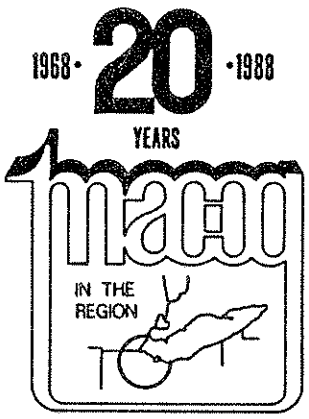
MAUMEE RIVER BASIN AREA OF CONCERN REMEDIAL ACTION PLAN Executive Summary

Volume 1: Investigation Report

August, 1988



tmacog

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ACKNOWLEDGMENTS

The Toledo Metropolitan Area Council of Governments would like to acknowledge the members of the Remedial Action Plan Advisory Committee and their alternates for their participation in developing the Investigation Report. This project would have been impossible without their input.

LOWER MAUMEE RIVER

REMEDIAL ACTION PLAN

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LOWER MAUMEE BASIN
REMEDIAL ACTION PLAN
INVESTIGATION REPORT

EXECUTIVE SUMMARY

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This document was prepared by the Toledo Metropolitan Area Council of Governments with funding from member local governments and was financed in part by a grant from the U.S. Environmental Protection Agency, through the Ohio Environmental Protection Agency.

INTRODUCTION

The *Investigation Report on the Lower Maumee River Basin* is the supporting documentation that identifies the environmental problems and the water and related uses that are impaired as a result of the problems. It also identifies the known sources of the pollutants. This report is Volume I, the first of two phases, in the development of the Remedial Action Plan (RAP).

RAPs are required in those Areas of Concern (AOC) as identified by the Water Quality Board of the International Joint Commission. Overall, there are 42 identified AOCs for the Great Lakes area. The RAPs are to become a part of the Great Lakes Water Quality Agreement of 1987 between the United States and Canada. This *Agreement* is a commitment to restore the water quality and the beneficial uses of the waters.

The AOC is an area of water impact. In some cases, however, the sources of these impacts are outside of the Lower Maumee River Basin's boundaries. This is particularly true of the agricultural sources. Therefore, implementation of the RAP must not be limited to the AOC's boundaries, if significant water quality improvements are to be made.

First, the *Investigation Report* discusses existing water uses and includes current water quality and sediment quality data. It also describes intensive or short-term monitoring surveys which have occurred along with an analysis of the data. The first part of this document summarizes this information.

Secondly, the *Investigation Report* describes ten different pollutant sources and the impacts of each. These include phosphorus sources, NPDES wastewater discharge permits for industrial and municipal sectors, package treatment plants, agricultural runoff, open water disposal of dredged materials, urban stormwater, home sewage disposal, active and closed landfills/dumpsites, and atmospheric disposition related to acid rain. This second part of this document summarizes these pollutant sources.

Lastly, key tables and maps are included with this document to assist the reader in reviewing the summarized information. A glossary is included which defines various terms and agencies found within this document.

The Toledo Metropolitan Area Council of Governments (TMACOG) is participating in a joint venture with Ohio Environmental Protection Agency (Ohio EPA) to prepare the RAP. TMACOG has three primary tasks: preparation of the *Investigation Report*, preparation of the Remedial Action Plan and conducting a program of extensive public involvement in the the RAP development so as to have substantial agreement among the public and private sectors for the actions adopted.

More than a hundred persons have had input into the preparation of this first phase work. The 74 member Remedial Action Plan Advisory Committee subdivided itself into six major subcommittees, bringing other persons into the process. These subcommittees included: Water Quality and Water Uses, Dredge Disposal, Agricultural Runoff, Home Sewage Disposal, Landfills and Dumps, and Public and Industrial Dischargers. However, TMACOG assumes responsibility for the accuracy of this report. Therefore, any errors or omissions should be directed to TMACOG. To obtain a copy of the full report, call TMACOG.

MAUMEE BASIN: DESCRIPTION AND USES

WATER USES

Lake Erie is the major surface water source of drinking water. Toledo's 120 million gallons per day (mgd) system services a total population of approximately 464,000 plus industrial customers, with Oregon's 8 mgd system serving a population of 25,000, and industrial customers. The Maumee River supplies the 0.8 mgd Waterville plant and the 6 mgd facility in Bowling Green. In the spring, these two plants have problems with nitrate and trihalomethane levels exceeding drinking water standards. These four systems service a combined population of just over 524,000.

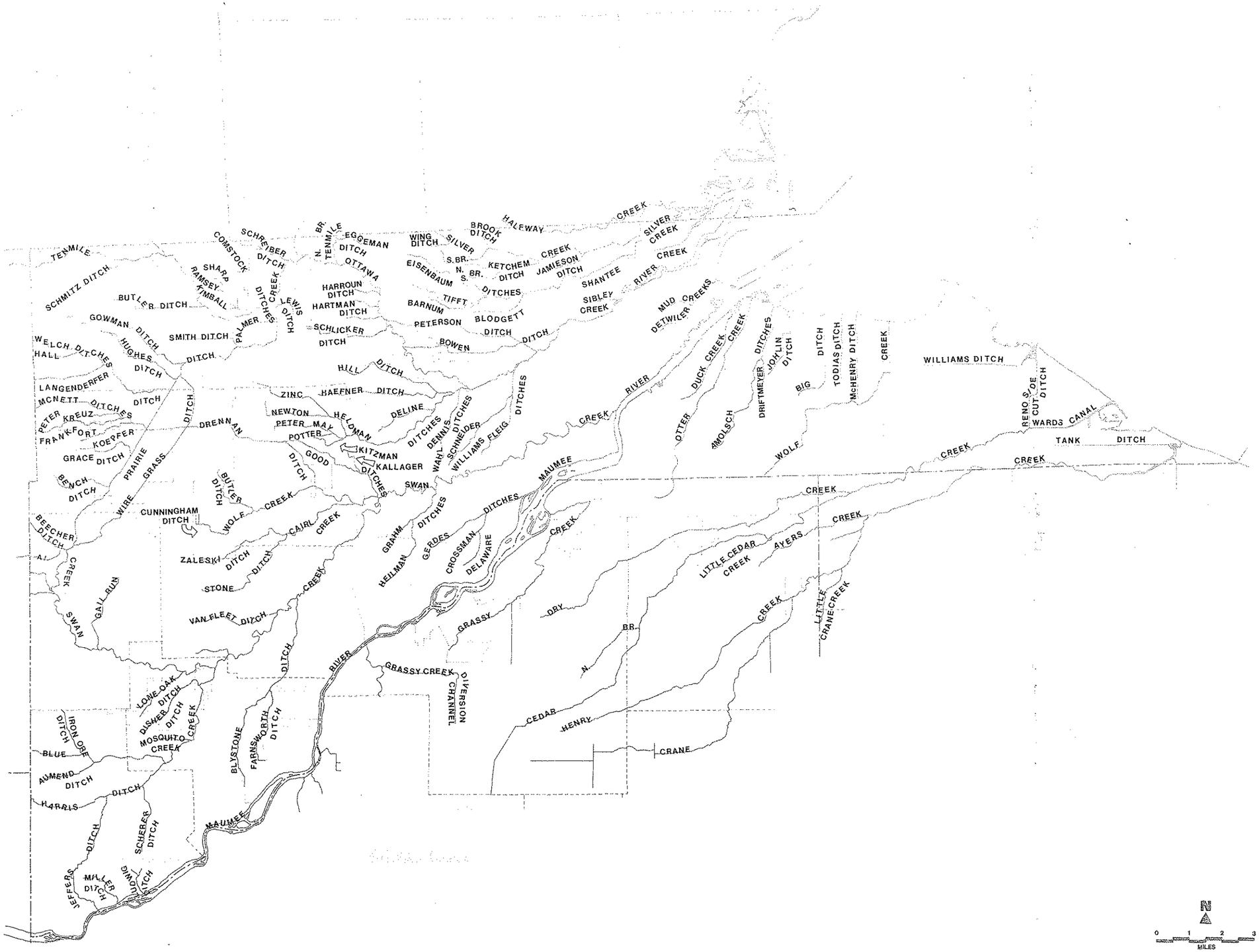
The Toledo Harbor is vital to the economic well-being of the region, with its location as a logical turn around point for the St. Lawrence Seaway traffic and the railroad yards. Various goods are shipped to and received from domestic, Canadian and foreign locations. Toledo is the third largest Port on the Great Lakes.

Walleye and white bass are the principle sport fish in the Maumee River, with the spring walleye run drawing people from as far away as Alaska. Other fish include yellow perch, channel catfish, small mouth bass, sauger and white perch. Both sport and commercial fishing occur in the Maumee Bay. The Western Basin of Lake Erie is known as the *Walleye Capital of the World.* While walleye declined in the early 1970's, their comeback has made charter boat services an important industry for the area.

The principal water-based recreational activities include sailing, canoeing, power boating, fishing, swimming, sail boarding, jet skiing, waterfowl hunting, birding and water skiing. Two state parks and five metroparks are directly linked to the AOC's surface waters. Due to warnings for body contact recreation, activities on the Ottawa River are limited to boating. There are some 23 square miles of coastal and estuarine marshes remaining in the AOC, with 8 specific marshes which attract migratory waterfowl from the Atlantic and Mississippi Flyways.

GEOGRAPHIC BOUNDARY OF THE STUDY

The Maumee River AOC has been identified as that area extending along the Maumee River from the Bowling Green water intake to the Maumee Bay, including the entire bay and near shore waters from the Michigan state line to Crane Creek State Park in Ohio. Included in the AOC are those tributaries in Lucas, Ottawa and Wood Counties which drain directly into these waters. These tributaries principally include Swan Creek, Ottawa River (Ten Mile Creek), Duck Creek, Otter Creek, Cedar Creek, Grassy Creek and Crane Creek. The Maumee Basin AOC is displayed in Figure 1 on the following page.



