Minnesota
F-29-R(P)-17
Area 340
Study 3
April 2000

Minnesota Department of Natural Resources
Division of Fish and Wildlife
Section of Fisheries

Survey Report

Elk River Population Assessment 1999

by

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Funded under Federal Aid by the Sport Fish Restoration Act, F-29-R(P)-17

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ABSTRACT

The Elk River flows though Benton and Sherburne Counties, Minnesota, and is a major tributary to the upper Mississippi River. The watershed includes approximately 392,474 acres with 41.8% of land use as agricultural, 28.3% pasture/grassland, 20.6% forested, 4.0% wetland, and 3.5% Rural/Residential. During 1999, a population assessment on the Elk River including electrofishing and mapping of major physical features using a global positioning system (GPS) was completed to update fisheries information. A total of 989 fish were sampled represented by 32 species of fish. White sucker was the most abundant species (16%), followed by shorthead redhorse (12%). Of the 6 game species encountered, yellow perch were most abundant (10.3%), followed by walleye (4.0%), northern pike (3.5%), and smallmouth bass (3.4%). With the exception of black bullhead, walleye and yellow perch, CPUE for other species appeared to decline since the previous survey (1987). Of the game species sampled in 1999, the recreational fisheries potential appears to be highest for smallmouth bass (total on-time CPUE =3.35), walleye (total on-time CPUE =3.97), and northern pike (total on-time CPUE =3.45). Overall the entire reach of the Elk River sampled during 1999 had 22 carry in access points, over 100 barriers to canoe travel, 15 substantial erosion sites, 27 major riffles, 22 areas of significant vegetation, and 12 tributaries with significant flow during the sampling period. Fisheries potential for the Elk River exists throughout the entire reach, however, the opportunity seems to be best in the area from County Road 43 to Lake Orono, where there was the largest amount of habitat diversity. There appears to be a need for aggressive livestock exclusion from the Elk River, and an effort to reduce overall nutrient loading within the Elk River watershed. Additionally, there may be a need to provide additional official access points to enhance recreational and angling opportunities throughout the area sampled during 1999.

STUDY AREA

The Elk River headwater is located near the town of Gillman, Minnesota, and flows approximately 65 miles though Benton and Sherburne Counties to its confluence with the Mississippi River at Elk River, Minnesota (Figure 1). It offers potential for recreational opportunities for canoeists, anglers, hunters and non-game wildlife viewers close to the City of St. Cloud and the Minneapolis - St. Paul Metropolitan area. The river has 15 tributaries along its length, a gradient of 3.0 feet per mile, with a sinuosity of 1.73. Mean flow recorded at Highway 15 during the sampling period in 1999 was 215.56 cubic feet per second (CFS), with a maximum flow during the early part of June (302 CFS) and a minimum flow during July (95 CFS) (Figure 14). The watershed includes approximately 392,474 acres with 41.8% of land use as agricultural, 28.3% grassland, 20.6% forested, 4.0% wetland, 3.5% Rural/Residential (Table 1, Figure 1).

METHODS

An initial survey of the Elk River was conducted in 1987, which compiled information on fish communities, physical and chemical characteristics and invertebrate species composition and abundance. During 1999, a follow up assessment including electrofishing and mapping of major physical features using a global positioning system (GPS) was completed to update fisheries and access information. The Elk River was divided into thirteen reaches within the Montrose Fisheries Management Area during the initial survey in 1987. All of the original reaches except for Big Elk Lake were sampled during the summer of 1999. Fish sampling methods included: back pack electrofishing (1 station at Benton County Road 62) and boat electrofishing (14 stations) during daylight hours for all species encountered and boat electrofishing during daylight hours for smallmouth bass only (1 station above Orono Lake) (Figures 2 -6) . All catch rates reported were number per hour on-time. Additionally, the entire length of the Elk River within the Montrose Fisheries Management Area from Highway 95 in Benton County to the confluence with the Mississippi River in Elk River, was mapped using a Corvallis Micro Technologies (CMT) GPS unit to mark locations of major barriers to boat travel, access points, vegetation and erosion sites, tributaries, riffles and electrofishing start and end points. Access to sampling areas was obtained through public

rights-of-way, public landing or park sites and limited private access sites. All fish sampled were identified, counted, measured and weighed to the nearest millimeter or gram, respectively. Scales were collected from all game species encountered. Access to selected portions of the river for electrofishing was limited by barriers to travel along the river, private property restrictions and lack of sufficient boat launching facilities. Comparisons to the initial survey were made by selecting electrofishing stations similar to those used in 1987. Catch data were combined across sampling stations for both years.

RESULTS

Sampling techniques used in 1999 revealed a total of 989 individuals represented by 32 species of fish (Table 2), of these, only 6 were game species. Of the 6 game species encountered, yellow perch were most abundant (10.3%), followed by walleye (4.0%), northern pike (3.5%), and smallmouth bass (3.4%) (Table 4). Northern pike were most abundant at stations 1 (74.81/hour) and 14 (13.23/hour), while walleye were most abundant at stations 3 (45.19/hour) and 5 (19.91/hour). White sucker was the most abundant species overall (16%), while shorthead redhorse was second most abundant (12%) (Table 4). Although common carp were not as abundant as other species, they were present in the most stations overall (Table 2). Species richness over the entire length of the river was highest at station 12 (17 species), near Big Lake, MN, and lowest at station 11(8 species) also near Big Lake (Table 2 and Figures 2 - 6). Catch per hour electrofishing (CPUE) for all species was highest at stations 4 (384.51 fish/hour) and 14 (408.07 fish/hour) (Table 3).

Northern pike were sampled in 8 out of the 14 stations at catch rates between 4 and 74 fish per hour on-time (Table 3). Northern pike ranged in length from 9 to 31 inches with 38 individuals sampled (Table 5, Figure 11). Overall catch was less than 1987, when 65 individuals were sampled. The CPUE in 1999 (7.80 fish/hour) was also less than 1987 (9.7 fish/hour) (Figure 13). Growth was below the statewide average as individuals reached 9.91, 11.96, 15.91, 17.50, 22.72 and 31.10 inches by Age I through V, and Age VIII, respectively (Table 7) .

Smallmouth bass were sampled in stations 5 and 8 through 15 with catch rates that ranged from 3

to 55/hour (Table 3 and Figures 2- 6). A total of 32 individuals were sampled, which ranged in length from 2 to 18 inches (Table 5, Figure 12). The catch rate of smallmouth bass from stations 1-15 in 1999 (14.28/hour), appeared to be lower than the overall catch rate of smallmouth bass in 1987 (18.3/hour) (Figure 13). Growth was below the statewide average as Age I through Age IV individuals reached 3.85, 6.92, 8.56, 10.47 inches, respectively, and one Age 9 fish at 18.42 inches (Table 8).

A total of 40 walleye were sampled which ranged in length from 7 to 19 inches (Table 5, Figure 11). CPUE for walleye was highest at station 3, above Big Elk Lake (45.19/hour) and station 5 near Becker (19.91/hour) (Table 3 and Figures 2 - 6). Growth was average as Age I through IV individuals reached 7.97, 11.12, 13.66 and 15.71 inches, respectively (Table 9). CPUE for walleye has increased from 4.2/hour in 1987 to 9.85/hour in 1999 (Figure 13).

Yellow perch ranged in length from 2 to 6 inches and the average length was 3.93 inches (Table 5). A total of 98 individuals were sampled overall, with highest catch rates from stations 4 (114.08/hour) and 14 (51.87/hour) (Table 3 and Figures 2 - 6). The catch rate of yellow perch appeared to increase from 11.7/hour in 1987, to 24.1/hour in 1999 (Figure 13). A total of 7 black crappie and 19 bluegill were sampled during 1999, and catch rates from 1999 (1.72/hour and 4.68/hour, respectively) were lower than in 1987(8.00/hour and 6.00/hour, respectively) (Figure 13).

A total of 160 white sucker were sampled during electrofishing which ranged in length between 2 and 18 inches, and a mean length of 8.4 inches (Table 5). The 1999 assessment revealed a decrease in the CPUE of white sucker (39.38/hour) from the 1987 survey (135.4/hour) (Figure 13). Common carp, , were not as numerous in 1999 survey (19.94/hour) as in the 1987 survey (23.7/hour) (Figure 13).

Daytime electrofishing for smallmouth bass at station 16 above Lake Orono resulted in a catch rate of 32.27/hour fish per hour on-time (Table 6 and Figure 12). A total of 26 smallmouth bass were sampled between 3 and 12 inches, with a mean length of 6.69 inches (Table 6). PSD for smallmouth bass was 14, and RSD-P was 0. Length frequencies for smallmouth bass from all species electrofishing and Station 16 (smallmouth bass only) appeared to be similar, although more individuals between 10 and 12 inches were observed from the smallmouth bass only electrofishing (Figure 12).

GPS Locations and Habitat

The Elk River was sampled by canoeing the entire stretch from Highway 95 in Benton County to Lake Orono near Elk River, in Sherburne County (approximately 40 Miles), and marking significant riffles, erosion, access sites, tributaries etc. The area from Highway 95 in Benton County to County Road 3 in Sherburne County (5 miles) was characterized by over 60 barriers to canoe travel (mostly fallen trees), narrow channel (15 - 20 feet) and a moderate canopy (Figure 8). This stretch appeared to have a flood plain which was fairly wide and silt deposition was common, although the major substrate type in the upper end of the stretch was mostly sand and gravel. The area surrounding the St. Cloud Municipal Airport was devoid of any canopy and was typified by slow runs with intermixed pools. Six erosion sites in this stretch were found at private accesses, near gravel pit operations and within the drainage from St. Cloud Airport (Figure 10).

The stretch from County Road 3 to Big Elk Lake (8 miles) had less meander than the upper stretch, and the channel width ranged between 15 and 50 feet (Figure 3). It was characterized by slow runs and large pools with fewer barriers to canoe travel, and several points that could offer potential access for small craft (Figures 7 and 8). The occurrence of riffles with larger boulders and vegetation was also evident (Figure 9).

The third stretch from the outlet on Big Elk Lake to County Road 4 (7 miles) had 9 barriers to canoe travel, and several erosion sites which were generated from unrestricted access to the river by livestock (Figures 8 and 10). Additionally, this stretch had the highest amount of significant vegetation present, and was covered by a significant canopy of trees (Figure 9). The width of the Elk River in this stretch was between 20 and 60 feet and the most common substrate found was sand or gravel.

