

14. BOLLER LAKE: A VITAL LINK IN THE MANAGEMENT OF LAKE WINONA

Boller Lake lies between Highway 61 and the Winona bluff line, bounded by Winona and Minnesota City (Fig. 14-1,2). The lake is not within the city limits of Winona, Minnesota City or Goodview, however, but is within the jurisdiction of Winona Township. The City of Winona has had flood easements on Boller Lake since 1944, and is thus entitled to control the water levels of Boller Lake. The history of Boller Lake up to 1973 is outlined in Chapter 3.

Boller Lake plays an integral part in the management of Lake Winona because: 1) it has intercepted eroded soil destined for Lake Winona since 1944, 2) it is connected to Lake Winona via County Ditch No. 3 and is a historic spawning area for many species of fish, especially carp, buffalo, bullheads and northern pike, 3) it is a productive marsh, producing waterfowl, fish, mammals, and other wildlife. The successful management of Lake Winona must also include management of Boller Lake.

Boller Lake's potential for producing rough fish is indicated by data obtained as a result of the 1973 rotenone treatment of the watershed. A total of 28,905 pounds of dead fish were picked up after the kill in Boller Lake. They included the following poundages: smallmouth buffalo 16,187; gizzard shad 6,284; carp 4,171; freshwater drum 699; crappie 486; bullhead 445; channel catfish 188; sunfish 171; northern pike 69; bowfin 69; walleye 52; largemouth bass 52; white bass 20; yellow perch 12.

Virtually no aquatic plants existed in Boller Lake in 1973 because the buffalo, carp and bullheads had destroyed them. Muskrats, waterfowl and other wildlife were scarce because of the dearth of aquatic food plants.

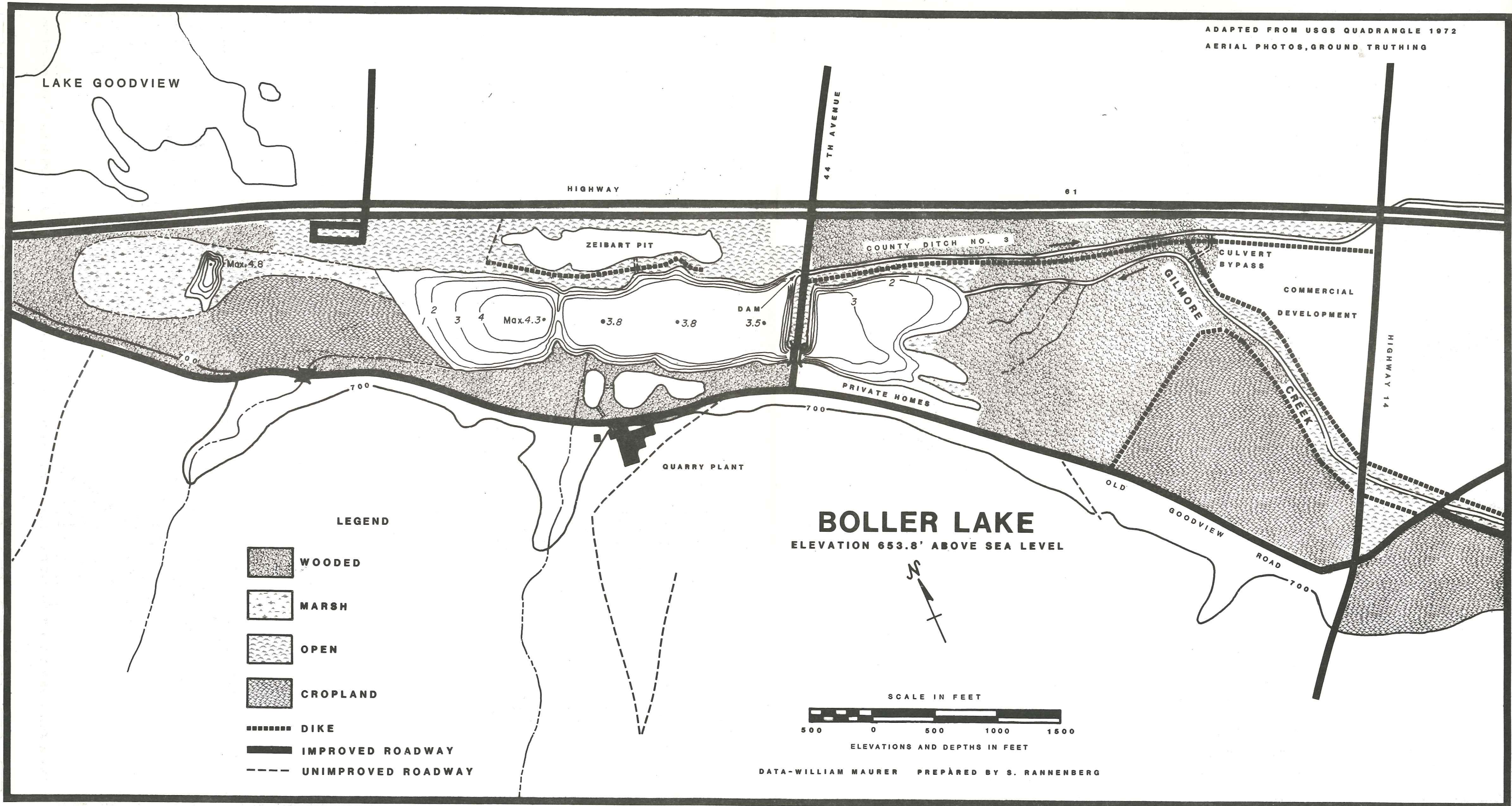
A malfunctioning electric weir allowed carp and other fish to gain entrance to Boller Lake in the spring of 1974. It was obvious that if not controlled, the carp produced in Boller Lake could overwhelm Lake Winona. Carp traps were employed in County Ditch No. 3, but it soon became obvious that they were not very effective (Fig. 14-3). Consequently, it was deemed necessary to develop an inexpensive method of killing all fish in Boller Lake whenever the lake became infested with undesirable species. Rotenone treatment of Boller Lake would have sufficed, but would have been prohibitively expensive. (The Ziebart Sand Pit which is connected to Boller Lake had to be treated with rotenone on October 25, 1976. It yielded about 1000 carp and about 60 northern pike).

