PLATTE RIVER

WATERSHED INVENTORY AND ASSESSMENT

This information is based on the

Platte River Watershed Inventory and Assessment

prepared by

Mike Bayless

and

Vince Travnichek

Missouri Department of Conservation

St. Joseph, Missouri

For additional information contact:

Harold A. Kerns

Northwest Regional office

701 NE College Drive

St. Joseph 64507

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EXECUTIVE SUMMARY

The Platte River is a low gradient, eighth order river located in southwest Iowa and northwest Missouri. The Platte River originates in Union County, Iowa and flows southward for about 200 miles where it empties into the Missouri River near the town of Farley, Missouri. The watershed contains 2,419 square miles with 786 square miles (32.5%) in Iowa and 1,633 square miles (67.5%) in Missouri and lies within the Dissected Till Plains physiographic region. The average annual discharge for the Platte River at Sharps Station (98% of the drainage basin) is 1,925 cubic feet per second. There are 435 third order and larger streams within the basin, and major tributaries include the 102 River, Third Fork, Honey Creek, Castile Creek, and the Little Platte River. Streams within the basin are typical of prairie type, with turbid water and generally homogeneous substrate consisting of silt and sand.

The basin is best characterized as rural with portions of the watershed lying within the cities of St. Joseph and Kansas City. Maryville is the largest urban area totally within the watershed, with a population of 10,663 (1990 census). Land use within the basin is dominated by agriculture and is comprised of about 60% row crop production, 17% pasture, and 11% forest. About 2% of the watershed is in public ownership. Channelization within the basin has resulted in about 250 miles of lost stream length and a 19.4% reduction in total stream miles from fourth order and larger streams.

Major water quality concerns in the basin are soil erosion from surrounding lands and unprotected stream banks and the deposition of sediment into stream channels. The high erosion and deposition rates within the basin have resulted in filling riffle and pool habitats, as well as widening of stream channels. This, along with reduced water absorbing and holding capacity of surrounding lands, and the resulting exaggerated high and low flow conditions, have been the major limiting factors to the diversity and abundance of fish within the basin. Point-source pollution is not considered to be a major threat to basin streams relative to non-point sources. Notable point source concerns in the basin are those associated with municipal waste near the three major urban areas and pollution from Kansas City International Airport.

In the period from 1941 to the present, Missouri Department of Conservation (MDC) personnel, Iowa Department of Natural Resources (IADNR) personnel, and angler creel records have documented 47 spnd **5)** increase recreational use. ecies of fish within the basin. Wide ranging, tolerant species were the most common types sampled, with minnows (Cyprinidae) being the dominant family. Eleven rare or endangered species with aquatic associations inhabit, or at one time inhabited, the Platte River basin. Recreational use surveys indicated that fishing accounted for 51% of the total trips and 73% of the total hours of use on the lower Platte River over a one year study period. Channel catfish (*Ictalurus punctatus*) and flathead catfish (*Pylodictis olivaris*) represented 54% of the total harvest from the study.

Other sportfish within the basin include largemouth bass (*Micropterus salmoides*), white bass (*Morone chrysops*), black crappie (*Pomoxis nigromaculatus*), white crappie (*P. annularis*), bluegill (*Lepomis macrochirus*), and green sunfish (*L. cyanellus*). Up to date angler surveys are lacking within the basin, but usage is probably high, especially with the basin's location relative to major urban areas.

Private ownership accounts for 98% of basin lands, making the private landowners the critical link between improving streams within the basin or their further degradation. The main objectives should be to increase public awareness, appreciation, and importance of stream resources within the basin. This would allow all of the goals set forth in this plan to be met. The main goals listed in the Platte River Basin Plan are: **1)**improve water quality and water quantity; **2)** improve riparian and aquatic habitats; **3)** maintain diverse and abundant populations of native aquatic organisms, while supporting the demands for quality fishing; **4)** increase public appreciation and awareness for stream resources; and **5)** increase recreational use.

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LOCATION

The Platte River originates near Spaulding, Iowa in the southwestern portion of the state, and enters Missouri near the town of Sheridan, Missouri (river mile 146). The Platte River flows through northwest Missouri, and drains into the Missouri River near Farley, Missouri (Missouri River mile 391). The 102 River is the largest tributary of the Platte River, while smaller tributaries include Honey Creek, Long Branch, Third Fork, Little Third Fork Platte River, Castile Creek, and Little Platte River (Figure 1). The Platte River has a peak elevation of 1,320 feet, mean sea level (M.S.L.), and elevation at the mouth is 760 feet M.S.L. Within the basin, there is a mean slope of 3.1 feet per mile (Committee on Public Works 1965).

The basin covers portions of 14 counties. These include Andrew, Buchanan, Clay, Clinton, DeKalb, Gentry, Nodaway, Platte, and Worth counties in Missouri and Adams, Ringgold, Taylor, and Union counties in Iowa. Portions of two large metropolitan areas (i.e., Kansas City and St. Joseph, Missouri) occur within the Platte River basin. The City of Maryville, Missouri is the only other large city in the basin (population 10,663 people, 1990 Census). The total basin population in 1990 was 91,491.

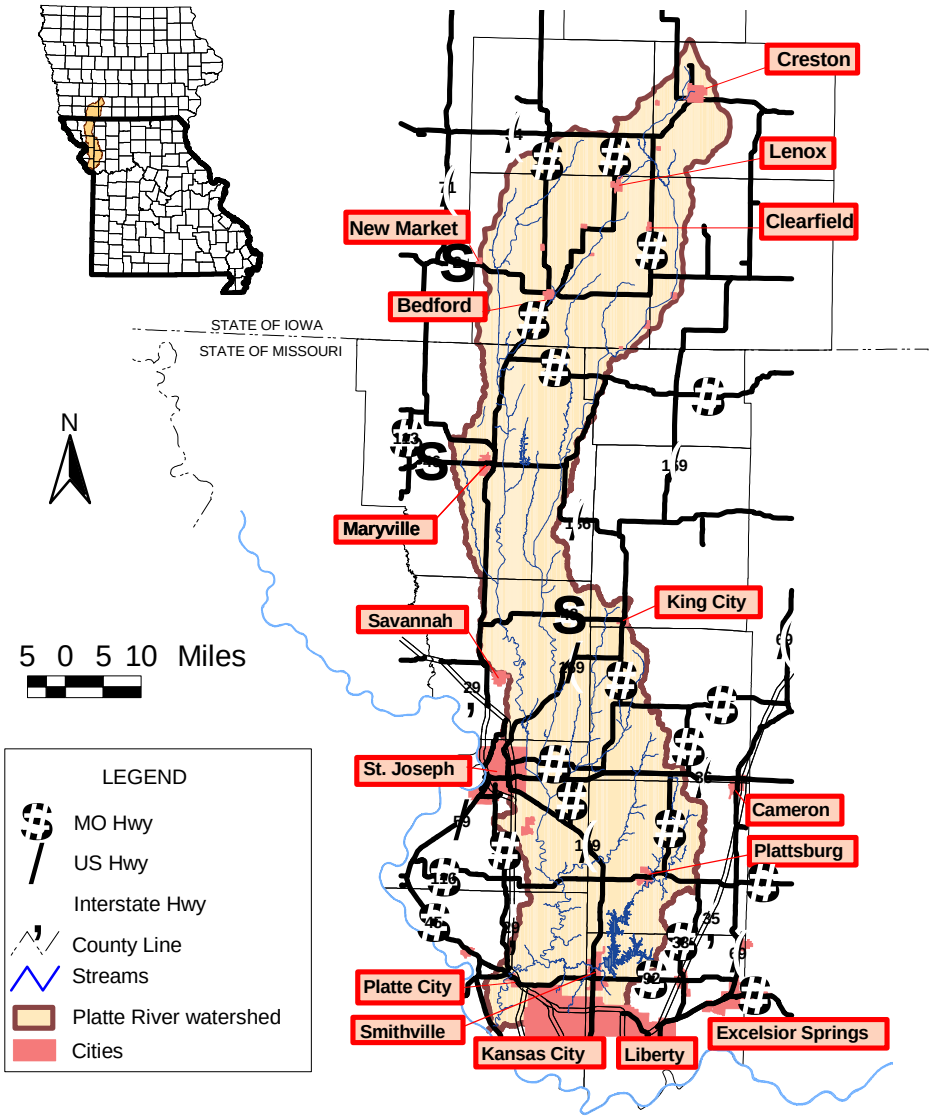

Figure 1. Platte river watershed.

GEOLOGY

Physiographic Region

The Platte River basin lies entirely within the Dissected Till Plains of the Central Lowlands physiographic province of Missouri (Fenneman 1938). This area is part of the Glaciated Plains Natural Division (Thom and Wilson 1980) (Figure nd). The upland areas range from rolling hills to nearly flat areas. Numerous draws and gullies ensure thorough drainage, but the rate of soil erosion is often high. Upland areas in this region are generally in cultivation. The bottom land areas are usually quite flat and are in cultivation. Flood plains in these areas range from 0.5 to 1.5 miles in width, and due to their flatness, the entire floodplain is frequently inundated.

Geology and Soils

Pennsylvanian age bedrock underlies the Platte River basin. Bedrock within the basin consists primarily of shale beds, limestone, and sandstone (MDNR 1995) (Figure ge). In general, progressively older formations are exposed from west to east within the Platte River basin.

The overlying soils within the basin (i.e., glacial till and loess) share their origin from the Pleistocene. Four major ice advances occurred during this time and had profound effects on northwestern Missouri. The first glacial advance, known as the Nebraskan, occurred 1.7 to three million years ago, and it leveled the topography of northern Missouri. Two hundred and fifty thousand years after the retreat of this glacier the final continental glaciation, the Kansan, covered earlier deposits with till as it retreated and further leveled the landscape. The last two ice advances, the Illinoisan and Wisconsinian had no direct physical presence in northwestern Missouri, but a thick layer of windblown silt, called loess, from these two glaciers was added to the deposits of glacial till already present. The ice advances of the Pleistocene were the major factors that deposited and leveled the highly erodible soils that are present in the basin today (Committee on Public Works, 1965). The low gradient, turbid prairie streams that characterize the Platte River basin developed after the last glacier retreated.

Watershed Area

The Platte River basin covers 2,419 square miles (USDA-SCS 1982), of which, 786 square miles (32.5%) are in Iowa and 1,633 square miles (67.5%) are in Missouri. The basin has a long and narrow shape, draining north to south. The basin is about 124 miles long, with a mean width of about 19 miles. The Platte River basin is bordered by the Grand River basin on the eastern side, the Nodaway River basin on the northwestern side, and various minor tributaries of the Missouri River on the southwestern border.

Channel Gradient

Gradient information for fourth order and larger streams within the Platte River basin was obtained from U.S. Geological Survey (USGS) 7.5 minute topographic maps. Gradient plots for each of these streams are provided in Appendix A (Contact authors for Appendix A information). The Platte River is a low gradient stream, having an average slope of 3.1 feet per mile. The other large streams within the basin (orders six and seven) also have relatively low gradients, ranging from 2.7 feet per mile on the 102 River to 7.8 feet per mile on the Little Third Fork of the Platte

River (Appendix A). Smaller order streams (orders four and five) have higher variability in gradients, ranging from 5.4 feet per mile for Castile Creek to 64.8 feet per mile for Pinhook Creek (Appendix A).

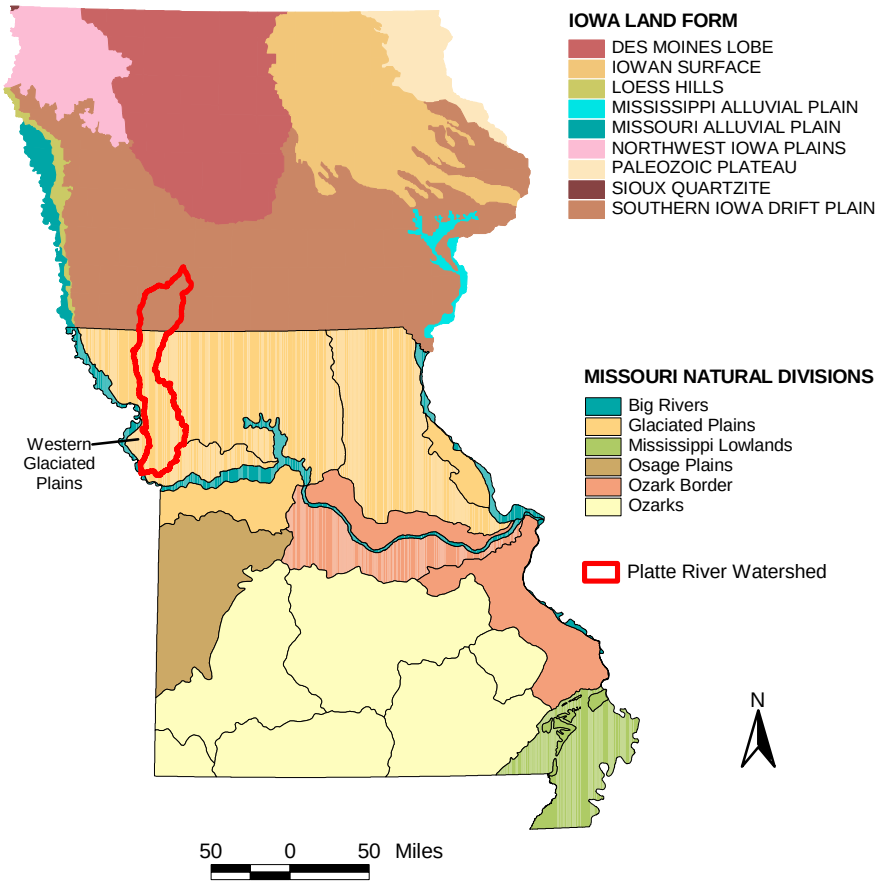

Figure nd. Location of the Platte River watershed within the natural divisions of Missouri.

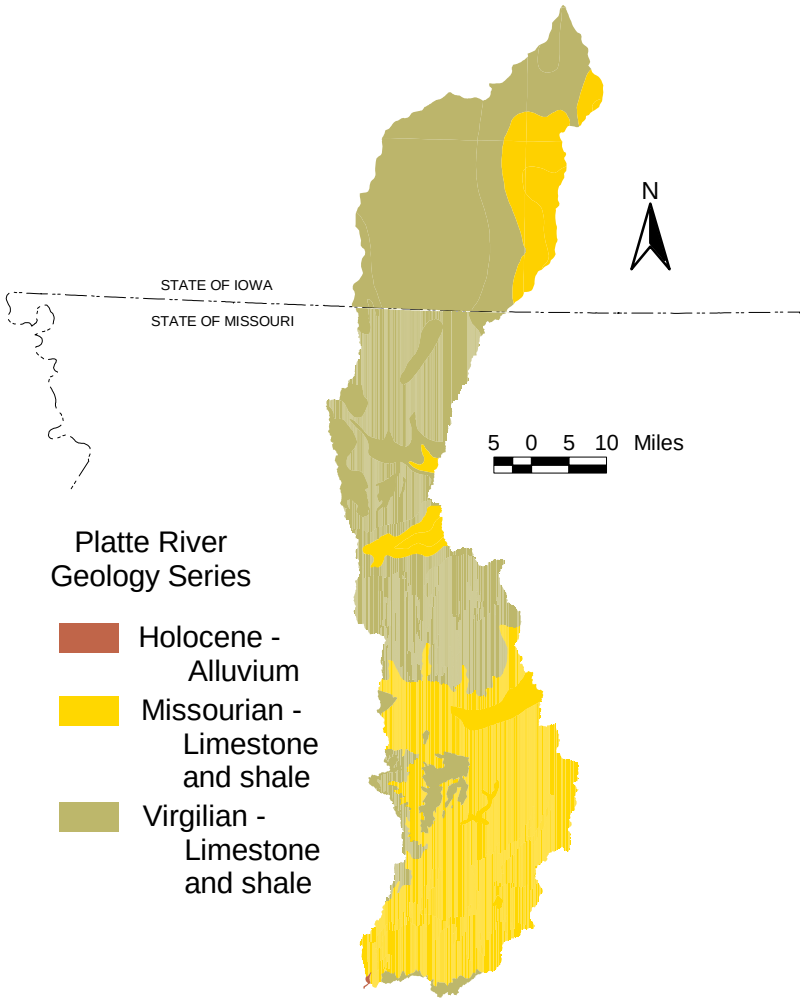

Figure ge. Geology within the Platte River watershed.

LAND USE

Historic and Recent Land Use

Prior to settlement, prairie grasses such as big and little bluestem dominated the landscape of the Platte River basin. Timber was generally confined to deep, narrow ravines or along major tributaries. Ravines or minor tributary draws opening to the east had less timber than those opening to the west. In addition, along the major south-flowing streams the woodland corridor was very narrow or absent on the west side, but was thicker on the eastern side (Schroeder 1982). This asymmetry was thought to be related to eastward moving fires that were stopped by the river channel firebreak (Clouser 1978).

Native American tribes inhabited the region prior to the 1830's and included the Sauk, Fox, Otoe, Ioway, Pottawattamie, and Sioux. Most of the Native Americans were displaced to the Kansas Territory from the Platte Territory during the 1830's when the State of Missouri acquired this portion of the state as part of the Platte Purchase of 1836. However, a few tribes in Gentry and Worth counties remained there until the early 1850's. Settlers of the region began arriving in the early 1830's, and most were from the eastern states of Kentucky, Tennessee, Georgia, Virginia, Ohio, and Indiana. Initially the soils in the woodland areas along the tributaries were cultivated because newcomers to the region did not believe that land supporting only grass had any value other than for grazing (Kramer 1993). However, settlers soon found that the deep, dark-colored prairie soils produced superior crops, and intensive breaking of the prairie sod began and did not cease until nearly all of the land was converted to agricultural production (Brown 1968). Corn was the primary crop, but wheat, oats, tobacco, hemp, flax, cotton, fruit trees, cattle, and hogs were also grown in the region (Kramer 1993).

The first railroads, built in the 1870's, increased the momentum of the agricultural movement by providing easy access to plows, reapers, and fencing. This enabled settlers to aggressively convert native prairie to cropland. Drainage of bottom lands also occurred during this time period. This opened up large new areas for settlement. The population of northwest Missouri peaked in the early 1900's after which the population began to decline, a trend within the region that continues to this day. Only the lower portion of the basin in Platte County is experiencing any population growth. This area will likely continue to grow at an accelerated rate as the suburbs of Kansas City continue to expand northward.

Current land use within the basin continues to be dominated by row crop production (Table 1 , Figure lu). In 1992, about 56% of land within the basin was in row crop production. Pasture and forest areas accounted for 29% and 8%, respectively, of the land use within the Platte River basin. However, there were differences in land use patterns between the states of Iowa and Missouri within the basin (Table 1). Almost 70% of the Platte River basin in Iowa was in row crop production, compared to only 50% in the Missouri portion of the basin. Forest and grassland areas accounted for 4% and 20%, respectively, of land use in the Iowa portion of the basin, while 9% and 32%, respectively, of the land use in Missouri were attributed to these two habitat types.

Soil Conservation Projects

Missouri has about 56,000 acres (3.6%) of the Platte River basin within Watershed Protection and Flood Prevention Act (PL 83-566) watershed projects (USDA-SCS 1993). Two watershed projects have been completed under PL 83-566 (Table 2). The Platte River Tributaries Watershed Project was completed in 1967, and it included 11 grade stabilization structures and 1.6 miles of channelization on small tributary streams. The 102 River Tributaries Watershed Project was completed in 1977, and it included 10 grade stabilization structures, 18 land treatment stabilization structures and one multipurpose dam. The Mozingo Creek Watershed Project designed to provide watershed protection, flood prevention, municipal water, and recreation, was completed in 1996. Mozingo Lake (1,000 surface acres), completed in 1994, is at full pool with three stabilization structures scheduled for construction above the lake and the fourth planned project canceled (Ross Braun NRCS personal communication). Three remaining watershed projects that were planned under PL 83-566 within the basin are currently inactive, including Little Third Fork Platte River, East 102 River, and Lower 102 River.

Special Area Land Treatment (SALT) and EARTH projects are state-funded programs administered by local Soil and Water Conservation Districts. These projects are designed to reduce soil erosion within each Conservation District by taking a watershed approach. There are currently six SALT projects and one EARTH project planned within the Platte River basin (Table 3) , however , none were completed as of February 1996.

Public Areas

The Missouri Department of Conservation (MDC) manages 6,946 acres of land within the Platte River basin (Table 4)(Figure mo). Lan d managed by MDC within the basin includes both pastured and forested areas, as well as land that is in row crop production. Opportunities exist for both consumptive and non-consumptive recreational activities on public lands owned by MDC.

There are 22 stream access or frontage sites in the Missouri portion of the Platte River basin (Figure mo), and boat ramps are provided at five of these areas (Table 4). McPherson (1994) identified seven additional significant stream resource areas (four access sites and three frontage sites) within the basin that were potential areas to be acquired by MDC (Table 5) . These sites would not only provide additional wade and bank fishing opportunity but would preserve high quality or remnant habitat and quality natural features. An additional stream access site on the Platte River in Buchanan County was identified as a high priority for acquisition by MDC in northwest Missouri (Table 5; see Kerns memorandum dated 6-27-96).

There are several other public areas within the Missouri portion of the watershed that are not owned by MDC (Figure ot). Two public ponds are located in the town of Savannah (Andrew County), and they total 2.5 acres. Four public ponds are located on the campus of Missouri Western State College in St. Joseph (Buchanan County) that total 4.0 acres. The city of Maryville (Nodaway County) owns 3,325 acres of public land, and included in this total is the recently (1994) impounded 1,000-acre Mozingo Creek Lake. Smithville Lake is a 7,190 acre U.S. Army, Corps of Engineers (USCOE) impoundment located in Clinton and Clay counties, Missouri. Construction of the dam at Smithville Lake was completed in 1977 and the reservoir began filling in October 1979. The reservoir impounded 18 miles of the Little Platte River valley. There

are 12,519 acres of public land that surround Smithville Lake that provide various recreational activities. This land is owned by the USCOE, and portions are managed by Clay County Department of Parks, Recreation, and Historic Sites, city of Plattsburg, and MDC.

There are 11 public areas within the Iowa portion of the Platte River basin (Table 6; Figure ia). These areas contain a variety of habitat types including wetlands, grasslands, timber, and row crops. These 11 areas total 2,755 acres. There are 10 impoundments on these 11 public areas that total 1,042 surface acres of water (includes Mitchell Marsh, a 50-acre marsh located within the Iowa portion of the basin).

Corps of Engineers 404 Jurisdiction

The Missouri portion of the Platte River basin is under the jurisdiction of the Kansas City District of the USCOE. The Iowa portion of the basin is administered by the Rock Island District of the USCOE. Applications for 404 permits should be addressed to the following offices:

In Missouri:

US Army Corps of Engineers
700 Federal Building
Kansas City, MO 64106-2896
Attention: MRKOD-P
phone: (816) 426-5357

In Iowa:

US Army Corps of Engineers
Clock Tower Building
Rock Island, IL 61201-2004
Attention: NCROD-S
phone: (309) 788-6361 ext. 6370

Table 1. Land use within the Platte River basin for Iowa, Missouri and the entire basin during 1992. Land use is expressed as acres and percentage of land use in parenthesis.