The stretch from County Road 4 to County Road 43 (10 miles) had several barriers to canoe travel, numerous potential access points for small craft, and several beds of vegetation (Figures 7 - 9). This stretch was characterized by long runs and moderate pools, which were mostly shallow as the width ranged from 20 to 60 feet. The area also had an increased influence from the population centers of

Becker and Big Lake as apparent sewage runoff was observed at one site (Figure 10), and the most common substrate type was silt.

The lowest stretch from County Road 43 to Lake Orono (10 miles), was characterized by 14 riffles which indicated the largest elevation drop in the entire reach of the Elk River (Figure 9)and a width that varied between 40 and 100 feet. Additionally, housing developments and 4 potential access points were present (Figure 7). Common substrate found in this stretch was sand and gravel in pool sections and boulder and cobble in riffle and run sections. The area downstream of Lake Orono dam was represented by only three riffles and run type habitat.

Typical vegetation types encountered throughout the Elk River were river pondweed, softstem bulrush, hardstem bulrush, common cattail, white water lily, yellow water lily, coontail, and arrowhead. River pondweed was most abundant in riffles and runs with moderate to fast flow. Cattail and bulrush were found in areas where the river channel had widened, on gravel and silt bars. Water lily and arrowhead were found in areas where pools or backwater areas predominated. Coontail was found in backwater and slow flowing areas where tributaries entered the Elk River (Figure 9).

DISCUSSION

Overall the entire reach of the Elk River sampled during 1999 had 25 potential accesses, at least 100 barriers to canoe travel, 19 sites where erosion was occurring, 90 riffles that were recorded, 31 areas of significant vegetation, 12 tributaries with significant flow during the sampling period, 22 storm sewers, and 10 rock dams. The utility of GPS locations of these features may be realized with future management of the recreational and fishery components of the Elk River from Highway 95 in Benton County to the confluence with the Mississippi River near Elk River.

The fishery sampled during 1999 was characterized by an abundance of white sucker and redhorse, although representative game species were sampled with low to moderate abundance. Changes in the fishery were evident since the Elk River was last sampled in 1987, as CPUE for species other than black bullhead, walleye and yellow perch, appeared to decline. Species diversity from 1987

and 1999 were similar, however, the absence of several cool water minnow species (sculpin and brook stickleback) from the 1999 survey may indicate a change in temperature profile. Of the game species sampled in 1999, the recreational fisheries potential appears to be highest for smallmouth bass, walleye , and northern pike in areas that have increased habitat diversity.

Management Implications

Fisheries potential for the Elk River exists throughout the entire reach, however, the opportunity seems to be best in the area from County Road 43 to Lake Orono, where there was the largest amount of habitat diversity. The water clarity throughout the first two stretches appeared to be good, while below Big Elk Lake to Lake Orono water clarity appeared to diminish. This trend was evident particularly during July and August of 1999 when flows had subsided considerably. The contribution of nutrients in the area surrounding Big Elk Lake may be influencing the water clarity throughout the lower portion of the Elk River. An effort should be made to ensure that landowners within the watershed apply best management practices to avoid additional nutrient loading in the Elk River.

Only two official canoe accesses were present on the entire reach of the Elk River sampled during 1999. There appears to be a need for more official canoe access points throughout the area sampled to provide additional recreation for anglers and canoeists. However, the addition of access points may necessitate center channel tree cutting (provided that no major changes to habitat or river morphology will occur) to allow for adequate transportation between access points.

A large portion of the erosion sites marked were due to livestock having unrestricted access to the Elk River. An effort should be made to minimize the impact of livestock on the erosion of the banks and channel of the Elk River. This could be accomplished through more active fencing of the riparian area to prevent access by livestock. Additionally, future home development should be carefully monitored to avoid municipal impacts to the Elk River morphology and chemistry. Consideration may also be needed for improving habitat in selected portions of the Elk River that offer value to recreation and angling.

Table 1. Elk River (M -65) major watershed land use by acres and percent.

Land Use	Acres	Percent
Rural/Residential	13,688.60	3.49%
Cultivated	163,986.68	41.78%
Grassland/Pasture	111,147.68	28.32%
Forest	80,992.27	20.64%
Lakes	6,150.31	1.57%
Wetlands	15,818.19	4.03%
Gavel Pits	527.57	0.13%
Bare Rock and Soil	12.62	0.00%
Unclassified	149.95	0.04%
Total Acres	392,473.87	

Table 2. Elk River (M -65) species composition by station, Summer 1999.

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	All
Black bullhead	3			1	1	1	1	2	3	6	2	1	1	2	2		26
Black crappie	3		1			3											7
Bluegill				8		4									7		19
Blacknose dace		5			1		2	17	1			2					28
Bluntnose minnow	1	1	10	1	2		2	7	1		2	10	8				45
Blacknose shiner	1	1		3								10	2				17
Blacksided darter	6	3			1		1					2		2			15
Carp	4		9	1	6	8	2	1	6	10	9	8	2	11	4		81
Central mudminnow		3															3
Creek chub		13				1											14
Common shiner		6		2				2	1	1				18			30
Fathead minnow	2	3		5				1									11
Green sunfish														2			2
Hornyhead chub					3			1				10					14
Johnny darter	3	4			1							6					14
Log perch			1	1				1				6	10				19
Mimic shiner			3	2	17									5			27
Northern hog sucker															1		1
Northern pike	16		2		2		2	2			2		1	4	2	5	38
Northern redbelly dace		14				1											15
Pumpkinseed sunfish															1		1
Red shiner				2	7									28			37
Rock bass	5					1		1		2	1	3		5			18
Shorthead redhorse	12		18	18	17	2	2	10	1	1	4	6	6	2	19		118
Silver redhorse									3			1			13		17
Smallmouth bass					1				1	1	1	3	2	16	7	26	58
Spottail shiner			6		2												8
Tadpole madtom								3									3
Walleye			18	2	6		3			3		2	2	2		2	40
White sucker	18		13	17	27	1	23	26	5	2	3	7	2	5	11		160
Yellow bullhead	1		1	1								1		1			5
Yellow perch	3	2	3	27	8		15	5		9		9	2	15			98
Station Total	78	55	85	91	102	22	53	79	22	35	24	87	38	118	67	33	989

Table 3. Elk River (M -65) electrofishing CPUE by station and species, Summer 1999.

Station	EF1	EF2	EF3	EF4	EF5	EF6	EF7	EF8
Effort (Hr)	0.21	0.18	0.40	0.24	0.30	0.30	0.24	0.27
Total Number	78	55	85	91	102	22	53	79
CPUE	364.68	302.29	213.39	384.51	338.43	74.44	220.58	291.99
Species	CPUE							
Black bullhead	14.03			4.23	3.32	3.38	4.16	7.39
Black crappie	14.03		2.51			10.15		
Bluegill				33.80		13.53		
Blacknose dace		27.48			3.32		8.32	62.83
Bluntnose minnow	4.68	5.50	25.10	4.23	6.64		8.32	25.87
Blacknose shiner	4.68	5.50		12.68				
Blacksided darter	28.05	16.49			3.32		4.16	
Carp	18.70		22.59	4.23	19.91	27.07	8.32	3.70
Central mudminnow		16.49						
Creek chub		71.45				3.38		
Common shiner		32.98		8.45				7.39
Fathead minnow	9.35	16.49		21.13				3.70
Green sunfish								
Hornyhead chub					9.95			3.70
Johnny darter	14.03	21.98			3.32			
Log perch			2.51	4.23				3.70
Mimic shiner			7.53	8.45	56.41			
Northern hog sucker								
Northern pike	74.81		5.02		6.64		8.32	7.39
Northern redbelly dace		76.95				3.38		
Pumpkinseed sunfish								
Red shiner				8.45	23.23			
Rock bass	23.38					3.38		3.70
Shorthead redhorse	56.10		45.19	76.06	56.41	6.77	8.32	36.96
Silver redhorse								
Smallmouth bass					3.32			
Spottail shiner			15.06		6.64			
Tadpole madtom								11.09
Walleye			45.19	8.45	19.91		12.49	
White sucker	84.16		32.64	71.83	89.59	3.38	95.72	96.10
Yellow bullhead	4.68		2.51	4.23				
Yellow perch	14.03	10.99	7.53	114.08	26.54		62.43	18.48

Table 3. Continued.

Station	EF9	EF10	EF11	EF12	EF13	EF14	EF 15
Effort (Hr)	0.26	0.29	0.33	0.28	0.24	0.29	0.24
Total Number	22	35	24	87	38	118	67
CPUE	83.28	122.09	72.97	311.02	158.89	408.07	283.43
Species	CPUE						
Black bullhead	11.36	20.93	6.08	3.57	4.18	6.92	8.47
Black crappie							
Bluegill							29.61
Blacknose dace	3.79			7.15			
Bluntnose minnow	3.79		6.08	35.75	33.45		
Blacknose shiner				35.75	8.36		
Blacksided darter				7.15		6.92	
Carp	22.71	34.88	27.36	28.60	8.36	38.04	16.92
Central mudminnow							
Creek chub							
Common shiner	3.79	3.49				62.25	
Fathead minnow							
Green sunfish						6.92	
Hornyhead chub				35.75			
Johnny darter				21.45			
Log perch				21.45	41.81		
Mimic shiner						17.29	
Northern hog sucker							4.23
Northern pike			6.08		4.18	13.83	8.46
Northern redbelly dace							
Pumpkinseed sunfish							4.23
Red shiner						96.83	
Rock bass		6.98	3.04	10.72		17.29	
Shorthead redhorse	3.79	3.49	12.16	21.45	25.09	6.92	80.38
Silver redhorse	11.36			3.57			54.99
Smallmouth bass	3.79	3.49	3.04	10.72	8.36	55.33	29.61
Spottail shiner							
Tadpole madtom							
Walleye		10.47		7.15	8.36	6.92	
White sucker	18.93	6.98	9.12	25.02	8.36	17.29	46.53
Yellow bullhead				3.57		3.46	
Yellow perch		31.40		32.17	8.36	51.87	

Table 4. Species composition by number and percent from electrofishing, Elk River, June and July 1999.