Despite Boller Lake's shallowness (Maximum depth 4.3 feet), fish are able to survive the winter because the lake does not freeze to the bottom and because Gilmore Creek flows through it,



Figure 14-1. Boller Lake. The City of Winona and Biesanz Stone Quarry lie in the upper right, the City of Goodview in the upper left, and Hidden Valley Trailer Court in the lower right

ADAPTED FROM USGS QUADRANGLE 1972
AERIAL PHOTOS, GROUND TRUTHING



LAKE GOODVIEW

HIGHWAY

44 TH AVENUE

61

ZEIBART PIT

COUNTY DITCH NO. 3

CULVERT BYPASS

COMMERCIAL DEVELOPMENT

Max. 4.8








Max. 4.3

DAM 3.5

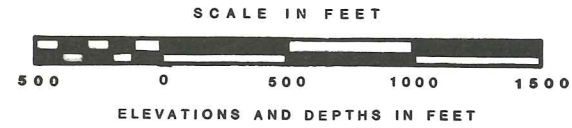
PRIVATE HOMES

GILMORE CREEK

LEGEND

-  WOODED
-  MARSH
-  OPEN
-  CROPLAND
-  DIKE
-  IMPROVED ROADWAY
-  UNIMPROVED ROADWAY

BOLLER LAKE
ELEVATION 653.8' ABOVE SEA LEVEL



DATA-WILLIAM MAURER PREPARED BY S. RANNENBERG

thus oxygenating it. It was reasoned that if Gilmore Creek could be diverted around Boller Lake at will, undesirable fish could be controlled with winterkills.

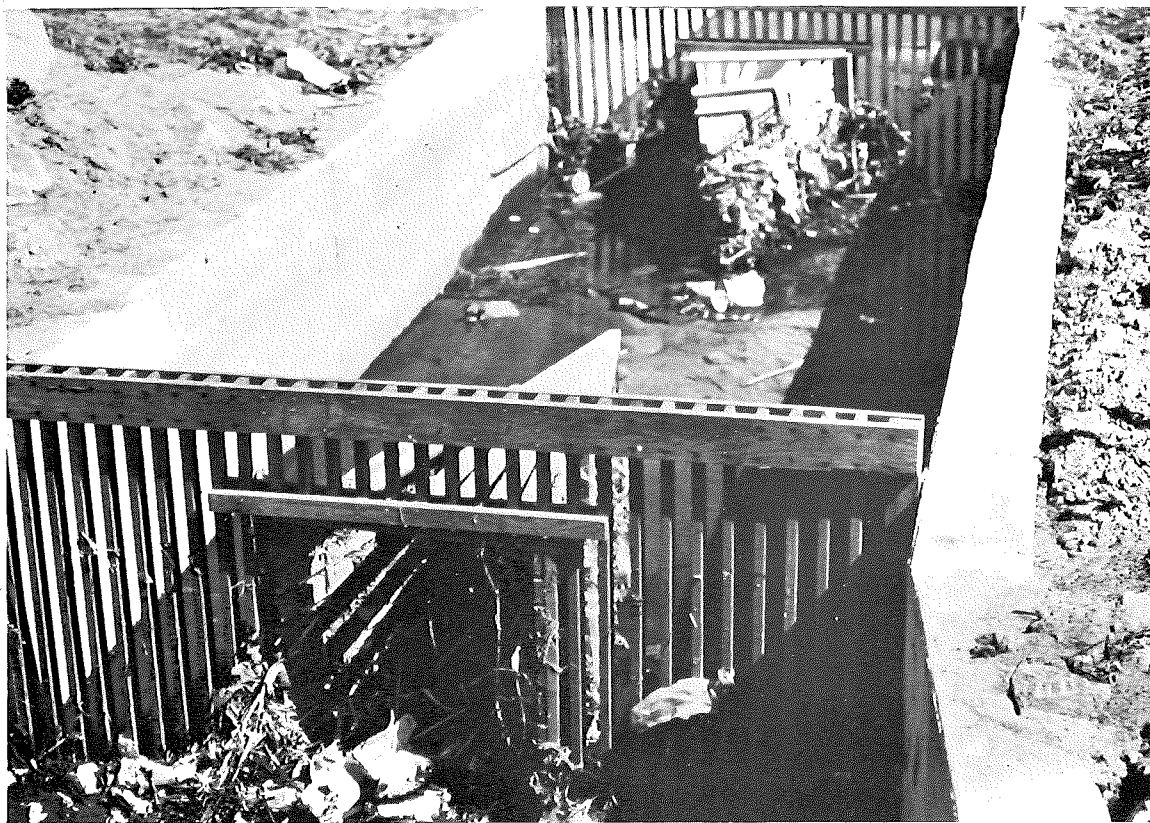
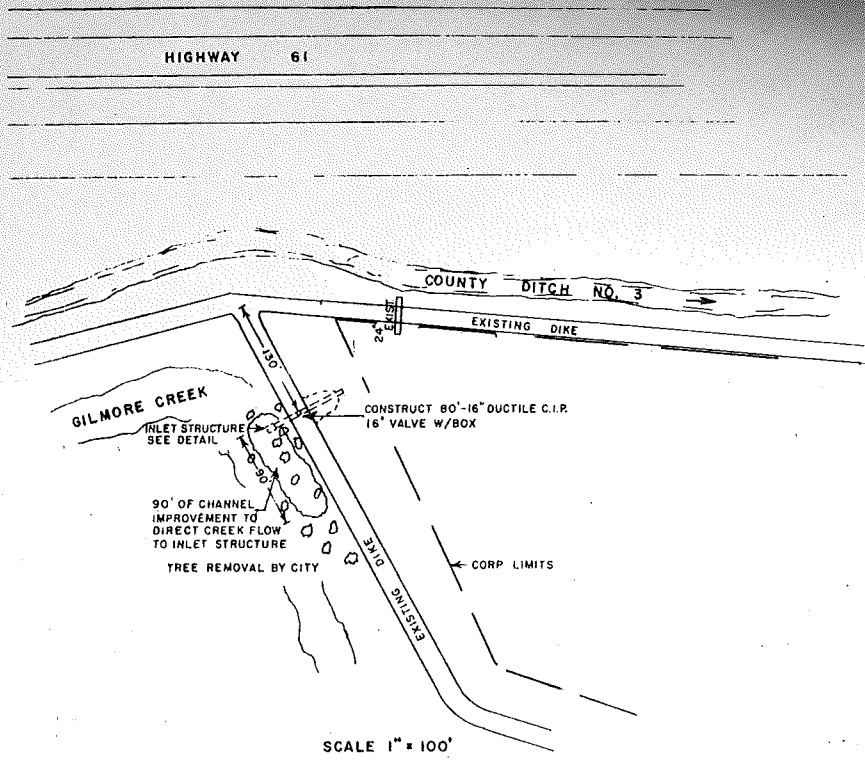
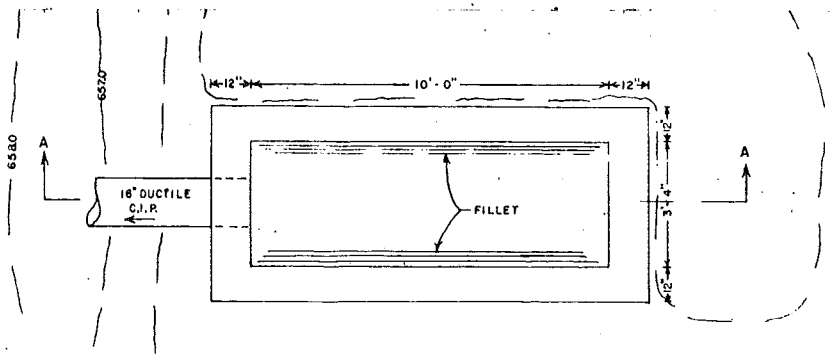