Land Use	Iowa	Missouri	Total
Cultivation	271,100 (68.8%)	469,100 (46.1%)	740,200 (55.7%)
Forest	16,500 (4.2%)	89,000 (8.7%)	105,500 (7.9%)
Pasture	78,800 (20.0%)	300,500 (29.5%)	379,300 (28.5%)
Federal (USCOE)	0 (0.0%)	15,600 (1.5%)	15,600 (1.2%)
Rural Transportation	11,700 (3.0%)	20,000 (2.0%)	31,700 (2.4%)
Urban	7,500 (1.9%)	27,000 (2.7%)	34,500 (2.6%)
Stream	8,200 (2.1%)	14,900 (1.5%)	23,100 (1.7%)

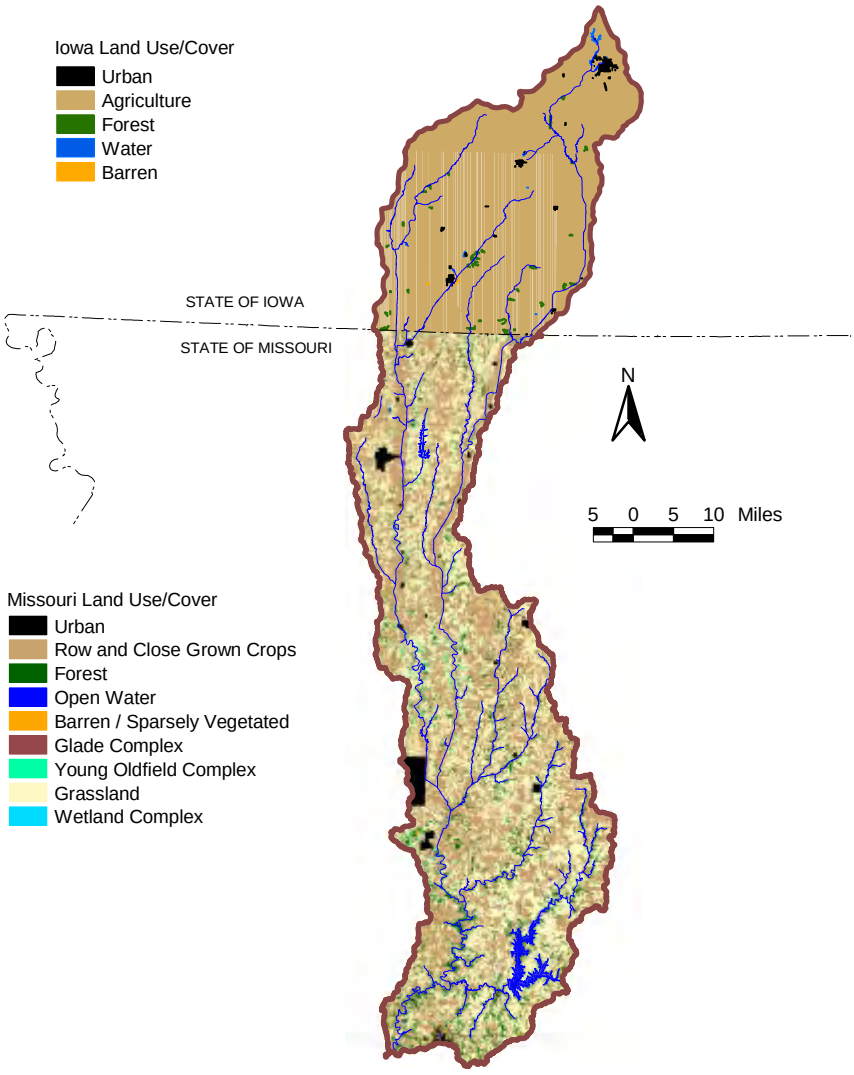

Figure lu. Land use within the Platte River basin in Iowa and Missouri (MORAP 1999 preliminary data).

Table 2. Information on PL-566 watershed projects in the Platte River basin (USDA-SCS 1993).

Watershed	County	Acres	Project Purpose	Status
Platte River Tributaries	Worth, MO	12,800	Watershed Protection Flood Prevention	Completed 1967
102 River Tributaries	Nodaway, MO	19,301	Watershed Protection Flood Prevention Recreation	Completed 1977
Mozingo Creek	Nodaway, MO	23,988	Watershed Protection Flood Prevention Municipal Water Recreation	Completed 1996
Little Third Fork Platte River	DeKalb, MO Gentry, MO	41,600		Inactive
East 102 River	Nodaway, MO Taylor, IA	110,305		Inactive
Lower 102 River	Nodaway, MO	27,523		Inactive

Table 3. Status of Special Area Land Treatment (SALT) and EARTH projects within the Platte River basin as of June 1996.

District	Project	Watershed Acres	Treated Acres	Completion Date	Type
Andrew	Agee Creek	6,071	698	1998	SALT
Andrew	Long Branch	4,864	515	1998	SALT
Clinton	McGuire Branch	12,160	3,610	1996	SALT
Clinton	Horse Fork	9,600	2,513	1996	SALT
Clinton / DeKalb	Little Platte	14,992	2,448	1997	SALT
Platte	Jowler Creek	4,142	1,938	1996	SALT
DeKalb	Third Fork	40,414	3,716	1999	EARTH

Table 4. Public areas within the Missouri portion of the Platte River basin owned by MDC.

Area Name	County	Total Acres	Impoundment Acres	Stream Access
Agency Access	Buchanan	1	0	Access to Platte R.
Agency C.A.	Buchanan	94	0	Frontage on Platte R.
Belcher Branch Lake C.A.	Buchanan	405	55	None
Bridgewater Access	Nodaway	14	0	Frontage on 102 R.
Bristle Ridge Access	Nodaway	1	0	Access to Platte R.
Burton Bridge Access	Buchanan	16	0	Frontage on Platte R.
Christie Memorial C.A.	Andrew	174	3	None
Elrod Mill Access	Andrew	57	0	Frontage on Platte R.
Davis Memorial C.A.	Andrew	30	0	None
Hadorn Bridge Access	Andrew	93	0	Frontage on 102 R.
Happy Holler Lake C.A.	Andrew	2,207	67	Frontage on 102 R.
Humphrey Access	Platte	12	0	Frontage on Platte R.
Keever Bridge Access	Nodaway	6	0	Frontage on Platte R.
Kendzora C.A.	Platte/ Buchanan	772	35	Frontage on Platte R.
Lathrop Bridge Access	Clinton	25	0	Frontage & ramp on L. Platte R.
Limpp Comm. Lake	Gentry	70	29	None
Midway Access	Andrew	1	0	Access to 102 R.
Nodaway Co. Comm. Lake	Nodaway	237	73	None
Pigeon Hill C.A.	Buchanan	336	0	None
Platte Falls C.A.	Platte	2,333	3	Frontage & ramps (2) on Platte R.
Ringgold Access	Platte	22	0	Frontage on Platte R.
Rochester Falls Access	Andrew	14	0	Frontage on Platte R.

Rock Quarry Access	**Andrew**	**9**	**0**	**Frontage & ramp on 102 R.**
Saxton Access	**Buchanan**	**5**	**0**	**Frontage on Platte R.**
Schimmel City Access	**Platte**	**11**	**0**	**Frontage & ramp on Platte R.**
Sharps Station Access	**Platte**	**10**	**0**	**Frontage & ramp on Platte R.**
Sheridan Access	**Worth**	**1**	**0**	**Access to Platte R.**
Union Mill Access	**Platte**	**2**	**0**	**Access to Platte R.**

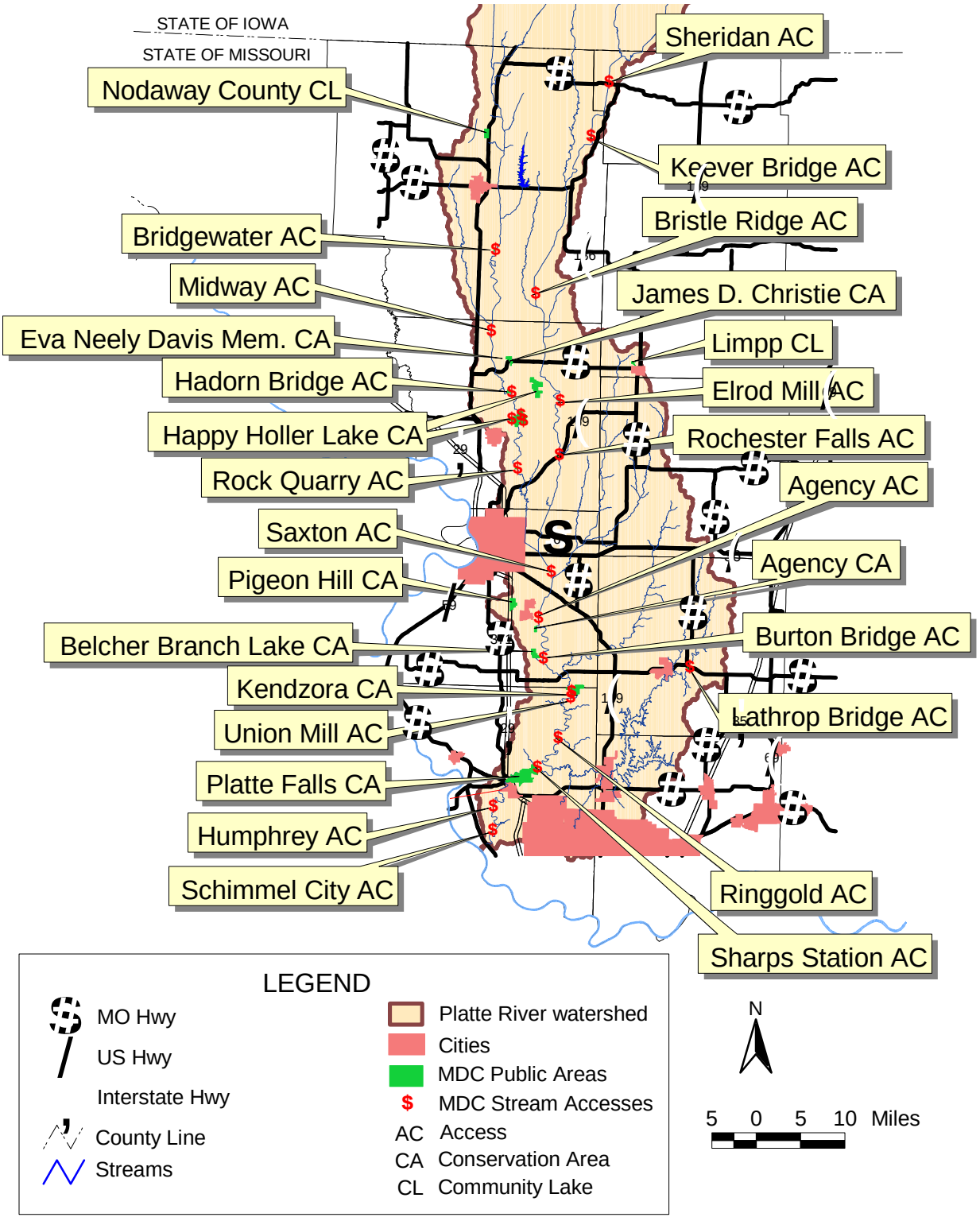

Figure mo. Public area in Missouri within the Platte River watershed and owned by the Missouri Department of Conservation.

Table 5. Potential stream acquisition areas within the Missouri portion of the Platte River basin (McPherson 1994; Kerns memorandum June 27, 1996).

County	Stream	Location (T,R,S)	Priority	Area Type
Buchanan	Platte R.	57N,34W,S4	Moderate	Access
Buchanan	Platte R.	56N,34W,S3,S10	High	Access
Buchanan	Platte R. / 102 R.	57N,34W,S21	High	Frontage
Buchanan	Castile Cr.	55N,33W,S16 55N,34W,S25	High	Frontage
Nodaway	Platte R.	64N,34W,S36	Moderate	Access
Nodaway	102 R.	64N,35W,S15	High	Access
Nodaway	Honey Cr.	65N,34W,S12 64N,34W,S14	High	Frontage

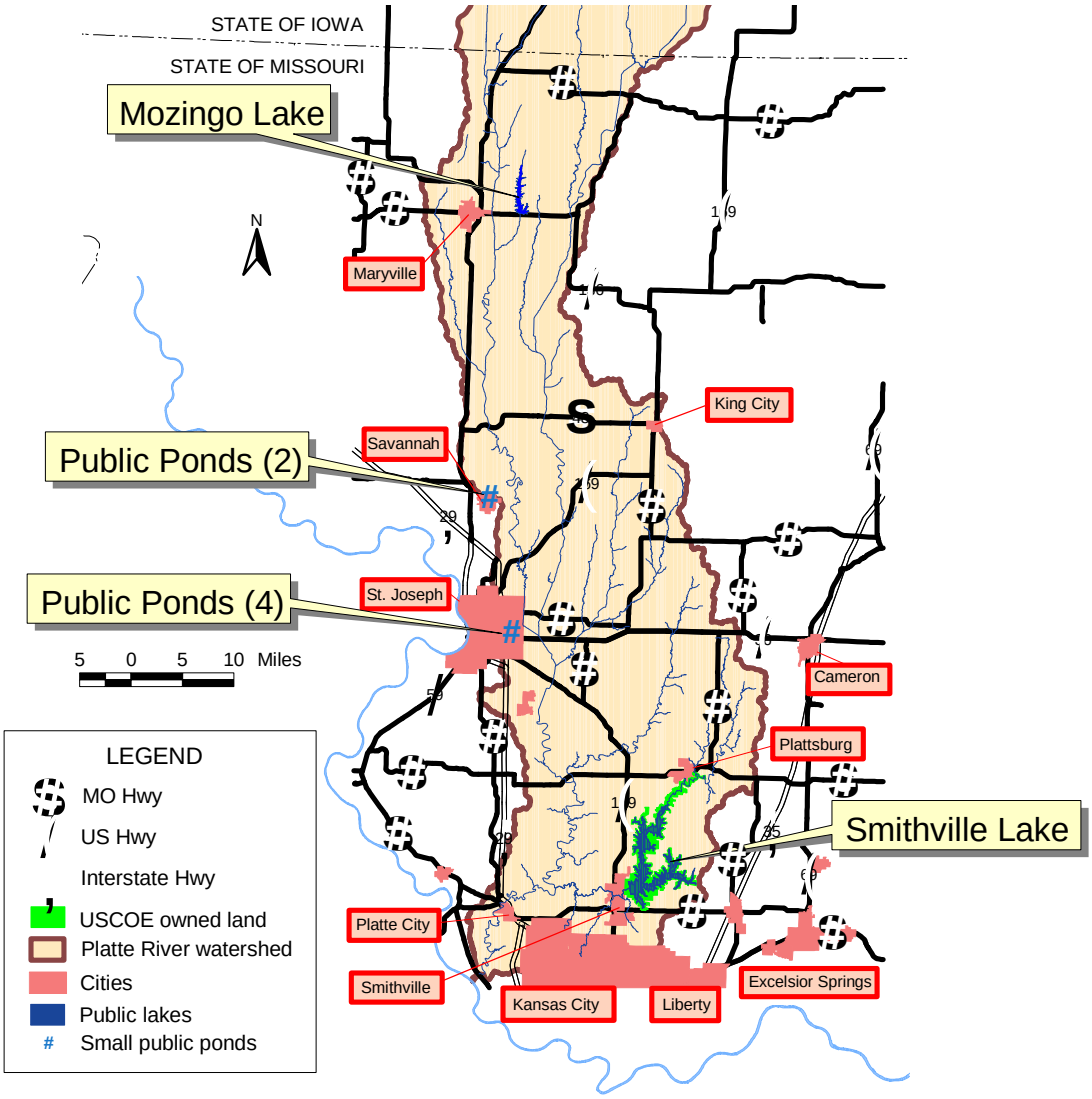

Figure ot. Public area in Missouri within the Platte River watershed and not owned by the Missouri Department of Conservation.

Table 6. Public areas within the Iowa portion of the Platte River basin.

Area Name	County	Total Acres	Impoundment Acres	Location (T,R,S)
Lenox Lake	Adams / Taylor	160	48	70N,32W,S5
French Wildlife Area	Taylor	80	0	68N,32W,S14
Lake of Threefires St. Park	Taylor	694	85	68N,34W,S1
Sands Timber	Taylor	235	70	68N,32W,S15
Wilson County Park	Taylor	50	24	70N,32W,S28
Windmill Lake County Park	Taylor	60	17	69N,35W,S36
Green Valley State Park	Union	1000	428	73N,31W,S23
Lake McKinley	Union	40	20	72N,31W,S11
Mitchell Marsh	Union	160	50	73N,31W,S26
Summit Lake	Union	250	220	72N,31W,S2

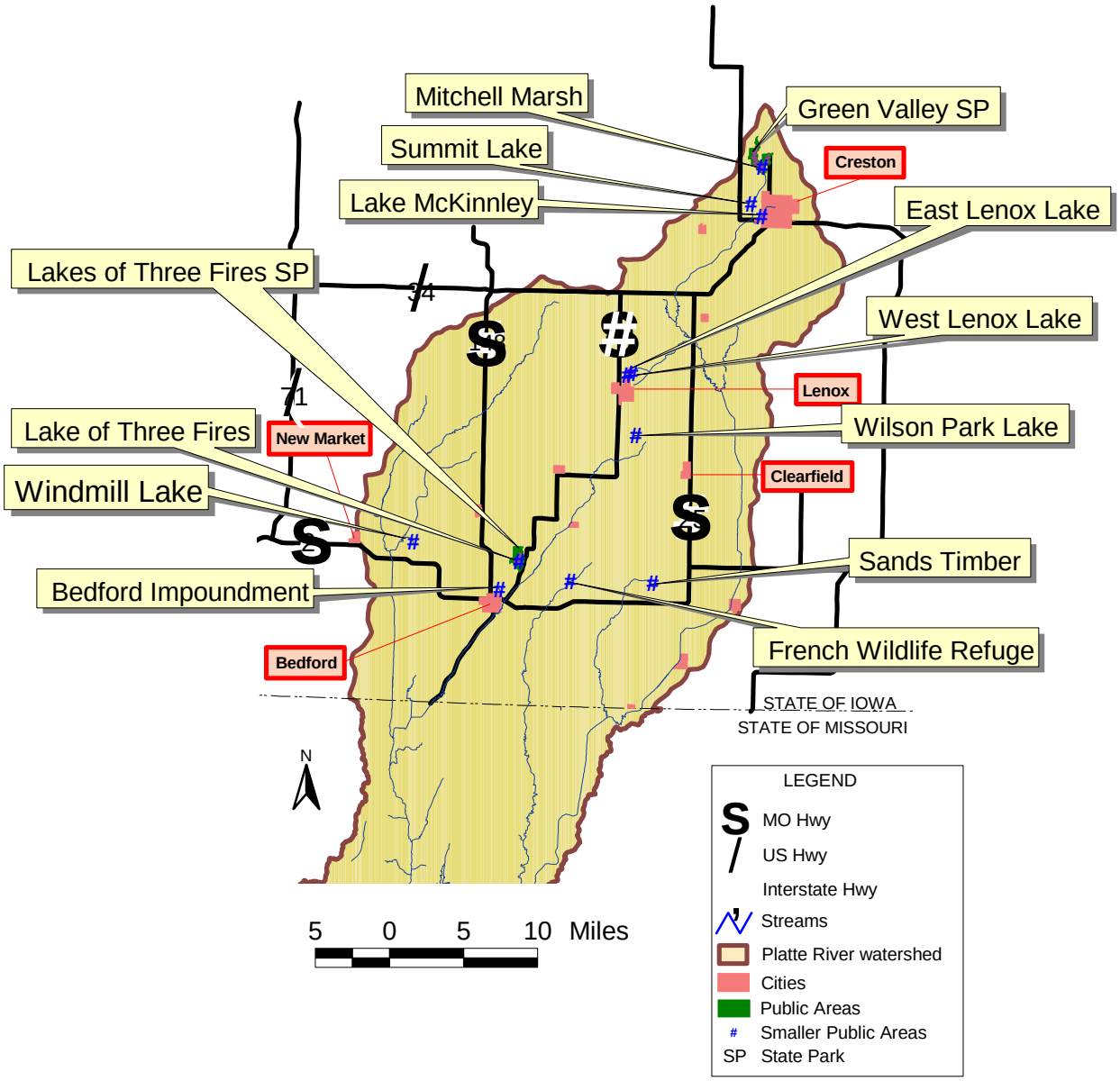

Figure ia. Public area in Iowa within the Platte River watershed.

HYDROLOGY

Precipitation

Average annual precipitation for the basin ranges from 31 inches in the northern part of the basin to 35 inches in the southern portion of the basin (USDA-SCS 1982). The greatest amount of precipitation usually occurs during June, while the least amount of precipitation generally occurs during the months of January and February (Figure 2). The basin is covered primarily in glacial till, and due to the clay content, movement of water to the subsurface is greatly diminished (Detroy and Skelton 1983). Thus, most rainfall runs off the surface rather than percolating into the soil. Streams in the basin show rapid flow increases in conjunction with rains, but quickly return to low flow conditions shortly after runoff ceases (MDNR 1995). Average annual runoff ranges from five inches in the northern portion of the basin to seven inches in the southern part of the basin (USDA-SCS 1982).

United States Geological Survey (USGS) Gage Stations

There are five active and 26 inactive USGS water gage stations throughout the Platte River basin (Appendix C). Two of the active gage stations are located on the 102 River in Iowa, near the towns of Gravity (crest station) and Bedford (Figure ga). The remaining three active stations are located in Missouri. One station is located on Little Platte River 2.4 miles below Smithville Reservoir, one is located at Smithville Reservoir in the dam, and the remaining one is located on the Platte River at Sharps Station (Figure ga). Discharges at these active gaging stations are presented in Table 7.

Permanent / Intermittent Streams

Permanency of flow in streams within the Platte River basin is best illustrated on USGS 7.5 minute topographic maps. The USGS identified perennial reaches of streams (defined as having water 12 months of the year during years of normal precipitation) on these maps with solid blue lines. Intermittent streams (defined as having water less than 12 months of the year) were indicated with broken blue lines. A listing of the 7.5 minute quadrangle maps covering each of the 435 third order and larger streams within the Platte River basin is provided in Appendix D (Figure to).

Funk (1968) classified Missouri streams as permanent if they maintained flow during drought. Intermittent streams were defined as those that maintained permanent pools when flow ceased during drought periods. Based on these criteria, Funk (1968) determined that the entire 138 miles of the Platte River in Missouri had permanent flow. In addition, the entire 70 miles of the 102 River in Missouri maintained permanent flow as well (Table 8). Information on the permanence / intermittence of flows in smaller tributaries within the basin is presented in Table 8.

Stream Flow

Average annual discharge for the Platte River at Sharps Station, which is 3.3 miles below the confluence of the Little Platte River in Platte County at river mile 25.1 (98% of the drainage basin), is 1,925 cfs (Table 7). Examination of the flow duration curve for the Platte River at

Sharps Station shows that temporal discharge variability within the basin is high (Figure 3). The highest instantaneous daily flow was 37,800 cfs recorded on July 26, 1993, while the lowest instantaneous daily flow was 12 cfs recorded on August 7, 8, 13, and 14, 1989. Stream flows within the basin are generally lowest in January, while peak flows occur during May, June, and July (Figure 4), and these flows coincide with monthly precipitation values. Low flows in the Little Platte River below Smithville Dam are maintained at 8 cfs. Hauth (1974) presented flood magnitudes at various recurrence intervals for several locations within the Platte River basin, and these are presented in Table 9 .

7-Da y Q_2 and Q_{10}Low Flows

Skelton (1976) noted that low-flow characteristics of streams vary among physiographic regions in Missouri, and that the low-flow potential of most streams in the Dissected Till Plains region is poor because of the low hydraulic conductivity of the clays and shales in the area. Skelton (1976) estimated that the 7-day Q_2 would be zero for drainage basins less than 100 miles^2. In addition, about 60% of streams with drainage basins of 100 to 200 miles^2 would have 7-day Q_2 values of zero, and the remaining streams of this size would have 7-day Q_2 values ranging from 0.1 to 1.0 cfs. Skelton (1976) also estimated that the 7-day Q_{10} would be zero for drainage basins less than 200 miles^2 in this region, with about 70% of the streams with drainage basins of 200 to 1,000 miles^2 having 7-day Q_{10}values of zero. The remaining 30% would have 7-day Q_{10} values ranging from 0.1 to 1.5 cfs. Data from the Platte River basin for seven day low-flows at two and ten year intervals were reported in Skelton (1970) and Skelton (1976), and these are presented in Table 10. The slope index (the ratio of the 7-day Q_2 to 7-day Q_{20}) for the Platte River at Agency was 73.3, and this high value indicates extremely high variability in annual low flows and poor groundwater supply. The average slope index for ten streams within the Dissected Till Plains region was 25 (Todd et al. 1994), and ranged from 8.7 in the Grand River near Gallatin to 73.3 for the Platte River. Channelization and watershed modifications were attributed to the wide range in slope index values within northern Missouri (Todd et al. 1994).

