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Maumee River REMEDIAL ACTION PLAN

Stage I Investigation Report

Executive Summary

October 1990

Maumee River Remedial Action Plan Advisory Committee

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Introduction

The Lower Maumee River Basin is one of 42 Areas of Concern (AOC) identified in 1985 by the Water Quality Board of the International Joint Commission (IJC). An AOC is an area with pollution problems so severe they impair the beneficial uses of the local water body. Heavy metals and organic chemical contamination have led to the basin being classified as an AOC. The Lower Maumee River Basin contains four major subbasins which include the Maumee River mainstem, Swan Creek, Ottawa River and Lake Erie Tributaries (See Figure 1). These subbasins drain portions of Lucas, Ottawa and Wood counties into Maumee Bay or Lake Erie.

The Maumee River is the largest tributary to the Great Lakes with a mean discharge to Lake Erie of 5,000 cfs (Horowitz, et al. 1975). The Maumee River Basin is intensely developed by agriculture, oil refining, petrochemicals, metal industries, auto parts, heavy machinery and other industries. This development generates pollution which, in turn, caused the basin to become an Area of Concern (AOC).

All of the streams in the Lower Maumee River Area of Concern have been assigned the following designated uses: Warmwater Habitat (WWH), Agricultural and Industrial Water Supply, and Primary Contact Recreation (PCR). Primary contact means the water is deep enough to support full contact recreational activities. The area is a corridor for migrating birds, and the Maumee River is an important spawning and nursery area for many species of game and forage fishes. It also is home to over 80 plants that are listed as endangered or threatened species. There must be improvement in air and water quality if all of these uses are to continue.

Existing water uses include public water supply, sport and commercial fishing, commercial navigation and recreation. Coastal and estuarine marshes provide habitat which supports a multitude of fauna and flora.

All of the cities and villages in the AOC use surface water for public water supply, except for the Village of Whitehouse uses ground water. Sediments, turbidity, and nitrates cause the most problems for treatment plants in the AOC.

Sport and commercial fishing occurs in Lake Erie and the Maumee Bay, whereas only sport fishing occurs in the rivers and streams. In 1987 and 1988, a public health advisory was issued against the consumption of carp and channel catfish taken from Lake Erie which affects Maumee Bay and the estuarine portion of the Maumee River.

The only commercial navigation route in the AOC is the Toledo shipping channel which begins near the I-75 bridge (RM 7.0) and extends out into Maumee Bay to Lake Mile (LM) 18. The channel receives a heavy sediment load from the Maumee River, and the U.S. Army Corps of Engineers must dredge approximately one million cubic yards of material from the channel each year.