Figure 14-3. Carp trap constructed in County Ditch No. 3 at Junction Street. The trap proved ineffective because debris from storm sewers plugged it continually.



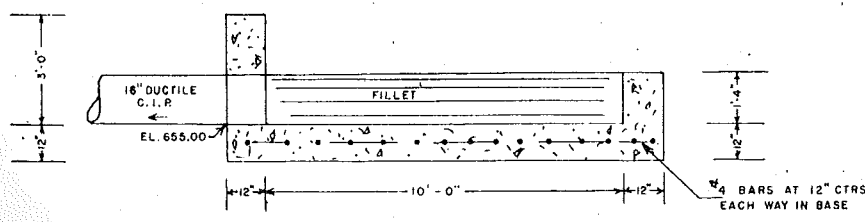
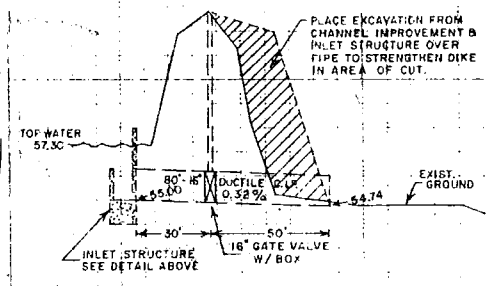
SCALE 1" = 100'



GILMORE CREEK INLET STRUCTURE

PLAN VIEW

SCALE 3/8" = 1'-0"



INLET STRUCTURE

SECT. A-A

Figure 14-4. By-pass constructed in 1975 to divert Gilmore Creek around Boller Lake at will, thus making it possible to control rough fish via a winterkill.

In the fall of 1975, a by-pass was installed which could divert Gilmore Creek directly into County Ditch No. 3 (Fig. 14-4). The by-pass has not functioned as well as expected because: 1) the culvert is not large enough to accomodate Gilmore Creek, 2) it is easily sabotaged by vandals who can plug the culvert from either end, 3) the gate valve is difficult to operate and is presently unworkable because the gears are stripped. To prevent vandalism, a heavy padlocked iron grating has been installed at the inlet to the culvert.

In the winter of 1976-1977, a spontaneous winter kill occurred in Boller Lake. In the fall, city crews had cut the brush from the diked portion of Gilmore Creek between St. Mary's College and Boller Lake as part of routine maintenance prescribed within the floodway. Because of extreme cold early in the winter and a lack of snow and protecting brush, a strong coat of ice developed on the creek. With the first snowfall, snowmobilers used the creek bed for a path, thus compacting the snow and reducing its insulation. As a result of subsequent extreme cold, anchor ice formed on the bottom of Gilmore Creek near its entrance to Boller Lake. Thus dammed, Gilmore Creek poured out over Boller Lake's ice cover, freezing as it did so. Because they were deprived of oxygenated water, Boller Lake fish suffocated during the winter of 1976-1977. Winona State University students assessed the kill the following spring (Fig. 14-5). Their data is summarized in Table 14-1.



Figure 14-5. Dead fish collected from Boller Lake by WSU students after the spontaneous winterkill of 1976-1977. An estimated 2,864 pounds of northern pike were lost.

