * |
| **Annelida** | **52 (1.6)** | **11 (1.6)** | **1 (<1.0)** |
| **Isopoda** | **1 (<1.0)** | * | * |
| **Amphipoda** | **73 (2.3)** | * | **2 (<1.0)** |
| **Decapoda** | **6 (<1.0)** | **2 (<1.0)** | **4 (<1.0)** |
| **Platyhelminthes** | **7 (<1.0)** | * | **35 (5.8)** |
| **Megaloptera** | **124 (3.9)** | **14 (1.4)** | **46 (7.7)** |
| **Nematoda** | * | **1 (<1.0)** | * |
| **Hemiptera** | * | * | **3 (<1.0)** |
| **Pelecypoda** | **3 (<1.0)** | * | * |
| **Nematomorpha** | **2 (<1.0)** | **1 (<1.0)** | * |

| - | Hurricane Mile 1 1985 | Greer SP Mile 1 1974 | Greer SP Mile 1 1979 |
|---|---|---|---|
| No. Samples | 1 | 4 | 1 |
| Total No. Organisms | 3435 | 2198 | 1134 |
| Avg. Number Organisms/ft | 573 | 73 | 142 |
| Trichoptera | 1648 (274.7) | 754 (25.1) | 852 (106.5) |
| Ephemeroptera | 558 (9.3) | 937 (31.2) | 86 (10.8) |
| Odonata | 8 (1.3) | * | * |
| Plecoptera | 26 (4.3) | 155 (5.2) | 16 (2.0) |
| Lepidoptera | 2 (<1.0) | * | 2 (<1.0) |
| Coleoptera | 253 (42.2) | 152 (5.1) | 46 (5.8) |
| Diptera | 86 (14.3) | 115 (3.8) | * |
| Arachnoidea | 8 (1.3) | 4 (<1.0) | * |
| Gastropoda | 741 (123.5) | 8 (<1.0) | * |
| Annelida | 17 (2.8) | 4 (<1.0) | 19 (2.4) |
| Isopoda | * | * | * |
| Amphipoda | 7 (1.2) | 37 (1.2) | 16 (2.0) |
| Decapoda | 3 (<1.0) | 21 (<1.0) | 4 (<1.0) |
| Platyhelminthes | 28 (4.7) | 3 (<1.0) | 2 (<1.0) |
| Megaloptera | 49 (8.2) | * | * |

| | | | |
|---|---|---|---|
| Nematoda | * | 5 (<1.0) | 2 (<1.0) |
| Hemiptera | 1 (<1.0) | * | * |
| Pelecypoda | * | * | * |
| Nematomorpha | * | * | * |

| - | McCormack Mile 0 1985 | McCormack Mile 0 1985 | 11pt River Mile 40 1983 |
|---|---|---|---|
| No. Samples | 1 | 1 | 1 |
| Total No. Organisms | 2092 | 1247 | 617 |
| Avg. Number Organisms/ft | 349 | 208 | 62 |
| Trichoptera | 1402 (233.7) | 308 (51.3) | 39 (3.9) |
| Ephemeroptera | 140 (23.3) | 452 (75.3) | 493 (49.3) |
| Odonata | 2 (<1.0) | 10 (1.7) | 11 (1.1) |
| Plecoptera | 6 (1.0) | 12 (2.0) | * |
| Lepidoptera | * | 2 (<1.0) | * |
| Coleoptera | 2 (<1.0) | 170 (28.3) | 30 (3.0) |
| Diptera | 236 (39.3) | 168 (28.0) | 39 (3.9) |
| Arachnoidea | 5 (<1.0) | * | * |
| Gastropoda | 13 (2.2) | 8 (1.3) | * |
| Annelida | 13 (2.2) | 49 (8.2) | 1 (<1.0) |

| | | | |
|---|---|---|---|
| Isopoda | 116 (19.3) | * | * |
| Amphipoda | * | * | * |
| Decapoda | * | * | * |
| Platyhelminthes | 59 (9.8) | 34 (5.7) | 1 (<1.0) |
| Megaloptera | 85 (14.2) | 32 (5.3) | 3 (<1.0) |
| Nematoda | * | * | * |
| Hemiptera | 2 (<1.0) | * | * |
| Pelecypoda | * | 2 (<1.0) | * |
| Nematomorpha | 8 (<1.0) | * | * |

| - | 11pt River Mile 40 1985 | 11pt River Mile 47 1974 | Spring Cr Mile 0 1974 |
|---|---|---|---|
| No. Samples | 2 | 4 | 4 |
| Total No. Organisms | 3985 | 3357 | 3045 |
| Avg. Number Organisms/ft | 247 | 93 | 102 |
| Trichoptera | 882 (55.1) | 865 (9.3) | 864 (39.1) |
| Ephemeroptera | 2161 (135.1) | 1897 (52.7) | 1123 (37.4) |
| Odonata | 25 (1.6) | 1 (<1.0) | 1 (<1.0) |
| Plecoptera | 130 (8.1) | 42 (1.2) | 29 (<1.0) |
| Lepidoptera | 2 (<1.0) | 2 (<1.0) | 1 (<1.0) |