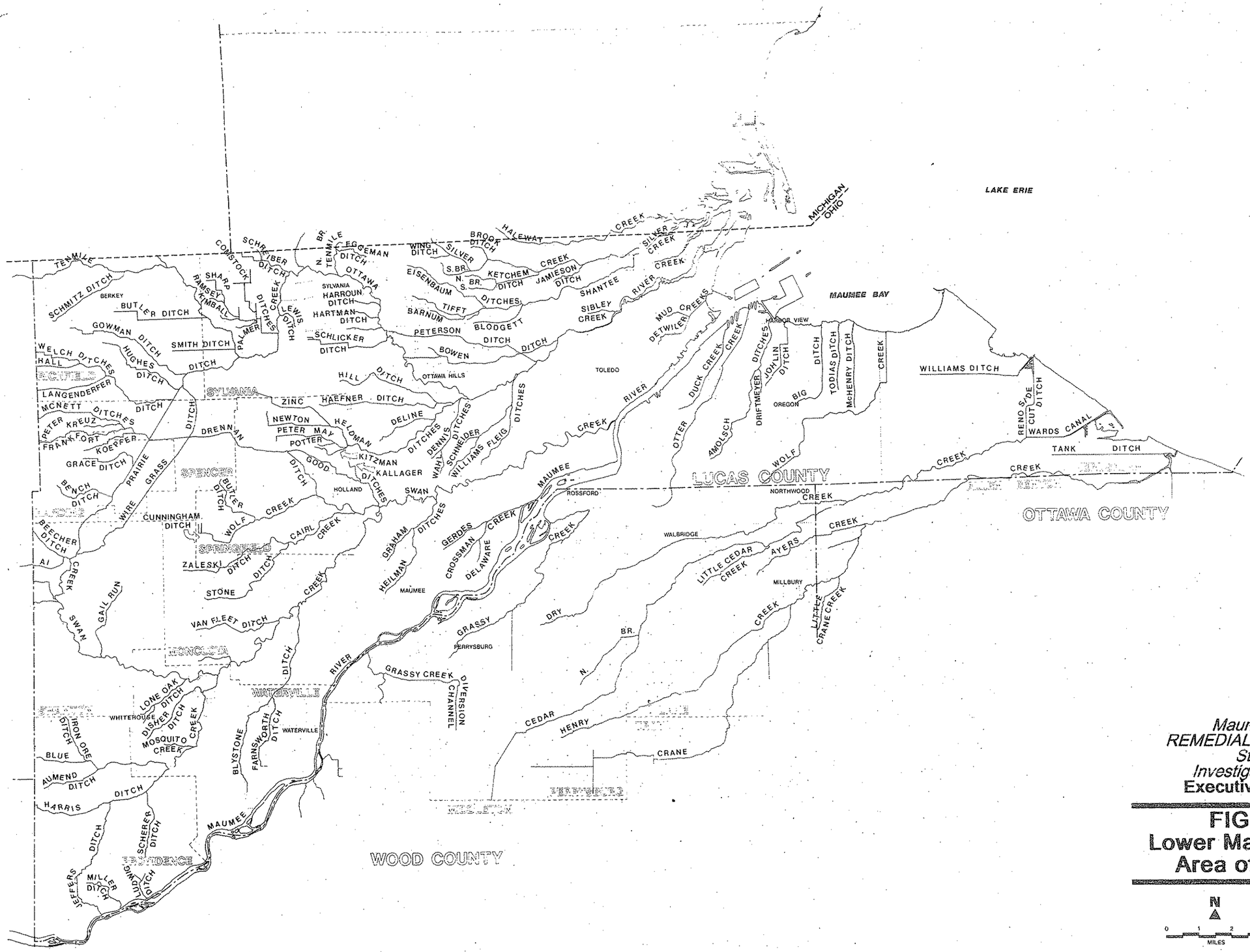

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FIGURE 1
Lower Maumee River Area of Concern

The Lower Maumee River Basin has pollution problems caused by excess sediments, nutrients and toxics entering the system (See Table 1). It has been designated an AOC because of the heavy metals and organic chemical contamination in the sediment. Sedimentation, turbidity and nitrates cause the biggest problem for public drinking water supplies. Erosion causes problems to navigation on the Maumee River and Bay because of an increase in sediments. The stream segments in the AOC are moderately to heavily polluted, depending on the particular metal and sampling point. Sources of water pollution in the AOC include municipal and industrial wastewater dischargers, municipal wastewater treatment plants, package sewage treatment plants, agricultural runoff, open water disposal of dredged material, urban runoff, home sewage disposal systems, industrial landfills, public landfills, and atmospheric deposition. The major source of metals is industrial waste dischargers, such as metal finishers or oil or chemical processors.

SOURCES OF WATER POLLUTION

NPDES Wastewater Discharge Permits

The National Pollutant Discharge Elimination System (NPDES) is the permitting system U.S. 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 2 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 metal 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 limits for three different outfall points.

At present, NPDES permits in the Maumee RAP area follow this breakdown:

Municipal NPDES Permits

4 NPDES permits are issued to municipal water treatment plants.
17 NPDES permits are issued to sewage water treatment plants.

Industrial NPDES Permits

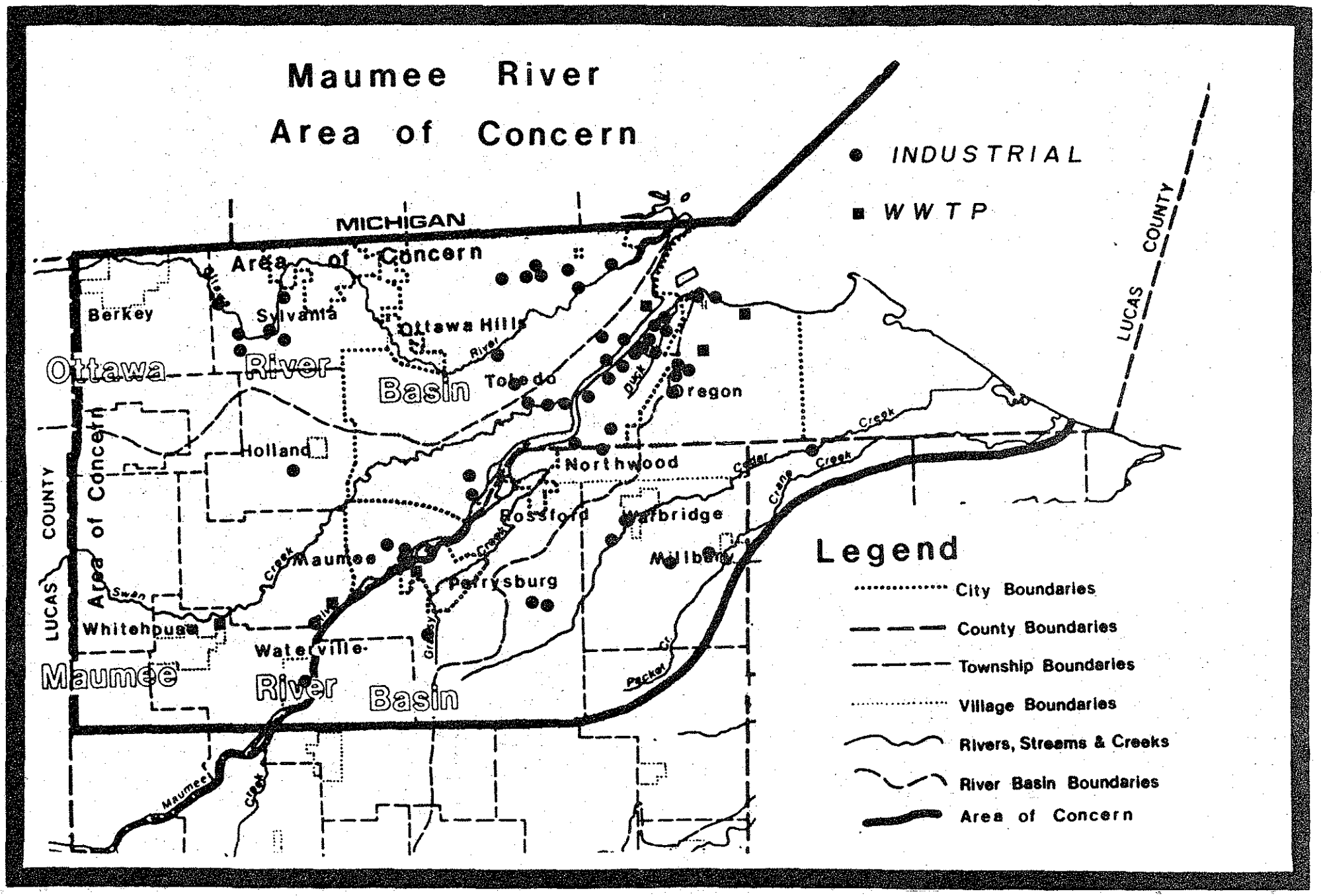
2 NPDES permits are issued to electric utilities.
2 NPDES permits are issued to landfill operations.
4 NPDES permits are issued to quarry or crushed stone producers.
33 NPDES permits are issued to other industrials and manufacturing dischargers.
62 NPDES permits total.

