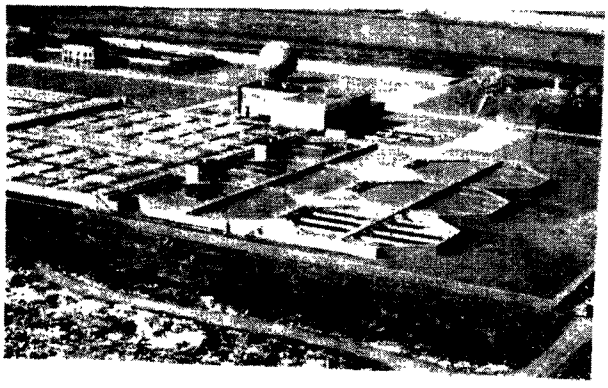
LAKE ERIE BASIN

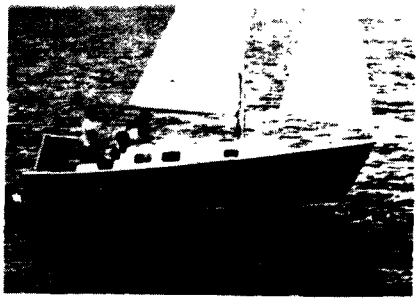
Water Quality

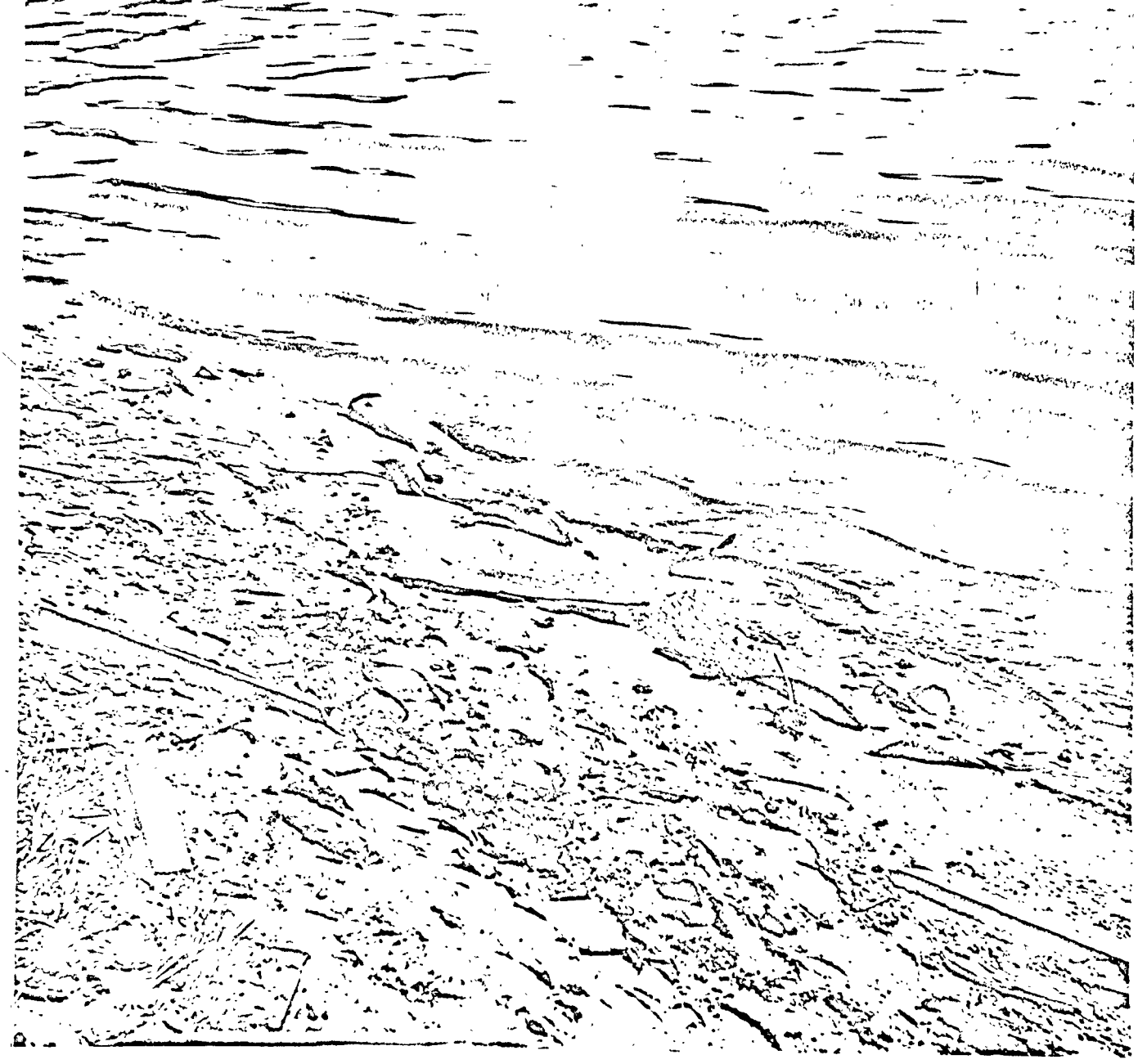
Problems



Needs

Actions





MUST OUR PROGRESS ENGULF US?
SHALL WE CHOKE ON OUR OWN SUCCESS?
DOES OUR SOCIETY NEED TO TOLERATE FILTHY RIVERS... TOO FEW PARKS? TOO FEW BEACHES? TOO LITTLE WILDLIFE? TOO MUCH UGLINESS AND TOO LITTLE BEAUTY?

WELL, I THINK THERE IS ONLY ONE ANSWER. NO. NO, WE WILL NOT.

---PRESIDENT JOHNSON

LAKE ERIE BASIN

Water Quality Problems

Needs and Actions

PROGRAM FOR WATER POLLUTION CONTROL

November 1967

U.S. DEPARTMENT OF THE INTERIOR

Stewart L. Udall, Secretary

Federal Water Pollution Control Administration

James M Quigley, Commissioner

FOREWORD

JAMES M. QUIGLEY, *Commissioner*
Federal Water Pollution Control Administration
U. S. Department of the Interior

Lake Erie is the economic lifeblood of a region of eleven million persons, and it is one of the most seriously polluted bodies of water in the nation. The lake suffers from the continual outpouring of industrial and municipal wastes and from runoff from urban and agricultural lands within the basin. This pollution limits the lake's recreational values, plagues its fishermen, periodically poses an impediment to its commerce, and occasionally causes unpleasant tastes and odors in its waters even after treatment for domestic consumption.

The abuses which the lake suffers certainly are not new. What is new, is a strong desire of the people of the basin to halt the continuing degradation of the lake and the tools required to restore it to its past usefulness.

Amendments to the Federal Water Pollution Control Act in 1965, and the supporting amendments enacted in 1966, gave new urgency, support, and direction to the cooperative work underway in Lake Erie since 1963. Explicitly affirmed, as a statutory declaration, was the policy that the purpose of the national pollution control effort is the management of future water quality to prevent pollution as well as the abatement of pollution which has occurred. To accomplish this historic shift in national policy, the Congress required, for interstate and coastal waters, the establishment of water quality standards, containing plans for their implementation. Congress also stipulated that pollution control planning at all levels of government henceforth be directed toward effecting the aims of the water quality standards program. Because of this requirement, the five States in the Lake Erie Basin have devoted substantial and commendable effort to the development of sound water quality standards and implementation plans for the interstate waters of the Lake Erie Basin. They also are moving to establish comparable standards for their intrastate waters in the basin.

It is the achievement of these standards toward which pollution control programs in the Lake Erie Basin must be directed in the years ahead. Success in this effort, however, will require integration of the States' plans for implementing water quality standards with programs of Federal water resource agencies and the periodic updating of the standards.

Needed, is an intergovernmental organization in the Lake Erie Basin through which this continuing updating of water quality standards and implementation plans, and the coordination of the programs of Federal, State and local agencies, can take place. To meet this need, this report recommends that this responsibility be undertaken by the Great Lakes Basin Commission, a river basin planning commission newly-created under the Water Resources Planning Act of 1965.

The Federal Water Pollution Control Administration, having recognized the needs, intends to pursue the clean-up of Lake Erie and its tributary streams by directing its many and varied programs toward that objective. We further urge all other concerned governments and agencies to make a similar commitment, and to join with us in a coordinated program to once again making Lake Erie suitable for all of the uses the inhabitants of its basin need and desire.

CONTENTS

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SCOPE

This report is a review of the problems still confronting the basin and a guide to the restoration of Lake Erie. Efforts along these lines began in 1963 when the Federal Government, in cooperation with the States, local units of government, and private interests, began an intensive program to define the pollution problem in Lake Erie and its tributary watersheds. The continuing objective has been the development of a cooperative Federal-State-local program which would provide for immediate abatement of existing pollution and would also provide plans for the long-range management of the Lake and its tributaries.

Early findings in this program pointed to the need for immediate enforcement actions in Lake Erie, under provisions of the Federal Water Pollution Control Act, to abate existing and preventable discharge of pollutants. At the request of the Governor of Ohio, an interstate enforcement conference, which remains in force, was held in 1965. Earlier, in 1962, a request from the Governor of Michigan had been the basis for convening a Federal intrastate enforcement conference covering Michigan's waters in the Lake Erie Basin.

The problems and damages to the varied water uses are described both in terms of the Lake proper and the seven major subbasins. The inputs to these sections have been derived from the wealth of technical data accumulated over the years through selected studies of the Lake, its tributaries and the waste sources themselves. The sheer magnitude of these data dictate their incorporation into separate technical reports, available to all in need of the collected information. An itemization of the specific pollutional sources are, however, included as tables in Appendices A and B.

The current needs of the basin to obtain effective pollution abatement and to assure continual water quality management are discussed in the Chapter on Corrective Requirements. It is also here that long range goals toward which all detailed planning should be directed are discussed.

Since we clearly recognize that the finest of plans are rendered useless unless implemented, the Chapter on Basin Coordinating Arrangements centers around a discussion of the mechanism now available to carry out cooperative planning and coordinated action at all levels of concern. The particular entity responsible for correction of specific problems in the basin has been identified. Only through concerned public and responsive governmental agencies will the matter be handled satisfactorily.

THE BASIN and ITS' PROBLEMS

CHARACTERISTICS

The area of the Lake Erie Basin including Lake St. Clair covered in this report is 39,900 square miles of which the lake itself contains 9,900 square miles, Figure 1. The basin basically reflects the bedrock structure overlain with glacial debris and lake outwash. The flatness of the basin is responsible for low gradient streams which have sluggish flows in all but the southeastern part. Although precipitation is relatively uniform during all months, the consumptive use in the summer months plus poor ground water reservoirs result in many intermittent tributaries and low flows in most of the major rivers. The few reservoirs often add to the pollution problem since they usually store the entire flow for municipal water supply purposes only.

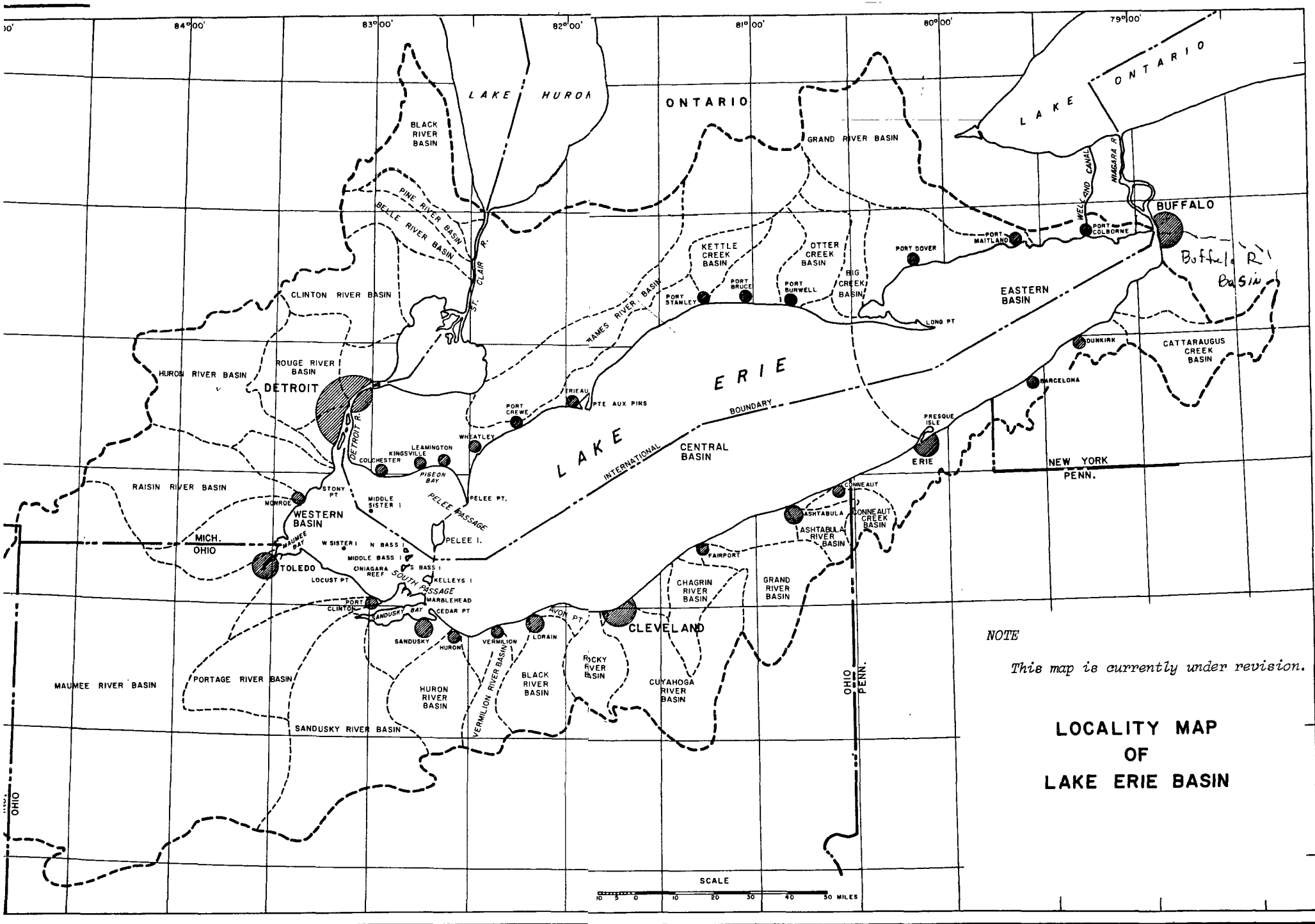
Lake Erie has the smallest volume of any of the Great Lakes. Its mean depth of 60 feet (216 maximum) provides a volume of 113 cubic miles. Eighty percent of the basin inflow, 187,000 cfs, enters through the St. Clair River while 202,800 cfs exit through Niagara River and another 7,000 cfs are passed through the Welland Canal. The average flow through time is approximately 920 days.

The lake has many peculiarities in the behavior of the water mass and these have been the subject of intensive studies over the years. From the data which are available, it can be summarized that: the lake undergoes thermal stratification resulting in oxygen deficient areas of the lake, surface currents are significant in accumulating the pollutants along the western and southern shores, wave action is significant in adding silt and maintaining turbidity, seiches or internal waves contribute to the turbidity by resuspending sediment but also serve to redistribute shoreline wastes throughout widespread areas of the lake.

The short flow through time, temperature, natural runoff and water movements all contribute to making Lake Erie the most naturally enriched lake of the five Great Lakes. Because of this unique status, the activities of man in the recent years have increased this rate of enrichment significantly and unless checked will ruin this great natural resource.

POPULATION AND ECONOMIC ACTIVITY

The most familiar measure of basin activity is population growth. In 1960 more than 10 million persons lived in the U. S. portion of the basin and 1.2 million lived in Canada, nearly a threefold increase over the 1910 population. It is estimated that the U. S. population may exceed 23 million by 2020. Figure 2 shows the current and projected populations



NOTE

This map is currently under revision.

LOCALITY MAP OF LAKE ERIE BASIN

FIGURE 1

for subareas. The trend toward increased urbanization, currently at 85 percent, will continue.

Municipal water use in the basin is 1,347 MGD of which 11 percent (158 MGD) is from inland sources, and 41 percent (551 MGD) is from Lake St. Clair and the Detroit River. The 2020 demand in the basin for 4,100 MGD will require 1,400 MGD from Lake Huron for the Detroit area and 2,500 MGD from Lake Erie since the inland sources are almost completely developed.

The industrial activity associated with the population growth has also been a significant factor in the pollution of Lake Erie. The availability of waters of Lake Erie for processing, cooling and navigation was a major reason for industry to locate in the basin. Figure 2 shows a total of $17 billion as the current value added by manufacture. This is expected to at least double by 2020 with some areas such as chemicals increasing up to four times the current rate. The self-supplied water requirements, currently 8,300 MGD will increase to 21,000 MGD. Most of this water is used for cooling, but will require treatment before returning to the lake.

Although the rural population in the basin is only 15 percent of the total, agricultural production is an important and stable part of the basin economy. The flatness and depth of soils plus climate make the area highly productive. Crop and livestock sales presently are $610 million and represent a wide variety of crops from dairy to truck crops. Areas devoted to agriculture should decrease slightly, but production will increase. The effects of land erosion, nutrient runoff, chemical pollutants and livestock wastes are major problems arising from the agricultural activity.

Trade at the major ports in was million tons. This major factor in the economy creates pollution from spills and illegal discharges of wastes. The need for dredging of harbors to sustain this shipping should be substantially reduced by proper waste treatment and agricultural practices.

Within the last 20 years, the fishing industry on the United States side of Lake Erie has suffered an almost disastrous decline because of the disappearance of prized species, such as walleye, blue pike, and whitefish, upon which the industry depended so heavily. Reluctance of the industry to adapt to less desirable types of fish also contributed to this decline. There is still about 20 million dollars of capital investment in the Ohio commerical fishing industry, but this is only about one-third of the investment in sport fishing.

Total catch in Lake Erie, in pounds, appears to be tenuously holding its own; but dollar value is decreasing. For example, in the 1950-59 decade, an average annual catch of 53 million pounds of fish brought 7.5 million dollars, while between 1960 and 1964, a catch of 52 million pounds brought only 3.9 million dollars.

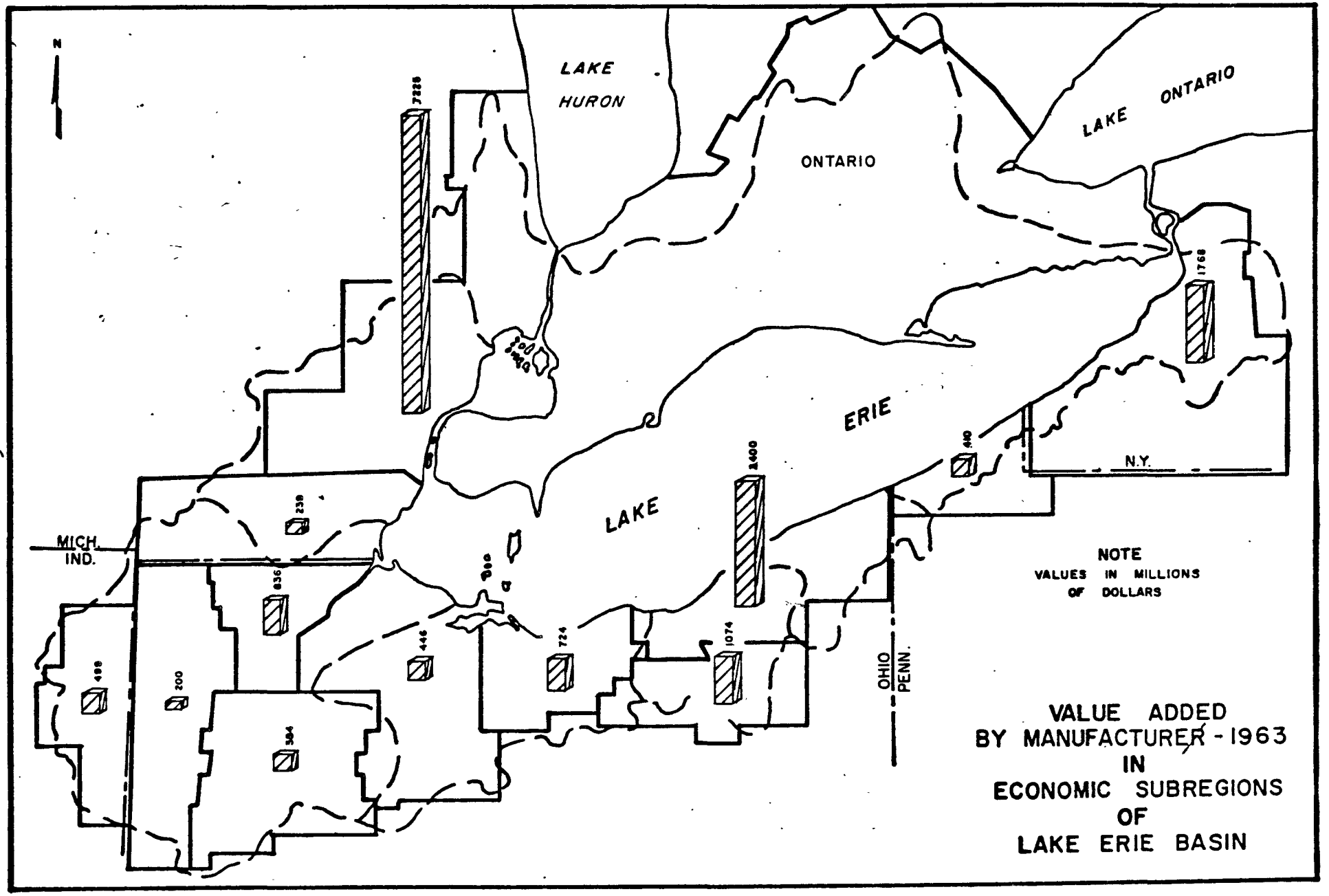

N
LAKE
HURON
ONTARIO
LAKE ONTARIO
ERIE
LAKE
N.Y.
MICH.
IND.
OHIO
PENN.
NOTE
VALUES IN MILLIONS
OF DOLLARS
VALUE ADDED
BY MANUFACTURER - 1963
IN
ECONOMIC SUBREGIONS
OF
LAKE ERIE BASIN

FIGURE 3

An increasingly important segment of the basin economy is tourism and recreation which adds hundreds of millions of dollars. The value of these opportunities for water based recreation far exceeds the economic impact. In the Lake Erie basin, most of this activity is directly related to the Lake and centered around the major cities. The development of facilities is not rapidly expanding except in a few local areas where State governments or large private enterprises are developing facilities.