| | | | |
|---|---|---|---|
| Coleoptera | 48 (3.0) | 86 (2.4) | 156 (5.2) |
| Diptera | 405 (25.3) | 340 (9.4) | 310 (10.3) |
| Arachnoidea | 1 (<1.0) | 19 (<1.0) | 7 (<1.0) |
| Gastropoda | 168 (10.5) | 67 (1.9) | 5 (<1.0) |
| Annelida | 37 (2.3) | 9 (<1.0) | 103 (3.4) |
| Isopoda | * | * | * |
| Amphipoda | * | 2 (<1.0) | 1 (<1.0) |
| Decapoda | 5 (<1.0) | * | 1 (<1.0) |
| Platyhelminthes | 2 (<1.0) | 1 (<1.0) | 30 (1.0) |
| Megaloptera | 18 (1.1) | 25 (<1.0) | 3 (<1.0) |
| Nematoda | * | * | 3 (<1.0) |
| Hemiptera | * | * | * |
| Pelecypoda | 34 (2.1) | * | * |
| Nematomorpha | * | 1 (<1.0) | 1 (<1.0) |

| - | 11pt River Mile 40 1985 | 11pt River Mile 47 1974 | Spring Cr Mile 0 1974 |
|---|---|---|---|
| No. Samples | 2 | 4 | 4 |
| Total No. Organisms | 3985 | 3357 | 3045 |
| Avg. Number Organisms/ft | 247 | 93 | 102 |

| | | | |
|---|---|---|---|
| **Trichoptera** | **882 (55.1)** | **865 (9.3)** | **864 (39.1)** |
| **Ephemeroptera** | **2161 (135.1)** | **1897 (52.7)** | **1123 (37.4)** |
| **Odonata** | **25 (1.6)** | **1 (<1.0)** | **1 (<1.0)** |
| **Plecoptera** | **130 (8.1)** | **42 (1.2)** | **29 (<1.0)** |
| **Lepidoptera** | **2 (<1.0)** | **2 (<1.0)** | **1 (<1.0)** |
| **Coleoptera** | **48 (3.0)** | **86 (2.4)** | **156 (5.2)** |
| **Diptera** | **405 (25.3)** | **340 (9.4)** | **310 (10.3)** |
| **Arachnoidea** | **1 (<1.0)** | **19 (<1.0)** | **7 (<1.0)** |
| **Gastropoda** | **168 (10.5)** | **67 (1.9)** | **5 (<1.0)** |
| **Annelida** | **37 (2.3)** | **9 (<1.0)** | **103 (3.4)** |
| **Isopoda** | * | * | * |
| **Amphipoda** | * | **2 (<1.0)** | **1 (<1.0)** |
| **Decapoda** | **5 (<1.0)** | * | **1 (<1.0)** |
| **Platyhelminthes** | **2 (<1.0)** | **1 (<1.0)** | **30 (1.0)** |
| **Megaloptera** | **18 (1.1)** | **25 (<1.0)** | **3 (<1.0)** |
| **Nematoda** | * | * | **3 (<1.0)** |
| **Hemiptera** | * | * | * |
| **Pelecypoda** | **34 (2.1)** | * | * |
| **Nematomorpha** | * | **1 (<1.0)** | **1 (<1.0)** |

| - | Tupelo Gum Mile 1 1985 | Barren Fork Mile 2 1974 | 11pt River Mile 49 1974 |
|---|---|---|---|
| No. Samples | 1 | 4 | 4 |
| Total No. Organisms | 30 | 4023 | 3288 |
| Avg. Number Organisms/ft | N/A (pond) | 118 | 110 |
| Trichoptera | * | 846 (24.9) | 1286 (42.9) |
| Ephemeroptera | * | 9 (<1.0) | 1 (<1.0) |
| Odonata | 8 | 9 (<1.0) | 1 (<1.0) |
| Plecoptera | * | 265 (7.8) | 134 4.5) |
| Lepidoptera | * | * | 1 (<1.0) |
| Coleoptera | 4 | 152 (4.5) | 254 (8.5) |
| Diptera | 2 | 758 (22.3) | 222 (7.4) |
| Arachnoidea | * | 8 (<1.0) | 1 (<1.0) |
| Gastropoda | * | * | 2 (<1.0) |
| Annelida | * | 148 (4.4) | 5 (<1.0) |
| Isopoda | * | 10 (<1.0) | * |
| Amphipoda | * | * | * |
| Decapoda | * | * | 3 (<1.0) |
| Platyhelminthes | * | 10 (<1.0) | 184 (6.1) |
| Megaloptera | 2 | 100 (2.9) | 10 (<1.0) |

