

SECTION 319 NONPOINT SOURCE POLLUTION CONTROL PROGRAM
WATERSHED PROJECT FINAL REPORT

**LITTLE MINNESOTA RIVER WATERSHED/BIG STONE
LAKE RESTORATION/CONTINUATION PROJECT**



By
Roberts Conservation District

Sponsor
Roberts County

February, 2001

This Project was conducted in cooperation with the State of South Dakota and the United States Environmental Protection Agency, Region 8.

Grant #: C9998185-96

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EXECUTIVE SUMMARY

PROJECT TITLE LITTLE MINNESOTA RIVER WATERSHED/BIG STONE LAKE
RESTORATION/CONTINUATION PROJECT

PROJECT START DATE 7/22/1996 PROJECT COMPLETION DATE 12/31/1999

FUNDING:	TOTAL BUDGET	<u>\$696,219.00</u>
	TOTAL EPA GRANT	<u>\$93,536.00</u>
	TOTAL EXPENDITURES OF EPA FUNDS	<u>\$93,536.00</u>
	TOTAL SECTION 319 MATCH ACCRUED	<u>\$237,553.29</u>
	BUDGET REVISIONS	<u>NONE</u>
	TOTAL EXPENDITURES	<u>\$517,829.94</u>

SUMMARY ACCOMPLISHMENTS

The following table summarizes the activity products that were planned in the project implementation plan, and the activity products that were actually accomplished.

Table 1. Summary Accomplishments for the Little Minnesota River Watershed / Big Stone Lake Restoration / Continuation Project

Products	Planned	Accomplished
Animal Waste Management Systems	7	12
No-Till Acres	4,000	25,459
Multiple Use Wetlands	33	26
Riparian Demonstration Projects	3	0
News Releases	6	11
Farm Show Display / Booth	1	4
Audits	3	0
Final Report	1	1

The remainder of this report will provide further details on the accomplishments of the project. Appendix A contains photographs of some completed conservation practices, and Appendix B provides a brief history and current status of the Big Stone Lake Restoration Project.

INTRODUCTION

Big Stone Lake is a 12,610-acre interstate body of water located along the Minnesota and South Dakota border (Figure 1). Its 740,157-acre watershed includes portions of Roberts, Grant and Marshall Counties in northeastern South Dakota, and Big Stone and Traverse Counties in western Minnesota. The principal tributaries to Big Stone Lake include the Whetstone River, which enters the lake from the southwest near the lake's outlet, and the Little Minnesota River, which lies northwest of the lake and empties into its upper end. The Little Minnesota River subwatershed (286,414 acres) is the largest of Big Stone Lake's subwatershed areas. Table 2 shows a summary of Big Stone Lake characteristics.

Table 2. Big Stone Lake Characteristics

Lake surface area	12,360 acres
Maximum depth	16 feet
Average depth	8 feet
Length	26 miles
Shoreline	62 miles
Acre-feet of water storage	98,880 acre-feet

The condition of Big Stone Lake has gradually improved from hypereutrophic to eutrophic. Restoration of the lake was initiated in 1983, and since then, a 15 to 20 percent reduction of in-lake phosphorous concentration has been realized. These improvements in water quality have been noted in previous Big Stone Lake 319 Project Final Reports (#C9008522-89 and #C9008631-92). This EPA 319 project was designed to continue the restoration effort and is a bridge to the USDA PL-566 watershed project.

The project area (247,873 acres) consists of the Lower Little Minnesota River watershed and the immediate drainage area on the western edge of Big Stone Lake (Figure 2). The northern portion of the Little Minnesota River watershed has gentle slopes with abundant wetlands. No significant sources of phosphorous or sediment were identified in the upper portion of the Little Minnesota River watershed, and so it was not included in the project.

Figure 1. Big Stone Lake location.

