HABITAT CONDITIONS

Dam and Hydropower Influences

Section 236.400 of the Missouri Revised Statutes defines a dam as "any artificial or manmade barrier which does or may impound water, and which impoundment has or may have a surface area of fifteen or more acres of water at the water storage elevation, or which is thirty-five feet or more in height from the natural bed of the stream or watercourse measured at the downstream toe of the barrier or dam, if it is not across a streambed or watercourse, together with appurtenant works." (MGA 2000a).

The Dam Safety Law of 1979 established a "Dam and Reservoir Safety Council" associated with the MDNR (MDNR 2000e and MGA 2000a). The responsibility of this council is to "...carry out a state program of inspection of dams and reservoirs in accordance with regulations adopted by the council" (MGA 2000b). The MDNR Dam and Reservoir Safety Program operates under the guidance of the council. The program is responsible for regulating all new and existing nonfederal, non-agricultural dams which have a height of 35 feet or greater in order to ensure that these structures meet minimum safety standards. In order to facilitate this, the program maintains a database on over 4,000 dams within the state to be used by private owners, professional engineers, mining companies, emergency management officials, educational institutions, other government agencies as well as private individuals (MDNR 2000f). This database includes permitted dams as well as some dams which don't require a permit.

Within the Big Piney Watershed there are currently 6 dams which have records within the Dam and Reservoir Safety Program Database (Figure Hc01) (MDNR 2000g). All are reinforced earth structures with heights ranging from 12 to 27 feet. Impoundment areas range from 4 to 45 acres. Two additional dams located on the lower Big Piney River are mentioned in MDC 2003f. One is a low rock structure located upstream from the FLW golf course. The other is a concrete structure approximately 4.3 miles downstream of the aforemention structure. The latter structure backs up the Big Piney River for approximately one mile upstream (MDC 2003f).

In an effort to further determine the presence of significant dam and reservoir structures within the watershed, analysis was performed on National Wetlands Inventory (NWI) GIS data for the watershed. Data was analyzed based on all diked/impounded waters within 100 feet of third order (Strahler) and larger stream segments. This method yielded 14 potentially significant diked/impounded sites. The largest of these sites was 2.0 acres; with the smallest being less than 1 acre. It is estimated that 2 of these structures are in-stream, based on analysis of their spatial relationship to the 1:24,000 hydrography layer.

Channel Alterations

Alterations of stream channels by human activity can take several forms including channelization, channel constriction through bridge construction, raising of the base level of the stream by improper construction of low-water bridges sand and gravel removal, etc. All of these

activities can adversely affect stream habitat as well as water quality and thus the health of riparian and aquatic communities.

Channelization of a stream involves the straightening, deepening, and/or widening of the stream channel. Frequently, stream channels, in their natural states, have a complex morphology composed of meanders, riffles, and pools. The meanders of a stream help to dissipate the streams energy. A meandering stream also allows surface and ground water within a drainage to be released gradually relative to a straight stream thus allowing for better maintained base flows during dry periods. Channelizing can have several direct and indirect negative effects. These include shortening of the stream, increasing channel gradient of the channelized segment, loss of well defined riffles and pools, increased erosion including headcutting upstream of the channelized segment, increased deposition and flooding downstream of the channelized segment, lowering of the flood plain water table, and a loss of habitat diversity to name a few (Bolton and Shellberg 2001). These impacts can spread to other streams within the respective watershed as well. The aforementioned impacts not only negatively effect aquatic habitats and biotic communities, but can also be damaging to property both up and downstream due to the potential for increased erosion and flooding in these areas respectively. Estimates based on analysis of National Wetlands Inventory data indicate that only about 3 miles of channelized stream exist within the Big Piney Watershed (Figure Hc01). All channelization within the watershed appears to be relatively small and localized. It is possible that smaller unknown channelization projects have probably occurred on private property and also from road and bridge construction elsewhere in the watershed.