| | | | |
|---|---|---|---|
| Nematoda | * | * | * |
| Hemiptera | 10 | * | 1 (<1.0) |
| Pelecypoda | 3 | * | 8 (<1.0) |
| Nematomorpha | * | 5 (<1.0) | * |

| - | 11pt River<br>Mile 49 1985 | Mid Fk/11 Pt<br>Mile 1 1974 |
|---|---|---|
| No. Samples | 1 | 4 |
| Total No. Organisms | 3193 | 5395 |
| Avg. Number Organisms/ft | 399 | 317 |
| Trichoptera | 1188 (148.5) | 980 (28.8) |
| Ephemeroptera | 1550 (193.8) | 3096 (91.1) |
| Odonata | 6 (<1.0) | 4 (<1.0) |
| Plecoptera | 10 (1.3) | 249 (7.3) |
| Lepidoptera | 2 (<1.0) | * |
| Coleoptera | 32 (4.0) | 25 (>1.0) |
| Diptera | 363 (45.4) | 918 (27.0) |
| Arachnoidea | 3 (<1.0) | 1 (<1.0) |
| Gastropoda | 4 (<1.0) | 6 (<1.0) |
| Annelida | 16 (2.0) | 20 (<1.0) |

| | | |
|---|---|---|
| **Isopoda** | * | * |
| **Amphipoda** | * | 2 (<1.0) |
| **Decapoda** | 4 (<1.0) | 3 (<1.0) |
| **Platyhelminthes** | * | 47 (1.4) |
| **Megaloptera** | 13 (1.6) | 31 (<1.0) |
| **Nematoda** | * | * |
| **Hemiptera** | * | * |
| **Pelecypoda** | 2 (<1.0) | * |
| **Nematomorpha** | * | 2 (<1.0) |

**Table Bc11. Comparison of riffle habitat benthic invertebrate collections from stream mile 33 on the Eleven Point River; Numbers beside family names indicate total number of taxa with the number of organisms/ft$^2$ in parentheses (MDC 1995b). (*)indicates none found.**

| - | Eleven Point River Mile 33 October 25, 1974 | Eleven Point River Mile 33 October 31, 1985 |
|---|---|---|
| Effort (FT$^2$sampled) | 12 FT$^2$ | 8 FT$^2$ |
| Trichoptera | 7 (170) | 5 (216) |
| Ephemeroptera | 6 (68) | 13 (231) |
| Plecoptera | 2 (0.8) | 3 (1.3) |
| Lepidoptera | 1 (0.1) | 1 (0.3) |
| Coleoptera | 2 (50) | 2 (9) |
| Diptera | 4 (6) | 3 (8) |
| Arachnoidea | 1 (0.3) | 1 (0.5) |
| Gastropoda | 2 (4) | 3 (3) |
| Annelida | 1 (1.5) | 1 (1) |
| Isopoda | * | 1 (13) |
| Amphipoda | 1 (0.1) | 1 (1) |
| Decapoda | 1 (0.2) | 3 (1) |
| Platyhelminthes | 1 (5) | 1 (12) |
| Megaloptera | 2 (0.6) | 2 (0.4) |

Table Bc12. Species of conservation concern within the Eleven Point Watershed (MDC 1988,(1 of 4) Pflieger 1996, MDC 1998a, MDC 1998b MDC 1998c and MDC 1999).

| Scientific Name | Common Name | Federal Status | State Status | G Rank | S Rank |
|---|---|---|---|---|---|
| **Mammals** | * | * | * | * | * |
| *Myotis grisescens* | Gray Bat | E | E | G3 | S3 |
| *Myotis sodalis* | Indiana Bat | E | E | G2 | S1 |
| *Sylvilagus aquaticus* | Swamp Rabbit | * | * | G5 | S2? |
| **Birds** | * | * | * | * | * |
| *Aimophila aestivalis* | Bachman's Sparrow | * | E | G3 | S1 |
| *Ardea herodias* | Great Blue Heron | * | * | G5 | S5 |
| *Buteo lineatus* | Red-shouldered Hawk | * | * | G5 | S3 |
| *Haliaeetus leucocephalus* | Bald Eagle | T | E | G4 | S2 |
| *Limnothlypis swainsonii* | Swainson's Warbler | * | E | G4 | S1 |
| **Amphibians** | * | * | * | * | * |
| *Cryptobranchus alleganiensis (bishop)* | Ozark Hellbender | * | * | G4T3 | S2 |
| **Fish** | * | * | * | * | * |
| *Hiodon tergisus* | Mooneye | * | * | G5 | S3 |
| *Notropis ozarcanus* | Ozark Shiner | * | * | G3 | S2 |
| *Noturus flavater* | Checkered Madtom | * | * | G4 | S3S4 |
| *Typhlichthys subterraneus* | Southern Cavefish | * | 8 | G3 | S2S3 |
| **Invertebrates** | * | * | * | * | * |
| *Agapetus artesus* | Artesian Agapetus Caddisfly | * | * | G? | S3 |
| *Cambarus hubrichti* | Salem Cave Crayfish | * | * | G2 | S3 |
| *Hesperochernes occidentalis* | A Troglobitic Pseudoscorpion | * | * | G? | S3 |