Large numbers of boats are trailered to Lake Erie on summer weekends, many from 100 or more miles away. Twenty thousand boats have been counted in the Ohio waters of Lake Erie on a warm summer weekend. This number may be equaled or exceeded in Lake St. Clair and the Detroit River. The reduction of pollution will stimulate tourism leading to an increase in the establishment of facilities. Even under present circumstances, the total tourism industry should double its present activity by the year 2020 due to increasing available leisure time. Certain facets of the industry, especially those centered around small boating activities, are now expending rapidly and should increase at a significantly greater rate than the population growth.

Sport fishing is a major recreational attraction in Lake Erie. In Ohio waters the sport fishing catch of yellow perch frequently exceeds the commercial catch. The heaviest sport fishing activity occurs in the western basin and particularly in the island area. Ice fishing has also become an increasingly popular form of recreation, with good catches being reported. It is imperative that there be action taken to prevent further decline in the sport fish species if this form of recreation is to be maintained.

LAKE ERIE

The principal pollutional materials discharged into Lake Erie and its tributaries are municipal and industrial wastes. These wastes consist not only of continuous, direct discharges, but also of combined sewer overflows and overflows from treatment plants of inadequate size. A third significant, but harder to define, source is from land runoff.

Other significant contributors to the pollution problem are wastes from commercial and pleasure craft, harbor dredging operations, urban runoff and shore erosion. All of these combined are now potentially disastrous to Lake Erie water quality. The most obvious signs of pollution occur in the tributaries and around the lake shoreline where recreational and water supply uses are greatest. An enigma as menacing as a cancerous growth is also taking its toll in the entire lake, the seemingly inexorable onslaught of premature aging.

Three geographical areas are primarily responsible for the present condition of Lake Erie (Table 1). These areas, in order of decreasing effect on the overall quality of Lake Erie water, are: (1) Detroit, Michigan and its surrounding municipalities, (2) the Cleveland-Cuyahoga River basin, and (3) the Maumee River basin. Many other areas have problems which are primarily local; but cumulatively, they also have a profound effect on the general water quality. Table 2 is a summary of the wasteloads to the Lake from the different sources.

TABLE 1

PERCENT CONTRIBUTIONS OF POLLUTANTS FROM MAJOR AREAS IN THE LAKE ERIE BASIN

	Detroit and Southeast Michigan	Cleveland-Akron-Cuyahoga	Toledo-Maumee River
Phosphorus	40.0	18.6	15.3
BOD_5	60.3	11.0	15.5
Chloride	51.0	10.6	4.7

TABLE 2

WASTE LOADS TO LAKE ERIE BASIN WATERS - 1966
Pounds/Day

	BOD_5	Chlorides	Total Phosphorus	Suspended Solids
Western Basin				
Industrial	261,000	6,200,000	4,000	
Municipal	632,000	1,060,000	55,000	
Rural Runoff		1,600,000	13,000	
Urban Runoff			4,000	
Lake Huron outflow	950,000	6,500,000	20,000	3,800,000
U. S. (undifferentiated)				27,000,000
Canada (undifferentiated)		1,400,000	5,000	1,100,000
Subtotal	1,843,000	16,760,000	101,000	31,900,000
Central Basin				
Industrial	110,700	4,500,000	1,400	
Municipal	149,300	646,000	27,000	
Rural Runoff		1,220,000	4,000	
Urban Runoff			4,000	
U. S. (undifferentiated)				45,000,000
Canada (undifferentiated)		1,000,000	8,000	50,000,000
Subtotal	260,000	7,366,000	44,400	95,000,000
Eastern Basin				
Industrial	160,000	280,000	500	
Municipal	72,1000	128,000	4,400	
Rural Runoff		294,000	1,220	
Urban Runoff			760	
U. S. (undifferentiated)				1,000,000
Canada (undifferentiated)		500,000	5,000	6,000,000
Subtotal	232,100	1,202,000	11,880	7,000,000
GRAND TOTAL	2,335,100	25,328,000	157,280	133,900,000

The waste substances that are discharged to the lake from municipal and industrial outfalls, tributaries, and land drainage are many; and their effects on water uses are varied. Those substances that have the most damaging effects on the total waters of the lake are phosphorus, carbonaceous oxygen-consuming materials and suspended solids (sediment). Phosphorus is the principal contributor to the ~~overfertilization of the lake.~~

Chlorides and dissolved solids have not reached damaging concentrations, but their dramatic increases are indicative of the rate at which water quality is being degraded. Many substances such as acid, oil, cyanide, iron, coliform bacteria, phenol, and other oxygen-consuming materials exhibit severe effects on water uses in the localities of the discharge.

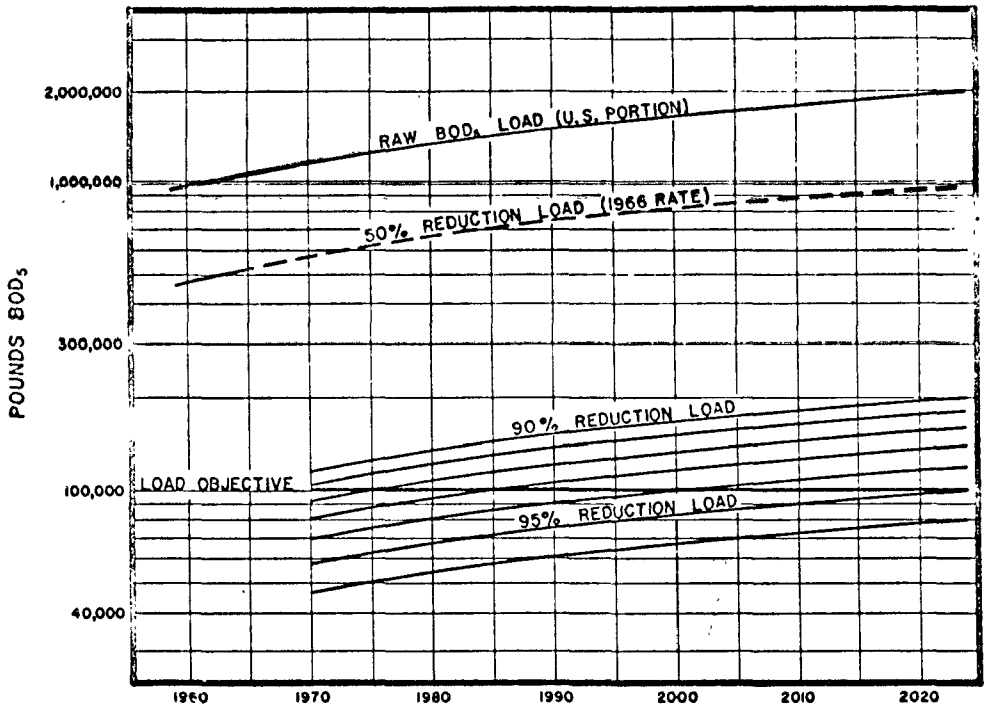
Carbonaceous Oxygen-Consuming Materials - Carbonaceous oxygen-consuming materials, usually measured by the 5-day biochemical oxygen demand (BOD_5) depress the levels of dissolved oxygen. The immediate effect is not as pronounced in lakes such as Lake Erie because of its tremendous oxidative capacity. Carbonaceous BOD_5 of wastes are most effectively removed by secondary or tertiary treatment.

The present and projected daily BOD_5 loading for the entire basin is shown in Figure 4 along with the loading after various degrees of reduction. Figure 5 shows projected loadings for each of the sub-basins. As this figure indicates, the Detroit area contributes more BOD_5 to Lake Erie than all other known sources combined.

Suspended Solids - Damages to Lake Erie resulting from suspended matter entering from waste discharges and tributaries are dependent on the nature of the material. Suspended matter from municipal discharges is primarily organic, and its deposition results in enriched bottom muds or sludge banks. Effects of these wastes are largely local and can be corrected by proper treatment. Suspended matter from certain industries and the material from tributaries originating as land runoff are largely inorganic and serve to fill harbors, embayments, ship channels, and the lake.

The principal sources of suspended solids discharged to Lake Erie are the Detroit, Maumee, Cuyahoga, and Grand Rivers which represent a total of 12,700,000 pounds per day of known discharges. A significant portion of the suspended solids of the Detroit River discharges are from industrial and municipal sources. The Maumee discharges are largely silt from land runoff with the greatest quantities being released during periods of heavy rain and high runoff. The Cuyahoga and Grand River (Ohio) discharges are largely a combination of land runoff and from industrial and municipal wastes. This load on Cleveland's harbor and channels results in severe discoloration and the need for frequent dredging.

LAKE ERIE BASIN
(U.S. PORTION)
TOTAL PROJECTED DAILY BOD_5 LOAD AND EFFECT OF REDUCTION
INDUSTRIAL SOURCES



LAKE ERIE BASIN
(U.S. PORTION)
TOTAL PROJECTED DAILY BOD_5 LOAD AND EFFECT OF REDUCTION
MUNICIPAL SOURCES

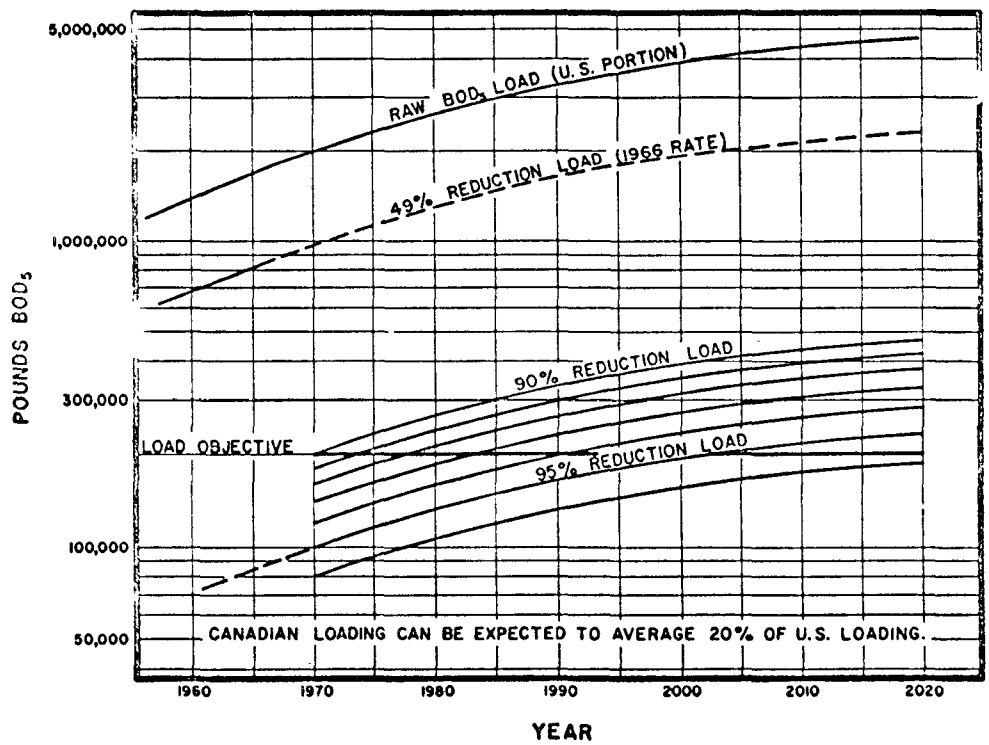


FIGURE 4

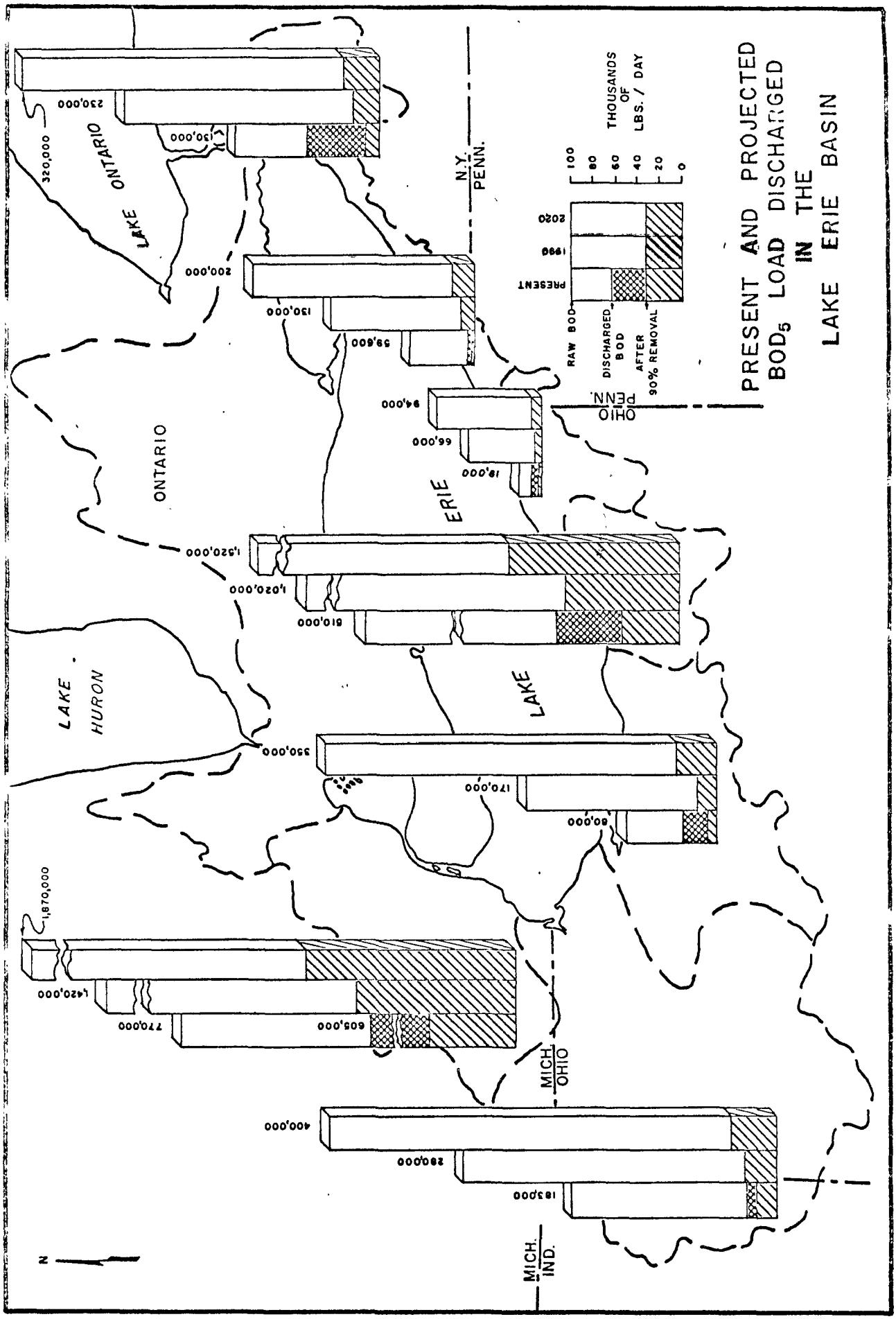

PRESENT AND PROJECTED
BOD5 LOAD DISCHARGED
IN THE
LAKE ERIE BASIN
THOUSANDS OF LBS. / DAY
100
80
60
40
20
0
2020
1990
PRESENT
RAW BOD
DISCHARGED BOD AFTER 90% REMOVAL
LAKE ONTARIO
ONTARIO
LAKE HURON
LAKE ERIE
N.Y. PENN.
OHIO PENN.
MICH/OHIO
MICH/IND.
320,000
230,000
130,000
200,000
130,000
59,600
94,000
66,000
18,000
1,920,000
1,020,000
610,000
350,000
170,000
80,000
1,870,000
1,420,000
770,000
605,000
400,000
280,000
183,000
N

FIGURE 5

Chlorides - Lake Huron discharges 6.5 million pounds of chlorides per day, accounting for 26 percent of the total chloride load to Lake Erie and the Detroit-Windsor area discharges 9.5 million pounds per day or 38 percent. Thus, nearly two-thirds of the chloride load to Lake Erie enters at the mouth of the Detroit River. The Grand River (Ohio) contributes another 3.9 million pounds, or 15 percent, and the Cuyahoga and Maumee Rivers contribute 1.5 million pounds per day or about 6 percent of the total to Lake Erie.

Exclusive of the Lake Huron input, chlorides contributions are as follows: industry - 43 percent, municipal wastes - 7 percent, and street deicing (runoff) - 12 percent. The remaining 12 percent is derived from undifferentiated Canadian sources.

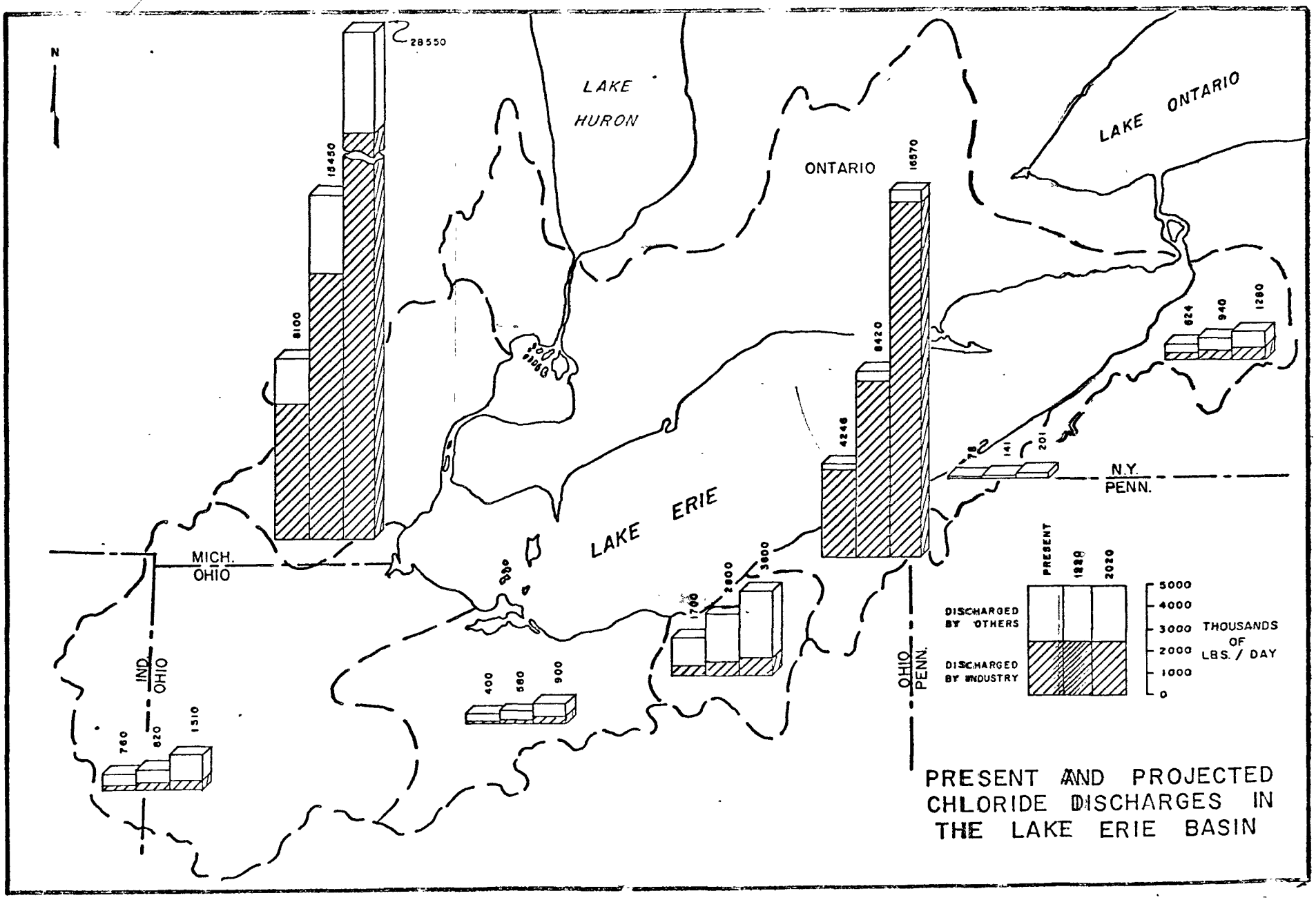
Historical data indicate that the concentration of chloride in Lake Erie was 7 mg/l at the beginning of this century. At that time a noticeable increase began and in 60 years the concentration has tripled.

