Minnesota Water Quality

Water Years 1982-1983

The 1984 Report to the Congress of the United States by the State of Minnesota Pursuant to Section 305(b) of the Federal Water Pollution Control Act

on the cover

The sketch of the Showy Lady Slipper was done by Bill Hodgins, a former MPCA employee. Bill collected the samples for the Primary Monitoring Network during the first thirty years of the Network's operation. At the end of the sampling season in 1983, Bill changed careers and is now devoting his time to his artistic interests.

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Minnesota Pollution Control Agency

Roseville, Minnesota 55113

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SUMMARY

Minnesota is known for its abundance of water (Figure 1). This wonderful natural resource of lakes, streams, wetlands and ground water has created a unique life style for Minnesotans and annually draws thousands of visitors to the State. Even Minnesota's borders are formed by lakes and rivers (Figure 2).

Minnesota has recognized the value of this resource and has worked to protect it. Progress has been made toward carrying out the mandates of the Clean Water Act. The overall water quality of the State is generally quite good. Minnesota's lakes and rivers support a wide variety of recreational uses as well as providing water for agriculture, industry, and domestic consumption.

In the past decade since the passage of the Clean Water Act in 1972, Minnesota has experienced an improvement in water quality for its rivers, lakes and Lake Superior shoreline. This is a direct result of an increase in the percent of the State's population served by secondary or more advanced levels of sewage treatment and an increase in significant municipal and industrial facility compliance.

As point source dischargers have provided better treatment, Minnesota has begun to address the problems of nonpoint source pollution. Runoff in both agricultural and urban areas contributes to pollution in the State's lakes and streams. Combined sewer overflows in the Twin Cities continue to adversely affect the Mississippi River in the Metro Area. Control of nonpoint source pollution and combined sewer overflows will help to insure the maintenance of existing good water quality and will also help to improve water quality in impacted lakes and streams.

Minnesota's ground water is as important to the State as its surface water. Almost two-thirds of Minnesota's population uses ground water as a source of drinking water. Although the extent of ground water pollution has not been defined, it is estimated that less than one-tenth of one percent of available ground water in the State cannot be used because of contamination. Control and cleanup of solid and hazardous waste will help to insure continued protection of this valuable resource.

FIGURE 1

MINNESOTA

Background

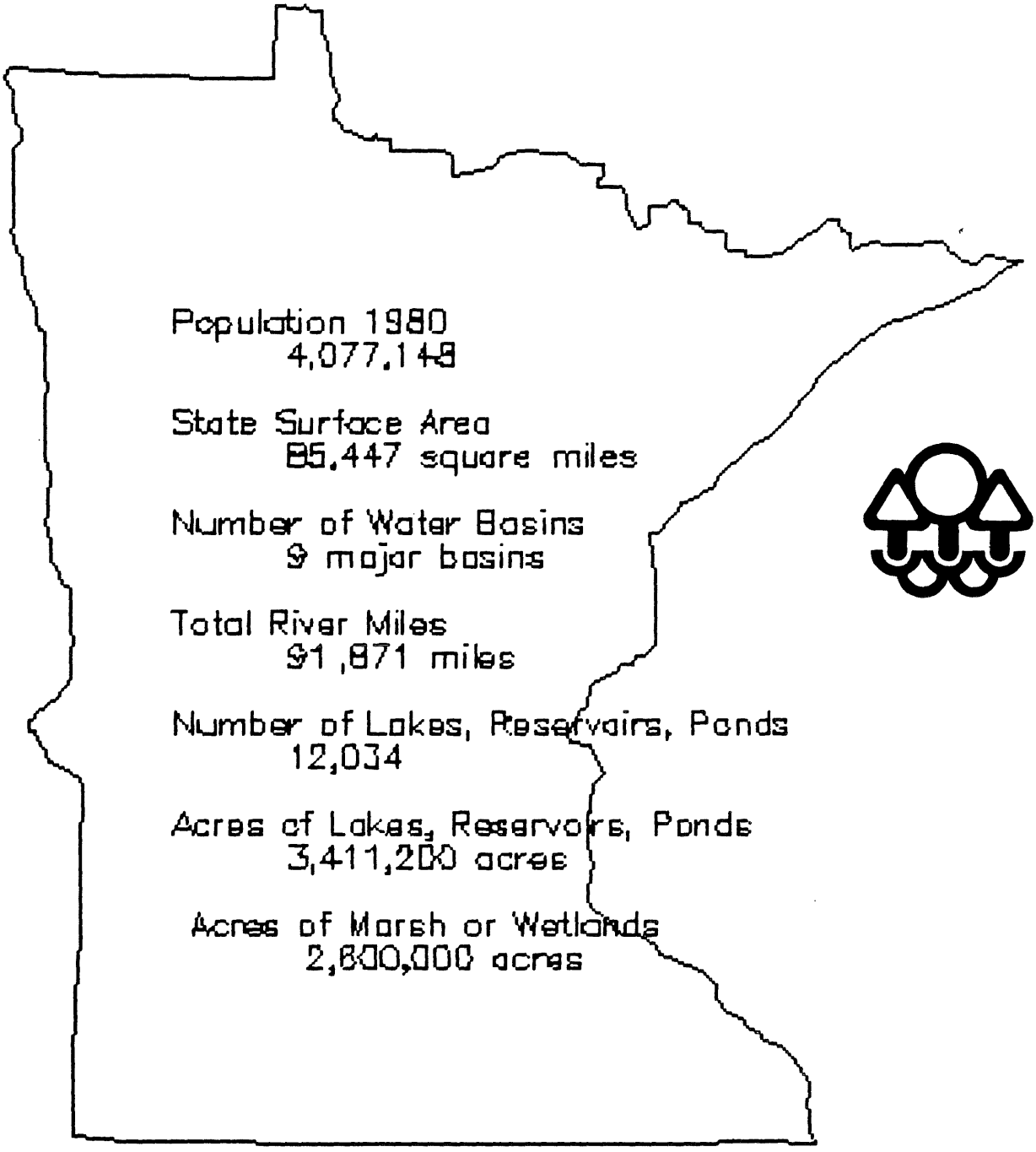
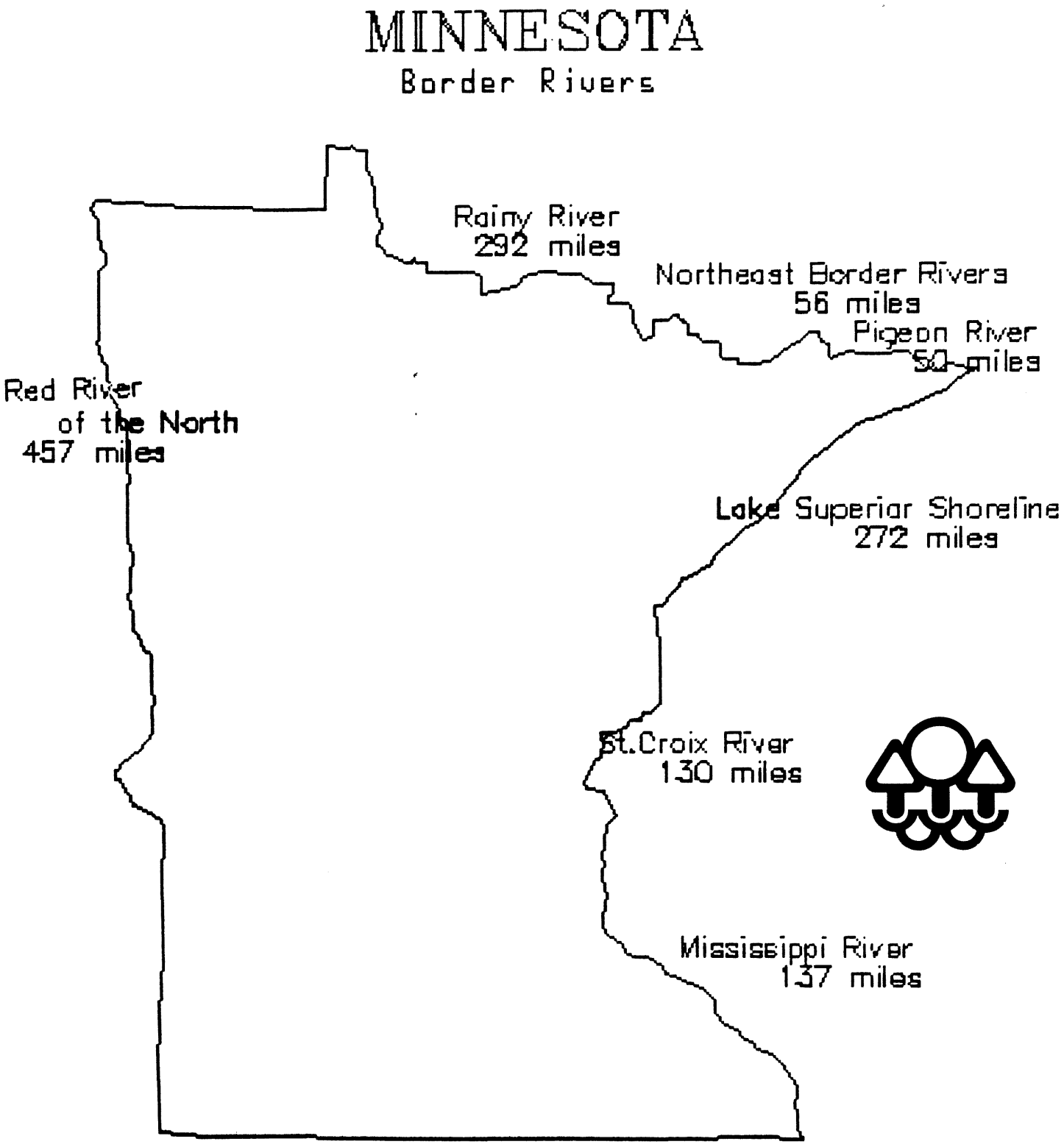


FIGURE 2


MINNESOTA
Border Rivers
Rainy River
292 miles
Northeast Border Rivers
56 miles
Pigeon River
50 miles
Red River
of the North
457 miles
Lake Superior Shoreline
272 miles
St.Croix River
130 miles
Mississippi River
137 miles

SURFACE WATER QUALITY

Rivers and Streams

Within the State of Minnesota there are nine major river basins with water flowing in three geographic directions. Rivers and streams flow north to Hudson Bay, east through the Great Lakes to the Atlantic Ocean, and south to the Gulf of Mexico. Rivers formed the first highways in the State and accounted for Minnesota's early exploration and settlement.