Table Bc12. Species of conservation concern within the Eleven Point Watershed (MDC 1988, (2 of 4) Pflieger 1996, MDC 1998a, MDC 1998b MDC 1998c and MDC 1999).

| Scientific Name | Common Name | Federal Status | State Status | G Rank | S Rank |
|---|---|---|---|---|---|
| *Hydropsyche piatrix* | A Net-spinning Caddisfly | * | * | G? | S4 |
| *Ligumia recta* | Black Sandshell | * | * | G5 | S1S2 |
| *Ochrotrichia contorta* | Contorted Ochrotrichian Micro Caddisfly | * | * | G? | SU |

| | | | | | |
|---|---|---|---|---|---|
| *Orconectes eupunctus* | Coldwater Crayfish | * | * | G2 | S3 |
| *Ptychobranchus occidentalis* | Ouachita Kidneyshell | * | * | G3G4 | S2S3 |
| *Pseudosinella espana* | A Springtail | * | * | G? | S3 |
| *Scoterpes dendropus* | A Cave Millipede | * | * | G? | S2? |
| *Stenonema bednariki* | A Heptageniid Mayfly | * | * | G? | S3 |
| *Stygobromus onondagaensis* | Onondaga Cave Amphipod | * | * | G1 | S3? |
| *Toxolasma lividus* | Purple Lilliput | * | * | G2 | S2? |
| **Plants, Ferns, Fern Allies, and Mosses** | | * | * | | |
| *Armoracia lacustris* | Lake Cress | * | * | G4? | S2 |
| *Aster furcatus* | Forked Aster | * | * | G3 | S2 |
| *Aster macrophyllus* | Big-leaved Aster | * | * | G5 | S2 |
| *Berberis canadensis* | American Barberry | * | * | G3 | S2 |
| *Bromus latiglumis* | A Brome | * | * | G5 | S2S3 |
| *Calamagrostis porteri ssp. insperata* | Reed Bent Grass | * | * | G4T3 | S3 |
| *Carex alata* | Broadwing Sedge | * | * | G5 | S2S3 |
| *Carex comosa* | Bristly Sedge | * | * | G5 | S2 |
| *Carex decomposita* | Epiphytic Sedge | * | * | G3 | S3 |
| *Carex stricta* | Tussock Sedge | * | * | G5 | S2? |
| *Castanea pumila var. ozarkensis* | Ozark Chinquapin | * | * | G5T3 | S2 |

Table Bc12. Species of conservation concern within the Eleven Point Watershed (MDC 1988, (3 of 4) Pflieger 1996, MDC 1998a, MDC 1998b MDC 1998c and MDC 1999).

| | | | | | |
|---|---|---|---|---|---|
| *Cyperus retrofractus* | Teasel-like Cyperus | * | * | G5 | S1S2 |
| *Cypripedium candidum* | Small White Lady-slipper | * | * | G4 | S1 |
| *Cypripedium reginae* | Showy Lady-slipper | * | * | G4 | S2S3 |
| *Dryopteris celsa* | Log Fern | * | * | G4 | S1 |
| *Eleocharis equisetoides* | Horsetail Spike Rush | * | * | G4 | SX |
| *Euonymus americanus* | Strawberry Bush | * | * | G5 | S2 |
| *Glyceria acutiflora* | Sharp-scaled Manna Grass | * | * | G5 | S3 |
| *Helodium paludosum* | A Moss | * | * | G3G5 | S1 |
| *Hottonia inflata* | Featherfoil | * | * | G4 | S2 |

| | | | | | |
|---|---|---|---|---|---|
| *Isoetes engelmannii var. engelmannii* | Engelmann's Guillwort | * | * | G4T? | S1? |
| *Juncus debilis* | Weak Rush | * | * | G5 | S1 |
| *Lemna trisulca* | Star Duckweed | * | * | G5 | S2 |
| *Liatris spicata* | Button Snakeroot | * | * | G5 | SX |
| *Liatris scariosa var. nieuwlandii* | A Blazing Star | * | * | G5? TU | S2 |
| *Ludwigia microcarpa* | A False Loosestrife | * | * | G5 | S2 |
| *Lycopodium digitatum* | A Clubmoss | * | * | G5 | S2 |
| *Malaxis unifolia* | Green Adder's Mouth | * | * | G5 | S3 |
| *Marshallia caespitosa var. caespitosa* | Barbara's Buttons | * | * | G4T4 | S3 |
| *Mecardonia acuminata* | Water Hyssop | * | * | G5 | S1 |
| *Myurella sibirica* | A Moss | * | * | G4? | S? |
| *Najas gracillima* | Thread-like Naiad | * | * | G5? | S2 |
| *Paspalum dissectum* | Mudbank Paspalum | * | * | G4? | SH |