Dam and Hydropower Influences

Smithville Lake, a 7,190-acre impoundment on the Little Platte River, and Mozingo Lake, a 1,000-acre impoundment on Mozingo Creek, are the two largest impoundments within the basin. In 1984, there were 59 impoundments greater than two surface acres within the Missouri portion of the basin, and these totaled 635 acres (MDNR 1995). Although no information exists on the total number of impoundments within the Iowa portion of the basin, ten public impoundments totaling 1,042 acres were identified. Undoubtedly, the number of impoundments greater than two acres has increased dramatically throughout the basin since 1984 in association with PL 83-566, SALT, EARTH, and other erosion control projects. Concern exists on what effects these impoundments have on low flow conditions because they intercept runoff and provide little or no provisions for maintenance of stream flows. There are no hydropower facilities within the Platte River basin.

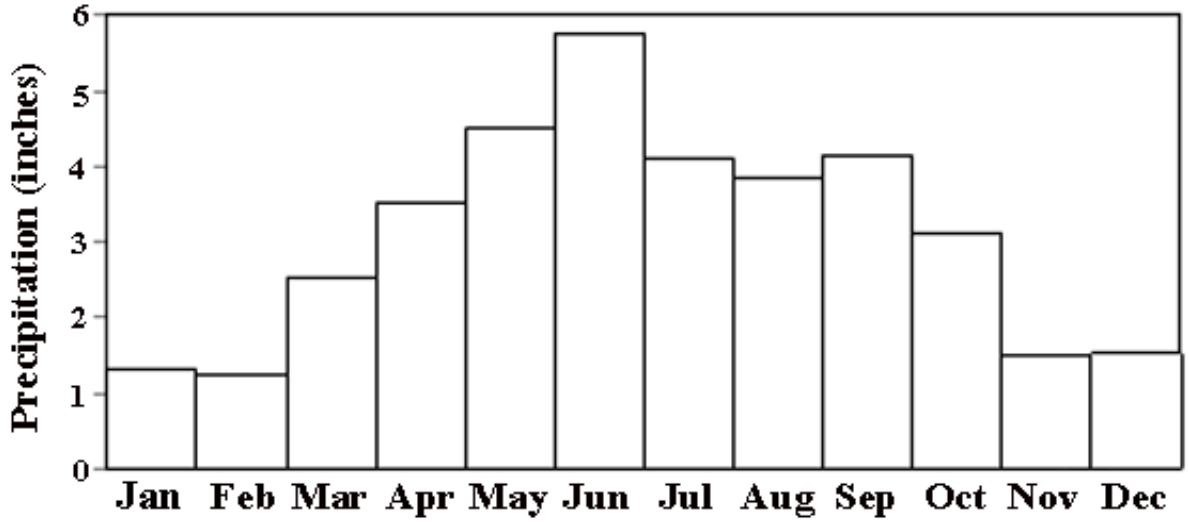

Figure 2. Average monthly precipitation for northern Missouri.

Appendix C. Listing of the active and inactive USGS water gaging stations within the Platte River basin. C = crest-stage gage; D = continuous record streamflow gage; L = low flow gage; Q = water quality station.

Station #	Station Name	Location (Latitude, Longitude)	Type	Period of Record
06818650	E. Platte R. near Knowlton, IA	40º54'00" 94º26'00"	L	Scattered 1969-1975
06818700	Platte R. near Knowlton, IA	40º52'00" 94º26'00"	L	Scattered 1969-1977
06818750	Platte R. near Diagonal, IA	40º46'02" 94º24'46"	D	1969-1971
06819180	E. Fork 102 R. near Conway, IA	40º44'00" 94º39'00"	L	Scattered 1969-1984
06819185	E. Fork 102 R. at Bedford, IA	40º39'38" 94º42'59"	D	1983-Present
06819190	E. Fork 102 R. near Bedford, IA	40º38'01" 94º44'41"	C	1959-1983
06819195	Middle Fork 102 R. near Bedford, IA	40º35'00" 94º49'00"	L	Scattered 1969-1976
06819120	W. Branch 102 R. near Gravity, IA	40º48'00" 94º49'00"	L	Scattered 1970-1976
06819100	W. Branch 102 R. near Gravity, IA	40º49'00" 94º49'00"	L	Scattered 1970-1976

06819140	W. Branch 102 R. near New Market, IA	40º44'00" 94º51'00"	L	Scattered 1969-1976
06819150	W. Branch 102 R. near New Market, IA	40º43'00" 94º51'00"	L	Scattered 1969-1975
06819110	W. Branch 102 R. near Gravity, IA	40º49'31" 94º44'36"	C	1966-Present
06818900	Platte R. at Ravenwood, MO	40º24'42" 94º41'09"	C	Scattered 1921-1932; 1958-1971
06819010	Long Branch near Guilford, MO			Scattered 1940-1960's
06819020	Platte R. at Whitesville, MO	40º03'41" 94º43'37"	L	1963-1970
06819090	Platte R. near St. Joseph, MO	39º46'40" 94º43'24"	L	1962-1965; 1967; 1972
06919500	102 R. near Maryville, MO	40º23'15" 94º49'35"	D	1932-1990
06820000	White Cloud Creek near Maryville, MO	40º23'22" 94º54'33"	D	1948-1970
06820400	White Cloud Creek near Barnard, MO			Scattered 1940-1960's
06920420	102 R. at Rosendale, MO	40º02'44" 94º49'41"	L	1963-1965; 1967; 1969-1970
06820460	102 R. at Avenue City, MO	39º51'29" 94º46'07"	L	1942-1972
06920480	102 R. near St. Joseph, MO	39º47'00" 94º45'55"	L	1962-1965; 1967; 1971

06820490	**Third Fork Platte R. near Easton, MO**	**39º46'10" 94º38'10"**	**L**	**1971-1972**
06920500	**Platte R. near Agency, MO**	**39º41'20" 94º42'15"**	**D**	**1924-1987**
06920900	**Castile Creek near Gower, MO**	**39º35'40" 94º34'30"**	**L**	**Scattered 1940-1960's**
06821000	**Jenkins Branch at Gower, MO**	**39º37'29" 94º36'01"**	**D**	**1950-1976**
06821050	**Castile Creek near Edgerton, MO**	**39º33'25" 94º40'00"**	**L**	**1962-1965; 1967**
06821190	**Platte R. at Sharps Station, MO**	**39º24'03" 94º43'36"**	**D, Q**	**1978-Present**
06821200	**Platte R. at Platte City, MO**	**39º22'09" 94º47'10"**	**L**	**1962-1975**
06821140	**Smithville Reservoir near Smithville, MO**	**39º23'50" 94º33'25"**	**C**	**1981-Present**
06821150	**Little Platte R. at Smithville, MO**	**39º23'17" 94º34'44"**	**D**	**Scattered 1940-1960's; 1966-Present**

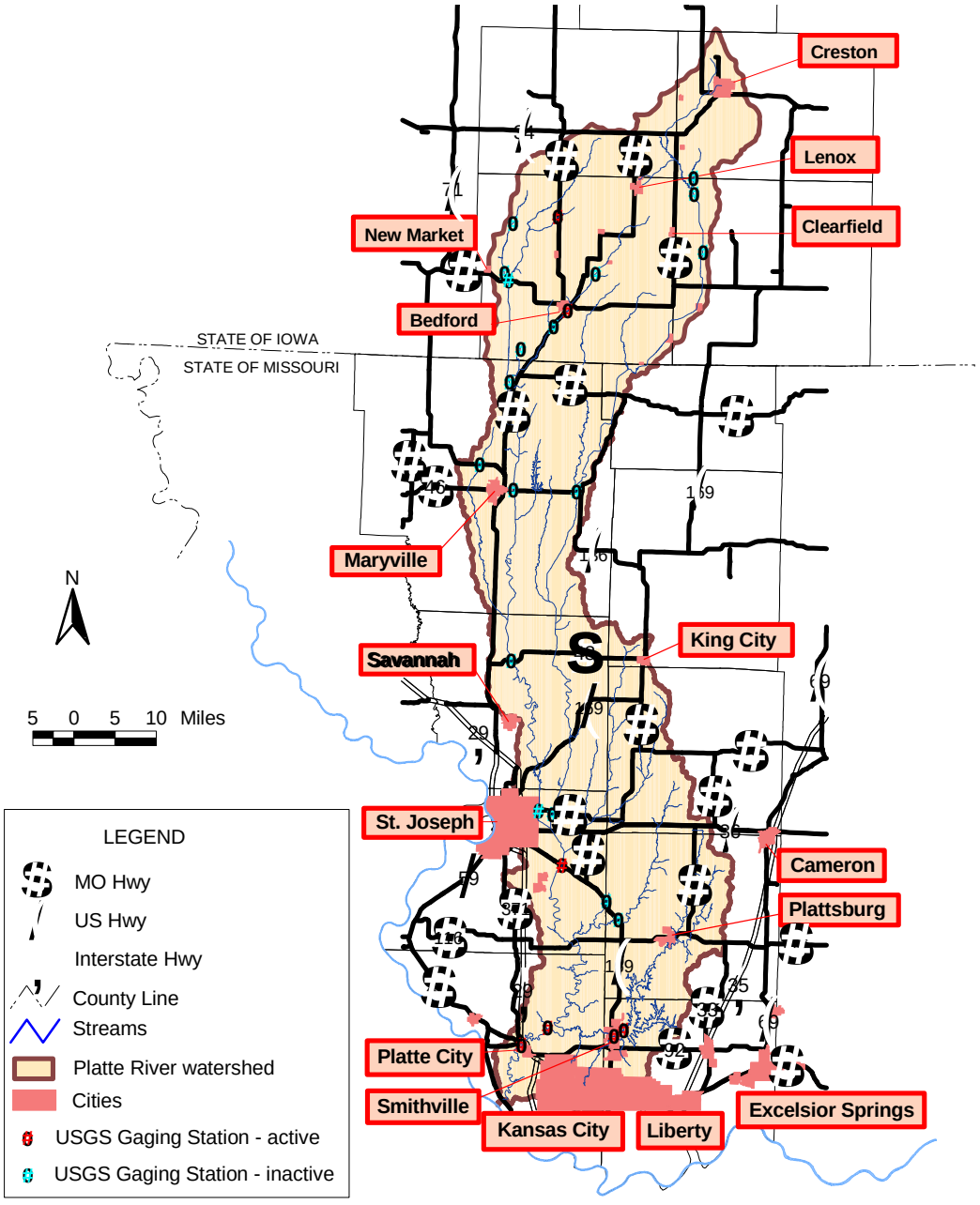

Figure ga. Active and inactive gage stations within the Platte River basin.

Table 7. Discharge information (cfs) for active USGS gage sites within the Platte River basin for the total period of record (USGS 1995; USGS 1996).

Location	Annual Mean	Highest Annual Mean	Lowest Annual Mean	10% Exceed	50% Exceed	90% Exceed
East Fork 102 R., Bedford, IA	64.1	200.0	12.0	99.0	8.3	0.5
Platte R., Agency, MO	980.0	4108.0	67.4	2080.0	190.0	22.0
Little Platte R., Smithville, MO	179.0	476.0	35.4	560.0	22.0	8.4
Platte R., Sharps Station, MO	1925.0	5697.0	464.0	4650.0	667.0	70.0

Appendix D.Table a. Stream information for third order and larger streams from the Platte River basin (Information source: 7.5 minute series, 1:24000 scale, USGS topographic maps). Original length and miles channelized for all streams fourth order and larger were estimated using 7.5 minute series, 1:24000 scale, USGS orthophoto quadrangle maps.

Stream Name	Max. Order	Location at Mouth T R S	Map Numbers[1]	Recieving Stream	Original Length (Mi.)	Current Length (Mi.)	Miles Channel-ized
Platte River	8	51-35-04	R9,Q9,Q10,P10,O10,N10,M10, L10,K9,K10, J10,I10,I11, H11,H12,G12, F12,E12,D12, C12	Missouri River	281.1	195.5	89.9
Prairie Creek	4	52-35-23	R9,R10	Platte River	8.4	8.1	0.4
Sand Branch	3	52-35-23	R9,R10	Prairie Creek		4.2	
Fox Creek	3	52-35-13	R9,R10	Prairie Creek		3.0	
Lanter Branch	3	52-35-15	R9	Platte River		2.0	
Unnamed #001	3	53-35-25	Q9	Platte River		2.4	
Murray Branch	3	53-35-24	Q9	Platte River		2.8	
Clear Branch	3	53-34-29	Q10,R10	Platte River		3.5	
Jowler Creek	4	53-34-16	Q10,Q9,P9	Platte River		10.5	
Unnamed #002	3	53-34-06	Q9	Jowler Creek		2.9	
Little Platte River	6	53-34-14	Q10,Q11,P11, P12,O12,O13, N12	Platte River	67.6	66.4	2.7
Todd Creek	4	53-33-19	Q10,R10	Little Platte River	12.3	11.9	1.0
Wildcat Branch	3	52-34-01	R10	Todd Creek		4.3	
Unnamed #003	3	53-33-20	Q11,Q10	Little Platte River		2.8	
Owens Branch	3	53-33-22	Q11	Little Platte River		4.5	
Second Creek	4	53-33-22	Q11,R11,R10	Little Platte River		15.8	
First Creek	3	53-33-27	R11	Second Creek		10.3	
Unnamed #004	3	52-33-19	R10	Second Creek		3.9	
Wilkerson Creek	4	53-33-23	Q11,R11	Little Platte River	11.4	9.4	1.0
Rocky Branch	3	53-33-36	R11	Wilkerson Creek		7.1	
Polecat Creek	3	52-32-07	R11,R12	Wilkerson Creek		2.7	
Unnamed #005	3	53-33-24	Q11	Little Platte River		1.6	
Crows Creek	4	53-33-24	Q11,R11	Little Platte River		5.7	
Mitchell Branch #1	3	53-32-30	Q11,R11	Crows Creek		3.0	
Camp Branch	5	53-32-18	Q11,Q12	Little Platte River		12.7	
Owl Creek	4	53-32-10	Q12,P12	Camp Branch		10.8	
Unnamed #006	3	54-32-34	Q12,Q11	Owl Creek		1.8	
Holtzclaw Creek	3	53-32-11	Q12,R12	Camp Branch		4.9	
Unnamed #007	3	53-32-01	Q12	Camp Branch		5.7	
Duncan Branch	3	53-32-07	Q11	Little Platte River		2.4	
Rock Branch	3	54-32-30	Q11	Little Platte River		2.7	
Linn Branch	4	54-32-19	Q11,P11	Little Platte River		8.6	
Roberts Branch	3	54-32-18	Q11,P11,P12	Linn Branch		13.2	
Unnamed #008	3	54-33-13	Q11	Linn Branch		2.2	
Unnamed #009	3	54-32-09	P12	Little Platte River		2.9	
Unnamed #010	3	54-32-09	P12,Q12	Little Platte River		2.3	
Unnamed #011	3	54-32-03	P12	Little Platte River		2.6	
Unnamed #012	3	54-32-03	P12	Little Platte River		2.2	
Unnamed #013	3	54-32-03	P12	Little Platte River		3.6	
Unnamed #014	3	55-32-34	P12	Little Platte River		2.5	
Unnamed #015	3	55-32-35	P12	Little Platte River		3.3	
Funkhouser Creek	4	55-32-26	P12	Little Platte River		3.9	
Unnamed #016	3	55-32-26	P12	Funkhouser Creek		2.3	
Unnamed #017	3	55-32-25	P12	Little Platte River		1.7	

Stream Name	Max. Order	Location at Mouth T R S	Map Numbers[1]	Recieving Stream	Original Length (Mi.)	Current Length (Mi.)	Miles Channel-ized
Horse Fork	5	55-32-24	P12,O12	Little Platte River		12.0	
Reservoir Branch	4	55-32-13	P12	Horse Fork		3.5	
Unnamed #018	3	55-32-14	P12	Reservoir Branch		2.0	
Unnamed #019	3	55-31-18	P12	Horse Fork		0.8	
Unnamed #020	4	55-31-07	P12	Horse Fork		3.0	
Unnamed #021	3	55-32-01	P12	Unnamed #020		1.0	
Unnamed #022	3	56-31-30	O12	Horse Fork		1.9	
Unnamed #023	4	56-31-30	O12	Horse Fork		2.3	
Unnamed #024	3	56-32-24	O12	Unnamed #023		2.1	
Unnamed #025	5	55-31-30	P12	Little Platte River		4.9	
Unnamed #026	4	55-31-30	P12	Unnamed #025		3.6	
Unnamed #027	3	54-31-06	P12	Unnamed #025		1.0	
Unnamed #028	3	55-31-32	P12	Unnamed #026		2.2	
Unnamed #029	3	55-31-30	P12	Little Platte River		1.0	
Unnamed #030	3	55-31-20	P12	Little Platte River		2.0	
Grindstone Creek	3	55-31-17	P12,P13	Little Platte River		6.8	
Unnamed #031	3	55-31-08	P12	Little Platte River		1.3	
Unnamed #032	3	55-31-09	P12	Little Platte River		1.2	
Unnamed #033	5	55-31-04	P12,P13,O13	Little Platte River		9.0	
Unnamed #034	4	55-31-09	P12,P13	Unnamed #033		3.8	
Unnamed #035	3	55-31-10	P13	Unnamed #034		1.7	
Unnamed #036	4	55-31-03	P13	Unnamed #033		2.4	
Unnamed #037	3	55-31-02	P13	Unnamed #036		1.1	
Unnamed #038	3	55-31-02	P13	Unnamed #036		0.7	
Unnamed #039	3	56-31-34	O13	Unnamed #033		3.7	
Unnamed #040	3	55-31-04	P12	Little Platte River		1.9	
Unnamed #041	3	56-31-33	O12	Little Platte River		1.4	
Smith Fork	5	56-31-27	O13	Little Platte River	8.5	8.3	0.8
Unnamed #042	3	56-31-15	O13	Smith Fork		1.1	
Unnamed #043	4	56-31-11	O13	Smith Fork		3.2	
Unnamed #044	3	56-31-12	O13	Unnamed #043		1.0	
Unnamed #045	3	56-31-12	O13	Unnamed #043		0.7	
Unnamed #046	3	56-31-10	O13	Smith Fork		1.2	
Unnamed #047	3	56-31-02	O13	Smith Fork		2.8	
Unnamed #048	3	56-31-21	O12	Little Platte River		1.7	
Unnamed #049	4	56-31-16	O12	Little Platte River	3.5	3.7	0.2
Unnamed #050	3	56-31-08	O12	Unnamed #049		1.6	
Unnamed #051	3	56-31-05	O12	Little Platte River		1.9	
Unnamed #052	3	57-31-32	O12	Little Platte River		3.0	
Unnamed #053	3	57-31-33	O12	Little Platte River		2.7	
Unnamed #054	3	57-31-21	O12	Little Platte River		1.4	
Unnamed #055	3	57-31-21	O12,O13	Little Platte River		1.5	
Unnamed #056	3	57-31-16	N12,N13	Little Platte River		1.3	
Unnamed #057	4	57-31-16	N12	Little Platte River		3.5	
Unnamed #058	3	57-31-17	N12,O12	Unnamed #057		2.0	
Alger Creek	3	53-34-15	Q10	Platte River		5.9	
Unnamed #059	3	53-34-02	Q10	Platte River		2.6	
Dicks Creek	4	54-34-35	Q10,Q11	Platte River	13.0	12.4	0.4
Unnamed #060	3	54-33-33	Q11	Dicks Creek		2.3	
Bell Creek	3	54-34-24	Q10	Platte River		4.0	
Grove Creek	4	54-34-13	Q10,P10,P11	Platte River	7.2	6.9	0.5
Unnamed #061	3	54-33-09	P11	Grove Creek		3.4	
Holland Branch	4	54-34-11	P10	Platte River		5.8	
Chestnut Branch	3	54-34-10	P10	Holland Branch		4.1	
Mitchell Branch #2	3	54-33-06	P10,P11	Platte River		3.6	
Castile Creek	5	55-34-25	P10,P11,O11, O12,N12,M12	Platte River	48.4	45.3	3.6
Malden Creek	4	55-34-24	P10,O10,O11	Castile Creek	17.3	15.7	1.1

Stream Name	Max. Order	Location at Mouth T R S	Map Numbers[1]	Recieving Stream	Original Length (Mi.)	Current Length (Mi.)	Miles Channel-ized
Crabapple Branch	3	55-33-07	P10	Malden Creek		3.0	
Jenkins Branch	3	55-33-17	P10,P11,O11	Castile Creek		6.4	
Unnamed #062	3	55-33-16	P11	Castile Creek		4.4	
Unnamed #063	3	55-33-10	P11	Castile Creek		4.2	
Unnamed #064	3	55-33-02	P11,O11	Castile Creek		3.2	
Unnamed #065	3	55-33-12	P11	Castile Creek		3.7	
Unnamed #066	3	55-33-01	P11	Castile Creek		3.2	
Unnamed #067	3	56-32-32	P11	Castile Creek		2.7	
Unnamed #068	4	56-32-29	O11,O12,P12	Castile Creek	4.9	4.3	0.5
Unnamed #069	3	56-32-28	O11,P11,P12	Unnamed #068		1.9	
Unnamed #070	3	56-32-28	O11,O12	Unnamed #068		0.9	
McGuire Branch	3	56-32-29	O11	Castile Creek		9.9	
Unnamed #071	4	56-32-29	O11,O12	Castile Creek		5.2	
Unnamde #072	3	56-32-22	O12	Unnamed #071		2.3	
Unnamed #073	3	56-32-21	O11,O12	Castile Creek		2.1	
Unnamed #074	3	56-32-09	O11,O12	Castile Creek		2.2	
Unnamed #075	4	56-32-09	O12	Castile Creek	4.5	4.2	0.4
Unnamed #076	3	56-32-10	O12	Unnamed #075		3.0	
Unnamed #077	3	56-32-14	O12	Unnamed #075		1.4	
Unnamed #078	4	56-32-04	O12	Castile Creek	6.9	6.1	0.8
Unnamed #079	3	56-32-02	O12	Unnamed #078		3.4	
Unnamed #080	3	57-32-34	O12	Castile Creek		1.3	
Unnamed #081	3	57-32-34	O12,O11	Castile Creek		1.9	
Unnamed #082	3	57-32-27	O12	Castile Creek		4.3	
Unnamed #083	3	57-32-22	O12,N12	Castile Creek		2.2	
Unnamed #084	3	57-32-22	O11,O12,N11	Castile Creek		3.2	
Unnamed #085	4	57-32-15	N12,N11	Castile Creek	4.2	3.8	0.4
Unnamed #086	3	57-32-09	N11	Unnamed #085		1.5	
Unnamed #087	3	57-32-09	N11	Unnamed #085		1.7	
Unnamed #088	3	57-32-15	N12	Castile Creek		2.6	
Unnamed #089	3	57-32-03	N12	Castile Creek		0.6	
Unnamed #090	4	57-32-02	N12	Castile Creek	5.2	4.8	0.4
Unnamed #091	3	58-32-35	N12	Unnamed #090		3.1	
Unnamed #092	3	58-31-31	N12	Unnamed #090		1.5	
Unnamed #093	3	58-32-34	N12	Castile Creek		2.4	
Unnamed #094	3	58-32-35	N12	Castile Creek		2.5	
Unnamed #095	4	58-32-24	N12	Castile Creek	2.9	3.1	0.5
Unnamed #096	3	58-31-19	N12	Unnamed #095		1.2	
Unnamed #097	3	58-32-13	N12	Castile Creek		2.0	
Unnamed #098	3	58-32-13	N12,M12	Castile Creek		3.6	
Unnamed #099	3	55-34-27	P10	Platte River		4.4	
Belcher Branch	4	55-34-21	P10,P9	Platte River		2.9	
Unnamed #100	3	55-34-16	P10,P9	Belcher Branch		2.8	
Unnamed #101	3	55-34-10	P10	Platte River		1.5	
Unnamed #102	3	55-34-03	P10,O10	Platte River		2.4	
Unnamed #103	3	55-34-04	P10	Platte River		1.8	
Rock Creek	3	56-34-33	O10,P10,P9	Platte River		3.3	
Pigeon Creek	3	56-34-21	O10,O9	Platte River		7.1	
Riley Branch	3	56-34-03	O10,O11	Platte River		8.3	
Third Fork	7	57-34-34	O10,N10,N11, M11,L11,L10	Platte River	53.1	41.8	18.5
Unnamed #104	3	57-34-13	N10	Third Fork		2.1	
Unnamed #105	3	57-34-18	N10,N11,O10	Third Fork		2.8	
Muddy Creek	4	57-33-18	N10,M10	Third Fork	17.8	16.9	2.4
Unnamed #106	3	57-33-07	N10	Muddy Creek		4.1	
Unnamed #107	3	58-33-30	N10	Muddy Creek		1.5	
Unnamed #108	3	58-33-19	N10	Muddy Creek		1.5	
Unnamed #109	3	58-33-18	N10	Muddy Creek		1.2	