Table 1: Summary of Environmental Problems for the Lower Maumee River

Potential Use Impairment	Maumee Rv	Maumee Bay	Ottawa Rv	Swan Cr	Otter Cr	Delaware Dt	Grassy Cr	Hill Dt	Silver Cr	Shantee Cr	Heilman Dt
Restrictions on fish & wildlife consumption	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No
Tainting of fish and wildlife flavor	No	No	No	No	No	No	No	No	No	No	No
Degraded fish and wildlife populations	Yes	No	Yes	Yes	Yes	No	No	No	No	No	No
Fish tumors or other deformities	Yes	No	Yes	Yes	No	No	No	No	No	No	No
Bird or animal deformities or reproductive problems	No	No	No	No	No	No	No	No	No	No	No
Degradation of benthos	Yes	No	Yes	Yes	Yes	No	No	No	No	No	No
Restrictions on dredging	Yes	No	No	No	No	No	No	No	No	No	No
Eutrophication or undesirable algae	Yes	Yes	No	No	No	No	No	No	No	No	No
Restrictions on drinking water consumption or taste & odor problems	Yes	No	No	No	No	No	No	No	No	No	No
Beach closings	No	Yes	No	No	No	No	No	No	No	No	No
Degradation of aesthetics*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Added costs to agriculture or industry	No	No	No	No	No	No	No	No	No	No	No
Degradation of phytoplankton and zooplankton populations	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Loss of fish and wildlife habitat	No	No	No	No	No	No	No	No	No	No	No

* After a rainstorm

FIGURE 2: NPDES Discharges



Industrial Dischargers

There are no pending Findings and Orders for industrial NPDES dischargers in the Maumee Basin RAP area. Largest dischargers include Toledo Edison with 760 million gallons per day (mgd) of cooling water and sewage at the Bayshore Plant and 406 mgd of cooling water at the Acme Station. Sohio is next with 25 mgd of processed wastewater and sewage, followed by 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. All of these facilities are in compliance with their NPDES permits.

Municipal Wastewater Treatment Plants

There are 8 active public sewage treatment plants [publicly-operated treatment works (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 one mgd. The larger treatment plants are required to meet specific effluent limits for BOD and suspended solids (SS); plants treating more than 1.0 mgd also are required to get the effluent phosphorus concentration down to 1.0 mg/l or less. Table 2 gives a summary of the POTWs, with their effluent limits, and number of months in 1986 they failed to meet those standards.

TABLE 2
SUMMARY OF PUBLIC SEWAGE TREATMENT PLANT DATA FOR FINAL EFFLUENT (1989)

Treatment Facility	1989 Average Flow (mgd)	BOD Limit (ppm)	Average BOD Conc (1989)	SS Limit (ppm)	Average SS Conc (1989)	P Limit (ppm)	Average P Conc (1989)
LUCAS COUNTY							
Maumee River	10	30	13	30	14	1.0	.74
Oak Openings (Industrial Park)	0.061	10	48	12	151	---	---
Oak Terrace	.176	10	6.5	12	22		
Oregon (DuPont)	4	20	6	20	10	1.0	0.75
Toledo*	77	40	14	60	23	1.0	.69
Whitehouse	0.25	30	37	30	38	---	5
WOOD COUNTY							
Haskins	0.072	---	---	12	8	---	1.5
Perrysburg*	3.00	50	15	50	18	1.0	0.55

Source: 1989 LEAPS Data.
* Interim effluent standards

Findings and Orders

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

Harbor View

Harbor View has sanitary sewers but cannot use them because they do not connect to a treatment plant. While these sewers are planned ultimately to be connected to the Oregon sanitary sewer system, there is no project underway at present.

House of Correction

The City of Toledo owns and operates the House of Correction. The old treatment plant, which was not providing adequate sewage treatment, has been replaced.

Interchange Five Area

Sanitary sewers to serve the Interchange Five area in Wood County have been installed. These sewers connected to the existing Wood County sanitary sewer system. All but one of the package plants in the area is out of service. Wastewater will receive treatment at the Toledo Bay View WWTP.

Maumee

The City of Maumee plans to separate its combined sewers into four phases, spaced at three-year intervals. The first phase has been completed. The separation program is scheduled for completion in 1996 and will result in the elimination of 90 percent of bypasses.