Table Bc12. Species of conservation concern within the Eleven Point Watershed (MDC 1988, (4 of 4) Pflieger 1996, MDC 1998a, MDC 1998b MDC 1998c and MDC 1999).

| *Scientific Name* | Common Name | Federal Status | State Status | G Rank | S Rank |
|---|---|---|---|---|---|
| *Plagiomnium ellipticum* | A Moss | * | * | G5 | S? |
| *Platanthera flava var. herbiola* | Northern Rein Orchid | * | * | G4 T4Q | S2 |
| *Potamogeton pulcher* | Spotted Pondweed | * | * | G5 | S2S3 |
| *Sacciolepis striata* | American Cupscale | * | * | G5 | S1 |
| *Schoenoplectus etuberculatus* | Canby's Bulrush | * | * | G3G4 | S1 |
| *Schoenoplectus subterminalis* | Swaying Rush | * | * | G4G5 | S1 |
| *Sida elliottii* | Elliott Sida | * | * | G4G5 | S1 |
| *Sphagnum centrale* | Sphagnum | * | * | G5 | S1S2 |
| *Spiranthes ovalis var. erostellata* | Oval Ladies' Tresses | * | * | G5T? | S2 |
| *Tipularia discolor* | Cranefly Orchid | * | * | G4G5 | S1 |
| *Tridens flavus var. chapmanii* | A Grass | * | * | G5T? | SX |
| *Trillium pusillum var. ozarkanum* | Ozark Wake Robin | * | * | G3T3 | S2 |
| *Viburnum recognitum* | Northern Arrow-wood | * | * | G5 | S1 |

| | | | | | |
|---|---|---|---|---|---|
| *Waldsteinia fragarioides ssp. fragarioides* | Barren Strawberry | * | * | G5T5 | S2 |
| *Wolffiella gladiata* | Wolffiella | * | * | G5 | S1 |
| *Yucca arkansana* | Arkansas Yucca | * | * | G5 | S2 |
| *Zigadenus nuttallii* | Death Camas | * | * | G5 | S1 |

Note: This table is not a final authority. Data subject to change.

**Federal Status**

E=Endangered

T=Threatened

* =Former category-2 candidate (In December of 1996, the USFWS discontinued the practice of maintaining a list of species regarded as "category-2 candidates". MDC continues to distinguish these species for information and planning purposes.

**State Status**

E=Endangered

**SRrank**

S1=Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. (typically 5 or fewer occurrences or very few remaining individuals)

S2=Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. (6 to 20 occurrences or few remaining individuals or acres)

S3=Rare and uncommon in the state. (21 to 100 occurrences)

S4=Widespread, abundant, and apparently secure in state, with many occurrences, but the species is of long-term concern. (usually more than 100 occurrences)

S5=Demonstrably widespread, abundant, and secure in the state, and essentially ineradicable under present conditions.

SU=Unrankable: Possibly in peril in the state, but status uncertain; need more information.

SE=Exotic: An exotic established in the state; may be native in nearby regions.

SH=Historical: Element occurred historically in the state (with expectation that it may be rediscovered). Perhaps having not been verified in the past 20 years, and suspected to be still extant.

SX=Extirpated: Element is believed to be extirpated from the state.

S?=Unranked: Species is not yet ranked in the state.

**Qualifier:**

? =Inexact or uncertain: for numeric ranks, denotes inexactness. (The ? qualifies the character immediately preceding it in Srank)

Q=Questionable taxonomy: taxonomic status is questionable; numeric rank may change with taxonomy.

**Grank**

G1=Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. (typically 5 or fewer occurrences or very few remaining individuals or acres)

G2=Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction throughout its range. (6 to 20 occurrences or few remaining individuals or acres)

G3=Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range. (21 to 100 occurrences)

G4=Widespread, abundant, and apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery. Thus, the element is of long-term concern. (usually more than 100 occurrences)

G5=Demonstrably Widespread, abundant, and secure globally, though it may be quite rare in parts of its range, especially at the periphery.

**Subrank:**

T=Taxonomic subdivision: rank applies to subspecies or variety.