Stream Name	Max. Order	Location at Mouth T R S	Map Numbers[1]	Recieving Stream	Original Length (Mi.)	Current Length (Mi.)	Miles Channel-ized
Unnamed #110	3	58-33-07	N10	Muddy Creek		1.6	
Unnamed #111	3	58-33-05	N10,M10	Muddy Creek		2.8	
Unnamed #112	3	59-33-20	M10,M11	Muddy Creek		1.4	
Little Third Fork	6	57-33-08	N10,N11,M11, M12,L11	Third Fork	38.2	30.9	11.3
Jordan Creek	4	57-33-03	N11	Little Third Fork	6.5	5.9	1.3
Unnamed #113	3	57-33-10	N11,O11	Jordan Creek		4.0	
Unnamed #114	3	57-33-10	N11,O11	Jordan Creek		3.4	
Unnamed #115	3	57-33-11	N11	Jordan Creek		1.9	
Unnamed #116	3	57-33-03	N11	Little Third Fork		1.0	
Unnamed #117	3	58-33-35	N11	Little Third Fork		2.1	
Unnamed #118	3	58-33-36	N11	Little Third Fork		1.5	
Unnamed #119	3	58-33-36	N11	Little Third Fork		2.3	
Unnamed #120	4	58-33-25	N11	Little Third Fork		2.0	0.0
Unnamed #121	3	58-33-24	N11	Unnamed #120		0.8	
Unnamed #122	3	58-32-30	N11	Little Third Fork		1.1	
Unnamed #123	3	58-32-30	N11	Little Third Fork		0.8	
Unnamed #124	3	58-32-30	N11	Little Third Fork		2.5	
Unnamed #125	3	58-32-20	N11,N12	Little Third Fork		2.2	
Unnamed #126	3	58-32-20	N11	Little Third Fork		1.8	
Morgan Branch #1	5	58-32-17	N11,M11	Little Third Fork	8.6	7.8	0.9
Unnamed #127	4	58-32-08	N11	Morgan Branch		1.7	
Unnamed #128	3	58-32-07	N11	Unnamed #127		1.0	
Unnamed #129	3	58-32-06	N11	Unnamed #127		0.7	
Unnamed #130	4	58-32-05	M11	Morgan Branch		2.2	
Unnamed #131	3	59-32-31	M11	Unnamed # 130		0.5	
Unnamed #132	3	59-32-19	M11	Morgan Branch		0.8	
Unnamed #133	4	58-32-17	N11,N12	Little Third Fork	3.1	3.0	0.4
Unnamed #134	3	58-32-17	N11,N12	Unnamed #133		2.0	
Unnamed #135	3	58-32-09	N11,N12	Unnamed #133		1.3	
Unnamed #136	3	58-32-16	N12	Unnamed #133		1.3	
Unnamed #137	3	58-32-05	N11	Little Third Fork		0.8	
Unnamed #138	3	58-32-05	N11	Little Third Fork		0.4	
Unnamed #139	4	59-32-33	M11,M12	Little Third Fork		1.8	
Unnamed #140	3	59-32-33	M12,N12	Unnamed #139		1.2	
Unnamed #141	3	59-32-33	M11	Little Third Fork		1.2	
Unnamed #142	3	59-32-33	M11,M12	Little Third Fork		0.6	
Unnamed #143	4	59-32-28	M12	Little Third Fork	2.5	2.5	0.4
Unnamed #144	3	59-32-27	M12	Unnamed #143		1.5	
Unnamed #145	3	59-32-27	M12	Unnamed #143		1.5	
Unnamed #146	3	59-32-21	M11	Little Third Fork		1.5	
Unnamed #147	4	59-32-21	M12,M11	Little Third Fork	3.9	3.5	0.6
Unnamed #148	3	59-32-17	M11	Unnamed #147		1.3	
Unnamed #149	3	59-32-17	M11	Unnamed #147		1.3	
Unnamed #150	3	59-32-16	M12,M11	Little Third Fork		3.2	
Unnamed #151	4	59-32-10	M12	Little Third Fork	3.5	3.5	0.6
Unnamed #152	3	59-32-04	M12,M11	Unnamed #151		1.9	
Unnamed #153	3	60-32-28	M12,M11	Little Third Fork		2.1	
Unnamed #154	3	57-33-08	N10	Third Fork		1.8	
Unnamed #155	3	58-33-33	N11	Third Fork		0.9	
Unnamed #156	3	58-33-33	N11	Third Fork		1.4	
Bays Branch	4	58-33-22	N11	Third Fork		5.0	
Unnamed #157	3	58-33-23	N11	Bays Branch		0.5	
Unnamed #158	3	58-33-15	N11	Third Fork		1.4	
Unnamed #159	4	58-33-10	N11	Third Fork	3.3	3.3	0.5
Unnamed #160	3	58-33-11	N11	Unnamed #159		1.6	
Unnamed #161	3	58-33-10	N11	Third Fork		1.6	
Unnamed #162	3	58-33-03	N11	Third Fork		1.3	

Stream Name	Max. Order	Location at Mouth T R S	Map Numbers[1]	Recieving Stream	Original Length (Mi.)	Current Length (Mi.)	Miles Channel-ized
Unnamed #163	4	58-33-03	N11,M11	Third Fork	3.6	2.9	0.7
Unnamed #164	3	59-33-35	M11	Unnamed #163		0.9	
Unnamed #165	3	58-33-03	M11,N11	Third Fork		1.2	
Unnamed #166	3	59-33-34	M11	Third Fork		1.6	
Unnamed #167	3	59-33-27	M11	Third Fork		3.6	
Unnamed #168	3	59-33-22	M11	Third Fork		1.2	
Crooked Creek #1	5	59-33-15	M11	Third Fork	8.4	7.2	1.9
Unnamed #169	3	59-33-15	M11	Crooked Creek #1		1.5	
Unnamed #170	3	59-33-14	M11	Crooked Creek #1		0.8	
Unnamed #171	4	59-33-11	M11	Crooked Creek #1		1.7	
Unnamed #172	3	59-33-12	M11	Unnamed #171		1.5	
Unnamed #173	3	59-33-13	M11	Unnamed #171		0.6	
Unnamed #174	3	59-33-12	M11	Crooked Creek #1		1.2	
Unnamed #175	3	59-33-12	M11	Crooked Creek #1		0.4	
Unnamed #176	3	59-33-01	M11	Crooked Creek #1		2.0	
Unnamed #177	3	59-33-01	M11	Crooked Creek #1		2.1	
Unnamed #178	3	59-33-01	M11	Crooked Creek #1		2.0	
Unnamed #179	3	60-33-36	M11	Crooked Creek #1		1.2	
Unnamed #180	3	59-33-10	M11	Third Fork		1.6	
Unnamed #181	3	59-33-10	M11	Third Fork		2.0	
Unnamed #182	3	59-33-03	M11	Third Fork		1.2	
Unnamed #183	3	59-33-03	M11,M10	Third Fork		2.4	
Unnamed #184	3	59-33-03	M11,M10	Third Fork		3.4	
Unnamed #185	3	60-33-34	M11	Third Fork		2.0	
Unnamed #186	3	60-33-27	M11	Third Fork		2.1	
Bull Creek	4	60-33-27	M11,L11,L10	Third Fork	7.0	5.7	2.4
Unnamed #187	3	60-33-27	M11,M10	Bull Creek		3.4	
Unnamed #188	4	60-33-23	L11	Third Fork		3.0	
Unnamed #189	3	60-33-24	L11,M11	Unnamed #188		1.7	
Elm Grove Branch	3	60-33-14	L11,L10	Third Fork		6.6	
Unnamed #190	3	60-33-14	L11	Third Fork		4.0	
Unnamed #191	3	61-35-25	L11	Third Fork		4.4	
Candy Creek	3	57-34-27	O10,O9	Platte River		7.2	
102 River	6	57-34-17	N10,N9,M9,L 9,K9,J9, I9,H9	Platte River	100.4	78.6	31.3
Unnamed #192	3	58-34-30	N9	102 River		3.0	
Long Branch #1	4	58-34-18	N9,N10,M10	102 River	13.7	12.3	1.2
Bench Creek	3	58-34-18	N9,N10	Long Branch #1		1.4	
High Prairie Creek	3	58-34-06	N10	Long Branch #1		1.6	
Unnamed #193	3	59-34-32	M10	Long Branch #1		1.1	
Unnamed #194	3	59-34-32	M10	Long Branch #1		1.0	
Two Creek	3	59-34-29	M10	Long Branch #1		1.2	
Unnamed #195	3	59-35-12	M9,M10	102 River		2.0	
Unnamed #196	3	60-35-36	M9,M10	102 River		1.9	
Unnamed #197	3	60-35-23	L9,N9	102 River		2.6	
Unnamed #198	3	60-35-14	L9	102 River		2.9	
Unnamed #199	3	60-35-22	L9,M9	102 River		5.2	
Kellog Branch	4	60-35-15	L8,L9	102 River	6.3	5.9	0.3
Riggin Branch	3	60-35-16	L9,M9	Kellog Branch		1.9	
Unnamed #200	3	60-35-10	L9	102 River		4.0	
Lower Neely	3	61-35-34	L9	102 River		5.0	
Unnamed #201	3	61-35-27	L9	102 River		2.8	
Unnamed #202	3	61-35-22	L9	102 River		3.7	
Unnamed #203	3	61-35-15	L9	102 River		3.3	
Upper Neely	3	61-35-15	K9,L9	102 River		7.5	
White Cloud Creek	4	61-35-03	I8,J8,K8,K9,L 9	102 River	38.9	30.1	8.7
Pumpkin Center Creek	3	62-35-18	K8,K9	White Cloud Creek		2.7	

Stream Name	Max. Order	Location at Mouth T R S	Map Numbers[1]	Recieving Stream	Original Length (Mi.)	Current Length (Mi.)	Miles Channel-ized
Mullin Creek	3	63-36-36	J8,J9,K8	White Cloud Creek		4.7	
Theater Creek	3	63-36-12	J8	White Cloud Creek		2.9	
Peach Creek	3	64-36-35	J8	White Cloud Creek		5.0	
Big Slough	3	64-36-22	I8,J8	White Cloud Creek		6.2	
Pond Creek	3	64-36-02	I8,I9	White Cloud Creek		2.8	
Unnamed #204	3	61-35-03	L9,K9	102 River		2.7	
Unnamed #205	3	63-35-34	K9	102 River		2.2	
Dog Branch	3	63-35-27	J9,K9	102 River		6.4	
Jones Branch	3	63-35-10	J8,J9	102 River		4.1	
Mozingo Creek	4	63-35-03	H10,I9,I10,J9	102 River	25.0	20.0	6.1
Unnamed #206	3	64-35-36	J9	Mozingo Creek		1.5	
Unnamed #207	3	64-35-13	J9	Mozingo Creek		2.1	
Unnamed #208	3	64-35-12	I9,J9	Mozingo Creek		1.3	
Long Hollow	3	65-35-25	I9,I10	Mozingo Creek		2.3	
Unnamed #209	3	65-34-18	I9,I10	Mozingo Creek		1.5	
Unnamed #210	3	64-35-27	J9	102 River		3.4	
Thill Branch	3	64-35-15	I9,J9	102 River		4.1	
Unnamed #211	3	65-35-34	I9	102 River		2.4	
Canal Branch	4	65-35-27	I8,I9	102 River		5.3	
Unnamed #212	3	65-35-29	I9	Canal Branch		2.5	
Pinhook Creek	4	65-35-27	I9	102 River	3.1	2.6	0.2
Unnamed #213	3	65-35-26	I9	Pinhook Creek		1.0	
Unnamed #214	3	65-35-22	I9	102 River		3.8	
Norvey Creek	4	65-35-15	H9,H10,I9	102 River	20.0	17.0	4.0
Unnamed #215	3	65-35-14	I9	Norvey Creek		1.9	
Unnamed #216	3	65-35-14	I9	Norvey Creek		1.0	
Unnamed #217	3	65-35-11	I9	Norvey Creek		1.2	
Unnamed #218	3	65-35-02	I9	Norvey Creek		1.7	
Unnamed #219	3	66-34-30	I9	Norvey Creek		1.5	
Unnamed #220	3	66-34-29	H9,I9	Norvey Creek		2.5	
Unnamed #221	3	67-34-34	H10	Norvey Creek		3.2	
Unnamed #222	3	65-35-15	I9	102 River		2.5	
Harmon Creek	4	65-35-10	I8,I9	102 River		4.0	
Unnamed #223	3	65-35-04	I9	Harmon Creek		1.8	
Unnamed #224	3	65-35-03	I9	102 River		1.9	
Slaughter Branch #1	3	66-35-35	I9	102 River		3.8	
Unnamed #225	3	66-35-34	I8,I9	102 River		2.8	
Slaughter Branch #2	3	66-35-27	H9,I9	102 River		3.8	
Beard Branch	4	66-35-22	H9	102 River		9.1	
Unnamed #226	3	66-35-12	H9	Beard Branch		2.3	
Unnamed #227	3	66-35-22	H8,H9	102 River	3.2	2.3	0.2
West Fork 102 River	5	66-35-10	E9,E10,F9,G9, H9	102 River	56.7	40.8	21.1
Unnamed #228	3	66-35-03	H8,H9	West Fork 102 River		2.7	
Unnamed #229	3	67-35-27	H8,H9	West Fork 102 River		4.5	
Unnamed #230	3	67-35-22	H8,H9	West Fork 102 River		4.0	
West Branch 102 River	5	68-35-03	E10,E11,F9, F10,G9	West Fork 102 River	35.1	29.4	7.3
Unnamed #231	3	69-35-28	F8,F9	West Fork 102 River		2.1	
Rose Branch	3	70-34-07	E9,F9	West Fork 102 River		7.8	

Stream Name	Max. Order	Location at Mouth T R S	Map Numbers[1]	Recieving Stream	Original Length (Mi.)	Current Length (Mi.)	Miles Channel-ized
Middle Branch 102 River	4	69-34-06	E11,F9,F10,F11	West Branch 102 River	21.9	18.2	4.4
Unnamed #232	3	70-34-34	F10	Middle Branch 102 River		7.8	
Unnamed #233	3	70-34-29	E10,F9,F10	West Branch 102 River		5.5	
Unnamed #234	3	70-34-12	E10	West Branch 102 River		2.4	
Lonzo Creek	3	70-34-01	E10,E11	West Branch 102 River		3.0	
Willow Creek	3	71-33-29	E10,E11	West Branch 102 River		6.0	
Unnamed #235	3	71-33-09	E10	West Branch 102 River		1.3	
Middle Fork 102 River	4	66-35-02	F10,G9,G10,H9	102 River	32.5	27.9	5.8
Brushy Creek	3	67-35-24	G9,H9	Middle Fork 102 River		12.9	
East Fork 102 River	4	66-35-02	F11,G9,G10, G11,H9	102 River	45.0	31.0	16.3
Daugherty Creek	3	67-34-09	G9,G10	East Fork 102 River		7.8	
Unnamed #236	3	67-34-03	G10	East Fork 102 River		2.4	
Unnamed #237	3	68-34-18	G10	East Fork 102 River		5.9	
Unnamed #238	3	68-33-04	G10,G11	East Fork 102 River		4.9	
Ash Branch	3	69-33-23	F11	East Fork 102 River		4.3	
Hog Branch #1	3	69-33-13	F11,F12	East Fork 102 River		6.1	
East River	4	69-33-01	E11,F11,F12	East Fork 102 River	13.8	10.6	4.9
Unnamed #239	3	70-32-28	F11	East River		3.3	
Unnamed #240	3	57-34-16	N10	Platte River		3.9	
Unnamed #241	3	57-34-04	N10	Platte River		3.0	
Unnamed #242	3	58-34-32	N10	Platte River		1.6	
Unnamed #243	3	58-34-28	N10	Platte River		1.6	
Unnamed #244	4	58-34-22	N10	Platte River	4.7	4.1	1.1
Unnamed #245	3	58-34-16	N10	Unnamed #244		2.4	
Unnamed #246	3	58-34-22	N10	Platte River		1.8	
Unnamed #247	3	58-34-15	M10,N10	Platte River		3.2	
Unnamed #248	3	58-34-15	N10	Platte River		2.2	
Unnamed #249	4	58-34-10	N10	Platte River		3.0	
Unnamed #250	3	58-34-11	N10	Unnamed #249		1.5	
Unnamed #251	3	58-34-03	M10,N10	Platte River		2.5	
Unnamed #252	3	58-34-03	M10,N10	Platte River		1.9	
Unnamed #253	3	58-34-02	M10	Platte River		1.0	
Unnamed #254	3	59-34-35	M10	Platte River		2.5	
Unnamed #255	3	59-34-26	M10	Platte River		1.5	
Unnamed #256	3	59-34-26	M10	Platte River		2.1	
Unnamed #257	3	59-34-27	M10	Platte River		1.2	
Niagara Creek	4	59-34-23	M10	Platte River	8.0	6.9	0.6
Unnamed #258	3	59-34-23	M10	Niagara Creek		2.1	
Unnamed #259	3	59-34-13	M10	Niagara Creek		1.5	
Unnamed #260	3	59-34-13	M10	Niagara Creek		1.7	
Unnamed #261	4	59-34-22	M10	Platte River		1.9	
Unnamed #262	3	59-34-22	M10	Unnamed #261		1.1	
Unnamed #263	3	59-34-15	M10	Platte River		1.7	
Unnamed #264	3	59-34-10	M10	Platte River		1.3	

Stream Name	Max. Order	Location at Mouth T R S	Map Numbers[1]	Recieving Stream	Original Length (Mi.)	Current Length (Mi.)	Miles Channel-ized
Unnamed #265	3	59-34-10	M10	Platte River		1.7	
Unnamed #266	3	59-34-03	M10	Platte River		1.6	
Unnamed #267	3	59-34-03	M10	Platte River		1.8	
Unnamed #268	3	60-34-34	M10	Platte River		2.6	
Unnamed #269	4	60-34-34	M10	Platte River		2.9	
Unnamed #270	3	60-34-34	M10	Unnamed #269		2.8	
Unnamed #271	3	60-34-34	M10	Platte River		1.8	
Unnamed #272	3	60-34-27	M10	Platte River		2.7	
Crooked Creek #2	4	60-34-15	L10	Platte River	8.8	7.2	1.2
Unnamed #273	3	60-34-14	L10,M10	Crooked Creek #2		3.8	
Agee Creek	3	60-34-09	L10	Platte River		6.8	
Unnamed #274	3	60-34-09	L9,L10	Platte River		3.7	
Unnamed #275	3	61-34-16	L9,L10	Platte River		3.7	
Hickory Creek	4	61-34-10	L10	Platte River	7.3	6.6	2.2
Unnamed #276	3	61-34-02	K10,L10	Hickory Creek		5.2	
Clear Creek	4	61-34-03	K10,L10	Platte River	9.6	7.4	3.1
Unnamed #277	3	62-34-13	K10	Clear Creek		1.1	
Long Branch #2	4	62-34-28	I10,J9,J10,K9, K10	Platte River	39.5	31.2	9.0
Unnamed #278	3	64-34-20	J10	Long Branch #2		2.5	
Unnamed #279	3	64-34-20	J10	Long Branch #2		2.9	
Unnamed #280	3	64-34-08	I10,J10	Long Branch #2		3.6	
Unnamed #281	3	62-34-17	K10	Platte River		1.7	
Unnamed #282	3	62-34-08	K10	Platte River		1.9	
Unnamed #283	3	62-34-05	K10	Platte River		3.9	
Unnamed #284	3	63-34-33	K10	Platte River		2.0	
Unnamed #285	3	63-34-22	K10	Platte River		1.6	
Unnamed #286	3	63-34-22	J10	Platte River		3.6	
Unnamed #287	3	63-34-11	J10	Platte River		1.6	
Unnamed #288	3	63-34-11	J10	Platte River		4.2	
Unnamed #289	3	64-34-35	J10	Platte River		3.3	
Unnamed #290	3	64-34-23	J10	Platte River		2.0	
Unnamed #291	3	64-34-24	J10	Platte River		2.1	
Unnamed #292	3	64-34-14	J10	Platte River		2.1	
Honey Creek	5	64-34-14	F11,F12,G10, G11,H10,I10, J10	Platte River	65.2	49.7	17.5
Unnamed #293	3	64-34-14	J10	Honey Creek		1.4	
Unnamed #294	3	64-34-11	J10	Honey Creek		2.1	
Unnamed #295	3	64-34-11	I10,J10	Honey Creek		2.3	
Unnamed #296	4	65-34-35	I10	Honey Creek		3.6	
Unnamed #297	3	65-34-35	I10	Unnamed #296		1.4	
Morgan Branch #2	3	65-34-25	I10	Honey Creek		2.0	
Hog Branch #2	4	65-34-13	I10	Honey Creek		5.0	
Unnamed #298	3	65-34-12	I10	Hog Branch #2		3.0	
Unnamed #299	3	67-33-29	H10	Honey Creek		4.1	
Unnamed #300	3	67-33-5	G10	Honey Creek		2.5	
Unnamed #301	3	64-34-12	J10	Platte River		2.6	
Brushy Creek	3	65-33-17	H10,H11,I10	Platte River		15.3	
Unnamed #302	3	66-33-26	H11,I11	Platte River		2.3	
Unnamed #303	3	66-33-2	H11	Platte River		2.7	
Platte Branch	4	67-32-31	F11,G11,H11	Platte River	23.0	20.3	5.5
Unnamed #304	3	67-32-19	H11	Platte Branch		2.6	
Unnamed #305	3	67-33-12	G11,H11	Platte Branch		4.1	
Unnamed #306	3	68-32-31	G11	Platte Branch		3.4	
Unnamed #307	3	67-32-12	G11,G12,H12	Platte River		5.5	
Unnamed #308	4	68-32-36	G12	Platte River		3.5	
Unnamed #309	3	68-32-25	G11,G12	Unnamed #308		3.3	
Unnamed #310	3	68-31-15	G12	Platte River		4.4	

Stream Name	Max. Order	Location at Mouth T R S	Map Numbers[1]	Recieving Stream	Original Length (Mi.)	Current Length (Mi.)	Miles Channel-ized
Unnamed #311	3	68-31-10	G12	Platte River		1.6	
Unnamed #312	3	69-31-34	G12	Platte River		3.4	
Turkey Creek	3	69-31-34	F12,G12	Platte River		7.3	
Unnamed #313	3	69-31-03	F12,F13	Platte River		4.5	
Gard Branch	3	70-31-28	F12	Platte River		6.5	
Unnamed #314	3	70-31-22	E12,F12	Platte River		5.7	
Unnamed #315	3	70-31-09	E12,F12	Platte River		2.6	
Middle Platte River	4	70-31-09	D12,D13,E12	Platte River	28.0	20.8	7.7
East Platte River	3	71-31-33	D13,E12,E13	Middle Platte River		16.3	
East Branch	3	71-31-16	D13,E12,E13	Middle Platte River		11.0	
Unnamed #316	3	70-31-06	E12	Platte River		3.4	
Unnamed #317	3	71-31-19	E12	Platte River		5.9	
Todd Branch	3	71-32-24	E11,E12	Platte River		7.3	
Saylings Creek	4	71-32-14	E11,E12	Platte River	11.8	9.3	3.4
Metz Creek	3	71-32-10	D11,E11	Saylings Creek		3.6	
West Platte River	3	71-32-02	D11,D12,E11, E12	Platte River		10.6	

1. Map names and corresponding map numbers are listed in the following table.

Appendix D. Table b. USGS 7.5 minute series topographic maps, 1:24,000 scale, for Platte River basin coverage.