LOWER MAUMEE RIVER REMEDIAL ACTION PLAN - AREA OF CONCERN

WATER QUALITY CONDITIONS OF THE RAP AREA

The *RAP Investigation Report* describes the present water quality of streams in the Maumee Basin AOC. What follows is a summary of the findings reported in the *Investigation Report.*

POLLUTION PATTERNS

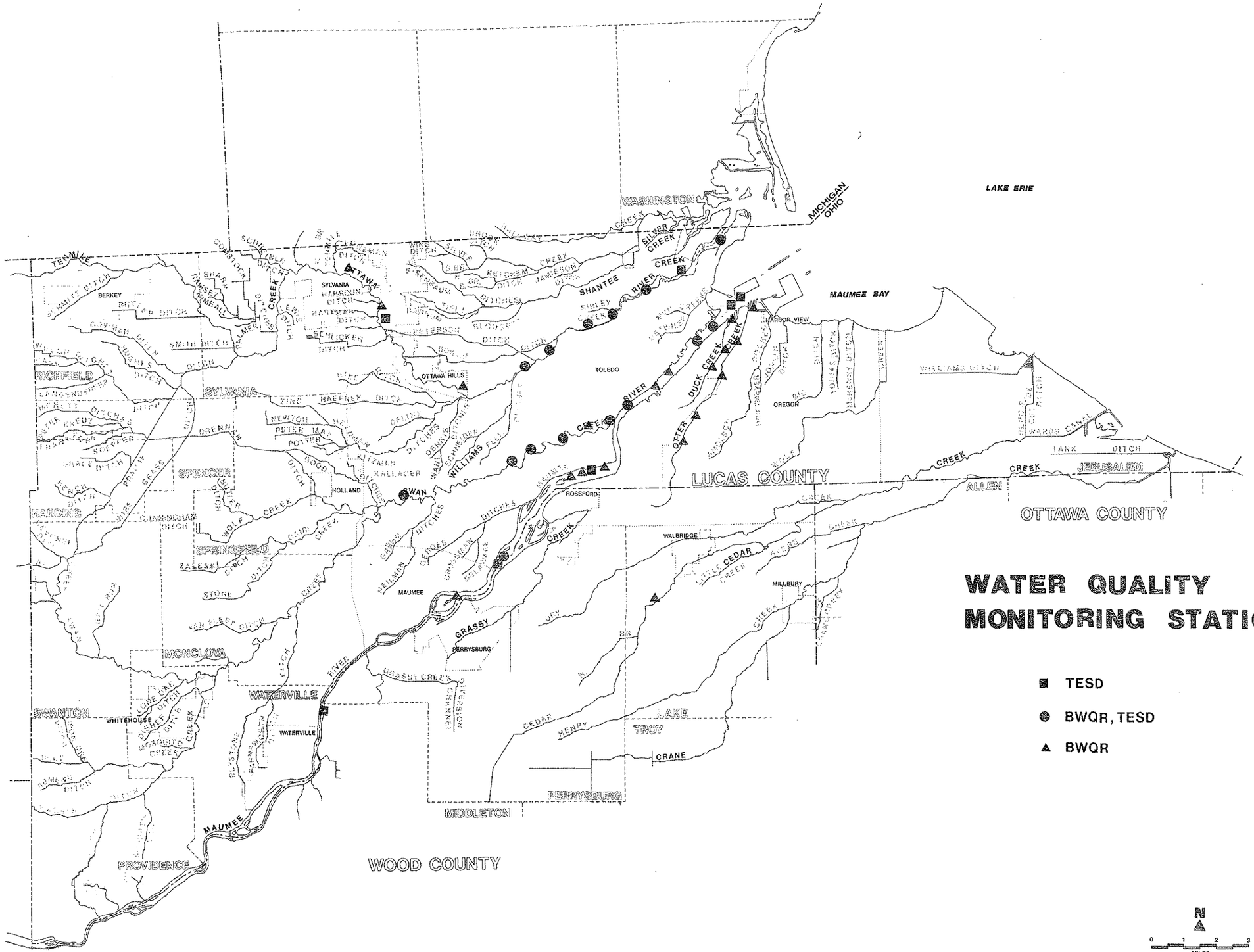
Overall the upstream segments of the Maumee River and the various tributaries to the Maumee Bay are relatively clean. When these water bodies approach Toledo, water quality gets progressively worse. The worst point for the Maumee River is located one or two stations above its mouth. From there, water quality improves slightly. The improvement near the mouth can be attributed to the "lake effect" (the periodic inflow of cleaner water from Lake Erie helps wash away pollutants from the lower reaches). This dilution effect also influences water quality for the Ottawa River, Swan Creek, Duck Creek, Otter Creek, and Crane Creek.

Contributing to the Maumee River water quality problems are the combined sewers which periodically discharge raw sewage within the inner city areas of Toledo. Swan Creek, which empties into the Maumee River, is also within the combined sewer area, as is a portion of the Ottawa River. Since these areas are urban, these receiving waters are the ultimate recipients of a variety of materials that storm water washes off urban surfaces. In addition, most of Toledo's major industries discharge their wastewaters to these areas. Leachate discharging from closed dumpsites also impact water quality in critical areas. Table 1 summarizes TESD's 1981-1986 water quality violations for specific water quality parameters for streams within the City of Toledo.

TABLE 1
WATER QUALITY VIOLATIONS IN THE TOLEDO AREA
TESD DATA, 1981-1986

STREAM	WATER QUALITY PARAMETER VIOLATED			WATER QUALITY VIOLATIONS		NUMBER OF SAMPLES
	P* (1 ppm)	DO (5 ppm)	Fecal Coliform (2000/100 ml)	No.	Pct.	
Swan Creek	10	29	102	141	62.9	224
Ottawa River	3	44	162	209	47.9	436
Maumee River	3	44	79	126	31.5	399
Delaware Creek	0	4	13	17	30.3	56
Grassy Creek	1	10	11	22	39.2	56
Heilman Ditch	23	1	21	45	86.5	52
Hill Ditch	0	0	27	27	48.2	56
Otter Creek	2	10	5	17	30.3	56
Shantee Creek	0	1	18	19	33.9	56
Silver Creek	0	1	24	25	44.6	56

* *There is not a specific numerical standard for P. 1.0 ppm is used here; this is the standard which major sewage treatment plants are required to meet.*



WATER QUALITY MONITORING STATIONS

- ■ TESD
- ● BWQR, TESD
- ▲ BWQR

N

0 1 2 3
MILES

LOWER MAUMEE RIVER REMEDIAL ACTION PLAN - AREA OF CONCERN

WATER QUALITY MONITORING SITES

The Toledo Environmental Services Division of the City of Toledo (TESD), performs the most extensive and continuous water quality monitoring in the area. TESD's data provides water quality profiles of the three major streams. Ohio EPA prepared a *Biological Water Quality Report* (BWQR) for the Lower Maumee Basin in 1986, which included detailed sampling. The sampling sites for these two programs are shown in Figure 2.

LOWER MAUMEE BWQR DATA

In 1986, Ohio EPA conducted a BWQR for the Lower Maumee. This study included a detailed investigation of the Maumee River's water quality below Napoleon and of the major tributary streams. The water quality parameters studied and what they mean are discussed below and graphically illustrated in exhibits 1-6.

Invertebrate Community Index (ICI)

The ICI is a measure of a stream's water quality in biological terms. The higher the ICI value, the better the water quality is. It is determined by collecting information about invertebrate animal life in the stream: what species live in the stream, and how plentiful are they? The ICI is important because it measures a stream's ability to support life.

Nutrients

Nutrients are the food and vitamins that make algae grow. They are undesirable in a stream and in Lake Erie because they can result in nuisance algae blooms which are harmful to fish life.

BOD_5

BOD_5 refers to Biochemical Oxygen Demand. It is an indirect way of measuring the amount of organic matter (food for algae) in the water. Low values of BOD_5 are desirable. There is no specific standard for BOD_5.

BOD_5 can come from a number of different sources, including sewage effluent, home or agricultural fertilizer runoff, or runoff from city streets.

DO

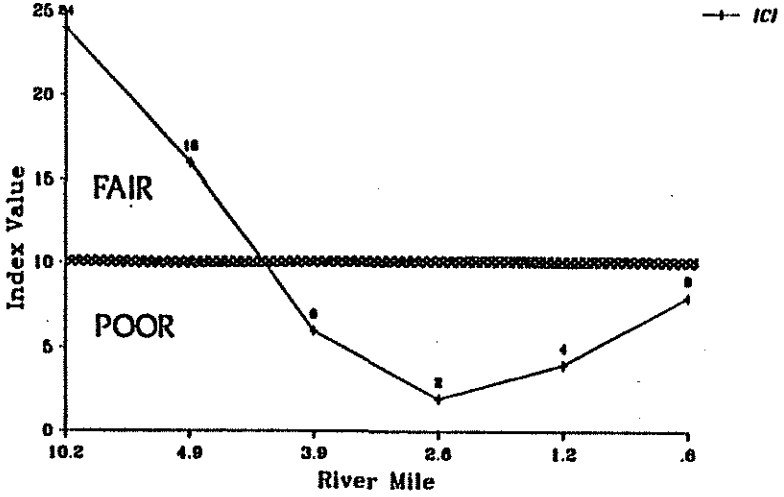
DO stands for Dissolved Oxygen. DO is what fish "breathe." Without adequate DO values in a stream, fish cannot live. Unlike the other nutrient parameters, high values are desirable. The standard for DO is 5.0 or more parts per million (ppm).

NH_3

NH_3 is ammonia which is a nutrient that algae requires. The NH_3 standards are complex: they depend on the temperature and the pH of the water sample. Sewage effluent and fertilizers are the most common sources of NH_3.