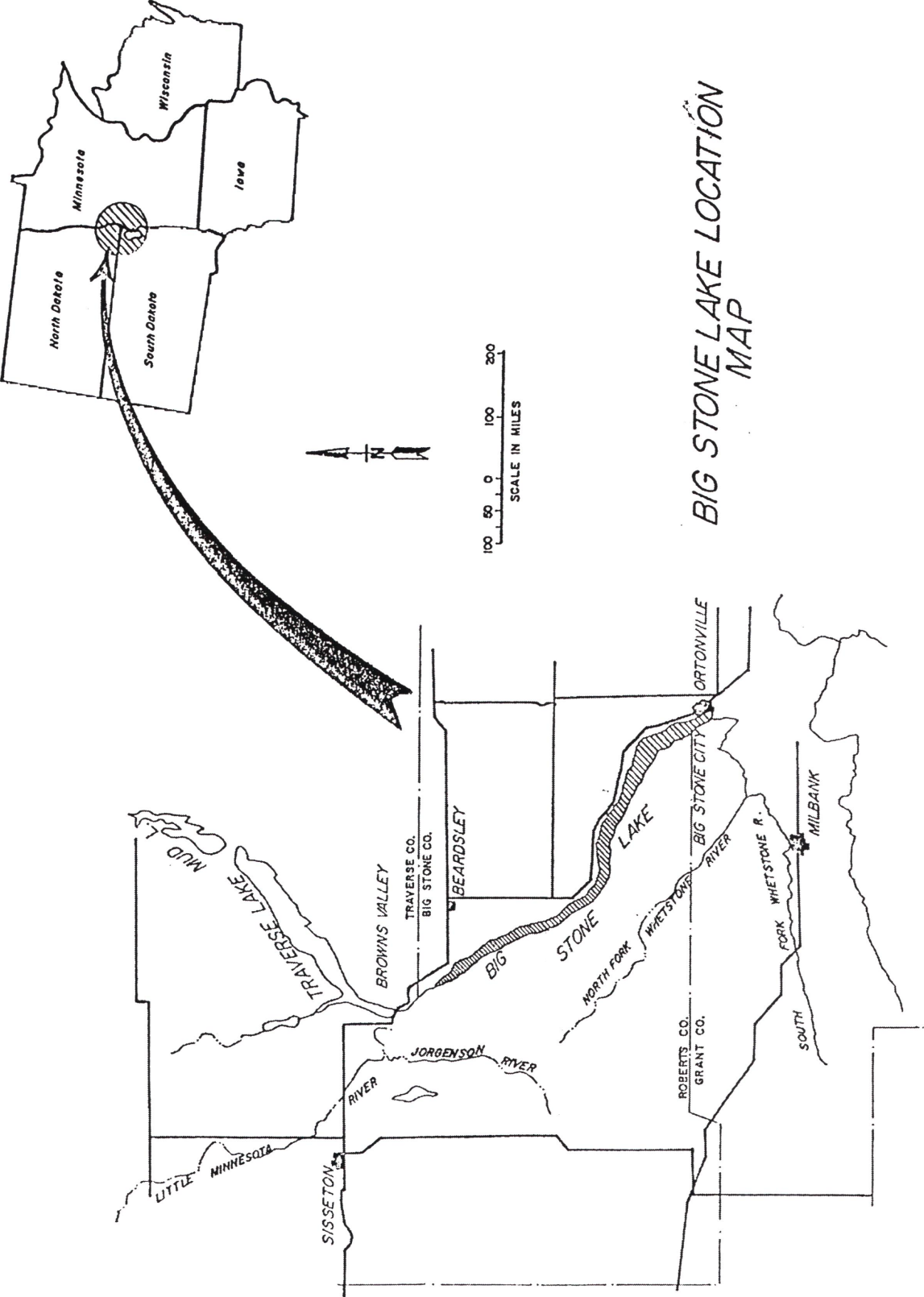
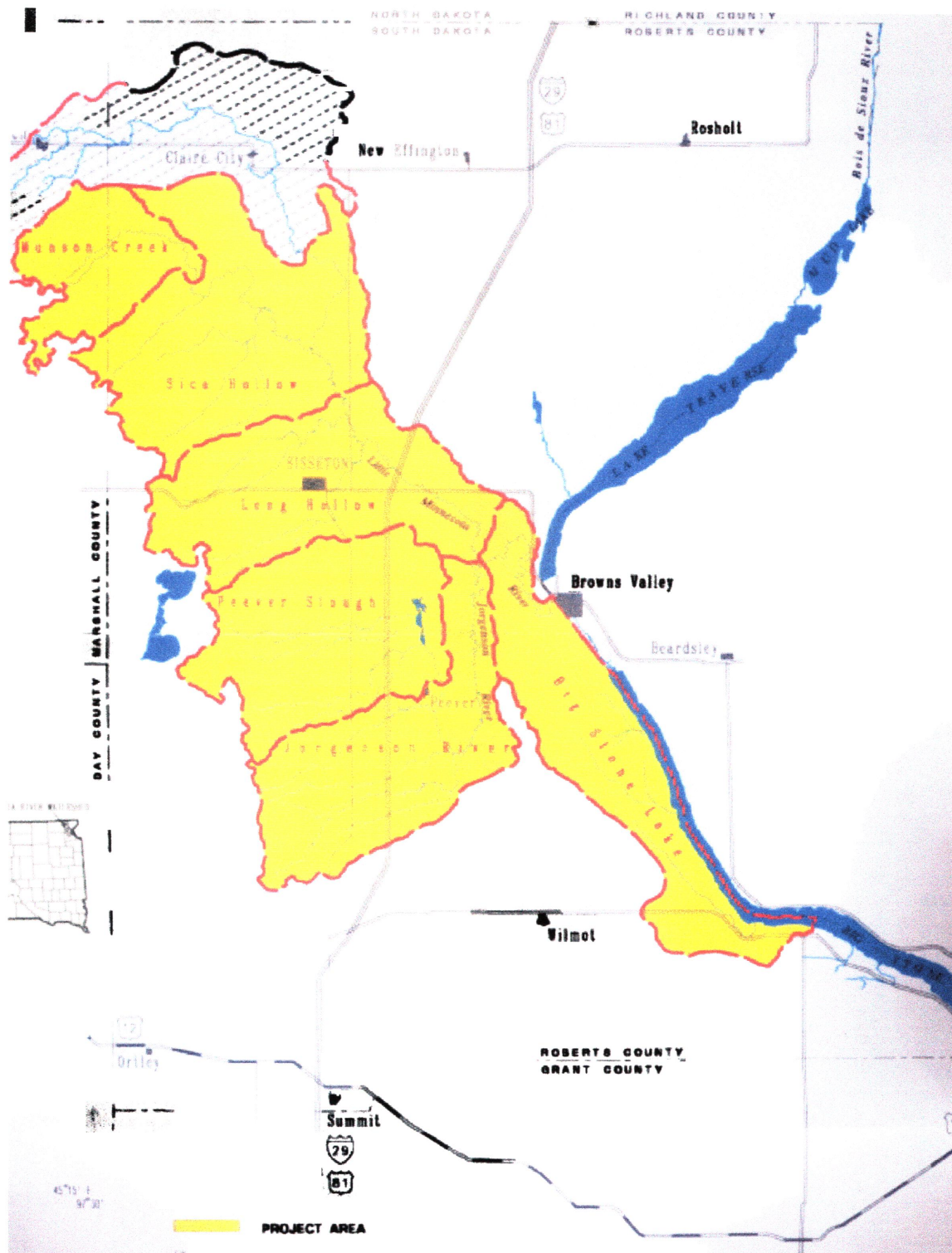


Figure 2. Lower Little Minnesota River watershed and Big Stone Lake project area.



Beneficial uses for Big Stone Lake include warm water permanent fish life propagation, immersion recreation, limited contact recreation, wildlife propagation, livestock watering, and irrigation. Since 1970, the lake has experienced an increase in the growth of rooted aquatic vegetation and nuisance algal blooms due to nutrients transported by runoff. Excessive sedimentation, especially from the bluffs on the western edge of the lake, has also been identified as contributing to the decline in the water quality of the lake. There has been growing public concern over the water quality of the lake, along with the loss of recreation and economic opportunities, as a result of the deterioration in environmental conditions.

The Little Minnesota River originates as an intermittent stream in the Coteau Hills of Marshall County, South Dakota and drops 780 feet in elevation over its 30-mile length. The river empties into the extreme upper end of Big Stone Lake, consequently influencing the entire length of the lake. The Little Minnesota River accounts for 90 percent of the water entering Big Stone Lake. Irrigation, wildlife propagation, livestock watering, warm water permanent fish life propagation, and limited contact recreation are the designated beneficial uses of the Little Minnesota River. Agricultural practices and the confinement of livestock in the Lower Little Minnesota River watershed have increased the amount of phosphorous and sediment transported into Big Stone Lake. Agriculture is the principal land use in the project area. Table 3 provides a specific breakdown of land uses in the Little Minnesota River watershed.