Improper bridge design which alters the normal flow pattern of a stream can also negatively impact a stream. Bridges can restrict stream flow especially at high flows, reducing flow velocities upstream of the bridge, thus increasing sedimentation. They can also increase velocities downstream of the bridge, thus increasing scour/erosion. Improperly designed low-water bridges can alter the base level (that level below which a stream cannot erode) of a stream, thus altering the stream gradient. They can also act as a dam, backing up water behind them and increasing sedimentation on the upstream side. Improperly constructed low-water bridges can also act as a barrier to fish movement. According to the U.S. Corps of Engineers Regulatory Program Database, no permits were issued for culvert construction, bridge construction, bridge removal, or bridge replacement in the Big Piney Watershed between January 2003 and September 2003 (USACOE 2003). According to the Missouri Department of Transportation Highway and Bridge Construction Schedule, there are currently (2003) no state highway projects which involve drainage and/or bridge construction or maintenance scheduled within the watershed from 2004-2008 (MDT 2003).

Gravel mining can also directly and indirectly contribute to channel alterations as well as water quality problems. The negative impacts of improper gravel mining have been shown to include channel incision, sedimentation of downstream habitats, accelerated bank erosion, channel shift, the lowering of the flood plain water table, and the formation of a wider and shallower channel which can result in increased temperature extremes (Roell 1999).

Since 1993, there have been 59 permitted instream sand and gravel removal operation sites within the Big Piney Watershed (MDNR 2003e). Figure Hc02 shows the general location and

relative level of activity of permitted gravel mining within the watershed. Much of the permitted sand and gravel removal activity has occurred on the Upper Big Piney and its tributaries. Other streams which have experienced activity include Bradford Branch, Elk Creek, Hamilton Creek, Hog Creek, Potters Creek, Spring Creek, and West Piney Creek.

Approximately 63 miles of streams within the Big Piney Watershed have seasonal restrictions placed on sand and gravel mining activities (Figure Hc02). Currently approximately 54 miles of the Big Piney River are closed to sand and gravel mining from March 15 through June 15 (MDC 2000). This closing is based on the following criteria: Sensitive species recovery or maintenance, RTE or sensitive species spawning, outstanding national or state water, specific species management by MDC, and unique community or diversity. In addition, approximately 9 miles of Spring Creek are closed to sand and gravel mining from November 15 through February 15 (MDC 2000). The criteria for listing includes RTE or sensitive species spawning and specific species management by MDC.

Many types of activities such as the filling of wetlands, placement of roadfills, construction of dams and the construction of cable or pipeline crossing, just to name a few, require permitting from the COE when they involve "waters of the United States". In the period from 1998 to 2002, approximately 29 permits were issued by the COE for activities within the Big Piney Watershed (USACOE 2003b). The most common activity for which permits were issued was gravel removal. Other activities for which permits were issued included road work, structures, bridge work, bank stabilization, and utilities. Additional information regarding the COE Regulatory Program can be found at http://www.nwk.usace.army.mil/regulatory/regulatory.htm

Natural Features

The MDC inventoried counties within the Big Piney Watershed between 1990 and 1992 for unique natural features (Ryan and Smith 1991 and Ryan 1992). 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.

In tandem with the initial natural features inventories, the Missouri Natural Heritage Database (NHD) was created. The NHD lists many of the features which were included in the Missouri Natural Features Inventory. The database, which is updated frequently, is a dynamic representation of the occurrence of many natural features in Missouri. Currently the database contains 172 features for the Big Piney Watershed (MDC 2003b). These include 33 examples of 15 types of natural communities (Table Hc01). Dolomite glades are the most commonly recorded community of the watershed within the database accounting for 5 records. Dry-Mesic Chert Forest are the second most commonly recorded community with 4 records. Table Hc02 lists 4 inventoried aquatic communities located within the Big Piney Watershed. These include examples of 2 types of aquatic communities including Ozark Creeks and Small Rivers and Ozark Headwater Streams. A detailed description of the previously mentioned terrestrial natural communities can be found in <a href="https://doi.org/10.1007/nc.1

Community Classification System for Missouri by Pflieger (1989).