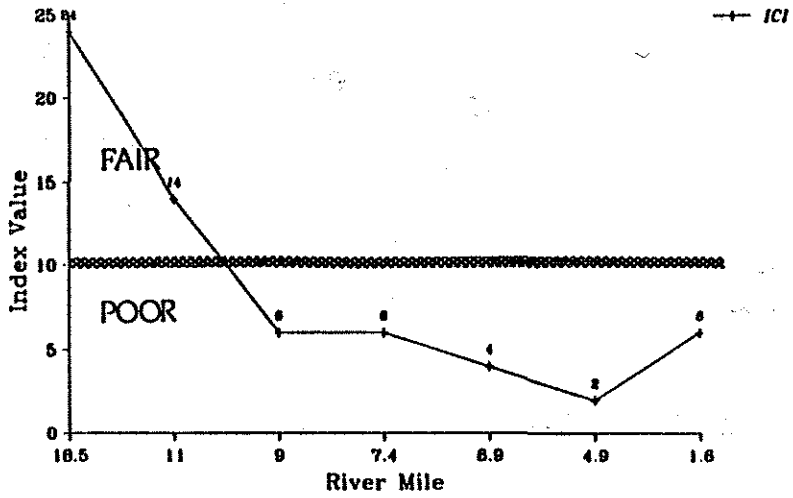
MAUMEE BWQR: SWAN CREEK

Figure 35: Invertebrate Community Index



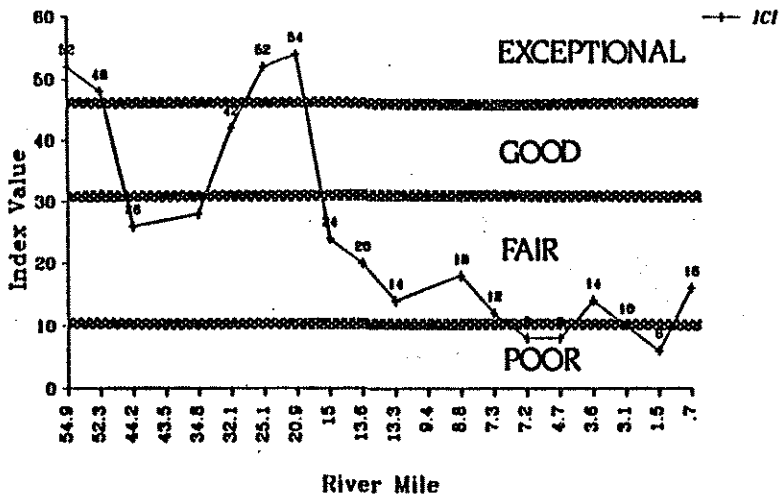
MAUMEE BWQR: OTTAWA RIVER

Figure 38: Invertebrate Community Index



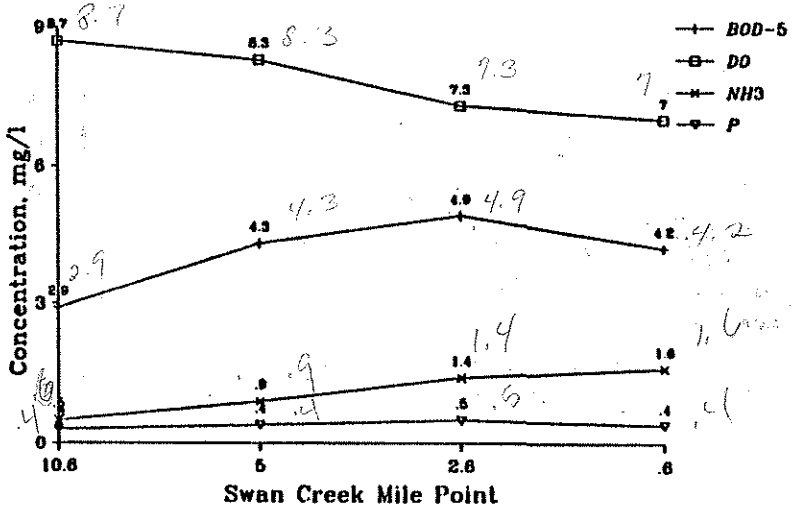
MAUMEE BWQR: MAUMEE RIVER

Figure 41: Invertebrate Community Index



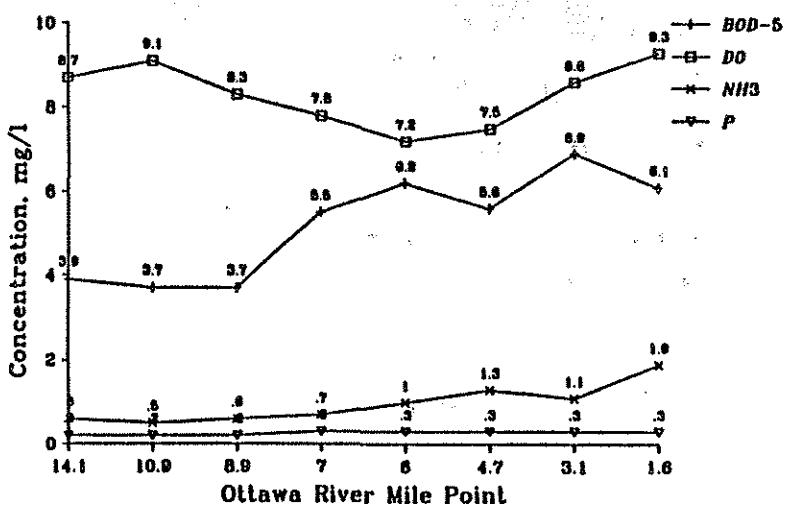
TESD DATA, 1981-1986: SWAN CREEK

Figure 9: Average Nutrient Parameters



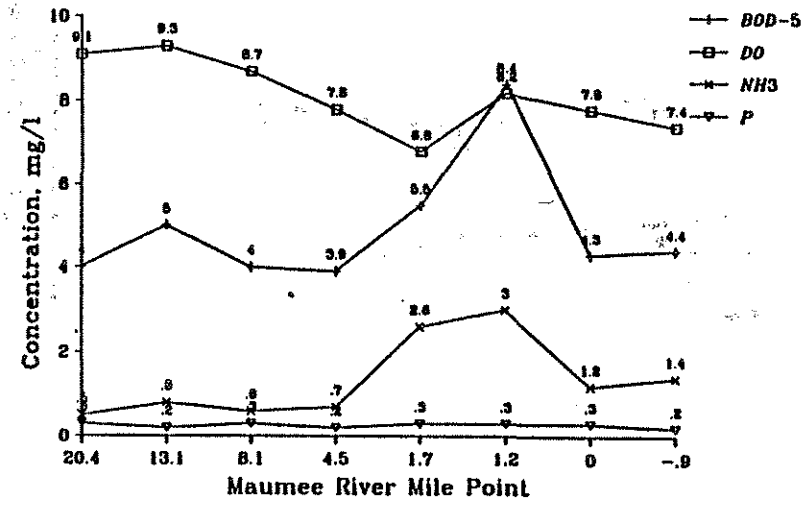
TESD DATA, 1981–1986: OTTAWA RIVER

Figure 17: Average Nutrient Parameters



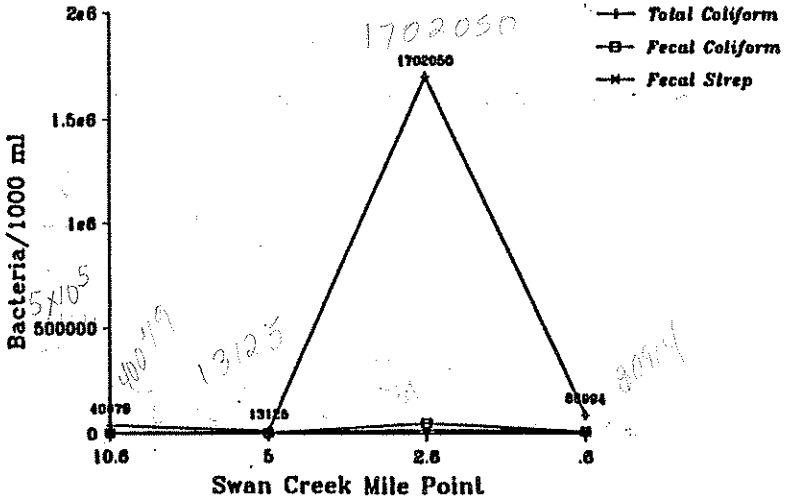
TESD DATA, 1981–1986: MAUMEE RIVER

Figure 24: Average Nutrient Parameters



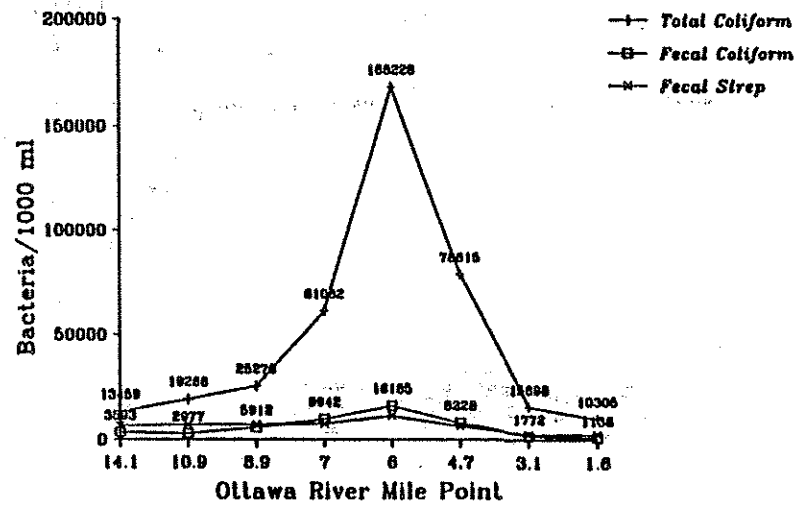
TESD DATA, 1981–1986: SWAN CREEK

Figure 10: Average Bacteriological Parameters



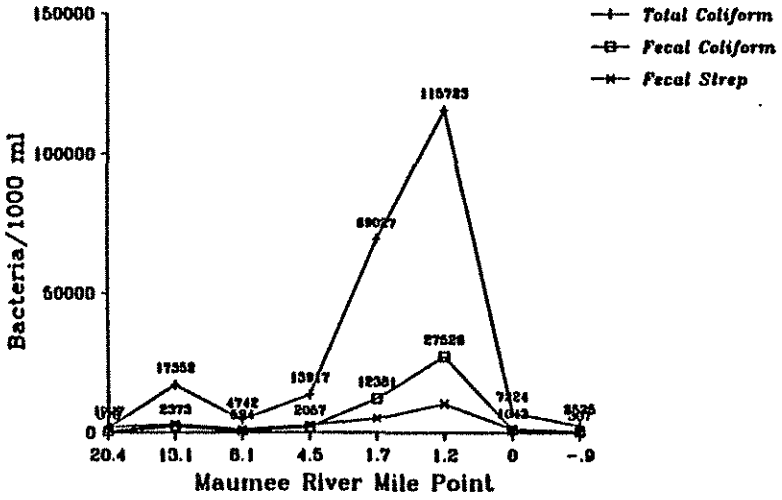
TESD DATA, 1981–1986: OTTAWA RIVER

Figure 18: Average Bacteriological Parameters



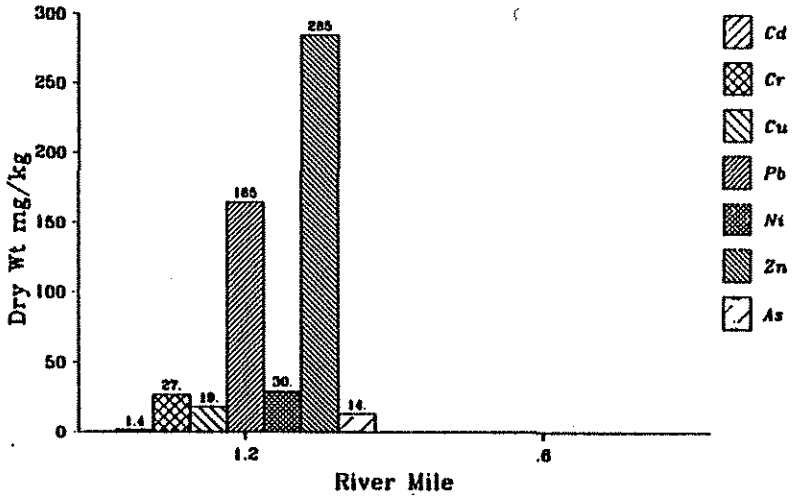
TESD DATA, 1981-1986: MAUMEE RIVER

Figure 26: Average Bacteriological Parameters



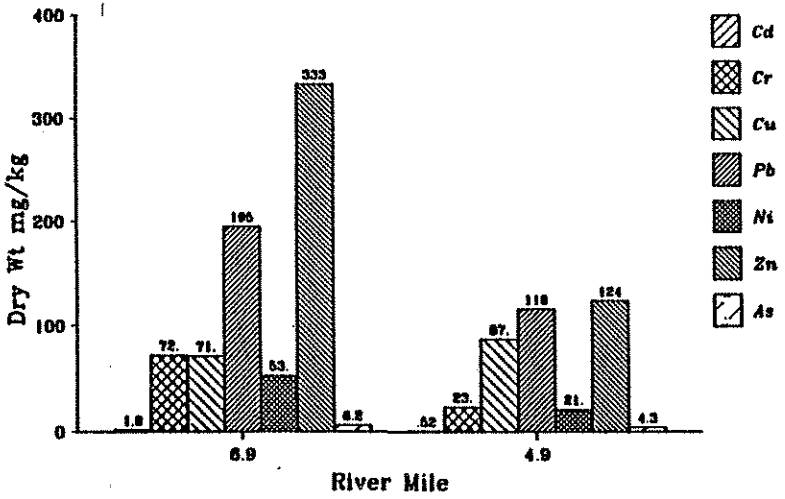
MAUMEE BWQR: SWAN CREEK

Figure 37: Sediment Metals



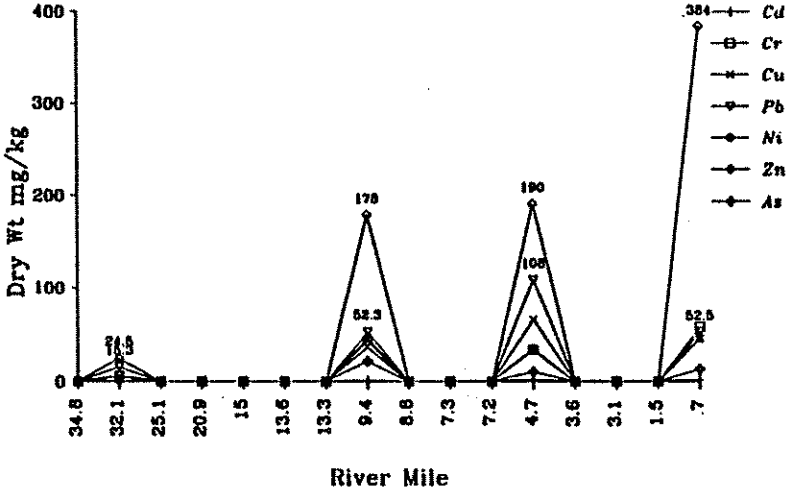
MAUMEE BWQR: OTTAWA RIVER

Figure 40: Sediment Metals



MAUMEE BWQR: MAUMEE RIVER

Figure 43: Sediment Metals



P

P stands for phosphorus, which is considered the critical nutrient for algal growth. Limiting the amount of phosphorus that reaches Lake Erie will control the algal blooms. Fertilizers and sewage effluent are major sources of P, but runoff from urban areas may also be a significant source. There is no *numerical* P standard, but water quality standards call for P to be limited to the extent necessary to prevent nuisance algal blooms.

Bacteria

Bacteria are normally present in streams. Certain groups of bacteria are used as indicators that a stream is contaminated with human wastes. The graphs show three types of bacteria, but the *fecal coliform* bacteria are usually of primary interest. The fecal coliform standard is 2000 bacteria per 100 milliliter (ml) sample.

Sediment Metals

Two major water quality sampling programs have included testing the sediments on the stream bottoms for their contents of heavy metals. These programs include work by the US Army Corps of Engineers and Ohio EPA's *Lower Maumee Biological Water Quality Report*. The graphs shown here are from the latter. The Corps' data are displayed in the *Investigation Report.*

Heavy metals are a water quality problem because, when present in high enough concentrations, they are toxic to fish. They can also be accumulated in fish tissue, and ultimately eaten by man. Metals sampled include Cd (Cadmium), Cr (Chromium), Cu (Copper), Pb (Lead), Ni (Nickel), Zn (Zinc), and As (Arsenic).

PCBs

Polychlorinated Biphenyls, or *PCBs,* are organic chemicals which were used as an insulating fluid in electrical equipment. PCBs are a suspected carcinogen. They have been found in waterways and sediments throughout the world, and are widely-spread contaminants of fish and wildlife resources.

Public health advisories were issued in 1987 and 1988, against consumption of carp and catfish from Lake Erie because of unacceptable PCB levels.

SEDIMENT QUALITY STANDARDS

Ohio EPA has recently established standards for the concentration of seven heavy metals (As, Cd, Cr, Cu, Fe, Pb, and Zn) in stream sediments. US EPA has suggested guidelines for other metals (Ni, Mn, Ba, Hg), organic matter concentrations, Nitrogen compounds, Phosphorus, Oils, Cyanide, and PCBs. The Corps' sampling data show that the stream sediments are moderately to heavily polluted, depending on the particular metal and sampling point as shown in Table 2. The highest concentrations of most metals in the sediment are found at or slightly above the mouth of the Maumee (river miles 0 to 2).

TABLE 2
SEDIMENT QUALITY

Based on Ohio EPA sediment standards, the Corps. data indicate:

Arsenic	Non-elevated to Elevated concentrations
Cadmium	Highly to Extreme Elevated concentrations
Chromium	Extreme Elevated concentrations
Copper	Highly to Extreme Elevated concentrations
Iron	Non-elevated to Slightly Elevated concentrations
