

WATER QUALITY

Beneficial Use Attainment

Approximately 150 stream miles within the Jacks Fork Watershed classified with beneficial uses as defined in Table H of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality (Table Wq01) (MDNR 1999a). These streams must meet or exceed established criteria as defined in Table A of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality for those beneficial uses (MDNR 1999b). All watershed streams listed in Table H are designated for livestock/wildlife watering as well as protection of aquatic life. Two streams within the watershed have additional designated beneficial uses. These streams are The Jacks Fork and Mahan's Creek. Approximately 39 miles of the Jacks Fork (from its mouth to Township (T) 28n, Range (R) 07w, Section 29) is designated for livestock/wildlife watering, protection of aquatic life, cool water fishery, whole body contact recreation, and boating/canoeing. Approximately 4.0 miles of Mahan's Creek (from its mouth to T28n, R04w, Section 09) is designated for livestock/wildlife watering, protection of aquatic life, and cool water fishery (MDNR 1999a). In addition to the aforementioned designated uses, the Jacks Fork River has been designated as "Outstanding National Resource Waters" from its mouth to its headwaters (MDNR 1999a). No streams within the Jacks Fork Watershed are designated for use as a drinking water supply. The streams of this watershed have no public surface water withdrawals.

Section 303(d) of the Federal Clean Water Law requires that states identify those waters for which current pollution control measures are inadequate (MDNR 1999b). This is accomplished by comparing data from those waters with water quality criteria established for designated beneficial uses of those waters (MDNR 1999b). Waters that do not meet their criteria 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 1999c). Five miles of Jacks Fork River from T29n, R3w, section 9 to T29n, R4w, section 26 are currently included in the 1998 303(d) list (MDNR 1999d). In this section of the Jacks fork, fecal coliform counts are periodically high indicating the presence of excessive organic wastes. The Clean Water Act requires that the 303(d) list be updated every four years (MDNR 2000a).

Chemical and Biological Quality of Streamflow

Data regarding the chemical and biological quality of stream flow within the Jacks Fork Watershed has been collected by several different entities since the 1960s. Government agencies which have conducted water quality sampling within the watershed include the Environmental Protection Agency, Missouri Department of Conservation, Missouri Department of Natural Resources, National Park Service, and the United States Geological Survey. In addition some water quality data has been collected by Stream Team organizations. The extensive amount water quality data available for various parameters and varying time periods within the Jacks Fork Watershed, makes an adequate summary of water quality data within this document, impractical.

In order to avoid going beyond the scope of this document by attempting to provide a comprehensive summary of all water quality data by all agencies for all available years, a single station within the Jacks Fork Watershed has been selected in order to provide a spatial and temporal snapshot of selected water quality values. USGS station 07066110 has been selected for this purpose. Station 07066110 is located

on the Jacks Fork River upstream from the mouth of Shawnee Creek at the Shawnee Campground (USGS 2000a). Water quality data has been collected at USGS Station 07066110 since 1973 (Figure Hy01 and Figure Wq01) (USGS 2000a). Table Wq02 lists selected water quality parameters and standards as well as maximum and minimum observations of selected parameters from station 07066110 for water years 1994-1998. Water quality at this station consistently met water quality standards for the selected parameters during the years examined with the exception of fecal coliform bacteria. Out of 31 observations conducted from 1994 to 1998, fecal coliform levels at station 07066110 exceeded state water quality standards for whole body contact recreation five times (Figure Wq02). All of these instances occurred during the recreational period, April 1-October 31 (as designated by MDNR 1999a). It is important to note that Station 07066110 is located on the section of the Jacks Fork River that is designated for whole body contact recreation. It is also notable that observed fecal coliform levels at station 07066110 did not exceed standards for whole body contact recreation during the 1998 water year. Water quality data also indicates that water at station 07066110 is hard as defined by the USGS (1999b)