The overall water quality of Minnesota's river basins has improved over the last 10 years. During water years 1982-83, the quality of the rivers monitored has been maintained and ranges from excellent in the Lake Superior Basin to somewhat impaired in the Minnesota River Basin where fecal coliform contamination, nutrient enrichment, and sediment loads remain a problem.

Of the 2708 miles of rivers monitored during water years 1982-83, 1776 miles supported designated uses (Figure 3), 1053 miles were not impaired for swimming (Figure 4), and 2558 miles were not impaired for fishing (Figure 5).

FIGURE 3

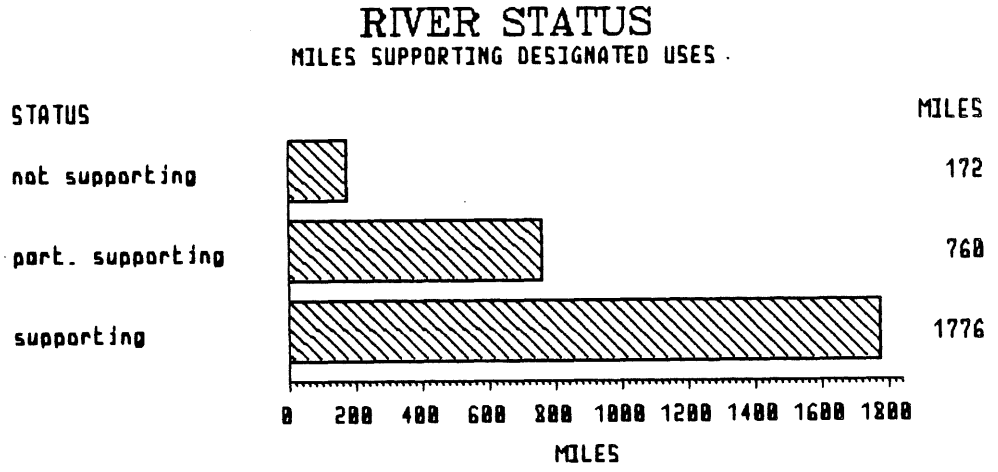
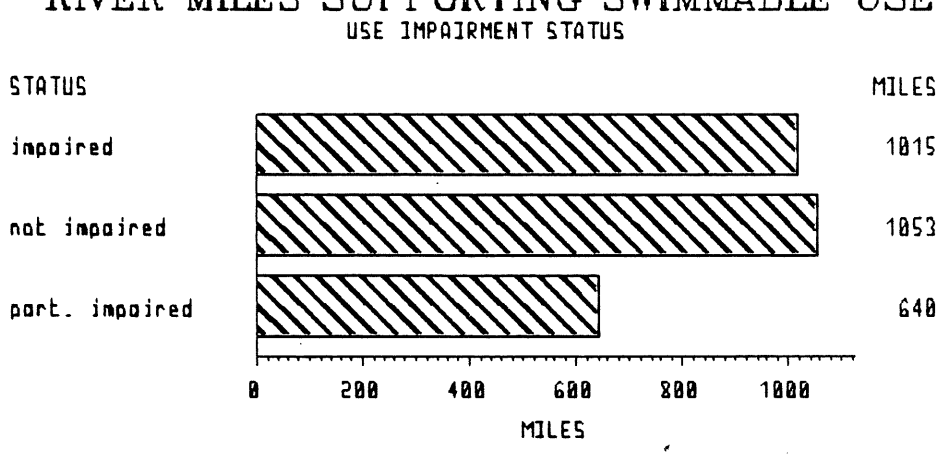
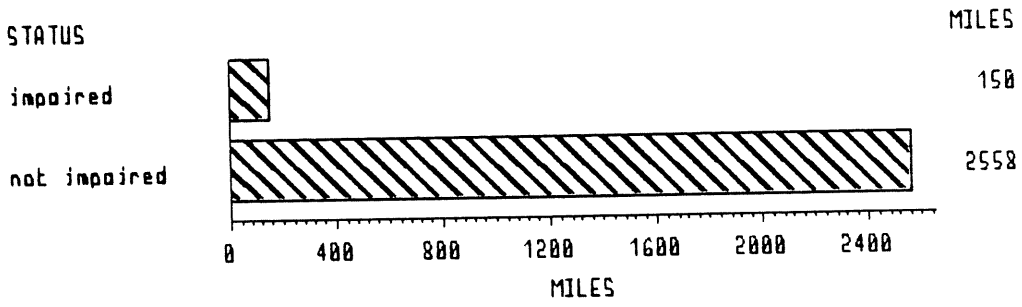


FIGURE 4



Swimming use is considered impaired if the fecal coliform standard is violated 50% or more of the time, and partially impaired if it is violated between 25% and 49% of the time.

FIGURE 5



Fishing use is considered impaired if either the un-ionized ammonia standard or the dissolved oxygen standard or both are violated 15% or more of the time

Lakes

From the boundary water lakes which form Minnesota's northern border to the more shallow lakes found in the southern and western parts of the State, Minnesota is truly the "Land of 10,000 Lakes." These lakes are an important natural resource and are used and enjoyed by many Minnesotans as well as visitors to the State.

The water quality in these lakes varies with the geology and development surrounding them. Lakes in northeastern or central Minnesota are more likely to be located in watersheds which are characterized by forests and noncalcareous soils or granite bedrock, while those in the southern and western part of this State usually have basins which are shallow and lined with rich, alkaline prairie soils.

In lakes such as those found in southern and western Minnesota, eutrophication proceeds more quickly than in northeastern Minnesota due to the nature of the basins and watersheds. The eutrophication process has been further accelerated by wastewater discharges, urban runoff, erosion, and drainage from cultivated farmlands.

Many of the lakes in the northeastern and central part of Minnesota face a different but equally serious threat to their water quality. These lakes tend to have low alkalinities (less than 20 mg/l) and are sensitive to acid rain.

During water years 1982-83, the water quality in assessed lakes was maintained. Of the 17,298 acres assessed, 11,256 acres supported designated uses (Figure 6). 1,250 lakes with data available in STORET from 1973-82 were ranked by Trophic State Index. The results are attached as Appendix A.

The Citizen Lake Monitoring Program was also active during 1982-83. Citizen volunteers continued to record weekly Secchi disc readings on lakes from June through September. These data are entered in STORET and published annually. The 1983 report is attached as Appendix B.

Lake Superior

A dramatic change in water quality along the North Shore of Lake Superior has occurred during the last four years due to the reduction of cummingtonite-grunerite fibers.

For many years Reserve Mining Company located at Silver Bay, Minnesota discharged 67,000 tons of waste tailings into Lake Superior every day as a result of its processing taconite into pellets. The federal courts ruled that the cummingtonite-grunerite fibers associated with these tailings were indistinguishable from commercial anosite asbestos fibers, a known carcinogen.

After lengthy legal battles, the Minnesota Supreme Court ordered construction of an on-land disposal basin for the tailings. That site, Milepost 7, is now in use, and on March 15, 1980 Reserve ceased discharging to Lake Superior.

The decrease in total suspended solids and fibers concentration has been quick and dramatic. Levels of fibers monitored at Lake Superior water intakes are now one-tenth the level present when the discharge existed. Continued improvement is expected. Lake Superior fully supports its designated uses (Figure 7) and the fishable/swimmable goals of the Clean Water Act (Figure 8).