Species	Total Number	Percent
Black bullhead	26	2.72%
Black crappie	7	0.73%
Bluegill	19	1.99%
Blacknose dace	28	2.93%
Bluntnose minnow	45	4.71%
Blacknose shiner	17	1.78%
Blacksided darter	15	1.57%
Carp	81	8.47%
Central mud minnow	3	0.31%
Creek chub	14	1.46%
Common shiner	30	3.14%
Fathead minnow	11	1.15%
Green sunfish	2	0.21%
Hornyhead chub	14	1.46%
Johnny darter	14	1.46%
Log perch	19	1.99%
Mimic shiner	27	2.82%
Northern hog sucker	1	0.10%
Northern pike	38	3.45%
Northern redbelly dace	15	1.57%
Pumpkinseed sunfish	1	0.10%
Red shiner	37	3.87%
Rock bass	18	1.88%
Shorthead redhorse	118	12.34%
Silver redhorse	17	1.78%
Smallmouth bass	58	3.35%
Spottail shiner	8	0.84%
Tadpole madtom	3	0.31%
Walleye	40	3.97%
White sucker	160	16.74%
Yellow bullhead	5	0.52%
Yellow perch	98	10.25%

Table 5. Number of measured fish per inch group from electrofishing at all stations, Elk River, June and July 1999.

	Species									
Inch Group	BLB	BLC	BLG	CAP	GSF	LGP	NHS	NOP	PMK	RKB
2					1	1				1
3	1		6		1					5
4	6		10							3
5	7		1						1	1
6	4	2	1				1			4
7	4	5	1							1
8	1									2
9	2							2		
10								4		1
11	1							5		
12								3		
13				1				4		
14								1		
15								3		
16								4		
17				1				2		
18				9				1		
19				17				2		
20				11				2		
21				12				1		
22				10				1		
23				6						
24				5				1		
25				4						
26				4				1		
27										
28										
29										
30										
31								1		
32										
33										
34										
Mean	5.81	6.71	4.00	20.86	2.50	2.00	6.00	15.21	5.00	5.06

Table 5. Continued

	Species							
Inch Group	SHR	SLR	SMB	SPO	WAE	WTS	YEB	YEP
2	2		1			2		8
3	7		7	6		11		51
4	3		8			15	1	24
5			5			21	2	11
6	1		10			13	1	2
7	1		10		1	14		
8	7		8		2	17	1	
9	6		2		2	10		
10	3		4		4	9		
11	5		1		9	10		
12	2		1		12	8		
13	2				3	7		
14	6				4	9		
15	5				1	3		
16	8				1	3		
17	13					1		
18	18	2	1			1		
19	8	5			1			
20	11	9						
21	4							
22	3	1						
23								
24	2							
25								
26								
27								
28								
29								
30								
31								
32								
33								
34	1							
Mean	14.67	19.59	6.43	3.00	11.73	8.03	5.60	3.46

Table 6. Length frequency and CPUE for smallmouth bass collected from station 16 above Lake Orono, (smallmouth bass only) Elk River, July 1999.

Inch group	N	CPUE
3	2	2.48
4	5	6.21
5	1	1.24
6	4	4.97
7	5	6.21
8	4	4.97
9	1	1.24
10	2	2.48
11	1	1.24
12	1	1.24
Min Length	3.00	
Average	6.69	
Max length	12.00	
CPUE	32.27	

Table 7. Length at capture, back-calculated lengths and standard errors for northern pike, Elk River, Summer 1999.

Elk River northern pike 99 - Spring
BODY-SCALE CONSTANT = 53.00 N = 34
Length at Capture in 1999

Year Class	Age	N	Average	Maximum	Minimum	Standard Error
1998	1	4	251.75	259.00	238.00	4.837
1997	2	13	304.00	346.00	270.00	7.096
1996	3	6	406.00	443.00	366.00	11.846
1995	4	4	446.75	500.00	410.00	20.006
1994	5	3	577.33	664.00	510.00	45.495
1993	6	3	570.33	622.00	527.00	27.739
1992	7	0	0.00	0.00	0.00	0.000
1991	8	1	790.00	790.00	790.00	0.000

Average Back-calculated Lengths for Each Age Class

Year Class	Age	N	Back-calculation Age 1	2	3	4	5	6	7	8
1998	1	4	163.17							
1997	2	13	210.22	268.96						
1996	3	6	178.11	285.27	371.32					
1995	4	4	159.31	254.30	338.55	416.32				
1994	5	3	172.18	311.93	411.76	486.23	556.56			
1993	6	3	196.18	282.14	391.69	458.35	521.09	550.55		
1992	7	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1991	8	1	171.67	343.29	488.36	552.03	643.14	684.16	719.92	773.24
All Classes			187.30	278.36	381.23	459.19	553.72	583.95	719.92	773.24
N		34	34	30	17	11	7	4	1	1

Table 8. Length at capture, back-calculated lengths and standard errors for smallmouth bass, Elk River, Summer 1999.

Elk River smallmouth bass 99 - Spring
BODY-SCALE CONSTANT = 35.00 N = 51

Length at Capture in 1999

Year Class	Age	N	Average	Maximum	Minimum	Standard Error
1998	1	13	98.00	116.00	73.00	3.903
1997	2	26	175.81	231.00	140.00	4.586
1996	3	6	217.50	237.00	200.00	4.877
1995	4	5	266.00	272.00	253.00	3.391
1994	5	0	0.00	0.00	0.00	0.000
1993	6	0	0.00	0.00	0.00	0.000
1992	7	0	0.00	0.00	0.00	0.000
1991	8	0	0.00	0.00	0.00	0.000
1990	9	1	468.00	468.00	468.00	0.000

Average Back-calculated Lengths for Each Age Class

Year Class	Age	N	Back-calculation Age 1	2	3	4	5	6	7	8	9
1998	1	13	77.82								
1997	2	26	91.83	143.77							
1996	3	6	117.93	164.96	193.58						
1995	4	5	100.17	150.01	210.73	252.79					
1994	5	0	0.00	0.00	0.00	0.00	0.00				
1993	6	0	0.00	0.00	0.00	0.00	0.00	0.00			
1992	7	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1991	8	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1990	9	1	138.28	180.63	214.02	261.43	309.80	350.83	398.56	437.43	453.33
All Classes			93.06	148.90	202.43	254.23	309.80	350.83	398.56	437.43	453.33
N		51	51	38	12	6	1	1	1	1	1

Table 9. Length at capture, back-calculated lengths and standard errors for walleye, Elk River, Summer 1999.

Elk River walleye 99 - Spring

BODY-SCALE CONSTANT = 28.00 N = 16

Length at Capture in 1999

Year Class	Age	N	Average	Maximum	Minimum	Standard Error
1998	1	2	202.50	211.00	194.00	8.500
1997	2	6	282.50	320.00	243.00	11.761
1996	3	5	347.00	380.00	300.00	15.192
1995	4	2	399.00	410.00	388.00	11.000
1994	5	0	0.00	0.00	0.00	0.000
1993	6	1	499.00	499.00	499.00	0.000

Average Back-calculated Lengths for Each Age Class

Year Class	Age	N	Back-calculation Age 1	2	3	4	5	6
1998	1	2	172.69					
1997	2	6	177.04	251.13				
1996	3	5	151.87	254.62	326.50			
1995	4	2	157.76	250.72	329.02	380.54		
1994	5	0	0.00	0.00	0.00	0.00	0.00	
1993	6	1	88.26	197.14	297.28	404.08	471.06	490.22
All Classes			160.67	248.46	323.48	388.39	471.06	490.22
N		16	16	14	8	3	1	1

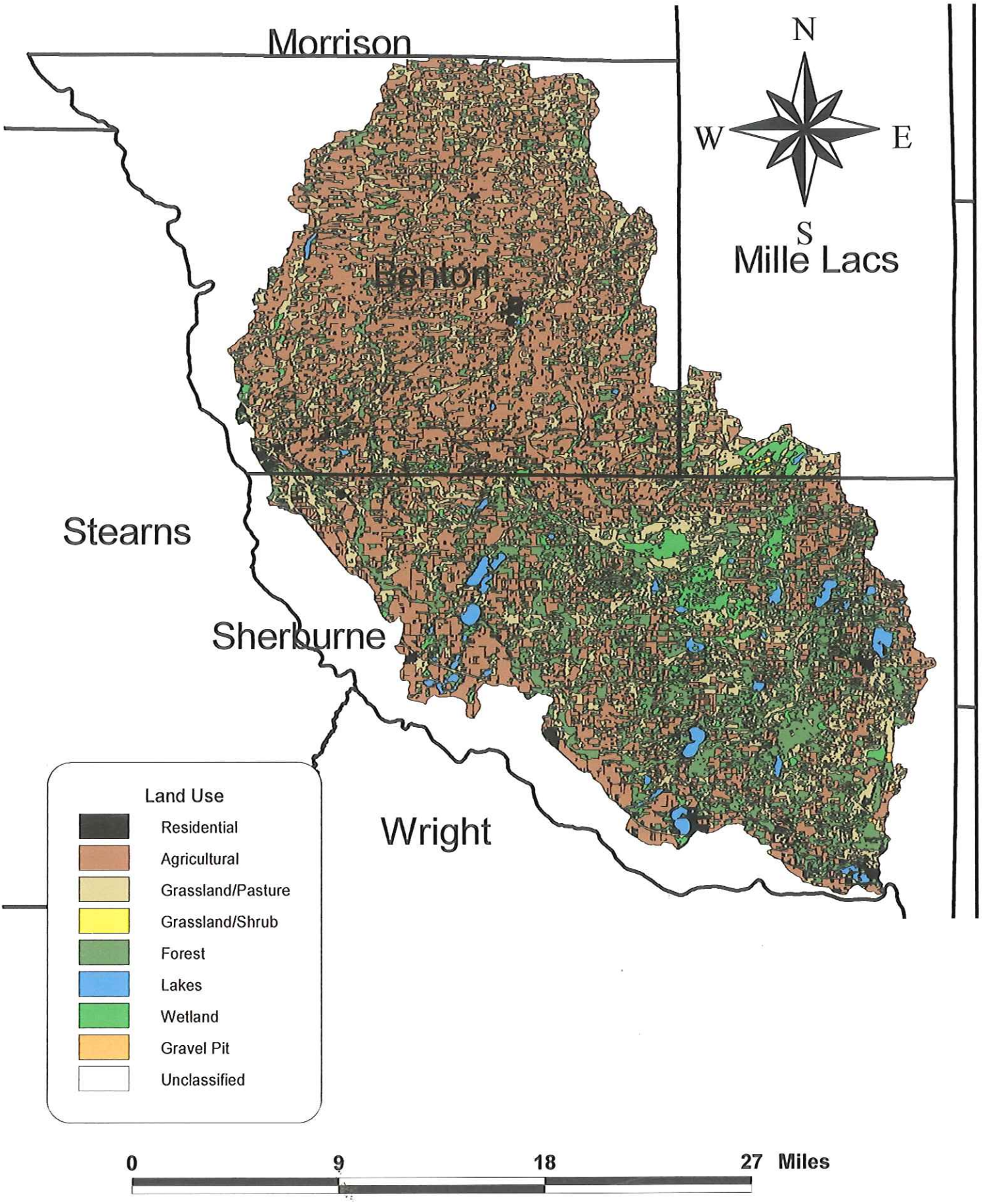


Figure 1. Land use within the Elk River (M-65) major watershed.