Lead	Non-elevated to Elevated concentrations
Zinc	Elevated to Highly Elevated concentrations

Using the US EPA sediment guidelines for the remaining parameters:

Cyanide	Heavily Polluted
COD	Polluted to Heavily Polluted
Mercury	Non-Polluted
Manganese	Polluted to Heavily Polluted
Nickel	Polluted to Heavily Polluted
Ammonia	Polluted to Heavily Polluted
Phosphorus	Heavily Polluted
TKN	Polluted to Heavily Polluted
Vol. Solids	Moderately Polluted

The major source of metals is probably industrial waste discharges, such as metal finishers, or oil or chemical processors. In recent years, there has been a substantial decrease in the number of industrial dischargers in the Toledo area. Many former dischargers now treat their wastes to remove toxics and then discharge the effluent to the sanitary sewer system. Other potential sources of metals include urban runoff and leachate from landfills.

Nutrient pollutants (e.g., BOD_5, P, NH_3) decrease in concentration over time, as bacteria and algae in the stream use up this food source. Once the source of the pollution is removed, a stream cleans itself up. This is not true for metals, however. Once stream sediments have been contaminated with metals, they remain contaminated unless the metals are washed away by stream currents or removed by dredging.

Sediment Pesticides and Other Chemicals

The Corps' sediment sampling program included testing for pesticides and other toxic chemicals in addition to heavy metals. It is thought that some of these chemicals may produce harmful effects in concentrations as low as 1 part per billion (ppb, μg/kg; or 0.001 ppm).

The following chemicals were found at detectable levels in the Maumee shipping channel: Bis(2-ethylhexyl)Phthalate; Phenanthrene; Anthracene; Fluoranthene; Pyrene; Benzo(a)Anthracene; Chrysene; Benzo(k)Fluoranthene; and Benzo(a)Pyrene. Further analysis of these substances will be included in the RAP.

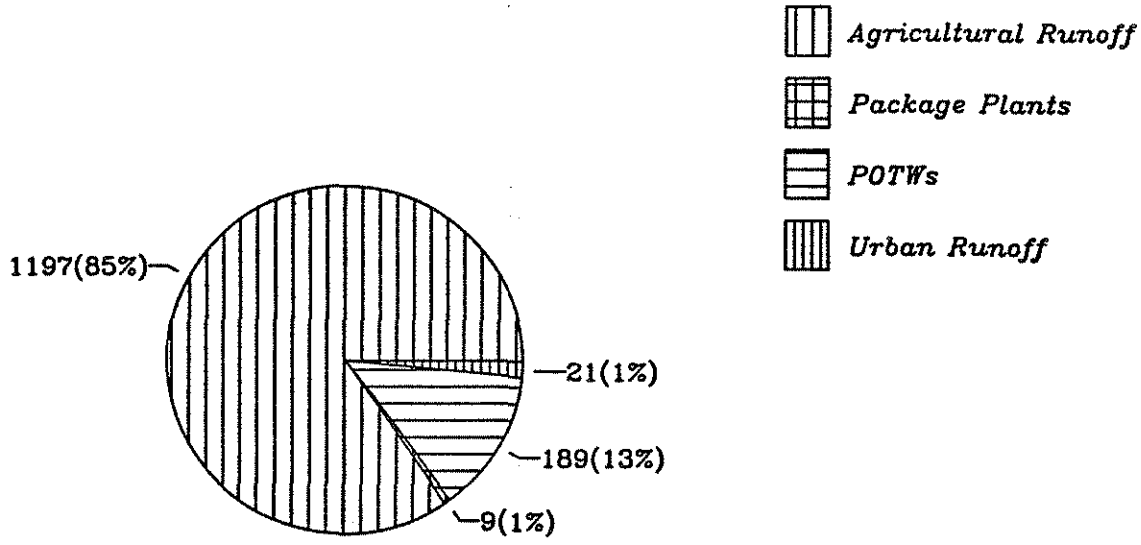
WATER POLLUTION SOURCES

SUMMARY OF PHOSPHORUS SOURCES

In terms of the greater Lake Erie Basin, phosphorus is considered the critical nutrient contributing to eutrophication (a natural aging process generally describing the fertility, mainly aquatic plant productivity, of lakes. This process is sped up if a lake receives an excess amount of nutrient pollutants, especially phosphorus.) Ohio EPA's Phosphorus Reduction Strategy for the Lake Erie Basin states that a total loading reduction of 1365 tons P/year needs to be achieved. This is for the entire Lake Erie Basin in Ohio, in which the Maumee Basin is one of the major sources. Total phosphorus loadings to the basin from various sources in the RAP area are estimated in the following chart.

PHOSPHORUS LOADINGS BY SOURCE

Figure 5: Maumee Basin AOC



Tons per year of Phosphorus

NPDES WASTEWATER DISCHARGE PERMITS

The National Pollutant Discharge Elimination System (NPDES) is a permitting system US EPA uses to regulate wastewater discharges. Permits are grouped into two broad categories: *Industrial* and *Municipal.* The municipal NPDES permits include city, county, and village-owned wastewater treatment plants. All other dischargers are considered industrial. Figure 4 shows the location of NPDES dischargers in the RAP area.

Industrial wastewater dischargers cover a broad range of types of facilities. Examples include treated chemical discharges from plating operations, cooling water from power generating stations, quarry dewatering from crushed stone producers, lime sludge from municipal water treatment plants, and treated process wastes from diverse manufacturers, such as food processing, automotive, plastics, and glass. Some NPDES permits fall into more than one category. For example, a manufacturer may have process wastes, site runoff, and a package sewage treatment plant. An NPDES permit deals with this situation by issuing discharge standards for three different outfall points.

There are presently 60 NPDES Permits in the RAP Area. The permit holders include 2 electric utilities, 2 landfill operations, 4 quarry and crushed stone producers, 4 municipal water treatment plants, 18 municipal wastewater treatment plants, and 30 industries or manufacturers.