As stated previously, a large amount of water quality data for a variety of parameters is available for the Jacks Fork Watershed. Microbiological sampling has been conducted within the Jacks Fork Watershed as part of a long term monitoring project cooperatively by the USGS, National Park Service, and the Missouri Department of Natural Resources (USGS 2001). Data is currently available for 35 sites with the number of samples at each site ranging from 1 to 55 <http://missouri.usgs.gov/wtrqual/jf.htm>. Water quality data is also available for additional parameters from the USGS Historical Water Quality Data Website <http://wwwdmorll.er.usgs.gov/watdata/wtrqual/> and the annual USGS Water Resources Data Reports as well as the EPA Storage and Retrieval (STORET) Database <http://www.epa.gov/storet/>. In addition, volunteer water quality monitoring data is available from the Missouri Stream Team online database <http://www.mostreamteam.org/vmsearch.html>. Additional State Water Quality Standards are available in the most current document of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality <http://mosl.sos.state.mo.us/csr/10csr/10c20-7a.pdf>.

USGS Pesticides National Synthesis Project

The United States Geological Survey conducted water quality samples within the Jacks Fork Watershed from 1993-1995 as part of the Pesticides National Synthesis Project in order to determine the spatial and temporal distribution of contamination by pesticides in the water resources of the United States (USGS 1999c). The Jacks Fork Watershed was part of the Ozark Plateaus Study Unit of the National Water Quality Assessment Program. One surface water sampling site and one ground water sampling site were selected within the watershed (Figure Wq02)(USGS 1999d and 1999e). A single sample was taken at the ground water sampling site in 1993. Four samples were taken between 1994 and 1995 from the surface water sampling site (USGS 1999f and 1999g). Pesticide compounds were detected in two of the four surface water samples. These compounds included Deethylatrazine, Thiobencarb, Atrazine, and Metalachlor. No pesticide compounds were detected within the single ground water sample. By comparison, 39 of 43 surface water sites within the Ozark Plateaus Study Unit had detections of pesticides with 18 sites having samples with six or more pesticide detections (Bell et al. 1997). In addition 73 of 215 ground water sample sites within the Ozark Plateaus Study Unit had pesticide detections with a maximum of 5 pesticides detected in any one sample (Adamski 1996).

Ground Water Quality

The presence of karst features both within and around the Jacks Fork Watershed such as Jam Up Creek, a losing stream, increases the risk of ground water contamination from point and non-point sources of pollution located on the surface. Due to the fact that most of the watersheds population is rural, indicating that most receive their water from untreated private wells, the quality of surface water which has the potential to enter the groundwater system is important. In addition, portions of the permanent flow within the watershed are enhanced by springs. Thus any contaminant which affects ground water quality is likely to affect surface water quality as well as drinking water quality. There are several ways in which contaminants can enter the groundwater system. These include losing streams, sinkholes, and abandoned wells. As indicated by dye traces performed within the watershed, ground water movement is not always restricted by surface watershed boundaries. Some groundwater does exhibit movement to other watersheds. The most notable example of this is groundwater movement from Jam Up Creek to Big Spring in Carter County.

Water quality tests performed by the Missouri State Public Health Laboratory in Springfield and Popular Bluff on 308 wells in Howell, Shannon, and Texas Counties from July 1998 to August 1999 indicate that 119 (38.6%) well samples tested were unsafe (Farmer, personal communication and Jones, personal communication). A well is considered unsafe if any coliform colonies result from the sample (Farmer, personal communication). Howell County had the highest percentage of unsafe wells with 40.6% of the wells tested in this group deemed as unsafe (Farmer, personal communication and Jones Personal Communication). It is important to note that other samples probably exist which are not included in these results. In addition, these results are inclusive of those portions of the counties mentioned which are outside the boundaries of the Jacks Fork Watershed. Many other variables such as spatial and temporal distribution of samples, as well as sample method variability, limit the use of this data. However, it can provide a rough insight into the ground water quality of the general area of the watershed.