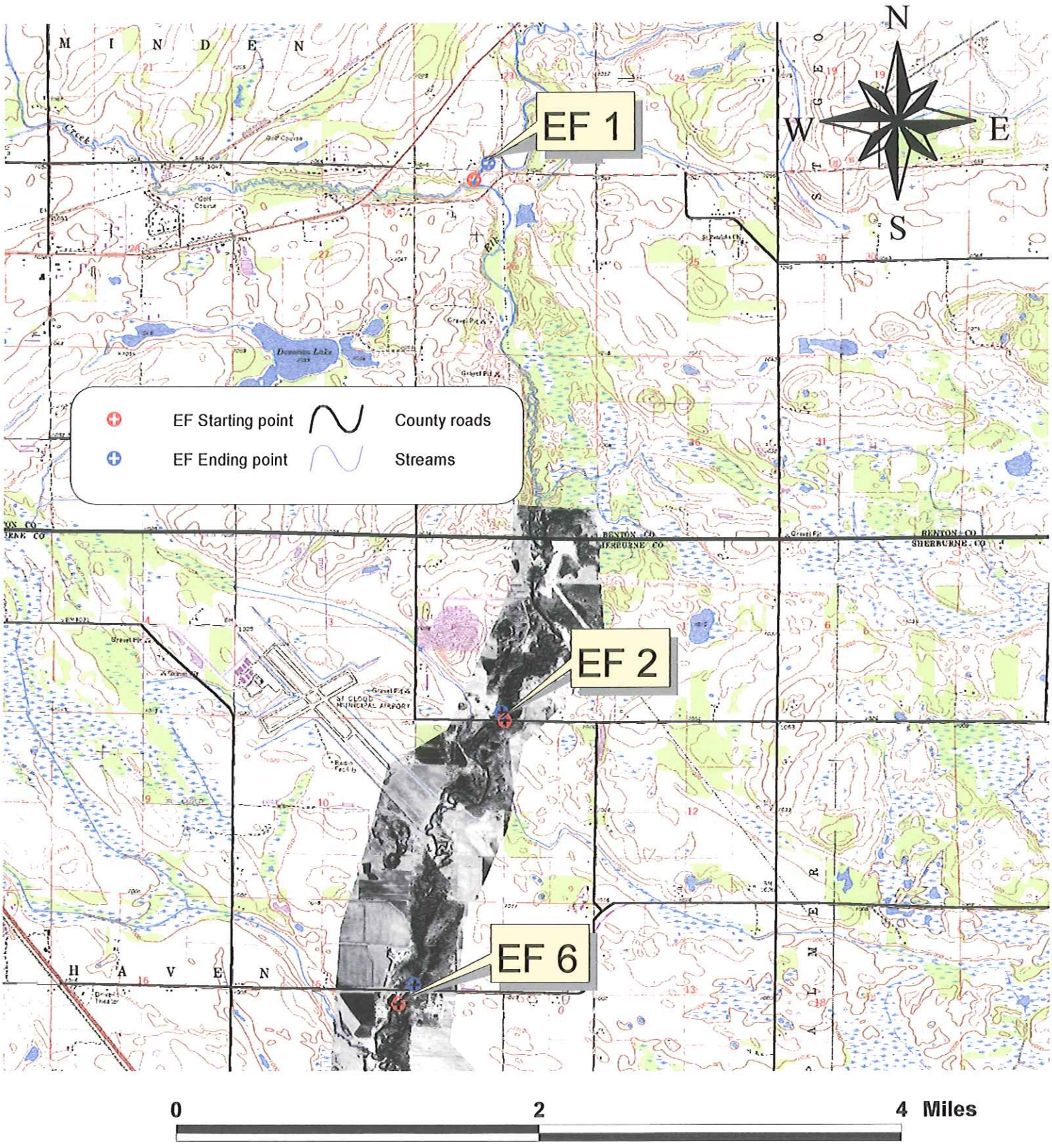


Figure 2. Electrofishing sampling locations for the Elk River population assessment, Summer 1999 (Highway 95, Benton County to County Road 3 Sherburne County).

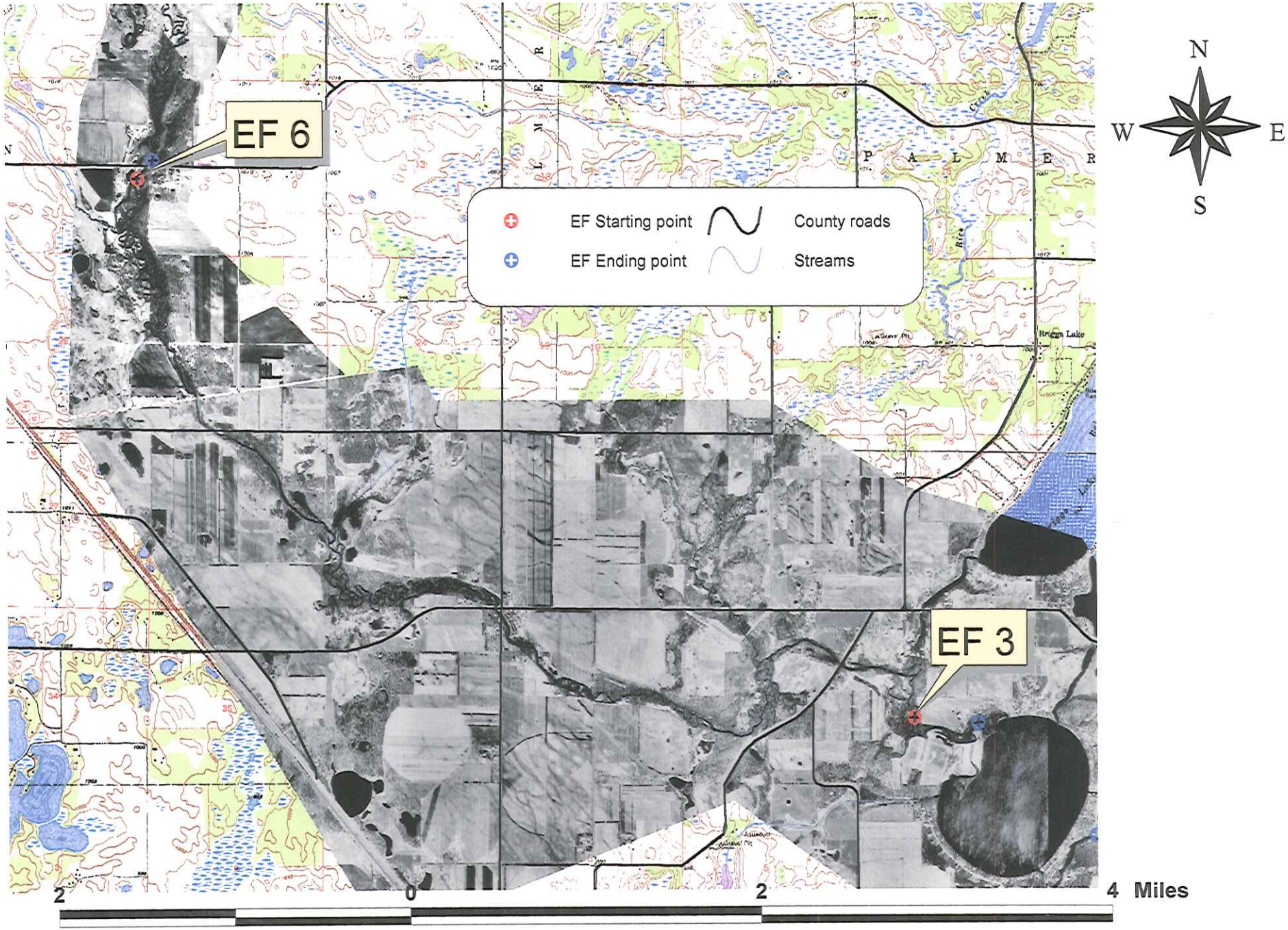


Figure 3. Electrofishing sampling locations for the Elk River population assessment, Summer 1999 (County Road 3 Sherburne County to Big Elk Lake).