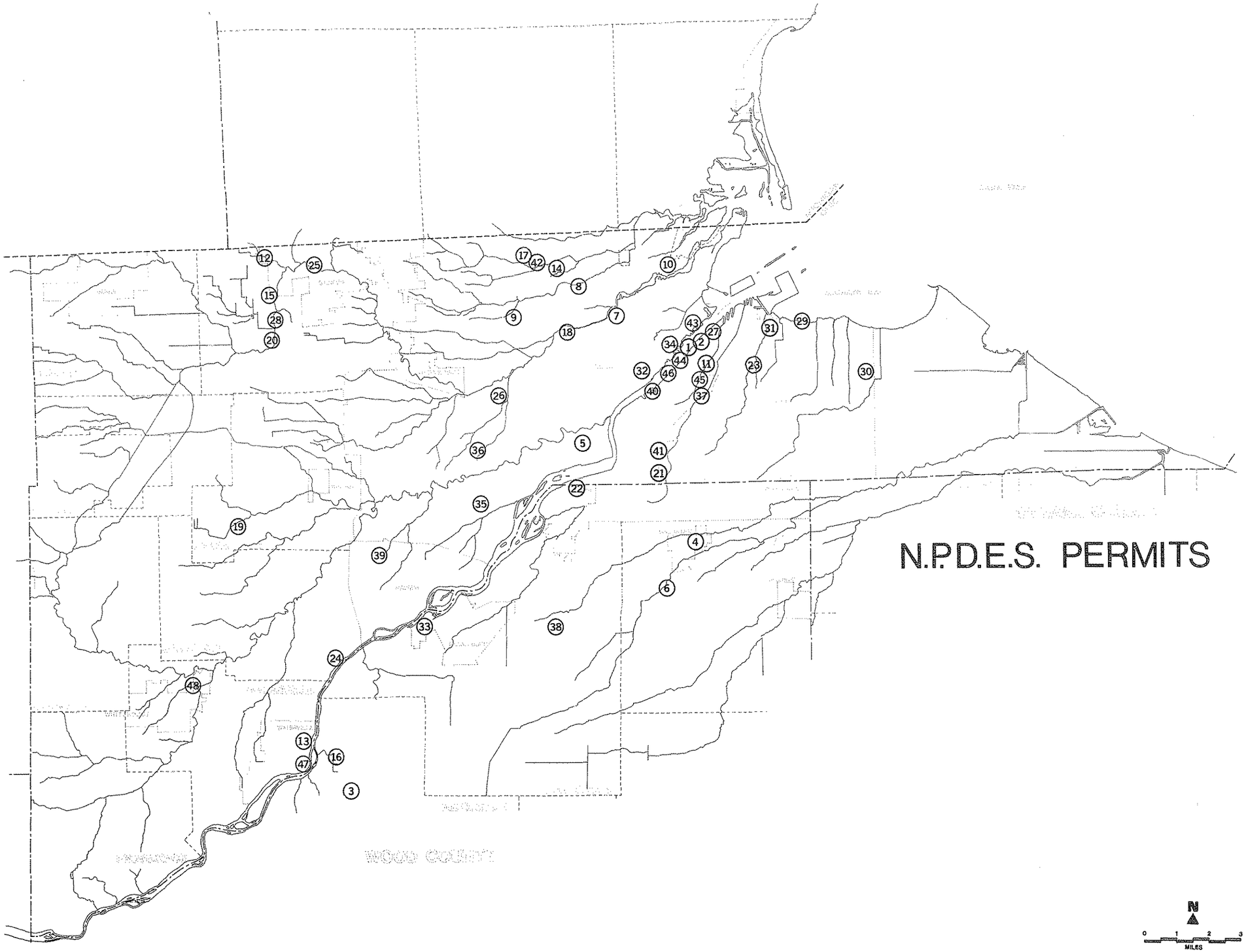
The largest dischargers include Toledo Edison with 760 million gallons per day (mgd) of cooling water at the Bayshore Plant and 406 mgd of cooling water at the Acme Station, followed by Sohio with 25 mgd of processed wastewater and sewage, Toledo Coke with 3.7 mgd of runoff and non-contact cooling water, and Sun Oil with 3 mgd of refinery waste, runoff, and non-contact cooling water.

When Ohio EPA finds a serious discharge pollution problem that does not appear likely to be solved voluntarily, the agency issues *Findings* of the problem, and *Orders* to abate it. There are no pending Findings and Orders for industrial NPDES dischargers in the Maumee Basin RAP Area. Ohio EPA notes that the Northwest District Office staff works closely with local industries to address NPDES permit violations and correct problems quickly as they are reported.

Problems do exist for some NPDES dischargers for which Findings and Orders have not been issued. These are noted in the listing of NPDES Dischargers, in Table 3.

Table 3
NPDES DISCHARGERS (REPRESENTED ON MAP)

MAP NO.	PROBLEM	FACILITY NAME	MAP NO.	PROBLEM	FACILITY NAME
1		Ashland Oil	25		Medusa Portland Cement
2		Atlantic-Richfield (inactive)	26		Midland-Ross Surface Combustion-Div.
3		Bowling Green WTP	27		Norfolk And Western R.R. Company
4		Chessie System-Walbridge Terminal	28		Northern Asphalt (inactive)
5	YES	Conrail	29		Oregon South Shore Park WWTP
6	YES	Conrail Corp. Stanley Yard	30		Oregon WTP
7		Diversi Tech General	31		Oregon WWTP
8	YES	Doehler-Jarvis/Farley Plant 2	32		Owens-Illinois, Libbey Plant 27
9		DuPont De Nemours, Automotive	33		Perrysburg WWTP
10		DuPont De Nemours, Chemical & Pigment	34		Petroleum Fuel and Terminal
11		Envirosafe Services of Ohio	35		Plaskon Electronic Materials
12		France Stone Co., Silica Plant	36		Standard Oil, Hill Ave. Terminal
13		France Stone Co., Waterville	37		Standard Oil, Toledo Refinery
14	YES	General Mills	38		Stoneco-Lime City Plant
15		Gerken Materials (inactive)	39		Stoneco-Maumee Plant
16		Haskins WWTP	40		Sun Petroleum-Marine Terminal
17		Hydra-Matic	41	YES	Sun Petroleum-Toledo Refinery
18		Jeep Corporation	42		Teledyne Industries
19		Kern-Liebers USA	43		Toledo Bay View Park WWTP
20	YES	King Road Sanitary Landfill	44		Toledo Coke
21	YES	Libbey Owens Ford #4 and #5	45		Toledo Collins Park WTP
22	YES	Libbey Owens Ford Glass Plant #6	46		Toledo Edison-ACME Station
23		Marathon Oil Company	47		Waterville WTP
24		Maumee River WWTP	48		Whitehouse WWTP



N.P.D.E.S. PERMITS

LOWER MAUMEE RIVER REMEDIAL ACTION PLAN - AREA OF CONCERN

MUNICIPAL WASTEWATER TREATMENT PLANTS

There are 12 active public sewage treatment plants ("publicly-operated treatment works", or "POTWs") in the RAP Area. These include city, county, and village sewage treatment plants, plus package plants that serve suburban or rural developments. Four of these plants are greater than 1 mgd. The larger treatment plants are required to meet specific effluent limits for BOD_5 and SS; plants treating more than 1.0 mgd are also required to get the effluent P concentration down to 1.0 ppm or less. Table 4 gives a summary of sewage treatment plant data for 1986 and Table 5 gives a summary of the POTWs, their effluent limits, and number of months in 1986 they failed to meet those standards.

TABLE 4
SUMMARY OF SEWAGE TREATMENT PLANT DATA FOR 1986

Treatment Facility	Design Flow (mgd)	1986 Flow (mgd)	BOD_5 Limit (ppm)	Months Over (1986)	SS Limit (ppm)	Months Over (1986)	P Limit (ppm)	Months Over (1986)
LUCAS COUNTY								
Fuller's Crk Est	0.27	0.10	30	1	30	1	---	-
Maumee River	15.0	9.01	30	0	30	0	1.0	0
Oregon (DuPont)	8.0	4.31	20	0	20	0	1.0	0
Oregon (S. Shore)	0.23	0.49	20	9	25	7	---	-
Toledo*	102	91.1	40	0	60	2	1.0	5
**			30		25		1.0	
Whitehouse	0.32	0.29	30	0	30	4	---	-
WOOD COUNTY								
Haskins	0.10	0.06	10	1	12	0	---	-
Perrysburg*	2.75	3.00	50	0	50	5	1.0	8
**			30		30		1.0	

* *Interim effluent standards*
** *Final effluent standards*
Note: Number of violations is the number of times the monthly average exceeded the 30-day average effluent limit.

Findings and Orders

Ohio EPA has current Findings and Orders issued for a number of smaller POTWs. Holders of NPDES permits were required under the Clean Water Act to be in compliance with their permits by July 1, 1988. That was the deadline for all Findings and Orders. Current Findings and Orders, the reason why they were issued, planned abatement actions, and present status are given in the following table:

TABLE 5
POTW FINDINGS AND ORDERS

SERVICE AREA/FACILITY	ORDERS TO:	ACTION	STATUS
Harbor View	Eliminate private systems	Tap into sewer	
Interchange-Five	Eliminate private systems	Build sewers	Under Construction
Maumee	CSOs	4-Phase project	Phase I Complete
Oregon S. Shore Pk	Effluent Limits	Tap into sewer	
Perrysburg	Effluent Limits	Expand WWTP	Under Design/ Construction
Whitehouse	CSOs, Effluent Limits	Tap into sewer	Under Design/ Construction

PACKAGE SEWAGE TREATMENT PLANTS

Package treatment plants frequently cause water quality problems. These are privately and publicly-owned treatment plants that serve mobile home parks, marinas, or restaurants in an unsewered area that produce too much wastewater for a septic tank. There are 119 package plants that discharge 2.09 mgd. Some are very well operated and maintained, but many are not.

Package plants cause problems for a number of reasons:

- *Lack of Training and Improper Operation and Maintenance*

Package treatment plant operation and maintenance is complicated. Often the responsibility of operating the plant falls with an untrained individual. This lack of training can result in many maintenance problems. In addition, maintenance work tends to be avoided because of the unpleasant nature of the work.

- *Lack of Enforcement*

Ohio EPA is responsible for the regulation of package plants. The main problem is that there are a lot of package plants. Lack of staff for field inspections and the issuance of enforcement letters has been a problem.

AGRICULTURAL RUNOFF WATER POLLUTION

The Maumee River flows through a predominantly agricultural landscape. As a result, the most prevalent water quality problem in the Maumee River is agricultural runoff which carries sediment, phosphorus, nitrogen, and pesticides into the river system.

Sediment

This is the most prevalent nonpoint pollutant by volume. It makes its way into the river system as a result of soil erosion. The problem stems from the predominance of agricultural land use, the extensive use of row-crop agricultural systems, and the soil characteristics of the Maumee River Basin. In spite of a low per acre rate of erosion, these factors create a significant water quality problem.

Phosphorus

This is the principle limiting nutrient in the cultural eutrophication of Lake Erie. It is also responsible for eutrophic conditions in the Lower Maumee River, Maumee Bay and their tributaries. Agricultural sources contribute about 64% of the total phosphorus load to the Lake. Therefore they have been assigned 64% of the necessary reduction. Nearly half of the required Ohio phosphorus reduction from agriculture will have to occur in the Maumee Basin.

Nitrogen

This is an essential plant nutrient that is applied to cropland as a fertilizer. Nitrates are soluble and are carried to the waterway with the runoff water, rather than the sediment. Tile effluent often carries nitrates to the waterways. Nitrate concentrations have exceeded standards on the Maumee River and drinking water alerts have been issued for communities that utilize the Maumee River for their drinking water supply.

Pesticides

These are used to control plant and animal pests and are usually applied in the spring and early summer. This is also when the concentrations of many of the commonly used pesticides increase in Lake Erie. Overall, concentrations of herbicides are greater than those of pesticides. Direct toxic effects of herbicides on aquatic life appears unlikely. However changes may be occurring in the existing aquatic plant communities which could eventually affect the fish and invertebrate communities. Pesticides are also a problem because they are difficult to remove from drinking water. In some cases, the finished tap water has concentrations similar to those of the untreated water.