FIGURE 6

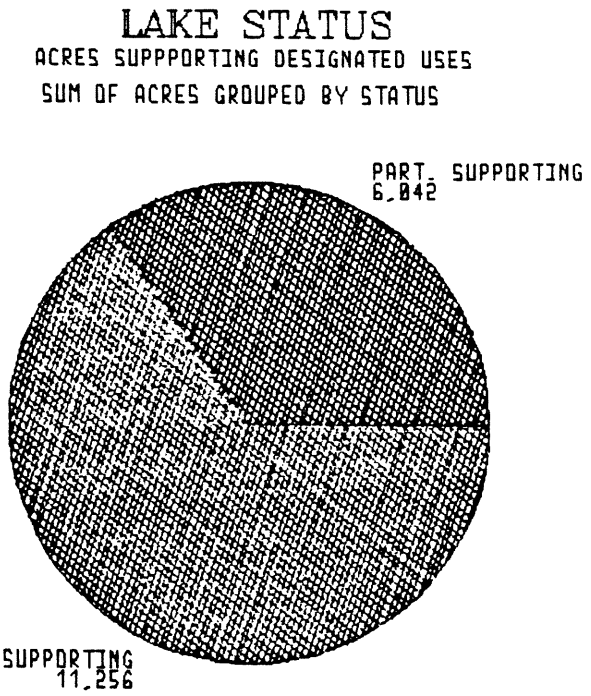


FIGURE 7

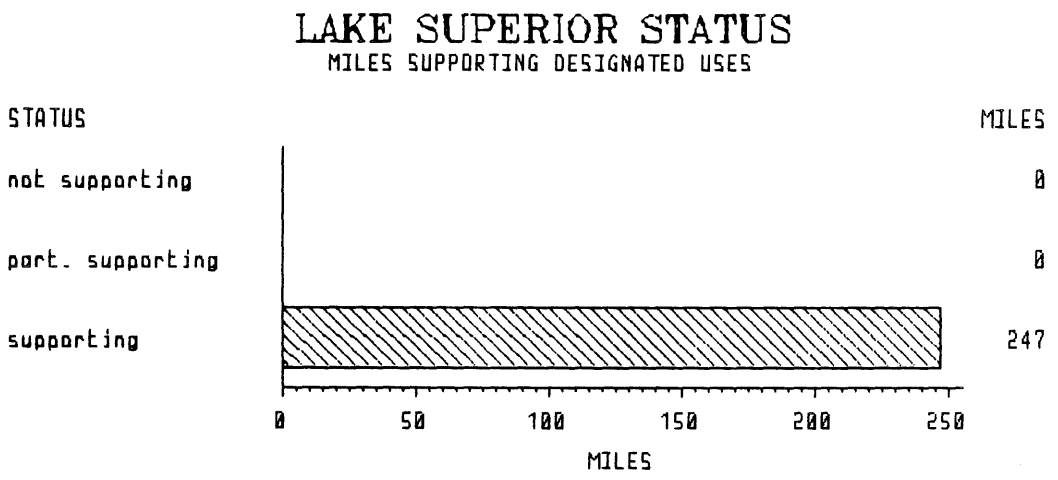


FIGURE 8

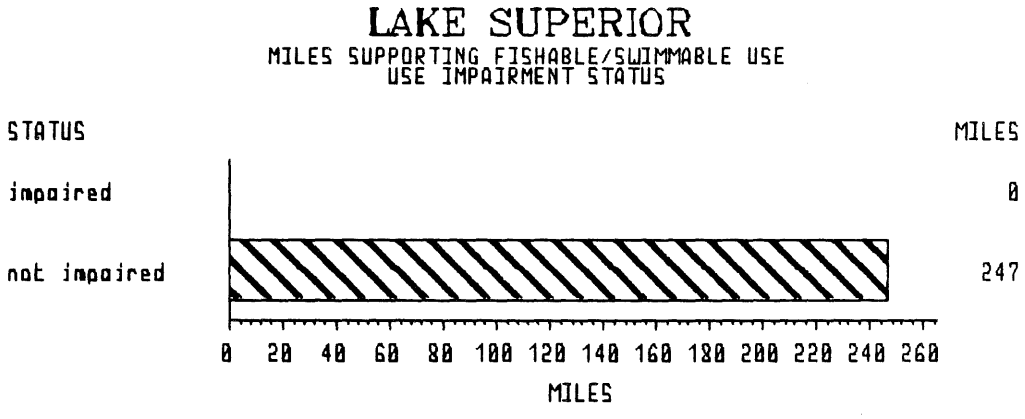
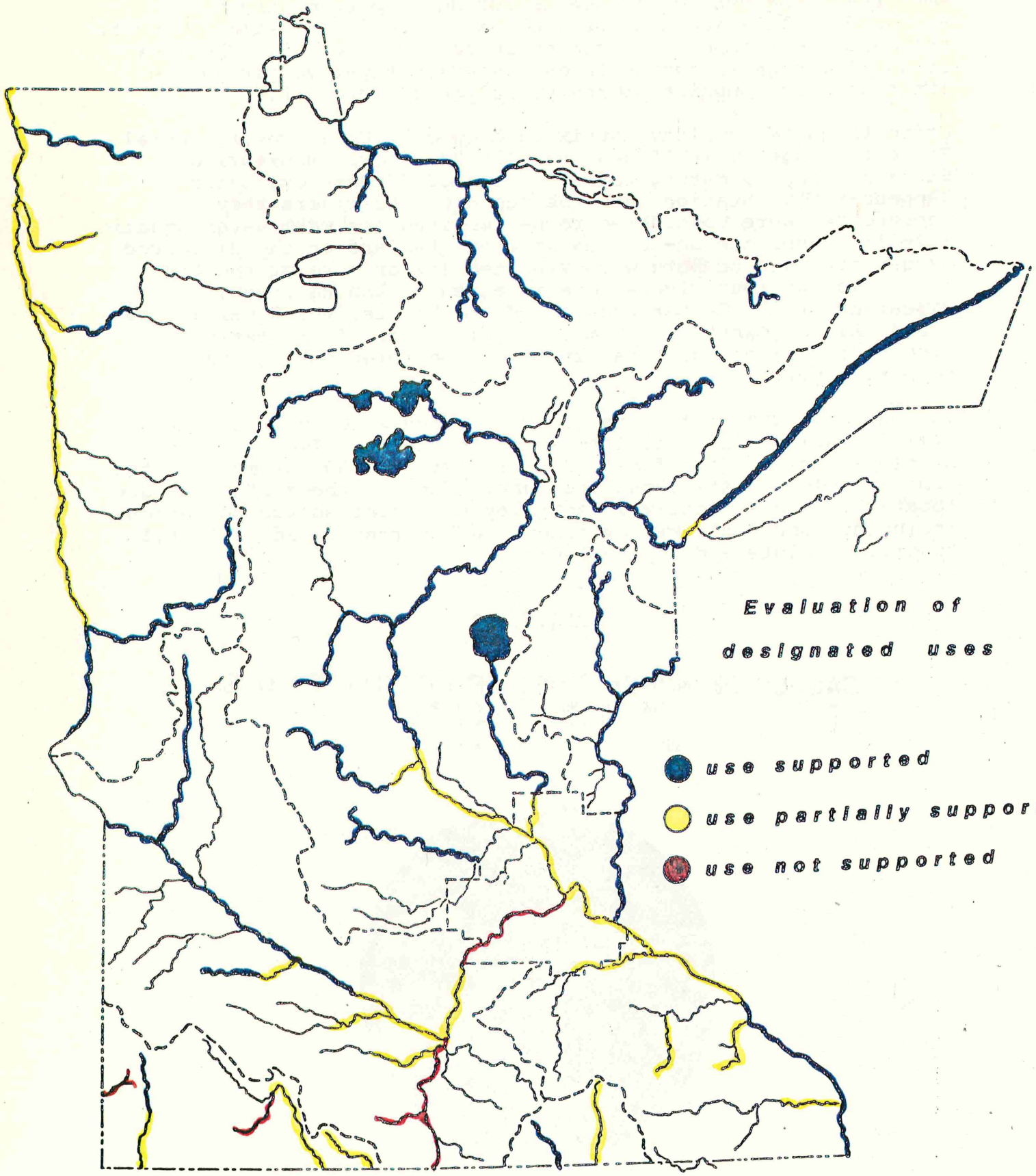


FIGURE 9

MINNESOTA

WATER YEARS 1982-1983



CAUSES OF NONSUPPORT OF DESIGNATED USES

Seventy-two percent of the cause for nonsupport of the 932 assessed miles which did not meet use criteria is estimated to be the result of nonpoint source pollution (Figure 10). The impact is equally significant on lakes where seventy-five percent is attributed to nonpoint source pollution (Figure 11).

Using the water quality matrix developed by U. S. Environmental Protection Agency (EPA) Region VIII, 72 Primary Monitoring Stations sampled during water years 1982-83 were evaluated (Appendix C). Stations and the reach of the rivers they represented were considered to be impaired for warm water aquatic life if either the un-ionized ammonia standard or the dissolved oxygen standard or both were violated 15% or more of the time. The following four rivers were impaired: Okabena Creek, Pipestone Creek, Center Creek, and the Mississippi River at Grey Cloud Island downstream from St. Paul. These four stations account for 5% of the total stations monitored during the reporting period.

In contrast, 38% of the stations monitored were impaired for swimming using fecal coliform as the criteria. Twenty-seven stations exceeded the fecal coliform standard 50% or more of the time. Table 1 lists those stations. Many of these stations are located in areas greatly impacted by non-point source pollution, including combined sewer overflows, urban runoff, agricultural runoff, feedlots and septic tanks.