Point Source Pollution

Table Wq03 lists 5 National Pollution Discharge Elimination System (NPDES) sites currently within the Jacks Fork Watershed (Figure Wq01) (MDNR 1998a). There are two permitted (by MDNR) municipal waste water discharges within the watershed. (MDNR 1998a). These serve the cities of Mountain View and Eminence. As of 1994, the Mountain View Waste Water Treatment Facility (WWTF) was discharging 0.250 million gallons per day (mgd) into Jam Up Creek; a losing stream. While the Eminence WWTF was discharging 0.292 mgd into the Jacks Fork River (MDNR 1994). Additional information regarding MDNR Water Pollution Control Program (WPCP) permitted facilities can be found at the WPCP permit website <http://www.dnr.state.mo.us/deq/wpcp/wpcpermits.htm>.

The Missouri Department of Natural Resources, Division of Geology and Land Survey has identified 13 active mines and 22 past producers within the Jacks Fork Watershed in Missouri (MDNR 1998b). All 13 current mines are gravel removal operations or limestone quarries. The highest percentage of past producers are copper and iron mines. Nearly all of these are surface mines which dot the watershed. These open pits can act as a direct link to the ground water system and thus pose a threat to ground water quality if pollutants are allowed to enter. This can effect wells from which nearly all of the watersheds population receives its water. It can be

assumed that many of these wells are shallow and/or untreated which makes ground water quality even more important.

Gravel mining also has the potential to threaten water quality as well as aquatic and riparian habitats

within the watershed. 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). In 1998 there were 4 permitted operations within the Jacks Fork Watershed (Figure Wq01)(USACOE 1998).

Land disruption from road and bridge construction and maintenance as well as urban expansion 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 down stream from the bridge. Since 1995 there have been no 404 permitted operations within the Jacks Fork Watershed (USACOE 1999).

According to the 2001-2005 Missouri Department of Transportation Highway and Bridge Construction Schedule <http://www.modot.state.mo.us/local/d9/d9.htm>, there are currently (2001) Two state highway

construction projects scheduled within the watershed (MDT 2001). These involve bridge replacement of the Highway 17 Jacks Fork bridge and the Highway 19 Jacks Fork Bridge.

Non-point Source Pollution

Perhaps one of the more difficult challenges to address within any watershed is non-point 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 non-point source pollution and its impacts.

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). As part of an Ozark National Scenic Riverways Groundwater Study, Aley and Aley (1987) identified pollution hazards including sewage disposal in the study region. They state that the primary type of sewage disposal within the study region is septic systems. Aley and Aley (1987) also state that according to a 1972 Missouri Clean Water Commission publication, sewage production is approximately 100 gallons per person per day. Using this information and assuming that nearly all of the populations of Mountain View and Eminence are served by municipal waste water treatment facilities, it can be estimated that 410,300 gallons of septic system effluent is generated per day within the Jacks Fork Watershed. Aley and Aley (1987) conclude that the "dispersed pattern of settlement in the study region is of great help in reducing groundwater contamination problems resulting from sewage disposal." Aley and Aley (1987) state that: "Instead, problems are centered on areas with concentrated settlement". It is important to stress that proper septic system installation and maintenance remains important to the protection of both surface and ground water systems.

Non-Point source contaminants of forestry activities within the Ozark National Scenic Riverways Groundwater Study Region were determined not to be significant enough to be designated by Aley and Aley (1987) as a hazard area within the study region. However, in certain areas of the study region, they did observe localized erosion "related primarily to logging roads and skid trails in rugged terrain" and concluded that "as a result, logging in the study region undoubtedly contributes to the sediment load of the springs in the Riverways". It is important to note that a considerable amount of land within the study region has since been transferred to public ownership.

As with other watersheds in the area, livestock, and in particular cattle populations, can potentially adversely affect both surface and ground water quality within the Jacks Fork Watershed. This is

especially true when livestock are allowed to linger in riparian zones. Current estimates of livestock populations based on watersheds appear to be scarce if not non-existent. Much of the livestock population data currently available is based on county estimates. Applying this data proportionally to a watershed is a dubious method, at best, due to the potential variability of spatial distribution of livestock populations within counties. Land cover may provide a partial clue: Forests and woodlands make up approximately 75% of the land cover within the Jacks Fork Watershed. Land cover within the riparian corridor reflects this characteristic. A high percentage of forest/woodland cover within the watershed would tend to indicate lower livestock populations. In addition, a high percentage of timbered riparian corridor would indicate, perhaps, more limited access to streams by livestock. Without good watershed-based livestock population data, much is left to speculation. What can be stated reliably is that limiting the presence of livestock from the riparian corridor is an effective way to help insure both surface and groundwater quality.