Figure 6 shows the projected chloride loadings by subbasin, and Figure 7 shows projected total lake loading and the effects of various degrees of reduction.

Dissolved Solids - Dissolved solids concentrations at the head of the St. Clair River average 110 mg/l,at the head of the Detroit River 126 mg/l, and in Lake Erie at Buffalo, New York, 180 mg/l. These levels represent daily inputs of 116 million pounds per day to the Niagara River from Lake Erie. Most of the increase within Lake Erie actually is derived from the Detroit area.

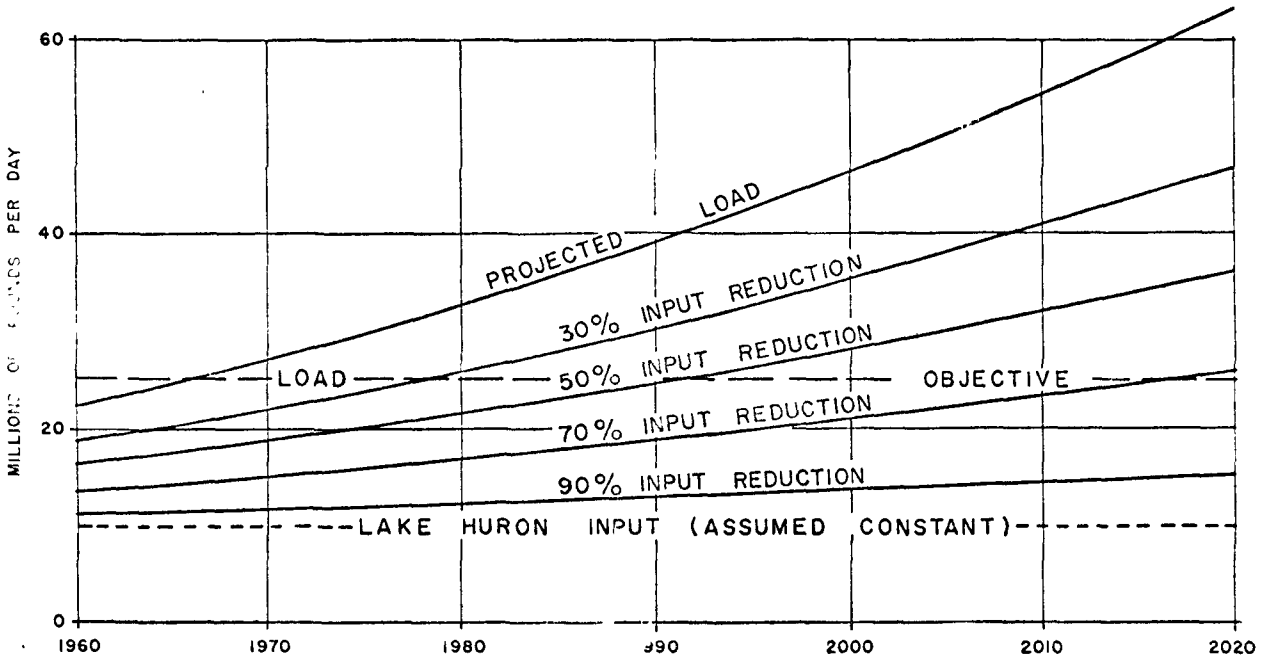
The concentration of dissolved solids in Lake Huron has remained fairly constant at 110 to 115 mg/l since 1900; whereas the increase in Lake Erie as measured at Buffalo in the same period has risen from 115 to 180 mg/l (Figure 8). If unchecked, the dissolved solids level will reach 230 mg/l by 2020.

The fact that Erie's waters are still useable is due to its tremendous capacity for dilution and natural purification. While the wastes cause problems of lesser degrees, there are now two areas which are critical, not because of incurability, but because of inattention. These problems are (1) over-fertilization of the entire lake which is serious throughout the western basin and along the shore and (2) bacterial contamination near shore which is most serious in the vicinity of metropolitan centers.



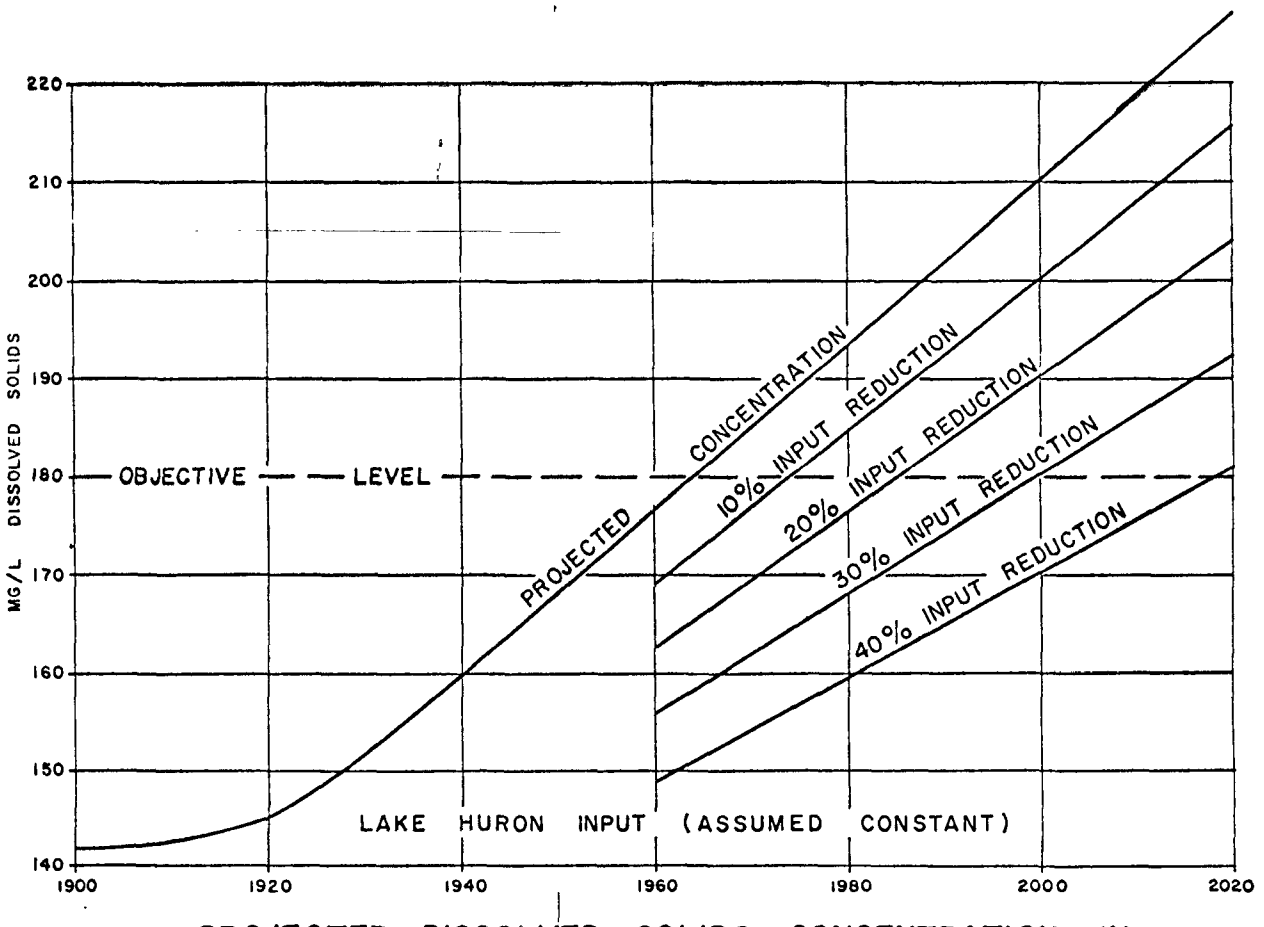
PRESENT AND PROJECTED CHLORIDE DISCHARGES IN THE LAKE ERIE BASIN

FIGURE 6



PROJECTED CHLORIDE LOAD TO LAKE ERIE AND LOADS WITH VARIOUS IN-BASIN LOAD REDUCTIONS.

FIGURE 7



PROJECTED DISSOLVED SOLIDS CONCENTRATION IN LAKE ERIE & EFFECT OF VARIOUS IN-BASIN INPUT REDUCTIONS.

FIGURE 8

LAKE ENRICHMENT

Lake Erie is naturally the most productive of the Great Lakes, meaning that even without the presence of man, it would be in a more advanced state of fertilization or enrichment. Proof of this lies in the quantity and variety of fish which inhabited the lake at the turn of the century, a result of the high productive capacity of the waters. At that time, Lake Erie had reached the ideal in its ability to support a prolific, varied, and balanced aquatic life, while at the same time providing for all the uses which man might then make of it.

The ideal level of quality should have held in Lake Erie so that a change would be practically immeasurable in a man's lifetime.

Such is not the case. Since the turn of the century the population and economic activity turned sharply upward. With the coming of many people and the industrial boom a corresponding change in the pollution level began. An indication of the increase that began at this time in the chemical characteristics of Lake Erie is shown in Figure *9*. Within two generations man has dumped enough fertilizing refuse into the lake to make the change not only measurable, but to make it glaringly obvious. The refuse contains excessive quantities of every nutrient known to be necessary to biological production, especially the crucial ones of nitrogen and phosphorus. These two nutrients are not being effectively controlled and in fact are increasing at an alarming rate (see Figure *10* and *11* and Table 3).

The present inbasin phosphorus load of 132,000 lbs/day is expected to increase to 337,000 lbs/day by 1990, if this waste discharge goes unchecked. The phosphorus contribution from within the Lake Erie basin is composed of 72 perdent from municipal wastes, 17 percent from rural runoff, 4 percent from industrial wastes and 7 percent from urban runoff. In municipal wastes, 66 percent of the phosphorus come from detergents. This one source, detergents, accounts for nearly half of the total phosphorus load going to the lake from all major sources. The Detroit and Maumee Rivers contribute 55 percent of the total load to Lake Erie.

Much evidence exists to show both directly and indirectly the state of enrichment of Lake Erie. Profuse alga growths occur in the Western basin and along the southern shoreline where nutrient levels are highest. For its size, Lake Erie's algae-producing capacity is among the highest in the world and its rate of algae production is increasing. The varieties of algae are changing to those which are more suitable to highly enriched environments.

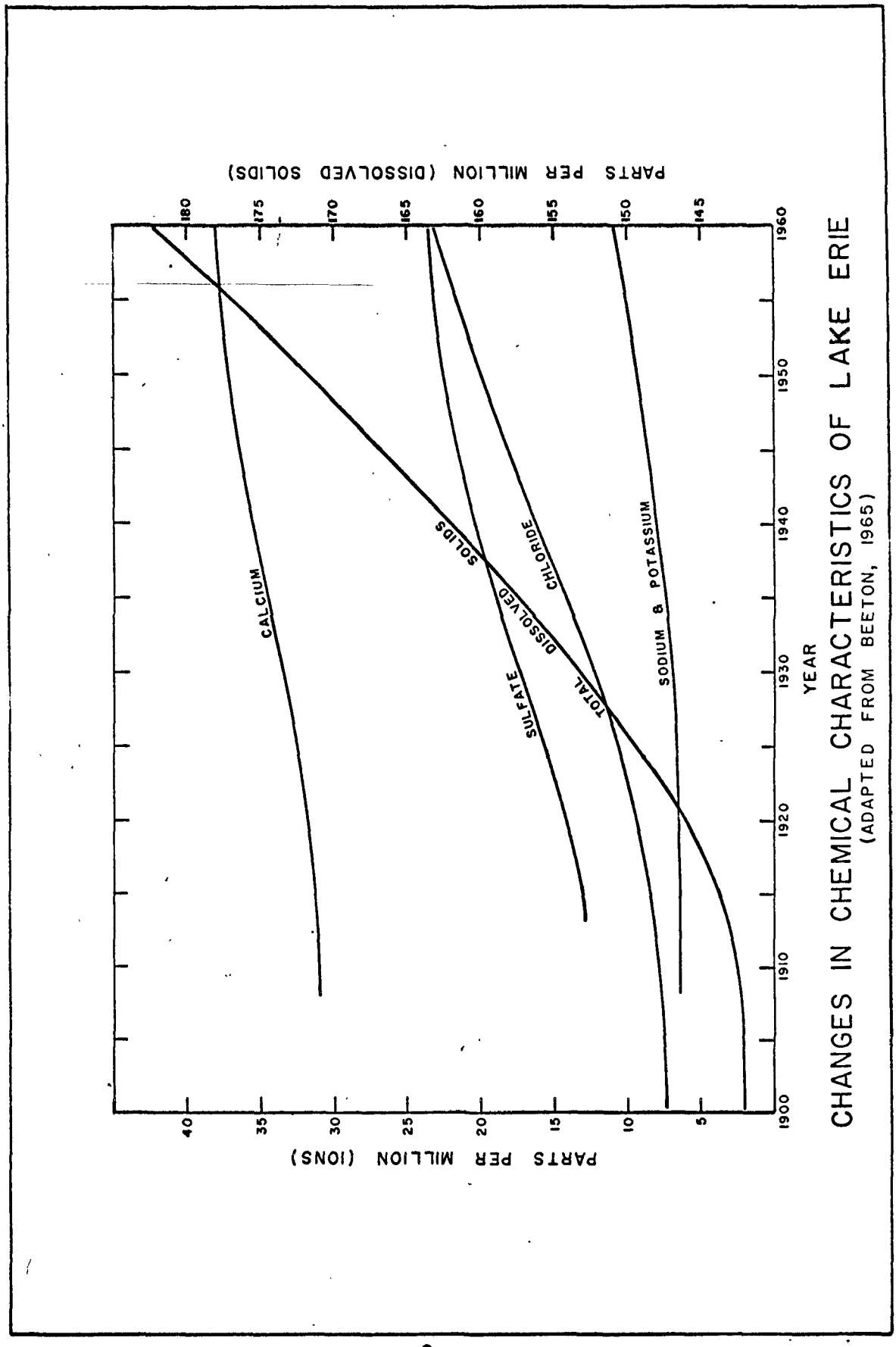
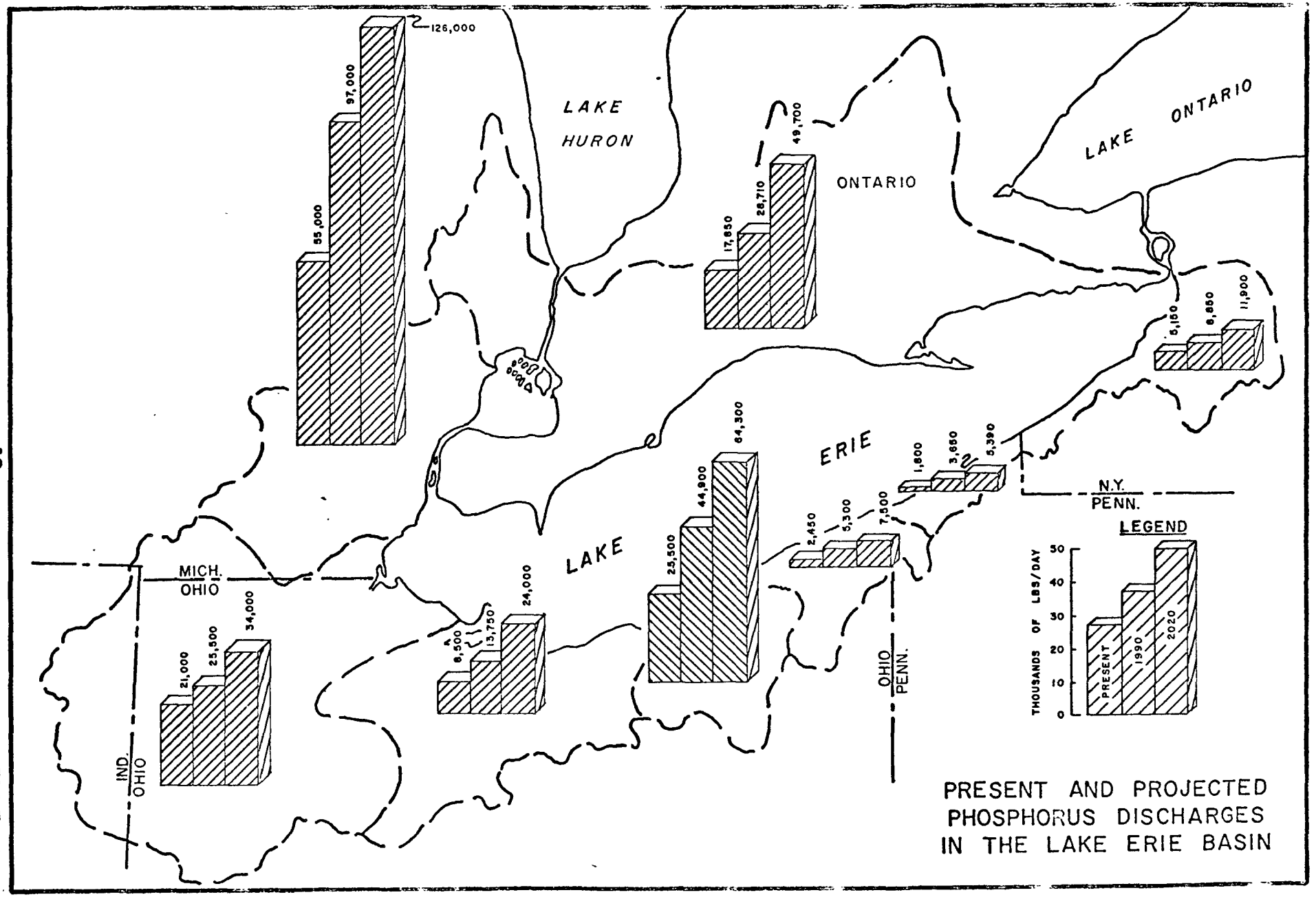
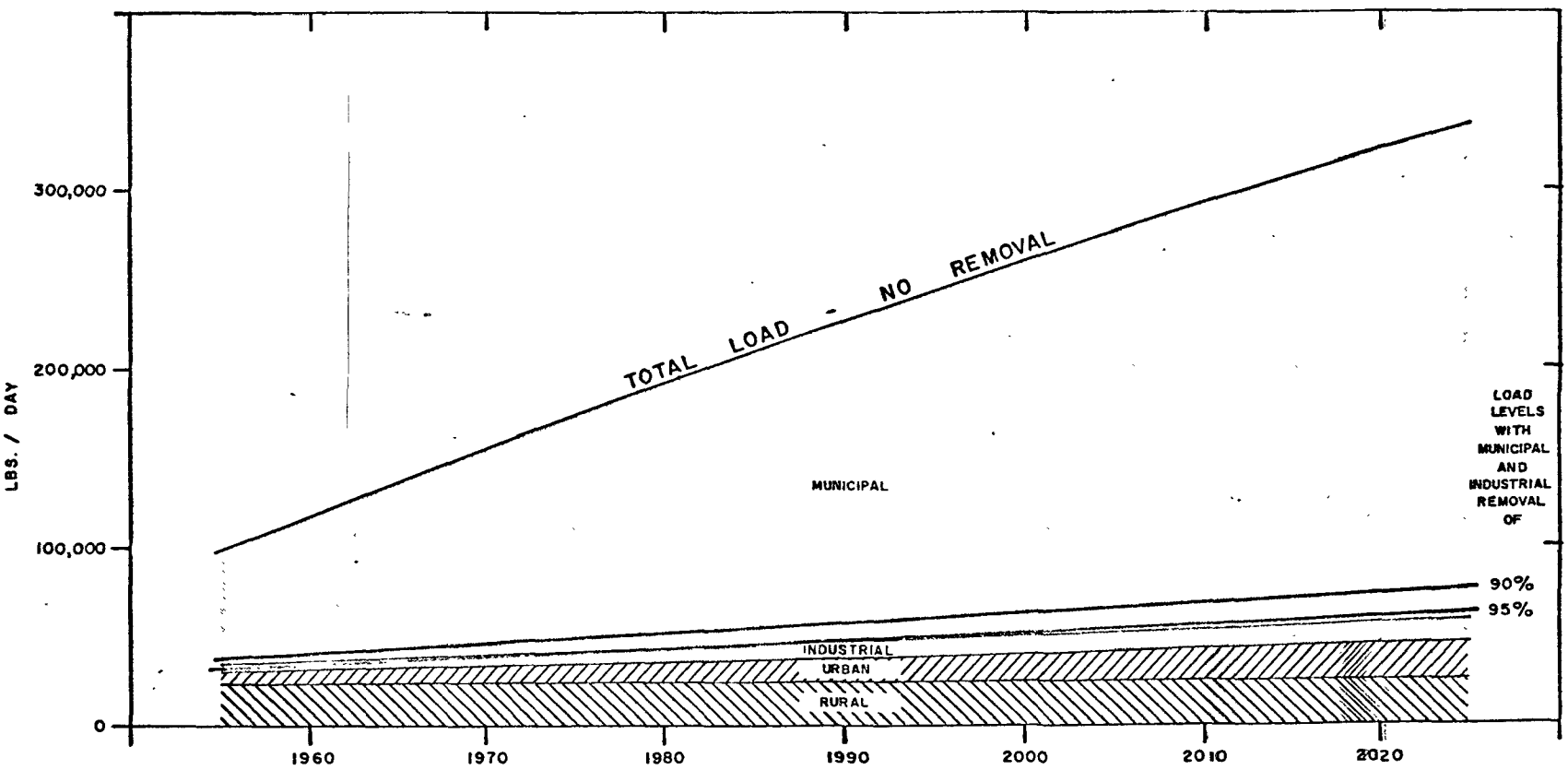