Undoubtedly more examples of natural features exist within the watershed. However, due to many circumstances including the limited access to private land and the large land area, many features may be as yet unrecorded. Therefore, the previous listing of features should not be regarded as final or comprehensive. However, this listing does provide a good cross section of the types of communities which can be found within the watershed.

Improvement Projects

Much of the stream improvement activity within the Big Piney watershed has been focused on the coldwater fishery of Spring Creek. Since 1988 several projects have been completed on Spring Creek. These projects include bank stabilization using rock blankets, cedar tree revetments, and willow staking; as well as in-stream habitat improvement utilizing the placement of boulders and rootwads. In addition, a single site on Potters Creek near Cabool has been the site of an ongoing streambank stabilization project since 1990. Stabilization practices which have been used at this site include a cedar tree revetment, rock blankets, rock barbs, and riparian corridor tree planting.

Stream Habitat Assessment

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 and beyond the scope of this document. 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 affects 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 dissolved oxygen, cover, spawning areas, etc.

Evaluation of riparian corridor land cover within the Big Piney Watershed was accomplished using Missouri Resource Assessment Partnership Land Cover Data (morapmd.wpd). A buffer zone 3 pixels (90 meters) wide was created which corresponded to a 1:24,000 hydrography coverage for the watershed. Percent land cover was then calculated for the area within this buffer based on the land cover categories of forest, wetland, grassland, cropland, urban, and water. Percentages of these categories were calculated for riparian corridors within each drainage unit as well as for the whole watershed.

Results from the Big Piney Watershed indicate that riparian corridor land cover consists of more forest/wetland (68.3%) than grassland/cropland (31.1%). Percentages for the remaining categories of urban and water are 0.2% and 0.4% respectively. Of the 4 eleven digit hydrologic units within the watershed, the Lower Big Piney Unit has the highest combined percentage of forest/wetland corridor land cover at 83.5%. It also ranks as having the lowest combined percentage of grassland/cropland corridor land cover at 14.8%. The Upper Big Piney Unit has

the lowest percentage of combined forest/wetland riparian corridor at 49.0% and the highest combined percentage of grassland/cropland at 50.6%. Table Hc03 gives riparian corridor land cover/land use percentages for all eleven digit hydrologic units within the watershed as well as percentages for the total watershed. Figure Hc03 presents a graphic representation of riparian corridor land cover for all units within the watershed.

In addition to analysis of riparian corridor within hydrologic units, riparian corridor land cover was analyzed for all fourth order (Horton) and larger streams within the watershed. A comparison of combined forest/wetland to combined grassland/cropland land cover for fourth order and larger streams indicates that 17 out of 21 streams have corridors with larger combined percentages of forest/wetland than grassland/cropland. The Little Bald Ridge Creek corridor has the highest percentage of forest/wetland at 93.0%, while the Potter Creek corridor has lowest percentage of forest/wetland at 22.6%. The Big Piney River corridor has combined percentages of forest and wetland at 79.5% and combined grassland cropland at 12.6%. Results for the remaining fourth order and larger streams are given in Table Hc04.

An aerial stream survey of the Big Piney Watershed was conducted by the MDC in the spring of 1991. The survey included portions of Big Piney River, as well as major tributaries. Points of interest such as unstable stream and riparian areas as well as other significant landmarks were cataloged and an index of photos taken during the flight was created. Topographic maps were labeled according to the video index time. Information from this survey will be useful for a variety of projects such as future habitat assessment, assisting landowners with problems associated with stream bank erosion and deposition, reviewing gravel mining permits, selection of aquatic biota sampling sites.

Cold Water Habitat

Approximately 7.4 miles of streams within the Big Piney Watershed are designated for coldwater sport fishery (Figure Hc01)(MDNR 2000b). Approximately 6.5 miles of Spring Creek are designated for cold-water sport fishery. Bender Creek and Stone Mill Spring Branch account for another 0.7 and 0.2 miles designated for cold-water sport fishery respectively.