Table 3. Land Uses in the Little Minnesota River Watershed

Land Use	Acres	Percent
Cropland	150,417	52.5
Rangeland	79,138	27.6
Hayland and CRP	31,083	10.9
Woodland	11,457	4.0
Other	14,319	5.0
Total	286,414	100.0

PROJECT GOALS, OBJECTIVES, AND ACTIVITIES

The overall long-term goal of the Big Stone Lake restoration project is to increase the recreation potential and life span of the lake by decreasing sediment and phosphorous loadings by 56%. The implementation of conservation practices in the lake watershed has been the primary effort toward reducing such loads. Project staff and NRCS personnel have developed these practices. USDA funds available from both the Environmental Quality Incentives Program (EQIP) and PL-566 cost-share programs have been used to assist in the construction of the practices. Because the restoration of Big Stone Lake is an extremely large undertaking, the project has been developed in a step-wise manner. The following best management practices were scheduled for implementation in the watershed area as part of the current EPA 319 grant project: animal waste management systems, no-till planting of cropland, multiple use wetlands, and riparian demonstration projects.

Planned and Actual Milestones, Products and Completion Dates

The following pages summarize the planned and completed milestone goals of the project in Tables 4 and 5. In addition, detailed information on the completed products is included in Tables 6 through 9.

Table 4. The Little Minnesota River/Big Stone Lake Restoration Project Planned Milestone Schedule

Tasks/Responsible Organizations	Output	Quantity	1996						1997						1998					
			O/N	D/J	F/M	A/M	J/J	A/S	O/N	D/J	F/M	A/M	J/J	A/S	O/N	D/J	F/M	A/M	J/J	A/S
Goal 1 Objective 1			XXXXXX																	
Task 1 Product 1 Trap Sediment from concentrated livestock Groups: 1,2,3,4,5,8,9	Animal Waste Management Systems	2 4 1							XXXXXX						XXXXXX					
Task 1 Product 2 Implement BMP's Groups: 1,2,3,4,5	No-Till Erodible Cropland	1000 2000 1000	XXXXXX						XXXXXX						XXXXXX					
Task 2 Product 1 Trap Sediment, benefit Wildlife & Alt. Water Source Groups: 1,2,3,4,6,9	Multiple Use Wetlands	13 20	XXXXXX						XXXXXX						XXXXXX					
Task 3 Product 1 Streambank erosion Control & benefit wildlife Groups: 1,2,3,4,6,7,9	Create Riparian Projects	1 2	XXXXXX						XXXXXX											
Goal 1 Objective 2			XXXXXX						XXXXXX						XXXXXXXXXXXXXX					
Task 1 Product 1 Information/Education Groups: 1,2,4,5	News Releases	2 2 2							XXXXXX						XXXXXX					
Task 1 Product 2 Information/Education Groups: 1,2,4,10	Farm Show	1							X											
Task 1 Product 3 Information/Education Groups: 1,2,10	Audits	1 1 1 1	X												X					
	Final Report	1													XX					
															X					

Table 5. The Little Minnesota River/Big Stone Lake Restoration Project Completed Milestone Schedule

Tasks/Responsible Organizations	Output	Quantity	1996					1997					1998									
			O/N	D/J	F/M	A/M	J/J	A/S	O/N	D/J	F/M	A/M	J/J	A/S	O/N	D/J	F/M	A/M	J/J	A/S		
Goal 1 Objective 1			X																			
Task 1 Product 1 Trap Sediment from Concentrated Livestock Groups: 1,2,3,4,5,8,9	Animal Waste Management Systems	1 3 5 3(1999)						X X X					XXXX X XX					X				
Task 1 Product 2 Implement BMP's Groups: 1,2,3,4,5	No-Till Erodible Cropland	8,022.7 5,528.4 6,214.0 5,693.5(99')	XXXXXX					XXXXXX					XXXXXX XXXXXX									
Task 2 Product 1 Trap Sediment, benefit Wildlife & Alt. Water Source Groups: 1,2,3,4,6,7,9	Multiple Use Wetlands	4 7 7 8(1999)	XXXX					XXXX					XXX					XXXX XXXXX XXXX				
Task 3 Product 1 Streambank erosion Control & benefit wildlife Groups: 1,2,3,4,6,7,9	Create Riparian Projects	0 0 0 0																				
Goal 1 Objective 2	News Releases	2 3 3 3(1999)	XX					XXX										XXX XXX				
Task 1 Product 1 Information/Education Groups: 1,2,4,5	Farm Show	1 1 1 1(1999)	X					X										X X				
Task 1 Product 3 Information/Education Groups: 1,2,10	Audits Final Report	0 0 0 1(2000)																X				

Table 6. Completed Animal Waste Management Systems

Date	Name	Watershed	County	Nominated	Non-Nomin.	Type	Cost (\$)	Total (\$)
10/96	Don Arbach	LM	Roberts		X	Dairy	20,754	20,754
12/97	William Koeppe	LM	Roberts		X	Beef	29,480	50,234
11/97	Dan Roark	LM	Roberts		X	Hogs	26,880	77,114
10/97	Jerry Currence	LM	Roberts	X		Dairy	41,267	118,381
7/98	Harry Ziemer	LM	Roberts		X	Hogs	27,095	145,476
11/98	Ed Lamers	LM	Roberts		X	Hogs	10,261	155,737
11/98	Bill McCleery	LM	Roberts	X		Dairy	40,649	196,386
11/98	Scott Nelson	LM	Roberts	X		Beef	23,549	219,935
10/98	Dana Stapleton	LM	Roberts	X		Beef	47,715	267,650
11/99	Larry Lekness	LM	Roberts	X		Beef	9,509	277,159
12/99	Frank Rinas	LM	Roberts	X		Beef	57,362	334,521
12/99	Robert Meland	LM	Roberts	X		Beef	14,214	348,735
Total Cost								\$348,735

Table 7. Completed No-Till Seeding of Erodiible Cropland

Year	Acres	Total Acres
1996	8,022.7	8,022.7
1997	5,528.4	13,551.1
1998	6,214.0	19,765.1
1999	5,693.5	25,458.6
Total Acres		25,458.6