FIGURE 10

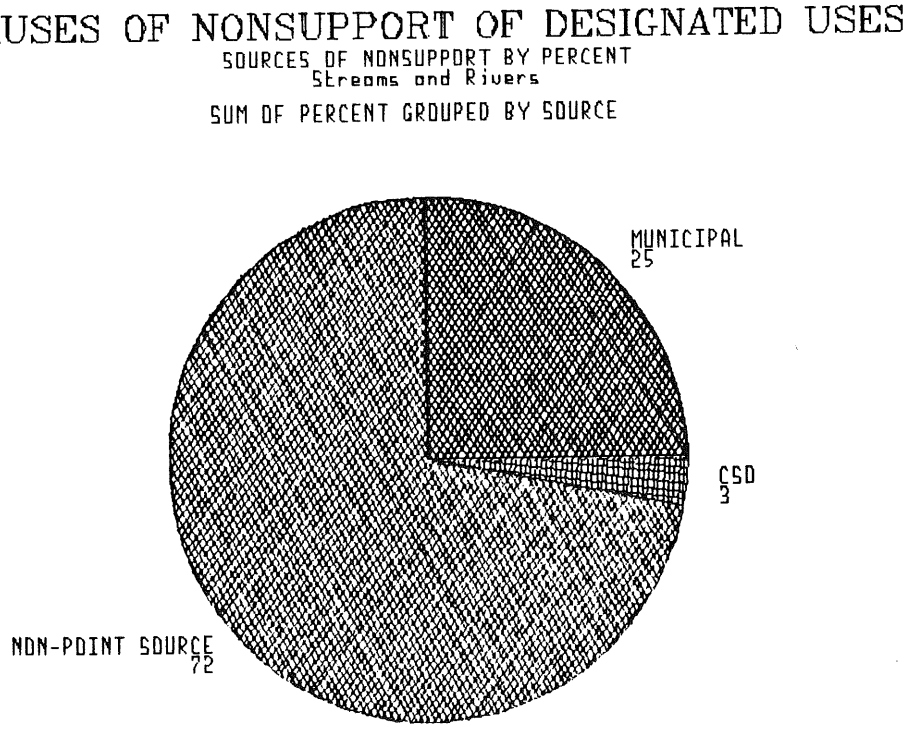


FIGURE 11

CAUSES OF NONSUPPORT OF DESIGNATED USES

SOURCES OF NONSUPPORT BY PERCENT
Lakes and Reservoirs

SUM OF PERCENT GROUPED BY SOURCE

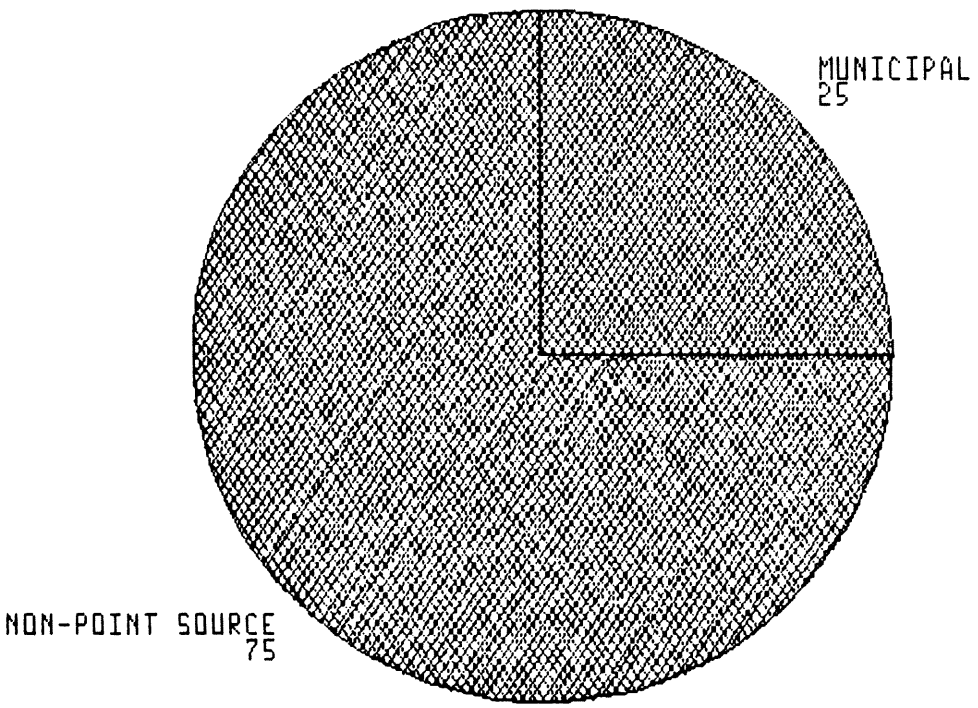


TABLE 1

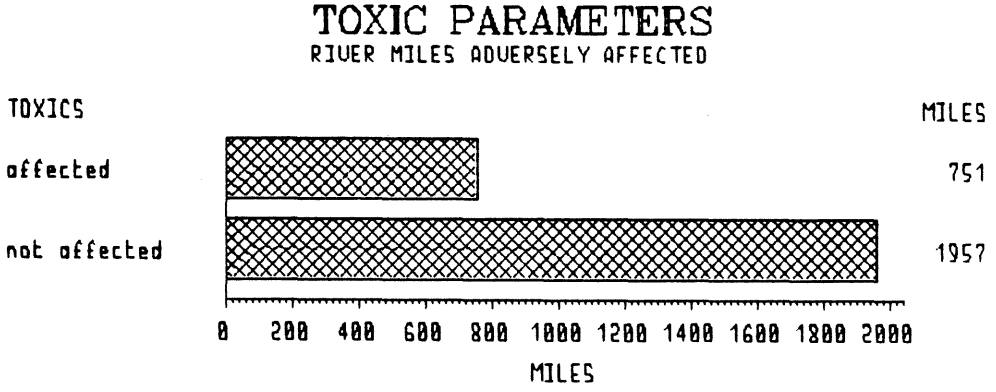
STATIONS IMPAIRED FOR SWIMMING

Location	Station Number
Minnesota River at Henderson	MI-64
Minnesota River at St. Peter	MI-88
Blue Earth River at Mankato	BE-0
Redwood River at North Redwood	RWR-1
Cottonwood River at New Ulm	CO-0.5
Watonwan River west of Garden City	WA-6
Chippewa River at Montevideo	CH-0.5
Center Creek north of Fairmont	CEC-13
Mississippi River at Grey Cloud Island	UM-826
Mississippi River at St. Paul	UM-840
Mississippi River at Clearwater	UM-914
Mississippi River at Sauk Rapids	UM-930
Sauk River at St. Cloud	SA-0
Cannon River at Welch	CA-13
Straight River by Clinton Falls	ST-18
Zumbro River - South Fork - by Rochester	ZRS-20
Whitewater River northwest of Utica	WWR-26
Root River east of Hokah	RT-3
Vermillion River east of Farmington	VR-32.5
Buffalo Creek by Plato	BFC-9
DesMoines River - East Fork - by Ceylon	EDM-6
DesMoines River - West Fork - by Petersburg	WDM-3
Okabena Creek west of Lakefield	OK-20
Pipestone Creek southwest of Pipestone	PC-1.5
Rock River south of Luverne	RO-0
Red River of the North, west of Perley	RE-403
Snake River north of Big Woods	SK-1.8

TOXIC PARAMETERS

Toxic compounds found in effluents or spills which enter the rivers, streams and lakes of Minnesota damage the aquatic environment in two ways. These compounds may be toxic enough to be directly lethal to aquatic life, or they may slowly accumulate, especially in sport fish, to levels hazardous for human comsumption or health. Of the 2708 river miles assessed, 751 miles were adversely affected by toxics. Fish consumption advisories account for all of these affected locations (Figure 12). Similarly, lakes with fish consumption advisories make up the 127,471 acres of lakes adversely affected by toxics (Figure 13). Not all of Minnesota's lakes have been monitored, however potentially impacted lakes are monitored on a priority basis.

FIGURE 12



There are a total of 91,871 river miles in Minnesota, of which 2708 miles were assessed.

FIGURE 13

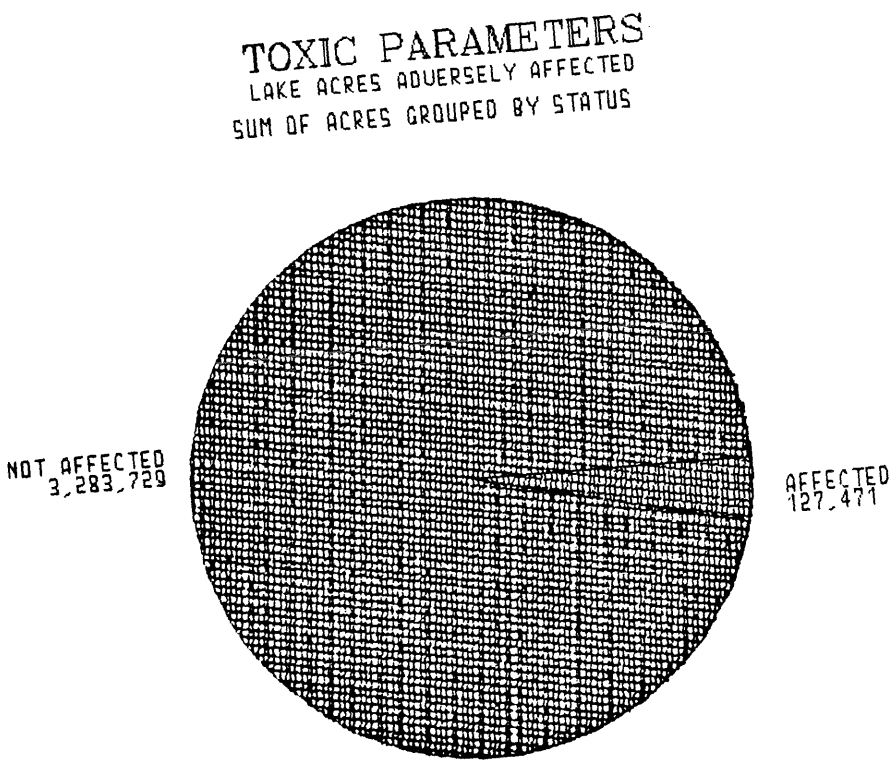
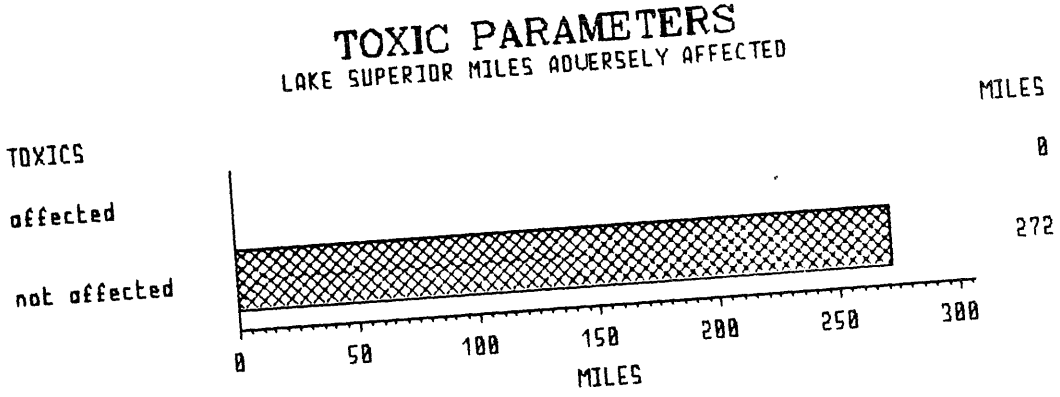