**Note:** Data in table subject to revision. This table is not a final authority.

# *MANAGEMENT PROBLEMS AND OPPORTUNITIES*

The management goals, objectives, and strategies for the Eleven Point River Watershed were developed using information collected from the Eleven Point Watershed Assessment and Inventory (WAI) and direction provided by the MDC Strategic Plan, and the Fisheries Division Five Year Strategic Plan (1995-2000). Objectives and strategies were written for instream and riparian habitat, water quality, aquatic biota, and recreational use. All goals are of equal importance, with objectives listed in prioritized order whenever possible. This plan includes only those activities and results the Fisheries Division of MDC can reasonably expect to achieve or influence during the next 25 years. Completion of these objectives will depend upon their status in overall regional and division priorities and the availability of human resources and funds.

**GOAL I: IMPROVE RIPARIAN AND AQUATIC HABITATS IN THE ELEVEN POINT WATERSHED.**

**Status:** Problems affecting riparian and aquatic habitats include insufficient wooded riparian corridors, stream bank erosion, gravel dredging, and other point and nonpoint sources of pollution. Protecting and enhancing the riparian corridor is essential to obtaining quality aquatic habitats. A timbered stream corridor significantly influences many components of the stream ecosystem including stream bank stability, water quality, ground water absorption and recharge to the stream, amount of physical instream habitat, spatial and structural complexity of physical in-stream habitat, and the food web.

**Objective 1.1**: With the assistance of willing landowners, over a 25-year period, increase by 50% the proportion of streams with a timbered corridor width >100 feet and decrease by 75% the amount of unvegetated stream bank.

**Strategy:** Using the following list of prioritized watersheds, (developed through our evaluations of forest cover, losing streams, public ownership, point and nonpoint source pollution, and fish community data), direct our management efforts towards those watersheds of highest priority: (1) Middle Fork, (2) Upper Eleven Point River, (3) Fredrick Creek, (4) Lower Eleven Point River.

1. Utilizing state and federal assistance programs, such as the MDC-DNR incentive programs and educational efforts, implement riparian and aquatic habitat protection measures on streams.

2. Using videotapes, field investigations, aerial photography, and satellite imagery, document and update the current and future conditions of riparian corridors and streambanks. Future projects such as the Missouri Resource Assessment Partnership Land Cover Classification need to be encouraged in order to insure that adequate data is available that will allow efficient analysis of riparian conditions over time.

**GOAL II: IMPROVE SURFACE AND SUBSURFACE WATER QUALITY IN THE ELEVEN POINT WATERSHED.**

**Status:** Water quality within the watershed is relatively good. High fecal coliform levels, nutrient loading, and sediment and gravel deposition are the most severe threats to water quality. Poor land use practices, gravel dredging, and increasing cattle populations are the primary causes of the water quality

problems. Lead prospecting has occurred throughout the watershed. Lead prospecting and lead mining are potential threats to water quality in the watershed.
**Objective 2.1:** Assure that watershed streams meet state standards for water quality.

**Strategy:** Protecting riparian corridors will reduce surface runoff and provide stream channel and bank stability. Streams also need protection from other pollutants. Education of the citizenry and land owners on water quality issues and land stewardship is the best hope for improving water quality. Encouragement of appropriate agencies to enforce existing water quality laws is also required to obtain satisfactory water quality.

1. Through media contacts, personal contacts, literature development, and speaking engagements to groups such as the Scenic River Watershed Partnership Work Group, private landowners etc; inform the public of water quality problems (e.g., excessive siltation, animal waste runoff, gravel dredging, septic system failure etc.) and potential solutions to these problems.

2. Encourage the establishment of additional state water quality standards for groundwater in order to ensure better treatment of discharges to losing streams.

3Establish a structured water quality sampling program within the watershed in cooperation with the Missouri Department of Natural Resources and Stream Teams.

4Assist with training and involvement of Stream Teams in water quality monitoring and advocacy in the Eleven Point River Watershed.

5Assist with enforcement of existing water quality laws by reviewing 404 permits, cooperating with other state and federal agencies to investigate pollution and fish kill reports, collecting water quality related data, and recommending measures to protect aquatic communities. Additional emphasis should be placed on losing streams.

6Encourage and assist with additional dye tracing studies within the watershed in order to further determine intra-watershed and inter-watershed ground water movement as well as recharge area of selected springs within the watershed with an emphasis on publicly owned spring outlets.

7. Promote "greenways" in urban and residential areas i.e. Willow Springs, Alton, etc.

8Encourage the entry of water quality data into a Geographic Information System (GIS) useable format in order to facilitate effective data updating and analysis. This includes the creation of a beneficial use data layer based on current Rule 10 CSR 20-7.031 of the Rules of Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality, Tables G and H.

9. Insure all department areas follow best management practices.

10.Encourage limiting livestock access in riparian areas through education and/or incentive programs for private landowners.