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 in the AOC that discharge a total of 2.02 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

The treatment process that package plants use is complicated and, unless the operator has received formal training, probably will not understand it. Operation usually falls to a janitor, the manager, or the owner of the facility, depending on the particular situation. In most cases, the person operating the package plant has not had any training at all. Lack of understanding also results in many maintenance problems. Also, maintenance work tends not to get done for the simple reason that most people consider working on the sewage plant an unpleasant job.

° Lack of Enforcement.

Ohio EPA has responsibility for enforcement for package plants but does not have a large enough staff to handle the many different package plants that need monitoring and enforcement. The main problem is that there are a lot of package plants. Lack of staff to do field inspections and write enforcement letters has been a long-standing problem.

Agricultural Runoff Water Pollution

The principal source of the sediment, phosphorus, nitrate and organic chemicals that pollute the Lower Maumee AOC are the croplands of the Maumee River Basin. Phosphorus and sediment have received the majority of the attention because phosphorus has been identified as the critical pollutant in Lake Erie, and sediment has been identified as the vehicle for transporting phosphorus. Nitrogen and pesticides have both received greater attention in recent years as public health issues.

Sediment

Sediment by volume is considered to be the most prevalent nonpoint source pollutant affecting the Lower Maumee AOC. Sediment enters the Maumee River because of soil erosion caused by rainfall, flowing water or wind action.

Soil erosion rates (per acre) in the Maumee River Basin generally are low, but because of the large amount of land in agriculture, erosion from cropland poses a major pollution problem. The sediment load in the Maumee River at high flow has been measured to exceed 150,000 tons per day. This can accumulate to nearly 2 million tons per year with 1.2 million tons per year being the average annual sediment load for the Maumee River to Lake Erie. There are numerous problems created by suspended and deposited sediment in the Lower Maumee River.

The State of Ohio Phosphorus Reduction Strategy for Lake Erie (Ohio EPA, 1989) shows that there were 3.3 million acres of cropland in the Ohio portion of the Maumee River Basin and the RAP area in 1980. This was estimated to yield approximately 6.4 million tons of sediment at the edge of the field (soil that that was eroded from the field) or 1.9 tons/acre/year. About 14 percent of this will be delivered to the RAP area. The erosion rates per acre are low but, because of the large number of acres in cropland, the total load to the river basin is high.

Phosphorus

Phosphorus has been identified as the critical pollutant in the eutrophication of Lake Erie, the Lower Maumee River, Maumee Bay and the tributaries of both.

The Lake Erie Wastewater Management Study concluded that even after the major wastewater treatment plants had achieved the 1.0 mg/l standard for phosphorus, there still would be a need to reduce phosphorus contributions to Lake Erie from nonpoint sources by 47 percent in order to upgrade the Western and Central basins of Lake Erie (USCOE, 1973).

Ohio has prepared the State of Ohio Phosphorus Reduction Strategy for Lake Erie which sets out Ohio's plan to reduce phosphorus loads to approximately 1,400 metric tons. Agricultural sources are considered to contribute about 64 percent of the total phosphorus load to the lake and, therefore, they have been assigned 64 percent of the reduction or 890 metric tons/year of phosphorus. The strategy identifies 112 watersheds that are to receive priority treatment with conservation tillage to be adopted on about 50 percent of the acreage. Fifty-seven of th' e watersheds are located in the Maumee River Basin and the RAP area and c .ntain nearly 1.2 million acres of cropland that are contributing about 1,200 metric tons of phosphorus. The strategy proposes that this contribution would be reduced by 450 metric tons on these 57 watersheds. This is about half of the required Ohio phosphorus reduction from agriculture.

Nitrogen

Nitrogen is an essential plant nutrient and is applied to cropland as a fertilizer. Nitrogen also is a nutrient for aquatic plants although it is less of a limiting nutrient than phosphorus. Concentrations of nitrate nitrogen increase during runoff events. However, nitrates are soluble and are carried to the waterway with the runoff rather than adsorbed to sediment as is phosphorus. Tile effluent often carries nitrates to the waterways.

The nitrogen export rate for the Maumee River Basin has been reported at 19 kg/hectare/year (17.1 lb/acre/year) (Heidelberg College, 1987). This is about 50 percent of the amount of fertilizers applied by farmers in the basin each year and represents a significant loss to these farmers.

Nitrate concentrations have exceeded the 10 mg/l standard for public water supply on the Maumee River 2.3 percent of the time over the past eight years. These events occurred usually during May, June and July when fertilizer application and runoff events are both likely. Over the past eight-year period, the nitrate level has been between 6.0 and 10.0 mg/l 24 percent of the time. Due to the solubility of nitrate nitrogen, it is not removed by conventional water treatment processes. The presence of soluble nitrate nitrogen in drinking water poses a health threat for pregnant women, infants and adults on restricted diets. Therefore, drinking water alerts have been issued for Bowling Green and the other communities that utilize Maumee River water for their drinking supply.

Pesticides

During spring and early summer, the concentrations of many of the currently used pesticides increase in the AOC Lake Erie tributaries. The herbicide concentrations in these rivers appear to be higher than in many other rivers draining cropland. The effects of these herbicides on ambient water quality remain uncertain. Because of the low acute toxicity, the relatively low persistence and the insignificant bioaccumulation (movement of a substance through the food chain) of most herbicides, direct toxic effects on animal life in streams and rivers appear unlikely. However, the concentrations of herbicides observed in these streams are within the range where effects on both algal and higher aquatic plant communities could be expected. Such effects may be occurring already in the existing aquatic plant communities in this region's streams and rivers, and within their associated wetlands and bays. Changes in these plant communities could affect the fish and invertebrate communities in streams and rivers.