TABLE 14-1

Standing crop of fish in Boller Lake as determined by fish pick-up following winter kill of 1976-1977. Total area of Boller Lake = 56 acres. (open water area)

Species	No. Measured and Weighed	Total No. Counted	Length(in.) Range	Length(in.) Mean	Wt. (lbs.) Range	Wt.(lbs.) Mean	Total wt. (lbs.)	Wt./acre (lbs.)
*N. Pike	103	1637	7-23	17.8	.3-3.4	1.8	2864	51.1
Carp	16	800	17:3-22.5	19.6	2.3-6.3	3.7	2975	52.4
L.M. Bass	35	239	10-17	12.2	.5-2.8	1.1	245	4.4
**B. Gill	59	449		3.8		.1		
Bullhead	3	13	7-8	7.3	.4-.5	.4	5.42	
Sucker	1	3	0	5	0	.5	1.5	
Crapple	0	2						
Darter sp.	0	1						
Perch		2						
Total							6091	107

* A few 5-10 lb. northern pike were observed during clean-up. They were counted but not weighed or measured.

** Hundreds of young-of-year bluegills were also present but were not counted and are not included in totals.

Total Area Boller Lake = 56 acres (open water area)

Distribution of species: All northern pike were found in the east basin, around the bridge and within a small area 50 feet west of the bridge. The zone of greatest concentration was under and around the bridge. Bass and carp were rare in the east basin. Young of year sunfish were most concentrated in a 50-ft. wide band along the high ground adjacent to the Highway Department's stock piles of sand.

From 1978 until 1985, Boller Lake has been used as a northern pike rearing area by the Lake Winona Committee in cooperation with the Minnesota Department of Natural Resources. Boller Lake is a prime area for northern pike reproduction because it is marshy and is bordered by terrestrial grasses. When flooded in the spring, the grasses provide excellent areas for pike spawning. (Chapter 10 contains additional information on the biology of northern pike.)

Detailed records and many valuable observations have been made of the northern pike rearing operation at Boller Lake. Lake Winona Committee volunteers and WSU students have literally spent thousands of hours on the project. It has consumed more time than any other lake project. Only a summary will be presented here.

The Lake Winona Committee constructed a new gate for the Boller Lake outlet dam in 1979 (Fig. 14-6). The stop-log structure had a small rectangular hole in the bottom which could be easily closed by positioning a piece of plywood on the upstream side of the dam. Water pressure held the plywood closure in place.

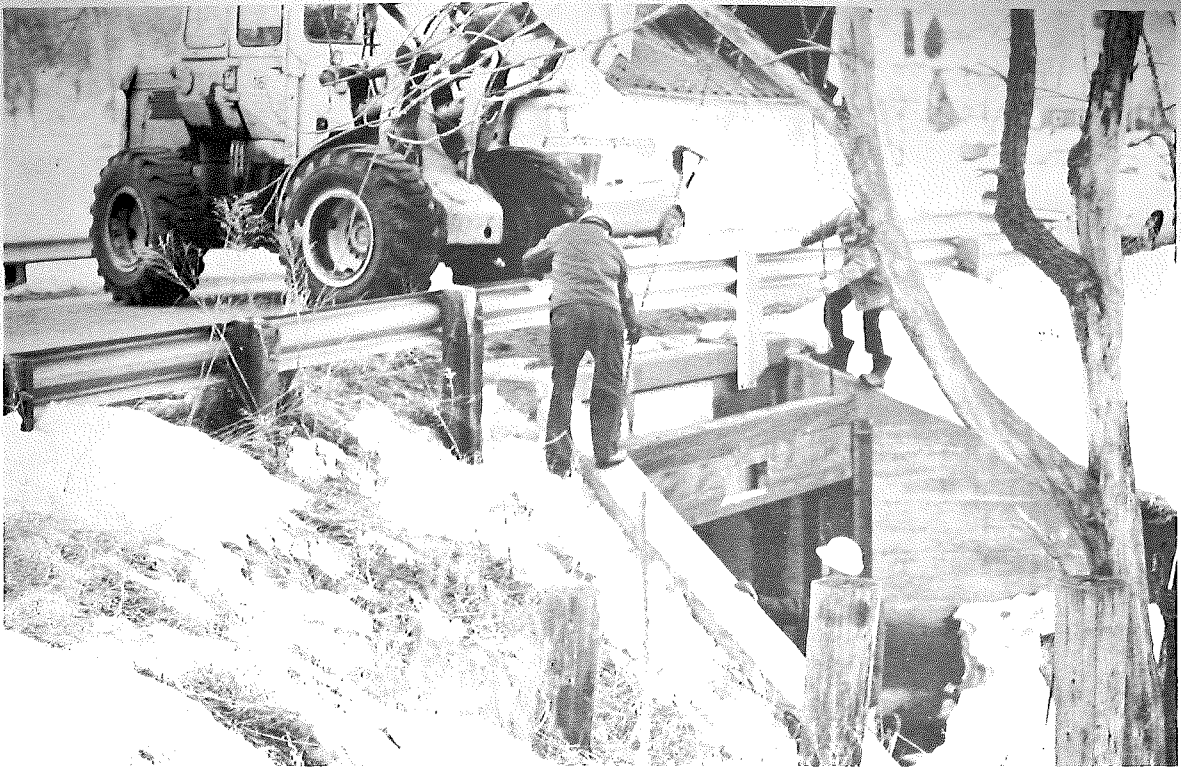


Fig. 14-6. Stop log gate being lowered into place at Boller Lake outlet dam. The rectangular hole in the bottom can be easily opened, thus allowing flow into a fish trap located in the culvert.



Fig. 14-7. Young-of-the-year northern pike captured at Boller Lake and stocked into Lake Winona

Water levels in Boller Lake were raised about one foot before freeze up in the fall. A water level gauge was erected above the Boller Lake dam and daily records were kept. In late December, after the ice cover was thick and there was a heavy covering of snow, the by-pass was opened to divert Gilmore Creek around Boller Lake, thus causing oxygen depletion and an impending winterkill. This operation also provided a flow of oxygen-rich water into Lake Winona. An aerator was installed just above the dam to attract northern pike. When oxygen levels throughout Boller Lake had dropped to less than 0.5 parts per million, the hole in the bottom of the dam was opened and water flowed into a trap constructed under the bridge at the Boller Lake outlet. Stressed northern pike followed the current into the trap, were netted out, and transported to Lake Winona (Fig. 14-7). A diagram of the trap is contained in the Annual Report for 1982-83, included at the end of this chapter.