CHANGES IN CHEMICAL CHARACTERISTICS OF LAKE ERIE
(ADAPTED FROM BEETON, 1965)
PARTS PER MILLION (DISSOLVED SOLIDS)
PARTS PER MILLION (IONS)
YEAR
CALCIUM
SOLIDS
DISSOLVED
TOTAL
SULFATE
CHLORIDE
SODIUM & POTASSIUM
180
175
170
165
160
155
150
145
40
35
30
25
20
15
10
5
1960
1950
1940
1930
1920
1910
1900

FIGURE 9



PRESENT AND PROJECTED PHOSPHORUS DISCHARGES IN THE LAKE ERIE BASIN

FIGURE 10



PROJECTED PHOSPHORUS LOAD TO LAKE ERIE BY SOURCE - CUMULATIVE

FIGURE 11

TABLE 3

PRESENT AND PROJECTED PHOSPHORUS DISCHARGES TO LAKE ERIE,
EXCLUSIVE OF LAKE HURON INPUT
lbs/day

Subbasins	Municipal Waste	Industrial Waste	Urban Runoff	Rural Runoff	Total
Present Loading					
Southeast Michigan	46,000	3,000	3,000	3,000	55,000
Maumee River Basin	9,000	1,000	1,000	10,000	21,000
North-Central Ohio	3,800	500	1,600	2,600	8,500
Greater-Cleveland-Akron area	22,000	800	2,000	700	25,500
Northeast Ohio	1,100	100	500	750	2,450
Pennsylvania	1,400	100	110	220	1,830
Western New York	3,000	500	650	1,000	5,150
Ontario	11,900	unknown	450	5,500	17,850
	98,200	6,000	9,310	23,770	137,280
Projected 1990 Loading					
Southeast Michigan	85,000	4,500	4,500	3,000	97,000
Maumee River Basin	12,000	1,500	2,000	10,000	25,500
North-Central Ohio	8,000	750	2,400	2,600	13,750
Greater-Cleveland-Akron area	40,000	1,200	3,000	700	44,900
Northeast Ohio	3,700	200	700	700	5,300
Pennsylvania	3,100	180	160	210	3,650
Western New York	6,100	750	1,000	1,000	8,850
Ontario	21,400	-----	810	6,500	28,710
	179,300	9,080	14,570	24,710	227,660
Projected 2020 Loading					
Southeast Michigan	111,000	6,000	6,000	3,000	126,000
Maumee River Basin	19,000	2,000	3,000	10,000	34,000
North-Central Ohio	17,000	1,000	3,400	2,600	24,000
Greater-Cleveland-Akron area	58,000	1,600	4,000	700	64,300
Northeast Ohio	5,400	400	1,000	700	7,500
Pennsylvania	4,700	270	220	200	5,390
Western New York	8,600	1,000	1,300	1,000	11,900
Ontario	40,500	-----	1,200	8,000	49,700
	264,200	12,270	20,120	26,200	322,790

When these organisms die and sink to the bottom, they decompose, thereby utilizing the water's life-giving oxygen. During summer temperature stratification periods in Lake Erie, the oxygen is consumed at a rate faster than it is replenished, leading to the annual occurrence of low dissolved oxygen (DO) in bottom waters. The length of time of existence of low oxygen levels is also increasing.

Low DO in turn has changed the aquatic food chain by killing off certain bottom dwelling organisms, such as the mayfly, which are important food for the desirable carnivorous fishes. Thus, these fishes are suffering for lack of food, and scavenger type fishes are replacing them. Low DO and undesirable habitat are also killing young fish and fish eggs. Stated simply, select fishes are vanishing from the lake because of undesirable alteration of their environment by water pollution.

Commercial fish catch statistics, gathered by the U. S. Bureau of Commercial Fisheries, have provided a long record of the relative abundance of desirable fish species in Lake Erie. In recent years, continuing surveys have been introduced by federal and state agencies on the reproduction phase of the life cycles of fishes and limited predictions of near-future populations are now possible.

The sturgeon almost disappeared from catch statistics at about the turn of the century. The cisco, once the dominant species of the commercial catch, experienced a sudden decline in 1926, showed a slight recovery, and declined to insignificance in 1957. Whitefish declined drastically in the commercial catch in 1955. The walleye began a drastic decline in 1957, and is still in great distress. The blue pike, which formerly produced several million pounds per year, became nearly extinct in 1958.

The yellow perch has managed to hold its own, but it also shown signs of weakening in the commercial catch. It is the only plentiful fish remaining of the former many prized varieties. The smelt is now commercially exploited and it, along with yellow perch, is sustaining the commercial fishing industry in Lake Erie.

Other evidences of over-enrichment are the increasing problems of surface algal scums, algal littering of beaches (with a subsequent decrease in shoreline property values), algae-produced bad taste and odor in drinking water supplies, and the clogging of intakes by algae. In spite of this, Lake Erie, even though it contained the lowest quality water of the five Great Lakes, remains a highly satisfactory source of raw water supply when compared with inland and groundwater supplies.

NEARSHORE BACTERIAL AND BLIGHT PROBLEMS

Many bathing beaches in Lake Erie are plagued by pollution problems. A danger to health is caused in the nearshore water by bacterial loading derived primarily from sewage discharges and combined sewer overflows. The greatest bacterial problems are found nearest the metropolitan centers where many beaches are rendered unsafe for water contact recreation, Table 4. In fact, even though there is a high demand for water contact recreation on Lake Erie from its 11,000,000 residents, much of this goes unsatisfied because water pollution limits the use.

The nearshore waters of Lake Erie are generally unattractive, being polluted by debris, silt, and decaying aquatic life and occasionally oily wastes. Nearshore waters are ordinarily very turbid in all of Lake Erie and in the western basin turbidity may extend from shore to shore. Turbidity in Lake Erie is high compared to the other Great Lakes. The turbidity is caused by silt washing in from the land, suspended solids from municipal and industrial wastes, plant life suspended in the waters, and lake shallowness which lets wave action stir up bottom muds. Total silt load to the lake is estimated at 134 million lbs/day. The problem of polluted nearshore waters is compounded by surface currents. In the Toledo area, an eddy from the Detroit River causes the accumulation of contaminants along the western shore. The prevailing winds move the surface waters in a general easterly direction over the rest of the lake, and then parallel to the shore towards the Niagara River.

Harbors in Lake Erie are now characteristically and continuously foul, unpleasant, and odorous becuase of waste discharges. Industrial and municipal discharges at Detroit and Monroe, Michigan; Cleveland, Ohio; Erie, Pennsylvania; Buffalo, New York, are particularly obnoxious in this respect. So much waste is added to major harbors that annual dredging is required to maintain them. Up to this time, dredged material has been dumped into the lake, further adding to the polluted condition.

Mid-lake waters, beyond a mile or so from shore, are generally bacterially acceptable, but in many shore locations, the waters are unfit a great deal of the time. In general, the most severe contamination fronts metropolitan areas, and the larger the metropolitan area, the more severe the condition. The offshore water intakes have generally provided a good raw water source for municipalities and industry. There have been an increasing number of taste, odor and bacterial problems in recent years. The control of the discharge of contaminants is necessary to prevent degradation of the water supplies. The problem of bacterial contamination extends up the many tributaries of the lake. Figure 9 12 shows the problem of recreational water use impairment.

TABLE 4

BATHING BEACHES ON LAKE ERIE THAT ARE UNSAFE FOR SWIMMING DUE PRIMARILY TO BACTERIAL POLLUTION FROM SEWAGE DISCHARGES

MICHIGAN	OHIO
Estral Beach	Little Cedar Point, Toledo
Maple & Milleville Beach	Lakeview Park, Lorain
Sterling State Park	Century Park, Lorain
Stony Point Beach	Rocky River Park
NEW YORK	All Cleveland beaches
Hamburg	Euclid Beach
Silver Creek	Reno Beach, Toledo
Westfield	

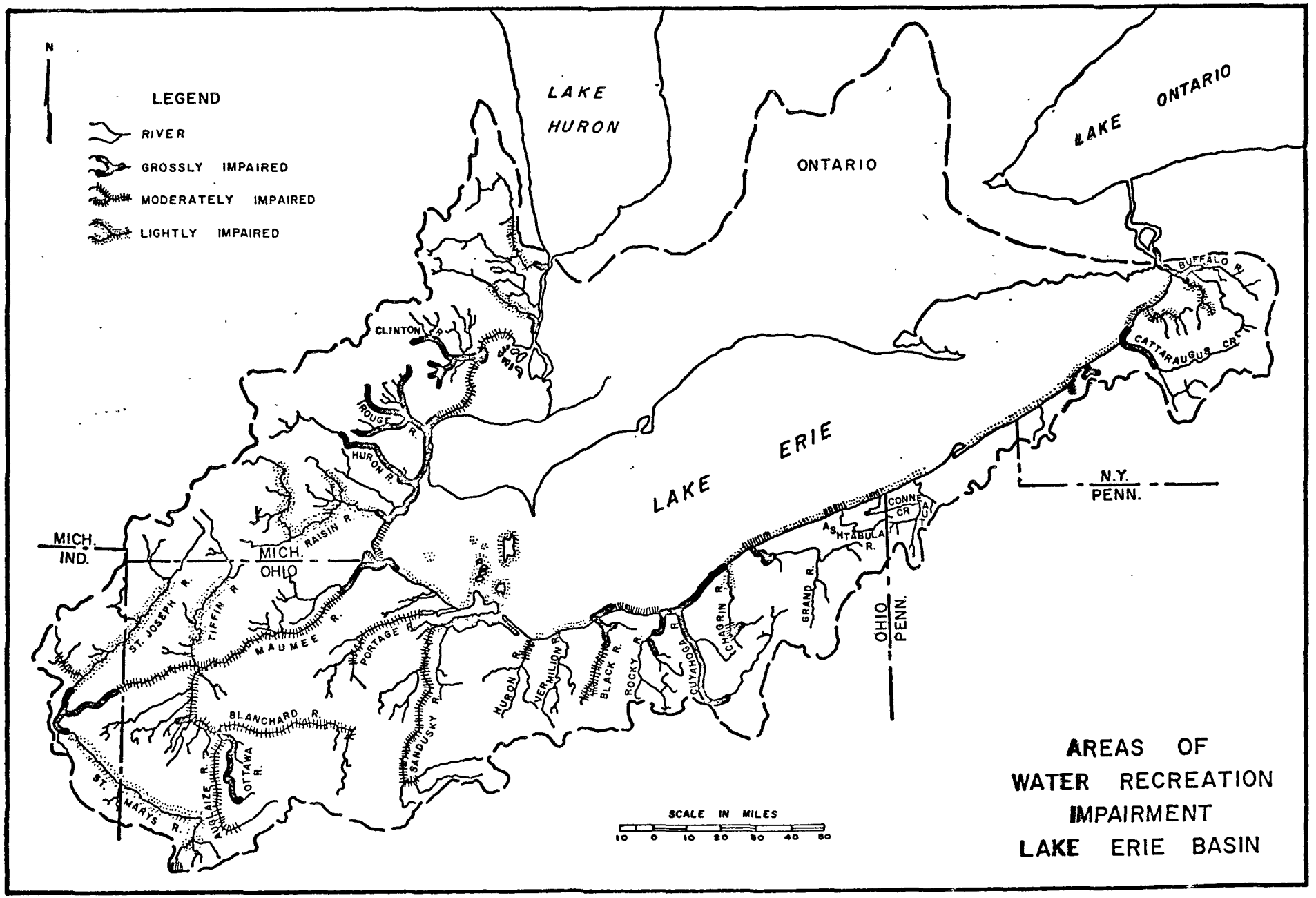

N
LEGEND
RIVER
GROSSLY IMPAIRED
MODERATELY IMPAIRED
LIGHTLY IMPAIRED
LAKE HURON
ONTARIO
LAKE ONTARIO
LAKE ERIE
CLINTON R.
ROUGE R.
HURON R.
RAISIN R.
MICH.
IND.
MICH.
OHIO
ST. JOSEPH R.
TIFFIN R.
MAUMEE R.
PORTAGE R.
SANDUSKY R.
BLANCHARD R.
AUGLAIZE R.
OTTAWA R.
ST. MARYS R.
HURON R.
VERMILION R.
BLACK R.
ROCKY R.
CUYAHOGA R.
CHAGRIN R.
GRAND R.
ASHTABULA R.
CONNE
CR
OHIO
PENN.
BUFFALO R.
CATTARAUGUS CR.
N.Y.
PENN.
SCALE IN MILES
10 0 10 20 30 40 50
AREAS OF
WATER RECREATION
IMPAIRMENT
LAKE ERIE BASIN

FIGURE 12

Sources of bacterial contamination are treated or untreated sewage discharges, industrial wastes, combined sewer overflows, storm sewer discharges, and general land runoff. Usually, however, the most severe contamination is associated with storm sewer overflow and sewage discharges although at Sterling State Park in Michigan paper mill wastes are a significant cause.

SUBBASIN AREAS

SOUTHEASTERN MICHIGAN

In the southeastern Michigan basin, the wastes from municipalities, industry, Federal installations, stormwater overflow, and in some areas navigation and dredging, cause the most concern. These wastes include organic material, suspended solids, nutrients and bacteria. These depress oxygen levels and cause sludge beds, bacterial contamination, and nutrient-stimulated slime and algal growths. Figure 13 summarizes the general water quality situation for this area.

St. Clair River Basin

The St. Clair River drains Lake Huron at an average rate of 187,000 cfs. Water leaving Lake Huron is of exceptionally high quality and remains satisfactory in the passage down the St. Clair River.

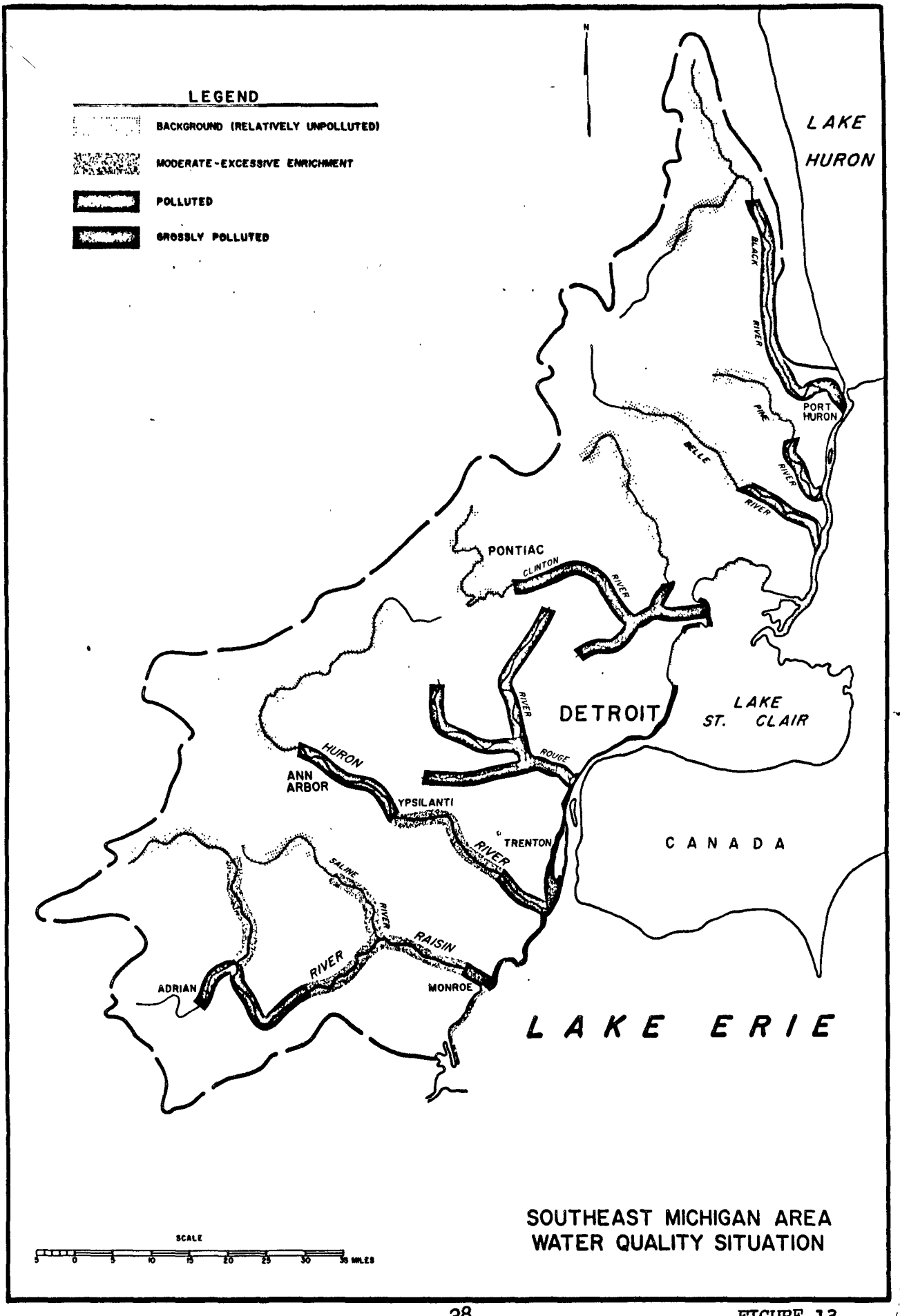
The only indication of degradation occurs from occasional high values of coliform and phenol. The cause of the high phenols is the petroleum complex in Canada at Sarnia, Ontario; the coliforms are caused by polluted water entering the St. Clair River from its tributaries.

Lake St. Clair

Discharges of storm water from the heavily populated Michigan shoreline and tributary inflow endanger swimmers in the lake. Metropolitan Beach, a recreational area, located on the west shore of Lake St. Clair near Mt. Clemens, Michigan, has had coliform densities occasionally as high as 8,600 organisms/100 ml.

Clinton River

The Clinton River is the major source of pollution in Lake St. Clair. All sewage treatment plants on the Clinton River are secondary, but some are inadequately operated or overloaded and a few small areas have no treatment. This fecal matter and bacterial pollution exclude water contact recreation. Most of the major industries on the river have treatment rated as adequate by the Michigan Water Resources Commission and cause few problems.



SOUTHEAST MICHIGAN AREA
WATER QUALITY SITUATION

FIGURE 13

The City of Pontiac's two sewage treatment plant effluents cause severe pollution problems in the upper Clinton River. From the City of Rochester all the way to the mouth, the lower river is also polluted by inadequately treated wastes from numerous cities. Red Run, a notoriously polluted Clinton River tributary, traverses a heavily populated area of suburban Detroit and receives large quantities of raw sewage through discharges from overloaded sewer systems.

Detroit River

The water quality of the Detroit River is discussed in detail in the "Report on Pollution of the Detroit River, Michigan Water of Lake Erie, and Their Tributaries," by the Federal Water Pollution Control Administration.

Since the study of the Detroit River, the Michigan Water Resources Commission has obtained stipulations or agreements with 23 individual municipal and industrial polluters to facilitate control of their effluents to recommended levels by 1970.

More than 1600 MGD of waste water flow into the Detroit River (1100 MGD from industry and 540 MGD from municipal sewage) and change the Detroit River from a basically clean stream at its head to a polluted one as it enters Lake Erie.

The City of Detroit's main sewage treatment plant, serving more than 90 percent of the people in the Detroit area contributes 95 percent of the municipal waste to the Detroit River and is also the major source of suspended solids, phenols, oil, inorganic nitrogen, phosphorus, and biochemical oxygen demand material in the river. Overflow from combined sewers in Detroit and its suburbs, carrying both stormwater and raw sewage, contributes greatly to the pollution load in the river.

In the upper Detroit River, the Great Lakes Steel Company and the Allied Chemical Corporation are the major sources of industrial wastes. The Ford Motor Company is the principal contributor of inorganic wastes to the Rouge River, and the Scott Paper Company is the principal contributor of organic wastes. Downriver industries contributing significant quantities of wastes are the Great Lakes Steel Corporation, the McLouth Steel Corporation, Pennsalt Chemical Corporation, and the Wyandotte Chemical Corporation.

Two municipal water intakes, the City of Detroit's Fighting Island supply and particularly that of Wyandotte, are endangered by the high bacterial counts of the river and the rising chloride levels indicate potential future problems for industrial water usage.

Pollution in the lower Detroit River makes all forms of water contact sports hazardous. Dissolved oxygen levels are approaching the danger point in the part of the river entering Lake Erie. The low DO levels together with bottom sludge deposits, oils, and toxic materials threaten fish, migratory birds, and other wildlife. In order to maintain navigation, extensive annual dredging is required in the Rouge River and at the mouth of the Detroit River.