Most of the pesticides are dissolved and, therefore, not removed by conventional water treatment processes. Thus, finished tap water has very similar concentrations of these pesticides as does the raw water. The concentrations of herbicides in Lake Erie tributaries do exceed some of the health advisories set by the federal government for relatively short periods of maximum concentration.

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 one million cubic yards of dredged material annually. Since the 1960s, about 90 to 95 percent of the material was placed in one of the confined disposal facilities (CDF) at the mouth of the Maumee River for settling and dewatering. In 1985, the Corps of Engineers proposed the open-lake disposal of about 60 percent of the material which is dredged from the Maumee Bay portion of the channel. U.S. 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 five year period with no open-lake disposal after 1991.

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

<u>Erosiveness and Incompatibility of Dredged Material with Substrate</u>

Dredged material that is open-lake disposed 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 also is higher in phosphorus. Therefore, the erosion and resuspension of the dredged materials result in the bottom sediments of the surrounding areas to be covered with lower quality dredged material.

<u>Suspended Particulates/Turbidity</u>

During open-lake 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 as a result of monitoring by the COE for 1985 (Fraleigh, 1986). The 1986 monitoring program detected several violations of Lake Erie Water Quality Standards both on and off the dump site, including excessive amounts of copper, cadmium, iron, mercury and dissolved solids (Tyler, 1986).

Phosphorus

Annual Lake Erie loading of bio-available phosphorus is 101 metric tons/year or 28 percent of the average annual Maumee River load. Resuspension from the dredging operation and disposal temporarily increases the phosphorus available for biological uptake. Because of this, the effects of open-lake disposal on phosphorus loads has become a topic of study.

Effect on Municipal Water Supplies

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

Urban Stormwater

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

Almost every town in the AOC has areas where sewage and runoff use the same or "combined" sewers (Figure 3). 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 which convey sewage to the treatment plant during dry weather. The City of Maumee has ten regulators with six overflows to the Maumee River. The City of Perrysburg has three overflow points to the Maumee River and four to Grassy Creek. The Village of Whitehouse had eight overflow points to Disher Ditch and three to Lone Oak Ditch which it has mostly eliminated. During heavy rains, one of the pump stations becomes overloaded, and it is necessary to bypass to Disher Ditch. These overflows are known to cause pollution problems during wet weather because they bypass the treatment plant and discharge directly into a water body.

The City of Toledo has a grant of $6.3 million for Phases I and II of its CSO abatement project. Toledo has already installed tide gates on regulators which cause them to close when river water enters the system. The City of Maumee has a four-phase plan to separate its combined sewers, with completion scheduled for 1996.