Map #	Map Name	Map #	Map Name	Map #	Map Name
C12	Orient, IA	I9	Pickering, MO	O12	Perrin, MO
C13	Zion, IA	I10	Parnell West, MO	O13	Cameron West, MO
D11	Prescott, IA	I11	Parnell East, MO	P9	Dearborn, MO
D12	Creston West, IA	J8	Maryville West, MO	P10	Edgerton, MO
D13	Creston East, IA	J9	Maryville East, MO	P11	Gower, MO
E9	Brooks, IA	J10	Ravenwood, MO	P12	Plattsburg, MO
E10	Corning South, IA	K8	Bolckow NW, MO	P13	Lathrop, MO
E11	Lenox, IA	K9	Barnard, MO	Q9	Tracy, MO
E12	Kent, IA	K10	Guilford, MO	Q10	Camden Point, MO
E13	Shannon City, IA	L8	Fillmore, MO	Q11	Smithville, MO
F8	Hawleyville, IA	L9	Bolckow , MO	Q12	Arley, MO
F9	Guss, IA	L10	Whitesville, MO	R9	Platte City, MO-KS
F10	Gravity, IA	L11	King City, MO	R10	Ferrelview, MO
F11	Merle Junction, IA	L12	Ford City, MO	R11	Nashua, MO
F12	Clearfield, IA	M8	Amazonia, MO	R12	Kearney SW, MO
F13	Diagonal, IA	M9	Savannah, MO		
G8	New Market, IA	M10	Helena, MO		
G9	Ladoga, IA	M11	Union Star, MO		
G10	Bedford, IA	M12	Wood, MO		
G11	Conway, IA	N9	St. Joseph North, MO-KS		
G12	Maloy, IA	N10	Cosby, MO		
H8	Hopkins SW, MO-IA	N11	Clarksdale, MO		
H9	Hopkins, MO-IA	N12	Amity, MO		
H10	Bedford SW, MO-IA	N13	Fordham, MO		
H11	Sheridan, MO-IA	O9	St. Joseph South, MO-KS		
H12	Blockton, MO-IA	O10	Agency, MO		
I8	Wilcox, MO	O11	Hemple, MO		

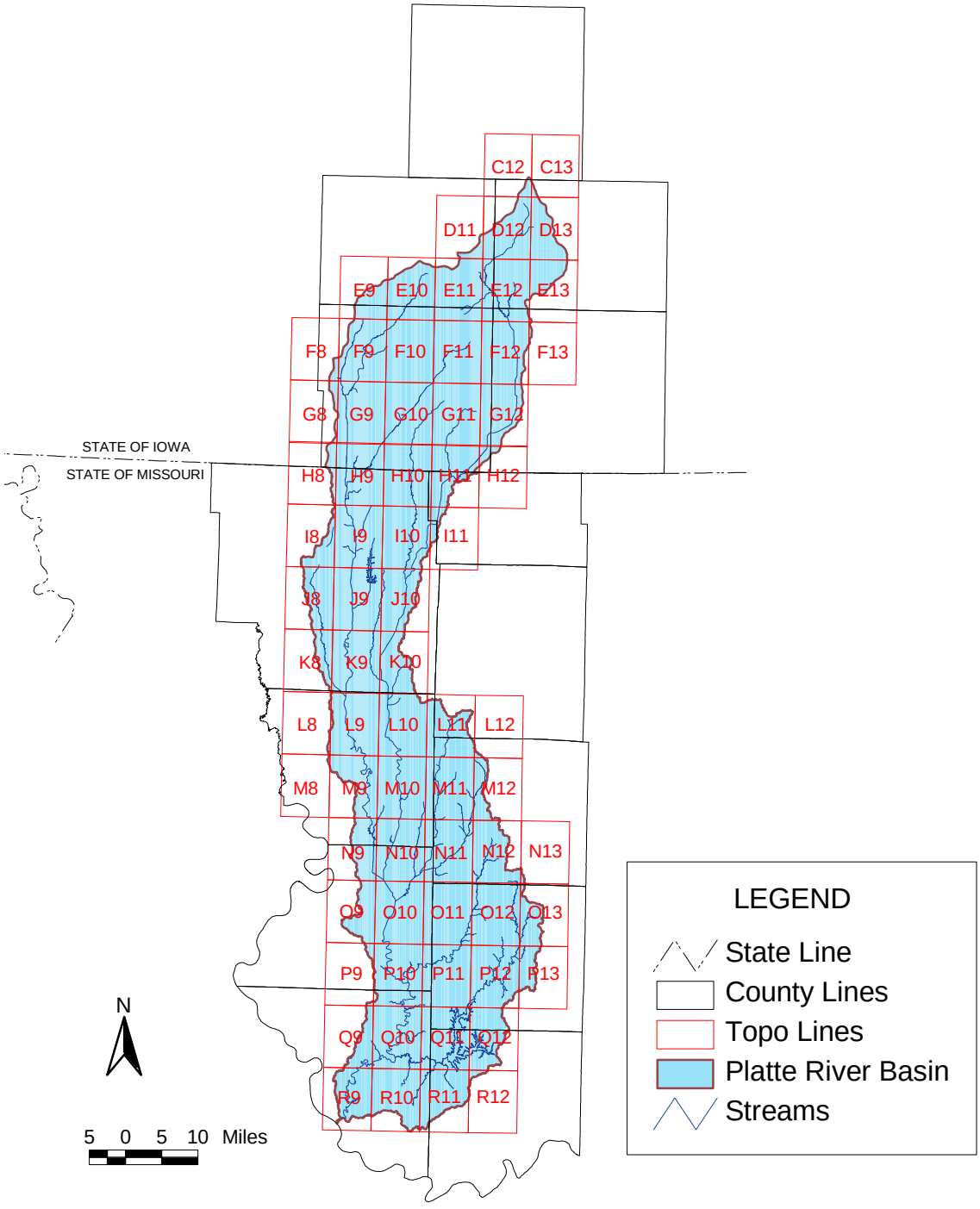

Figure to. Location of USGS 7.5 minute topographic maps within the Platte River basin.

Table 8. Miles of permanent and intermittent flow for selected streams within the Missouri portion of the Platte River basin (Funk 1968).

Stream	Maximum Order	Total Length	Permanent Flow (miles)	Intermittent Flow (miles)
Platte River	8	138	138.0	0.0
Third Fork Platte River	7	35	8.0	27.0
Little Platte River	6	44	12.0	32.0
L. Third Fork Platte River	6	27	12.0	15.0
102 River	6	70	70.0	0.0
Castile Creek	5	36	12.0	24.0
Long Branch	5	26	14.5	11.5
Honey Creek	5	10	8.5	1.5

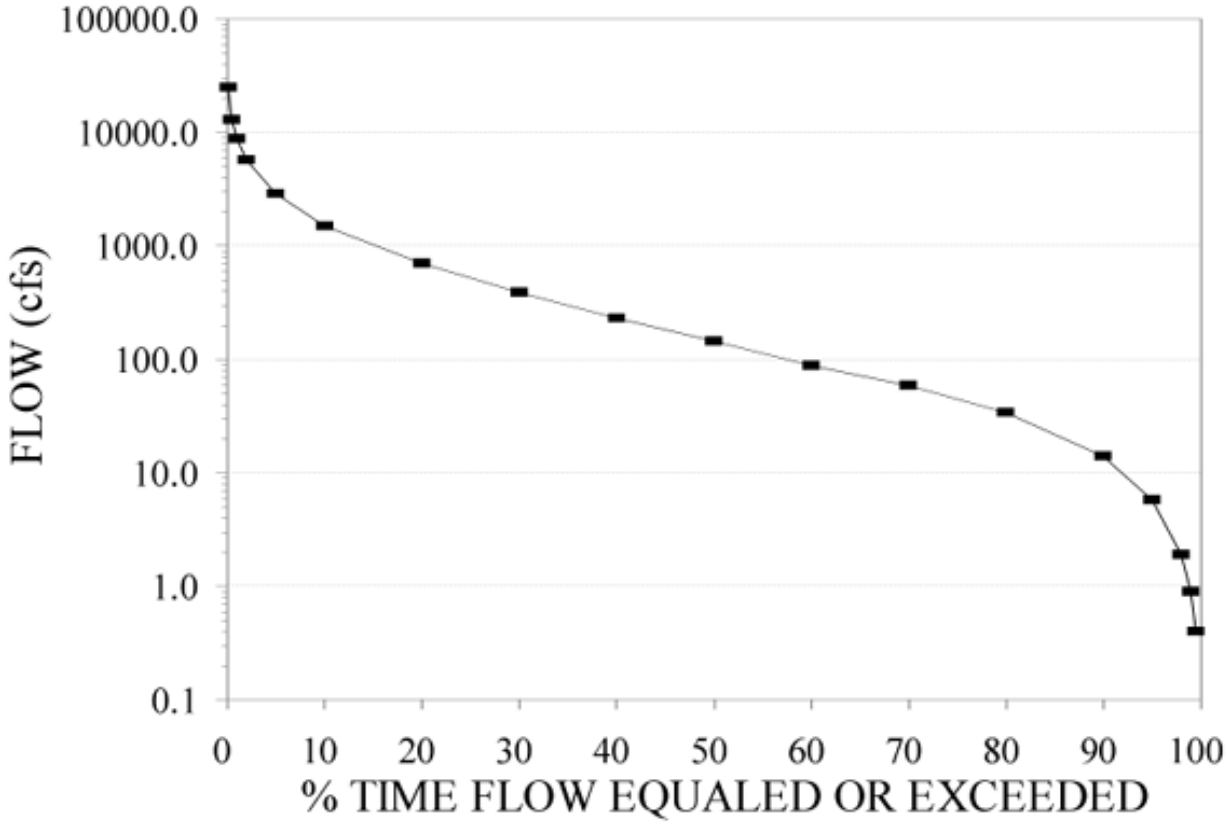

Figure 3. Flow duration curve for the Platte River near Agency, Missouri.

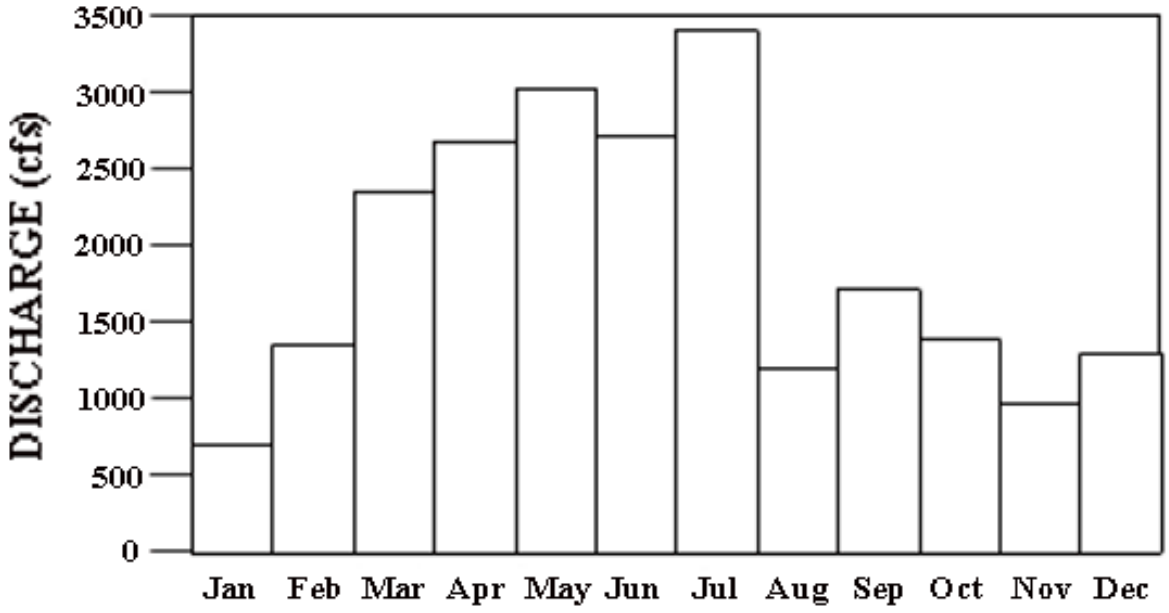

Figure 4. Mean daily discharge for the Platte River at Sharps Station by month for the period of record (December 1978 to September 1995).

Table 9. Flood magnitude at various recurrence intervals at four gaging stations within the Platte River basin in Missouri (Hauth 1974).

	Flood magnitude (cfs) for indicated recurrence interval					
Location	**2 yr**	**5 yr**	**10 yr**	**25 yr**	**50 yr**	**100 yr**
Platte R., Ravenwood MO[1]	**7,430**	**10,600**	**12,100**	**13,600**		
102 R., Maryville MO[1]	**6,800**	**11,600**	**15,100**	**19,600**	**23,000**	**26,400**
White Cloud Cr., Maryville MO[1]	**729**	**1,680**	**2,260**	**2,820**	**3,220**	**3,580**
Platte R., Agency MO[2]	**14,000**	**24,300**	**31,600**	**41,300**	**48,600**	**56,000**

[1] - Inactive stations 1996

[2] - Active stations 1996

Table 10. Seven day low flow characteristics (cfs) for 2, 10, and 20 year recurrence intervals for selected locations within the Missouri portion of the Platte River basin (Skelton 1976).

Location	7-Day Q_2	7-Day Q_{10}	7-Day Q_{20}
Platte R., Ravenwood MO	2.8	0.1	N/A
Long Branch, Guilford MO	0.0	0.0	0.0
Platte R., Whitesville MO	6.1	0.3	N/A
102 R., Maryville MO	5.2	0.4	0.2
White Cloud Cr., Maryville MO	0.0	0.0	0.0
White Cloud Cr., Barnard MO	0.0	0.0	0.0
102 R., Rosendale MO	3.0	0.2	N/A
102 R., Avenue City MO	5.8	0.3	N/A
102 R., St. Joseph MO	8.2	0.5	N/A
Platte R., Agency MO	44.0	2.6	0.6
Castile Cr., Gower MO	0.0	0.0	0.0
Jenkins Branch, Gower MO	0.0	0.0	0.0
Castile Cr., Edgerton MO	0.2	0.0	0.0
Platte R., Platte City MO	32.0	2.0	N/A

WATER QUALITY AND USE

Beneficial Use Attainment

The Platte River, including all of its tributaries, is classified for aquatic use, livestock watering, and wildlife use. The Platte River, 102 River, and Little Platte River, including Smithville Lake are also classified for drinking water use and irrigation. Smithville Lake also has classifications for boating and whole body contact (MDNR 1986a). Minor elevations in fecal coliform bacteria levels in lake arms following runoff may occur in Smithville Lake (MDNR 1995). However, whole body contact recreation should remain unaffected.

Water quality that maintains diverse aquatic communities and acceptable fisheries uses throughout the basin should remain adequate, though biomass and biotic diversity may be limited in various streams within the basin due to high levels of non-point suspended solids, sedimentation, occasional low dissolved oxygen, increased nutrification, and in short reaches, by point source pollution. Water quality for livestock and wildlife watering should remain satisfactory within the basin. Water quality of drinking supply sources should also remain adequate. Manganese and iron may pose occasional taste, odor, and staining problems if not adequately removed by conventional water treatment or if water is drawn from deep strata of Smithville Lake. Taste and odor may also be a problem if algal growth is excessive (MDNR 1995).

Chemical Quality of Stream Flow

Suspended sediment, elevated water temperatures, and acidic inflows are water quality problems affecting streams within the Platte River basin, and all are negatively affected by weak base flows. High levels of suspended sediments in runoff are a significant contributor to the low aquatic diversity associated with basin streams. Basin streams often have manganese and fecal coliform levels that are commonly above Missouri water quality criteria (USDA-SCS 1982). Elevated water temperatures are harmful to fish survival and diversity. Water temperatures in excess of 90^{o} F have been recorded in basin streams. These temperatures are found to be detrimental to the growth of largemouth bass, freshwater drum, bluegill, and crappie. Temperatures in excess of 80^{o} F are found to be damaging to spawning and egg development of channel catfish, buffalo, and gizzard shad (USDA-SCS 1982). Due to the shallow nature and weak base flows in basin streams, water temperatures in excess of 80^{o} F probably occur frequently during fish spawning and egg development (USDA-SCS 1982). Current trends show an increase in nitrate levels within basin streams, and this is thought to be associated with increased runoff of nitrogen-based fertilizers or increased runoff of animal waste (MDNR 1986b). Two years of water quality data from the gaging station at Sharps Station near Platte City are presented in Table 11.

Contaminants , Fish Kills, and Health Advisories

Since 1985, the Missouri Department of Health has issued a fish consumption advisory for Missouri, excluding the Ozarks (MDOH 1996). This advisory includes the Platte River basin. Consumption of fatty fishes such as catfish, common carp, suckers, freshwater drum, and paddlefish should be limited to no more than one pound per week (less than one pound per week

for pregnant or nursing females and young children) due to higher levels of contaminants found in these types of fish. No consumption advisories apply for bass, sunfish, crappie or walleye (MDOH 1996). No fish consumption advisories are posted for the Iowa portion of the basin (R. Currier, Iowa Department of Health, personal communication).

Contaminant samples collected from Smithville Lake in 1994 showed that chlordane levels exceeded the National Academy of Science/National Academy of Engineering (NAS/NAE) 1973 chlordane guidelines for protection of wildlife (100 parts per billion, ppb), but fell below the Food and Drug Administration action level of 300 ppb. Only chlordane exceeded the NAS/NAE guidelines for protection of wildlife based on the 28 contaminants sampled (Buchanan 1994). Numerous fish kills have occurred throughout the basin, and these have been attributed to naturally occurring conditions. Some of the larger fish kills have resulted from low dissolved oxygen levels associated with low flow conditions and increased water temperatures (Duchrow 1994). These conditions undoubtedly occur basin-wide. In addition, results may be magnified due to increased sedimentation and low base flows caused by channelization and detrimental agricultural practices (MDNR 1995).

Another threat to fish populations throughout the basin has been the improper management of municipal sewage and the subsequent runoff into receiving streams. Historically, this has been a chronic problem with the cities of Maryville and St. Joseph. Until 1971, the city of Maryville operated two primary sewage treatment plants, both located on tributaries to the 102 River. These facilities were responsible for several fish kills, the largest of which killed an estimated 250 fish and affected seven miles of the 102 River in 1971. In 1970, Maryville constructed five new sewage lagoons and shut down the existing plants. Pollution in the two tributaries and the 102 River ceased, and the present discharge has no apparent adverse effects on stream fauna. The eastern one-fourth of St. Joseph is drained by the Platte River basin, and at one time, 15 miles of small streams and 12 miles of the Platte and 102 rivers within this portion of the basin were considered to be grossly polluted from untreated municipal sewage runoff (MDC files). Although no documented fish kills were directly linked to sewage treatment plant (STP) discharges, the problems below the St. Joseph plants continued to be documented through 1981. Currently, the city of St. Joseph operates one STP within the Platte River basin, and no fish kills have been attributed to its effluent. A listing of municipal STP's and other permitted point pollution sources can be found in Tables 12 and 13.

Fish kills associated with runway de-icing using ethylene glycol and industrial effluent from Kansas City International Airport as well as municipal effluent from the Kansas City -Todd Creek STP have been a chronic problem in Todd Creek since 1976. This situation currently requires monitoring for metals and should be carefully reviewed for possible toxic effects (MDNR 1995). Enforcement actions may be forthcoming if violations continue (Duchrow 1994).

Another concern to fish populations within the Platte River basin is runoff of livestock manure, both from ranging animals and concentrated feedlot sources. Large documented fish kills have not been directly linked to livestock waste runoff in the basin. However, this is a concern due to

recent fish kills in northwest Missouri caused by livestock manure spills from concentrated animal feeding operations (CAFO's) in other river basins.

Norris and Sons Trash Service and the city of St. Joseph operate landfills near Pigeon Hill Conservation Area in Buchanan County. Leachate from these landfills has been responsible for past fish kills, and has been a noted contributor of pollutants to Pigeon Creek. The original landfill was constructed directly over a tributary to Pigeon Creek, and was responsible for most of the problems. Today both landfills are under state regulations, and safe operating guidelines have been put into place that should alleviate further problems. Four companies (Amoco, Mapco, Platte Crude, and Williams Brothers) maintain oil pipelines that underlie streams within the basin. These pipelines present a potential hazard for aquatic populations should a break occur.

Water Use

A. **Municipal-** Within the Missouri portion of the Platte River basin there are four surface water intakes designated for municipal use (Figure ws). Two surface water intakes are located on Smithville Lake and serve the cities of Smithville and Plattsburg. One is located on Mozingo Lake and serves the city of Maryville. The other municipal surface water intake within the Missouri portion of the basin draws directly from the 102 River and serves the city of Maryville (MDNR 1996).

The Iowa portion of the Platte River basin contains three surface water intakes for municipal use (Figure ws). Two of the surface water intakes are located on reservoirs and serve the cities of Lennox and Bedford. The other surface water intake is located on the 102 River at Bedford and serves as a backup system (J. Riessen, IADNR, personal communication).

B. **Agricultural-** Water use for irrigation purposes in the Missouri portion of the basin is minimal, although it varies annually depending upon rainfall. Only two of the nine Missouri counties within the basin (Andrew and Platte) reported any water use for irrigation (range 0.1 to 99 million gallons) during 1984 (MDNR 1986a).

Point-Source Pollution

Municipal sewage treatment plants are the major point-source pollution concern within the basin (Table 12; Figure st). Surveys directly below basin STP's have noted changes in fish and invertebrate quantity and quality, increased turbidity, and lowered beneficial use potentials. Improperly treated waste water has the potential to add excessive nutrients, elevate ammonia levels, increase levels of fecal coliform bacteria, and cause low levels of dissolved oxygen in receiving streams. Approximately 10 miles of stream (near the metropolitan areas of St. Joseph and Maryville) in the basin are thought to be negatively impacted by sewage effluent. These discharges have been responsible for severe stream degradation in the past. Currently STP's are monitored regularly and come under the scrutiny of National Pollution Discharge Elimination System (NPDES) permits. Non-municipal sewage effluent does not have large negative impacts on basin streams (MDNR 1995).

Unauthorized discharge from lagoons or pits serving CAFO's is another potential point-source pollutant within the basin. These discharges have been responsible for extensive fish kills in north Missouri, although no spills of this type have been documented as causing fish kills in the Platte River basin. Currently there are 75 CAFO's permitted within the basin, and it has been estimated that they generate 3,013,047 PE (human population equivalent) of waste annually (MDNR 1996 data). A listing of active and proposed CAFO's within the entire basin can be found in Table 14.

Non-Point Source Pollution

Non-point source pollution has the greatest negative influence upon water quality within the Platte River basin. The most common problems associated with non-point sources are low dissolved oxygen, high levels of turbidity, and organic nutrients, all of which are influenced by excessive runoff and extended low flows. The major factors contributing to non-point source pollution include channelization, intensive row cropping, and livestock (MDNR 1995). Urban construction and runoff may negatively affect basin streams in the Kansas City and St. Joseph areas (MDNR 1995).

Land use within the basin is dominated by row cropping and grazing of pasture land. One effect of intensive row cropping is increased runoff. This leads to increases in both upland and stream bank erosion and delivers high sediment loads and agricultural chemicals directly to basin streams. It is estimated that 23 tons of soil per acre are lost annually using straight row cropping with conventional tillage. Soil losses due to sheet and rill erosion on untilled uplands is 11 tons per acre annually. Gully erosion occurs at a rate of 1.2 tons per acre annually. This rapid erosion results in increased turbidity, degraded aquatic habitat, and increased nutrient and pesticide loads into streams (MDNR 1995). The Conservation Reserve Program (CRP) has removed some of the highly erodible land from production, but most of these CRP contracts will expire by 1998. Under the 1996 farm bill it has been estimated that erosion rates in northwest Missouri may rise from 10 to 40 percent as these highly erodible lands return to production (Otte 1996).

Livestock continues to be the main non-point source of organic nutrients to basin streams (MDNR 1995). The total number of livestock within the basin is estimated to equal 4,017,858 PE (T. Barney, USDA-NRCS, personal communication). The extent to which water quality, and subsequently aquatic life, is negatively affected by animal waste is difficult to estimate. The lack of adequate vegetation or buffer strips between feedlots or holding facilities and the stream allows runoff to carry waste and soil directly to streams. Direct access to streams by cattle is another major non-point pollution source within the basin. Excessive or untimely land application of animal waste can also add pollutants to basin streams. All of these situations can result in increases in sedimentation, fecal coliform bacteria, phosphorus, nitrates, ammonia nitrogen, and lowered dissolved oxygen (MDNR 1989).

Table 11. Selected water-quality for the Platte River at Sharps Station, MO at gage station 06821190, water years 1986 and 1994 (USGS 1987; USGS 1994; Missouri Code of State Regulations 10 CSR 20.7).