FIGURE 14



Fish Consumption Advisories

Periodically since 1970, the Minnesota Department of Health (MDH) has issued warnings concerning the consumption of fish from certain lakes and rivers in an effort to minimize human exposure to mercury and polychlorinated biphenyls (PCBs). Recent studies have yielded new evidence that fish in some parts of the State are contiminated with these toxic compounds.

The PCB contamination is largely confined to Lake Zumbro and to certain stretches of the Minnesota, Mississippi and St. Louis rivers. Mercury, in the form of methyl mercury, has reached potentially toxic levels in fish in some Minnesota Lakes.

The following fish consumption guidelines were issued in May, 1983 and are still in effect.

TABLE 2
MINNESOTA DEPARTMENT OF HEALTH
FISH CONSUMPTION GUIDELINES

PART 1: RIVERS

RIVERS	FISH SPECIES	MAXIMUM CONSUMPTION
Morton to Fort Snelling	Carp, White Bass	5 meals/month
	Channel Catfish	7 " "
	Sauger	10 " "
Mississippi River		
St. Cloud to Minneapolis (St. Anthony Falls)	Carp	3 " "
Minneapolis to Hastings	Carp, Bigmouth Buffalo	1 " "
Hastings to Dam #3 (North of Red Wing)	Carp	5 meals/year
	Walleye, Sauger	2 meals/month
	White Bass	1 " "
	Flathead Catfish	3 " "
	Channel Catfish	1 " "
Red Wing to Wabasha (Includes Lake Pepin)	Carp	5 meals/year
	White Bass	8 " "
	Channel Catfish	1 meals/month
	Walleye	3 " "
Alma to Dam #5	Channel Catfish	2 " "
	Flathead Catfish	8 " "
	Carp	5 " "
Red Lake River	Carp, Quillback Carpsucker	4 " "

PART 1: RIVERS, (Continued)

RIVERS	FISH SPECIES	MAXIMUM CONSUMPTION
Red River of the North		
North of Oslo	Northern Pike, Walleye, Sauger	7 " "
	Channel Catfish	17 " "
	Carp, Quillback Carpsucker	15 " "
Halstad to Oslo	Channel Catfish	16 " "
South of Halstad	Carp	3 " "
	Northern Pike	18 " "
Sauk River		
Cold Spring to Sauk Rapids	Carp, Smallmouth Bass	5 " "
St. Louis River		
Upstream from Cloquet	Northern Pike	16 " "
	Shorthead Redhorse	17 " "
St. Louis Bay	Northern Pike, Walleye	8 " "
	White Sucker	3 " "
Whitewater River	Brown Trout	11 " "

PART II: LAKES

LAKE (COUNTY)	FISH SPECIES	MAXIMUM CONSUMPTION
Bass Lake (Itasca) (11 miles east of Effie)	Northern Pike	16 meals/month
Basswood Lake (Lake)	Walleye, Northern Pike	10 " "
Burntside Lake (St. Louis)	Walleye, Northern Pike, Lake Trout	12 " "
Christianson Lake (Lake)	Northern Pike	5 " "
Coffee Lake (Lake)	Northern Pike, Walleye	13 " "
Crane Lake (St. Louis)	Walleye	5 " "

PART II: LAKES (Continued)

LAKE (COUNTY)	FISH SPECIES	MAXIMUM CONSUMPTION
Dunnigan Lake (Lake)	Walleye, Smallmouth Bass	12 " "
Fall Lake (Lake)	Walleye, Northern Pike	13 " "
Gunflint Lake (Cook)	Walleye, Northern Pike	13 " "
Hustler Lake (St. Louis)	Northern Pike	5 " "
Little Bass Lake (Pine) (2 miles NW of Finlayson)	Northern Pike Largemouth Bass	19 " "
Minnetonka (Hennepin)	Carp	5 " "
Namakan Lake (St. Louis) (14 miles East of Kabetogama)	Walleye	16 " "
North Cone Lake (Cook)	Walleye, Northern Pike, Smallmouth Bass	9 " "
Pelican Lake (St. Louis)	Walleye, Northern Pike	15 " "
Rainy Lake (St. Louis)	Walleye, Northern Pike	12 " "
Rice Lake (Crow Wing) (Near Brainerd)	Largemouth Bass Shorthead Redhorse	12 " " 8 " "
Sandpit Lake (Lake)	Northern Pike, Walleye	6 " "
Sand Point Lake (St. Louis)	Walleye Northern Pike	4 " " 12 " "
Sletten (St. Louis)	Largemouth Bass	10 " "
Trout (St. Louis) (11 miles North of Soudan)	Lake Trout, Walleye, Northern Pike	14 " "
White Iron Lake (St. Louis)	Walleye, Northern Pike, Lake Trout	13 " "
Lake Zumbro (Wabasha)	Channel Catfish Largemouth Bass Carp	1 " " 11 " " 2 " "

Fish Kill Incidents

During water years 1982-83, 18 fish kills caused by pollution were reported. Of the 124,755 estimated fish mortalities, 3% were game fish and 97% were non game fish. The majority of the kills occurred during the summer months and were caused by agricultural related activities. Table 3 summarizes pollution caused fish kills.

TABLE 3

POLLUTION CAUSED FISH KILLS

Date	Location	County	Nearest Town	Est. No. Killed	Game	Non Game	Cause
81-10-28	Little Cannon River	Goodhue	Kenyon	12,184	1%	99%	Manure drainage
81-11-15	Trib. to Big Cobb River	Blue Earth	Mapleton	360		100%	Unknown
81-11-21	Watonwan River	Blue Earth	Vernon Center	57,000	1%	99%	Fertilizers
81-12-11	Tanners Lake	Washington	Oakdale	60		100%	Unknown
81-12-16	Minnesota River	Dakota	Burnsville	500		100%	Thermal
82-4-16	Judicial Ditch	LacQuiParle	Dawson	116	98%	2%	Chemicals
82-5-4	Green Lake	Kandiyohi	Spicer	104	100%		Unknown
82-5-11	County Ditch #63	Renville	Olivia	2,000		100%	Poisons
82-6-7	Garvin Brook	Winona	Lewiston	32	10%	90%	Unknown
82-10-1	Sleepy Eye Creek	Brown	Sleepy Eye	5,000	70%	30%	Manure drainage
82-11-30	Minnesota River	Big Stone	Browns Valley	unknown	5%	95%	Unknown
82-12-3	Pearl Creek	Goodhue	Kenyon	7,900		100%	Fertilizers
83-4-13	Garvin Brook	Winona	Stockton	75	100%		Unknown
83-5-2	Unnamed Trib.	Mower	Brownsdale	500		100%	Pesticide
83-5-23	Unnamed Trib. to Zumbro River	Goodhue	Kenyon	8,400		100%	Manure drainage
83-6-8	Clearwater River	Red Lake	-	500	6%	94%	Turbidity
83-6-18	Dodge Center Creek	Dodge	Claremont	24		100%	Unknown
83-6-27	Shell Rock River	Freeborn	Albert Lea	30,000	1%	99%	Sewerage system

SPECIAL CONCERNS AND REMAINING PROBLEMS

Much of the effort in pollution control during the past decade has gone into reducing water quality problems through the proven technology of point source control. Improved treatment of point source discharges has provided relatively rapid dividends in improved water quality for rivers and streams in Minnesota's population centers. Lake improvements have been achieved by the diversion of nutrient rich effluents or supplying treatment to reduce nutrient levels. State waters with high quality were protected from degradation by good treatment. Over the past decade, Minnesota's goal has been to reduce conventional pollutant levels discharged into the State's waters and to eliminate completely all untreated discharges.

As point source dischargers provide better treatment, the contribution from nonpoint sources grows more important as an obstacle to achievement of the goals of the Clean Water Act. Runoff in both urban and agricultural areas adversely impacts Minnesota's lakes and streams and must be addressed if these goals are to be met.

Combined sewer overflows in the Twin Cities continue to prevent achievement of the fishable-swimmable status for the Mississippi River in the Metro area. Through 1983, Minneapolis has spent $91,094,306 and St. Paul has spent $75,157,000 on the separation of sewer systems. St. Paul estimates that an additional $171,846,000 is needed before separation will be complete, while Minneapolis estimates an additional expenditure of $52,400,000. South St. Paul will need to spend $12,000,000 to complete separation of sewer systems in that area. The Metropolitan Waste Control Commission will have further expenditures to complete the separation and eliminate the problem of combined sewer overflows in the Metro area.