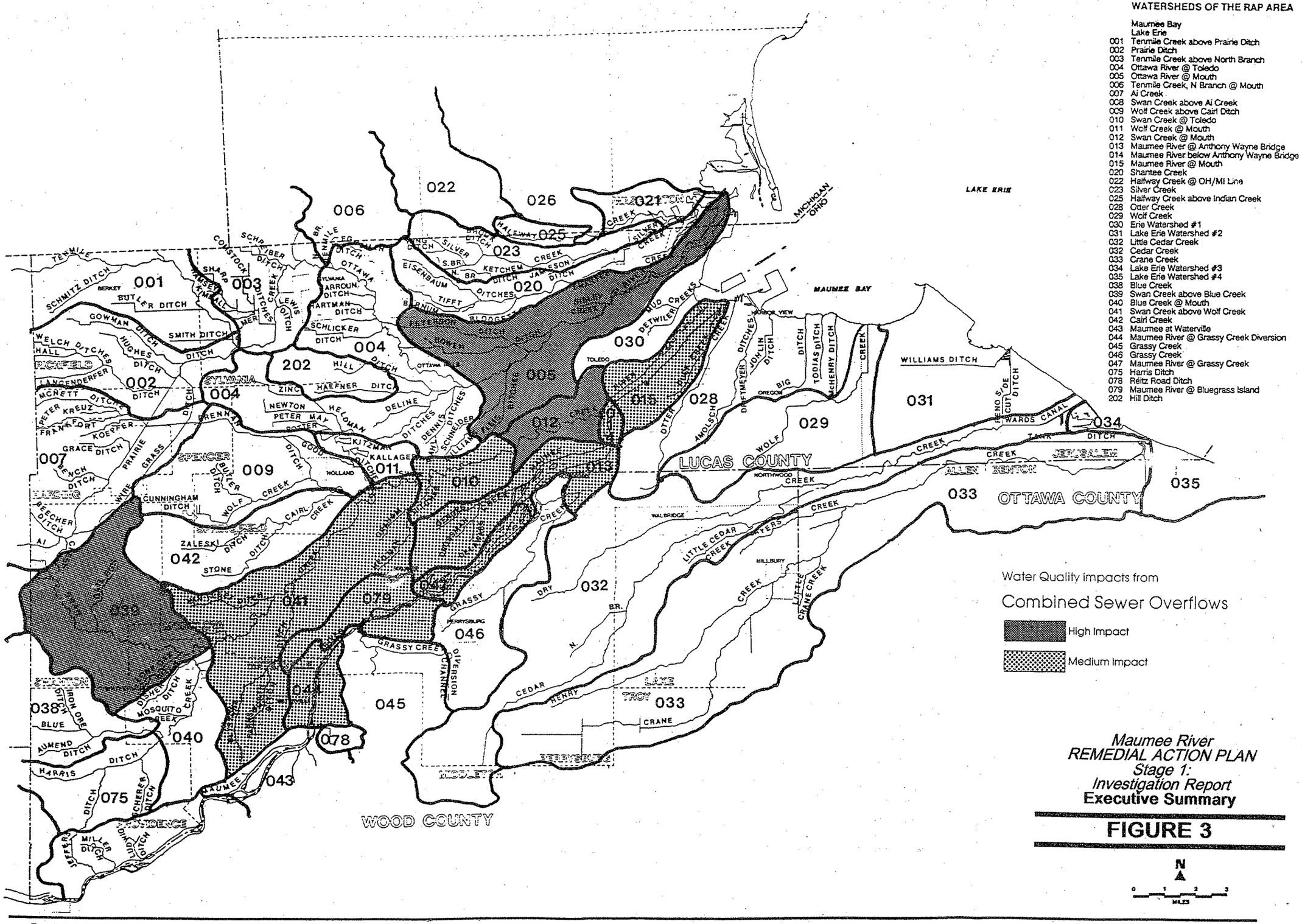


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FIGURE 3

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. This report identifies those political subdivisions wherein leachate problems exist due to failing and/or poorly functioning systems (Figure 4).

Conditions will continue to worsen in areas where densities are high. It is imperative that high growth areas such as Sylvania and Springfield Township 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 existing sewer system. In Wood County, this concern is confined largely to the urbanizing areas of Lake Township along Tracy Road, I-280, 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 development bans or 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.

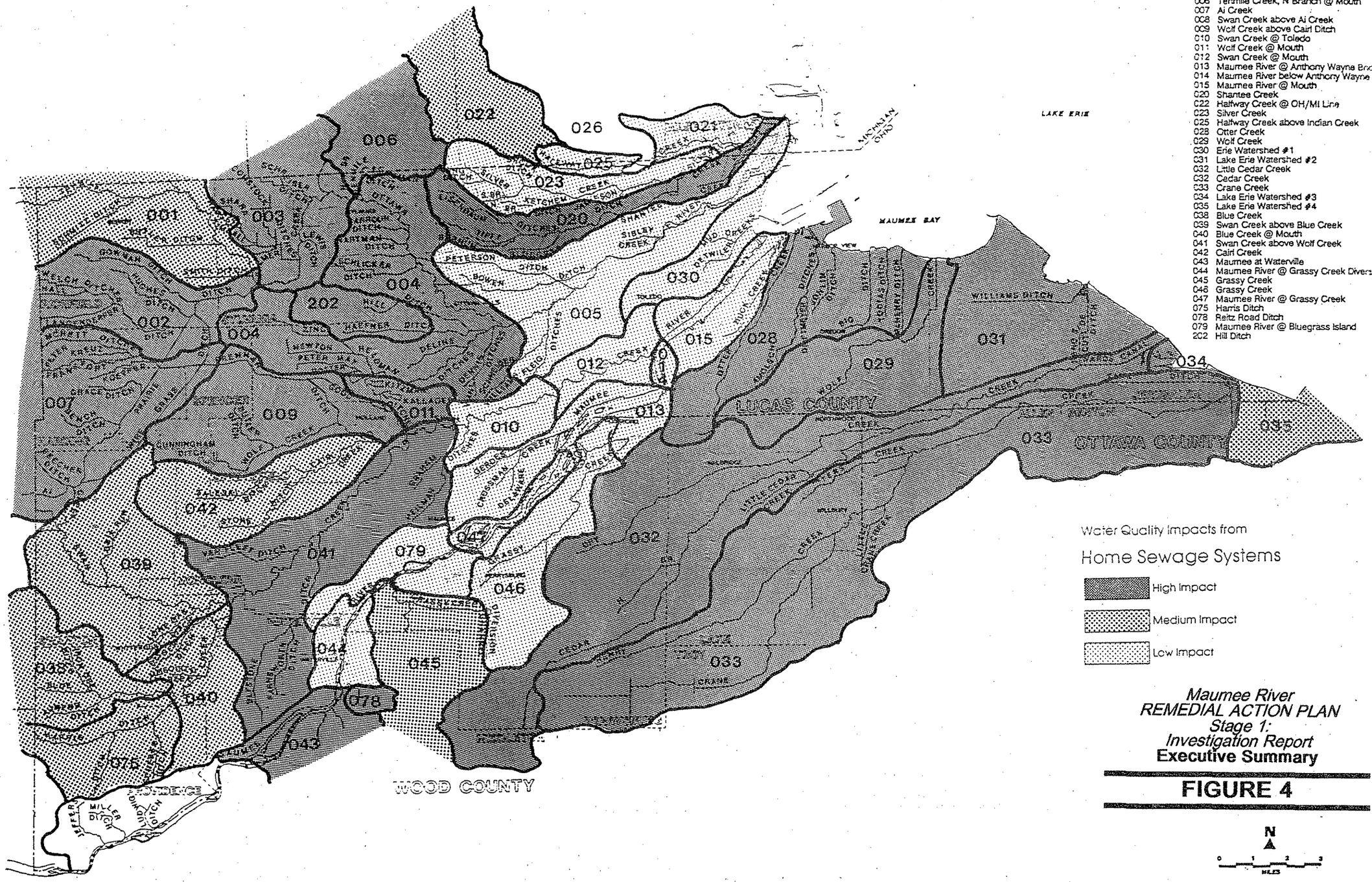
A fourth area of concern, primarily in Wood and Ottawa counties, deals with reported problems in areas of high bedrock (less than four feet to the surface).