OPEN WATER DISPOSAL OF DREDGED MATERIAL

The Corps of Engineers annually conducts maintenance dredging of the Toledo Harbor in order to maintain the depth of the shipping channel. This dredging produces about 1 million cubic yards of dredged material annually. In recent years (since 1960s), about 90 to 95% of the material was placed in one of the confined disposal facilities (CDF) at the mouth of Maumee Bay for settling and dewatering. In 1985, the Corps of Engineers proposed to change operations to the open lake disposal of about 60% of the material which is dredged from the Maumee Bay portion of the channel. US EPA approved this request for open lake disposal of portions of the dredged material with the following stipulation:

"Potentially adverse impacts of open-water disposal should be minimized by locating the open-water disposal sites in areas where the sediment will remain in-place and where biological productivity is relatively low."

Ohio EPA has provided annual Section 401 Water Quality Certifications (required for dumping operations) with special stipulations. In 1985 and 1986, the Corps of Engineers was required by Ohio EPA to conduct monitoring operations and to explore alternatives for the reuse and or disposal of the material other than open-lake disposal. In 1987, the annual 401 certification provided that open water disposal was to be phased out over a 5 year period with no open-lake disposal after 1991.

There are several affects of open water disposal that have negative impacts on the RAP Area of Concern.

- *Erosiveness and Incompatibility of Dredged Material with Substrate*

The material does not stay at the disposal site but is dispersed by the currents and wave action. Material from the Lake portion of the shipping channel is not similar in physical composition to the lake bottom surrounding the dump site: more silt in the dredged material, more clay in lake sediments, and much less sand in the dredged material. The dredged material is also higher in phosphorus. Therefore, the erosion and resuspension of the dredged materials results in the bottom sediments of the surrounding areas to be covered with lower quality dredged material.

- *Suspended Particulates / Turbidity*

During the dumping operations, a turbidity plume is created that is persistent for the duration of dumping operations and extends well beyond the one square mile of the dump site. The material can be spread around the Western Basin.

- *Water Quality Standards Violations*

A change in pH that violated Lake Erie Water Quality Standards was reported for 1985. The 1986 monitoring program detected several violations of Lake Erie Water Quality Standards both on and off the dump site, including copper, cadmium, iron, mercury, and dissolved solids.

- *Phosphorus*

Annual loading of bioavailable (useful for algae) phosphorus is 101 metric tons/year or 28% of the average annual Maumee River load.

- *Effect on Municipal Water Supplies*

The present dump site is within an area where currents carry the material to the water intake. The City of Toledo has requested that the dump site be moved to protect their water supply.

URBAN STORMWATER

Urban runoff is the third largest source of phosphorus in the RAP area, with an estimated 21 tons per year going to Lake Erie. Urban runoff is higher in suspended solids than sanitary sewage; the BOD is lower than that of sewage, but not low enough for runoff to be considered clean water. It is a significant source of nutrients, estimated to contribute 0.8 pounds of phosphorus per acre per year.

Ohio EPA, working under regulations established by US EPA, is preparing NPDES requirements for separate storm sewer outfalls. Municipal combined sewer outfalls are not affected, since those are already under NPDES permits. With the passage of the Water Quality Act of 1987 (WQA), sweeping changes have been made in these requirements. The WQA postpones application deadlines and staggers the dates, with the various deadlines falling between 1989 and 1994 for the different groups.

Storm runoff causes a serious pollution problem resulting from combined sewer overflows, or "CSOs". Almost every town has areas where sewage and runoff use the same, or "combined" sewers. See Figure 5 on following page. During a storm, runoff overloads these sewers, and causes a mixture of rainwater and raw sewage to overflow into the nearest receiving stream.

The City of Toledo has 67 combined sewage regulators along the Maumee River, Swan Creek and the Ottawa River. The City of Maumee has 10 regulators, with 6 overflows to the Maumee River. The City of Perrysburg has 3 overflow points to the Maumee River and 4 to Grassy Creek. The Village of Whitehouse has 8 overflow points to Disher Ditch, with three to Lone Oak Ditch. These overflows are known to cause pollution problems.

The City of Toledo has a grant of $6.3 million for Phases I and II for its CSO abatement project. The City of Maumee has a four-phased plan to separate its combined sewers, with completion scheduled for 1996.

Salt for deicing streets is a potential source of water pollution from urban runoff. If present in high enough concentrations, salt can be toxic to aquatic life. No data are available to indicate whether deicing salt causes problems in the RAP area.

COMBINED SEWER OVERFLOW AREAS

N

0 1 2 3
MILES

LOWER MAUMEE RIVER REMEDIAL ACTION PLAN - AREA OF CONCERN

HOME SEWAGE DISPOSAL

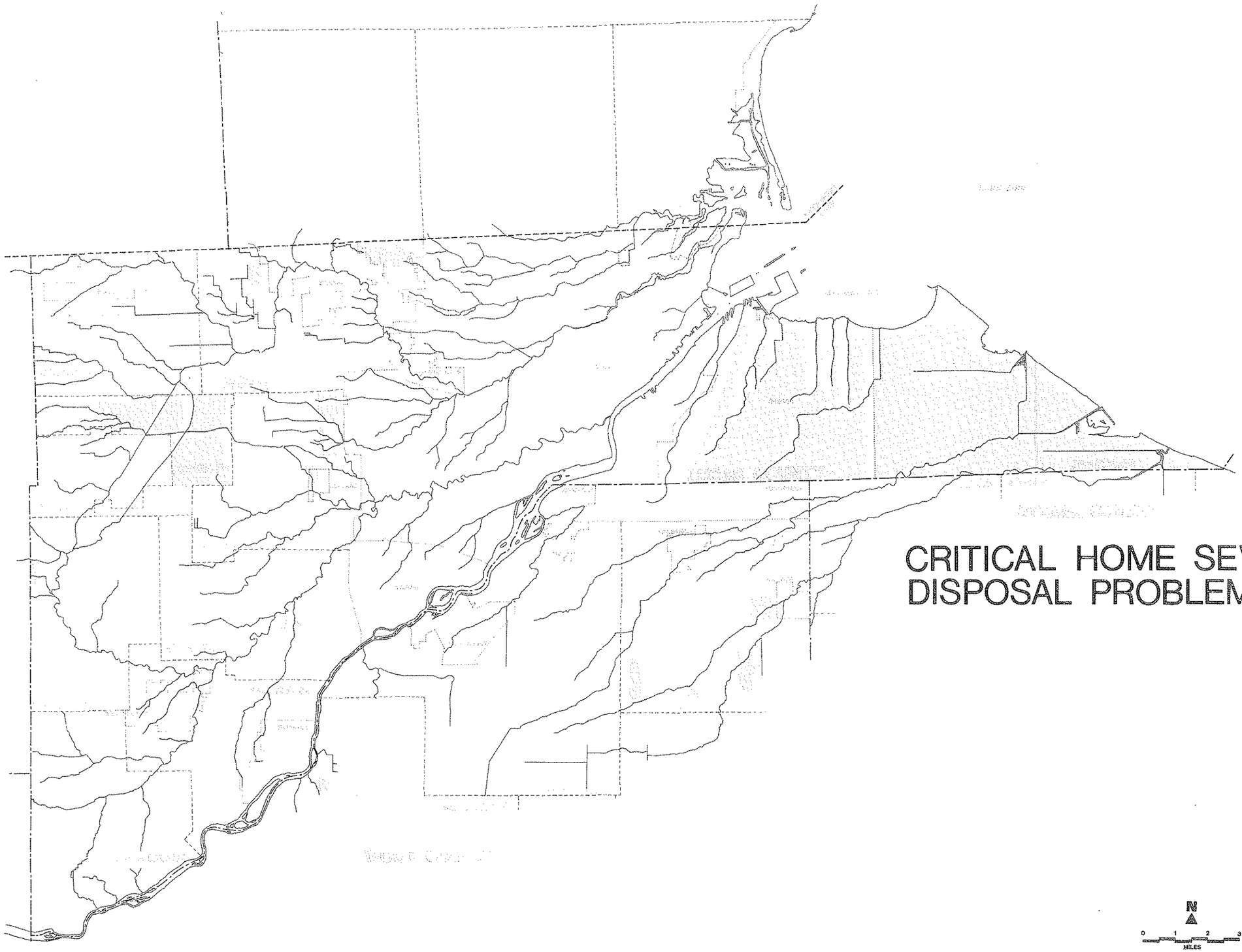
There are over 20,000 individual home sewage disposal systems and privies in the RAP area which affect ground and surface water quality. The report identifies those political subdivisions wherein leachate problems exist due to failing and/or poorly functioning systems. Critical Home Sewage Disposal Areas are shown in Figure 6 on following page.

Conditions will continue to worsen in areas where densities are high. It is imperative that high growth areas such as Sylvania and Springfield Townships and the City of Oregon in Lucas County be given highest priority for sewer construction with connection to existing wastewater treatment facilities.

A second area of concern are those areas not targeted for sewer connection in the near future. These are areas in eastern Lucas County and extreme western Lucas County, which are not near any sewer system. In Wood County this concern is largely confined to the urbanizing areas of Lake Township along Tracy Road and I-280, and in Millbury and Stony Ridge. Severe soil conditions, densities, lot size and high water table problems contribute to the overall problem.

A third area of concern is development in areas where soil conditions warrant building bans and in areas where systems are failing because of poor site selection in the past. These situations have resulted largely from inappropriate planning decisions and often left the local health department in a reactive position rather than in a guidance and advisory role for the development.

A fourth area of concern, primarily in Wood and Ottawa Counties, deals with reported problems in areas of high bedrock (less than 4 feet to the surface). Costs and cutbacks in federal funding will thwart the effect of public health improvements.



CRITICAL HOME SEWAGE DISPOSAL PROBLEM AREAS

N

0 1 2 3
MILES

LOWER MAUMEE RIVER REMEDIAL ACTION PLAN - AREA OF CONCERN

ACTIVE LANDFILLS / DUMPSITES

In past years, dumpsites were created by private companies and local governments. Generally these were created in a low area along a stream just at the edge of a populated area. Dumps were not designed to prevent leaching of the chemicals and liquidized substances into surface waters or groundwater.

The greatest concerns, identified in the *Investigation Report*, deal with the Dura Dump, the LOF Grinding Sand Settling Ponds, and the King Road Landfill. Concern is also expressed for the wall-to-wall dumps once sited in the floodplains of the Ottawa River. In addition, upstream on Ten Mile Creek, the King Road Landfill leaches heavy metals: cadmium, chromium, and lead, causing water quality problems.

The North Cove Landfill, formerly owned by American Motors, is leaching solvents, while further downstream on the Ottawa River, Lake Erie dilutes the leachates containing conventional pollutants and organic priority pollutants flowing from Dura, Stickney, and Tyler Dumps (all owned by the City of Toledo). The Dura Dump leachate contains high BOD, COD, and organics, among which include PCBs.

The degradation of Otter Creek is directly related to arsenic leaking from the LOF settling ponds created over 30 years ago (a 1986 Water Quality Investigation by OEPA pinpoints the source). In addition, Sun Oil Refinery causes the banks to be oil soaked, with nickel and cyanide which are also being detected. Lake Erie helps by diluting this industrial stream in the vicinity of the Evergreen, Fondessy, and Westover sites. The latter three sites now have leachate collection systems in place.