Table 8. Completed Multiple Use Wetlands

Date	Name	Watershed	Fund	Cost (\$)	Total Cost (\$)
10/96	Evenson Bros.	LM	PL-566	5,765	5,765
10/96	Evenson Bros.	LM	PL-566	6,263	12,028
11/96	Evenson Bros.	LM	PL-566	2,210	14,238
11/96	Evenson Bros.	LM	PL-566	6,184	20,422
08/97	Evenson Bros.	LM	PL-566	12,128	32,550
09/97	Dean Bendickson	LM	USF&W	4,717	37,267
09/97	Gordon D. Peterson	LM	PL-566	7,159	44,426
09/97	Roger Knapp	Whet.	USF&W	1,802	46,228
10/97	Clayton Palmquist	Whet.	USF&W	1,448	47,676
11/97	Paul Meyer	Traverse	USF&W	8,888	56,564
11/97	Waletich, Jr.	LM	PL-566	20,536	77,100
09/98	Evenson Bros.	LM	PL-566	3,450	80,550
09/98	Evenson Bros.	LM	PL-566	11,121	91,671
10/98	Harry Ziemer	LM	PL-566	21,628	113,299
10/98	Duane Steege	Whet.	USF&W	4,643	117,942
10/98	Harvey Harms	Whet.	USF&W	5,155	123,097
10/98	Evenson Bros.	LM	PL-566	8,962	132,059
11/98	Truman Nelson	LM	EQIP	6,279	138,338
09/99	Darin Mertens	Whet.	USF&W	9,431	147,769
09/99	Tim Rice	LM	PL-566	19,180	166,949
09/99	Harlan Steen	Traverse	USF&W	3,300	170,249
09/99	Whipple Ranch	Whet.	USF&W	1,261	171,510
10/99	Lynn Brandenburger	Traverse	USF&W	21,629	193,139
10/99	Billy Brooks	LM	USF&W	8,551	201,690
10/99	Evenson Bros.	LM	PL-566	12,829	214,519
12/99	Terry Rasmussen	LM	EQIP	1,272	\$215,791

There were no riparian projects implemented during the project period. However, a buffer strip was completed. A design was also drawn for a stream bank stabilization project. This project was pending at the end of the grant period.

Grassed waterways were not included in the project implementation plan. However, nineteen waterways were completed during the project period. The table below provides summary information about the completed waterways.

Table 9. Completed Grassed Waterways

Date	Name	Cost (\$)	Total Cost (\$)
9/97	Arbach	1,806	1,806
9/97	Evenson Bros.	3,549	5,355
09/97	Goodhart	6,456	11,811
09/97	Hanson	4,727	16,538
09/97	Peterson	1,500	18,038
09/97	Schauman	5,723	23,761
09/97	Waletich, Jr.	2,210	25,971
09/97	Waletich, Jr.	4,848	30,819
09/97	Wenshlag	5,373	36,192
10/97	Apple	2,562	38,754
10/97	Goodhart	2,940	41,694
10/97	Currence	6,856	48,550
09/98	Hmcir	3,750	52,300
09/98	Bob Weeks	4,713	57,013
09/98	Ed Lamers	3,321	60,334
09/98	Medhaug	4,090	64,424
10/98	Evenson Bros.	2,774	67,198
10/98	Evenson Bros.	2,613	69,811
09/99	Tim Rice	4,845	\$74,656

Evaluation of Goal Achievement

The Big Stone Lake Restoration Project is a long-term restoration effort. Big Stone Lake and its tributaries have been extensively monitored since 1971. Available information provided data to establish a baseline from which to assess problems and suggest solutions. Although water sampling was not included as part of the current project, other long-term monitoring results indicate that the water quality of Big Stone Lake has gradually improved from a hypereutrophic to a eutrophic condition.

Work consisting of the implementation of best management practices and surveying feedlots was accomplished during the current project period (1996 to 1999). It was difficult to implement some practices due to wet weather and a shortage of available contractors. Overall, however, the goals of the project were met or exceeded. A couple of exceptions were that the number of riparian demonstration projects and multiple use wetlands did not meet planned objectives.

With the exception of a few practices, the long-term restoration project is also on schedule. Additional funding has been allocated to practices that are in a design phase or are awaiting construction. It is anticipated that additional progress can be achieved in coming years, including more emphasis on riparian areas. The project has been implemented in accordance with the South Dakota Nonpoint Source Management Plan.

BEST MANAGEMENT PRACTICES DEVELOPED AND/OR REVISED

The best management practices implemented during the project period were developed in accordance with the approved project implementation plan. There were no revisions to the project implementation plan.

RESULTS OF BEST MANAGEMENT PRACTICE OPERATION AND MAINTENANCE REVIEWS

Limited operation and maintenance surveys have been completed over the years. Very few problems have been noted concerning the best management practices that have been implemented. All practices are constructed to the standards recommended by the Natural Resources Conservation Service. Most, if not all, landowners have been satisfied with the working operation of their practices.

COORDINATION EFFORTS

Coordination efforts for the project have been widespread. There have been many organizations, agencies, and units of government involved with the Little Minnesota River/Big Stone Lake water planning and implementation process. They are as follows:

1. Roberts County: Roberts County served as the project sponsor. Most project responsibilities were delegated to the Roberts Conservation District.
2. Roberts Conservation District: The Roberts Conservation District administered the project, coordinated between agencies and hired project staff. Project staff addressed all facets of the 319 project including planning, information and education, and assistance in the implementation of best management practices.
3. South Dakota Department of Environment & Natural Resources (SD DENR): The Department of Environment and Natural Resources administered the project grant and provided technical assistance on matters pertaining to water quality.
4. Natural Resources Conservation Service (NRCS): The USDA Natural Resources Conservation Service provided engineering and technical assistance for the design and construction of best management practices.

5. NRCS Animal Waste Technical Assistance Team: The NRCS Animal Waste Technical Assistance Team provided engineering designs for animal waste management systems.
6. NRCS East River Riparian Technician: The NRCS East River Riparian Technician assisted in the prioritization and design of riparian area practices.
7. Farm Service Agency (FSA): The USDA Farm Service Agency provided cost-share funds for the implementation of best management practices.
8. US Fish & Wildlife Service: The US Fish and Wildlife Service provided technical assistance and cost-share funds for the construction of multiple use wetlands.
9. Citizens for Big Stone Lake (CBSL): The Citizens for Big Stone Lake organization provided cost-share funds for multiple use wetlands and assistance with information and education activities.

Other USDA Programs

Other USDA programs within the project area help control sediment and nutrient runoff. These programs promote soil conservation, water conservation, and wildlife habitat. The other programs include the following: Floodplain Easement, Wetland Reserve Program, Conservation Reserve Program, and the Continuous Conservation Reserve Program.