Active and Closed Industrial Landfills/Dump Sites

There are seven licensed solid waste landfills in the RAP area which receive or have received solid wastes from commercial and industrial sources. Landfill #1, formerly operated by Fondessy Enterprises, is partially closed and the operational portion now functions as a hazardous waste facility managed by Envirosafe Services, Inc. The Westover Landfill also is closed. The Toledo Edison Company manages a landfill for its exclusive use for fly ash disposal. The National Castings Landfill is a private site for foundry sand managed by Midland Ross Corporation.

The other three landfills, Hoffman, Evergreen and Rossford are open for public use. The Rossford site is exclusively for its residents and businesses. As there is no leachate collection system, this site has suspected leachate problems with contaminants leaching into Grassy Creek.

The 1981 Ohio EPA Open Dump Inventory listed only two industrial landfills, the National Castings Landfill and the Rossford Landfill. Excluded from the list was the Libbey-Owens-Ford Co.'s abandoned landfill which is reported to be infiltrating into Otter Creek via deteriorated sewer lines under the site at the rate of 100,000 gallons per day.



LOWER MAUMEE RIVER REMEDIAL ACTION PLAN - AREA OF CONCERN

Some 44 sites have been the subject of Preliminary Assessments under the Comprehensive Environmental Response Compensation and Liability Act of 1980 CERCLA/Superfund, as revealed in an Ohio EPA computer printout dated November 15, 1986. However, none have been placed on the National Priority List for cleanup under Superfund.

There are 14 different RCRA (Resource Conservation and Recovery Act of 1976) facilities licensed to operate by the Ohio Hazardous Waste Facility Board in the treatment and disposal of hazardous waste, with monitoring and enforcement of the regulations being carried out by Ohio EPA. The Evergreen Landfill, operated by Ohio Waste Systems, a subsidiary of Waste Management, ceased operating as a hazardous waste facility in November 1985, and the Fondessy Landfill #2 has not received refinery sludges for well over a year, with Ohio EPA recommending that the site be closed due to seasonal high water and other problems.

Active and Closed Public Landfills/Dump Sites

There are some 56 known public dumps or landfills in the RAP area. The location of some sites is not known today and, periodically, one is found because the buried material has moved upward to the surface, or someone uncovered it during excavation. These dumps often are sources of ground water contamination and are not monitored for their impact.

Of these closed sites, three sites have had the most public attention: Dura, King Road and Millbury (Asman). Dura Dump, closed in 1974, has had leachate seeps into the Ottawa River for over 15 years. Recent models showed the estimated rate to be 54,700 gallons of liquid waste per day, with the river bank in the vicinity being contaminated with 193 parts per million PCBs, a level that is deemed unsafe by federal standards. The King Road Landfill was closed in 1976, but was leaching heavy metals into Ten Mile Creek. Enforcement action is pending. The Millbury Dump closed in the early 1970s and had problems with bacterial contamination to area wells. There still is a leachate problem from the solid waste.