**GOAL III: MAINTAIN THE ABUNDANCE, DIVERSITY, AND DISTRIBUTION OF AQUATIC BIOTA AT OR ABOVE CURRENT LEVELS WHILE IMPROVING THE QUALITY OF THE SPORT FISHERY IN THE ELEVEN POINT WATERSHED.**

**Status**: An assemblage of 66 fish species, 23 naiad species, 6 crayfish species, and 19 families of benthic

macro-invertebrates have been identified throughout the Eleven Point Watershed. A total of 77 "species of conservation concern" are known to occur in the watershed. This includes four species of fish, one species of amphibian, three species of mussel, and two species of crayfish . Major sport fish include rainbow trout, walleye, smallmouth bass, largemouth bass, shadow bass, white crappie, and channel catfish. Exotic aquatic species found in the watershed include common carp and Asian Clam.

**Objective 3.1**: Maintain the diversity, abundance, and distribution of native non-sport fish and invertebrate communities at or above current levels.

**Strategy:** High priority should be placed on protecting state and federally listed species and unique community assemblages. Focusing enhancement and protective efforts on a few species can be effective in helping other species that share the same habitat. Detecting changes in faunal composition and abundance can be accomplished by conducting routine surveys of fish and invertebrate communities. Determining reasons for any changes will be more difficult since a variety of factors (e.g., interspecific and intraspecific competition, water quality, habitat condition, etc.) could be involved.

1Assist with recovery efforts for any state or federally-listed rare or endangered species in the watershed.

2Survey fish communities every 10 years at historical sampling sites in the watershed using standardized sampling techniques. Establish additional sampling sites as necessary with priority given to Missouri Department of Conservation Areas. Document changes in species diversity, abundance, and or distribution.

3. Using GIS, document locations and identify unique fish assemblages associated with natural features and special habitats such as oxbow lakes, spring branches, and marshes.

4. Develop criteria for identifying instream habitat needs (e.g., presence of listed species, extent of timbered stream corridor, size of stream, land use, soils, presence of permanent water, presence of game fish, natural features, critical habitat, etc.) and develop a prioritized list of streams and stream reaches needing instream habitat restoration with priority given to stream reaches on public land.

5. If appropriate, initiate research projects to investigate reasons for significant changes in faunal abundance and distribution and recommend corrective measures.

6. Coordinate with Missouri Department of Conservation Research Staff and other groups (i.e. University of Missouri, etc.) to conduct a survey of mussels on all fifth order and larger streams. Resurvey every 10 years to document changes in species abundance, diversity, and distribution.

7. Coordinate with Missouri Department of Conservation Research Staff and other groups (i.e., MDNR, University of Missouri, etc.) to conduct a survey of benthic invertebrates on all fifth order and larger streams. Resurvey every 10 years to document changes in species abundance, diversity, and distribution.

**Objective 3.2**: Maintain or improve populations of sport fish while maintaining a stable and diverse fish community.

**Strategy**: Proper management of sport fish populations will depend on obtaining adequate samples to determine the status of the fishery and angler attitudes. Sport fish survey data on the upper and middle sections of the Eleven Point River are relatively current, however, insufficient data exist on the lower section of the Eleven Point River for setting specific management objectives. Once adequate information

is obtained, future management efforts will be directed toward setting appropriate fishing regulations, protecting and improving fish habitat, and stocking where appropriate.

1. Develop and initiate a regular sampling regime for high priority sport fishes to evaluate the status of their populations and provide baseline data for management decisions.

2. Complete fish habitat improvement projects at MDC-managed areas where sport fish habitat is limited.

**Objective 3.3:** Prevent detrimental impacts on native fauna of the Eleven Point Watershed by exotic aquatic species.

**Strategy:** Controlling the introduction of exotic species into the state is the easiest way to prevent detrimental impacts to native fauna. Once a detrimental exotic species becomes established, research will be needed to seek ways to contain or eliminate the exotic from the system.

1. Continue Division participation in the Missouri Aquaculture Advisory Council (MAAC) and other organizations and advocate controlling the introduction of exotic fauna into state waters.

2. Monitor for potentially harmful exotic species (i.e., zebra mussel or grass carp).

This can be performed during fish community surveys.

**GOAL IV: INCREASE PUBLIC AWARENESS AND PROMOTE WISE USE OF AQUATIC RESOURCES IN THE ELEVEN POINT WATERSHED.**

**Status:** Angler survey information indicates substantial fishing activity is occurring on the Eleven Point River from Thomasville to the Arkansas state line. Canoeing is also a popular activity along this section of the Eleven Point River. However, fishing pressure is relatively low on tributaries to the Eleven Point River, such as, Middle Fork, Spring Creek, Hurricane Creek, and Fredrick Creek.