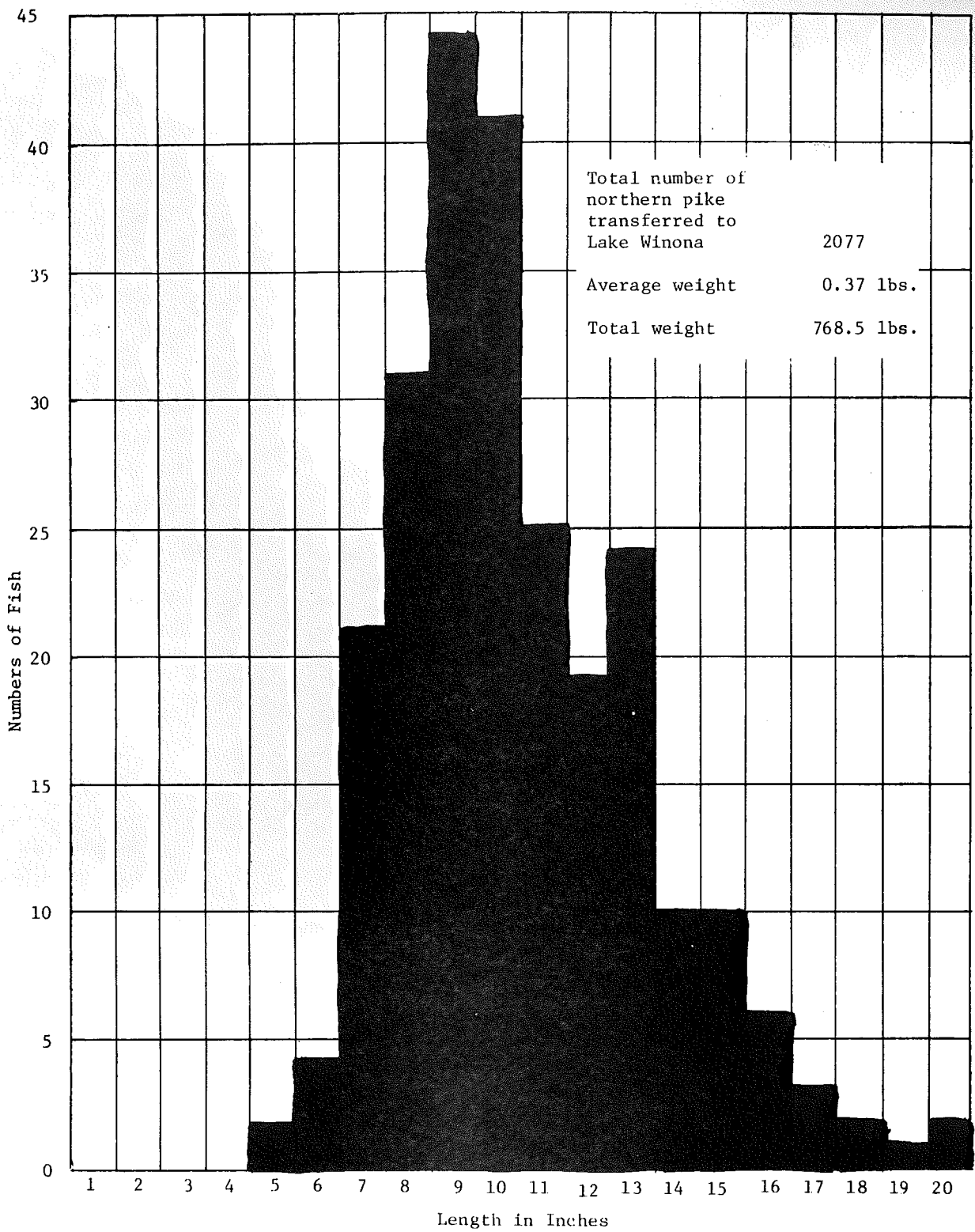
After the pike run had ceased, the remaining fish in Boller Lake were allowed to die. The following spring, the by-pass and the dam were closed, thus allowing the level of Boller Lake to rise high enough to flood terrestrial grasses. This provided optimal spawning conditions for the brood stock northern pike stocked into Boller Lake each spring by the Minnesota DNR. The catch of northern pike by this system is summarized in Table 14-2. Fig. 14-8 shows the length-frequency data for February-March, 1980.

1. The top edge of the south angle iron of the Boller Lake dam serves as a bench mark. It is 659.7 ft. above sea level.

Table 14-2 Northern pike reared at Boller Lake, captured during the winter and stocked into Lake Winona.

<u>Winter</u>	<u>Number</u>
77-78	455
78-79	1355
79-80	2077
80-81	----
81-82	72
82-83	1343
83-84	109
84-85	755

Northern Pike Lengths
 Boller Lake
 Winona County
 February - March, 1980



Unfortunately, the northern pike rearing operation at Boller Lake was plagued by adversity. Gardeners complained about high spring water levels, even though they were gardening within the City of Winona's flood easement zone. Nearby residents (and one over a mile away) complained that high lake levels adversely affected their septic tank systems. Vandals plugged the by-pass culvert repeatedly, stole the by-pass grating, filled the gate valve control shaft with sand, plowed snow off the ice to prevent a winterkill from occurring, and unplugged the aeration unit. Thieves stole the 200-foot power cable which supplied the aerator.

The greatest problems, however, were with the by-pass itself. It simply would not accept all of Gilmore Creek's flow, thus allowing a trickle to enter Boller Lake, thus providing northern pike a sanctuary of oxygenated water. The gate valve malfunctioned frequently. Heroic efforts at building temporary dams and water diversions were frustrating and time consuming.