	State Standard				Water Year	Water Year
Parameter	**I**	**III**	**VI**	**VII**	**1986**	**1994**
Temperature (Deg. F)	90 deg max				33.8-80.6	45.5-82.4
Specific Conductance (us/cm)					137-394	307-406
Turbidity (NTU)					8.1-750	33-63
Oxygen, dissolved (mg/l)	5				5.1-15.6	7.0-13.7
Coliform, fecal (Cols./100ml)				200-storm runoff	600[K]-23,000	44-410[K]
Streptococci, fecal (Cols./100ml)					3200[K]-35000	52-2300[K]
Total hardness (mg/l) $CACO_3$					54-190	130-180
Nitogen, total ammonia + organic (mg/l as N)	dependent on pH and temp.				0.70-2.1	1.2-4.6
Phosphorus, total (mg/l as P)					0.090-0.550	0.200-0.300
Manganese, dissolved (ug/l as Mn)		50		50	170-440	54-190
Iron, dissolved (mg/l as Fe)	1,000	300		300	18-100	6-18

K: Non-ideal count of colonies (e.g., sample was not diluted enough, colonies merged)
I: Protection of aquatic life
III: Drinking water supply
VI: Whole body-contact recreation
VII: Groundwater

Table 12. Municipal sewage treatment plants (STP's) within the Platte River basin (MDNR and IADNR 1996 data) .

Facility Name	Receiving Stream	Flow** (MGD)	Type	Location T R S
Gower STP	Jenkins Branch	0.119	3 Cell Lagoon	55N 33W 04
St. Joe, Faraon St. STP	102 River	0.414	2 Cell Lagoon	57N 34W 07
K.C., Northland STP	Wilkerson Creek	0.030	Extended Aeration Activated Sludge	52N 32W 19
K.C., Rocky Branch STP	Rocky Branch Creek	0.745	Contact Stabilization 2 Cell Lagoon	52N 33W 11
Smithville STP	Little Platte River	0.090	2 Cell Aerated Primary	53N 33W 22
Plattsburg STP	Smithville Reservoir	0.200	Trickling Filter	55N 32W 25
Trimble STP	Dicks Creek	*	Currently Unsewered Under Construction	54N 33W 26
Clarksdale STP	Third Fork	*	Currently Unsewered Under Construction	58N 32W 30
King City STP	Little Third Fork	0.080	2 Cell Lagoon	60N 32W 08
Stewartsville STP	Castile Creek	0.105	3 Cell Lagoon	57N 32W 21
Union Star STP	Third Fork	0.032	3 Cell Lagoon	60N 33W 34
Barnard STP	102 River	0.008	3 Cell Lagoon	62N 35W 15
Conception Junction STP	Platte River	0.008	3 Cell Lagoon Sludge Lagoon	63N 34W 14
Hopkins STP	Middle Fork 102 R.	0.060	3 Cell Lagoon	66N 35W 02
Maryville STP	102 River	1.400	5 Cell Aerated Lagoon	64N 35W 22
Ravenwood STP	Platte River	0.003	2 Cell Lagoon Sludge Lagoon	64N 34W 13
Edgerton STP	Grove Creek	0.016	2 Cell Lagoon	54N 33W 08
K.C., Todd Creek STP	Todd Creek	1.200	Contact Stabilization Sludge Lagoon	52N 34W 01
Platte City STP	Platte River	0.250	Extended Aeration Activated Sludge	53N 35W 35
Tracy STP	Trib. to Platte River	0.009	Extended Aeration	53N 35W 23
Clearfield STP	Turkey Creek	*	Waste Stabilization Lagoon	69N 31W 06
Lenox STP	Middle Br. 102 River	*	Aerated Lagoon	70N 32W 07
Bedford STP	East Fork 102 River	*	Trickling filter	68N 34W 26
New Market STP	West Fork 102 River	*	Waste Stabilization Lagoon	69N 35W 32
Creston STP	Trib. to Platte River	*	Trickling Filter	72N 31W 01
Cromwell STP	West Fork Platte River	*	Waste Stabilization Lagoon	72N 31W 07

*information not available, ** MGD = Millions of gallons per day

Table 13. Permitted point pollution sources in the Missouri portion of the Platte River basin (MDNR 1997 data).

Facility Name	Receiving Stream	Location (T R S)	County
Midwest Acres Inc.	Trib to 102 River	60N-35W-33	Andrew
Marcum Oil and Gas	Trib to 102 River	59N-35W-09	Andrew
MMA, Flag Springs Quarry	Trib to 102 River	60N-35W-24	Andrew
Herzog Red E Mix	102 River		Andrew
St. Joseph Wilburt	102 River		Andrew
Shady Lawn Rest Home	Long Branch	59N-34W-18	Andrew
North Andrew R-6	Kellog Branch	60N-35W-07	Andrew
Bolckow Water System	102 River	61N-35W-03	Andrew
Dishman Lime and Phosphorus	Niagara Creek	59N-33W-19	Andrew
Rea Grain and Feed Co.	Trib to Platte River	61N-34W-29	Andrew
Acoustics Dev. Corp.		52N-35W	Buchanan
Altec Industries Inc.	Trib to Platte River	57N-34W-03	Buchanan
Bessie Ellis School	Trib to Platte River	57N-34W-10	Buchanan
Boehringer Ingelheim	Trib to 102 River	57N-35W-02	Buchanan
Carriage Oaks II	Trib to 102 River	58N-35W-35	Buchanan
Cristgen 66	Trib to 102 River	57N-35W-11	Buchanan
Drury Conoco	Trib to 102 River	57N-35W-02	Buchanan
Green Acres Rest Home	Trib to 102 River	58N-35W-27	Buchanan
National Guard Shop	Trib to 102 River		Buchanan
Mitchell Woods Bus. Prk.	Trib to 102 River	57N-34W-17	Buchanan
Norris & Sons Transfer	Trib to 102 River	57N-35W-13	Buchanan
Purina Mills Inc.	Trib to 102 River	57N-35W-26	Buchanan
Richmond Screw Anchor	Trib to 102 River	57N-35W-25	Buchanan
St. Joe Sanitary Landfill	Pigeon Creek	56N-35W-13	Buchanan
Swiss Highlands	Trib to 102 River	58N-35W-34	Buchanan
Woodbine Road Paving	Trib to 102 River	57N-34W-06	Buchanan
169 Hwy. Partnership	Trib to 102 River	57N-35W-25	Buchanan
Communities of Bristo	Little Platte River		Clay
Harborview 4th and 5th	Little Platte River	53N-33W-12	Clay
Little Platte Park	Little Platte River	53N-33W-12	Clay
Somerbrooke	Wilkerson Creek	52N-33W-26	Clay
Timber Court	Wilkerson Creek	52N-33W-26	Clay
Airy Acres Mobile Homes	Castile Creek	55N-33W-15	Clinton
AT&T Cable Removal	Castile Creek	55N-33W-01	Clinton
AT&T Cable Removal	Horse Fork	55N-31W-07	Clinton
AT&T Cable Removal	Little Platte River	55N-31W-08	Clinton
Centennial Acres	Grove Creek	54N-33W-15	Clinton
Everett Quarries	Trib to Platte River	55N-33W-32	Clinton
Everett Quarries	Little Platte River	55N-31W-30	Clinton
Everett Quarries	Little Platte River	55N-31W-29	Clinton
Sur-Gro,Plattsburg	Little Platte River	55N-32W-23	Clinton
United Coop	Little Platte River	55N-32W-23	Clinton
Waste Water Collection	Trib to Platte River	54N-33W-26	Clinton

Table 13, continued.

Facility Name	Receiving Stream	Location (T R S)	County
MFA Oil Co.	Elm Grove Branch	61N-32W-32	Gentry
Sur-Gro, King City	Elm Grove Branch	61N-32W-32	Gentry
Conoco All-Pro	White Cloud Creek	64N-36W-14	Nodaway
Gray Oil & Gasoline	White Cloud Creek	65N-35W-31	Nodaway
Kawasaki Motors Mfg.	White Cloud Creek		Nodaway
Laclede Chain Mfg.	Trib to 102 River		Nodaway
LMP Steel and Wire Mfg.	Trib to 102 River		Nodaway
Maryville Sanitary Landfill	White Cloud Creek	64N-35W-07	Nodaway
Metal Culverts, Maryville	Trib to 102 River		Nodaway
MFA Agri-Service	Trib to Platte River	63N-34W-14	Nodaway
MFA Bulk Storage	Trib to 102 River	64N-35W-07	Nodaway
Barnard Quarry	Trib to 102 River	62N-35W-09	Nodaway
Gooden Quarry	Trib to Platte River	65N-33W-31	Nodaway
Mount Alverno	Trib to Platte River	64N-34W-14	Nodaway
Nodaway Worth Elec.	Trib to Platte River	64N-34W-23	Nodaway
Airworld Center	Todd Creek	52N-34W-25	Platte
Basswood Country RV	Little Platte River	53N-34W-27	Platte
Choice Properties	Second Creek	52N-34W-36	Platte
Citicorp Credit Service	Second Creek	52N-34W-25	Platte
Conoco Portable	Todd Creek	52N-34W-15	Platte
Coves North 13th	Second Creek	51N-33W-08	Platte
Erie Strayer Central	Prairie Creek	52N-34W-09	Platte
Harley Davidson Mfg.	Todd Creek	52N-34W-24	Platte
Hunt Midwest	Todd Creek	53N-34W-36	Platte
Hunt Midwest	Todd Creek	52N-34W-02	Platte
K.C. International Air	Todd Creek	52N-34W-22	Platte
K.C. International Air	Todd Creek	52N-34W-34	Platte
Trans World Airlines	Todd Creek	52N-34W-23	Platte
KCI Multipurpose Exp.	Prairie Creek	52N-34W-09	Platte
Kelly Crossing	Second Creek	51N-33W-18	Platte
Lakes at Oakmont	Prairie Creek	52N-34W-07	Platte
North American Auction	Platte Creek	53N-35W-11	Platte
Alan Acres	Second Creek	52N-33W-06	Platte
Platte Co. R-III Elementary	Trib to Platte River	53N-35W-36	Platte
Platte Co. Ready Mix	Trib to Platte River		Platte
Prairie View Plaza	Prairie Creek	52N-34W-06	Platte
Quick Trip #256	Trib to Platte River	53N-34W-31	Platte
Shiloh Golf Course	Trib to Platte River	53N-34W-33	Platte
Timber Creek	Second Creek	53N-33W-32	Platte
Timber Park	Prairie Creek	52N-34W-07	Platte
MFA Bulk Storage	Trib to Platte River	66N-33W	Worth
Sheridan Rural Rental	Trib to Platte River	66N-33W-15	Worth

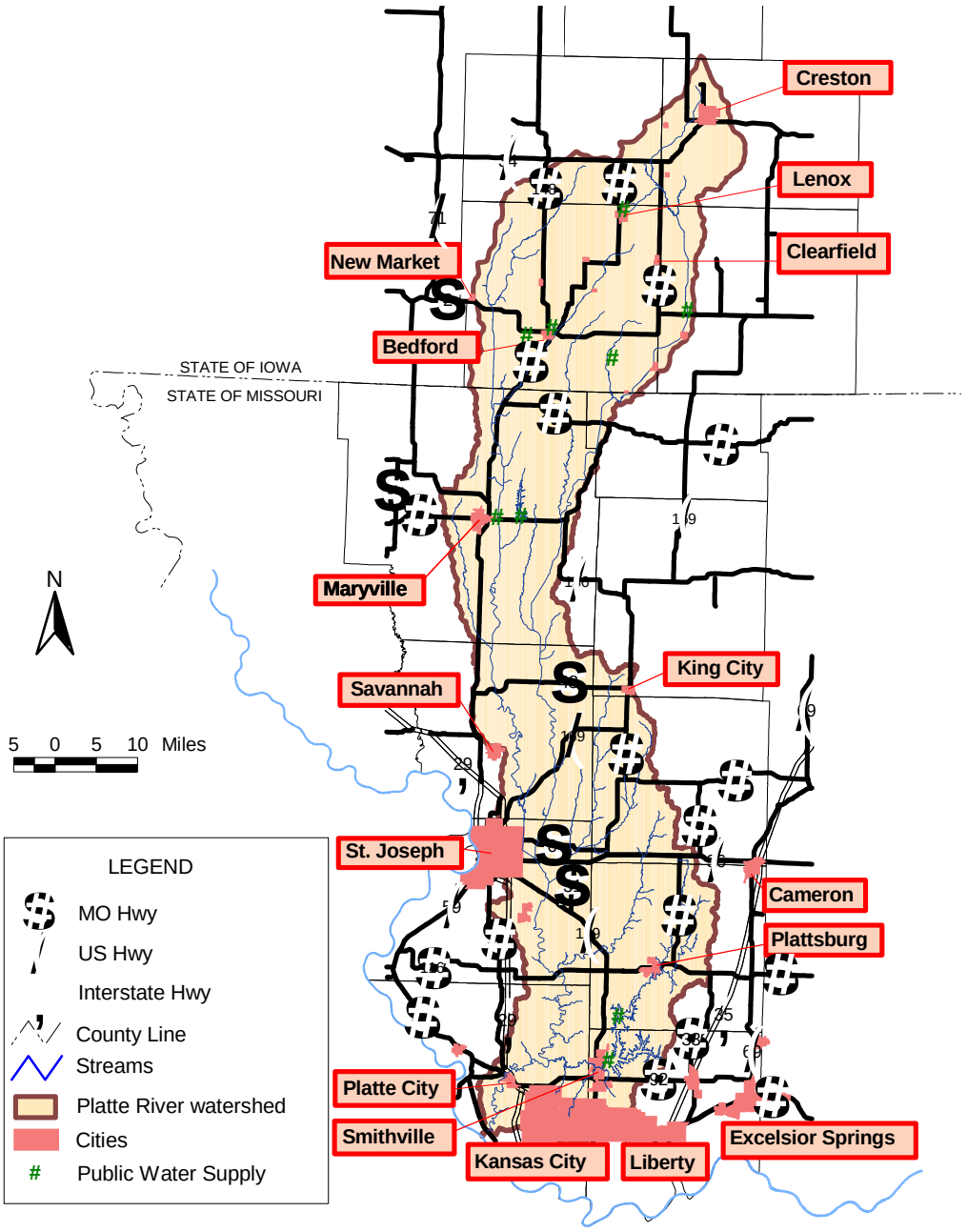

Figure ws. Water surface intake sites within the Platte River basin.

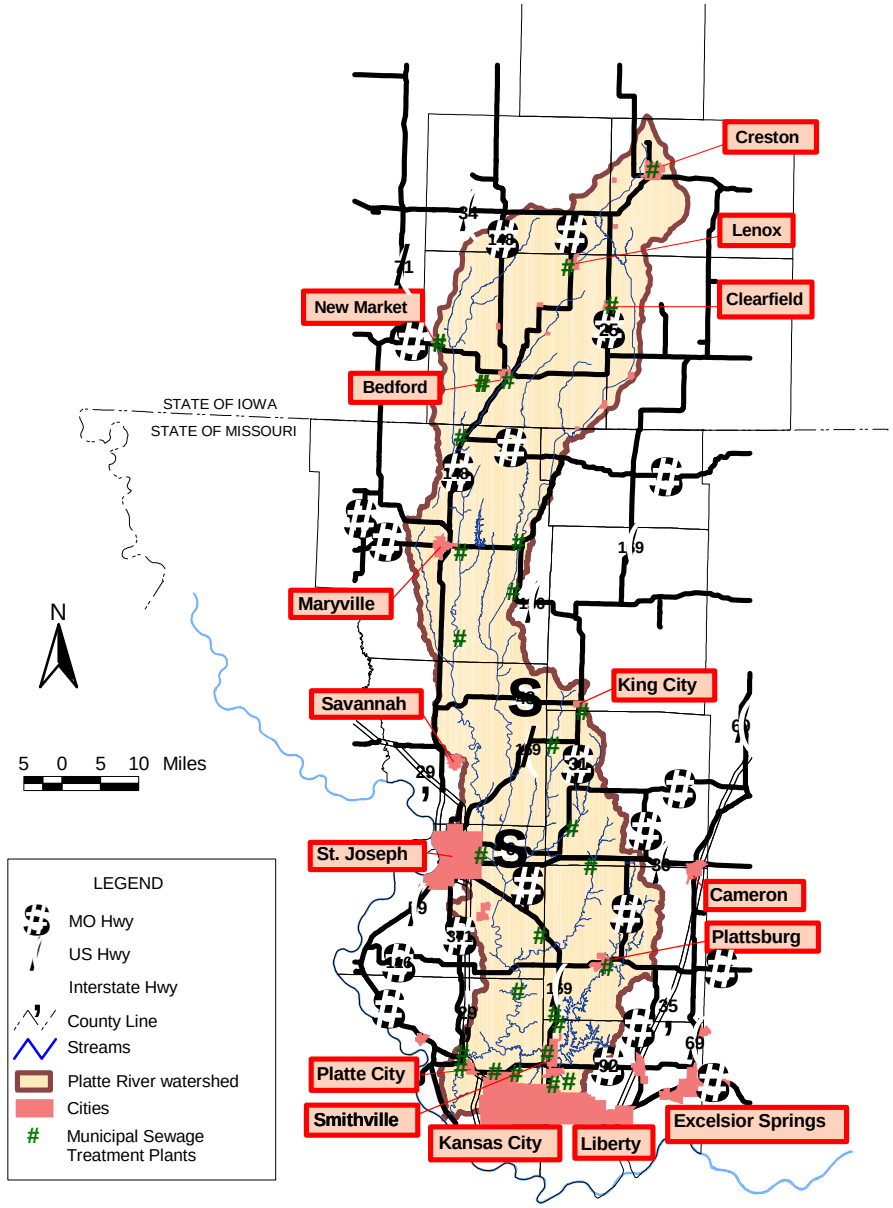

Figure st. Municipal sewage treatment sites within the Platte River basin.

Table 14. Permitted Concentrated Animal Feeding Operations (CAFO's) in the Platte River basin (MDNR and IADNR 1996 data).

Facility I.D.	County	Waste Type[1]	Animal Amount[2]	Population Equivalent	Facility Type	Location T R S
LA7000532	Andrew	SF	306	673		60N 33W 09
LA7000405	Andrew	SF	240	528		59N 33W 09
LA7102272	Andrew	SF	470	1,034	Aerobic Lagoon	59N 34W 21
LA7103771	Andrew	SS	40	1,449	Concrete Pit	60N 35W 33
ND7100153	Andrew	SN	500	1,100		60N 34W 30
LA7100026	Andrew	DM	80	1,840		58N 34W 17
LA7000539	Andrew	SS	400	2,395		60N 34W 31
LA7100828	Andrew	SF	650	1,430		59N 34W 29
LA7103774	Buchanan	PB	80,000	6,154	Dry Manure Storage, Compost	55N 34W 17
ND7100156	Buchanan	DM	140	3,220	Earth Manure Pit	57N 34W 36
LA7000389	Buchanan	DM	90	2,070		57N 34W 07
LA7101135	Buchanan	SF	600	1,320		57N 34W 08
LA7103637	Buchanan	SF	200	440		55N 33W 17
LA7103747	Buchanan	SS	32	231	Anaerobic Lagoon	56N 34W 35
LA7100007	Buchanan	DM	50	1,150		57N 34W 04
LA7000557	Buchanan	SS	24	108		57N 34W 14
LA7103755	Buchanan	SS	12	141	Anaerobic Lagoon	56N 33W 32
LA7100118	Clinton	SF	420	924		55N 32W 03
LA7100008	Clinton	SS	26	117		57N 31W 30
LA7000558	Clinton	SF	420	924		56N 31W 02
LA7100009	Clinton	SF	625	1,375		55N 32W 32
LA7000056	Clinton	SF	320	704		54N 33W 14
LA7000542	Clinton	SF	560	1,232		55N 31W 02
LA7100006	Clinton	SS	12	141		56N 33W 21
LA7000534	Clinton	DM	80	1,840		55N 33W 24
LA7103769	Clinton	SS	150	4,211		56N 33W 27

Table 14, continued.

Facility I.D.	County	Waste Type[1]	Animal Amount[2]	Population Equivalent	Facility Type	Location T R S
LA7103729	Clinton	SF	1,150	3,323	Concrete Pit	55N 32W 03
LA7103808	Clinton	SF	3,840	8,179	Anaerobic Lagoon	56N 31W 23
LA7102753	Clinton	SN	240	240		57N 31W 32
LA7102508	DeKalb	SS	24	444		60N 33W 26
LA7103758	DeKalb	DM	140	3,640	Anaerobic Lagoon	57N 33W 10
LA7103826	DeKalb	SS	75	1,700	Anaerobic Lagoon Concrete Pit	60N 32W 30
LA7103800	DeKalb	DM	400	3,360	Anaerobic Lagoon	57N 33W 11
LA7103739	DeKalb	PB	36,000	3,600	Dry Manure Storage	
LA7103813	DeKalb	PB	80,000	12,111	Dry Manure Storage, Compost	58N 22W 01
LA7103779	DeKalb	DM	120	3,406	Vegetative Filter	58N 32W 13
ND7100168	DeKalb	BF	125	2,542		58N 32W 09
LA7103748	DeKalb	SS	83	1,950	Anaerobic Lagoon	60N 32W 29
LA7000416	DeKalb	SF	170	374		59N 32W 04
LA7101253	DeKalb	SF	400			59N 32W 08
LA7000278	DeKalb	DM	90	2,070		58N 32W 25
ND7100524	Gentry	SF				61N 32W 21
LA7000279	Nodaway	SS	34	363		63N 35W 08
LA7000429	Nodaway	SS	40	180		63N 35W 23
LA7000212	Nodaway	SS	152			67N 36W 34
LA7102067	Nodaway	SS	16	72	Anaerobic Lagoon	65N 35W 02
LA7100021	Nodaway	SS	16	72	Earth Manure Pit	62N 34W 10
LA7000244	Nodaway	DM	135	3,105		64N 35W 31
LA7103806	Nodaway	SS	202	9,245	Dry Manure Storage, Anaerobic Lagoon	65N 35W 31
LA7000472	Nodaway	SN	200	140		65N 35W 09
LA7103746	Nodaway	SS	24	282	Anaerobic Lagoon	62N 35W 12
LA7000455	Nodaway	SF	750	1,848		63N 34W 17

Table 14, continued.

Facility I.D.	County	Waste Type[1]	Animal Amount[2]	Population Equivalent	Facility Type	Location T R S
LA7103762	Nodaway	SS		1,976	Anaerobic Lagoon Concrete Pit Vegetative Filter	64N 36W 22
LA7000078	Nodaway	SF	500	1,100		64N 36W 34
LA7100725	Nodaway	SF	800	1,760		67N 35W 36
LA7000094	Nodaway	SN	160	166		65N 33W 08
LA7103784	Nodaway	SF	1,800	4,050	Earth Manure Pit	64N 33W 31
LA7100800	Nodaway	SS	360	1,620		63N 34W 19
LA7000275	Nodaway	SF	240	440		63N 35W 19
LA7100020	Nodaway	SS	20	90	1 Cell Lagoon	63N 35W 19
LA7103791	Platte	SS	1,200	8,415	Anaerobic Lagoon	53N 33W 06
MOG010019	Platte	SS	192	8,415	Anaerobic Lagoon	53N 33W 06
LA7102633	Platte	DM	100	2,300	Anaerobic Lagoon	52N 33W 17
LA7100010	Platte	SS	30	369		54N 34W 20
ND7100319	Platte	SF	90	198	1 Cell Lagoon	54N 34W 31
LA7103735	Platte	SS	570	3,835	Concrete Pit	53N 33W 09
Iowa	Ringgold	SN	455,000	6,825	Lagoon	70N 31W 10
Iowa	Ringgold	SS	1,462,500	21,907	Lagoon	70N 31W 04
Iowa	Ringgold	SS	1,050,000	15,750	Lagoon	68N 31W 17
Iowa	Ringgold	SS	405, 000	6,075	Lagoon	68N 31W 31
Iowa	Taylor	SS	367,500	6,825	Basin Earthen	68N 32W 11
Iowa	Taylor	SF	455,000	5,513	Lagoon	69N 32W 36
Iowa	Taylor	SS	288,000	4,020	Basin Earthen	68N 32W 12
Iowa	Taylor	SS	1,920,000	28,800	Lagoon	69N 33W 15
Iowa	Taylor	SS	270,000	4,050	Basin Earthen	70N 33W 31

1. Waste Type: Beef feeding (BF); Dairy milking (DM); Poultry broiler (PB); Swine finishing (SF); Swine nursery of pigs (SN); Sows, boars, farrowing (SS).