**Objective 4.1:** Within compliance with USFS guidelines, assure access sites and stream frontage areas are developed at desirable locations, and in sufficient numbers, to encourage dispersal of public use throughout the watershed.

**Strategy**: Acquisition and development of additional stream access sites in order to provide additional recreational opportunities throughout the watershed.

1. Cooperate with USFS to develop new and upgrade existing river accesses.

2. Pursue the acquisition of additional stream access sites based on availability and site suitability in order to provide accesses in areas where use is currently limited due to a lack of public access thus dispersing public use within the watershed.

3. Pursue the acquisition of stream frontage sites based on availability and site suitability in order to provide access to public stream frontage in areas where use is currently limited due to a lack of public stream frontage thus dispersing public use. within the watershed.

**Objective 4.2:** Increase awareness of stream recreational opportunities and appreciation of stream ecology and advocacy to a level that will encourage a widespread and diversified public interest in the watershed.

**Strategy:** Careful publicity which focuses state and federally listed species as well as abundant local fish

stocks, such as redhorse suckers, longear sunfish, walleye, shadow bass, and smallmouth bass can maintain and promote a continued appreciation of these types of resource elements.

Providing opportunities for the public to learn about holistic stream ecology will, hopefully, create stream advocates.

1. Write fishing prospectus for public release to local media, describing the specific fisheries and angling opportunities associated selected streams within the watershed as additional data becomes available.

2. In cooperation with the United States Forest Service, develop and maintain fishing regulation signs at all river access sites.

3. Provide the local and statewide media with timely "How to", "When to" articles and interviews that focus attention on activities and places such as: wade gigging; wade fishing; seasons; baits; methods and techniques for catching particular species; life histories, habitats and behaviors of various aquatic animals.

4. Publicize the acquisition, development and opening of new public access sites.

5. Conduct recreational use surveys at 10 year intervals in conjunction with creel surveys to determine levels of public use and satisfaction.

6. Emphasize stream ecology and good stream stewardship (utilizing aquaria and stream tables where applicable) during presentations to school groups, youth organizations and private landowner contacts.

7. Conduct outdoor youth events, such as Ecology Day at stream sites with field activities that demonstrate stream ecology and good stream stewardship.

8. Facilitate the development and activity of Stream Teams, Scenic River Watershed Partnership Work Group, or other groups interested in adopting or otherwise promoting good stewardship and enjoyment of watershed streams.

9. Make public presentations that focus on the MDC Streams For The Future program.

10. Provide promotional, educational, and technical stream materials to groups, fairs and other special events.

11. Develop brochure which promotes best management practices within the watershed.

# ANGLER GUIDE

## Eleven Point River

The Eleven Point River is one of the most scenic and diverse fishing streams in the state. The 17 miles from Thomasville to Greer Spring offer excellent fishing for warm-water species. **Smallmouth bass** and **shadow bass** (goggle-eye) are the most sought after species in this section. As part of the U.S. Forest Service's Scenic River program, access to this area is limited to Thomasville, Cane Bluff, and Greer so plan on bringing a canoe to help get to the better fishing spots. On days when the smallmouth and shadow bass are not biting, a good population of **longear sunfish** will shorten the time between bites.

Greer Spring instantly transforms the river into a coldwater fishery, and the next 5.5 miles downstream to Turner Mill is home of some very large **rainbow trout**. This area was designated as a Wild Trout Management Area in 1992 and the fishery is still improving. Special regulations include an 18" minimum length limit, one fish per day, and flies and artificial lures only. Synthetic eggs and soft plastic lures are specifically excluded. Anglers can expect to catch and release good numbers of sublegal trout. A few trout will reach the 27" and 12 pound range. Access is limited to Highway 19 crossing at Greer and U.S. Forest Service gravel roads to Turner Mill. The remaining 15 miles from Turner Mill access downstream to Highway 160 at Riverton is managed as a put-and-take fishery. From February to mid-October, about 16,000 10-12" rainbow trout are stocked. Statewide regulations of no size limit and five fish per day apply. Access is provided at Turner Mill, Whitten and Highway 160. The 13 miles from Highway 160 downstream to the Arkansas state line offer good fishing for smallmouth bass and shadow bass (goggle-eye).Look for smallmouth in deep holes with cover provided by rocks, bluffs, or rootwads. Shadow bass can be found in rootwads and submerged vegetation in the tail end of riffles where the current begins to slow. A few **walleye** can be found in the deepest pools.Wade fishing on the Eleven Point is possible; however, the deep pools can make it difficult getting from shoal to shoal. A leisurely float in a canoe or jon boat will help make fishing on this scenic river more enjoyable. The Eleven Point River is always floatable downstream from Greer Spring and most of the time downstream of Thomasville.

# *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.

**Hypolimnion** 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 an flowing year-round.

**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 (USCOE) and now (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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