Another major obstacle existed in County Ditch No. 3 at the outlet of Boller Lake. The gradient of the ditch is so slight that it filled with water when the dam was opened. When the water level in the ditch equalled that in Boller Lake, water ceased to flow through the trap. Washouts occurred between Boller Lake and Ziebart Sand Pit, causing a loss of water needed to run the trap.

Because of all of these problems, the northern pike project at Boller Lake was abandoned in 1985. The Minnesota DNR has agreed to try to stock Lake Winona yearly with about 3,000 northern pike from state-controlled freeze-out lakes farther north.

Water levels at Boller Lake will be stabilized at relatively low levels and the lake will continue to be managed as a sport fishery and as a marsh for the production of muskrats, waterfowl and other wildlife. It will be necessary, however, to monitor Boller Lake for the presence of carp. If they should gain access to Boller Lake, it will be necessary to precipitate a winterkill.

Because they contain valuable biological observations, and because they explain the complexity of the Boller Lake project, annual reports for 1981-1982 and 1982-1983 are included here.

ANNUAL REPORT

NORTHERN PIKE CAPTURE AT BOLLER LAKE, WINONA, MINNESOTA

DURING THE WINTER OF 1981-82

Report by Cal Fremling
Work by Lake Winona Committee and
Winona State University Students

The water level in Boller Lake was 2.2 feet on December 30, 1981 (as recorded on the gauge at the dam). Ice thickness was 6 inches above the dam, and there was a trickle of water going through the dam under the top log. County Ditch No. 3 was partially full of water and it seemed that recent cold weather had frozen the bottom of the ditch, preventing seepage.

On January 7, dissolved oxygen tests showed 1.1 ppm, 1.4 ppm and 1.6 ppm at sites I, II and III respectively. Ice thickness at the by-pass was 4 inches, and there was very little flow under the ice into Boller Lake. This was due to extremely cold weather, but also to the fact that City crews had brushed out Gilmore Creek downstream from the Highway 14 bridge allowing the water to super-cool. Most of the flow of Gilmore Creek into Boller Lake was over the ice. The flow was not apparent because it occurred under the snow. It passed through the east lake, went under the bridge, and flowed to the dam. It hugged the edge of the west lake along the road because the ice was anchored to the shore in that area and was not as high as it was in the center of the lake. On this date, County Ditch No. 3 had a layer of ice on it, but there was a 6-inch air space under the ice indicating that the creek bottom might be absorbing water.

Workers from the Lake Winona Committee installed the fish trap below the Boller Lake dam on January 9. The by-pass was opened, and the gate in the Boller Lake dam was opened halfway. The wind chill was -80°F. By January 13, the water levels in County Ditch No. 3 and Boller Lake had equalized because the frozen ditch bottom would allow no seepage. Consequently, flow through the trap was scarcely detectable.

On January 16, a 3-inch, 5 h.p. pump was borrowed from the City of Winona and water was pulled through the trap from 2:30 PM until 10 PM. Only 11 northern pike were collected - even though observations made from a portable dark house showed that pike were common above the dam. The pumping operation was repeated from 8 AM until 4 PM on January 23, but only one pike was collected. At 8 AM there were two dead pike in the trap and the D.O. in the trap was 0.1 ppm. Even though there was a 10-inch head of water over the trap inlet, water would not flow into County Ditch No. 3 because the ditch was frozen to the bottom.

On January 29, an inspection was made around the Biesanz Stone Quarry settling ponds to see if there was seepage water coming into Boller Lake. None was found. On this date, there was a 4-inch head of water at the gated culvert which connects Boller Lake with the sand pit. There was an open-water seepage area around the culvert inlet. The water was foul, however, and no fish were

more slowly in the west end of the west lake. The aerator was made operational on January 14. We delayed opening the gate to the trap until we were certain that oxygen levels were low enough. We did not want to waste water and run the chance of running out before we had captured most of the fish. By February 12, the water in Boller Lake had fallen to 2.3 feet because of leakage through the dike which separates west Boller from the sand pit.

Northern pike were first observed inside the primary trap on February 10, and plans were made to begin trapping on Saturday, February 12. The gate in the dam was opened at 9 a.m. on February 12 so that northerns could be collected in the trap which had been placed below the dam. By 1:30 p.m. we had collected 516 northerns. A total of 1343 northerns were trapped and transferred to Upper Lake Winona during the week. One hundred fifty-four northerns weighed 38.8 pounds (average weight 0.25 pounds). Most of the northerns were collected on February 12.

An unseasonable thaw began on the afternoon of February 12 and it stayed unusually warm for the remainder of the winter. Very few northerns (or other fish) were collected after run-off began to enter the lake. Also collected were about 25 gallons of 3-4 inch black bullheads (8.5 lb./gal.), about 15 8-9 inch yellow perch, 6 8-9 inch common suckers, about 200 young of year green sunfish, about 20 tadpole madtoms and one mud minnow. No young of year bluegills or yellow perch were observed. No carp were seen.

Because County Ditch No. 3 below the dam was dredged last summer by the Minnesota Department of Transportation, we had no problems with the ditch filling with water as we did last year. Everything worked perfectly, except that it thawed. We realize now that we should have worked all night on February 12 when the northerns were still coming to the trap. Instead, we closed the dam, planning to save water and work all day Sunday. Sunday's thaw was greater than expected.

We will go into the winter of 1983-84 with Boller Lake at 2.2 feet. This level will slow the eroding of the dike between West Boller and the sand pit. It will also enable terrestrial grasses to grow around the edges of Boller Lake, thus facilitating northern pike spawning when lake levels are raised the following spring. Stable water levels during the summer will also enhance muskrat populations. Normal overflow from Boller Lake during the summer will pass through the existing culvert into the sand pit. Heavy rains will pass over the dam into County Ditch No. 3. A carp barrier will be installed at the dam.