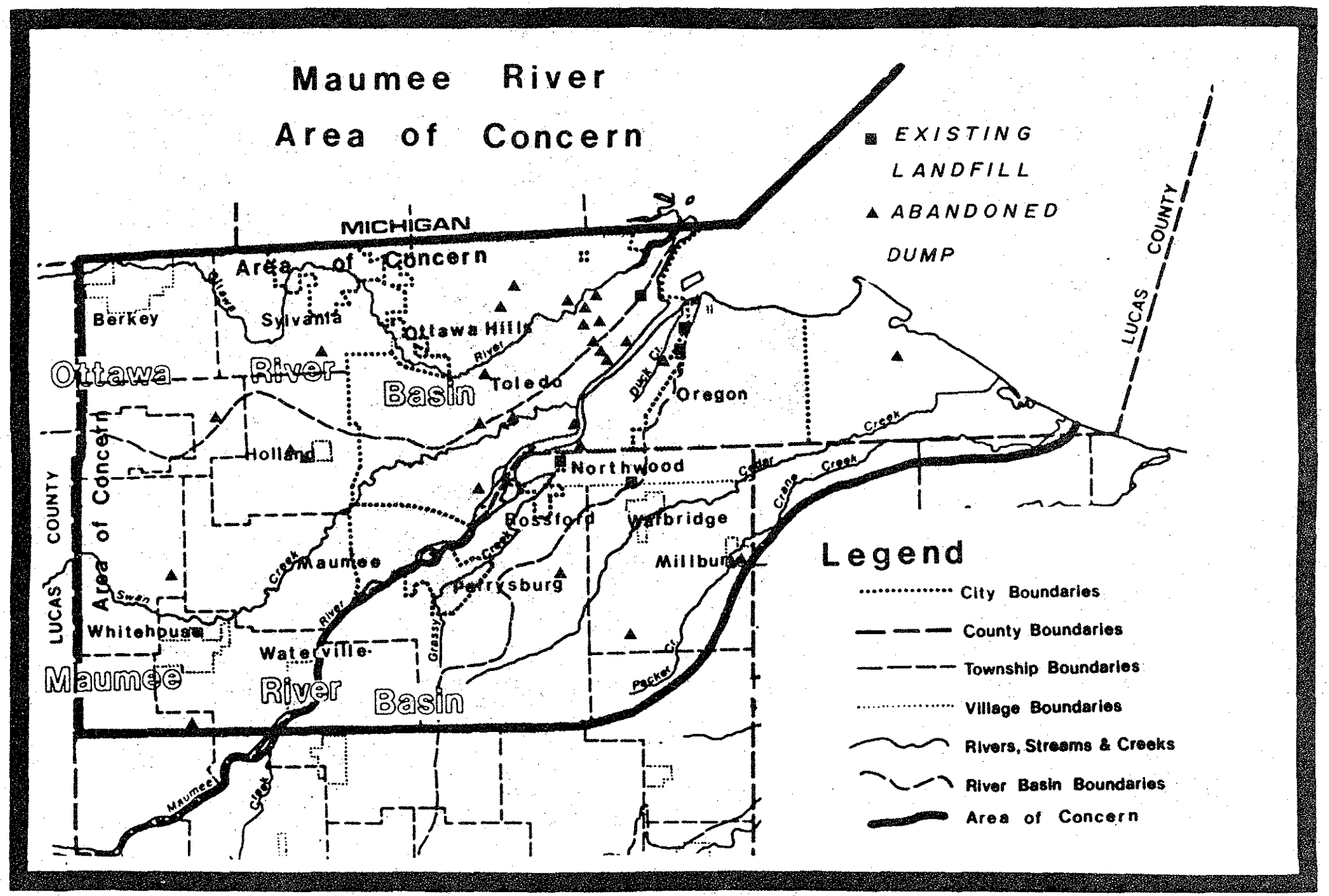
Today, there are three active landfills: Hoffman Road, Evergreen Landfill, now accepting only solid waste, and Rossford.

Figure 5 shows the location of existing landfills and abandoned dump sites in the RAP area.

Atmospheric Deposition

The Great Lakes National Program Office, U.S. EPA, has operated the Great Lakes Atmospheric Deposition (GLAD) network since early 1981. A precipitation sampling station as a part of GLAD 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 sampling 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 of 3.6 for early 1984, with nine quarterly averages being about 4.1.

FIGURE 5: Existing Landfills and Abandoned Dumps



The pH of 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 the natural occurring limestone bedrock and local soils of the AOC which mitigate the ecological effects of acid rain on the receiving streams.

The RAP area has varying status pertaining to the following monitored air pollutants:

LEAD: Attainment. Level, related to fuel switching and further reduction of lead levels in leaded gasoline, has dropped substantially since the early 1970s. The air quality related to lead is approximately ten times cleaner than the national standard.

NITROGEN DIOXIDE: Attainment. It is a brown gas, formed during high temperature combustion, which reacts with hydrocarbons in the presence of sunlight to produce photochemical oxidants or smog. It also is a contributor to acid rain.

OZONE: Non-attainment. It is the principal constituent of smog. The level of this pollutant has dropped with only one violation of the standard in 1983, and no violations for succeeding years. Attainment status is expected to be redesignated by U.S. EPA.

CARBON MONOXIDE: Attainment. The automobile engine is the main source of this pollutant. The level has dropped measurably in 1976 and 1983. Two violations were measured in 1984, but none in the intervening years.

SULFUR DIOXIDE: Non-attainment for areas east of Route 23 and west of eastern boundary for City of Oregon, with attainment for remainder area. Formed primarily by combustion of sulfur-bearing fuels. Sulfates, combined with moisture in the atmosphere, produce acid rain.

PARTICULATE MATTER: Primary attainment with secondary non-attainment for areas of Toledo and Oregon, and primary and secondary attainment for remainder area. Data show no violation of primary or secondary standards for 1983, 1984 or 1985 with the Toledo Environmental Services Division petitioning for redesignation. However, there is a small area, mainly in East Toledo where the monitoring station is located, that indicated a secondary violation for 1986.

The Ecosystem Approach

The Lower Maumee River Area of Concern (AOC) has been designated as such because of a heavy metal and organic chemical contamination problem. In addition to heavy metals and chemicals, the AOC has problems with nutrients and sediments.

The Lower Maumee River Basin has undergone significant agricultural and industrial development. Such development creates different sets of problems. Because of agriculture, the Maumee River contributes the largest sediment loading of all tributaries to Lake Erie. Due to industry, there is a toxic problem which causes fish consumption advisories for certain species. In order to attain the beneficial uses defined by the Great Lakes Water Quality Agreement, the physical, chemical and biological integrity must be restored.

In order to restore the beneficial uses of the lower Maumee River Basin, all impacts on living organisms must be incorporated into the planning process. Because of the inter-relationship of animals, plants and bacteria with their chemical and physical environment, the ecosystem approach must be utilized when implementing the recommendations.

The principles guiding this approach are first: conservation of quality, defined as leaving the Great Lakes Basin ecosystem in no worse condition than it was received from previous generations; and second, to conserve options, meaning to conserve the diversity of the natural resource base of the Great Lakes (National Research Council, 1985).

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