Spills of hazardous materials, although better documented and reported than a decade ago, are causing mounting concern. Leaks from underground fuel tanks and pipelines may become more numerous as these structures continue to age. The transport of hazardous materials is also increasing in Minnesota.

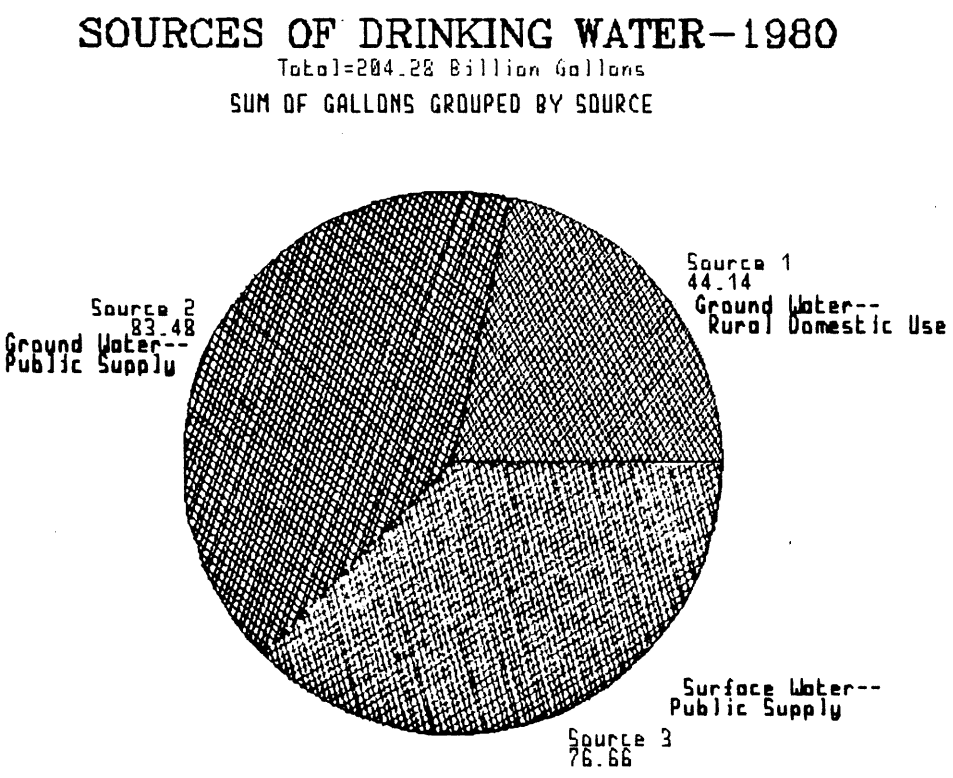
The newest threat to water quality in Minnesota is acid rain. Between 1400-2500 of the State's lakes are sensitive to acid deposition, or about 25% of the lakes classified as fishing lakes. Acid rain may lower the pH of these waters with little buffering capacity so that they become unsuitable for aquatic life. It also may leach increasing amounts of heavy metals, particularly mercury, from the watersheds. The lower pH of the waters enchances the potential for bioaccumulation of heavy metals in fish tissue, possibly creating a health risk to consumers. Included as threatened are such outstanding national resources as Voyageurs National Park, Superior National Forest, and the Boundary Waters Canoe Area.

Three reports concerning the problem of acid rain in Minnesota were published in 1983. They include: Acid Deposition, a study on the impact of snowmelt on the surface water quality of northeastern Minnesota (Appendix D); Acid Rain, Intensive Study Lakes Program (Appendix E); and Acid Rain Sensitivity, a study of contributing factors in remote northeastern Minnesota Lakes. March, 1983 (Appendix F).

GROUND WATER QUALITY

Although Minnesota is best known for its many lakes and rivers, the State is highly dependent on ground water. Almost two out of every three Minnesotans use ground water as their source of drinking water. Figure 15 clearly indicates the importance of ground water for domestic use. Ground Water in Minnesota (Appendix G) is a guide to understanding this valuable resource. In an effort to guide actions which will maintain and improve the quality of the State's ground water, the Ground Water Protection Strategy Framework for Minnesota (Appendix H) was published in 1983.

FIGURE 15



In 1978, the Minnesota Pollution Control Agency (MPCA) began monitoring a statewide network of wells and springs to determine the natural quality of Minnesota's ground water and to discover and monitor long-term quality changes. The six year old program consists of 390 wells and springs, representing all of Minnesota's 87 counties and its 12 principal aquifers. Wells are selected for the program to be representative of the aquifers and the area's water use. All of the wells and springs are sampled on a rotating cycle of 4 to 5 years. The list of constituents analyzed for each of the water samples includes 54 volatile organic chemicals and 20 to 40 inorganic and physical tests. All of the resulting data are entered in STORET. Appendix I is the latest publication of data from this program.

The extent of ground water pollution in Minnesota is presently undefined. However, it is estimated that less than one-tenth of one percent of available ground water in Minnesota has actually been made unusable due to contamination. Most MPCA programs currently deal with monitoring areas where ground water contamination is known to have occurred and examining areas where the potential of contamination exists or is suspected. Table 4 describes the 8 sites where domestic consumption wells were closed due to contamination during water years 1982-83.

Minnesota was the first state to receive Federal Superfund monies for remedial actions not because this State's hazardous waste problems are worse than other states, but rather because Minnesota has been more aggressive in identifying problems and beginning the cleanup process. The 1983 Minnesota Legislature also created a State Superfund to deal with those sites which are not covered by the Federal Superfund and to provide compensation for injuries to people. Appendix J describes the current hazardous waste sites being investigated by the MPCA.

TABLE 4
WELL CLOSURES IN MINNESOTA

Site Name	Description	Action Taken
FMC Corporation Fridley	6 wells on FMC and Naval property are contaminated with chlorinated solvents	On June 8, 1983 the MPCA Citizens Board approved and adopted an "Administrative Order and Interim Response Order by Consent" between the MPCA, EPA, and FMC. Construction of containment facility began in May, 1983 with all wastes placed in facility by July 1, 1983.
Hastings-former City Dump	Private domestic wells and a municipal well north of the site are contaminated with trichloroethylene and other solvents.	Sampling of wells to determine extent of pollution started in May, 1983. Work continues with city to investigate mitigation possibilities.
Joslyn Manufacturing and Supply Co. - Brooklyn Center	Private well and local ground water contaminated with PAH compounds, metals, phenol and PCP.	Plant shut down in September, 1980. Company removed 30,000 gallons of wood treating solutions to out of state hazardous waste facility, Dec. 1981. Request for Response Action issued in September 1983.
LeHillier and Mankato	Local drift and bedrock aquifers contaminated with trichlorethylene and other halogenated volatile hydrocarbons have impacted approximately 60 private domestic wells	HUD grant awarded for a water supply system for LeHillier residents. Completion expected in 1985. EPA providing bottled water to affected residents.
Twin Cities Army Ammunition Plant - New Brighton/Arden Hills	Area-wide ground water contamination over approximately 18 square miles. Includes municipal wells in New Brighton and St. Anthony as well as 30 private wells.	Initial studies of area conducted by Army, EPA and MPCA. New wells constructed by New Brighton. New water main constructed by MPCA and Arden Hills. EPA funded carbon filtration of 2 New Brighton wells. Remedial investigation continues.
Oakdale-Chemical Waste Dump Sites	9 private domestic wells are contaminated with ethylbenzene, isopropyl ether, benzene, heptane, and toluene.	3M conducted surficial cleanup in Nov. 1981. On July 26, 1983, 3M, EPA, and MPCA entered into a Response Order by consent to have 3M conduct remedial action.
Reilly Tar and Chemical Corp. - St. Louis Park	One Hopkins and 6 St. Louis Park municipal wells are contaminated with polycyclic aromatic hydrocarbon.	In 1982, EPA awarded $400,000 grant for site investigation, and in 1983 EPA awarded $1.99 million Superfund grant.
Washington County Landfill - Lake Elmo	Three private domestic wells southwest of landfill contaminated with trichloroethylene.	Gradient control well installed on southwest edge of landfill site.

Point Source Control Program

The improvement in Minnesota's water quality in the past decade has been the direct result of an increase in the percent of the State's population served by secondary or more advanced levels of sewage treatment and an increase in significant municipal and industrial facility compliance.

During the past ten years, 901 million federal, state and local dollars have been spent to improve Minnesota's municipal wastewater treatment facilities (Figure 16). This has resulted in a compliance rate of 88% among these facilities during water years 1982-83 (Figure 17), and a larger segment of the total State population now is serviced by a higher level of wastewater treatment (Figure 18). Because of this, municipal treatment facilities had a 92% removal rate for population equivalents of BOD loadings (Figure 19).

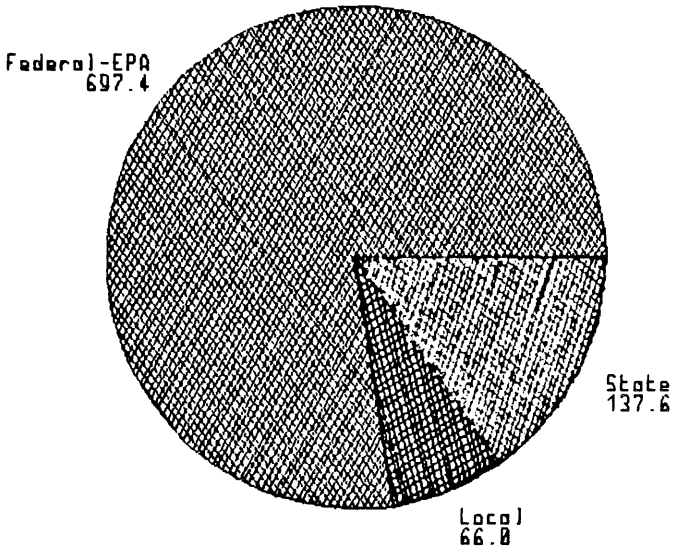
Industrial compliance has increased in the past five years by 5%. During water years 1982-83, 80% of the non-municipal facilities were in compliance with their permits (Figure 20), and 97% of the flow from these facilities met permit requirements.