Next winter it may be well to gradually cut off the flow of Gilmore Creek into Boller Lake, instead of doing it suddenly. A gradual cutoff would compensate for water lost by seepage and would keep the lake level up. It would also cause northerns to concentrate in East Boller and in the area near the trap. This should make capture much easier.

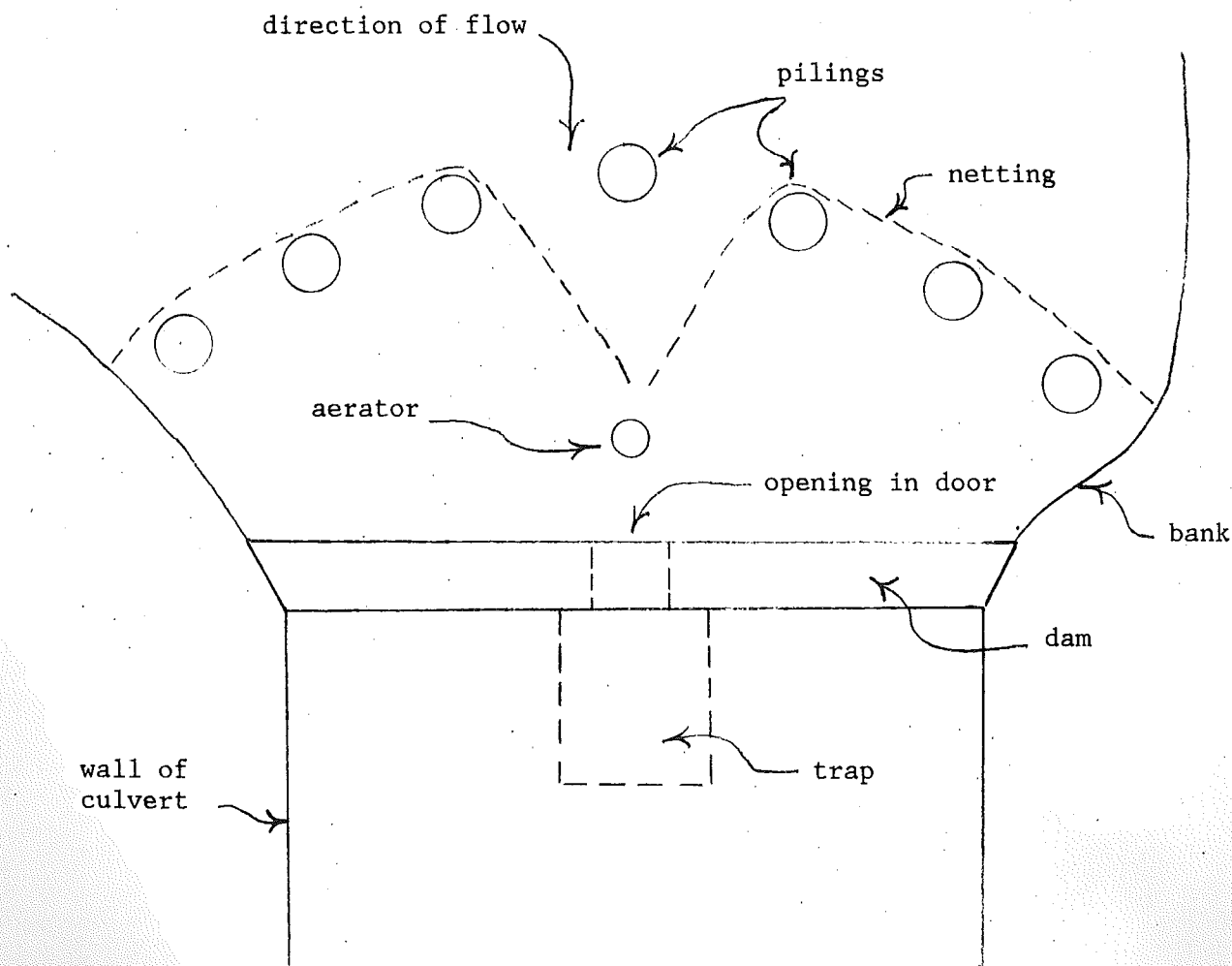
TABLE 1. OBSERVATIONS MADE AT BOLLER LAKE DURING NORTHERN PIKE TRAPPING OPERATIONS IN WINTER (1981-1982).