Huron River

The Huron River in Michigan empties into Lake Erie south of Detroit. Its source is a series of recreational lakes in southeast Michigan and because of this and ground water storage, flows during drought periods are sustained. The average discharge is approximately 445 cfs; the once-in-10 year, 7 day low flow is 30 cfs. Water quality in the Huron River and lakes upstream from Ann Arbor is reasonably good and is used by numerous bathers in the summer and ice fishermen in the winter. The Cities of Ann Arbor and Flat Rock use the Huron River for water supply. Eight secondary sewage plants and three primary plants within the watershed serve a population of 132,000 of a total 247,000. The primary plants are located at Dexter, Flat Rock, and Rockwood. Most of the area has separate sewer systems. Below the secondary sewage plant at Ann Arbor, the river begins to show signs of degradation and remains unsatisfactory the rest of the way to Lake Erie.

This is noticed in a series of manmade impoundments further downstream where the lakes are continually choked with algae being fed by the nutrients from Ann Arbor and other sewage treatment plants.

Bacterial problems exist in most of the Huron River from Ann Arbor to the mouth during periods of heavy storm runoff and non-chlorination of sewage effluents and ~~are most severe~~ below Ann Arbor, in the Ypsilanti area and the Flat Rock-Rockwood area.

Four industries in the watershed have unsatisfactory treatment and the effect of their wastes can be observed in the river. Longworth Plating Company at Chelsea discharges toxic compounds. The General Motors Corporation, Fisher Body Division, discharges a variety of waste materials (oils, toxic compounds, and sewage) to Willow Run, a small tributary of the Huron River. Peninsula Paper Company in Ypsilanti discharges large quantities of oxygen consuming wastes and Huron Valley Steel Corporation at Belleville does not adequately control suspended solids.

River Raisin

The River Raisin watershed had a 1960 population of 131,000. Four primary sewage treatment plants serve 29,479 people, five secondary plants serve 32,563 people, and 68,958 are without public sewerage systems.

The River Raisin discharges an average of 714 cfs to Lake Erie. It rises in a series of small recreational lakes which partly sustain its flow in drought periods. The water quality in the river upstream from Manchester is generally good and the recreational lakes are safe for bathing. Above Monroe, the river is able to absorb most of the wastes dumped into it without creating serious impairment of existing water uses. Concentrations of phosphorus sufficient to cause algal blooms are noticed throughout the river below Manchester.

In the Monroe area the river becomes grossly polluted. This area was included in the Detroit River-Lake Erie enforcement conferences because of the severe effect the lower few miles of the River Raisin has on recreational uses of the Lake Erie shoreline. In its last three miles, the river receives the primary sewage plant effluent of Monroe (serving 22,000 persons), the effluents from five paper mills with a BOD population equivalent of 225,000, and 1,000 lbs/day of cyanides from the Ford Motor Company. These sources are under orders of the Michigan Water Resources Commission to stop polluting.

The Brest Bay beach area, a series of unsewered communities with a population of 4,000, just north of the River Raisin mouth, discharges septic tank wastes to Brest Bay and the effect of these wastes is intensified when heavy rains fall.

The lower Raisin River is frequently devoid of dissolved oxygen, resulting in a continuous state of putrefaction during the summer months. Consequently, the lower Raisin River can only be used now for waste disposal and navigation, and deposits of settleable solids at the mouth even interfere with ship movement to the extent that annual dredging is required to remove bottom material.

The combined effect of the City of Monroe municipal wastes, paper mill wastes (containing coliform bacteria in the 100,000/100 ml level) and the Brest Bay beach area discharge have resulted in the unsafe bathing conditions at Sterling State Park. Pollution-stimulated algae growths have forced Monroe to move its water intake point to avoid unpleasant tastes and odors in the water.

MAUMEE RIVER BASIN

Industry, cities, and agriculture are all major sources of wastes which pollute many of the basin's streams. The effluents from the cities' sewage treatment plants seriously depress the receiving waters of oxygen and contribute to the algal growth in many areas. Industrial waste discharges also depress the basin's rivers of oxygen, cause taste and odor problems in domestic water supplies, and interfere with the esthetic enjoyment of the basin's water in a number of areas. The runoff from agricultural areas causes turbidity in waters of the area, requires extensive dredging of the shipping channel, and helps to produce the abundant algal growths.

A population growth projection made by project economists indicates that the Maumee Basin's population will increase from 1,140,000 to 1,600,000 in 1980 and 2,700,000 by 2020. Industrial activity is also projected to increase by a substantial quantity in the basin over the same period. It is apparent that the existing degraded conditions will become much worse unless extensive control measures are taken now and continued into the future.

Figure 14 depicts water quality in the Maumee River Basin.

St. Marys River

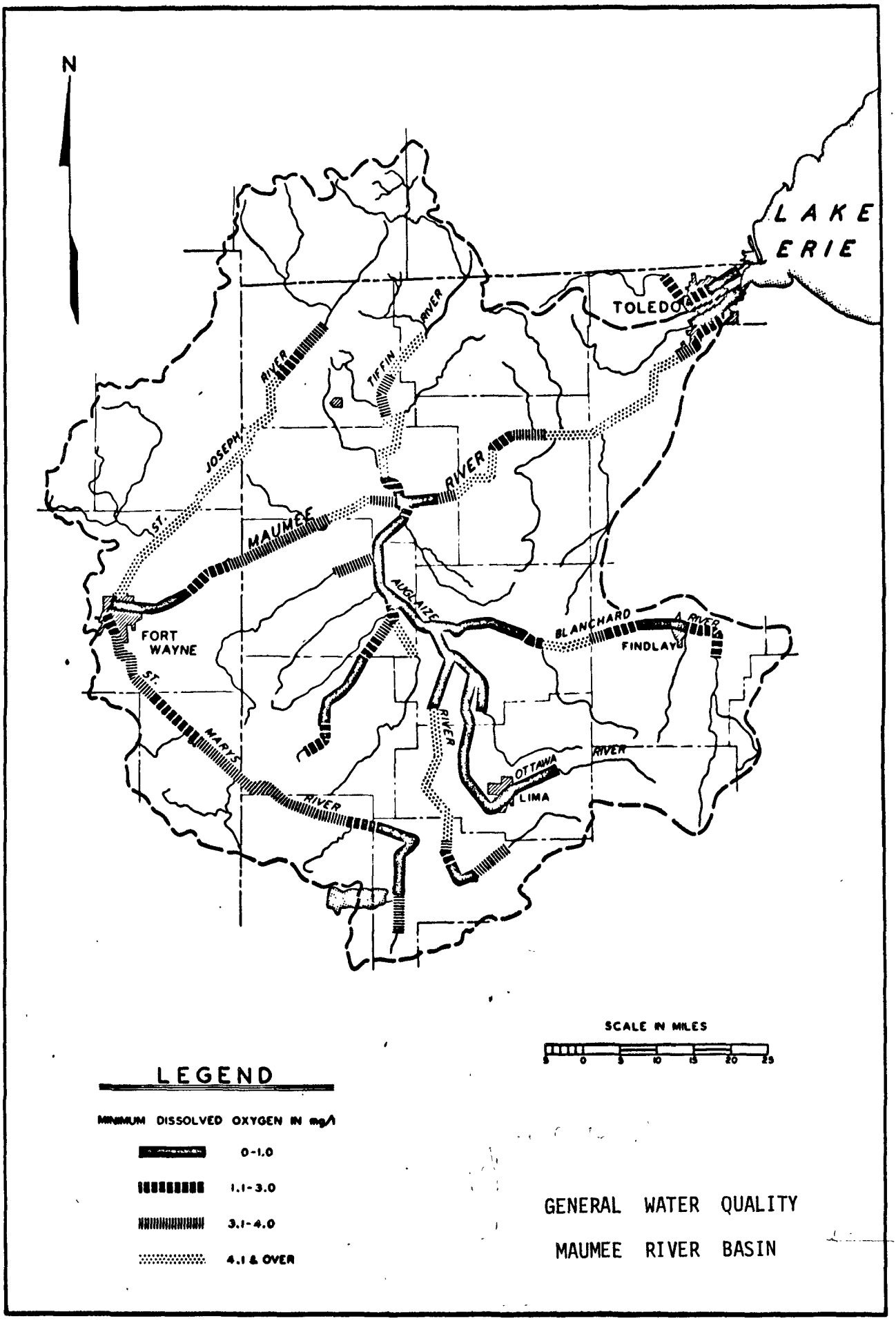
A pollution problem occurs on the St. Marys River below the City of St. Marys, caused by the discharges of the St. Marys sewage treatment plant, Goodyear Tire and Rubber Company, Beatrice Foods Company, and Weston Paper Manufacturing Company.

At Willshire, Ohio, a large dump along the St. Marys River just above the Indiana line spills garbage, trash, and other deleterious refuse into the St. Marys River.

Another pollution problem occurs downstream from the Decatur, Indiana secondary treatment plant. The loading from the plant is relatively low, but the river cannot accommodate these loads during the low flow months.

Upper Maumee River

The Upper Maumee River varies in water quality from extensively polluted in the upper reaches below Fort Wayne to enriched above the Defiance area.



GENERAL WATER QUALITY
MAUMEE RIVER BASIN

FIGURE 14

Bacterial, dissolved oxygen and enrichment problems occur in the upper Maumee primarily caused by municipal wastes from the Fort Wayne area. High concentrations of phenols occur below Fort Wayne, with a maximum concentration 12.6 miles below the Fort Wayne sewage treatment plant. The source of these phenols is the General Electric Company which discharges through the Fort Wayne sewage treatment plant, and the Essex Wire Company. In winter months, phenols persist for many miles downstream adding to the extensive taste and odor problems in the City of Defiance's water supply.

Auglaize River Basin

The main stem of the Auglaize River above the confluence with the Ottawa River is of good quality except in a stretch below Wapakoneta. In the lower areas, the Auglaize is severely degraded by wastes entering from the Ottawa and Blanchard Rivers. At Wapakoneta, the Auglaize receives the effluent from the sewage treatment plant, two packing companies, a Pepsi-Cola bottling plant, and the Monarch Battery Company. The stream bottom which is scoured clean of silt and organic deposits during the spring becomes covered with black, septic, malodorous sludge by July. Below this point, the Auglaize River recovers and for over 50 miles, gives little evidence of organic pollution, although algae and other aquatic plants prevail.

As the Ottawa River nears Lima, its water quality is degraded by the effluent from septic tanks and agricultural runoff. All the flow in this stretch of the river during low flow months is utilized by Lima to augment its water supply.

Below Lima, the low flow in the Ottawa River is composed entirely of the effluent from Lima's secondary sewage treatment plant, discharge from Sohio's chemical and petrochemical plants and refinery, and phenol contaminated effluent from Republic Creosote.

Severe bacterial pollution exists along the Ottawa River. The stream bottom is rock and shale which in the spring is scoured clean of any silt or sludge. During low flow, a black, oily sludge with a strong petrochemical odor accumulates over the stream's bottom. Below Lima, the Ottawa River usually shows no signs of recovery. The only aquatic life are a very sparse population of sludgeworms and midge larvae near the mouth. The complete absence of attached algae and bottom-dwelling animals indicate not only severe oxygen deficits, but the presence of highly toxic chemicals.

The water quality in the Blanchard River varies from good to excessively polluted. Samples collected reveal two critical areas. The first is immediately below the City of Findlay's sewage treatment plant where sewage solids have been observed floating in the water.

The other area is below Ottawa, Ohio, where in addition to the municipal effluent, the Buckeye Sugar Company discharges high oxygen demanding wastes.

Lower Maumee River

The water quality of the Lower Maumee River (confluence of the Tiffin River to the navigation channel) is moderately to severely polluted. Taste and odor problems are prevalent throughout most of the year in the water supplies at Defiance, Napoleon, Bowling Green, and other cities that use this source. At Defiance, during periods of low temperatures and ice cover, problems are encountered with phenolic compounds which impart a medicinal taste and odor enhanced by chlorination. During spring runoff, the water has an intense earthy or musty taste.

The taste and odor problems at Napoleon are similar to those in Defiance with the exception of additional interference from ammonia compounds from the Auglaize River. Campbell Soup Company has reported excessive taste and odor problems at times in their raw water supply, but they are able to remove it in their extensive treatment plant. Large concentrations of ammonia at the plant have created peak chlorine demands. The company reports that the quality of its raw water supply has deteriorated in recent years.

The main sources of ammonia, nitrates and phenols to the waters in this area are surface runoff from agricultural sources and the industrial discharges from General Electric, Essex Wire, Sohio, and Johns-Manville Fiberglass.

Below the City of Defiance, Ohio, another pollution problem occurs in the Maumee caused by the addition of the highly polluted Auglaize River and the Defiance sewage treatment plant effluent.

Municipal wastes are also discharged to the lower Maumee by communities of Perrysburg and Waterville. Perrysburg has only primary treatment while Waterville has a secondary plant.

Toledo Channel, Harbor, and Lakefront

Lake level fluctuations have been found to affect the Maumee River as far as 15 miles upstream; therefore, pollution which enters the Maumee at one point in this lake-affected area may degrade the water quality for some distance upstream as well as downstream.

The waters in the channel and lakefront areas are severely polluted. Very high bacterial densities were found confirming the health hazard to persons exposed to these waters.

Sediment is a problem in the navigation channel and it must be continuously dredged. The suspended sediment is extremely fine and stays in suspension for long periods of time. The Maumee discharges over 2 million tons of sediment a year to Lake Erie.

The principal cities are Lorain, Elyria, and Sandusky, but by 2020 it is projected that the entire shoreline region from Toledo to Cleveland will be a continuous population unit.

Most of the area's major waterways are either polluted or enriched. Figure 15 shows the present water quality situation during critical flow periods.

Portage River

Dissolved oxygen deficits are the major pollutional problems in this basin. Throughout a large part of the year, algae problems exist on the lower portions of most tributaries.

Cities such as McComb, North Baltimore, Fostoria, Bowling Green, Gibsonburg, and Bradher are located on small tributaries which have virtually no flow for over half the year. Therefore, no capacity exists for absorbing wastes and the receiving waters become septic. Areas such as Elmore, Pemberville, and Woodville, presently do not even have septic tanks, but discharge their raw sewage directly to the Portage River through misused storm drains.

The Seneca Wire and Manufacturing and Swift and Company, both located in Fostoria, discharge oil, color, metals, BOD, and solids. The river is often an oily-turbid-white and rust color within Fostoria. Two other industries, Foster Duck Farm and Hirzel Canning Co. require reduction of their effluent BOD.

Sandusky River

The Sandusky River, Lake Erie's second largest tributary, has the dubious distinction of being polluted from its headwaters to where it enters Lake Erie. Sixty percent of all reported fish kills in the North Central area occur in the Sandusky basin. With the present waste treatment and storm runoff provided by municipalities and industries the river is never allowed to completely recover before it receives further waste loadings. Algal growths are prolific throughout this system. The Lower Sandusky River and Harbor is bacteriologically polluted.

The Northern Ohio Sugar Co., the Pioneer Rubber Co., and the Pennsylvania Railroad all contribute significant wastes to this basin. Oil slicks are found below Crestline and in Fremont.

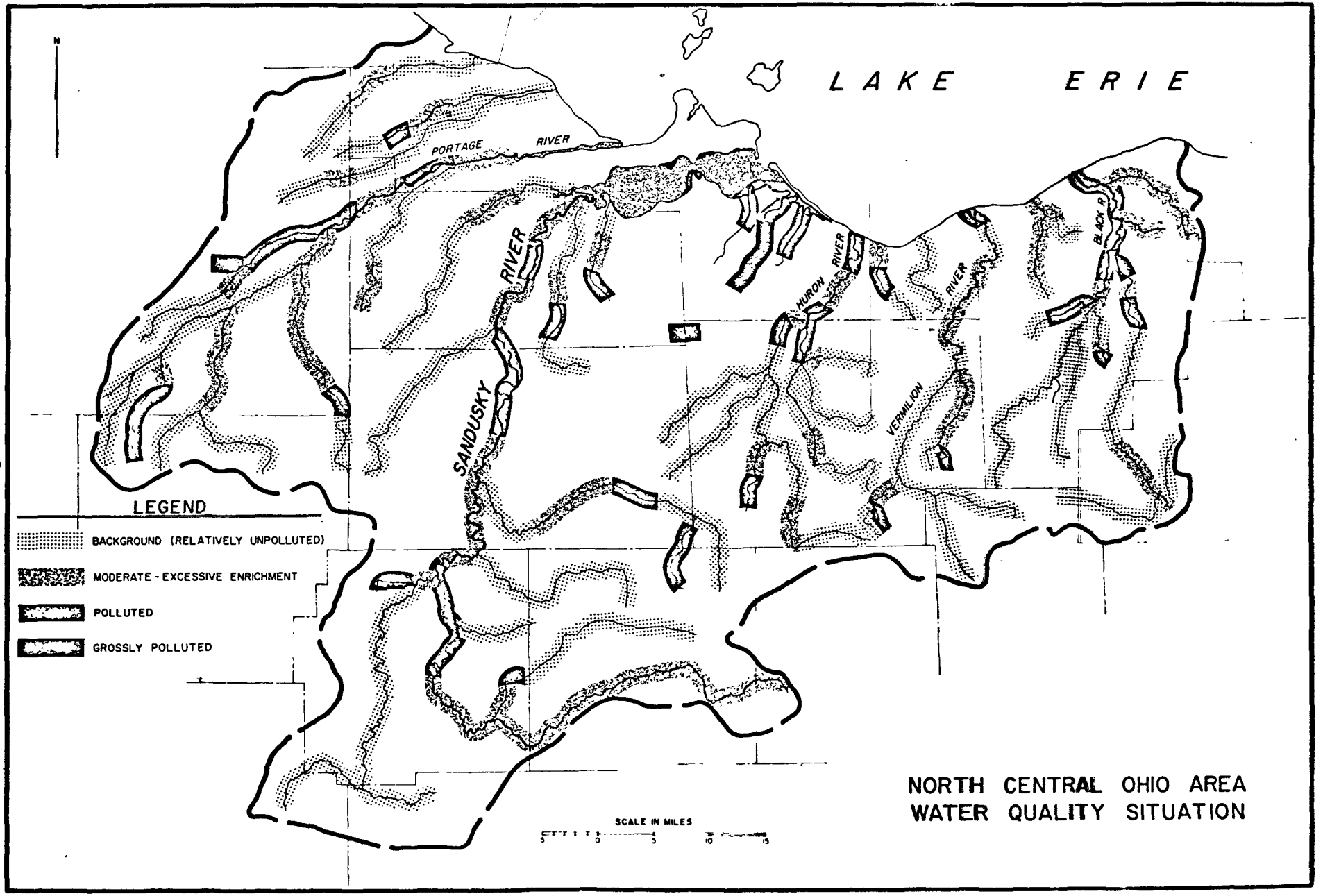

N
LAKE ERIE
PORTAGE RIVER
SANDUSKY RIVER
HURON RIVER
VERMILION RIVER
BLACK R.
LEGEND
BACKGROUND (RELATIVELY UNPOLLUTED)
MODERATE - EXCESSIVE ENRICHMENT
POLLUTED
GROSSLY POLLUTED
SCALE IN MILES
5 0 5 10 15
NORTH CENTRAL OHIO AREA
WATER QUALITY SITUATION

FIGURE 15

Dumps for trash and garbage are common along the banks, and in places the streams are clogged with logs and debris.

Since the Sandusky is used almost throughout its length as a municipal water supply, and since numerous areas are suitable for whole or partial body contact recreation, a major effort is necessary to remove existing health hazards.

Huron River

Through the majority of its course the Huron River and its tributaries are of fair to good water quality. Pollution problems exist below Willard, Munroeville, and Norwalk, and in the City of Huron. This degraded water quality is mostly from inadequately treated sewage, except at Willard where industrial wastes are also important. The cities of Plymouth and North Fairfield have a less critical pollution situation, but their effluents do produce algae growths.

Both bacteriological and biological problems exist below most built-up areas near the lake. In the lake-affected portion, siltation and local waste sources degrade the waters. Oil slicks from the Baltimore and Ohio Railroad yards at Willard are at times found all the way to the lake-affected area. The Clevite Corporation at Milan discharges wastes containing heavy metals, acids, and solids.

Vermilion River

Except for several of its tributaries and the lake-affected portion the Vermilion River has good water quality. There are only three municipalities which discharge significant wastes to the Vermilion River; these are Greenwich, New London, and the City of Vermilion. In times of low flow a dissolved oxygen deficit exists in all three of these areas. Below these locations and at Wakeman and Birmingham nuisance algae conditions exist.

Black River

Below Lodi and Grafton on the East Branch moderate enrichment is caused by the discharge from treatment plants. In its lower reach it is completely degraded by septic tank and other wastes as it enters Elyria. The Buckeye Pipeline Co. has had several breaks in its transmission lines across this area, spilling oil to the waters.

Wellington and LaGrange pollute two small tributaries to the West Branch of the Black River. The City of Oberlin's discharge to Plum Creek also affects the main stem of the West Branch. Between Oberlin and the mouth of the Black River, biological conditions typical of a polluted stream are found. Numerous fish kills have occurred in this area. The General Motors Co., Ternstedt Division, and the Republic Steel Co., Steel & Tube Division contribute solids, oil, cyanide, and chrome wastes to this area.

The main stem of the Black River is polluted by the wastes discharged to the two branches and by the Elyria waste treatment plant and septic tanks in Vincent, North Ridgeville, Avon, and Elyria, and the discharges from U. S. Steel's Tubular Operations in Lorain. From Elyria to Lake Erie the river is at times depleted of oxygen, covered with oil slicks, particularly in Lorain, and multi-colored from industrial and other wastes. Upstream the rivers are green with algae and often covered with the scum of aquatic plants. Several dumps are located along the river's banks and debris choke its flow. In the late summer, the entire flow in the river is from waste discharges.