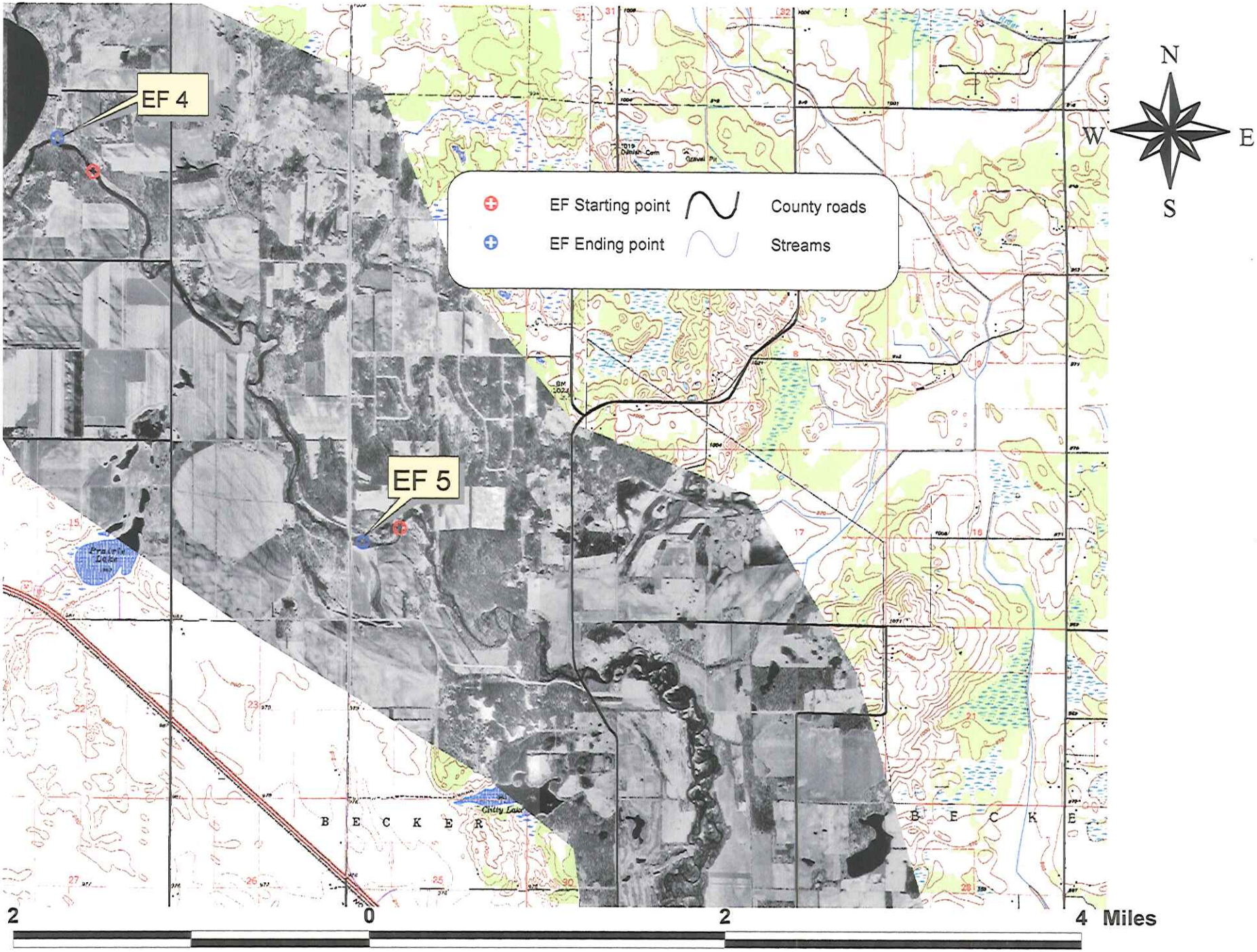


Figure 4. Electrofishing sampling locations for the Elk River population assessment, Summer 1999 (Big Elk Lake to County Road 4).

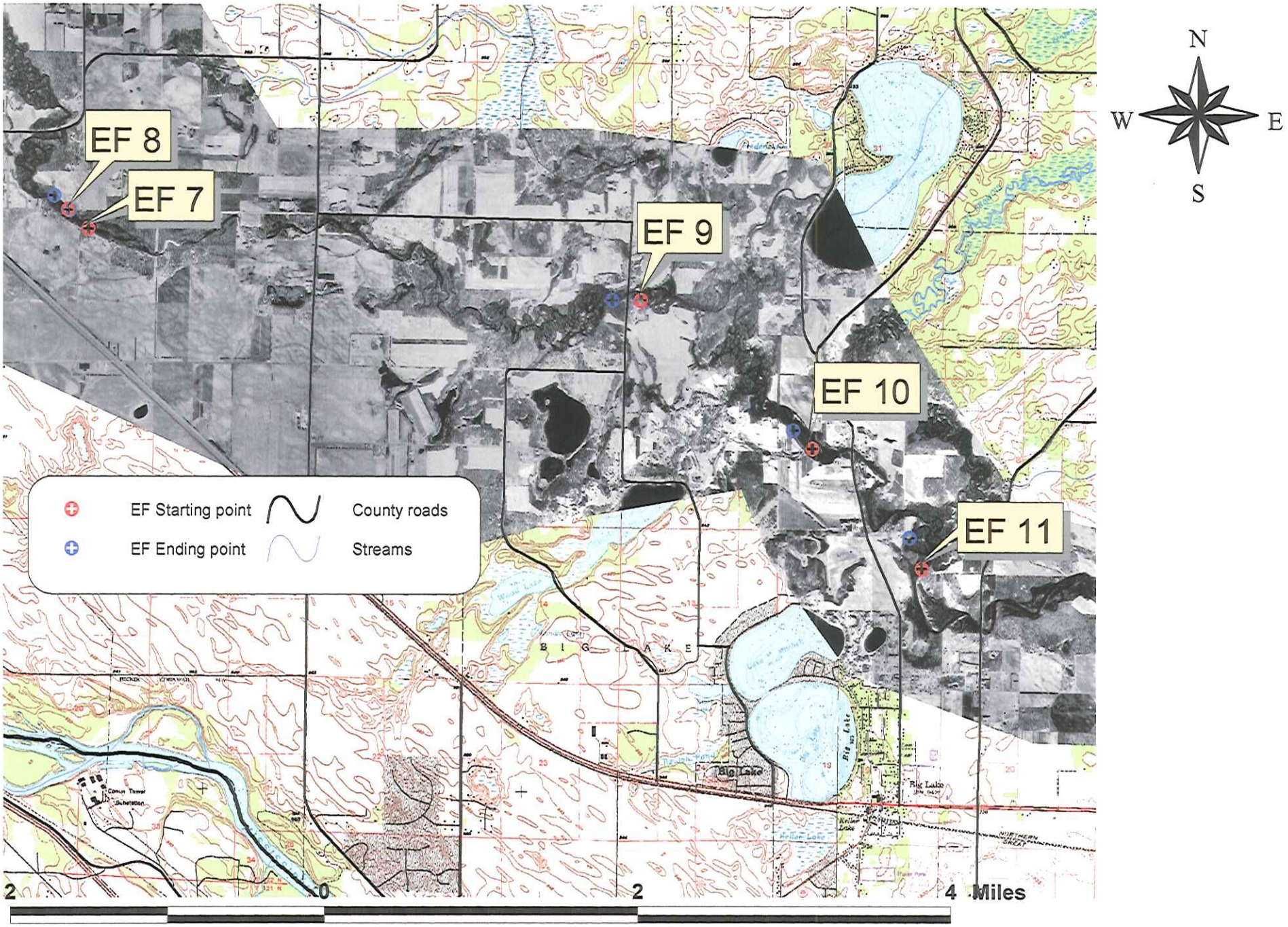


Figure 5. Electrofishing sampling locations for the Elk River population assessment, Summer 1999 (County Road 4 to Conty Road 43).

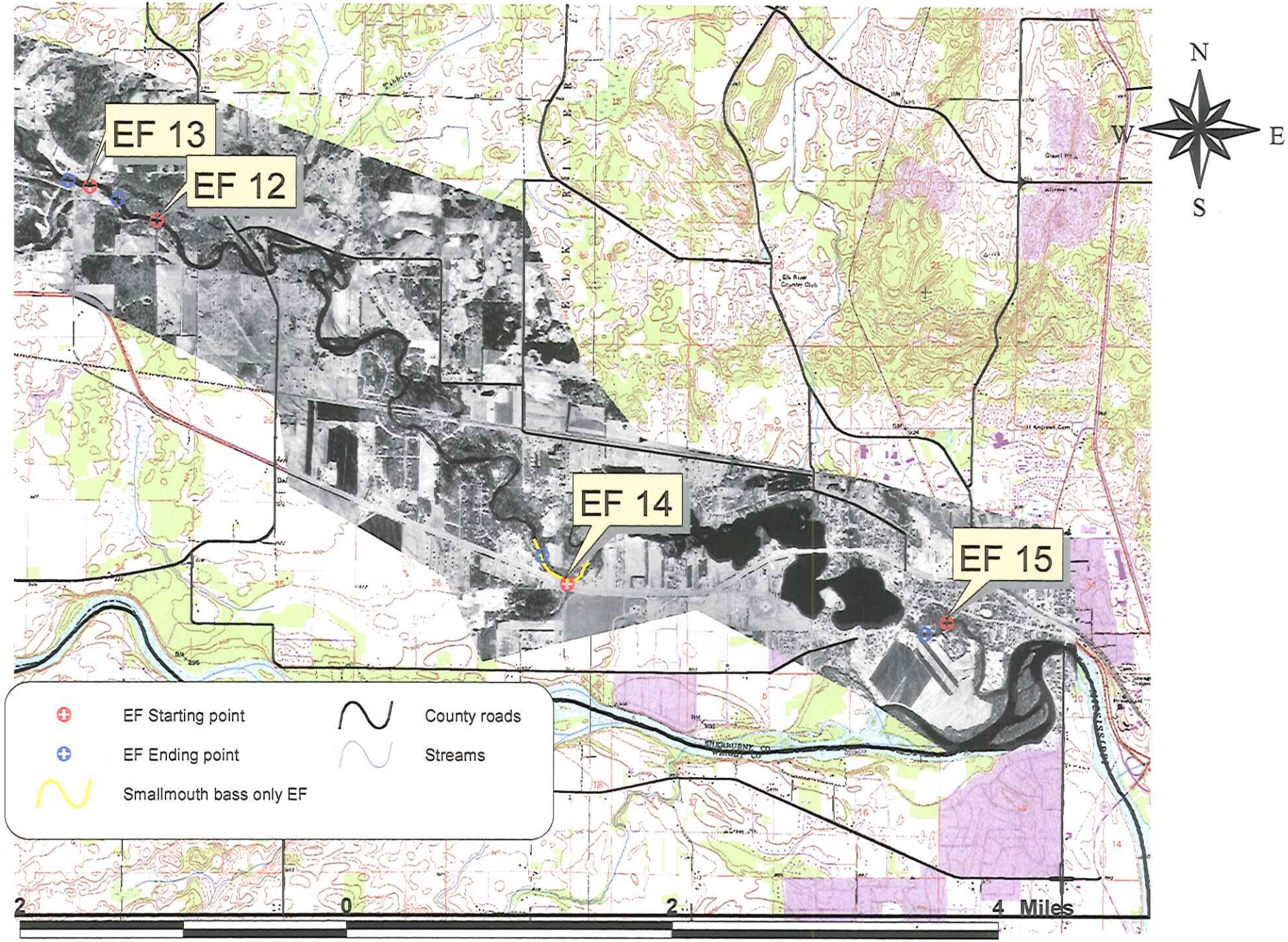


Figure 6. Electrofishing sampling locations for the Elk River population assessment, Summer 1999 (County Road 43 to confluence with Mississippi River near Elk River).