Table Hc01. Inventoried natural communities within the Big Piney Watershed (MDC 2003b).

Community	Number of Records in Watershed				
Cave	3				
Creeks And Small Rivers (Ozark)	2				
Dolomite Glade	5				
Dry Limestone/Dolomite Cliff	3				
Dry-Mesic Chert Forest	4				
Dry-Mesic Chert Woodland	2				
Dry-Mesic Sandstone Forest	2				
Dry-Mesic Sandstone Woodland	2				
Headwater Streams (Ozark)	2				
Mesic Limestone/Dolomite Forest	1				
Moist Limestone/Dolomite Cliff	2				
Moist Sandstone Cliff	1				
Ozark Fen	2				
Sandstone Glade	1				
Upland Flatwoods	1				

Table Hc02. Inventoried aquatic natural communities within the Big Piney Watershed (MDC 2003b).

Aquatic Community Type	Name	Significance
Creeks and Small Rivers (Ozark)	Arthur Creek	E
Creeks and Small Rivers (Ozark)	Big Piney River	ND
Headwater Streams (Ozark)	Arthur Creek	E
Headwater Streams (Ozark)	Bender Creek	E

Significance: S=Significant, E=Exceptional, ND=No Data

Table Hc03. Percent riparian corridor land cover for eleven digit hydrologic units within the Big Piney Watershed. Data is based analysis of MoRAP Missouri Land Cover Data (1999).

Unit Name	Forest	Wetland	Grassland	Cropland	Urban	Water
Upper Big Piney	49.0	0.0	50.6	0.1	0.2	0.1
Middle Big Piney	78.9	0.0	20.4	0.0	0.2	0.4
Spring Creek	64.8	0.0	35.1	0.1	0.0	0.0
Lower Big Piney	83.5	0.0	14.7	0.1	0.5	1.2
Big Piney Watershed	68.3	0.0	31.0	0.1	0.2	0.4

Table Hc04. Percent riparian corridor land cover for fourth order and larger streams within the Big Piney Watershed. Streams having combined percentages of grassland and cropland exceeding combined percentages of forest and wetland are in *bold italics*. Data is based on analysis of Missouri Land Cover Data (MoRAP 1999) and Kansas land cover data (KARS 1993).

Stream Name	Forest	Wetland	Grassland	Cropland	Urban	Water
Arthur Creek	78.9	0.0	21.1	0.0	0.0	0.0
BPW023	39.8	0.0	60.2	0.0	0.0	0.0
Bald Ridge Creek	75.2	0.0	24.6	0.0	0.0	0.2
Bender Creek	64.0	0.0	35.9	0.0	0.0	0.1
Berry Branch	59.7	0.0	40.3	0.0	0.0	0.0
Big Paddy Creek	88.3	0.0	11.3	0.0	0.0	0.4
Big Piney River	79.5	0.0	12.6	0.0	0.4	7.5
Burton Branch	67.4	0.0	32.6	0.0	0.0	0.0
Crossing Hollow	88.2	0.0	11.8	0.0	0.0	0.0
Dry Creek	60.1	0.0	36.1	0.1	3.7	0.0
Elk Creek	33.7	0.0	66.3	0.0	0.0	0.0
Hog Creek	55.4	0.0	44.6	0.0	0.0	0.1
Little Bald Ridge Creek	93.0	0.0	7.0	0.0	0.0	0.0
Little Paddy Creek	91.5	0.0	6.1	0.0	0.0	2.5
Long Hollow	59.1	0.0	40.9	0.0	0.0	0.0
Potter Creek	22.6	0.0	77.4	0.0	0.0	0.0
Sherrill Creek	62.5	0.0	37.5	0.0	0.0	0.0
Spring Creek	47.4	0.0	52.2	0.1	0.3	0.0
Steam Mill Hollow	73.0	0.0	27.0	0.0	0.0	0.0
Watts Hollow	84.7	0.0	14.8	0.0	0.0	0.4
West Piney Creek	65.5	0.0	34.4	0.1	0.0	0.0