Other non-point pollution concerns within the Jacks Fork Watershed are recreation oriented. These include the large numbers of floaters (including people using johnboats, canoes, and innertubes) and people on summer weekends as well as horse trail rides and the associated facilities which are located along the Jacks Fork (MDNR 1994). As of 1994, monitoring had not shown any water quality problems associated with river recreation activities.

An increased awareness by the public will be important to the protection of both surface and ground water quality from non-point sources of pollution within the Jacks Fork Watershed.

Water Pollution and Fish Kill Investigations

As discussed previously, 5 miles of Jacks Fork River from (T29n, R3w, section 9 to T29n, R4w, section 26) are currently included in the 1998 303(d) list due to elevated fecal coliform levels (MDNR 1999d). Table Wq04 lists 7 water pollution impacts which have occurred within the Jacks Fork Watershed since 1990 (MDC 1991-1995; MDNR 1999e; and MDC 1999a). Elevated fecal coliform levels were the most frequent impact. No known fish kills have occurred within the watershed since 1990. The Missouri Department of Conservation has not performed toxicological sampling of fish from the Jacks Fork Watershed.

Water Use

Estimates of water use for the Jacks Fork Watershed are currently unavailable. However water use data for the Current River Watershed (of which the Jacks Fork is a part) obtained from the United States Geological Survey National Water Use Database (1998b) indicate that total water withdrawn within the Current River Watershed in 1995 was 34.99 million gallons per day (mgd). Most of the water withdrawn in the watershed was from the groundwater system. Groundwater withdrawn within the watershed was 29.46 million gallons per day (mgd) while surface water withdrawn was 5.53 mgd.

Estimated water withdrawal for irrigation purposes was the most prevalent use within the Current River Watershed in 1995 (USGS 1998b). Combined groundwater and surface withdrawals for irrigation equaled 30.38 million gallons per day (mgd). It is important to note that irrigation is not a use of the two major water users (defined as those facilities capable of withdrawing 100,000 gallons/day) in the Jacks Fork Watershed; thus the large amount of water withdrawn for irrigation in the Current River Watershed is not believed to be reflected in the Jacks Fork Watershed (MDNR 1997). Domestic use was the second most prevalent within the Current River Watershed with domestic deliveries equaling 2.51 mgd.

Self-supplied water withdrawn in 1995 for domestic use equaled 1.08 mgd. The human population within the Jacks Fork Watershed comprises approximately 21% of the total estimated Current River Population. Since domestic water use is directly related to human population, it is estimated that domestic water use for the Jacks Fork is 21% of that of the Current River Watershed or 0.53 mgd.

Major water use information for the Jacks Fork Watershed was obtained from the Missouri Department of Natural Resources (MDNR), Division of Geology and Land Survey. The MDNR maintains records of "major" surface and ground water users (those facilities capable of withdrawing 100,000 gallons/day) throughout the state. Recent records (1997) indicate there were two major water users within the watershed. These were the Cities of Mountain View and Eminence which had ground water withdrawals of approximately 147 million gallons and 40 million gallons respectively in 1997 (MDNR 1997).

Recreational Use

In 1982, the recreational value of the Jacks Fork Watershed was ranked fifth out of 37 major watersheds in Missouri (MDC and MDNR 1982). Results were obtained by surveying professional staff from six state and federal agencies. Threats to the Jacks Fork which would result in a lower of its ranking were identified as intensive recreational use, bank and shoreline development, and poor land use with intensive recreational use being the primary factor in the decline.

The National Park Service initiated a river use management plan in 1985 in order to help insure that the Jacks Fork, as well as the Current River, would continue to provide quality and diverse recreational opportunities to the public,. This plan was designed, in part to "protect the river environment and provide a variety of quality recreational experiences for visitors" (NPS 1989). This was accomplished by dividing the Jacks Fork and the Current River into zones and establishing maximum levels of canoe use designated as low (up to 10 canoes per mile), medium (11-40 canoes per mile), and high (41-70 canoes per mile). In some zones, the established maximum level of canoe use was different between weekends/holidays and weekdays.