Small Tributaries

The small tributaries discharging direct to Lake Erie vary in water quality from excellent to grossly polluted. Particularly in the Sandusky, Amherst, and Sheffield-Avon areas, heavy pollution is in evidence. This pollution not only causes local oxygen and bacteriological problems, but it also interferes with the use of nearby bathing beaches where the streams enter the lake.

The City of Bellevue is a special case in that it discharges untreated domestic and industrial wastes to underground caverns. The ground water in this and the downstream area is heavily polluted.

The five major industries discharging to small tributaries are Bechtel-McLaughlin, Central Soya, G. E. Bellevue Lamp Plant, Hirzel Canning, Lake Erie Canning and the Norfolk & Western Railroad. These industries discharge BOD, COD, oil, solids, chrome, etc.

Direct to Lake Erie

High recreational use is made of a number of sections of the lakefront. Most noticeable of these are Cedar Point, Kelleys and the Bass Islands, and East Harbor State Park.

The beaches immediately adjacent to Toledo are polluted by the Maumee River, storm and combined sewer overflows, and the effluent and bypassing from the Toledo treatment plant. The county health department does not recommend swimming at any of the beaches in Lucas County except at Crane Creek State Park.

The Lorain City Health Department has recommended that Lakeview Park and Century Park beaches be closed due to high coliform concentrations. The Lorain County Health Department recommends against swimming in the Sheffield Lake-Avon Lake area. Near river and stream mouths high pollution is expected. Enteric pathogens were isolated from the lower sections of all major rivers in this area with the exception of the Portage.

The two major industries discharging directly to the lake are the Cleveland Electric Illuminating Co. (solids), and the U. S. Gypsum Co. (BOD, color, and solids).

GREATER CLEVELAND-AKRON AREA

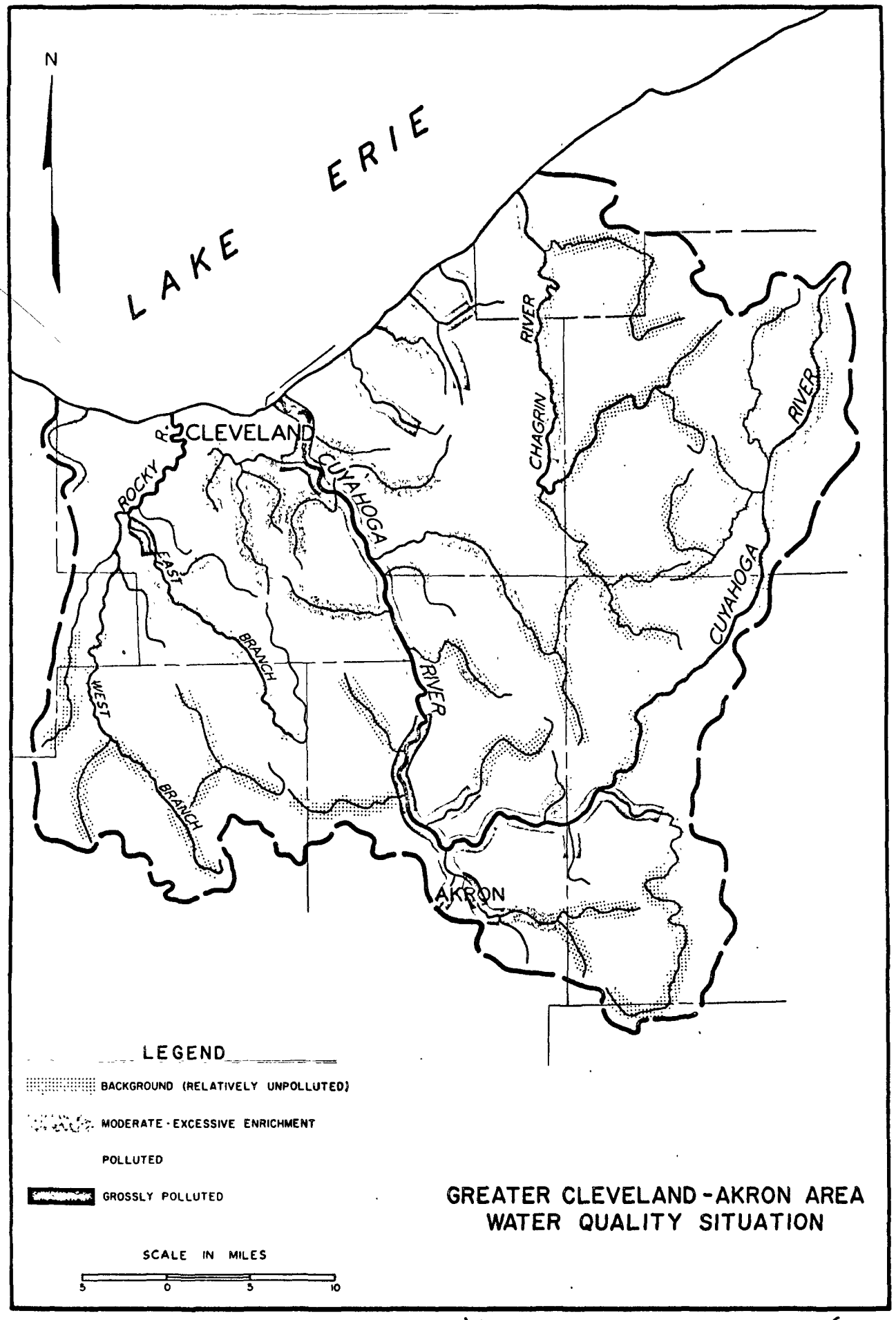
The Greater Cleveland-Akron Area covers 1,490 square miles and includes the Rocky, Cuyahoga, and Chagrin Rivers and several minor streams. The population of Cleveland and Akron is 876,000 and 290,000 respectively, and the total population in the area is presently 2,270,000. It is projected to increase to 4,200,000 by 1990 and to 6,000,000 by 2020. Cleveland is one of the great steel producing and fabricating areas in the country and Akron is the country's main supplier of rubber.

Figure 16 depicts the present water quality of the Rocky, Cuyahoga, and Chagrin Rivers.

Rocky River

The present water quality in most parts of the Rocky River system is degraded. The reason there are not more major problems is because of the steep slope and, therefore, high reaeration rate of this watercourse. The major sources of pollution are the many small municipalities which dot its course. The river contains high BOD and total coliform concentrations below most sewer outfalls. Excessive algal growths occur throughout its course and high turbidity and sediment problems exist in many locations. In the summer, the stream bottom is covered with rotting masses of algae which are unsightly and produce foul odors.

The West Branch of Rocky River receives the discharge from five major treatment plants and from a number of small package plants. There are several dumps



GREATER CLEVELAND - AKRON AREA
WATER QUALITY SITUATION

FIGURE 16

along the stream banks and flood plains in the Columbia Station area and numerous septic tanks and misused storm drains which pollute the waters in Olmsted Falls. The City of Olmsted Falls has been under orders from the Ohio Water Pollution Control Board for several years to treat their wastes, and has recently moved to remedy this situation.

The City of Berea depends upon Baldwin Reservoir on the East Branch for its municipal water supply. The reservoir and nearby Wallace Lake are also used for swimming, boating, and fishing. The East Branch flows through Cleveland's Metropolitan Park from near the Cuyahoga County line to its confluence with the West Branch. Extensive recreational use is made of this scenic area.

Six municipal waste treatment plants discharge treated sewage to the river within this reach. These discharges contribute organic wastes and nutrients to the river. Excessive nuisance algal growths are produced by these effluents and by septic tank effluents. Coliform counts show that a potential health hazard exists for visitors to the park. The extensive algal blooms cause taste and odor problems in Berea's water supply. Such algal growths are also offensive to recreational use of the river.

Hinckley Lake is extensively used for swimming, boating, and fishing, but is adversely affected by nutrients and sediments. The Cleveland Metropolitan Park Board has had to perform extensive dredging on this lake to maintain depth. The source of this sediment is mainly from highway construction and subdivision development, and in the past from the testing grounds of the Cleveland Tank Plant. In new contracts being let, the Ohio Department of Highways now includes provisions which require the prevention, control, and active abatement of pollution during construction.

The discharge from the Berea sewage treatment plant reduces the oxygen content of the receiving waters to near zero in the summer. These anaerobic conditions produce foul odors in the East Branch which make part of the park esthetically undesirable. This problem has also occurred below Middleburg Heights which in part is served by inadequate septic tanks.

The main stem of the Rocky River flows entirely in Cleveland's Metropolitan Park. The Cities of Lakewood, Brook Park, and Middleburg Heights, and the Astoria Plating Co. discharge wastes to this area of the stream. Near the mouth of Rocky River, several small boat harbors, yacht clubs, marinas, and boat launching facilities exist. The water quality in this area is seriously degraded at low flows and in many instances, contains disease causing organisms.

Cuyahoga River

The waters of the Cuyahoga River Basin are seriously degraded in quality

in many sections. The effects of pollution are particularly evident below Kent, Stow, and Akron, and in Cleveland. All water uses in these areas both actual and potential, are influenced by this pollution.

The first major source of pollution enters the Cuyahoga River at Breakneck Creek (Congress Lake Outlet). This creek is degraded by the discharge or bypassing of Ravenna's sewage treatment plant and the numerous businesses, motels, and homes in this area. Below Breakneck Creek, during low flow, the river is colored gray-brown with an abundance of aquatic plants along the shoreline and floating algae on the surface. These are indicative of the nutrients added by Ravenna's discharge and the inadequately treated wastes from the other sources.

Above the Kent treatment plant, the discharge from Lamson & Sessions Co. enters the river. This discharge is reddish and has a high oil content. A bridge abutment at this point is stained red from the wastes and the stream bank is oily.

Below Kent, the river deteriorates to such an extent that only sludgeworms, midge larvae, leeches, and pulmonate snails can be found.

Firestone Tire and Rubber Co., General Tire Co., B. F. Goodrich Co., Goodyear Tire and Rubber Co., Tire Division, Goodyear Tire and Rubber Co., Aerospace Division, and Diamond Salt Co., in Akron, Ohio, all discharge wastes to the Little Cuyahoga River which seriously degrade its water quality.

During low flow the odor imparted to the receiving waters can be detected as far downstream as Peninsula. The wastes from the four rubber plants contain color, odor, oils, solids, complex organics, high temperature, and oxygen demanding materials. The discharge from the Aerospace Division of Goodyear contains heavy metals, cyanides, and other toxic materials. Diamond Salt Co. discharges wastes containing chlorides to the Ohio Canal. They also discharge large concentrations of chlorides to the Akron treatment plant which cannot treat this waste.

Below, as in many areas above Akron, the river is often blocked with trees, brush, and junk. There are dumps along the river at Independence, Boston Mills, Jaite, Akron and other towns.

The waste materials discharged from the Akron area are noticeable even in the lower sections of the Cuyahoga above the navigation channel. Numerous anaerobic sludgebanks exist along the river banks throughout this reach. Whenever any appreciable fall occurs in the river, detergent foam is produced which gives the river the appearance of "white water."

The first major waste entering the Cuyahoga in the Cleveland area is from Tinkers Creek, which contains the wastes of the Cities of Streetsboro, Twinsburg, Solon, Bedford Heights, Bedford, and Walton Hills. Master Anodizer, Weathertite, and other industries also discharge to this creek. Tinkers Creek is degraded throughout most of its course by wastes from these sources.

Heavily polluted Big Creek enters the lower Cuyahoga just above the navigation channel, carrying wastes from the Bailey Wallpaper Co., Cuyahoga Meat Co., E. W. Ferry Screw Co., and Ford Motor Co.

The oil content of the bottom muds increases within the Cleveland industrial area. The extremely high concentrations in the muds near the mouth of Big Creek indicate it as a major source of oil pollution.

The major source of municipal pollution to the Lower Cuyahoga is the Cleveland Southerly Sewage Treatment Plant, which discharges an average of 80 mdg of wastes. Five times in the last five years there has been a break in the main interceptor sewer to this plant. This break has resulted in the discharge of billions of gallons of raw sewage to the Cuyahoga.

In the Cleveland industrial complex, the water quality becomes very poor and remains so until the river disperses along the lakeshore. Sixteen industries, an undetermined number of storm water overflows, and three creeks discharge into this section of the river. Oil scum and lack of turbulence compound the effects of pollution and the oxygen content often drops to zero. Studies conducted in this reach revealed 14 different species of disease causing organisms. The major wastes discharged in this section are solids, acid, phenol, oil, iron, sulfates, and heavy metals.

The major industries discharging wastes to this lower reach of the Cuyahoga River are: Republic Steel, U. S. Steel, E. I. DuPont, Jones & Laughlin Steel, and Harshaw Chemical.

Chagrin River

Except for reaches near the cities of Chagrin Falls, Willoughby, and Eastlake, the water quality of the Chagrin River is presently good to excellent.

During periods of low flow, the Chagrin River above Chagrin Falls is completely degraded by waste materials discharged by the Chase Bag Co. The water below Chase's effluent is highly colored and is oxygen deficient. Sediment and sludge banks are also prevalent. The pooled water behind the low head dam above the falls presently acts as a treatment lagoon for these wastes. This pooled area is severly degraded with no fish present, and produces excessive odors in the late summer.

The effluent from the City of Chagrin Falls sewage treatment plant degrades the river for approximately 2 miles below the City, but the most polluted stretch of the river exists near the mouth caused by wastes from inadequate sewers in the Willoughby and Eastlake areas.

Lakefront

The major pollutant in the Greater Cleveland area lakefront with an immediate effect on the area's water quality is microbiological organisms. Unlike many cities which are able to rid themselves of their wastes by discharging them to a nearby river which carries them out of the area, Cleveland's wastes are discharged at its own front door.

Only Huntington Park outside the western city limits is generally within the accepted level for full body contact recreation. Even though all bathing beaches within the Cleveland city limits are microbiologically polluted far in excess of the recommended limits for full body contact recreation, the Cities of Cleveland and Rocky River still do not prohibit swimming in these areas.

The effluent from the following sewage treatment plants contribute significant amounts of microbial pollution to the shoreline region: Rocky River, Lakewood, Cleveland Westerly, Cleveland Southerly, Cleveland Easterly, Euclid, and Willoughby-Eastlake. Besides their microbiological content, the wastes from these seven plants contain a BOD loading with a population equivalent of over 500,000.

Other major sources of pollution are the numerous combined sewers and storm sewer overflows along the lakefront and tributaries which during period of rainfall discharge raw sewage to the area. Even during periods of several weeks of no rain, raw sewage from overflows of the combined sewers is observed along the shoreline between the Cuyahoga and Chagrin Rivers. These dry weather discharges are caused mainly by the overloading of sewers in the central city area.

Debris, color, suspended solids, oxygen-consuming materials, oil, odor, and nutrients also cause problems along the lakefront. The discolored water and floating debris which hang along the shoreline, and particularly behind the Federal Breakwater, reduces the esthetic value. Discarded lumber, tree limbs, sewage, metal cans, paper products, dead fish, old car bodies, oil slicks, grease, and scum have been observed. The lumber and tree limbs are also a navigation hazard to boaters, since these materials tend to collect in the small boat harbors as well as behind the Federal Breakwater. The sources of the debris and waste are dumps, industries, municipal treatment plants, storm water overflows, stream bank erosion, and dredging.

NORTHEASTERN OHIO AREA

The Northeastern Ohio area drains 1,040 square miles in Ohio and 170 square miles in Pennsylvania. It extends 53 miles along the Lake Erie shoreline and includes the Grand River, Ashtabula River, and Conneaut Creek Basins.

These streams flow through rural areas except near Lake Erie where the larger urban areas are located such as Ashtabula (25,449), Painesville (16,116) and Conneaut (10,557).

Northeastern Ohio is a major industrial area. Two of Ohio's seven salt plants which account for half of the state's salt production are located in this area. The large salt deposits have attracted many chemical industries, which are now predominant.

Grand River

In the lower stretch, the Grand River is one of the most chemically polluted streams in the Lake Erie Basin due to the extremely high solids load discharged by the Diamond Alkali Company. Occasionally, the river is brightly colored with hues ranging from bright green and yellow to black. The green and yellow colors result from the chemical discharges while the black color is attributed to fly ash discharges.

The Diamond Alkali Company, which has several outfalls to the Grand River, discharges approximately 6.5 million pounds of dissolved solids and 4 million pounds per day of chlorides. The chloride discharge is 15 percent of the total lake input. For all practical purposes, this is being discharged entirely from the overflow of the waste settling basin.

In addition to the large chemical waste discharges, the lower reach of the Grand River receives the inadequately treated effluent of the Painesville and Fairport sewage treatment plants and secondary effluent from Chardon and Jefferson.

The A. E. Staley Manufacturing Company located in the municipality of Grand River discharges soybean processing wastes directly to the Grand River.

Microbiological problems also prevail in the lower reaches of the Grand River. During periods of rain, much organic matter is carried into the storm sewers and is discharged to the streams without any treatment. Bacterial pollution also occurs in the stream during dry weather. This can be attributed to the unsewered areas of Grand River and Painsville Northeast as well as inadequate disinfection procedures at the Painsville and Fairport sewage treatment plants.

Astabula River

The Ashtabula water quality varies from very good in the upper reaches to polluted in the lower reaches. The water quality in the harbor area and navigational portion of the river is degraded by pollution from vessels and corresponding dock activities and unsewered residential areas. Definite bacterial contamination exists in the harbor.

Fields Brook, a small tributary near the mouth of the Ashtabula River, carries wastes from a large industrial complex outside Ashtabula into the lake-affected portion of the River. The industries are primarily chemical industries whose effluents contain both organic and inorganic wastes. The effect of Fields Brook on the Ashtabula River is reduced because lake waters dilute the constituents which are discharged into the river.

The waters of Fields Brook are normally milky white from wastes of the Cabot Titania Corporation plants. The color is caused by small amounts of titanium dioxide, which is used as a white color base for paint and paper. Another contributor of high suspended solids is the Reactive Metals, Inc. - Metals Reduction Plant. A storm sewer, which discharges the wastes of several industries into Fields Brook, receives large loads of suspended solids from Detrex Chemical Industries, Inc. - Chlorinated Solvents Plants, and Reactive Metals, Inc. - Sodium and Chlorine Plant. In addition to the discoloration problem, there is a strong chemical or medicinal odor that is always present.

Conneaut Creek

The water quality of the upper reaches of Conneaut Creek above Springboro, Pennsylvania is good.

Conneautville, Pennsylvania, a municipality of 1,200 (1960 population), contributes nutrients as well as bacterial pollution to Conneaut Creek. Although this municipality has several storm sewers, it does not have a sewage treatment plant. The Corps of Engineers in a flood control study reported the discharge of raw sewage into Conneaut Creek from three sewer pipes in Conneautville. Most of the sewage from Conneautville receives minimal treatment in septic tanks.

Below Conneautville, Conneaut Creek has very little flow for dilution of waste discharges in the summer months. Because of this low flow, small waste loads have a degrading effect on the stream in this location.

At Springboro, Pennsylvania, the water quality of Conneaut Creek becomes seriously degraded due to wastes tributary inflow from the Albro Packing Company and the effluents of many septic tanks. Sludge deposits are found on the bank and beds of Conneaut Creek and throughout the entire length of the unnamed tributary.

The water quality of Conneaut Creek is very good as it flows across the Pennsylvania-Ohio line.

Conneaut Creek becomes turbid as it flows through the City of Conneaut, Ohio, a condition caused by dredging operations just upstream from the navitation channel. Dredged materials have been deposited along the east bank of Conneaut Creek for about 100 feet. Behind these deposits is a dumping area which may adversely affect water quality in Conneaut Creek during the high flow season.

A large storage area for the Pittsburgh-Conneaut Docking Company is across the creek from the dump and dredging deposits. Large slugs of coal have spilled into Conneaut Creek. According to the Ohio Division of Wildlife, there could be an adverse effect on fish if this spill-over occurs with any frequency. Drainage through the stored coal may also have a degrading effect on the water quality of Conneaut Creek.

Near the mouth of Conneaut Creek in the lake affected portion of the stream, the Conneaut sewage treatment plant discharges inadequately treated wastes. Conneaut Creek in this stretch is overenriched as evidenced by the abundant growths of algae.

PENNSYLVANIA AREA

The streams of Pennsylvania that flow to Lake Erie are generally small and, except for those in Greater Erie, pass through relatively unpopulated areas.

Small Tributaries

Elk Creek, the largest of the Pennsylvania tributaries, drains 100 square miles and receives discharges from two sewage treatment plants, Lake City and Girard. Elk Creek is classified by the Pennsylvania Health Department as a "complete treatment stream," which means that all municipal and industrial waste discharges to the stream have a minimum of at least adequate secondary treatment. The Girard sewage treatment plant does not meet this requirement and has been placed under orders by the Pennsylvania Sanitary Water Board. The Lake City plant also discharges inadequately treated wastes to Elk Creek.

Another water quality problem in Elk Creek is caused by the discharges from the Gunnison Brothers Tannery located in Girard Township and discharging to Brandy Run, a tributary of Elk Creek. Although this discharge is quite small, the flow in the receiving stream is also small, especially in the late summer months.