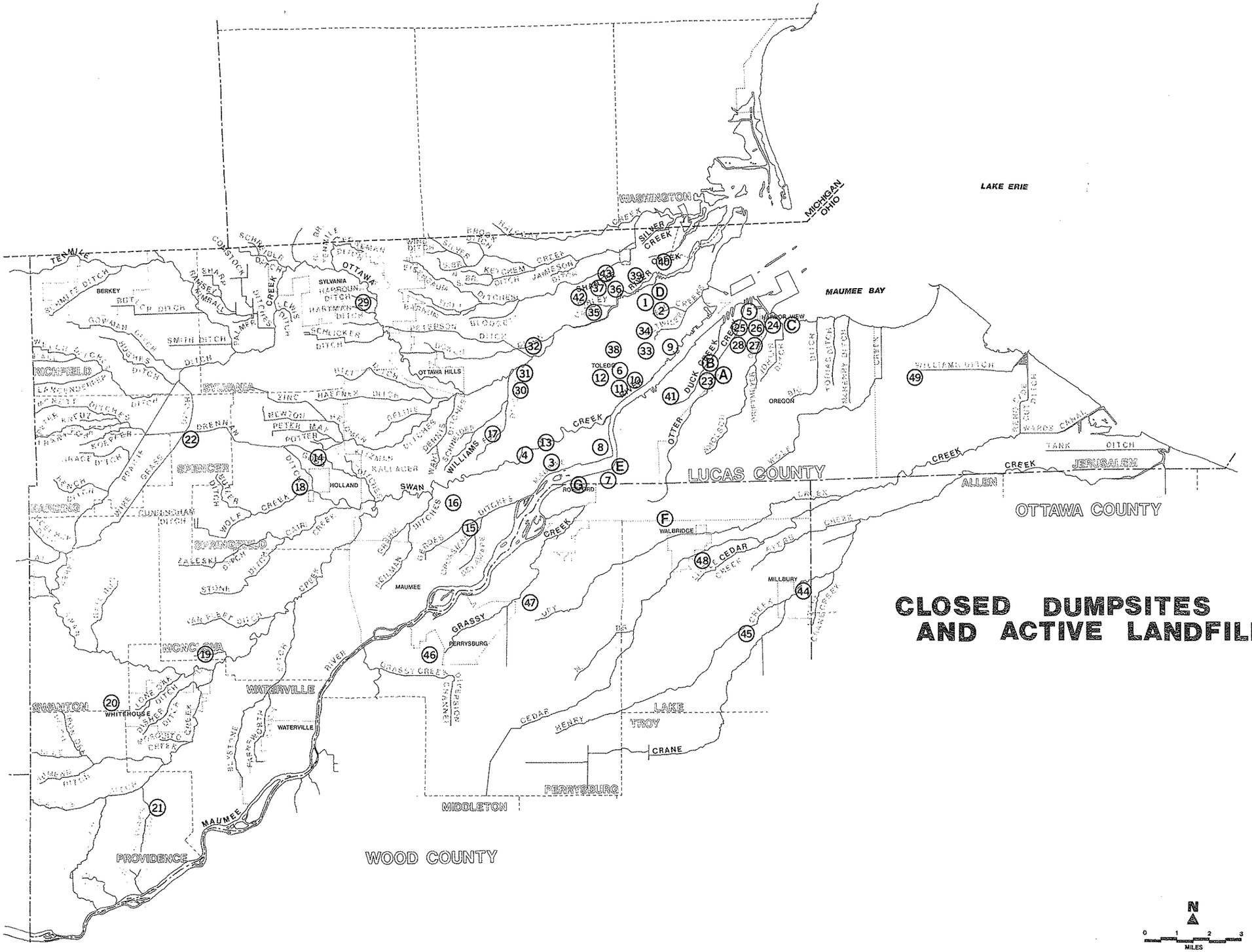
The ten dumpsites along Swan Creek do not appear to have made an impact on water quality, but this may be due to a lack of thorough investigation of sediments and fish sampling.

Figure 7 displays the seven licensed landfills and the 49 known closed dumpsites. Table 6 provides a listing of the sites along with a key for interpreting the map. The problem status is very brief, with the reader urged to consult the full investigation report for details.

Figure 8 illustrates the 36 sites which include some 68 impoundments. Table 7 lists the sites and is a key for the map. None of the pits, ponds or lagoons, as displayed, were lined by today's standards, nor were monitoring wells in place for water quality sampling purposes. The data shown are 10 years old and were taken from the OEPA *Surface Impoundments Assessment File.* Each site was evaluated at the time of the inventory, and included a table which scored the Groundwater Contamination Potential Rating (GWCPR). The highest GWCPR a site could receive is "29" while the lowest is "1".

TABLE 6
LICENSED SOLID WASTE LANDFILLS AND CLOSED DUMPSITES
(Represented on Following Map)

MAP NO.	FACILITY NAME	STATUS	PROBLEM
A	Fondessy Enterprises Landfill #1	Closed	
B	Westover Landfill	Closed	
C	Toledo Edison Co.		
	(Bay Shore Ash Landfill)	Active	
D	Hoffman Rd. Landfill	Active	
E	National Castings Landfill	Active	
F	Evergreen Landfill	Active	
G	Rossford Landfill	Active	Yes
1	Manhattan Dump (Miracle Park)	Closed	
2	Treasure Island Landfill	Closed	
3	South Ave. Dump	Closed	Yes
4	NL Industries		
	(Bunting Brass and Bronze)	Closed	
5	Gulf Oil Refinery	Closed	Yes
6	Owens-Illinois Inc.	Closed	Yes
7	Florence Street	Closed	
8	St. Mary's Street	Closed	
9	Columbus Street	Closed	
10	Buckeye Street	Closed	
11	Mulberry Street	Closed	
12	Buckeye Basin	Closed	
13	Western Ave.	Closed	
14	Angola Rd.	Closed	
15	Arlington Ave.	Closed	
16	Swan Creek Landfill	Closed	
17	Scott Park	Closed	
18	Holland Village	Closed	
19	Springfield- Monclova Township	Closed	
20	Swanton Township	Closed	
21	Providence Township	Closed	
22	Spencer Township	Closed	
23	Sun Oil of Pennsylvania	Closed	
24	Union Oil Co. of CA.	Closed	Yes
25	Heist Corporation	Closed	Yes
26	Standard Oil Co.	Closed	
27	Westover	Closed	Yes
28	Fondessy Landfill #1	Closed	
29	King Road Landfill	Closed	Yes
30	Owens-Illinois Inc.	Closed	
31	Owens-Illinois Inc.	Closed	
32	South Cove Blvd.	Closed	
33	Willys Park	Closed	Yes
34	Joe E. Brown Park	Closed	
35	North Cove Landfill	Closed	Yes
36	Sheller-Globe Corp.	Closed	
37	Tyler Street Dump	Closed	Yes
38	Stickney Ave. Landfill	Closed	Yes
39	Dura Dump	Closed	Yes
40	DuPont Waste Lagoon	Closed	
41	Consaul Street Dump	Closed	Yes
42	Jackman Road	Closed	
43	NL Industries/Doehler-Jarvis		
	Farley/Metals Inc.	Closed	
44	Millbury Village	Closed	Yes
45	Asman Dump	Closed	Yes
46	Perrysburg Township	Closed	
47	Perrysburg City	Closed	
48	Walbridge-Lake Township	Closed	
49	Jerusalem Township	Closed	

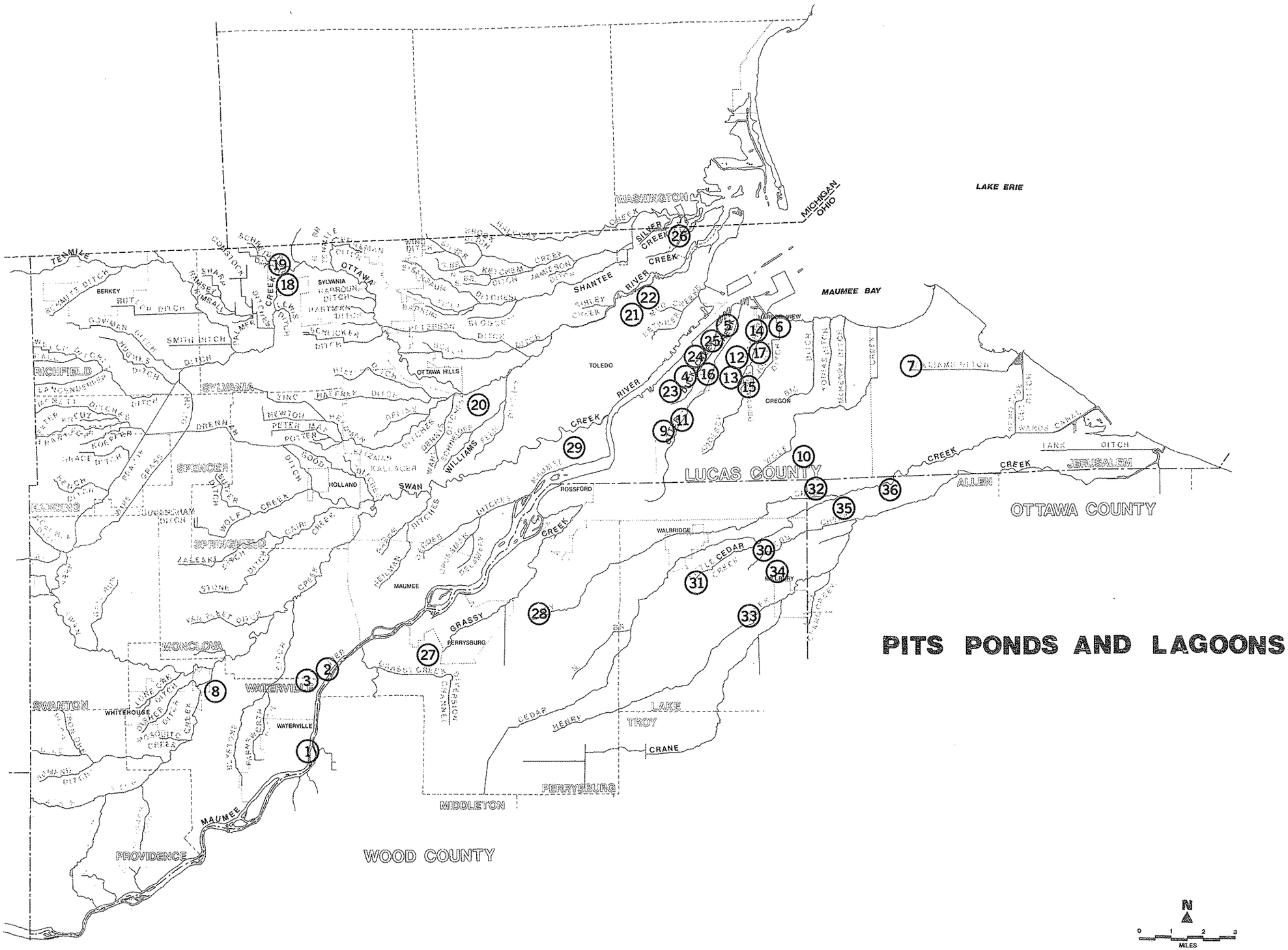


CLOSED DUMPSITES AND ACTIVE LANDFILLS

LOWER MAUMEE RIVER REMEDIAL ACTION PLAN - AREA OF CONCERN

TABLE 7
LIST OF IMPOUNDMENTS
(Represented on Following Map)