The Jacks Fork River was divided into two zones: Zone 9-the confluence of the North and South Prongs to Alley Spring (24.5 miles) and Zone 10-Alley Spring to Two Rivers (14.9 miles). Both Zones were designated for medium canoe use during all time periods. in order to help insure that the Jacks Fork, as well as the Current River, would continue to provide quality and diverse recreational opportunities to the public. In order to evaluate the fulfillment of objectives set forth in the river use management plan, a monitoring program was established which set forth a periodic river use survey (Brown and Chilman 1998).

Since the establishment of a monitoring program, river use surveys were conducted in 1987, 1990, 1993, and 1997. In 1997, surveys were conducted between May 16 and August 13 (Brown and Chilman 1998). Canoes were the most prevalent watercraft, accounting for approximately 89% of total watercraft followed by innertubes (9%), johnboats (1%), and kayaks (<1%). Weekends accounted for the most use of the river by watercraft at 80% with an average daily count of 214 watercraft. Weekdays accounted for 20% of watercraft use with a daily average of 44 watercraft. It is important to note that counts were only performed on four of the five weekdays.

Angler surveys are useful for evaluating angler use, species preference, and satisfaction. Angler surveys can also be used to identify changes or trends in angler responses over time. These surveys provide the information necessary for managers to meet angler needs, as well as improve and validate decisions to

change or maintain regulations.

Results from statewide annual angler surveys which were conducted by the Missouri Department of Conservation from 1983 to 1986 estimate that on an annual basis, an average of 45,979 total hours were spent angling on the Jacks Fork River and its tributaries (MDC 1987). Total hours fished increased from 53,920 in 1983 to 71,094 in 1984. Pressure dropped to 32,135 total hours in 1986. Bass species accounted for the most preferred group fished for. On average, 16,290 hours (35%) were spent fishing for bass per year. However, most angling pressure, an estimated average 20,529 hours per year (45%), was not directed at a specific species.

Angler surveys have been conducted annually on the Jacks Fork River since 1990 (1990, 1991, and 2000 data currently unavailable) in conjunction with a smallmouth bass research project being carried out by the Missouri Department of Conservation (MDC 1999b). These surveys are focusing on 37.4 miles in three segments (one treatment and two non treatment segments) of the Jacks Fork River. Initially, these surveys were daytime surveys conducted throughout the year. However, due to low fishing pressure during the winter months, the survey period was shortened, beginning in 1992, to include only the period of April through October of each year. For the purposes of this document, data from the previously mentioned segments are combined. Average fishing pressure for the area and time period previously described was estimated to be 8,276 hours. Pressure ranged from a maximum of 15,702 hours in 1992 to 3,421 in 1997. Angling pressure in 1998 was 4,547. It is important to note that these are preliminary findings and thus may be subject to future modification. This survey is scheduled to be concluded in 2001 (Kruse, personal communication).

Figure Wq01.