Date (1982)	Time of Sampling	Weather Conditions	Oxygen Concentrations/Water Temperatures			Pike		Notes
			Site 1	Site 2	Site 3	AM	PM	
Jan. 5	6:00 PM	Cloudy	2.00 ppm 0°C	2.70 ppm 0°C	3.70 ppm -1.0°C			Boller L. level 2.2'. Ice 6" thick. Co. Ditch 3 partially full due to bottom being frozen.
Jan. 6	4:00 PM	Clear	2.70 ppm 0°C	3.40 ppm 0°C	3.20 ppm -1.0°C			
Jan. 7	7:30 AM	Cloudy	1.05 ppm 0°C	1.35 ppm 0°C	1.60 ppm -1.0°C			Gilmore Creek frozen almost to bottom, flowing over ice on Boller L. all way to dam.
Jan. 7	4:30 PM	Clear	5.50 ppm 0°C	2.65 ppm -0.25°C	1.70 ppm -1.0°C			
Jan. 8	4:30 PM	Clear	5.60 ppm 0°C	3.95 ppm -1.0°C	2.40 ppm -1.0°C			
Jan. 9	8:30 AM	Cloudy	1.85 ppm 0°C	1.30 ppm -1.0°C	0.55 ppm -1.0°C			Opened by-pass. Opened gate into trap 1/2 way. Wind chill -60°F.
Jan. 9	4:30 PM	Cloudy	3.20 ppm -0.25°C	1.30 ppm -1.0°C		0	0	
Jan. 10	4:30 PM	Cloudy	2.75 ppm -0.50°C			0	0	Small crappies and bluegills in trap. Wind chill -80°F.
Jan. 11	4:30 PM	Clear	4.10 ppm -1.0°C	1.00 ppm -1.0°C	0.70 ppm -1.0°C	0	2	
Jan. 12	4:30 PM	Clear	2.60 ppm -1.0°C	0.75 ppm -1.0°C	0.60 ppm -1.0°C	3	3	15 gal. of y. of y. bullheads, small crappies & bluegills in trap.
Jan. 13	4:15 PM	Clear	2.65 ppm -0.50°C	1.45 ppm -0.50°C	0.25 ppm -1.0°C	2	5	Co. Ditch 3 same level as Boller L. Flow through trap very feeble. Dead damsel fly nymphs at sites 2 & 3.
Jan. 14	4:15 PM	Clear	1.30 ppm -1.0°C	0.55 ppm -1.0°C	0.25 ppm -1.0°C	3	0	10 gal. bullheads, crappies & bluegills in past 2 days. Dead damsel fly nymphs at all sites.
Jan. 15	4:30 PM	Clear	0.30 ppm -1.0°C	0.15 ppm -1.0°C		4	5	Flow through trap feeble. Dead bluegills in trap. Northerns not stressed.
Jan. 16	4:30 PM	Cloudy	0.25 ppm -1.0°C	0.15 ppm -1.0°C	0.01 ppm -1.0°C	6	5	Installed dark house near trap, saw about 25 pike, none stressed.
Jan. 17	4:15 PM	Partly Cloudy	0.20 ppm -0.25°C	0.10 ppm -1.0°C		2	3	
Jan. 18	4:30 PM	Cloudy	0.10 ppm 0°C	0.05 ppm -1.0°C		3	0	Used 3", 5 h.p. pump to move water into trap (2 PM-10 PM)
Jan. 19	4:30 PM	Partly Cloudy	0.10 ppm -0.50°C	0.05 ppm -1.0°C		6	6	
Jan. 20	4:15 PM	Partly Cloudy	0.10 ppm -0.50°C	0.05 ppm -1.0°C		1	0	
Jan. 21	4:15 PM	Cloudy	0.10 ppm -1.0°C			1	0	A northern pike regurgitated a small carp in trap.
Jan. 22	4:30 PM	Cloudy	0.10 ppm -1.0°C			0	0	
Jan. 23	4:00 PM	Cloudy	0.10 ppm -1.0°C			0	0	Used 3", 5 h.p. pump to move water through trap (8 AM-4 PM). Two dead pike in trap at 7 AM.
Jan. 24	4:30 PM	Cloudy	0.05 ppm -1.0°C			0	2	
Jan. 25	4:15 PM	Cloudy	0.05 ppm -1.0°C			0	0	
Jan. 26	4:30 PM	Cloudy	0.05 ppm -1.0°C			0	0	
Jan. 27	4:30 PM	Clear	0.05 ppm -1.0°C			0	0	
Jan. 28	4:30 PM	Cloudy	0.05 ppm -1.0°C			0	0	
Jan. 29	4:30 PM	Cloudy	0.05 ppm -1.0°C			0	0	Dead mud minnow in trap.
Jan. 30	5:00 PM	Partly Cloudy	0.05 ppm -1.0°C			0	0	One live bullhead and 2 dead bullheads in trap.
Feb. 1	4:30 PM	Clear	0.05 ppm -1.0°C			0	0	

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DURING THE WINTER OF 1982-83

Report by Cal Fremling
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Prior to freeze-up, a new trapping system was installed at the Boller Lake dam (see diagram below). The trap which had been used in previous years was placed below the dam as usual, but a new net was constructed and placed around the pilings in Boller Lake to serve as a primary trap. An aerator installation was erected within the primary trap so that a 1/3 hp Minno-Saver agitator-type aerator could be mounted later. Electricity was provided by a line extended to the nearby Goodview Motor Mart. Tim Breza, owner of the Mart, made this possible and also paid several months of electricity. The Lake Winona Committee agreed to pay for the electricity for the remainder of the winter.



The by-pass was opened on January 1, thus allowing Gilmore Creek to flow directly into Lake Winona via County Ditch No. 3 instead of flowing through Boller Lake. Four inches of snow fell on January 4. Another 11 inches fell on February 1 and 2. Dissolved oxygen dropped steadily at most Boller Lake stations, but fell much

observed, The water around the fish trap was also foul on this date and it was assumed that most game fish in the lake were dead. Temperatures have been abnormally low throughout the trapping period and snow cover has been heavy.

A total of 72 northern pike were collected from Boller Lake and transferred to Upper Lake Winona. Of 35 fish measured, 33 ranged from 12-21 inches in length. Their weights ranged from 3/4 pound to 1-3/4 pounds. Scale analysis of these fish indicated that they were two years old. Scales were not examined from smaller fish, but the fish may have only been one year old.

Conferences with Bud Ramer (Ramer Fish Co.) and with Gary Grunwald and Larry Gates of the Minnesota DNR provided some suggestions. Trapping during the 1982-1983 season could probably be improved by implementing one or more of the following procedures:

1. Go into the winter with Boller Lake 8 inches higher than it has been previously (2.2 ft).
2. Do all trapping in late December.
3. Do not open the gate on the dam until dissolved oxygen readings are less than 1.0 ppm for three consecutive days at all three sampling stations.
4. Place a trap in front of the dam gate so that the gate can be opened about one-fourth of the way to conserve water.
5. Install an aerator at the dam to attract fish to the trapping area.
6. String netting around the pilings to make a primary trapping area.
7. Install a trap under the south bridge.
8. Use the sand pit culvert as a third trapping area. The culvert still had a 4-inch head of water when water had ceased to flow through the dam.
9. Consult the City and County to see if they can dredge County Ditch No. 3 below the dam.