2. Animal Amounts: Missouri amounts are listed in animal units. Iowa amounts are listed in pounds of live weight.

HABITAT CONDITIONS

Channel Alterations

Channelization and levee construction were once a widely used and accepted technique in stream management in Missouri, especially in the more productive agricultural areas such as the Platte River basin. The objectives of channelization were to reduce floods by permitting more rapid run-off of precipitation and to facilitate drainage of low-lying agricultural land. Levees were also constructed to eliminate or reduce flooding by isolating a stream from its flood plain. Effects of channelization and levee construction include loss of stream habitat, loss of aquatic productivity, increased stream bed and bank erosion, and a reduction of ground water levels.

Originally, the Platte and 102 rivers were sinuous, and meandered from wide to narrow alluvial valleys. However, most of the channels through the wide upstream areas were straightened prior to the 1930's, but relatively few channel alterations were made in the narrower downstream valley reaches (Committee on Public Works 1965). About 250 stream miles have been lost in the Platte River basin due to channelization (Table 15 ; Appendix D - see Hydrology chapter), and this represents about a 20% loss in stream mileage for fourth order and larger streams. Larger streams within the basin have been channelized to a greater extent than lower order streams (Table 15; Appendix D). All sixth order and larger streams within the basin have been channelized. Seven out of the 11 fifth order streams have been channelized, while 41 of 74 fourth order streams have experienced channelization. Any flood control benefits that resulted from channelization during the 1930's is rapidly diminishing because much of the down-cutting in the basin is complete and now sedimentation and filling of the channel is occurring (USDA-SCS 1982).

Unique Habitats

Aquatic habitat throughout the Platte River basin has been degraded through channelization and erosion. Because of this habitat degradation, any substantial section of larger streams that has not been channelized or significantly affected by channelization (e.g., downcutting) should be considered unique. Coarse substrate within streams is also rare, and therefore, it could also be considered unique where it occurs. Castile Creek, located in the lower portion of the basin, was listed as an exceptional prairie stream due to the clear water and gravel substrate present (Currier and Smith 1988). Honey Creek was considered to be one of the better tributaries of the upper Platte River (see Pflieger memorandum dated 9-26-91), and was tentatively classified as notable. Two small waterfalls were considered notable within the basin (Kramer 1993). Rochester Falls is located on the Platte River near Rochester, Missouri (59N 34W S22), while the other unnamed waterfall is on the 102 River east of Savannah, Missouri (59N 34W S14,15). MDC owns a frontage site along the Platte River at the Rochester Falls area.

Three marshes were identified within the basin as unique (Currier and Smith 1988; Kramer 1993), primarily because marsh communities within the region are now rare due to channelization and levee construction (Currier and Smith 1988). Little Platte Marsh in Clay County (53N 33W S22) was listed as significant by Currier and Smith (1988), but this 15-acre marsh was considered to be moderately disturbed due to historic and current grazing. Two

marshes in Nodaway County were listed as notable (Kramer 1993). The first marsh (65N 35W S9) was three to four acres in size, and it was moderately disturbed with low plant diversity, likely a result of grazing. The other marsh (65N 33W S19, 20) was three acres in size and had a moderate diversity of plants. However, it was considered moderately disturbed because of being surrounded by crop fields and having a power line crossing the west side.

Improvement Projects

Only one improvement project has been completed within the Platte River basin. It is located on an unnamed tributary of Castile Creek (57N 32W S4, 9) in DeKalb County. The project, completed in 1994, included 150 to 200 feet of cedar tree revetment along the streambank for stabilization and 1.4 miles of fencing to exclude cattle from the stream. However, the MDC "Streams for the Future" program will likely generate some new improvement projects within the basin. This program consists of three components: stream / watershed restoration, alternative livestock watering sources, and stream stewardship agreement. All three components are designed to improve water quality and overall stream health.

Stream Habitat Assessment

Stream habitat was assessed at three sites (Figure hs) in the Iowa portion of the basin by Iowa Department of Natural Resources personnel using a metric type index based on flow, substrate diversity, pool-riffle frequency, channel alterations, bank stability, bank cover, and influence of waste water treatment facilities on streamflow or habitat. Based on these criteria, habitat at all three sites was classified as fair.

Stream habitat was described qualitatively within the Missouri portion of the Platte River basin at the 18 sites (Figure hs) sampled for fish community composition in 1995 and 1996. The homogenous habitat conditions throughout the basin allowed generalizations to be made with regard to stream habitat conditions within the basin. Streambanks along channelized reaches were highly susceptible to erosion (bank stability ranked as fair to poor) resulting in poorly vegetated (generally herbaceous vines with shallow root systems), high vertical stream banks. In areas that were not channelized, streambanks generally were more stable (usually had stability ranking of good), and over 50% of the streambank vegetation consisted of trees and shrubs.

Most streams throughout the basin have little or no woody stream corridor. None of the sites surveyed had a 100 feet wide wooded corridor, and most had less than 50 feet width of woody vegetation along either streambank. Fencing of the stream corridor was rare. When cattle were present they usually had free access to the streams causing further habitat degradation. Land use at over half of the sites surveyed consisted entirely of row crop production, and crops were often planted up to the edge of the streambank. Land use at the remaining sites consisted of 20 to 50% pastured areas with the remaining land generally in row crop production.

Channel conditions throughout the basin were generally poor. Channelization and siltation have eliminated much of the riffle-pool complex in most of the streams within the basin. Loss of quality pool habitats, large woody debris, and riffles, are serious habitat related problems in the Platte River basin. Elimination of this habitat has likely resulted in the decrease of fish production throughout the basin. Instream habitat was lacking. Instream habitat usually consisted

of a small root wad or a tree in channelized sections with larger amounts of woody cover in unchannelized sections. Substrates varied at each of the sampling sites, but sand generally dominated substrate composition at all sites. Silt and clay substrates were also relatively common substrates. When larger substrate was present, it was often covered with silt, and interstitial areas were often reduced or eliminated due to siltation.

Table 15. Miles of stream channelization for fourth order and larger streams within the Platte River basin.

Order	Total Number of Streams	Number of Streams Unaltered	Original Miles	Current Miles	Miles Lost to Channelization (% of orig.)	Current Miles Channelized (% of current)	Current Miles Unchannel-ized (% of current)
8	1	0	281.1	195.5	85.6 (30.5)	89.9 (46.0)	105.6 (54.0)
7	1	0	53.1	41.8	11.3 (21.2)	18.5 (44.3)	23.3 (55.7)
6	3	0	206.2	175.9	30.3 (14.7)	45.3 (25.8)	130.6 (74.2)
5	11	4	269.5	227.1	42.4 (15.7)	53.1 (23.4)	174.0 (76.6)
4	74	33	664.0	583.7	80.3 (12.1)	102.6 (17.6)	481.1 (82.4)

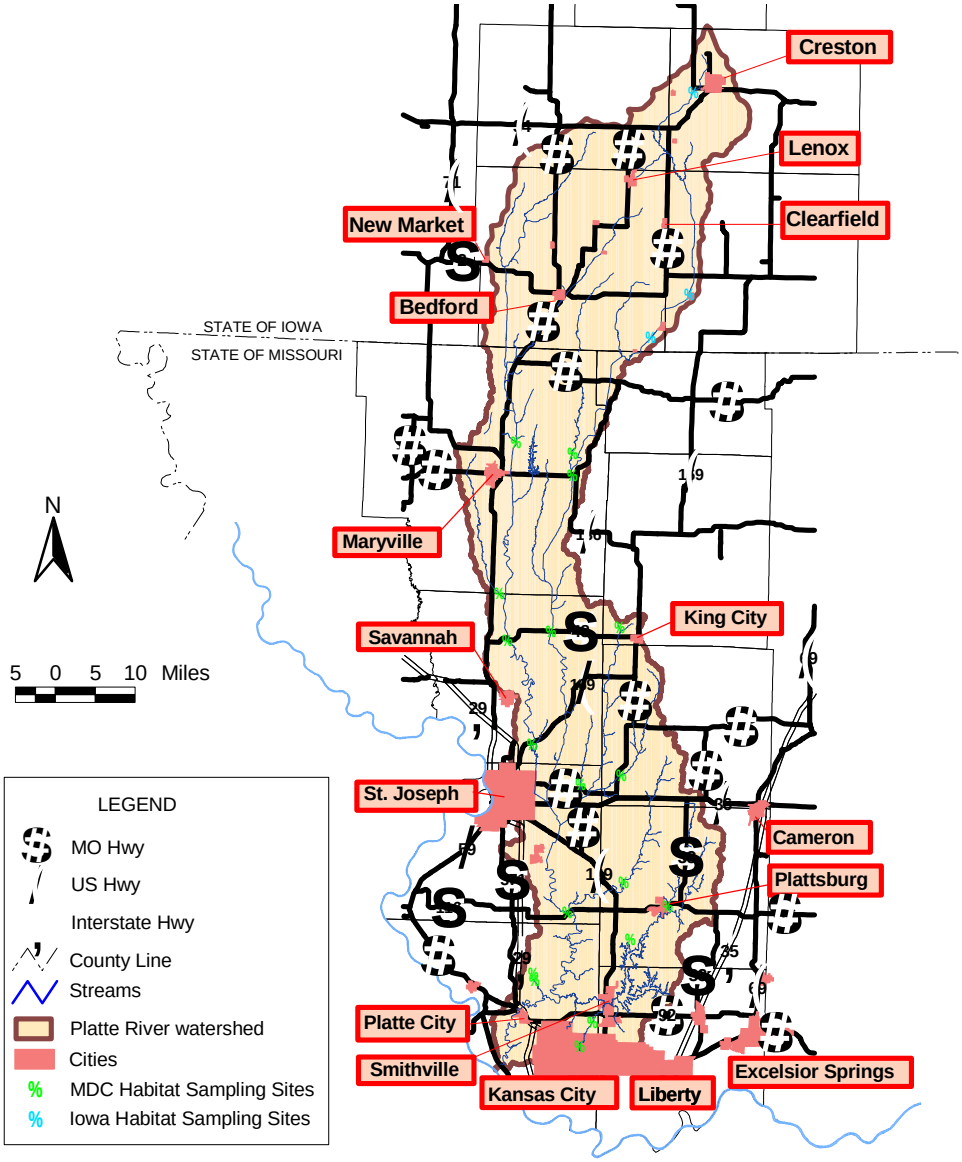

Figure hs. Habitat sampling sites within the Platte River basin in Missouri and Iowa.

BIOTIC COMMUNITIES

Fish Community Data

Fifty-one species of fish, representing 15 families, have been collected from the Platte River basin since 1941, and of these, five were identified from angler creel records (Table 16). Distribution maps from Pflieger (1975) indicate that the ranges of 23 additional species include parts of the basin, although none of these species have been collected within the basin. Four species of fish were only collected prior to 1905, and they include common shiner (*Notropis cornutus*), Topeka shiner (*N. topeka*), hornyhead chub (*Nocomis bigattatus*), and johnny darter (*Etheostoma nigrum*). These four species were each collected at separate single locations and have not been sampled since their initial collection which suggests they have been extirpated from the basin (Pflieger 975). Locations of recent and historical fish collection sites are shown in Figure fs and Table 17 gives a summary of the fish and habitat sample sites from the recent MDC collections.

Eighteen sites were recently sampled by MDC personnel throughout the basin during 1995 and 1996 (Table 17, Figure fs), and these samples (excluding Location # 1378 which was affected by Smithville Lake) are the basis for the following comparisons. The most common group of fishes (by number) collected based on geographical distribution patterns of Pflieger (1971) were those classified as wide ranging, and these accounted for 42.2% of all fish collected. Six other faunal groups were represented and are ranked as follows: big river (20.1%), prairie (20.0%), Ozark prairie (6.7%), Ozark (4.4%), lowland (4.4%), and Ozark lowland (2.2%). Dominant families included Cyprinidae (minnows; 16 species), Catostomidae (suckers; seven species), Ictaluridae (catfish; six species), and Centrarchidae (sunfish; seven species).

Red shiner was the most abundant species overall, and was also the most common nektonic, mid-water, species collected. They accounted for 67.1% of the fish collected in the recent samples, and they were found at all of the sites. The second most common nektonic species was sand shiner, and they accounted for 11.2% of the overall sample. Other common nektonic species in order of abundance were bigmouth shiner, central stoneroller, creek chub, and fathead minnow. The most commonly collected large fish was green sunfish, accounting for 2.9% of the recent sample. Other common large species in order of abundance were channel catfish, bluegill, yellow bullhead, common carp, largemouth bass, and river carpsucker. Benthic species were the most lacking group in terms of diversity and numbers within the basin. However, this is somewhat common for this type of system. The suckermouth minnow was the most abundant benthic species sampled, comprising 96.0% of the benthic sample and accounting for 1.2% of the overall sample. The only other representatives in this category were three stonecat, and one tadpole madtom. The collection of the tadpole madtom indicates an extension of its described range (Pflieger 1971, 1975).

Channel catfish and flathead catfish are two of the most popular sportfish within the basin. All reaches of the Platte River and its tributaries offer good catfishing opportunities, but the best fishing is found in the lower unchannelized reaches of the Platte River. Common carp and bullheads also provide angling opportunities throughout the basin, while white bass and crappie

provide seasonal opportunities. The Missouri state record grass carp was taken from the Platte River near MDC's Saxton Access in 1992, and it weighed 55 pounds and 12 ounces.

A detailed study comparing fish populations in channelized versus unchannelized portions of the Platte River was conducted by Michaelson (1971). Results from the study indicated that an inverse relationship existed between abundance of fish and amount of stream channelization. The study found that average standing crop of fish at two unchannelized sites was 691.5 pounds per acre compared to 103.0 pounds per acre at two channelized sites. This represented an 85% reduction of fish from unchannelized to channelized sites. The study also showed a 77% reduction in number of harvestable size (> 10 inches) fish per acre and a 90% reduction in pounds of harvestable fish per acre in the channelized sites compared to unchannelized sites. An estimate of the amount of fish that would be lost if the remaining 56 miles of unchannelized Platte River (from Agency to the Missouri River) were channelized was also formulated. It was estimated that about 130,000 pounds (86%) of all fish and 131,000 pounds (91%) of harvestable sized fish would be lost (note - the loss of harvestable-sized fish is greater than the loss of the total fish population because channelized sections contain disproportionately fewer numbers of harvestable-sized fish). Currently, the Platte River from Agency to its mouth remains unchannelized, and it is probably one of the best remaining sections of fishable river left in the basin.

Aquatic Invertebrates

A. Mussels- A 1913 survey of the northern Missouri rivers found that the Platte River and its tributaries held a considerable number of mussels of commercial value, and the resource was in demand due to mussel depletions from the Missouri and Mississippi rivers (Campbell 1914). The mussel resources in the Platte River basin were soon depleted (Oesch 1984), but recent sampling of streams in northern Missouri has found mussels that were once thought to be eliminated (S. Bruenderman, MDC, personal communication). Chemicals related to agriculture and high rates of sedimentation have also been detrimental to mussels within the basin. Oesch (1984) indicated that 16 species of freshwater mussels historically occurred in the Platte River basin (Table 18).

B . Aquatic Insects- A detailed survey of benthic macroinvertebrates was conducted in 1974 and 1976 on the Little Platte River (river mile 34) prior to impoundment of Smithville Lake (USCOE 1981). The 1974 sample was conducted at a riffle just downstream from the Plattsburg sewage treatment plant and an area landfill. Samples collected from the site indicated a fairly diverse community, but one with limited density. The low density was attributed to runoff from the two upstream pollution sources. The site was resurveyed in 1976, and diversity was comparable between the two years (19 taxa collected each year). Benthic density substantially increased from 3,391 organisms/meter^2 in 1974 to 16,454 organisms/meter^2 in 1976. The 1976 sample was dominated by species that were tolerant of low dissolved oxygen and pollution. This was not true of the 1974 sample. The high density of pollution tolerant species combined with the chemical nature of the water gave evidence that the two sources were contributing organic pollution to the stream.

Pool habitats within the Little Platte River were sampled in 1976. Benthic densities in pools in the lower and middle reaches were lower than benthic densities in pools of upper stream reaches. The upper pools also contained more pollution intolerant species. Community diversity in pool habitats was lower than those in the riffle situations, which would be expected.

Macroinvertebrates were also collected in Camp Branch and Crows Creek, both tributaries of the Little Platte River. Benthic densities at each of these sites were similar to those found on the mainstem, but community diversity was higher, with several pollution intolerant taxa present (USCOE 1981). The increased macroinvertebrate diversity in tributary streams may be attributed to the more diverse stream habitat along with improved water quality. Silt deposition and loss of habitat due to extensive channelization seem to be major limiting factors in this region along with marginal dissolved oxygen levels and increased nutrient loads.

C. Crayfish- Few species of crayfish are known to occur in the northern prairie region of Missouri, which includes the Platte River basin. Only three of the seven different species thought to occur within the basin have been collected. The northern crayfish (*Orconectes virilis*) is the most abundant crayfish found in the basin, followed by the papershell crayfish (*O. immunis*) and the prairie crayfish (*Procambarus gracilis*), respectively. The devil crayfish (*Cambarus diogenes*) has not been collected in the basin but may occur undetected because of its habit of spending most of its life underground and its general distribution throughout the region (Pflieger 1996).

Threatened and Endangered Species

Topeka shiners were collected in the 102 River near Maryville, MO and Bedford, IA prior to 1905, which suggests a former, more widespread distribution than more recent sampling has indicated. The species has not been collected in the basin since 1905 (Pflieger 1975). Theflathead chub (*Platygobio gracilis*) is a fish associated with the Missouri and Mississippi rivers and enter tributary streams only in extreme northwest Missouri. In smaller streams, the flathead chub prefers pools with moderately clear waters, little current, and bottoms composed of coarse gravel and bedrock. The only documentation within the basin was based on one individual collected in the Platte River near St. Joseph in 1941 (Pflieger 1975). The rock-pocketbook mussel (*Arcidens confragosus*) was collected at one location in the Platte River prior to 1920 and is probably extirpated from the basin (Oesch 1984). Other species that are listed as either threatened or endangered that may occur within the basin are listed in Table 19.

Fish Stockings

Numerous stockings of fish, both native and non-native, have occurred within the basin. The majority of stockings have occurred in private and public lakes and ponds. The most widely stocked fish within the basin is channel catfish. Stocked fish undoubtedly escape, but negative impacts have not been documented within the basin.

Spotted bass (*Micropterus punctulatus*) were stocked in the Platte River at six different sites in 1970 and 1971. A total of 24,000 one to three inch fish was stocked over the two-year period. Since this time, no spotted bass have been collected within the basin. The status of spotted bass is not known at this time, but it is unlikely they are present based on lack of sampling evidence

and their intolerance for water conditions which exist basin wide. Based on follow-up samples of stockings from similar systems it is likely that if a population does exist within the basin it would be in smaller more undisturbed tributary streams (Fajen 1975). A list of species from documented stockings and their locations can be found in Table 20 .

Creel Survey Data

A recreational use survey on the unchannelized portion of the Platte River, from Agency to the confluence with the Missouri River, was conducted by Fleener (1971). Results of the study were considered conservative because surveys were only conducted on public lands and no attempt was made to survey private accesses. The study showed that fishing accounted for 49,500 (51%) of the total trips and 253,315 (73%) of the total hours. Other significant activities included hunting, sightseeing, picnicking, and camping. About 36,000 fish were harvested over this period with 19,500 of them being channel or flathead catfish, and this represented 54% of the total harvest (Table 21) .

Present Regulations

Statewide creel and fish size limits apply to the streams within the basin. One special regulation area does apply: fish may only be taken by pole and line (as defined in the Wildlife Code of Missouri) on the Little Platte River between Smithville Dam and U.S. Highway 169. In addition, special regulations may apply to other public impoundments within the basin.

Table 16. Fish species sampled in the Platte River basin from 1941-1996.

Common Name	Scientific Name	Collected 1941-57	Collected 1958-79	Collected 1980-96
American eel*	*Anguilla rostrata*		X	
Paddlefish	*Polyodon spathula*	X	X	X
Northern pike*	*Esox lucius*		X	
Longnose gar	*Lepisosteus osseus*	X	X	
Shortnose gar	*Lepisosteus platostomus*	X	X	X
Goldeye	*Hiodon alosoides*	X	X	X
Gizzard shad	*Dorosoma cepedianum*	X	X	X
Skipjack herring	*Alosa chrysochloris*			X
Mosquitofish	*Gambusia affinis*		X	X
Brook silverside	*Labidesthes sicculus*			X
Bigmouth shiner	*Notropis dorsalis*	X	X	X
Sand shiner	*Notropis stramineus*	X	X	X
Emerald shiner	*Notropis atherinoides*	X		X
Red shiner	*Cyprinella lutrensis*	X	X	X
Fathead minnow	*Pimephales promelas*	X	X	X
Bluntnose minnow	*Pimephales notatus*		X	
Central stoneroller	*Campostoma anomalum*	X	X	X
Common carp	*Cyprinus carpio*	X	X	X
Grass carp *	*Ctenopharyngodon idella*			X
Bighead carp*	*Hypophthalmicthys nobilis*			X
Plains minnow	*Hybognathus placitus*	X		
Western silvery minnow	*Hybognathus argyritis*	X		
Creek chub	*Semotilus atromaculatus*	X	X	X
Golden shiner	*Notemigonus crysoleucas*		X	X
Redfin shiner	*Lythrurus umbratilis*	X		X
Suckermouth minnow	*Phenacobius mirabilis*	X	X	X

Table 16, continued.