Jacks Fork Watershed Water Quality

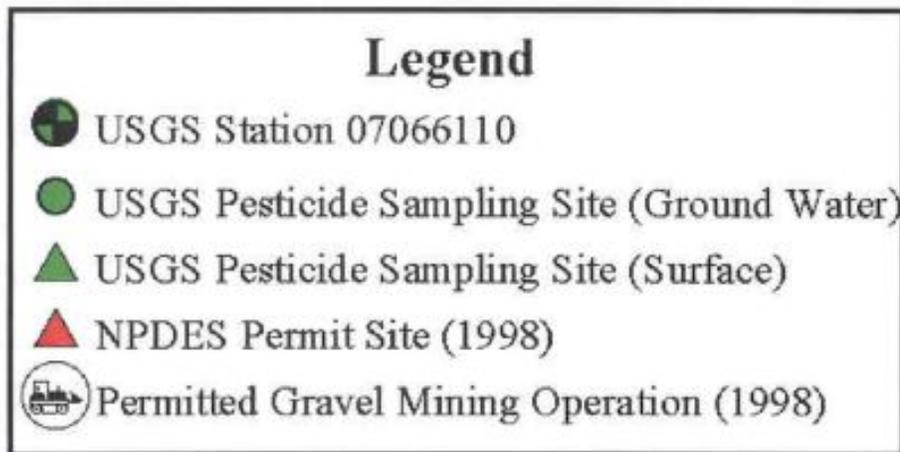
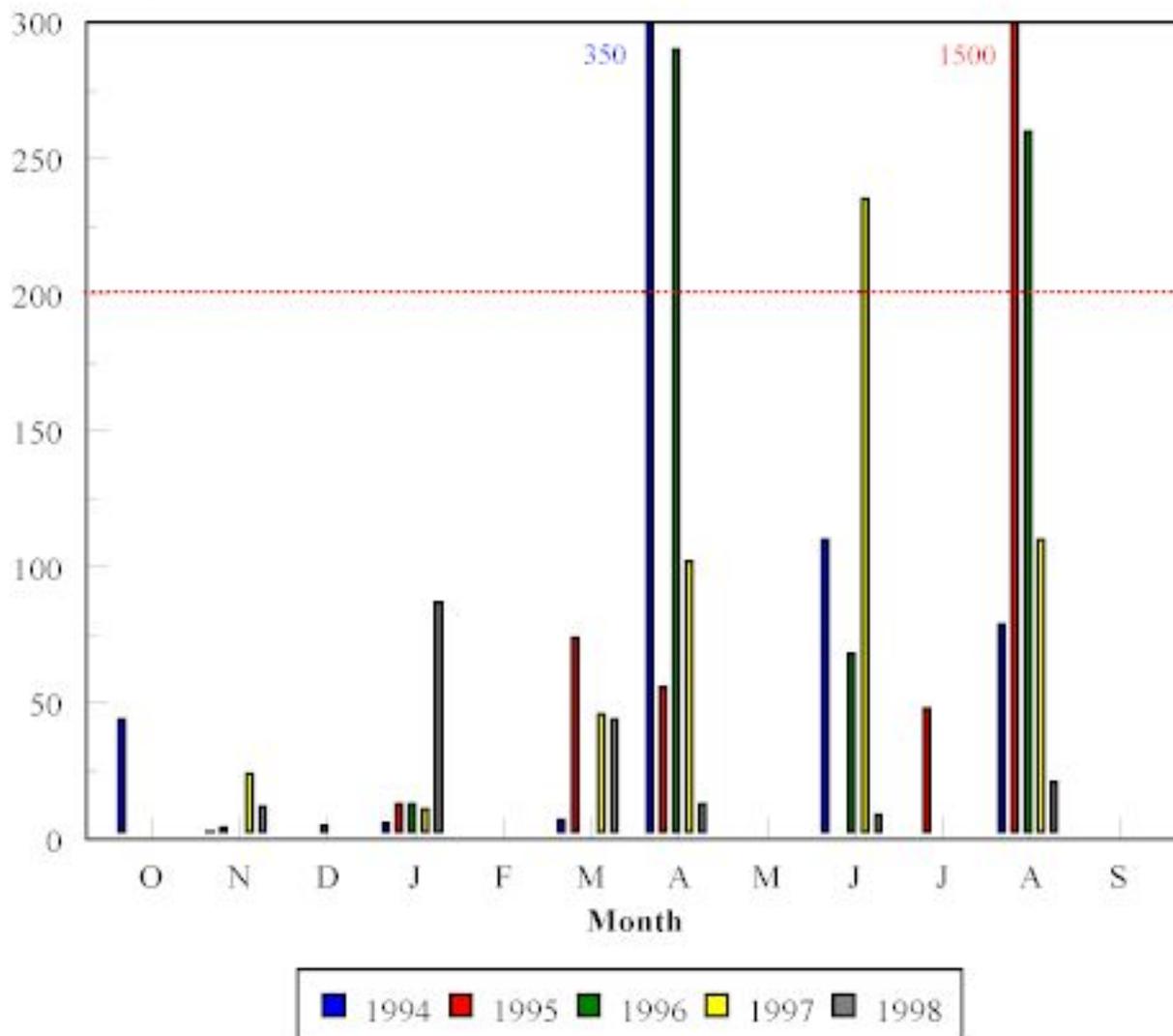


Figure Wq02. Fecal colliform colony counts per 100 milliliters at Station 07066110 (Jacks Fork above Two Rivers) (USGS 1995, 1996, 1997a, and 1998a, 1999a).