Appendix K ranks municipal and industrial discharges by flow and pounds per day of phoshorus, total suspended solids, and BOD during 1982 and 1983.

FIGURE 16

CUMULATIVE CAPITAL INVESTMENT
FOR MUNICIPAL WASTEWATER FACILITIES
BY SOURCE OF FUNDS
1972-1982

SUM OF DOLLARS GROUPED BY SOURCE



Dollars are given in millions.

FIGURE 17

SIGNIFICANT MUNICIPAL FACILITY COMPLIANCE

BY PERCENTAGE

SUM OF PERCENT GROUPED BY FACILITY

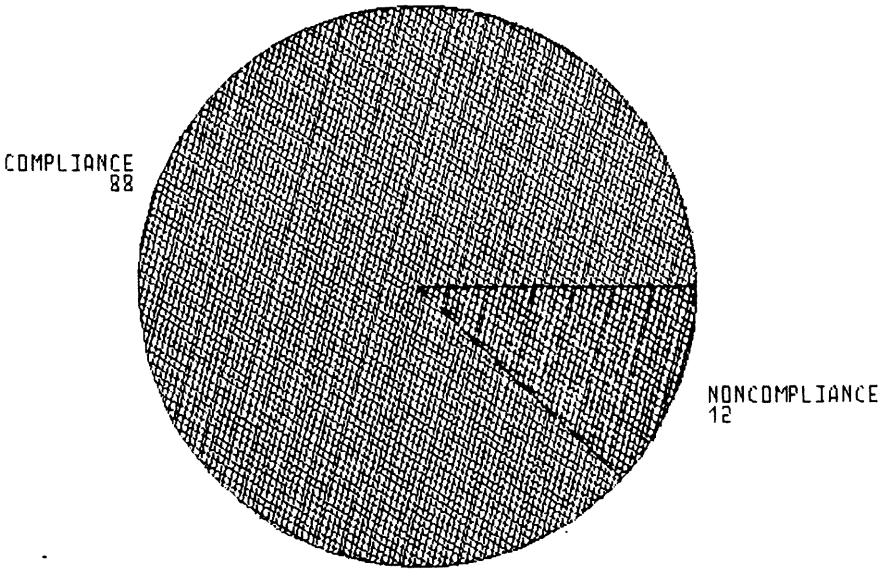
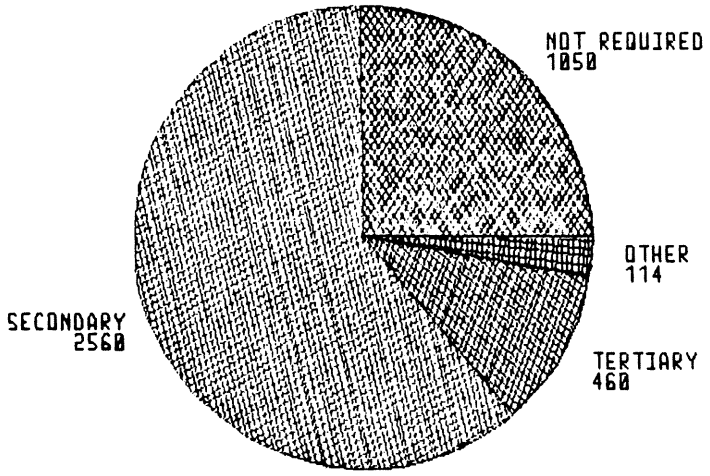


FIGURE 18

LEVEL OF WASTEWATER TREATMENT

PROVIDED TO STATE POPULATION

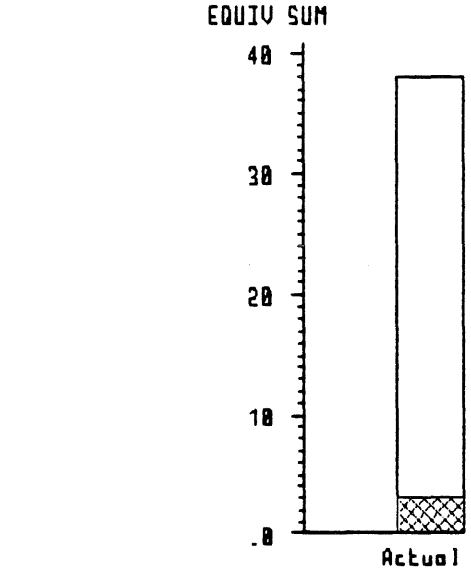
SUM OF PEOPLE GROUPED BY LEVEL



Number of people is given in thousands.
OTHER includes 100,000 people who MAY need a system, but do not have one, 4000 people who have no treatment, and 10,000 people served by a primary treatment system.

FIGURE 19

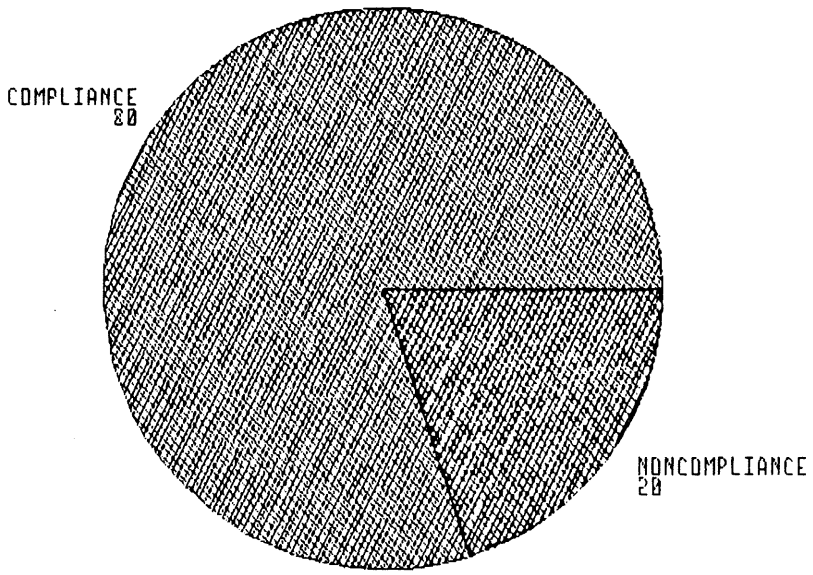
Annual Population Equivalents of BOD Loads Generated
vs Loads Discharged by Municipal Treatment Facilities



LEGEND: BOD ▨ Discharged ☐ Generated
*Includes loads to municipal facilities from other than domestic sources.
Equivalents are population equivalents of BOD expressed in one-hundred thousands.

FIGURE 20

SIGNIFICANT NON-MUNICIPAL FACILITY COMPLIANCE
BY PERCENTAGE
SUM OF PERCENT GROUPED BY FACILITY



Nonpoint Source Control Program

Nonpoint sources are responsible for most of the pollution in Minnesota's surface and ground waters. Generally, nonpoint source problems in Minnesota are regional in nature. Northern Minnesota has problems with inappropriate shoreline development, mining and silviculture. The problems in the central region of the State involve agricultural runoff and hydrologic modifications and construction. Southeastern Minnesota faces problems with urban and agricultural runoff and hydrologic modifications. An estimated 75% of Minnesota's streams, lakes and wetlands are adversely affected by nonpoint sources. A study of the Minnesota River Basin has shown its waters to be particulary impacted by nonpoint source pollution.

Addressing such nonpoint source pollution problems has proven difficult. Although the EPA has assisted with 208 planning and the Lake Restoration Program, and the U.S.D.A. has helped with a Rural Clean Water Project at Garvin Brook, federal nonpoint source pollution control measures have been very feeble.

In response to weak federal assistance on nonpoint source pollution control, the State of Minnesota has enacted two pieces of legislation designed to address nonpoint source pollution: The Metropolitan Surface Water Management Act and the State Agricultural Land Preservation and Conservation Policy Act. Although these Acts provide a framework for addressing nonpoint control, the State does not have sufficient funding to adequately implement the Acts.