The Floodplain Easement program is a perpetual program that reduces the risk of flood damaged cropland. By paying one lump payment to the landowner the cropland is set aside, never to be cropped again. This program reduces soil erosion, sedimentation, and nutrient runoff. There are three contracts in the project area for Floodplain Easement with a total of 186.7 acres.

The Wetland Reserve Program offers landowners the opportunity to protect, restore, and enhance wetlands on their property through either perpetual or 30-year contracts. To qualify, the land must have a cropping history. There are 29 contracts in the project area for the Wetland Reserve Program with a total of 1,346.2 acres.

There has also been extensive implementation of the Conservation Reserve Program. One important aspect of this program is the continuous CRP sign-up for riparian buffers and filter strips. There are eleven contracts for this practice in the project area, with a total of 120.3 acres. The buffers and filter strips are located adjacent to permanent water bodies. These practices are 100 feet wide on either side of the water bodies.

Regular CRP sign-ups are also very important. CRP plantings filter water from fields and protect the fields from wind and water erosion. Within the project area, there are 104 active contracts in regular CRP, with 6,854.7 acres of cropland planted. These plantings not only enhance water filtration, but also improve wildlife habitat.

Although these other USDA programs are not directly a part of the project, they do play a vital role in keeping water resources clean and abundant. These program practices, along with the Big Stone Lake Project practices, help to improve water quality in the project area.

SUMMARY OF PUBLIC PARTICIPATION

Conservation practices acceptable to the public in the watershed were identified through four public meetings and two mail-in surveys. The Marshall County and Roberts County Conservation Districts developed a survey for residents in each subwatershed. The survey presented practices proposed by a planning team. Participants were asked to rank the practices in order of priority for achieving a reduction in phosphorus delivered to the lake. The survey also requested landowners and operators to identify other conservation practices that they would like to implement if the project was funded. In order to reach as many people as possible, brief overviews of the project and the surveys were presented at

agricultural meetings in the watershed. Surveys were also mailed to all township board chairmen for board members to complete. The surveys supported the participation rates estimated by NRCS and conservation district personnel. Based on survey results, the top five practices ranked from the highest to lowest priority were minimum tillage, critical area treatment, grassed waterways, no-till planting, and animal waste management systems.

ASPECTS OF THE PROJECT THAT DID NOT WORK WELL

During the project there were some problems with the construction of grassed waterways. Timing was critical for this practice. Normally the landowner had to harvest his crop before construction could begin. It was suggested that a small grain crop be planted the year of construction. Construction at the middle to the end of August was preferred so that a grass seeding could get established before winter. In some instances the seedings did not take, and the waterways were washed out the following spring. The waterways then had to be re-shaped and seeded again.

Another practice with some problems was the riparian buffer strip. Most landowners were not sold on this practice due to the fact that they perceived little to no direct benefit. Another reason was that if they had to fence out cattle, they were concerned that the fence might get washed out in some places near the river in normal years. It is believed that additional cost-share may be necessary as an incentive for this practice.

PROJECT BUDGET AND EXPENDITURES

The budget and expenditures for the Little Minnesota River Watershed / Big Stone Lake Restoration / Continuation Project are summarized in the table below:

Table 10. Project Budget and Expenditures

Date	EPA (\$)	Local(cash \$)*	Farmer (cash \$)	PL-566(\$)**	Total(\$)
1997	30,227.16	39,888.18	62,428.49	20,353.20	152,896.78
'98, Jan.-Feb.	4,407.78	2,238.05	16,748.61	20,971.66	44,366.09
'98, Mar.-April	4,645.43	1,548.48	0.00	0.00	6,193.91
'98, May-June	4,149.90	3,130.85	1,163.90	0.00	11,444.65
'98, July-Aug.	4,544.61	4,494.33	25,587.31	0.00	34,626.25
'98, Sept.-Oct.	4,361.66	5,737.95	10,453.83	0.00	20,553.44
'98, Nov.-Dec.	5,195.10	10,364.42	26,382.69	111,084.04	153,026.25
'99, Jan.-Feb.	4,697.08	1,597.38	0.00	0.00	6,294.46
'99, Mar.-April	4,871.46	4,052.51	5,860.57	16,842.11	31,626.65
'99, May-June	5,174.71	1,769.21	4,794.90	14,340.39	26,079.21
Special Office	4,086.00	0.00	0.00	0.00	4,086.00
'99, Sept.-Oct.	6,680.73	2,226.92	0.00	0.00	8,907.65
'99, Nov.-Dec.	5,470.73	1,001.33	1,211.25	3,149.25	10,832.60
TOTALS	\$93,536.00	\$79,921.74	\$157,631.55	\$186,740.65	\$517,829.94

*SD Consolidated Water Facilities Construction Fund= \$11,354.00 (Not included in figures above)

*Roberts County, Roberts Conservation District, SD Game, Fish & Parks, and other state or county funds

**US Fish & Wildlife, FEMA, EQIP, North American Wetlands, and other federal funds

FUTURE ACTIVITY RECOMMENDATIONS

Prescribed burning revives and promotes native grasses. It also has been proven to control noxious weeds. Perhaps in the next few years this method could be implemented in selected areas. Also, a conservation demonstration project could be incorporated into the project. This would entail renting, leasing, or buying a small area of land near a river or stream and adjacent to a major highway or road. A variety of conservation practices such as riparian buffer strips, native grass seedings, and stream bank stabilization could be implemented as part of the demonstration. An information center could be constructed at the site that would provide information to the public on the importance and benefits of the demonstrated conservation practices.

LITERATURE CITED

Big Stone Lake Restoration Final Report Two (1992-1995)
Continuation Report EPA 319 (July 1996)

These reports are on file at the Roberts Conservation District Office, Sisseton, SD, and at the SD DENR Office at Watertown, SD.

Appendix A

Project Photographs

LITTLE MINNESOTA RIVER / BIG STONE LAKE WATERSHED PROJECT
Final Report for EPA 319 Grant C9998185-96



An animal waste management system was constructed for Frank Rinas in the fall of 1999. The sediment basin is in the foreground, and the evaporation pond is in the background.



The animal waste management system constructed for Frank Rinas. The sediment basin with screened inlets is on the left, and the evaporation pond is on the right.



An animal waste management system under construction for Larry Lekness during the summer of 1999.



The completed animal waste management system constructed for Larry Lekness.



An animal waste system built for Scott Nelson in 1998: holding pond to the left, sediment basin to the right.



Close-up view of the sediment basin and screened inlet for the Scott Nelson animal waste system.



Views of a multipurpose dam under construction for Bill Brooks during 1999.