Colonies per 100 ml



Dashed red line represents limit in waters designated for whole body contact recreation from April 1-October 31 and any time for losing streams (MDNR 1996a).

Note: Data includes results based on colony count outside the acceptable range (non-ideal colony count). A non-ideal colony count refers to counts in which crowding and insufficient media (insufficient for full development of colonies) exist for an ideal colony count or the colony count is so low that its statistical validity is questionable (USGS 1997b).

Table Wq01. Missouri Department of Natural Resources use designations for selected streams within the Jacks Fork Watershed (MDNR 1999a). Locations are given in section, township, range format.

Stream Name	Class ¹	Miles *acres	From	To	Designated Use*
Alley Br.	P	1.0	Mouth	25,29n,5w	lww,aql
Alley Br.	C	2.0	25,29n,5w	22,29n,5w	lww,aql
Trib to Alley Br.	C	1.0	Mouth	22,29n,5w	lww,aql
Barn Hol.	C	8.0	Mouth	18,27n,7w	lww,aql
Trib to Barn Hol.	C	1.0	Mouth	4,27n,7w	lww,aql
Clear Spring	P	0.1	Mouth	19,28n,8w	lww,aql
Coon Hol.	C	3.0	Mouth	14,28n,7w	lww,aql
Flinger Br.	C	1.7	Mouth	17,28n,8w	lww,aql
Grassy Hol.	C	3.9	Mouth	9,28n,7w	lww,aql
Jacks Fork	P	39.0	Mouth	29,28n,7w	lww,aql,clf,wbc,btg
Jam Up Cr.	P	3.0	Mouth	16,27n,6w	lww,aql
Jam Up Cr.	C	2.0	16,27n,6w	20,27n,6w	lww,aql
L. Shawnee Cr.	P	2.0	Mouth	29,29n,3w	lww,aql
L. Shawnee Cr.	C	2.0	29,29n,3w	4,28n,3w	lww,aql
Mahans Cr.	P	4.0	Mouth	9,28n,4w	lww,aql,clf
Mahans Cr.	C	4.1	9,28n,4w	28,28n,4w	lww,aql
Mayhen Br.	C	1.3	Mouth	18,28n,8w	lww,aql
N. Prong Jacks Fk.	P	8.0	29,28n,7w	11,28n,8w	lww,aql

Note: This table is not presented as a final authority.

* lww-livestock & wildlife watering clf-cool water fishery

aql-protection of warm water aquatic life wbc-whole body contact recreation

and human health-fish consumption. btg-boating & canoeing

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 Wq01. Missouri Department of Natural Resources use designations for selected streams within the Jacks Fork Watershed (MDNR 1999a). Locations are given in section, township, range format.

Stream Name	Class ¹	Miles	From	To	Designated Use*
N. Prong Jacks Fk.	C	7.0	11,28n,8w	25,29n,9w	lww,aql
Open Hol.	C	1.0	Mouth	16,28n,4w	lww,aql
Panther Hol.	C	1.1	Mouth	10,27n,7w	lww,aql
Peters Cr.	C	3.5	Mouth	22,29n,8w	lww,aql
Pine Br.	C	4.2	Mouth	1,28n,8w	lww,aql
Pine Cr.	P	8.0	Mouth	5,27n,9w	lww,aql
Pine Cr.	C	1.0	5,27n,9w	5,27n,9w	lww,aql
Pine Hol.	C	4.0	Mouth	25,28n,5w	lww,aql
S. Prong Jacks Fk.	P	6.0	29,28n,7w	21,28n,8w	lww,aql
S. Prong Jacks Fk.	C	4.0	21,28n,8w	14,28n,9w	lww,aql
Shawnee Cr.	P	2.0	Mouth	30,29n,3w	lww,aql
Shawnee Cr.	C	10.3	30,29n,3w	19,28n,3w	lww,aql
Shuld Br.	C	2.0	Mouth	26,28n,9w	lww,aql
Stories Cr.	C	2.5	Mouth	16,29n,4w	lww,aql
Wolf Cr.	C	5.2	Mouth	10,27n,8w	lww,aql
Wyrick Br.	C	1.3	Mouth	10,28n,9w	lww,aql