TABLE 5
SEVERITY AND EXTENT OF NONPOINT SOURCE CONTRIBUTIONS

TYPE OF NPS	EXTENT	SEVERITY	PRIMARY PARAMETERS
urban	L	S	N SS,T
agriculture (irrigated)	W	S	N SS,T
agriculture (nonirrigated)	W	S	N SS,T
animal wastes	L	M	C
silviculture	L	I	SS,T
mining	L	S	M SS,O*
construction	L	S	SS,T
hydrologic modification	W	S	LF O
saltwater intrusion	W	I	S
residual waste /landfill	L	M	C,P OD

*direct habitat destruction

--- EXTENT ---
W = widespread (50% or more of the State's waters are affected)
M = moderate (25% to 50% of the State's waters are affected)
L = localized (less than 25% of the State's waters are affected)

--- SEVERITY ---
S = severe (des. use is impaired)
M = moderate (des. use is not precluded, partial support)
I = minor (des. use is almost always supported)

--- PRIMARY PARAMETERS ---
C = coliforms
LF = low flow
M = metals
N = nutrients
OD = oxygen demand
P = pesticides/herbicides
S = salinity
SS = suspended solids
T = turbidity
O = other (please specify)

TABLE 6
EXISTING AND RECOMMENDED NONPOINT SOURCE CONTROL PROGRAMS

TYPE OF NONPOINT SOURCE	TYPE OF CONTROL PROGRAM	
	EXISTING	RECOMMENDED
urban	S	SFRE
agriculture (irrigated)	S	SFRE
agriculture (nonirrigated)	S	SFRE
animal wastes	RS	SFRE
silviculture	R	SRE
mining	SR	SFRE
construction	SR	EFRT
hydrological modifications	SR	ESRT
saltwater intrusions		TRE
residual waste/ landfill	SR	TRFE

-- TYPE OF CONTROL PROGRAM --

S = structural/public works
E - education .
T - tech. assistance
F = financial incentives
R = regulation
O = other

MONITORING PROGRAMS

Toxics Surveys

During water years 1982-83, toxics surveys were conducted in areas with known or suspected toxic problems. Water, sediment and tissue samples were collected to confirm and better define toxic pollution in Minnesota. PCBs, mercury, and other heavy metals were the major parameters of concern.

Snapping turtles were collected from four sites on the Mississippi River, the Pomme de Terre River, Silver Lake, and Reeds Lake. Fat and meat samples were analyzed for PCBs, mercury, and cadmium and the resulting report was published in August, 1982.

PCBs and heavy metals were also measured in fish samples collected from Mille Lacs Lake and 15 acid rain intensive study lakes during 1982. Analyses for these parameters in fish tissue continued to 1983 in acid rain intensive study lakes, lakes impacted by mining operations, and rivers and lakes providing information for trend analyses and consumption advisories.

Appendix L details the sample location and type of sample collected during 1982 and 1983 for toxics surveys.

Ambient Monitoring Network

The Minnesota Pollution Control Agency's Routine Water Quality Monitoring Program has been operational since 1953, with periodic adjustments in sampling stations and analyses to adequately monitor significant waters of the State. In October, 1980, rising analytical costs combined with budget cuts caused a reduction in the sampling year to nine months, with no sampling in November, December, and February.

At that time it was determined that a better way of monitoring the State's waters would be to emphasize sampling in a different watershed each year, while maintaining representative sampling in the other watersheds. Sampling stations were added in the Lake Superior Basin from October, 1980 through September, 1981. In water year 1982, stations were deleted from the Lake Superior Basin and added to the Des Moines, Missouri, Minnesota and Mississippi River basins. The Red River of the North and the Rainy River basins were emphasized in water year 1983. Thus, a three year rotation was established.

During water years 1982-83, a total of 85 stations were monitored for the following parameters: temperature, dissolved oxygen, BOD_5, fecal coliform, suspended solids, pH, organic nitrogen, ammonia nitrogen, nitrate + nitrite nitrogen, total phosphorus and conductivity. All resulting data were entered in STORET. The data provided ambient water quality information on approximately 1500 miles of rivers and streams in Minnesota. Appendix M is the most recent publication of that data.

BIOASSAY PROGRAM

Minnesota's bioassay program began in 1979 and has been operational for 4 years. As part of the program, two types of bioassays have been used by the Agency. The 24-hour static bioassays have been conducted on minor NPDES permitted discharges primarily as a screening technique to uncover problems needing further investigation. The 96-hour flow-through bioassays have been conducted on major NPDES permitted discharges utilizing seven concentrations in 75%, 65% or 56% geometric dilution series. Table 7 summarizes the test performed in water years 1982-83. A listing of the test locations and results can be found in Appendix N.

TABLE 7
BIOASSAY PROGRAM
1982-83

Year	Test	Sites Completed	Number Toxic
1982	Flow-through	3	1
1982	Static	63	26
1983	Flow-through	3	0
1983	Static	54	13

During 1982-83, six, 96-hour flow-through bioassays were conducted in Minnesota by the MPCA. Table 8 summarizes the results.

TABLE 8
1982-83 FLOW-THROUGH BIOASSAY LOCATIONS

Site	Location	Date	Result
Western Lake Superior Sanitary District	Duluth	7/29/82 - 8/2/82	LC50=91%
Boise Cascade Corporation	International Falls	8/22/82 - 8/26/82	Not toxic
Mankato Wastewater Treatment Plant	Mankato	9/16/82 - 9/20/82	Not toxic
Owatonna Wastewater Treatment Plant	Owatonna	6/13/83 - 6/19/83	Not toxic
Boise Cascade Corporation	International Falls	7/21/83 - 7/25/83	Undetermined
Boise Cascade Corporation	International Falls	11/11/83 - 11/15/83	Not toxic

Intensive Surveys

The intensive surveys and use attainability studies were all conducted in conjunction with advanced wastewater treatment justifications. Of the 20 sites surveyed, 17 had documented violations of ammonia, dissolved oxygen, pH, or fecal coliform water quality standards. Table 9 summarizes these surveys. Appendix O contains the completed reports.

TABLE 9
INTENSIVE SURVEYS
OCTOBER 1981 - SEPTEMBER 1983

Community	Receiving Waters	Survey Dates	Comments
*Albertville	Mud Lake and School Lake	March - June 1983	draft report
*Bovey-Coleraine	Trout Lake and Trout Creek	Aug. 1982, Feb.-June, Aug. 1983	reports complete
*Blackduck	Coburn Creek and Blackduck Lake	Aug, Sept. 1983	ongoing
*Canby	Canby Creek	Feb. 1982	ongoing
*Cook	Littlefork River	Feb. 1982	ongoing
*Cyrus	Chippewa River	Aug., Sept. 1983	draft report
*Dassel	Spring Lake	March - June 1983	draft report
*Gonvick	Lost River	Aug. 1982	ongoing
*Grove City	Unnamed tributary and Grove Creek	Feb. 1982	ongoing
*Holland	Rock River	Aug. 1983	draft report
Lake Crystal	Lily Lake	March - June 1983	draft report
*Litchfield	Jewitts Creek	Aug. 1982	ongoing
Mabel	Riceford Creek	Aug. 1982	report complete
Melrose	Sauk River and Horseshoe Chain of Lakes	Jan., March - Sept., 1983	ongoing
*Plainview	Unnamed tributary and North Fork of the Whitewater River	Aug. 1983	draft report
*Starbuck	Outlet Creek	Feb., Aug. 1982	letter
*Waseca	Unnamed tributary and LeSueur River	Aug., Sept. 1983	reports complete

Table 9 - Continued

Community	Receiving Waters	Survey Dates	Comments
*Williams	Williams Creek	Feb. 1982	ongoing
*Windom	West Fork of the Des Moines River	Feb. 1982	ongoing
*Worthington	Okabena Creek	July 1982	report complete

*documented violations of water quality standards.

RECOMMENDATIONS

Financial support for both construction and administration costs of pollution control will continue to be required if the object "... to restore and maintain the chemical, physical, and biological integrity of the Nation's waters..." of the Clean Water Act is to be achieved.

The dollars which have been spent thus far to control point source pollution in Minnesota have resulted in an improvement in the State's water quality in the last decade. Continued financial support will insure that wastewater treatment plants are replaced and expanded as communities and industries change and grow.

As point source discharges have provided better treatment, nonpoint source pollution has accounted for more of the nonsupport of designated uses in both Minnesota's lakes and streams. Combined sewer overflow, urban runoff, and agricultural runoff all have known impacts. Addressing these types of pollution has proven difficult, and federal support has been lacking. Federal assistance aimed at defining and controlling nonpoint source pollution and combined sewer overflows is essential if progress is to continue towards the fishable/swimmable goals of the Act.

Toxic compounds pose a threat to the surface and ground water in Minnesota. The extent to which toxics have already damaged the environment must be better assessed and steps taken to control the release of these compounds must be taken. Financial support and a commitment at the federal level are necessary if the control of toxics in the environment is to be accomplished.

The commitment to providing the nation with clean water must continue. The states in partnership with the Federal government can accomplish the objective of the Clean Water Act and insure that Minnesota will always have its valuable natural resources of clean lakes, streams and ground water.

List of Appendices

Appendix A

Ranking of 1250 Minnesota Lakes by Trophic State Index.

Appendix B

Report on the Transparency of Minnesota Lakes - Citizen Lake Monitoring Program 1983. April 1984.

Appendix C

Region VIII EPA Water Quality Matrix. May 7, 1984.

Appendix D

Acid Deposition, A study on the impact of snowmelt on the surface water quality of northeastern Minnesota. June, 1983.

Appendix E

Acid Rain, Intensive Study Lakes Program. 1983.

Appendix F

Acid Rain Sensitivity, A study of contributing factors in remote northeastern Minnesota Lakes. March, 1983.

Appendix G

Ground Water in Minnesota, A User's Guide to Understanding Minnesota's Ground Water Resource. January, 1984.

Appendix H

Ground Water Protection Strategy Framework for Minnesota. June, 1983.

Appendix I

Ground Water Quality Monitoring Program, Volume 5, July, 1983.

Appendix J

Minnesota Pollution Control Agency Hazardous Waste Site Log. March, 1984.

Appendix K

Ranking of Industrial and Municipal discharges for 1982 and 1983.

Appendix L

Fish collection for 1982 and 1983.

Appendix M

Water Quality Sampling Program, Minnesota Lakes and Streams. April, 1983.

Appendix N

Facilities Tested during 1982 and 1983 Static Bioassays.

Appendix O

Reports for completed intensive surveys and use attainability studies.