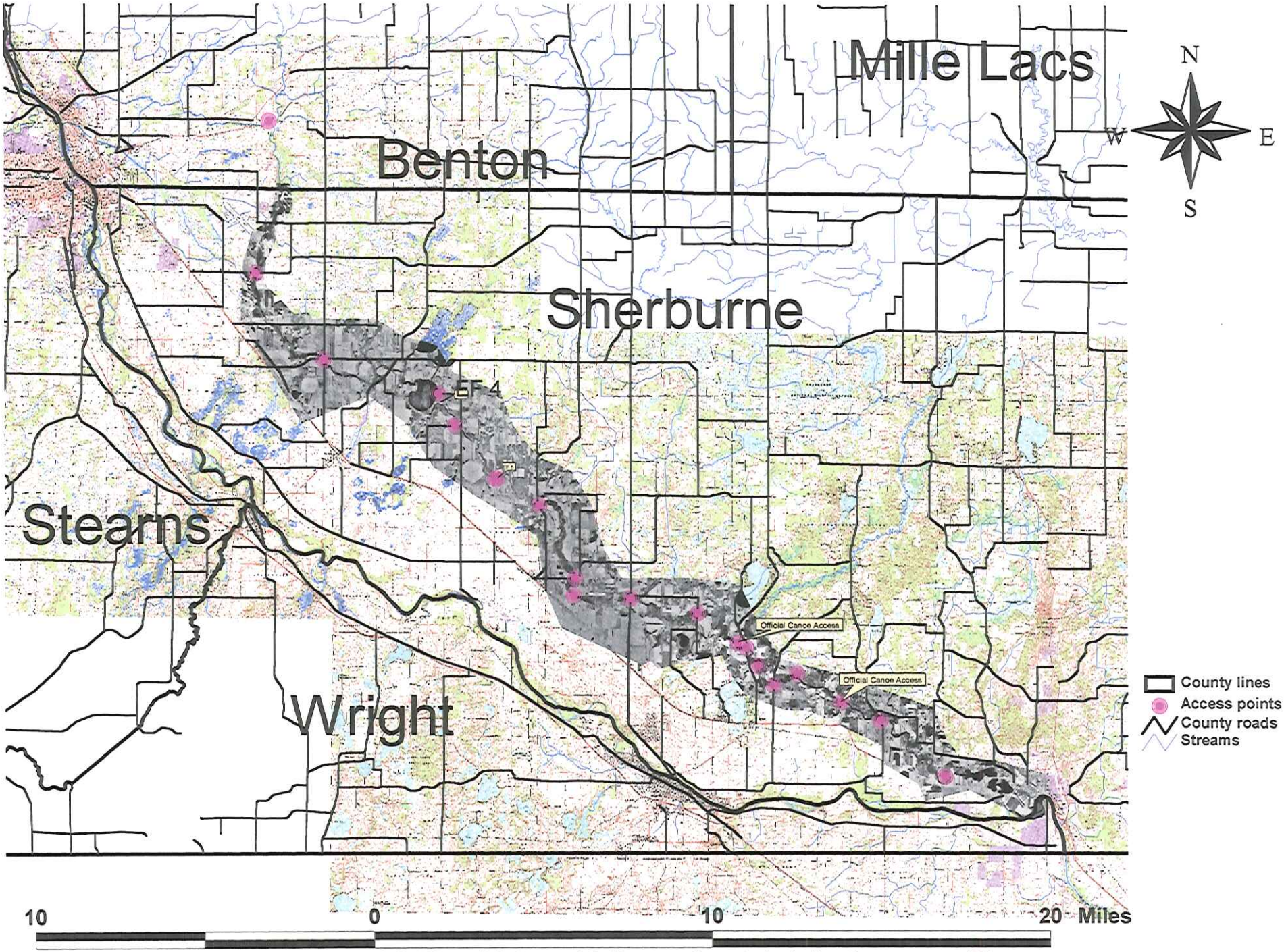


Figure 7. Access point locations on the Elk River (Highway 95, Benton County to Lake Orono, near Elk River), Summer 1999.

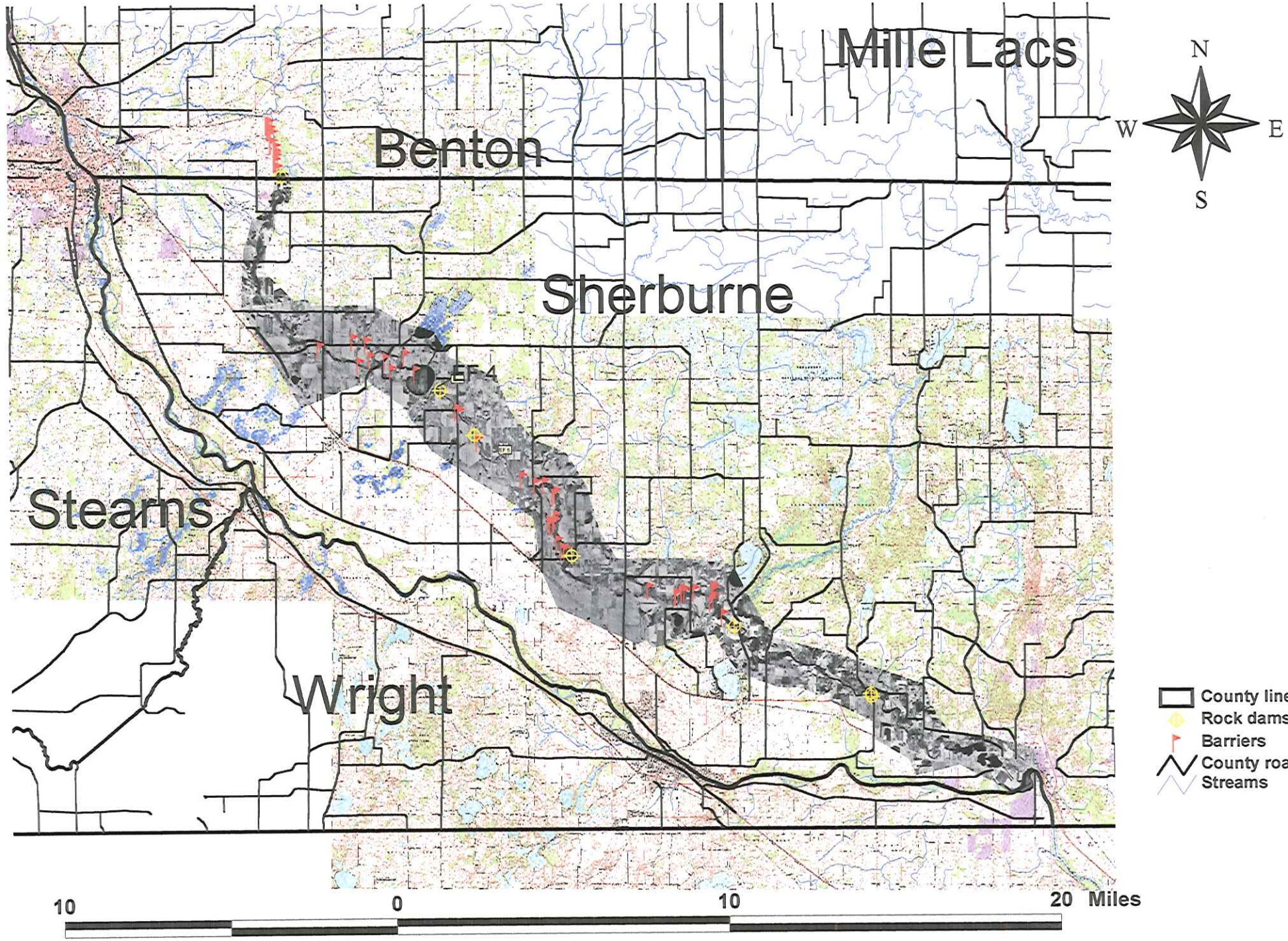


Figure 8. Barrier and rock dam locations on the Elk River (Highway 95, Benton County to Lake Orono, near Elk River), Summer 1999.

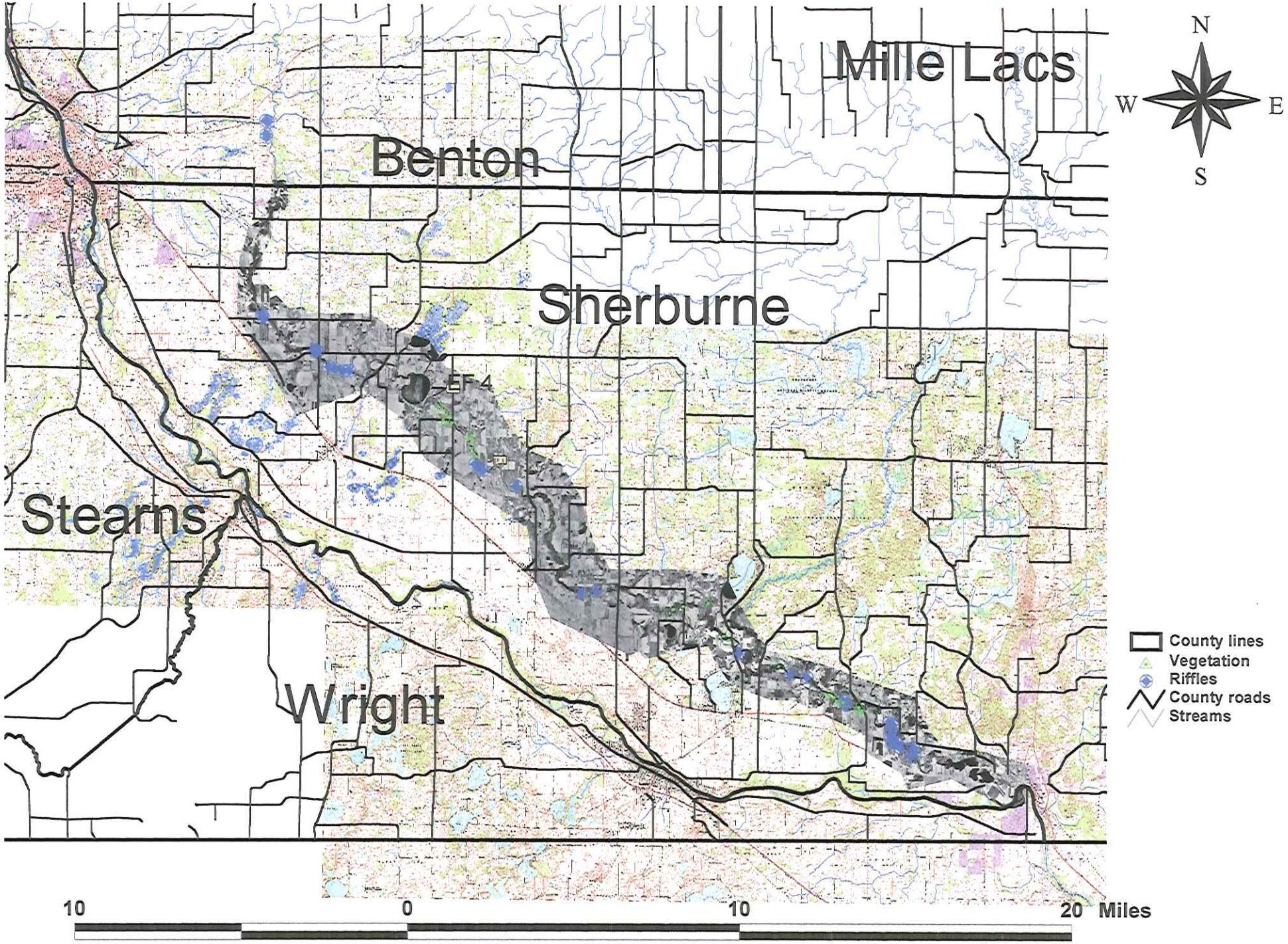


Figure 9. Vegetation and riffle locations on the Elk River (Highway 95, Benton County to Lake Orono, near Elk River), Summer 1999.