A multipurpose dam was constructed for Evenson Farms in the fall of 1999.



A multipurpose dam was constructed for Tim Rice in May of 1999.

Appendix B

Brief History and Current Status of Big Stone Lake Restoration Project

BRIEF HISTORY AND CURRENT STATUS OF THE BIG STONE LAKE PROJECT

Big Stone Lake is located on the border between South Dakota and Minnesota. The lake occupies the valley of a glacial river that drained historic Lake Aggasiz. The surface area of the lake is 12,610 acres, and it extends southward for 26 miles from Browns Valley, Minnesota to Ortonville, Minnesota and Big Stone City, South Dakota.

In the early 1980's, citizens of South Dakota and Minnesota requested assistance from both states and the US EPA to begin efforts to restore Big Stone Lake. The primary concerns were poor water quality, excessive algal blooms, sedimentation, rooted aquatic vegetation, and reduced recreation potential. An EPA Section 314 grant was awarded to South Dakota to conduct a Diagnostic / Feasibility Study. The study was completed in 1983, and additional EPA Section 314 grants were awarded in 1984 to South Dakota and Minnesota to begin a lake and watershed restoration project. Subsequent EPA grants have been provided to both states to continue the restoration effort. EPA Section 319 grant funding has been provided for the Big Stone Project since 1989, with the most recent 319 grants being awarded in 1996 and 1999. In addition, a USDA PL-566 grant was awarded to the Roberts County (SD) Conservation District in 1996 to assist with continuation of the project.

Conservation practices completed in the lake watershed since the beginning of the restoration project include 45 animal waste management systems, 25,459 acres of no-till crops, 56 stock water ponds, 20 grassed waterways, and 1 stream buffer strip. Six municipal wastewater treatment facilities have been upgraded in the watershed. Restoration practices implemented at the lake include access road erosion control, shoreline stabilization, and upgraded wastewater treatment. A new lake outlet control structure and debris barrier were constructed at the south end of the lake. The main purpose of this project was to divert the majority of flow from the Whetstone River away from Big Stone Lake. The Whetstone River was diverted into the lake in the 1930's to augment lake levels. However, the diversion resulted in excessive nutrients and sediment being deposited in the lake. The new control structure allows the diversion of these contaminants away from the lake in accordance with the original river flow pattern.

The results of the Big Stone Lake Restoration Project are beginning to be realized in improved water quality. Water sample results have shown a gradual but steady improvement in recent years. The trophic status of the lake has changed from hypereutrophic (extremely nutrient rich) to eutrophic (nutrient rich). This has subsequently resulted in less extensive and shorter duration algal blooms. In addition, the fisheries of the lake have improved to the point that a national walleye circuit fishing tournament is held annually at Big Stone Lake. Attendance records at Big Stone Lake State Park on the Minnesota side and Hartford Beach State Park on the South Dakota side have documented substantial increases in recreational use of the lake. Comments by lake residents indicate appreciation of the water quality improvement that has occurred to date. The key partners in the Big Stone Lake Restoration Project include watershed land owners; lake residents; local counties, conservation districts, and municipalities; the Upper Minnesota River Watershed District; the Citizens For Big Stone Lake; the South Dakota Department of Environment and Natural Resources; the Minnesota Pollution Control Agency; the US EPA; the USDA; and the US Fish and Wildlife Service. Additional information on state park usage and the lake fisheries is provided below.

STATE PARK INFORMATION (personal communications with park managers, 2/8-10/00)

The following table summarizes attendance at the two state parks on Big Stone Lake in recent years. The increases in attendance correlate with improvements in water quality.

	Big Stone Lake State Park (MN)	Hartford Beach State Park (SD)
Year	Attendance	Attendance
1986 to 1993 (ave.)	11,000 to 13,000	57,000 to 59,000
1994	15,500	55,000*
1995	18,500	66,336
1996	25,000	61,944
1997	28,500	66,375
1998	33,700	72,000
1999	36,559	77,229

*Hartford Beach campground under construction / renovation.

The manager of the Hartford Beach State Park stated that he has not had to post the swimming beach for unsafe swimming (based on water sample bacteria results) for the past eleven years.

FISHERIES INFORMATION (excerpts from Lake Management Plan, Minnesota Department of Natural Resources, 5/29/96)

SOCIAL CONSIDERATIONS

Big Stone Lake and its fishery provide the primary feature for Big Stone Lake State Park, Hartford Beach State Park and several resorts, as well as an important recreational attraction for Ortonville, Big Stone City and surrounding communities. The fishery of the lake has the potential to contribute substantially to local and state economies. Angler creel surveys conducted during open water and ice fishing seasons estimated the following:

Creel Survey	Angler Trips	Angler Hours	Economic Value
1987-88	60,575	195,446	\$1,272,075
1993-94	73,981	287,306	\$2,737,297
1994-95	95,334	329,633	\$3,908,694

PAST MANAGEMENT

The fishery of Big Stone Lake has historically been managed primarily for walleye, with a secondary emphasis on yellow perch, bluegill, black crappie, northern pike, largemouth bass and channel catfish. . . . Walleye abundance, as measured by average gill net catch rates, was near the low end of the "normal range" for lakes with similar physical and chemical characteristics in 1971 through 1985 samples. Since 1985, abundance has increased substantially, been above normal, and been higher than the current objective (15/gill net). . . . Yellow perch abundance declined from 1971 through 1985, increased in 1987, declined again through 1991, then has increased since then. Even when perch were lowest in abundance, they were still above the normal range for similar lakes. Only at their lowest levels of abundance (1985 and 1991) were gill net catch rates lower than the objective (45/gill net). The decline in perch abundance in 1991 was due to a particularly weak 1990 year class of perch, and was concurrent with recruitment of a large 1990 year class of walleye and a tremendous increase in walleye abundance.

PRESENT LIMITING FACTORS

(continued from Lake Management Plan, MN DNR, 5/29/96)

Agricultural, domestic, and municipal pollution have degraded fisheries habitat, reduced recreational opportunities, reduced the aesthetic quality of the lake and increased the likelihood of more direct effects to the fisheries in the form of fish kills. Drainage and land use changes in the lake's watershed have contributed to increased sedimentation, nutrient loading, changes in tributary flows, increases in water level fluctuations, and direct destruction of aquatic habitats (particularly streams and wetlands). Sedimentation and nutrient loading have probably degraded water quality, and altered physical habitat. Vegetation and bottom substrates may have changed to become less conducive for desirable fish species.