Note: This table is not presented as a final authority.

* lww-livestock & wildlife watering clf-cool water fishery

aql-protection of warm water aquatic life wbc-whole body contact recreation

and human health-fish consumption. btg-boating & canoeing

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 Wq02. Selected water quality data for gage station 07066110 (Jacks Fork above Two Rivers) for water years 1994-1998 (USGS 1995, USGS 1996, MDNR 1996a, USGS 1997a, USGS 1998a, USGS 1999a). This table is not a final authority.

Parameter	State Standard					Measurement
	I	III	V	VI	VII	Min-Max
Temperature (°F) (cool water fishery)	84.0 Max					41.0-74.5
pH	-----6.5-9.0-----					6.9-8.5
Oxygen, dissolved (mg/L) (cool water fishery)	5.0 Min					7.7-13.2
Coliform, fecal (colonies / 100 ml)				200		k1-1500
Streptococci, fecal (colonies / 100 ml)						k2-800
Alkalinity ¹ (mg/L as CaCO ₃)						91-231
Hardness (mg/L as CaCO ₃)						140-180
Total Ammonia (mg/L as N)	0.1-32.1 ²					<0.010-0.048
Phosphorus, Total ³ (mg/L as P)						<0.02-0.120
Manganese, dissolved (ug/L as Mn)		50			50	1-7
Fluoride, dissolved (mg/L as F)		4	4		4	<0.10

Iron, dissolved (ug/L as Fe)	1000	300			300	<3-20
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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 maximum chronic and acute standards for cold-water fishery. Levels are pH and temperature dependent. The maximum acute value at 4° C and pH of 6.6 is 32.1 mg/l. The maximum acute value at 30° C and pH of 9.0 is 0.6 mg/l. The maximum chronic value at 4° C and pH of 6.6 is 2.4 mg/l. The maximum chronic value at 30° C and pH of 9.0 is 0.1 mg/l. 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 Wq03. National Pollution Discharge Elimination (NPDES) permit sites within the Jacks Fork Watershed (MDNR 1998a).

Facility Name	Receiving Stream	Facility	County
Mountain View WWTP	Jam Up Cr.	Waste Water Treatment Plant	Howell
Willow Springs Landfill	Trib. Pine Cr.	Land Fill	Howell
U.S. National Park Service	Jacks Fork R.	Park*	Shannon
Bryan Pump and Plumbing	L. Shawnee Cr./ Jacks Fork	Sludge Disposal/ Hauler	Shannon
Eminence WWTF	Jacks Fork R.	Waste Water Treatment Plant	Shannon

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

*Waste water treatment plant (land application of effluent)

Table Wq04. Fish kill and water pollution impacts investigated within the Jacks Fork Watershed from 1990-1998 (MDC 1991-1995; MDC 1999a; and MDNR 1999e).

Date	Stream	Facility Ownership	Fish Kill	Impact Description
11/90	Jacks Fork	N/A	No	Transportation: truck
6/11/92	Jacks Fork, North & South Prongs	N/A	No	Other Source: Erosion sediment/nutrient runoff.
8/14/92	Jacks Fork	Private	No	Agricultural: Horse manure/bedding.
10/92, 8/93, 10/93	Jacks Fork	Private	No	Elevated fecal coliform
6/93	Jacks Fork	Municipal	No	High effluent.
6/25/94	Mahans's Creek	N/A	No	Transportation: Asphalt oil.
2/26/96	Jacks Fork	?	No	?

N/A=Not Applicable

?=No data given