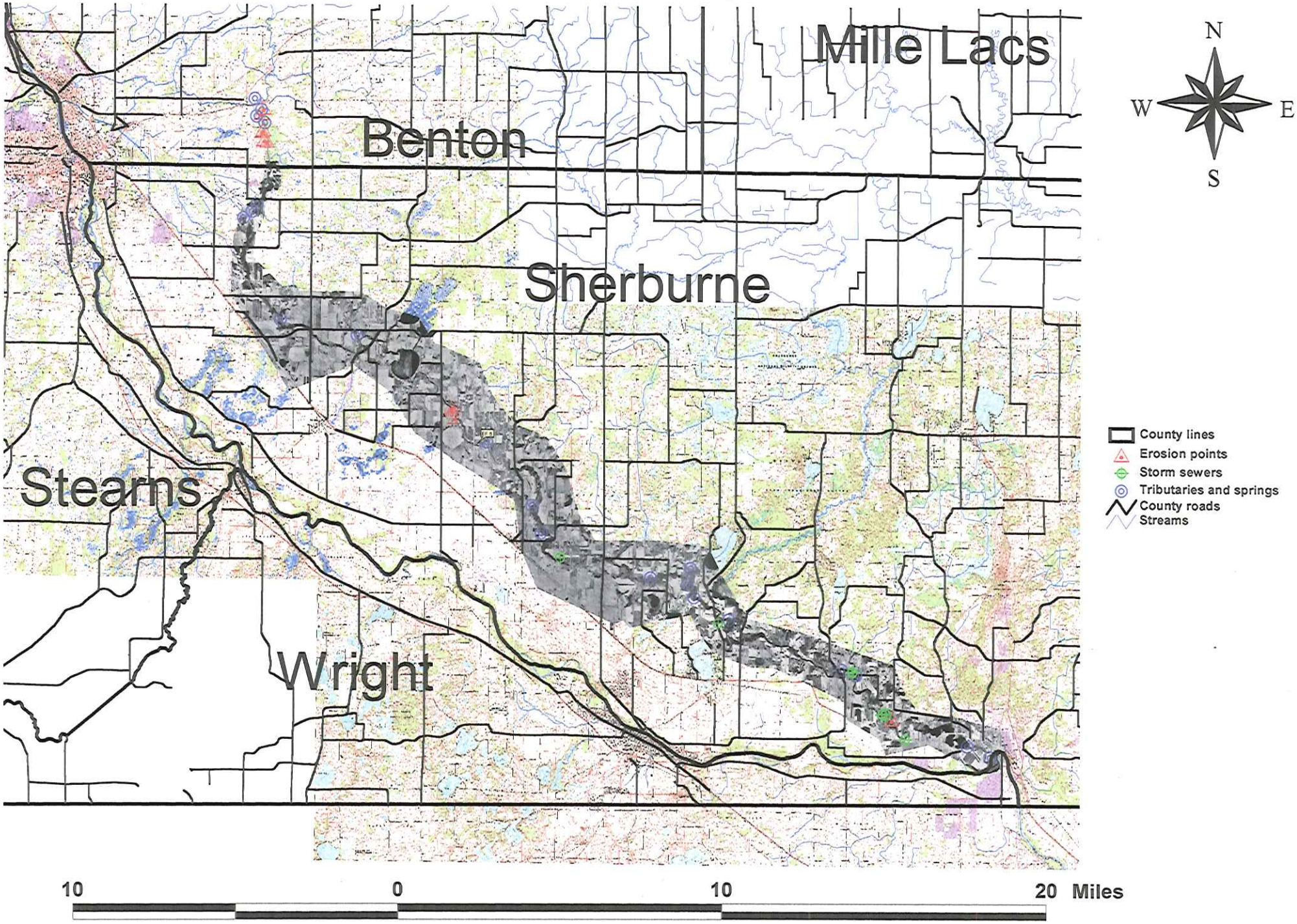


Figure 10. Tributary, storm sewer and erosion locations on the Elk River (Highway 95, Benton County to Lake Orono, near Elk River), Summer 1999.

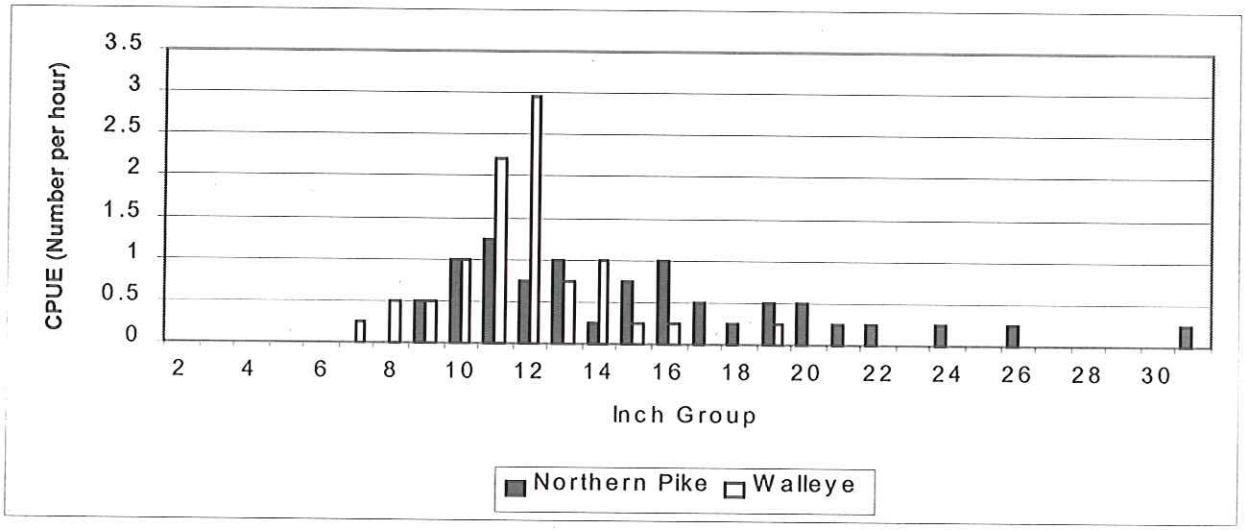


Figure 11. Length frequency and CPUE for northern pike and walleye collected by electrofishing, Elk River June 1999.

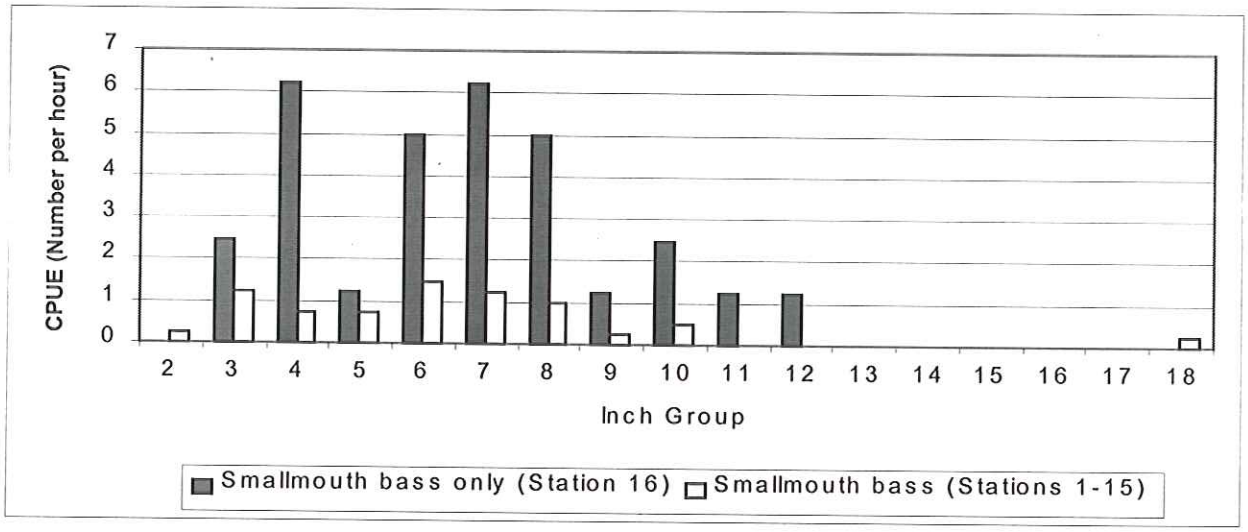


Figure 12. Length frequency and CPUE for smallmouth bass collected from all species electrofishing and from smallmouth bass only electrofishing sites, Elk River, June and July 1999.

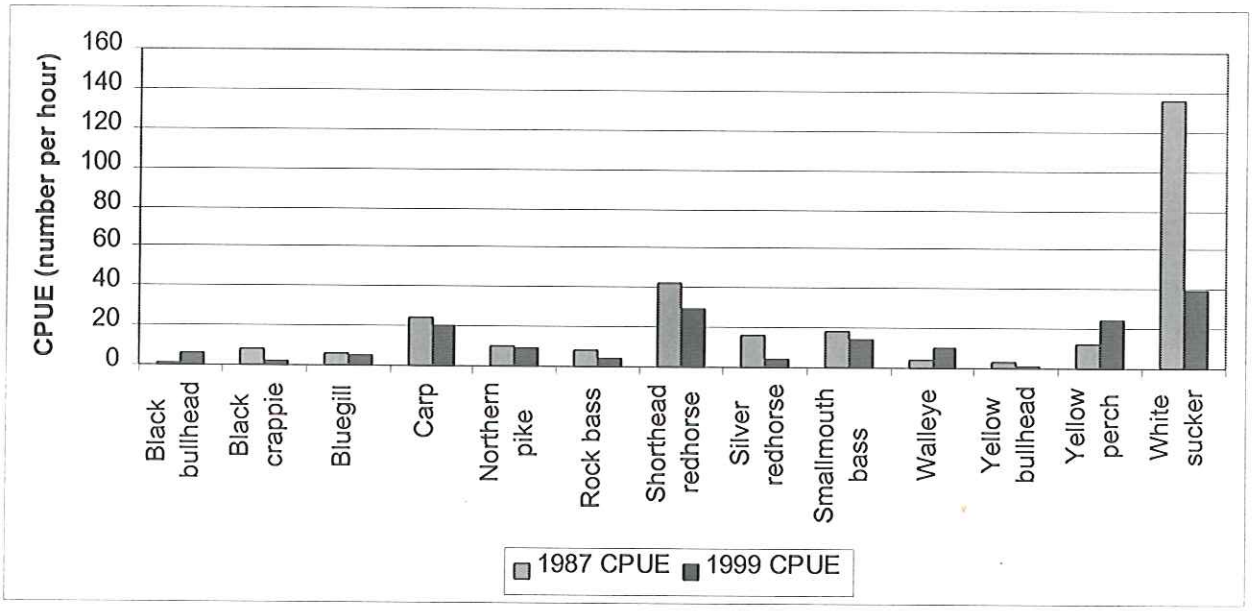


Figure 13. Catch per hour (CPUE) for selected species from sampling the Elk River during 1987, and 1999.