MAP NO.	FACILITY NAME	GWCPR	MAP NO.	FACILITY NAME	GWCPR
1	Waterville Water Treatment	13	19	Medusa Cement Co.	15
2	Johns-Manville Products Corp.	17	20	Cleveland Metal Abrasive Co.	16
3	Johns-Manville Products Corp.	16	21	Incorporated Crafts Inc.	17
4	Consolidated Dock Inc.	19	22	Royster Co., Inc.	15
5	Gulf Oil Co.	16	23	Toledo Water Treatment Plant	16
6	Toledo Edison Co.	17	24	Norfolk and Western Railway	18
7	Oregon Water Supply	18	25	Westway Trading Corp.	
8	American Can Co.	17	26	General Motors Corp.	18
9	Libbey-Owens-Ford Co.	16	27	Owens-Illinois Inc.	14
10	Libbey-Owens-Ford Co.	14	28	Maumee Stone Co.	23
11	Sun Oil Co. Of Penn	16	29	Penn Central Transportation	18
12	Phillips Petroleum Co.	13	30	C&O RR	15
13	C.H. Heist Corp.	14	31	Burndy Corp.	17
14	Commercial Oil Services, Inc.	18	32	Hirzel Canning Co.	16
15	Bills' Road Services	17	33	Standard Oil Co. Of Ohio	15
16	Fondessy Enterprises, Inc.	17	34	Molnar Packing Co.	13
17	Standard Oil Of Ohio	16	35	Permaglass Div. of Guardian Industries	13
18	Northern Ohio Asphalt Paving	17	36	Stokley-Van Camp, Inc.	17



PITS PONDS AND LAGOONS

LOWER MAUMEE RIVER REMEDIAL ACTION PLAN - AREA OF CONCERN

ATMOSPHERIC DEPOSITION

According to the *Summary of the Great Lakes Water Quality Board Report to the International Joint Commission, November 1987*, available evidence indicates that atmospheric deposition is a major pathway for contamination of the Great Lakes ecosystem. Lead releases, into the atmosphere, primarily from automotive exhausts, have decreased with a decline in the use of leaded gasoline in the United States and Canada. Atmospheric transport and deposition of certain pesticides (e.g. DDT) into the Great Lakes continues, even with bans or severe restrictions on usage in effect in the United States and Canada. These chemicals are still manufactured and used in other locations of the world. Without a worldwide ban of these chemicals, appreciable contamination of the Great Lakes ecosystem will continue indefinitely.

Acid Rain

The US EPA's Great Lakes National Program Office has operated the Great Lakes Atmospheric Deposition (GLAD) network since early 1981. A GLAD precipitation sampling station had been located near Maumee Bay in Oregon from 1981 through 1985. Budget constraints eliminated this station. During the period when the station was in operation, the process consisted of collecting weekly samples and checking pH and conductivity prior to sending the sample to the GLAD laboratory for further analysis. The results for pH on a quarterly average showed a low 3.6 for early 1984, with 9 quarterly averages at about 4.1.

The pH of neutral, unpolluted rain is about 5.6. Because the pH scale is logarithmic, rain with a pH of 4.6 is ten times as acidic as "normal" rain, while rain with a pH of 3.6 would be 100 times as acidic. The RAP area is most fortunate in that the acidic rainfall is buffered by our naturally occurring limestone bedrock and local soils which apparently mitigate the ecological effects of acid rain on our receiving streams.

TABLE OF REFERENCED ELEMENTS

Symbol	Element	Symbol	Element
Ag	Silver	Fe	Iron
As	Arsenic	Hg	Mercury (heavy metal)
Ba	Barium (heavy metal)	K	Potassium
Be	Beryllium (heavy metal)	Mn	Manganese
C	Carbon	N	Nitrogen
Cn	Cyanide	Na	Sodium
Cd	Cadmium (heavy metal)	Ni	Nickel (heavy metal)
Cl	Chlorine	P	Phosphorus
Cr	Chromium (heavy metal)	Pb	Lead (heavy metal)
Cu	Copper	Se	Selenium
F	Fluoride	Zn	Zinc (heavy metal)

GLOSSARY

$\mu g/l$	Micrograms/liter (parts per billion)
BOD, BOD_5	*Biochemical Oxygen Demand*. This is a water quality parameter which serves as an indirect measure of the amount of organic matter (food) available for bacteria in a water sample. It measures the amount of oxygen, in pounds, needed to support the growth of bacteria in a water sample over a specified period of time; usually 5 days.
BWQR	Biological Water Quality Report: a detailed water quality survey of a stream reach conducted by OEPA. BWQRs were formerly known as CWQRs (Comprehensive WQR).
CDF	*Confined Disposal Facility*. Diked areas in Maumee Bay which are used to hold and dewater sediments dredged off the bottom of the shipping channel.
COD	*Chemical Oxygen Demand.* An indirect measurement of the amount of carbon (food) in a water sample. This test is somewhat similar to the BOD test, in that it measures the pounds of oxygen needed to use up (oxidize) the carbon in a water sample. The COD uses chemicals to determine the amount of oxygen needed, while the BOD test is a biological test.
CSO	Combined sewer overflow
CL,Cl^-	Chlorine, chloride. Chlorine is a poisonous gas commonly used to kill germs in treated sewage or drinking water. Chloride is an electrolyte, a "salt" (sodium chloride), and is not a disinfectant.
Corps	US Army Corps of Engineers
Combined sewage	Sanitary sewage and stormwater combined. Ideally, sanitary sewage and stormwater are carried in separate pipelines. In many inner-city areas, however, there is only one sewer system, and it carries combined sewage.
Conductivity (cond.)	A specific laboratory test for determining the conductivity of a water sample. It indicates the quantity of dissolved electrolytes in a sample.
DO	Dissolved oxygen. Amount of oxygen dissolved in a water sample (in mg/l or ppm). DO is necessary for the survival of fish and other aquatic life.
EPA	Environmental Protection Agency. US EPA is the Federal agency, and Ohio EPA is Ohio's statewide equivalent.

Eutrophication	A natural aging process generally describing the fertility (mainly aquatic plant productivity) of lakes. This process is speeded up if a lake receives an excess amount of nutrient pollutants, especially phosphorus.
Fecal Coliform	Bacteria which when found in large numbers in a water sample, indicate the presence of untreated sewage.
ICI	Invertebrate Community Index: a numerical measure of water quality as reflected by a stream's ability to support aquatic life.
IJC	International Joint Commission
kg	Kilogram(s): 1000 grams. A kilogram is slightly more than two pounds.
LM	Lake mile. How many miles downstream (and out into Lake Erie) a given point is from the mouth of the Maumee
Leachate	Liquid that leaks out of a landfill or or dump; usually ground or surface water highly contaminated with wastes from the dump or landfill.
MG	Million gallons
mg	Milligram(s): a thousandth of a gram. There are 454 grams to a pound.
mg/kg	Milligrams per kilogram
mg/l	Milligrams per liter (= ppm)
mgd	Million gallons per day
ml	Milliliter(s): a thousandth of a liter. A liter is slightly less than a quart.
MP	Mile point. How many miles upstream (above) the mouth of a stream a given point is. See RM.
NH_3	Ammonia: a form of nitrogen, which is a pollutant.
Nitrate/NO_3	A form of nitrogen, which is a pollutant
Nitrite/NO_2	A form of nitrogen, which is a pollutant.
NPDES	National Pollutant Discharge Elimination System. Refers to a permit which is required in order to discharge wastewater to a stream. This permit dictates how clean the water must be before it can be discharged.
O/G	Oil and grease. In water quality monitoring, refers to a specific chemical test for amount of oils in a sample.
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
PAH	*P*olynuclear *A*romatic *H*ydrocarbons
PCB	Polychlorinated Biphenyls. Organic chemicals which, during the 50 years they were manufactured and used, an estimated 400 million pounds entered the environment, according to US EPA Hazardous Waste laboratory. Their use ranged from dielectric oils to carbonless paper production. A colorless liquid, it was used as an insulating fluid in electrical equipment: e.g., transformers, capacitors, because of its stability and heat resistance. PCBs are a suspect carcinogen. A significant health impact has been linked to incomplete combustion of PCBs. The oxidation of PCBs form dioxins and furans, the most toxic of all man-made substances. They have been found in measurable concentrations in waterways and sediments throughout the world, and are widely-spread contaminants of fish and wildlife resources. PCB contamination began in an era when industrial wastes were disposed of by flushing them directly into waterways, local sewage treatment plants, or landfills.

PEMSO	*P*lanning and *E*ngineering *D*ata *M*anagement *S*ystem for *O*hio (PEMSO) system, which Ohio EPA uses for classifying stream segments, modeling pollution sources, and their effects on water quality. Related watershed classification systems: TMACOG uses smaller watersheds, which are generally a subset of the PEMSO watersheds. The third system is *L*and *R*esources *I*nformation *S*ystem (LRIS), developed for the 208 program, and further defined for the Lake Erie Wastewater Management Study (LEWMS).[16] LRIS watersheds are usually, but not always, the same as TMACOG's.
pH	A measure of acidity or alkalinity, on a scale of 1 to 14. Neutral is 7.0; lower values are acidic, and higher values are alkaline (basic).
POTW	Publicly-Operated Treatment Works. A wastewater treatment facility operated by a city, village, or county that treats primary domestic sewage. Usually refers to a municipal sewage treatment plant.
ppb	Parts per billion (= μg/l)
ppm	Parts per million (= mg/l)
RM	River mile: how many miles upstream (above) the mouth of a stream.
Regulator	A device used to control the bypass of untreated combined sewage to a stream. The purpose of the regulator is to allow the system to bypass combined sewage when the system is overloaded from stormwater; but to prevent bypasses during dry weather.
SS	Suspended solids: in water quality sampling, the weight of solids (in mg) suspended in a milliliter (ml) of water.
TESD	Toledo Environmental Services Division: a division of the City of Toledo which is responsible for performing air and water quality monitoring in Toledo. Formerly TESA (*Agency*).
TKN	Total Kjeldahl Nitrogen: a specific chemical test used to determine how much of certain forms of nitrogen are in a water sample. It includes organic and ammonia nitrogen, but excludes nitrites and nitrates.
TMACOG	Toledo Metropolitan Area Council of Governments: regional planning agency for Lucas, Wood, Ottawa, Sandusky and Erie Counties in Northwest Ohio, and Erie, Bedford, and Whiteford Townships in Monroe County, Michigan
tpy	Tons per year
Turbidity (turb.)	Turbidity: a measure of whether or not water is clear. When used in terms of water quality monitoring, it refers to a specific test used to quantity *how* turbid a water sample is.
USGS	United States Geological Survey. Federal agency involved in detailed mapping of the U.S., and surface and groundwater monitoring.
WQ	Water quality
WQA	Water Quality Act of 1987
WTP	Water Treatment Plant. Usually refers to a municipal plant for producing city drinking water.
WWH	Warmwater Habitat: a stream classification used by Ohio EPA to set the water quality standards for a stream. Warmwater standards are not as stringent as Coldwater.
WWTP	Wastewater Treatment Plant. Usually refers to a municipal treatment facility, and often used interchangeably with "Sewage Treatment Plant".