HABITAT DEVELOPMENT AND PROTECTION

As a result of the EPA Clean Lakes Program, sewage treatment facilities at Browns Valley and Sisseton* have been improved and several feedlot retention dams have been built. . . . Acquiring property or using cost-share programs to protect marginal land, critically eroding areas, or to provide vegetative buffer strips along the lakeshore or tributaries could minimize erosion, siltation and sedimentation or its impacts on fisheries habitat.

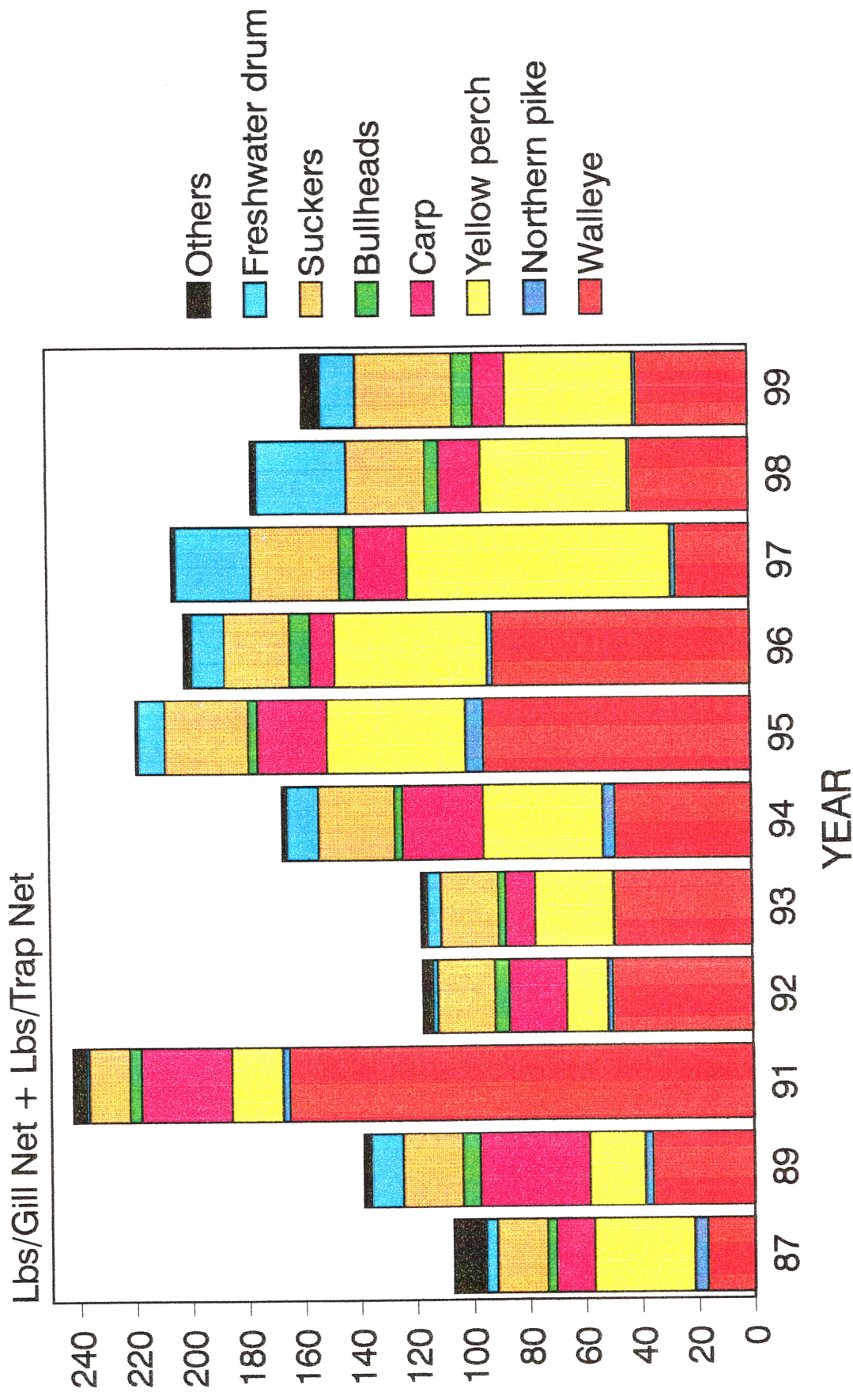
[*Wastewater treatment facilities at Veblen, SD; Peever, SD; Wilmot, SD; and Big Stone City, SD; have also been upgraded in recent years.]

FISHERIES GRAPHS

The Minnesota Department of Natural Resources Area Fisheries Office at Ortonville, Minnesota provided the graphs on the following pages.