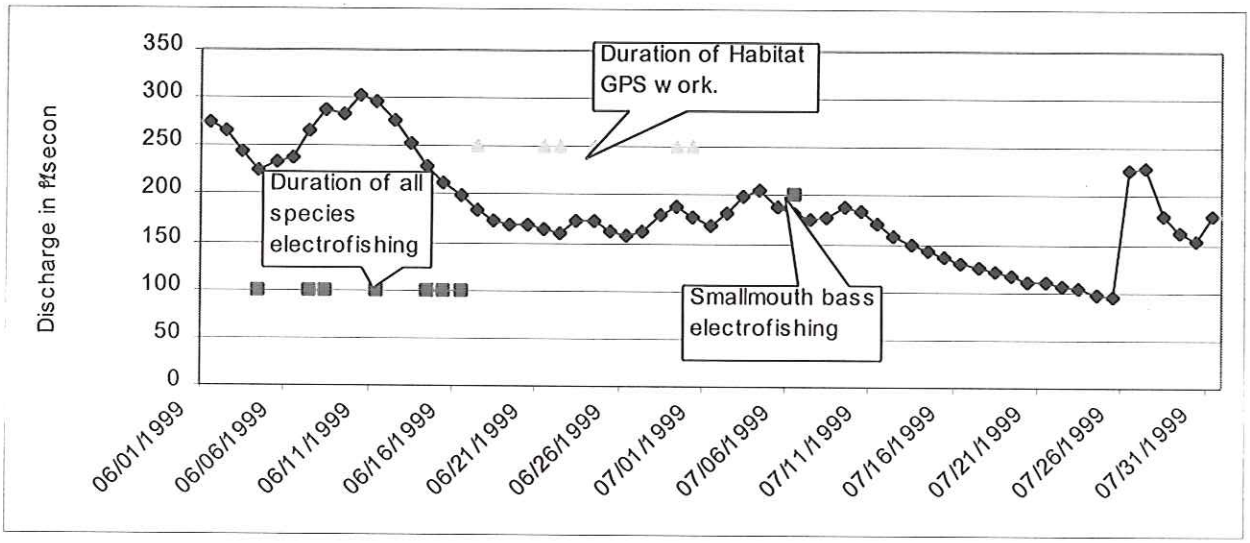


Figure 14. Elk River (M -65) daily discharge (CFS) at gaging station Highway 15, and duration of sampling during June and July 1999.

REFERENCES

Elk River Survey. 1987. Minnesota Department of Natural Resources, Division of Fish and Wildlife, Section of Fisheries, St Paul.

ACKNOWLEDGMENTS

The author would like to thank David Anderson, Paul Diedrich, and Brad Maas for their work in field collection. The author would also like to thank John Hiebert, David Anderson and Paul Diedrich for technical and logistical support.

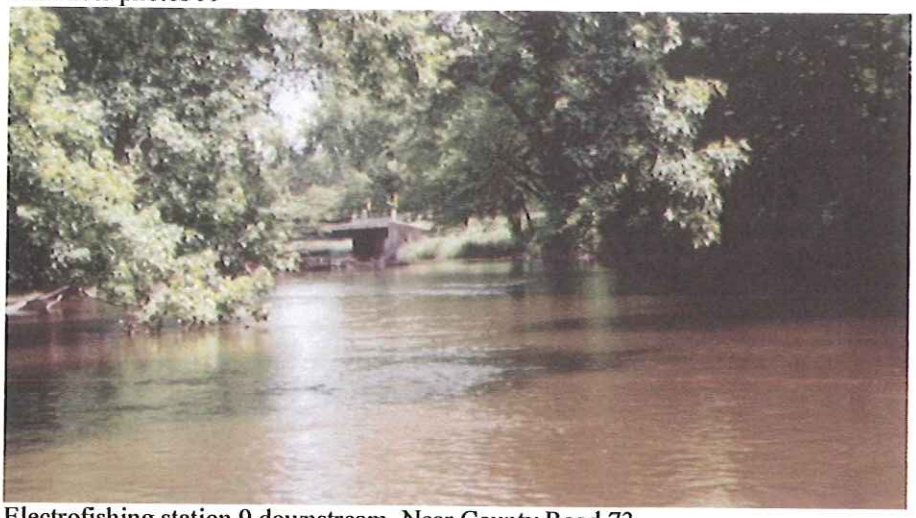
ELK RIVER

Author — 3-22-2000 Date

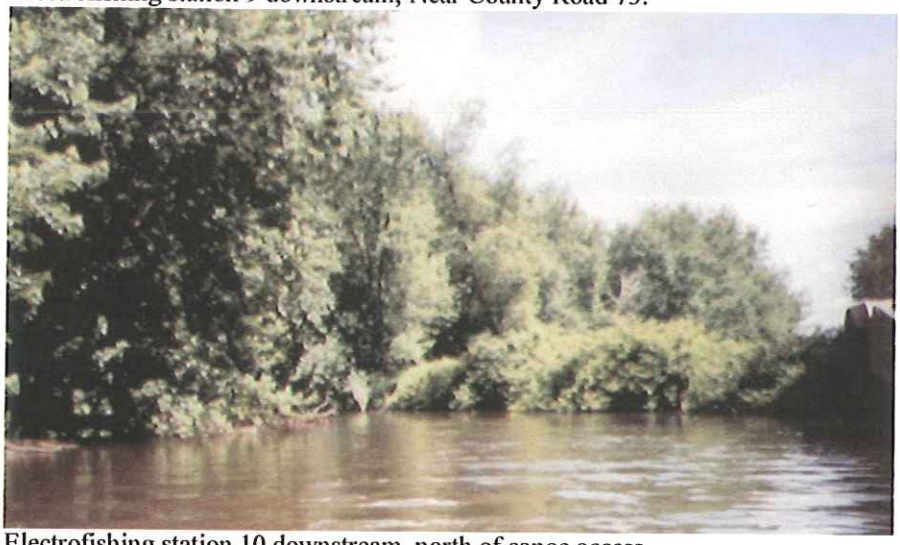
Area Fisheries Supervisor — 3-22-00 Date

Regional Fisheries Supervisor — 04-10-2000 Date

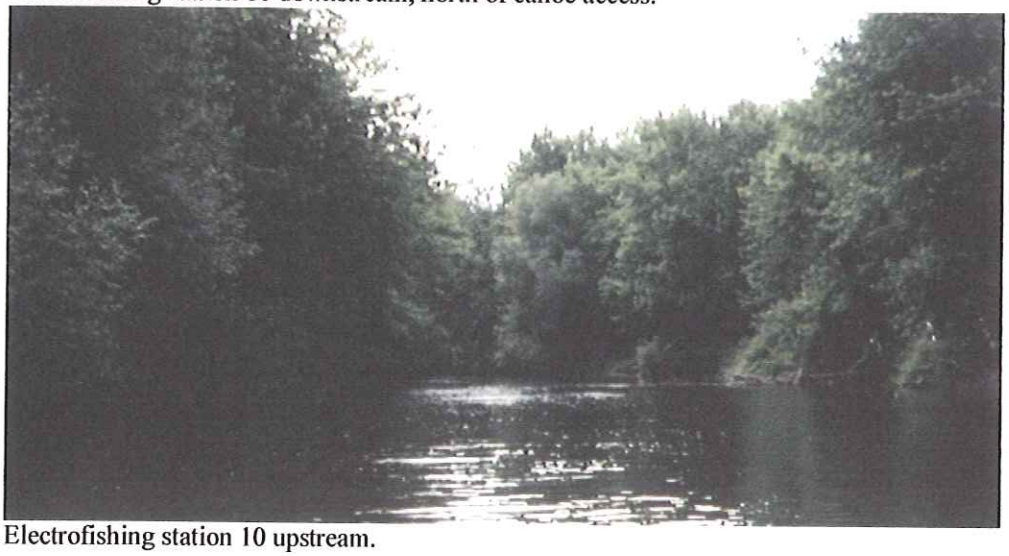
Elk River photos 99



Electrofishing station 9 downstream, Near County Road 73.

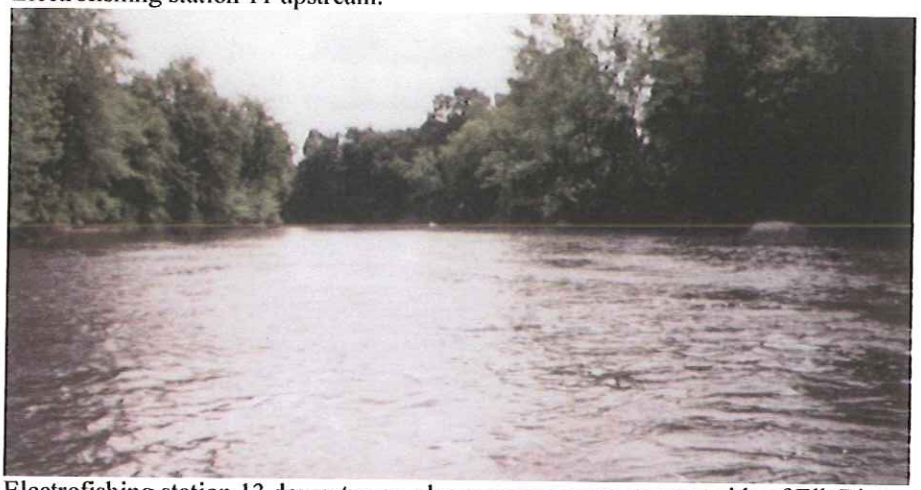


Electrofishing station 10 downstream, north of canoe access.



Electrofishing station 10 upstream.

Electrofishing station 11 upstream.



Electrofishing station 13 downstream, above canoe access on west side of Elk River.