Common Name	Scientific Name	Collected 1941-57	Collected 1958-79	Collected 1980-96
Flathead chub	*Platygobio gracilis*	X		
Bigmouth buffalo	*Ictiobus cyprinellus*	X	X	X
Smallmouth buffalo	*Ictiobus bubalus*	X		X
Quillback	*Carpiodes cyprinus*		X	X
River carpsucker	*Carpiodes carpio*	X	X	X
Shorthead redhorse	*Moxostoma macrolepidotum*			X
White sucker	*Catostomus commersoni*			X
Blue Sucker*	*Cycleptus elongatus*			X
White bass	*Morone chrysops*		X	X
Black bullhead	*Ameiurus melas*	X	X	X
Yellow bullhead	*Ameiurus natalis*	X	X	X
Stonecat	*Noturus flavus*	X	X	X
Tadpole madtom	*Noturus gyrinus*			X
Channel catfish	*Ictalurus punctatus*	X	X	X
Flathead catfish	*Pylodictis olivaris*	X	X	X
Green sunfish	*Lepomis cyanellus*	X	X	X
Bluegill	*Lepomis macrochirus*		X	X
Orangespotted sunfish	*Lepomis humilis*	X	X	X
Redear sunfish	*Lepomis microlophus*			X
Largemouth bass	*Micropterus salmoides*		X	X
Black crappie	*Pomoxis nigromaculatus*	X		X
White crappie	*Pomoxis annularis*		X	X
Walleye	*Stizostedion vitreum*			X
Logperch	*Percina caprodes*			X
Freshwater drum	*Aplodinotus grunniens*		X	X

***indicates record from angler survey**

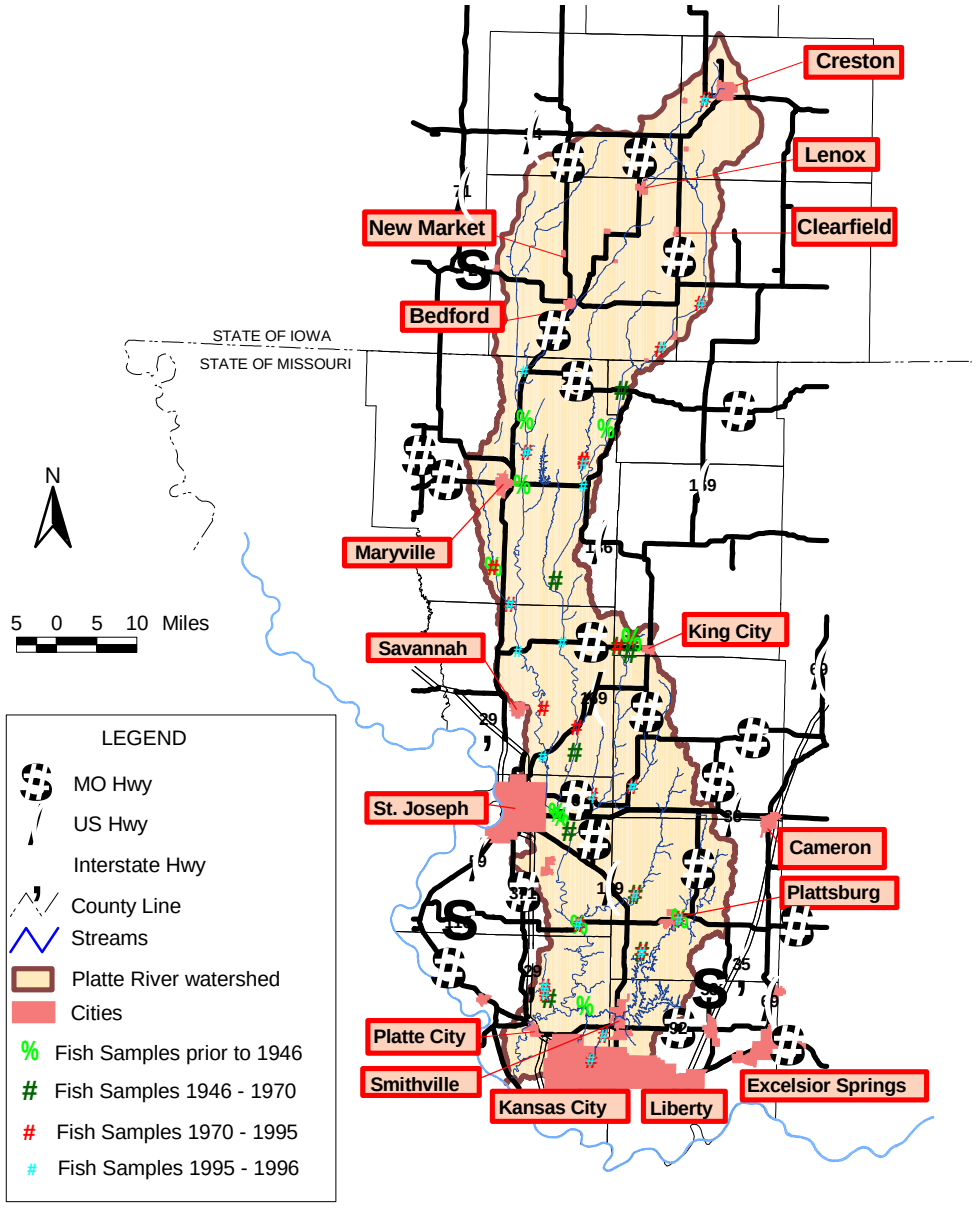

Figure fs. Fish species sampled in the Platte River basin from 1941-1996.

Table 17. MDC fish and habitat sample locations for the Platte River basin plan from 1995-96.

Loc. #	Coll. #	Stream Name	Location (T R S)	Date Sampled	Sample Type * K D EF	# of Fish Types ** L N B T
1719	TW96-02	Horse Fork	55N-32W-24	07-09-96	X X X	7 9 2 18
1326	TW96-01	Third Fork	61N-33W-24	06-27-96	X X X	4 5 0 9
1377	TW96-03	Castile Creek	55N-33W-01	10-07-96	X X X	9 2 1 12
1378	TW96-04	Roberts Branch	54N-32W-08	07-11-96	X	8 1 0 9
	JA96-01	Jowler Creek	53N-34W-06	09-18-96	X	4 2 0 6
	JA96-02	Jowler Creek	53N-34W-06	09-18-96	X X X	3 3 0 6
	JA96-03	Second Creek	53N-33W-33	09-11-96	X X X	8 6 1 15
	JA96-04	Second Creek	52N-33W-19	09-11-96	X X X	6 7 1 14
946G	B95-145	Platte River	64N-34W-14	10-18-95	X X	2 3 2 7
947G	B95-142	Platte River	61N-34W-27	10-17-95	X X	5 5 1 11
952G	B95-141	102 River	61N-35W-34	10-17-96	X X	4 5 1 10
953G	B95-147	Platte River	55N-34W-26	10-19-95	X X	5 4 0 9
2454G	B95-144	102 River	65N-35W-34	10-18-95	X X	4 5 1 10
	MB96-05	102 River	58N-35W-12	11-04-96	X X X	2 5 2 9
	MB96-06	Muddy Creek	57N-33W-06	11-06-96	X X X	6 7 1 14
	MB96-07	Little Third Fork	58N-33W-36	11-06-96	X X X	3 5 1 9
	MB96-08	Honey Creek	64N-34W-02	11-07-96	X X X	3 3 1 7
	MB96-09	White Cloud Cr.	61N-35W-04	11-08-96	X X X	5 4 1 10
	TOTALS	95-96 Sampling				16 11 3 30

*K=Kick seining
D=Drag seining
EF=Electrofishing

**L=Large fish species
N=Nektonic fish species
B=Benthic
T=Total

Table 18. Freshwater mussel species found in the Missouri portion of the Platte River basin (Oesch 1984).

Common Name	Scientific Name	Period Last Collected
Black sandshell	*Ligumia recta*	Before 1920
Deertoe	*Truncilla truncata*	Before 1920
Fragile paper shell	*Leptodea fragilis*	After 1965
Giant floater	*Anodonta grandis* sp.	Before 1920
Mapleleaf	*Quadrula quadrula*	Before 1920
Pimpleback	*Quadrula pustulosa*	Before 1920
Pink heelsplitter	*Potamilus alatus*	Before 1920
Pink papershell	*Potamilus ohiensis*	Before 1920
Pistol grip	*Tritogonia verrucosa*	Before 1920
Rock-pocketbook*	*Arcidens confragosus*	Before 1920
Squawfoot	*Strophitus undulatus* sp.	Before 1920
Threeridge	*Amblema plicata*	After 1965
Threehorn wartyback	*Obliquaria reflexa*	Before 1920
Washboard	*Megalonaias nervosa*	Before 1920
White heelsplitter	*Lasmigona complanata*	Before 1920
Yellow sandshell	*Lampsilis teres* ssp.	Before 1920

*** indicates state listing of rare.**

Table 19. Threatened and endangered species in the Missouri portion of the Platte River basin (MDC 1997; USFWS 1996).

Common Name	Scientific Name	Missouri status	Federal status
Flathead chub	*Platygobio gracilis*	Endangered	
Topeka shiner	*Notropis topeka*	Endangered	Candidate
Rock-pocketbook	*Arcidens confragosus*	Rare	
Henslow's sparrow	*Ammodramus henslowii*	Rare	
Northern harrier	*Circus cyaneus*	Endangered	
Bald eagle	*Haliaeetus leucocephalus*	Endangered	Threatened
Brown bog sedge	*Carex buxbaumii*	Rare	
Sartwell's sedge	*Carex sartwellii*	Endangered	
Rock elm	*Ulmus thomasii*	Rare	

Table 20. Fish stockings within the Platte River basin, except channel catfish, bluegill, and largemouth bass (MDC files; Mike McGhee IADNR, personal communication).

Water body	County	Species Stocked
Smithville Lake	Clinton, Clay	Flathead catfish, Black crappie, White crappie, Fathead minnow, Walleye, Tiger muskie (*Esox masquinongy x Esox lucius*)*, Blue catfish (*Ictalurus furcatus*)*
Nodaway County Community Lake	Nodaway	Gizzard shad, White crappie, Fathead minnow, Northern pike, Tiger muskie*, Grass carp*, Redear sunfish*
Limpp Lake	Gentry	Fathead minnow, Grass carp*, Redear sunfish*
Mozingo Lake	Nodaway	Walleye, Redear sunfish*
Kendzora Lake	Platte	Redear sunfish*
Platte River	Andrew Platte Nodaway	Spotted bass*
Belcher Branch Lake	Buchanan	Fathead minnow, Redear sunfish*
Happy Holler Lake	Andrew	Fathead minnow, Redear sunfish*
Green Valley State Park Lake	Union, IA	Redear sunfish*, Tiger muskie*, Northern pike
Summit Lake	Union, IA	Walleye, Tiger muskie*, Muskellunge (*Esox masquinongy*)*, Northern pike
Blockton Lake	Taylor, IA	Flathead catfish, Redear sunfish*, Black crappie
Wilson Co. Park Lake	Taylor, IA	Walleye, Grass carp*
Windmill Lake	Taylor, IA	Walleye
Lake of Three Fires	Taylor, IA	Flathead catfish, White crappie, Black crappie, Tiger muskie*

***indicates non-native to basin**

Table 21. Estimated fish harvest from Platte River (Agency to confluence with Missouri River) for period of August 31, 1970 to August 29, 1971 (Fleener 1971).

Species	Upper Section	Lower Section	Total Number	Percent of Total
Common Carp	3,710	10,566	14,276	39.6
Channel catfish	2,346	11,436	13,782	38.3
Flathead catfish	173	5,605	5,778	16.0
Bullhead	0	479	479	1.3
Freshwater drum	0	754	754	2.1
Crappie	0	291	291	0.8
Paddlefish	0	72	72	0.2
American eel	486	0	486	1.4
Largemouth bass	66	0	66	0.2
Buffalo	0	16	16	0.1
Total	6,781	29,219	36,000	100.0

MANAGEMENT PROBLEMS AND OPPORTUNITIES

The Platte River Basin Plan was developed to address objectives provided in the Missouri Department of Conservation Strategic Plan, Fisheries Division Operational Plan (FY 1996-2000), Stream Areas Program Plan, and the Stream Access Acquisition Plan. These plans indicate areas of future expanded resource management, public awareness, and access needs. Major areas of concern in the Platte River basin include water quality, riparian and aquatic habitat, aquatic communities, and recreational use. All goals are of equal importance, however, objectives are listed in order of priority under each goal. This plan only includes those items that the Missouri Department of Conservation can reasonably attain or influence during the next 25 years. Completion of these objectives will depend upon their status in overall Regional and Divisional priorities, as well as the availability of personnel and funds.

GOAL 1: IMPROVE WATER QUALITY AND MAINTAIN OR IMPROVE WATER QUANTITY IN THE PLATTE RIVER BASIN SO THAT ALL STREAMS ARE CAPABLE OF SUPPORTING NATIVE AQUATIC COMMUNITIES.

Status: Streams within the Platte River basin suffer from several water quality problems associated with point and non-point source pollution. Sewage effluent from several waste water treatment facilities is the primary point source pollutant within the basin. Turbidity and sedimentation from erosion, and organic runoff from livestock operations are non-point sources of pollution in the basin. The Conservation Reserve Program (CRP) has reduced the acreage of highly erodible soil that once was in row crop production within the basin. However, most contracts will expire by 1998, and this could result in this land reverting to row crop production. In addition, there is increased interest in construction of concentrated animal feeding operations within the basin that could result in an increase in livestock waste runoff.

Objective 1.1: Water quality standards met in all streams within the basin.

Strategy: Enforcing existing state and federal water quality regulations will help reduce the number of violations that currently occur. Providing assistance in gathering additional water quality data within the basin will provide more information about stream health throughout the entire basin. This information can be used to provide justification for further protection and increased enforcement.

- Review NPDES, 404, and other permits and provide recommendations so that compliance with water quality standards are maintained within the basin.

- Collect fish for contaminant analysis for the Missouri Department of Health and cooperate in advising the fishing public on the effects of contaminant levels in fishes within the basin.

- Cooperate with other state and federal agencies to investigate fish kill reports and other water quality related problems that are reported in the basin.

- Monitor water quality and insure compliance with discharge permits. Most of this work is under the jurisdiction of Missouri Department of Natural Resources, but with training, volunteer groups such as Stream Teams could assist with water quality monitoring and be strong advocates for water quality throughout the basin.

- Inform the public of water quality problems (i.e., sedimentation, livestock runoff, and sewage effluent) affecting streams in the basin through media and personal contacts, literature development and distribution, and special or educational events such as National Hunting and Fishing Day.

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

Strategy: Work closely with agricultural agencies to address concerns related to adequate streamflows within the basin, and work with state and local governments on laws and regulations pertaining to maintenance of base flows.

- Support the development of a Missouri water law that addresses the quantity of water in Missouri streams.

- Provide technical assistance for SALT and EARTH projects as requested by Soil and Water Conservation Districts so base flows can be maintained.

- Inform the public of water quantity problems affecting streams in the basin through media and personal contacts, literature development and distribution, and special or educational events such as St. Joseph Sport Show and National Hunting and Fishing Day.

GOAL 2: IMPROVE OR MAINTAIN RIPARIAN AND AQUATIC HABITATS IN THE PLATTE RIVER BASIN.

Status: Channelization and levees negatively affect riparian and aquatic habitats through increased stream bed and bank erosion, sedimentation, and by reducing wooded corridors, instream cover, and pool/riffle habitat complexes. Due to past channelization, some stream channels have down-cut below the root systems of trees. Thus, the few trees that are present provide little, if any, streambank stabilization. In addition, landowners in the basin are reluctant to restore 100 feet wide vegetated corridors along each streambank due to the loss in row crop acreage.

Objective 2.1: Eliminate additional channelization, re-channelization, or levee construction projects within the Platte River basin.

Strategy: Preventing future channel alterations will require a combination of watchdog activities that will facilitate enforcement of current laws and educational programs so in the future, the need for law enforcement action will be minimized.

- **!** Review all 404 and other permits within the basin and provide comments on these applications to reduce impacts of channelization and levee construction.

- **!** Cooperate with MDC Outreach and Education Division in presenting materials related to stream ecology and effects of channelization to elementary and/or secondary school teachers and students within the basin.

Objective 2.2: Inform landowners within the Platte River basin about good stream stewardship practices and the importance of riparian corridors. Efforts to maintain and improve riparian conditions will be concentrated along Castile Creek and portions of Honey Creek, both of which were identified as possessing unique habitat within the basin.

Strategy: Advertising and promoting stream incentive programs, installing and maintaining demonstration projects, and providing educational opportunities regarding stream stewardship will allow landowners to be more aware of the reasons and techniques for protecting streams. Promoting stream incentive programs for improving riparian habitats will likely encourage more landowners to participate.

- **!** Cooperate with Farm Service Agency (FSA), Natural Resources Conservation Service (NRCS), and University Extension personnel to promote cost share programs that include streambank and streambed stabilization, alternate watering sources, excluding livestock access, and establishing and maintaining adequate stream corridors.

- **!** Provide recommendations to all landowners who request assistance that are willing to establish and maintain adequate stream corridors.

- **!** Provide stream management workshops for NRCS and University Extension staff every five years for those people who have responsibilities for agriculture programs within the Platte River basin.

- **!** Cooperate with NRCS and Soil and Water Conservation Districts to establish SALT and EARTH projects within the basin.

- **!** Establish stream management demonstration sites within the basin.

- **!** Promote sound land management practices that enhance stream quality through landowner workshops and demonstration site tours within the basin.

- **!** Cooperate with MDC Outreach and Education Division in using streams within the basin for aquatic education programs.

GOAL 3: MAINTAIN DIVERSE AND ABUNDANT POPULATIONS OF NATIVE AQUATIC ORGANISMS WHILE SUPPORTING ANGLER DEMANDS FOR QUALITY FISHING.

Status: A comprehensive survey of the fishes inhabiting the Platte River basin is needed in unsampled, or inadequately sampled streams. Several species of fish desirable to anglers are found in the basin. Catfish (channel, blue, and flathead) are the most sought after species, but sufficient samples to assess their populations are lacking. Some invertebrate sampling has been conducted, but a comprehensive study across the basin has not been conducted.

Objective 3.1: Assess and maintain native non-game fish populations and aquatic invertebrates at or above present levels throughout the basin.

Strategy: Assess the status of fish and invertebrate communities throughout the basin through a cooperative effort between MDNR, MDC, Iowa DNR, Missouri Western State College, and Northwest Missouri State University. Achieving habitat objectives within the basin should ensure maintenance and improvement of aquatic communities within the basin. To determine if there are changes in aquatic communities within the basin, periodic surveys will need to be conducted with directed effort toward collecting uncommon species within the basin.

- Develop standard sampling techniques for assessing fish and aquatic invertebrate communities, including use of indicator species.

- Implement a sampling program that monitors diversity and abundance of aquatic communities throughout the basin in cooperation with MDNR, Iowa DNR, Missouri Western State College, and Northwest Missouri State University. Through training, Stream Teams could provide additional information on aquatic communities within the basin.

- Enforcement of regulations pertaining to water quality and quantity, enhancement of riparian corridors, and improvement of instream habitat will help protect and enhance native aquatic communities within the basin.

Objective 3.2: Evaluate sportfish populations within basin streams and provide recommendations for maintenance and improvement of these populations to a level that satisfies the angling public.

Strategy: Assess the quality of sportfish populations and provide recommendations for the enhancement of populations through regulations, habitat improvement, or stocking. Information on angler use, harvest, or attitudes within basin streams has not been collected since the early 1970's. This information would be of utility in managing sportfish populations within the basin, and it would provide guidance for future management within the basin.

- Develop standardized sampling protocol for target species (primarily catfish), and implement monitoring program to collect trend data on sportfish populations within the basin that will be used to evaluate and manage these populations.

- Identify critical habitats for catfish (primarily channel catfish and flathead catfish) at all life stages and maintain or enhance these areas as needed to increase production.

- Improve populations of sportfish through regulations and habitat improvements once population objectives have been determined.

- Conduct a creel survey to determine angler use, harvest, and attitudes within the basin. Compare these results with previous study conducted in the early 1970's.

- Increase awareness of the recreational potential of fishes other than sportfish such as common carp, buffalo, gar, and freshwater drum through articles in local newspapers, outdoor magazines, and/or a possible *Missouri Conservationist* magazine article.

GOAL 4: INCREASE PUBLIC APPRECIATION FOR STREAM RESOURCES IN THE PLATTE RIVER BASIN.

Status: Most citizens within the basin have a lack of understanding and appreciation for the importance of stream resources in the region. There is little regard for the well-being of streams within the basin.

Objective 4.1: Increase the current level of public understanding of local stream resources and proper stream management practices.

Strategy: Increasing public awareness and education of stream values should result in improvements in the level of appreciation local stream resources now receive. Enhanced awareness of streams within the basin should result in heightened concern about stream quality within the basin.

- Promote formation of Stream Teams within the basin through contacts with local civic organizations and schools.

- Locate local streams within the basin that are near schools that also possess adequate access for field trips.

- Cooperate with Missouri Western State College, Northwest Missouri State University, and MDC Outreach and Education Division in using local streams in the basin for aquatic education programs.

- Promote the values of stream resources within the basin through local newspaper articles, radio, and television.

GOAL 5: INCREASE RECREATIONAL USE OF STREAMS IN THE PLATTE RIVER BASIN.

Status: Past recreational use on the lower Platte River was dominated by fishing and hunting activities. However, 38% of all trips were not related to hunting or fishing, and this indicated the needs of this group should be addressed. This study was conducted more than 25 years ago, and current recreational use within the basin is unknown. Turbid water and intensively farmed land are not aesthetically pleasing to most, and this limits the amount of recreational float trips in the basin. There are still some areas in the basin that are scenic, and with restoration of wooded corridors and public awareness of the resource, increases in non-consumptive use are possible.

Objective 5.1: Increase recreational opportunities on and along streams within the basin.

Strategy: The MDC strategic plan calls for an increase in stream use to accommodate an overall increase in the level of use as construction of new reservoirs declines. Public satisfaction with existing recreational opportunities on and along streams within the basin needs to be determined. In addition, future acquisition sites, facilities, and recreational opportunities should be identified.

- Conduct creel, recreational use, and needs survey periodically (every 10 years) to identify needs of the public.

- Continue acquisition and development of stream access and frontage sites within the basin based on Stream Areas Program Strategic Plan and recommendations from MDC Fisheries staff in the Northwest and Kansas City Regions.

- Increase recreational use at current MDC sites within the basin through implementation of management plans for each area.

Objective 5.2: All potential recreationists have access to information on stream use opportunities within the basin.

Strategy: It is assumed that the public is not fully aware of the recreational opportunities that currently exist on or along streams within the basin. Publicity should increase the awareness and use of opportunities within the basin. This in turn should lead to an appreciation of this resource and foster an opinion that the resource is worth protecting.

- Publicize recreational opportunities within the Platte River basin in local newspaper, radio, and television programs, and the MDC's web page.

- Include information from the Platte River basin in publications that promote hunting, fishing, floating, hiking, and other activities related to stream resources.

- Maintain a stream emphasis at public events such as the St. Joseph Sport Show and the National Hunting and Fishing Day.

ANGLER GUIDE

Platte River

Channel catfish and flathead catfish are common in the Platte River and its larger tributaries. Both species can be found in the deeper holes with flatheads preferring areas with heavy woody cover. Channel catfish can be caught on a variety of natural and prepared baits, while flatheads are caught using primarily live bait (goldfish, sunfish, creek chubs, small carp, or even worms). Blue catfish are occasionally caught in the lower portion of the Platte River, but are more common near the confluence with the Missouri River. Some anglers prefer to wade or float the Platte and 102 Rivers, and they fish the deep holes with cane poles using worms or minnows as bait. If nothing bites within a few minutes, they move on to the next hole. Carp, buffalo, freshwater drum, and gar are common throughout the basin, and they are caught on a variety of baits.

Mozingo Lake

Mozingo Lake, a 1,000-acre lake three miles east of Maryville, is quite popular in northwest Missouri. It provides some good angling opportunities, especially for bluegill. Several of the bluegill exceed 8 inches in length, and there should be some that exceed 10 inches. There is a high density of largemouth bass at Mozingo Lake, but most are still less than 15 inches long. It is not uncommon to catch over 20 bass in a few hours of fishing. Some anglers find success for larger bass near the 15 submerged brush piles along the old creek channel throughout the lake. These are generally in 20-25 feet of water, so try vertical jigging. Fishing for channel catfish and bullheads is also good, with channel catfish averaging 2-pounds and bullheads averaging 1-pound in size. Crappie numbers are low at Mozingo, but most over 9 inches long. Most of the walleye exceed the 18 inch minimum length limit, but are low in number. Most walleye caught at Mozingo are by anglers fishing for bass with crankbaits. The City of Maryville continues to improve facilities at this area. New campground facilities and picnic pavillions are being built, and the lake already has several boat ramps, boat docks (including disabled-user), and a disabled-user accessible covered fishing dock.

Smithville Lake

Smithville Lake, covering 7,190 acres, has many timbered coves and wind swept points. Crappie and largemouth bass are the most sought after species at Smithville, but channel, blue and flathead catfish offer great fishing opportunities. Walleye are also available to add an unusual component to the catch. Recently white bass have become a larger part of the fishery as well. A high percentage of 9 inch and larger crappie are present in the reservoir. Weather conditions can make crappie fishing finicky, but if you fish away from the areas that get fished a lot (bridges and marinas) your catch of larger crappie should be good. Bass continue to improve. Efforts continue to establish aquatic vegetation in Smithville Lake. Volunteers recently planted a dump truck full of coontail along the shoreline throughout the lake, and more is planned for the future. Catfishing at Smithville can be outstanding. For fast action, fish for channel catfish at night in the upper ends of the lake arms. Trotlines also work well for channel cats. Blue catfish are best caught fishing with jugs in the main lake. Bait with live shad and watch out for boat traffic. It's best to wait until late evening to try this method. Flatheads are becoming more common in the

lake, and their numbers are increasing. Fish live bait in the timbered, rocky areas near creek channels. An exciting quarry at Smithville is the growing white bass population. These fish are fun to chase in the fall with crankbaits or topwater lures as the white bass come to the surface chasing shad. Wait for a school to begin feeding and rush to the spot and cast rapidly. Smithville Lake offers a variety of fishing opportunities for everyone from the "worm_dunker" to the high_tech bass angler. There's even a special dock for the disabled_user at the Crows Creek access.

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 1^o Celcius per meter of depth.

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

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

Faunal The animals of a specified region or time.

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

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

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

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

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

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

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

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

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

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

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

Loess Loamy soils deposited by wind, often quite erodible.

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

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

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

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

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

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

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

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

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

Optimal flow Flow regime designed to maximize fishery potential.

Perennial streams Streams fed continuously by a shallow water table.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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