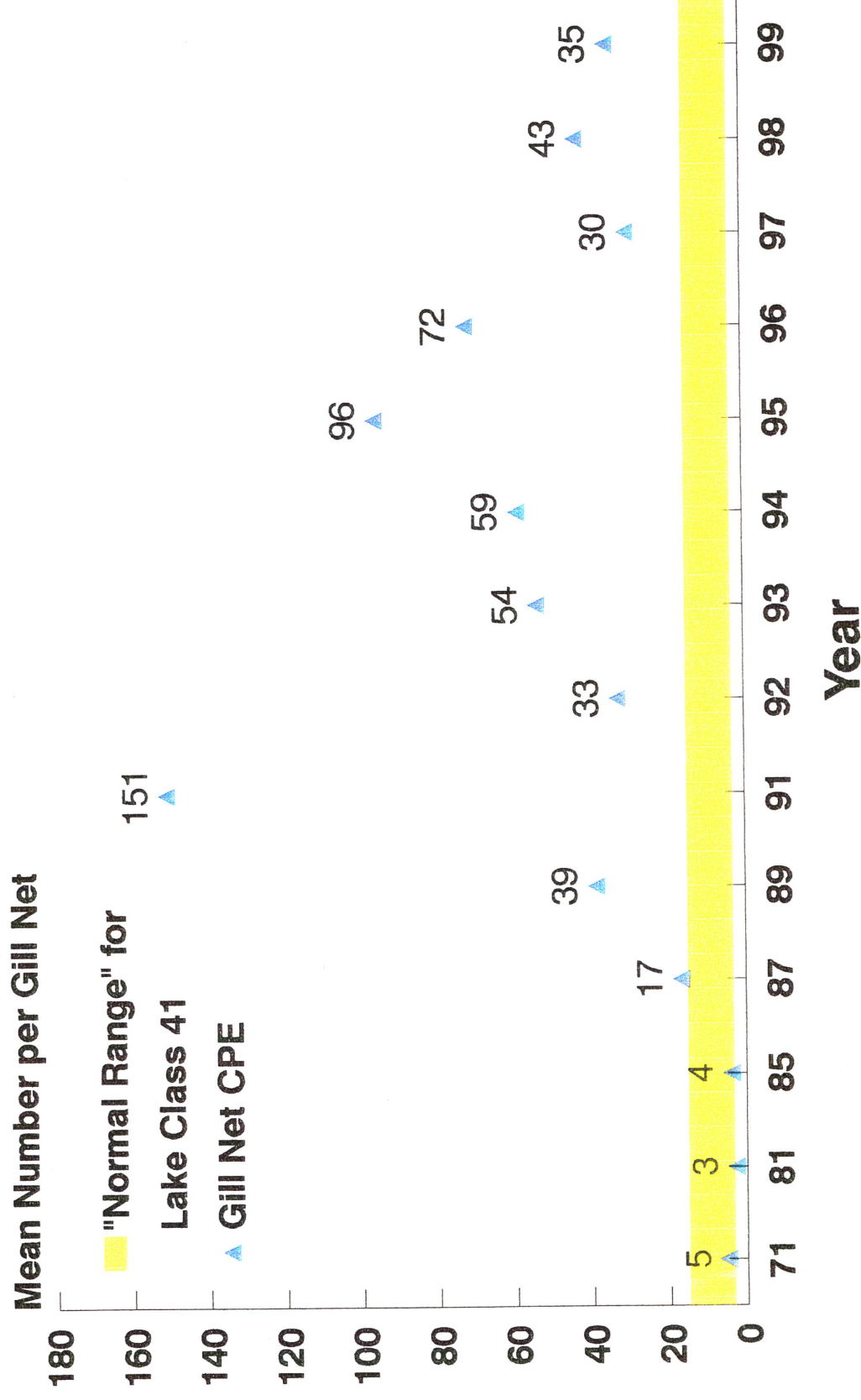
Species Relative Abundance by Weight

Big Stone Lake, 1987-1999



Number Walleye Caught Per Gill Net

Big Stone Lake 1971-1999



Summer sampling 1971, 81, & 85; all others fall sampling.

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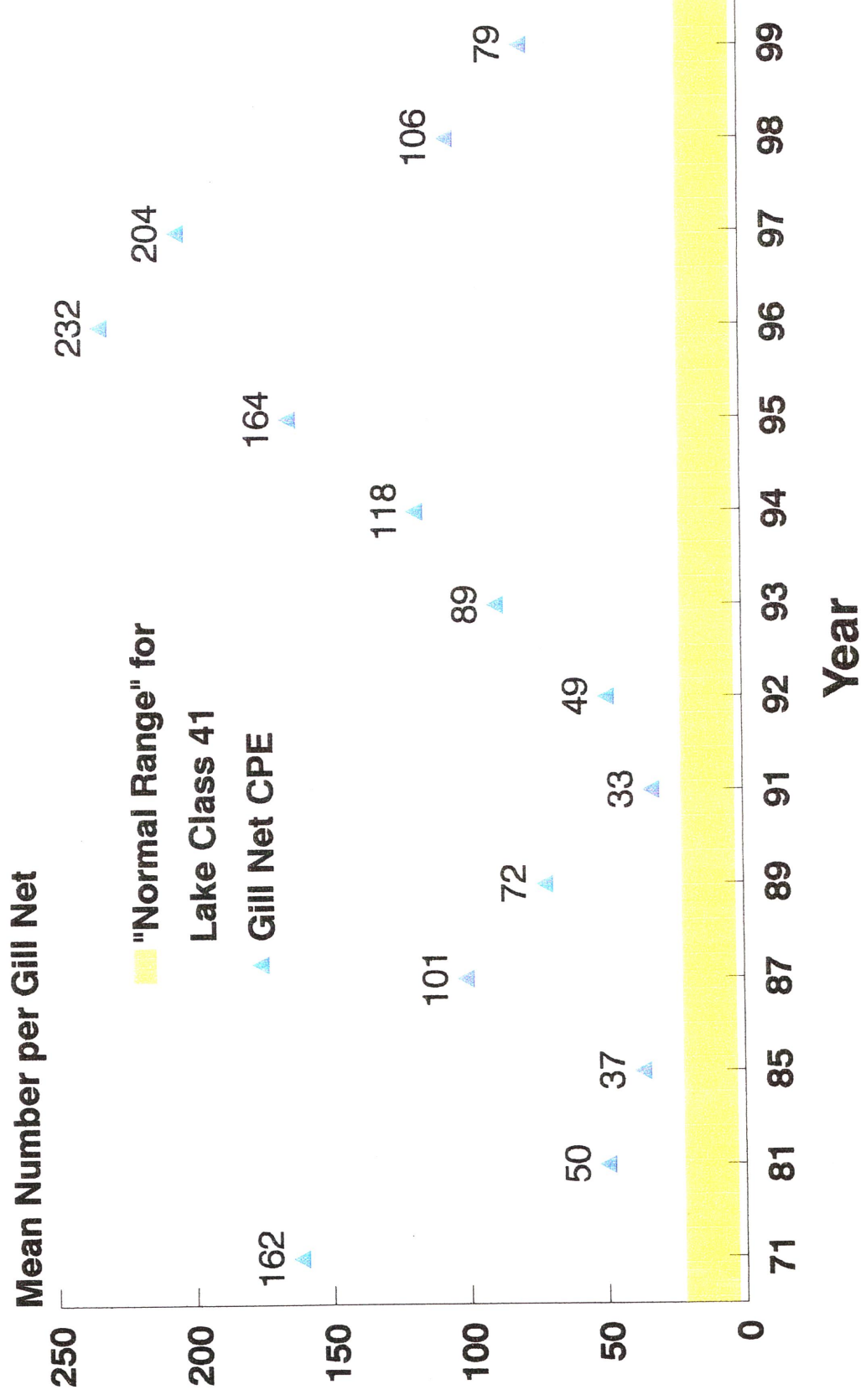
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Number Yellow Perch Caught Per Gill Net

Big Stone Lake 1971-1999



Summer sampling 1971, 81, & 85; all others fall sampling.

Yellow Perch Length and Age Frequencies

Big Stone Lake Gillnetting, Fall 1999

Mean GN catch = 79 (Normal range 3-23)

