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 $CaCO_3$), 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 $CaCO_3$), 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

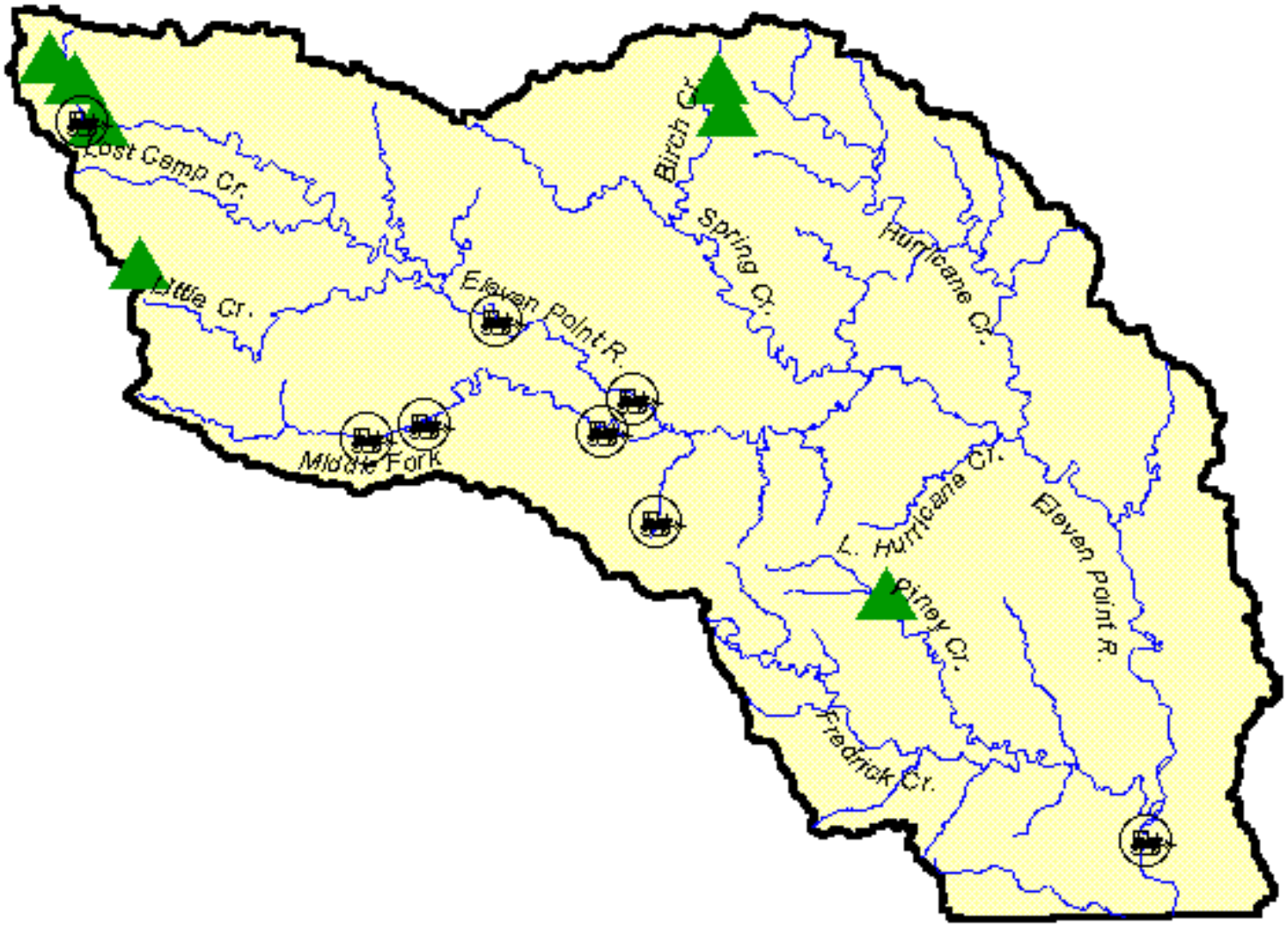
(http://www.health.state.mo.us/NewsReleases/99ADVSRYpr.html) on an annual basis. The advisory indicates the amount of different types of fish that the department believes can be safely consumed by people.

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
1995	Sucker sp.	21	<50	122	3.9	<10
1996	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