The greatest pollution problems in the Pennsylvania streams are in Cascade Creek, Garrison Run and Mill Creek which flow through Erie to the harbor and receive the combined sewer overflow and storm sewer discharges from the Erie collection system. Mill Creek flows under the City of Erie through a large tube. Erie Brewing Company, which previously discharged to Mill Creek, has connected to the municipal sewer system and their wastes are now treated by the Erie sewage treatment plant. Bottom deposits in the harbor are a brownish-black combination of mud, silt, and detritus. Sewage and chemical odors are present from some deposits inside and outside the harbor.

Direct to Lake Erie

Hammermill Paper Company is the largest source of paper mill wastes in the Lake Erie basin. Wastes from the bleaching process impart foam and color to the waters which, with westerly winds, have been detected along the shoreline for 20 to 30 miles. Sometimes, winds from the east cause wastes discharged by Hammermill to get into the Erie water supply and to foul the beaches at Presque Isle State Park. The color and foaming creates esthetically undesirable conditions especially for swimmers, boaters and fishermen. These wastes were to have been removed from the discharge to Lake Erie, and the spent liquors disposed of by deep well injection. However, these materials are still present in appreciable quantities. Pennsylvania's Health Department has Hammermill under orders to improve their treatment.

Just west of Hammermill Paper Company's outfalls and east of the harbor is the Erie sewage treatment plant outfall. The Erie plant provides secondary treatment but operates near capacity and frequently by-passes raw sewage to Mill Creek near Erie Bay.

Lakefront

An unsewered areaexists along the lake and bay front. Houses, cabins, motels, restaurants, etc. are located at the foot of the bluff atop which the City of Erie is located. The sanitary wastes from this area have been discharged directly to Lake Erie or Presque Isle Bay, and affect the water quality of the nearby beaches of Presque Isle State Park.

Although there are several small beaches along the Lake Erie shoreline in Pennsylvania, the major area is Presque Isle State Park, located on the peninsula separating Lake Erie from Presque Isle Bay. There are eleven main beaches on Presque Isle, all located on the Lake Erie side of the peninsula. The water quality of these beaches is generally excellent with the exception of Beach 11. This pollution comes from the several sources previously mentioned. Another source of pollution to Beach 11 is the bird sanctuary located to the north. A large total coliform and fecal streptococci concentration can be attributed to this sanctuary area.

All beaches east of Presque Isle are affected by algae. Also under normal conditions the effluent from Hammermill adversely affects beaches for over ten miles east of Erie. Besides the color, odor, taste, and foam problems associated with their wastes, wood chips are also found on beaches adjacent to their plant. Several of the small beaches east of Erie have excessive coliform concentrations, others are of unknown quality.

NEW YORK AREA

The New York Area comprises the eastern end of the Lake Erie drainage basin. It has a drainage area of 2,900 square miles and extends 67 miles along Lake Erie from the Pennsylvania-New York line to, and including, the Buffalo River. The general water quality of the New York streams is shown in Figure 17.

Except for the Greater Buffalo Metropolitan Area, this area is predominately rural. The present population of 500,000 is projected to increase to 790,000 by 1980 and to 1,100,000 by 2020. The majority of the population growth will take place in the rapidly developing southern and eastern suburbs of Buffalo. The City of Buffalo sewage treatment plant discharges to the Niagara River rather than Lake Erie and is not included in this report. However, the City does contribute a large share of the pollution loads to the Buffalo River through storm water and combined sewer overflows.

Buffalo River

The Buffalo River is formed by three tributaries: Buffalo Creek, Cayuga Creek, and Cazenovia Creek. The Buffalo River drains 436 square miles as it flows to Lake Erie through the City of Buffalo. The West Branch of Cazenovia Creek and the East Branch above East Aurora generally have good water quality; however, several areas show limited enrichment from septic tank effluents. Waste materials discharged by the Village of East Aurora, septic tank effluents, and misused storm drains seriously degrade the water quality below East Aurora. The waste discharge from the secondary treatment plant at East Aurora is much higher than can be adequately assimilated by the stream. The lower 0.7 mile is affected by backwater pollution from Buffalo River industries during low flow.

Above Lancaster both Cayuga Creek and its tributary, Little Buffalo Creek, contain excellent quality.

In the lower nine miles of its length, Cayuga Creek receives the poorly treated effluents from Depew and Lancaster, septic tank effluents from several rural communities, storm water overflows, untreated industrial wastes from the Symington Wayne Corporation, garbage and drainings from the village of Depew's dump, and garbage and debris from other sources. Conditions typical of severe pollution exist throughout this stretch. The water varies from grey to brown to black and normally is turbid and has a strong sewage odor during low flow periods. In many pooled areas the stream bottom is covered with a black, oily, septic sludge; and fecal matter has been observed floating in the water.

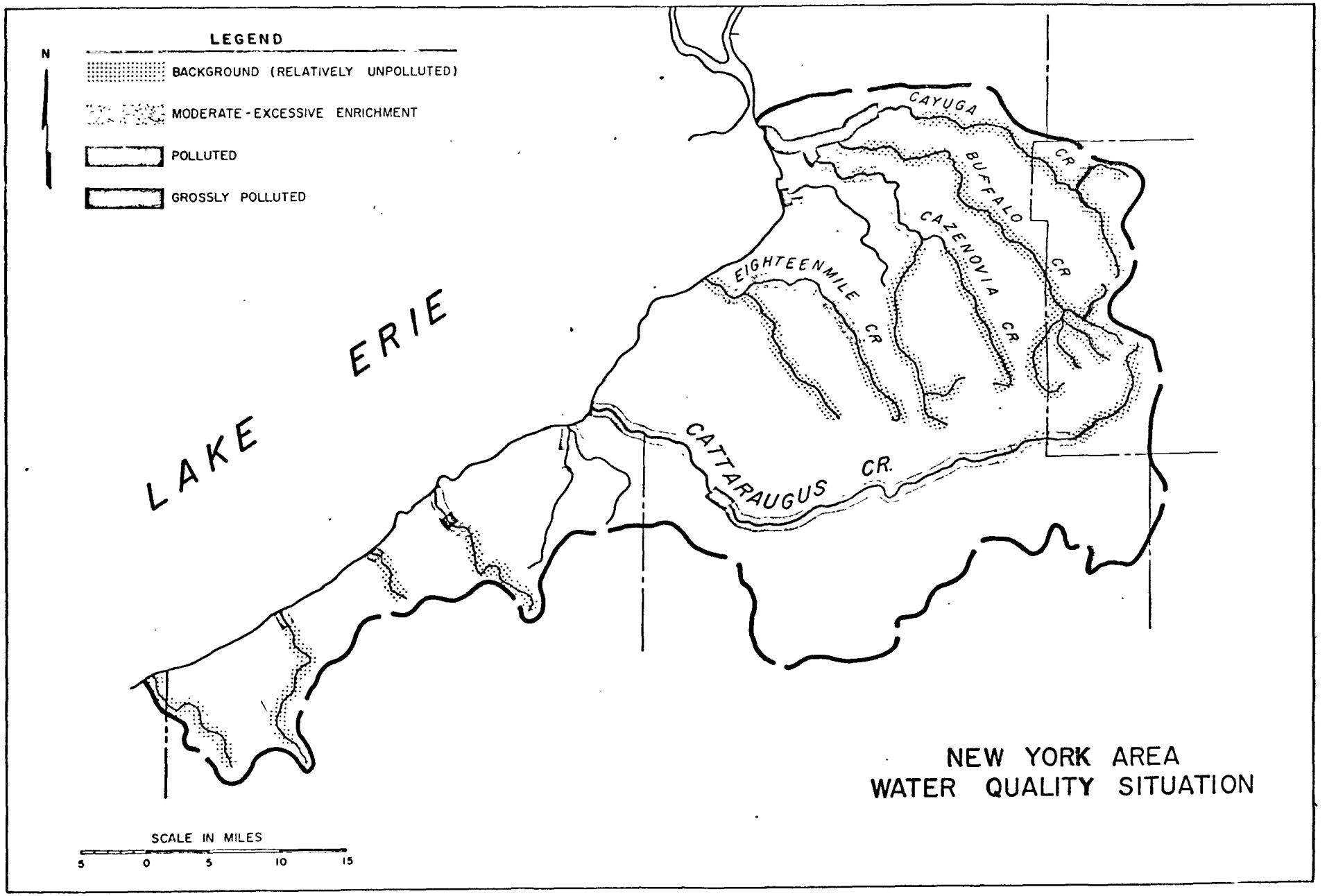

LEGEND
N
BACKGROUND (RELATIVELY UNPOLLUTED)
MODERATE - EXCESSIVE ENRICHMENT
POLLUTED
GROSSLY POLLUTED
LAKE ERIE
CAYUGA CR
BUFFALO CR
CAZENOVIA CR
EIGHTEENMILE CR
CATTARAUGUS CR.
SCALE IN MILES
5 0 5 10 15
NEW YORK AREA
WATER QUALITY SITUATION

FIGURE 17

Except for the lower two miles, Buffalo Creek is of excellent water quality with only a minimal amount of nutrients from wastes. In the early spring trout can be caught in the upper reaches of the Buffalo Creek watershed.

When Buffalo Creek enters the Gardenville area, the first noticeable signs of pollution become evident. Attributable to septic tanks in this area. Below Gardenville, additional waste inputs continue to degrade the water quality of the stream. Oil wastes from the Pennsylvania Railroad shops enter Buffalo Creek at the New York Central Railroad bridge. These wastes accumulate in a swamp during dry periods, and fires have occurred here. The accumulated oils discharge rapidly to Buffalo Creek during heavy rainfalls, and even contribute to the oil films present on the Niagara River.

The Buffalo River originates at the confluence of Buffalo and Cayuga Creeks. The flow in the river is negligible during dry periods. More than 70 days is required during low flow to supply the volume of water in the dredged portion of the river. At low flow both the rate and direction of movement of water in the dredged channel is primarily influenced by the rise and fall of Lake Erie levels at the river mouth.

The waters entering the Buffalo River at the confluence of Buffalo and Cayuga Creeks are poor in quality. One tenth mile downstream from the junction, the effluent from one of the Cheektowage sewage treatment plants causes additional degradation.

The West Seneca treatment plant discharges its effluent to the Buffalo River at milepoint 7.7. The river continues to deteriorate from this point to Lake Erie.

Several overflows from the combined sewer system in the Buffalo discharge to the river during periods of rainfall. About one mile above the mouth, raw sanitary sewage from the area between the Buffalo River and West Canal discharges to the river. Industrial wastes from chemical, coke, steel, refinery and grain malting plants also discharge to these waters.

Prior to March 1967 five major industries on the Buffalo River pumped 100 mgd (155 cfs) from the river for process and cooling water. During low flow periods they were literally recirculating their waste waters and increasing the concentration of many polluting constituents.

Thick films of oil are present on the Buffalo River at all times except during flood flows. Although Mobil Oil's refinery has reduced the concentration of oil in its effluent they still contribute to the oil pollution. Oils are also discharged from the Republic Steel Plant, Donner Hanna Coke Plant, and the Pennsylvania Railroad shops. Other oil sources are sanitary wastes and combined sewer overflows. The

heavy oil films on the Buffalo River and its oil-coated shores effectively prevent boating or any recreational activity on its waters. The largest polluter in the Buffalo River is Republic Steel.

Because of the prevailing winds the oils on the Buffalo River tend to move upstream rather than downstream during periods of low flow. A large increase in river flow moves most of these oils out into the Niagara River within a period of two to four days. This results in noticeable oil films along the United States shore of the Niagara River down to the Falls. At times oil has been observed from Lewiston to the mouth of the Niagara.

Except during low flow, the river contains relatively little suspended solids as most of the solids from land erosion and municipal and industrial wastes settle rapidly to the bottom of the dredged section.

The residential area on each side of Cazenovia Creek, extending 0.7 mile upstream of its mouth, is affected by Buffalo River backwater. Residents of this area complain vociferously each summer about the disagreeable odors emanating from the stream and the heavy oil film present. It is apparent that during the six month or longer period of low flow, the Buffalo River water is basically concentrated waste and is an extreme example how waters can be turned into a virtual cesspool. The Buffalo River ranks on a par with the Cuyahoga River in Cleveland as the most polluted major river in the Lake Erie basin.

The five major industries on the Buffalo River, Allied Chemical-Buffalo Chemical, Allied Chemical-Buffalo Dye, Donner-Hanna Coke, Mobil Oil, and Republic Steel, have recently placed in operation a water supply system which cost over $9,000,000. This system pumps Lake Erie water to the industries for their use, and eventual discharge to the Buffalo River which will provide greater flow in the lower section. The industries have committed themselves to discharge a minimum of 100 MGD to the stream during low natural flow whether or not they require the total quantity for their operations.

Cattaraugus Creek

Cattaraugus Creek varies in water quality from excellent to grossly polluted.

The first sources of pollution are near the headwaters. In the village of Arcade, several industries and the municipal sewage treatment plant discharge inadequately treated wastes to Cattaraugus Creek. The principal problem is from the Arcade sewage treatment plant which receives domestic wastes from approximately 1,900 people and sewage and industrial wastes from industries, employing approximately 1,000 people. The plant

provides secondary treatment; however, the plant is adversely affected by the industrial wastes which contain cyanides, zinc, copper, and cadmium.

The Arcade sewage treatment plant is under orders by the New York Health Department to improve their treatment. Since the plant is near the headwaters of the creek, an even more acute problem occurs because little water is available for dilution.

In its upper reach, Cattaraugus Creek has an extremely high reaeration rate due to its steep slope and swift flow. This aids materially in the natural self-purification of the waters. The waters recover to a natural condition as they flow through the Zoar Valley.

As Cattaraugus Creek flows through Gowanda, the water quality changes from a relatively clean water to a grossly polluted open sewer. Oils, toxic wastes, organic loadings, suspended and dissolved solids, and inadequately treated domestic wastes pour into the creek in the vicinity of Gowanda. The Peter Cooper Corporation and Moench Tanning Company are the principal sources of these wastes.

In addition, the sewage treatment plants at Gowanda State Hospital and the Village of Gowanda discharge inadequately treated sewage to Cattaraugus Creek. Both plants provide only primary treatment for the 7,200 people served. The plant at the state hospital also receives cannery wastes which increase the organic solids load during the canning season.

Blasdell and Smoke Creeks

Blasdell Creek, also known as South Ditch, is a small stream which would normally be dry most of the year. Bethlehem Steel plant wastes, entering at various points along the creek from the mouth to one mile upstream, maintain a considerable flow in this sector. At its mouth the creek is essentially a Bethlehem Steel waste outfall entering Lake Erie. In addition to other materials, large amounts of oil are continually discharged to the lake. During winter periods the ice holds much of the oil near the mouth. The oil is suddenly released when the ice moves out and this is probably one of the major causes of the slug discharges of oil to the Niagara River which occur each spring.

Smoke Creek extends through an urban area throughout most of its length. At the junction of the south and north branch, the stream is markedly degraded by organic wastes entering upstream. It contains considerable fatty matter of the type normally present in sanitary wastes, indicating the probability that septic tank effluent or other sanitary wastes are entering upstream of the junction.

The one mile length of stream from the junction of the branches to its mouth on Lake Erie receives industrial waste discharges. The South Buffalo Railway shops contribute some oil. The Buffalo Brake Beam Company discharges a small quantity of oil and sanitary wastes to the stream.

The principal flow at the mouth of Smoke Creek is Bethlehem Steel's wastes. The combined effect of the Blasdell and Smoke Creek discharges create an oil film and red discoloration of approximately two square miles on Lake Erie. The continuing oil discharge from Bethlehem is one of the principal if not the major source of oils causing damage to certain water uses of the Niagara River and in fact, is the largest single source of pollution in the entire basin discharging directly to Lake Erie. In addition, the discharge contains approximately 1.1 MGD of Lackawanna sewage treatment plant effluent.

The Bethlehem Steel Company is presently under orders from the New York State Health Department to remove an appreciable amount of their waste products.

Other small tributaries throughout western New York have localized problems but singly have little effect on Lake Erie. Most of the pollution problems are associated with grape processing industries.

Bathing Beaches

The beach with the most serious problem is that of Hamburg Town Park. Several storm sewer overflows are located near this beach with one overflow immediately adjacent to it. This beach has been closed by the Erie County Health Department. Also local bathing areas at Silver Creek and Westfield have been closed by the Chautauqua County Health Department. Periodically Miller's Beach, Evangola State Park, and Evans Town Park have experienced pollution problems but to a lesser degree.

Other similar beaches in Chautauqua County such as the two at Dunkirk also have serious problems. Pollution enters these beaches from septic tank effluents; inadequately treated sewage discharged to Canadaway Creek from the Fredonia sewage treatment plant; inadequately treated sewage from the Dunkirk sewage treatment plant; and combined sewer overflows from both Dunkirk and Fredonia.

CORRECTIVE REQUIREMENTS

CURRENT NEEDS

STANDARDS IMPLEMENTATION

Passage of the water quality standards provisions of the Federal Water Pollution Control Act created an effective new institution for the control of water pollution. The standards, once established, bring into focus actions needed both to abate existing pollution and to prevent further pollution.

The plans to implement the water quality standards are of primary significance, since they describe what must be done, by whom, and by what date to meet the quality criteria. These plans are based on present and anticipated uses of the waters, and on criteria associated with such uses. A major consideration in developing and evaluating the standards is the realistic proposition that what is needed is not the highest possible standard but the highest standard possible at this time. Without exception, this characterizes the standards proposed by the five States in the Lake Erie basin.

In general, the implementation plans cover many areas which can be characterized as a basic ingredient to any pollution abatement program, whether of a long-range blueprint type or a shorter-range plan for correcting current needs. Some of these elements incorporated in these plans, and to which the States as a consequence of the standards-setting process are committed, include:

1. The identification of significant sources of municipal and industrial wastewater and an estimate of the general level of treatment now being obtained from the principal treatment facilities.

2. A time schedule for completion of remedial facilities which will provide for the abatement of all existing conventional municipal and industrial pollution by mid-1972. In some cases, the time schedules contain detailed checkpoints; in others, a typical schedule is provided against which compliance can be measured.

3. The establishment of secondary biological treatment as a minimum treatment for all significant municipal wastes, and equivalent treatment as the minimum for industrial wastes.

4. Recognition of the need, before 1977, of treatment over and above secondary at specific installations. Also provided is an expression of intent on the part of the State agencies to require nutrient removal to the greatest extent possible, consistent with available technology.

5. The establishment of satisfactory bacteriological criteria for the primary and secondary type body contact. These uses are applied to various sections of the interstate waters so as to further these uses in the basin, consistent with long-range objectives.

6. General recognition and acceptance of the recommendations of the Detroit River and Lake Erie enforcement conferences along with the results of the evaluation by the latter's Technical Committee on nutrients and their effects. This evaluation provides the baseline for determining the total allowable loading of phosphorus to the Lake itself, a level toward which all efforts must be directed.

In some cases, the water quality standards proposed by the States include requirements in addition to the above, or include other expressions of intent. As an example, the standards proposed by the Ohio Water Pollution Control Board recognize and support the elements of Northwest Ohio Plan developed by the Ohio Water Resource Board. This plan recognizes, among other requirements, the need within the next decade for establishing sewer systems and advanced waste treatment in areas that are presently unsewered.

For intrastate waters in the basin, water quality standards are not a direct requirement under the Federal Water Pollution Control Act. The Act, however, does contain provisions which make it advantageous to the States to also promulgate standards in these waters. All of the Lake Erie States recognize these advantages -- i.e., the resulting larger contributions of Federal construction grant funds -- and are proposing to establish enforceable standards.

New York has had a system of standards for all of its waters and is now pledged to a continuing program of upgrading and improving the classification system and associated criteria.

Pennsylvania in 1944 adopted a system of standards for all of its streams. These have been subjected to periodic review and upgrading, where necessary. The State has indicated that this updating will continue, with priority on updating streams which at present are adversely affected by pollution.

The State of Ohio plans to develop water quality standards on all intrastate waters during fiscal year 1968 This program will begin with public hearings on tributaries to the western end of Lake Erie; hearings on tributaries to the eastern end of the lake will follow. Plans provide for correlation of the interstate and intrastate standards by using the basic criteria for water utilized in developing standards for interstate waters. Schedules for abatement will follow the establishment of the uses.

In establishing the interstate water quality standards in Indiana, the Stream Pollution Control Board at the time adopted standards for all intrastate waters. The criteria for the intrastate waters are identical to those approved by the Secretary of the Interior. The plans of implementation are also essentially the same, being modified to the situations present within a particular basin.

Michigan also has indicated an intent to establish standards on intrastate waters consistent with those already approved for interstate waters. This effort is to begin with public hearings in the southeastern portion of the State in the spring of 1968.

IMPERATIVE ACTIONS

Besides the need to expeditiously implement the water quality standards, there are other needs which must receive immediate attention if success is to be achieved. These needs relate to:

1. The establishment of priorities. Priorities for abating pollution must be established so as to provide for an orderly and efficient effort consistent with National goals. It is the responsibility of concerned Federal agencies to evaluate the relationship of various basin standards throughout the country to those of the Lake Erie basin so as to optimize the return on the Federal investment in water pollution control. Similarly, State and interstate agencies are required to evaluate these standards in their area of jurisdiction as required to meet local area as well as National goals. The primary mechanism for accomplishing an effective program through the establishment of priorities is the State Program Plans required under provisions of Section 7 of the Federal Water Pollution Control Act. These plans, developed through intergovernmental cooperation, will insure the effectiveness of the massive investment in water pollution control. Emphasis in the establishment of priorities should first be directed toward pollution control in Southeast Michigan, the Greater Cleveland-Akron area and the Maumee River basin.

2. Intrastate Water Pollution Control Institutions. The water quality standards established by the States pointed to some areas where more positive control over certain waste sources is required. These include wastes from marinas and vessels, dredging operations, mining operations, feed

lots, agricultural runoff, and flood plain zoning. These omissions indicate the necessity for changes in the State Statutes to permit more efficient control over all sources of water pollution.

In a similar vain, enabling legislation should be sought which would provide for the establishment of effective methods of dealing with the complexity of problems in the metropolitan areas of the basin. The state pollution control agencies should provide the leadership in these areas in relating waste treatment to the broader planning of the total urban environment. A pilot study known as Erieland 2000 recently conducted in Erie County, Pennsylvania provides an insight to the overall planning requirements.

The States of Ohio and New York should improve their programs to more effectively control industrial wastes, either through waste effluent requirements or other means.

3. Surveillance. Adequate water quality surveillance is essential in order to quickly identify compliance with water quality standards, document violations for corrective actions, and to identify new pollution trends, sources, and types before problems develop. The State agencies of the basin, acting in their own behalf, through local governments, and the private sector have the primary responsibility for maintaining a surveillance network capable of handling emergency pollution problems, locating and defining new problem areas and reporting on scheduled progress. Where such surveillance is not sufficient, the Federal Water Pollution Control Administration and other Federal agencies are responsible for filling the void.

4. Review of Progress and Updating. To give meaning to surveillance action, the Federal Water Pollution Control Administration and the affected interstate, State and local agencies must review progress, assess its adequacy and make necessary revisions in the implementation plans. A continuously updated plan is absolutely necessary to the attainment of the goal for a clean Lake Erie basin. The need for this action cannot be overemphasized.

5. Dredges Spoils and Erosion Control. The dredging of ports and waterways for the maintenance of navigation results in a problem of disposal of large quantities of dredged spoils. The current practice of disposal in Lake Erie results in pollution of large areas of the lake by redistribution of dredged sludges and silt. The Corps of Engineers and the Federal Water Pollution Control Administration should continue joint efforts in determining ways and means for curbing this pollution.

Additionally, control of soil erosion would aid measurably in reducing the need for dredging. The Soil Conservation Service should concentrate and expand its activities in this field and support research to assist in preventing silt deposits in navigable waters. Similarly all

agencies, Federal, State and local, involved in construction should invoke measures to prevent erosion occuring in conjunction with construction projects. Such a recognition of this problem has recently been made by the Bureau of Public Roads in connection with highway construction in the Cleveland Metropolitan area.

6. Research and Development. Emphasis in research and development programs on efficient, economical methods of tertiary treatment and nutrient removal, especially phosphorus is needed now. The water quality standards implementation plans call for maximum practicable phosphorus removal consistent with available technology. Some advances in modification of secondary treatment plants to achieve better phosphorus removal have been made in recent years, however, much more attention needs to be focused on this problem if the aging of Lake Erie is to be stopped. The Federal responsibility for this work rests with the Federal Water Pollution Control Administration. In the private sector, industry in concert with government must accelerate the search for a solution to the phosphorus problem associated with detergents. Another research need of Federal Water Pollution Control Administration or by contract with universities or other groups is a more closely defined role of the bottom sediments in the overall lake pollution problem.

Research should be carried out to define more exactly the causes behind fish mortalities in Lake Erie both manifested in sudden and dramatic fish kills and the slow unperceived disappearance of desirable species. The Federal responsibility for this rests with the U. S. Fish and Wildlife Service.

The Federal Water Pollution Control Administration should consider in its research needs, a final solution to the disposal of sewage and industrial sludges that will result from the more refined and advanced treatment systems.

7. Industrial Waste Reduction. The Lake Erie basin states should develop more effective means of controlling pollution from industrial establishments. Industries should be encouraged to consider process changes and joint treatment both with other industries and with municipalities. Better means should be provided for reporting on and assessing progress of industrial waste abatement, and additional emphasis at the local level is required on enforcing local sewer ordinances.

8. Training. The construction of waste treatment facilities alone does not insure the elimination of pollution. Satisfactory operation of these sophisticated plants consistent with design parameters requires trained personnel. Failure to provide the required manpower could delay the entire pollution control effort in the basin. The Federal Water Pollution Control Administration in response to Section 16 of the Act recently reported to Congress on the "Manpower and Training Needs in Water Pollution Control." This report outlines the available assistance from the Federal government in training personnel. This assistance ranges from utilization of ongoing training programs at various locations throughout the country to utilization of State Program Grant funds for training purposes. The States are encouraged to participate in these training programs to the maximum extent possible.

FINANCIAL RESPONSIBILITY AND ACTION

The cost for obtaining the desired water quality in the Lake Erie basin will be high. The estimated capitalized annual cost for meeting the current needs of the water quality standards implementation plans and additional areas on the intrastate streams in the basin is $78,000,000. This cost is exclusive of that required for either sewer separation or the treating of the combined sewage flows by other means. Of this amount, $60,000,000 is for municipal sewerage and treatment systems and $18,000,000 is for industrial treatment or equivalent process modification.

The basis in fact for the success of water pollution control in Lake Erie is the availability of these funds for its implementation. Intergovernmental action in financing needed improvements rests largely with the basin population. The Federal Government, through grants in aid administered through the Federal Water Pollution Control Administration, the Department of Housing and Urban Development, the Department of Commerce, and the Department of Agriculture provides incentive for proper basin action. In some instances pollution abatement results as a consequence of flood control programs administered by the Corps of Engineers. The administration of these funds by the responsible agencies must take into account the basin approach to water pollution control to be effective in optimizing the Federal investment.

Similarly the States, through grants made available in concert with the implementation plan, serve to increase the Federal contribution under Section 8 of the Federal Water Pollution Control Act.

None of these plans can succeed without the backing of affected local interests both governmental and private. Municipalities must be willing to undertake capital improvement programs in waste treatment through bonding, taxing or other means. Industries likewise must make substantial capital investments in waste treatment or equivalent process modifications.

Features contained in the 1966 Amendments to the Act provide for Federal participation up to 55 percent of the eligible cost of a grant for treatment works construction. Since the size of projects in the future will be larger than in the past, a smaller number of projects will be funded with the available funds. In order to accomplish the greatest good from this program it is recommended that the Lake Erie Basins States proceed with deliberate speed in improving their capability to provide grants to local governments in order to take full advantage of Federal Grants for Construction. Local governments should in turn proceed with the necessary bonding or other means for providing the local share of investment in water pollution control.

The objective of basin-wide pollution control and water quality management programs in all of the major watersheds was given new support and urgency by the Congress by authorizing planning grants to State-designated agencies. These grants are for the purpose of developing the necessary programs for the implementation and further improvement of the water quality standards. They are also available to the State-designated agencies seeking to develop an action program to control pollution throughout an intrastate basin or to a group of States wishing to develop such an action program throughout an interstate basin such as the Maumee. These grants also may be used to support the preparation of a regional plan for the provision of programs and facilities through which the communities and industries of a metropolitan or multi-community area in a basin can most effectively and economically control and abate pollution.

Table 5 is a summary of the current water pollution control needs.

TABLE 5

Summarization of

Current Water Pollution Control Needs

Category	*Requirement*	*Responsibility*
Implementation of Water Quality Standards	Obtain minimum of Secondary treatment or its equivalent	Basin Municipalities Basin Industries
Intrastate Control Institutions	Enabling Legislation for complete pollution control, basin compacts, and Metropolitan area entities.	Basin States Great Lakes Basin Commission Basin Metropolitan areas
Standards - Intrastate	Establishment of enforceable water quality standards on intrastate waters.	Basin States.
Surveillance	Development of data base to assess progress, compliance and new problem areas.	State Water Pollution Control agencies F.W.P.C.A. U.S.G.S.
Evaluation	Review and make revisions in abatement schedules.	State Water Pollution Control agencies
Dredging Control	Develop alternatives to lake disposal of dredged materials.	U.S. Corps of Engineers F.W.P.C.A.
Erosion Control	Reduce urban and agricultural soil erosion.	Soil Conservation Service Bureau of Public Roads U.S. Corps of Engineers Other Federal, State and local Construction agencies

TABLE 5 Continued

Category	*Requirement*	*Responsibility*
Research and Development	Improve upon pollution control techniques and basin management arrangements.	F.W.P.C.A. Industry Universities
Industrial Waste Reduction	Employment of water reuse techniques, joint treatment, process change.	Basin States Basin Industries
Training	Train additional personnel in the field of water pollution control and abatement.	Basin States Basin Industries Basin Municipalities F.W.P.C.A. Private and public institutions
Financial	Improvement in financial areas relative to pollution abatement facilities.	Federal Government F.W.P.C.A. Dept of Agric. Dept of Commerce Dept of H.U.D. Corps of Engineers Basin States Basin Municipalities

LONG RANGE NEEDS

The projected increasing population and economy of the Lake Erie Basin will intensify water pollution problems through time. Some of the long range needs to insure that the prospering basin community is able to cope with growing water pollution control problems are as follows:

1. Long range water pollution control goals in terms of water uses to be protected must continue to be updated. As presently foreseen maximum waste load limits for Lake Erie are 320,000 lb/day of oxygen demanding substances and 8,000 lb/day of phosphorous.

2. Water quality standards, both their criteria and implementation plans must be refined and revised with time. Technological and social changes that occur must be incorporated or this prime mechanism for action will certainly become impotent.

3. Intergovernmental relationships in the basin must be developed and strengthened. Multi-level agreements both formal and informal are important in securing arrangements for water pollution control. Included are all levels of government in the United States portion of the basin as well as appropriate governmental units in the Canadian subbasin. Water pollution in the Lake Erie Basin can be controlled only through such coordinated efforts.

More specifically, additional needs for construction of waste collection and treatment works in terms of today's technology are expected to be required. Included in these needs are (1) tertiary municipal works and appurtenances capable of removing in excess of 95 percent of the oxygen-demanding pollutants and phosphates; (2) Industrial treatment or equivalent measures capable of reducing the industrial pollutant load comparably to that attained by municipalities; (3) Separation of storm and sanitary sewage or satisfactory handling of this problem by other means; and (4) Control of rural runoff. The present worth of the capital investment required for these works is estimated to be $33 million. This value is based on a 5 percent interest rate, 25 year project life, including operation and maintenance and is discounted from the time of need. Based on current basin population, the present annual percapita cost of meeting these long-range needs is about $3.30.

A summary of long-range needs is shown in Table 6.

TABLE 6

Summarization of Long Range
Water Pollution Control Requirements

Category	Requirement	Responsibility
Goals	Update long-range goals in terms of uses to be protected in light of available technology.	Great Lakes Basin Commission F.W.P.C.A. Basin Water Pollution Control agencies
Standards	Refine and revise criteria and abatement plans as required.	F.W.P.C.A. in cooperation with G.L.B.C. and State Pollution Control agencies
Intergovernmental Cooperation	Further develop arrangements for continued planning and implementation of alternative methods of abating pollution.	G.L.B. Commission International agencies Federal agencies Metropolitan agencies Municipalities
Pollution Control	Provide treatment and control measures commensurate with pollution load limits calculated for Lake Erie.	Basin Municipalities Industries Federal Installations Agricultural Interests

BASIN ARRANGEMENTS FOR COORDINATING WATER QUALITY MANAGEMENT PROGRAMS

Enactment of the Water Quality Act of 1965 marks the important policy shift in the national water pollution control program from an emphasis on the abatement of pollution to the controlled management of future water quality. By Congressional mandate, water quality standards were made the central and key institutional arrangement for effecting that change. Planning, by a similar mandate, is to detail the means for achieving the water uses protected by standards established for that purpose.

All of the five States in the Lake Erie basin have responded to the opportunity afforded the States by the Congress to initiate proposals leading to the establishment of the water quality criteria and implementation plans which are at the heart of the water quality standards program.

These proposed criteria and plans, which were generally discussed in the previous section, thus are the foundation for a concerted program by the States to abate present pollution in Lake Erie and its tributaries and to initiate controlled management of the quality of the basin's water resources. As such, they will provide, after approval by the Secretary of the Interior, the essential elements of immediate and long-range action programs to guide pollution control and water quality management in these basins.

Authority and responsibility to manage the quality of the waters of the Lake Erie basin, however, today remain widely dispersed among Federal, State and local agencies. Because of this widely dispersed authority, an urgent need -- along with essential improvements in State and local pollution control programs -- is intergovernmental arrangements through which all levels of governments will coordinate their separate programs in the basin to achieve the water use and water quality objectives established in the water quality standards program.

The specifics of these arrangements include the following essential functions or features:

1. The arrangements are to provide means for coordinating water quality management programs within the Lake Erie basin as a whole, within individual water sheds tributary to the lake, and within major metropolitan areas in the basin.

2. The arrangements are to involve all of the Federal, State and local governments in the basin managing the quality of the basin's water resources -- and where appropriate, industries and other private activities as well -- as participants.

3. Initial emphasis is to be given to the development of coordinated programs to implement standards already established in the Lake Erie basin and then to serve as the vehicle for joint and continuing development of intergovernmental action programs to improve these standards.

Specific elements to be included in these coordinated implementation programs are:

a. Identification of and agreement on priorities among the various technological, financial, or institutional problems and needs in the Lake Erie basin.

b. The particular waste treatment or other water quality management activities which each level of government, or other participating entity, will undertake with respect to the planning of new or improved continuing programs.

c. Methods of funding planned projects and programs in the Lake Erie basin, including cost-sharing arrangements where these are necessary for a particular project or activity.

d. Arrangements for the flow and exchange of data which are necessary for a coordinated and basin-wide approach to water quality management program in the Lake Erie basin.

e. Procedures for initiating or continuing needed studies and planning to develop technological, financial, or institutional solutions to existing impediments to effective basin-wide management of water quality in the Lake Erie basin.

f. Arrangements for consultation with civic and other groups interested in the quality of the waters of the Lake Erie basin and for the dissemination of information to the citizens of the basin and their elected representatives in order that the latter may understand and properly guide the basin's water quality management programs.

g. Methods for reviewing progress under a particular action program and, based on such review, the adjustment of the current program or formulation of a new action program.

The vehicle for developing this needed intergovernmental coordination of water quality management programs throughout the Lake Erie basin is the newly-established Great Lakes Basin Commission. Including representatives from all States in the basin and from all Federal water resources agencies, this entity is charged by the Water Resources Planning Act of 1965 with serving as the principal agency for the coordination of Federal, State, local, and private plans for the development of the water and related land resources of the Great Lakes basin. As one phase of this role, the

Commission also will develop, if needed, more permanent organizational or procedural arrangements for managing the water and related land resources of the Great Lakes basin.

The Federal Water Pollution Control Administration, accordingly, urges all other Federal agencies, the States and local governments in the Lake Erie basin, and private interests concerned with water quality management in the basin, that they join with the Federal Water Pollution Control Administration in employing the structure and program of the new commission as the vehicle through which all levels of government in the basin will coordinate their pollution control programs to achieve the immediate and long range purposes of the water quality standards program.

COORDINATION WITH CANADA

Successful clean-up of Lake Erie's present pollution and effective management of its future water quality will require U. S.-Canadian agreements and cooperation. Indications that such will be forthcoming are available in Canadian assent to and participation in an investigation of pollution in Lake Erie now underway by the International Joint Commission. This investigation, requested jointly by the Government of Canada and the Government of the United States in 1964, will culminate in a report from the IJC which will include recommendations for needed remedial measures in pollution control in both countries.

Acceptance and adoption of the report, which is scheduled for completion in 1969, by the two countries, thus would launch a joint and coordinated U. S. and Canadian program to manage Lake Erie's water quality.

To further improve coordination with Canada in controlling pollution in Lake Erie, the Federal Water Pollution Control Administration suggests to the Department of State that this report be transmitted as soon as possible to the International Joint Commission and Canadian water pollution control agencies for information and appropriate consideration.

APPENDICES

PENNSYLVANIA AREA*

MAJOR INDUSTRIAL WASTE PROBLEMS

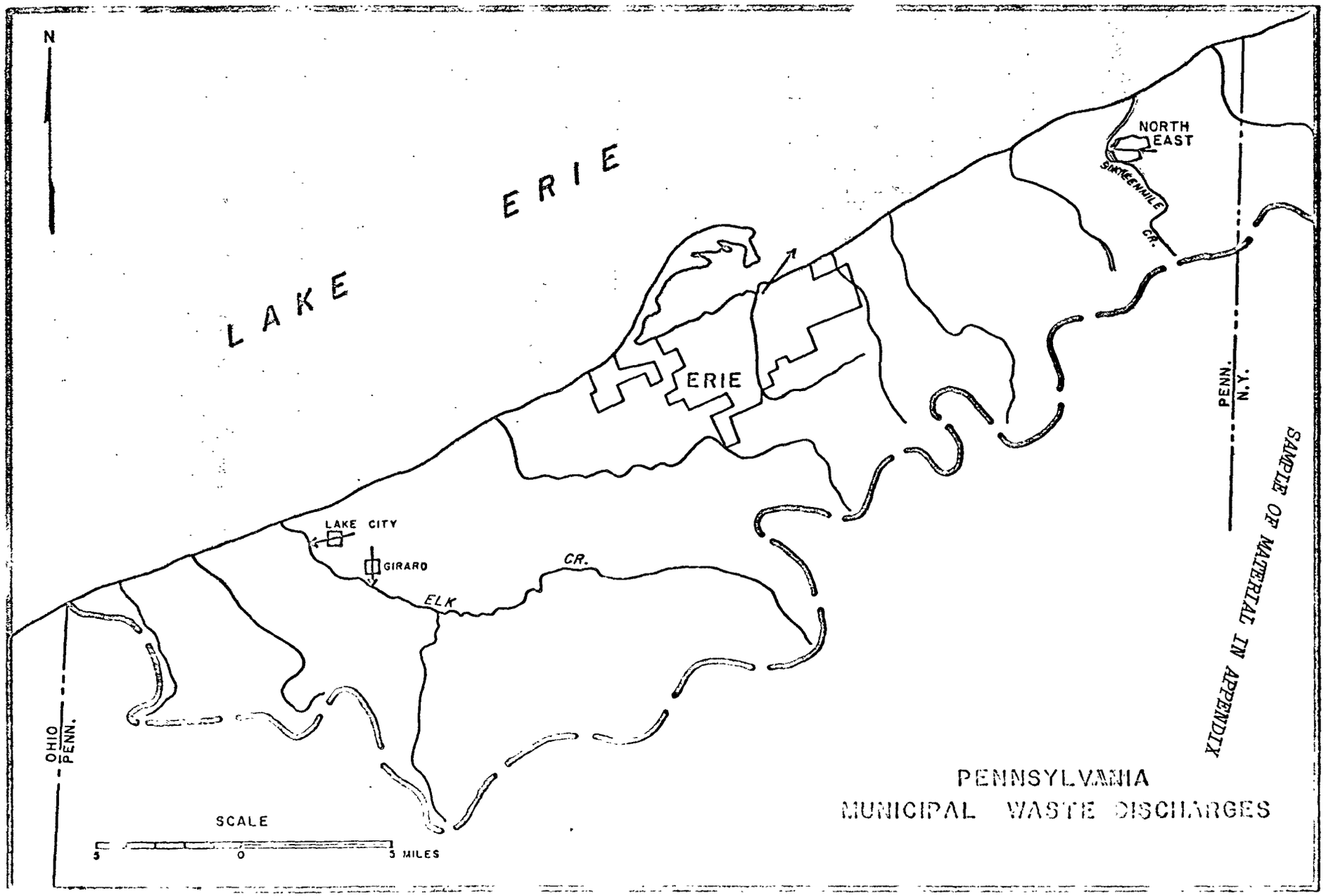
Industry	Flow	Waste Constituents - lbs/day			Control Measures Needed
		Solids**	BOD	Other	
Small Tributaries (ST)					
1-Gunnison Bros.	0.002	100T 20S	6		Advanced waste treatment
2-Parker White Metals	0.02	x	x	COD 22; Oil 90	Evaluate improvements
Direct to Lake Erie (LE)					
1-Hammermill	20	530,000T 84,000S	62,000	Color; SO_4 51,000	BOD***

SAMPLE OF MATERIAL IN APPENDIX

* See Figure

** Solids: T=Total Suspended and Dissolved, S=Total Suspended, and D=Total Dissolved

*** Covered by Interstate Water Quality Standards and Plan of Implementation for State of Pennsylvania.


N
LAKE ERIE
ERIE
NORTH EAST
SIXTEEN MILE CR.
PENN.
N.Y.
LAKE CITY
GIRARD
ELK CR.
OHIO
PENN.
SCALE
5 0 5 MILES
SAMPLE OF MATERIAL IN APPENDIX
PENNSYLVANIA
MUNICIPAL WASTE DISCHARGES

PENNSYLVANIA AREA*

MAJOR MUNICIPAL WASTE PROBLEMS

Municipality	Type Sewerage System**	Flow (mgd)	BOD (lbs/day) Raw	BOD (lbs/day) Final	Control Measures Needed
Small Tributaries (ST)					
1-Lake City	Secondary-S	0.4	868	227	Improvement
2-Girard	Intermediate-S	0.2	230	84	Secondary

SAMPLE OF MATERIAL IN APPENDIX

* See Figure

** S=Separate sewer systems