

# Maumee River Basin Area of Concern Remedial Action Plan Recommendations

## ***EXECUTIVE SUMMARY***

*(\*This summary is textually complete,  
however maps/images are not included)*

### **Introduction**

A 1815 account of Maumee River describes the fish as "*so numerous are they at this place that a spear may be thrown at random, and will rarely miss killing one! ...*" Some days there were not less than 1,000 taken by hook from Swan Creek (in downtown Toledo), and the shoals of the bay swarmed with ducks, and geese. The woods were filled with deer, elk and wild turkeys.

In 1887, Maumee Bay was one of the most prolific fish spawning grounds in Lake Erie.

Today, a description of the Maumee is not nearly so glowing. Swan Creek now has poor water quality. Heavy metals and PCBs contaminate the sediments, and harm the fish. Catfish and carp have been found with deformities: lesions, eroded fins, and black spots. The Ottawa River is very polluted, due primarily to the two miles of wall-to-wall dumps in the floodplains. Otter Creek, with its oil soaked banks, is known locally as the "industrial sewer."

In April, 1991, the Ohio Department of Health issued a fish advisory for the Ottawa River. It has the dubious honor of being tied for second place as the most polluted river in Ohio. The advisory cautions against eating fish from the river, or swimming or wading in the stream between I-475 in Sylvania Township and the mouth. Bacteria levels in Toledo area streams are too high for safe swimming nearly a third of the time.

A fish fillet sample from the Ottawa River found a PCB concentration of 65 ppm (parts per million). The US Food and Drug Administration's health standard for PCBs is 2 ppm. The Ohio Department of Health has issued fish consumption advisories for Channel Catfish and Carp because of PCB contamination.

PCBs are a family of chemicals, some of which cause cancer. They were mixed with oil and used as insulating fluids. A common use was in electrical transformers. When old transformers go in a dump, they may break open, allowing the oil-laden PCBs to leak out. At Stickney Avenue, an oil sheen had a PCB concentration of 376 ppm, and the sediments contained 5.1 ppm.

Not all pollution comes from toxic chemicals. Lake Erie fish populations dropped, and "trash fish" displaced "high value" fish through the mid twentieth century. The problem was that excess nutrients speeded up Lake Erie's natural aging process, *eutrophication*. The cause? Too much phosphorus, especially from farm runoff and wastewater treatment plants.

State and local governments, business, industry, and concerned citizens have been working for years to restore the Maumee. These efforts have paid off, but the Maumee is still a "hot spot."

The question is, what needs to be done to finish the job, and how can we do it? This is the *Remedial Action Plan's* purpose.

The International Joint Commission (IJC) classified the Maumee River Basin as an *Area of Concern* (AOC) in 1985. The label identifies the area as one having water pollution problems so severe that they hinder our use of the streams. The Maumee is one of forty-three such harbors on the Great Lakes.

Figure 1 shows the part of the Lower Maumee Basin that has been defined as the AOC. Figures 2 and 3 show the two largest tributaries: the Ottawa River (Tenmile Creek) and Swan Creek.

A treaty between the United States and Canada created the IJC in 1917. The Great Lakes Water Quality Agreement (1972) directed the IJC to oversee the Great Lakes clean-up. The *Remedial Action Plans*, or RAPs, are the process to put the clean-up into action.

Ohio EPA, the Toledo Metropolitan Area Council of Governments (TMACOG) and the RAP Advisory Committee (RAPAC) are spearheading the Maumee RAP. Concerned citizens and organizations, state agencies, and the communities of the Area of Concern comprise the RAPAC. The RAP has adopted the Great Lakes Quality Agreement vision based on *beneficial use* of our waters:

- & All streams should be fishable and swimmable.
- & Virtual elimination of toxics from discharges
- & Sustain and increase the fish stock, and recreation.
- & Protect and restore wetlands.
- & Acquire and preserve natural areas.
- & Environmentally sound public access to Lake Erie
- & Educate the Public on its role in protecting water quality.
- & Establish a citizens' monitoring group to track RAP progress.

The first step was to put together current information about what is doing the polluting. The sources are:

1. Municipal sewage treatment plants ("*publicly-operated treatment works*," or POTWs)

11. Leaking underground storage tanks
12. Deposition of chemicals discharged into the air, and
13. Water treatment plant sludge

The RAP outlines what makes each of these a problem and how they can be solved. For each polluting source, the *RAP Recommendations Report* identifies what should be done, who should do it, when it should be done, and where the money should come from.

### **The Big Three**

With all the sources of pollution degrading lower Maumee water quality, some are more severe than others. Three types of pollution are the main reasons why the Maumee has the "Area of Concern" designation.

1. **Agricultural Runoff** contributes to the eutrophication of Lake Erie, fills in the Toledo shipping channel, and threatens drinking water supplies.
2. **Combined Sewer Overflows** discharge untreated sewage. They make streams unsafe for swimming, and the resulting debris is unsightly.
3. **Contaminated Sediments** are a problem in central urban areas of the Maumee, Swan Creek, and the Ottawa River. Chemicals and sludge have accumulated in the mud at the bottoms of these streams over many years. These get into the food chain when bottom-feeding fish, particularly carp and channel catfish, get into the mud.

### **The Cost of Clean Water**

Money *is* a key part of the cleanup. Where possible, the RAP gives the price tag. The total is immense, but remember that it will be paid by many stakeholders over a period of years. Ordinary citizens must understand that they are the ultimate stakeholders. In the end, the public will pay for a cleaner environment in their sewer bills and at the cash register.

The committees that wrote the *RAP Recommendations Report* included the costs of their recommendations. These costs aren't necessarily complete; they're just the best information that exists, which is sometimes sketchy. The assumptions and information for figuring the cost are noted throughout this report. A table at the end of this report summarizes these costs. The costs list a range: low/median/high. Throughout the text, the "median" figure is used.

### **Publicly-Operated Treatment Works**

Toledo's Bay View Wastewater Treatment Plant needs to add a final clarifier to improve effluent quality. Perrysburg needs to complete the treatment plant expansion which, at this writing, is under construction.

The Harbor Area needs sanitary sewers, This area includes the Village of Harbor View, and the Case Farm Beach, East Harbor, and Immergrun subdivisions in Oregon.

The Maumee River WWTP needs to expand its hydraulic and solids handling. These facilities must continue to meet their NPDES permit requirements.

The cost to upgrade these treatment systems will be \$23 million. The cities, villages, and counties that use public sewerage systems will bear these costs. The most likely financing method will be user fees and assessments.

### **Combined Sewer Overflows**

Combined Sewer Overflows (CSOs) are an aesthetic and public health problem. Combined sewage, a mixture of sanitary sewage and street runoff, puts oil, sediment, human wastes, and bacteria into the streams.

A third of Toledo uses combined sewers, which overflow from thirty-five outfalls into the Ottawa River, Maumee River and Swan Creek. The three waterways are highly polluted, in part, because of these overflows. During low flow periods, the water turns septic and odorous. During low and high flow, sewage floats on the surface, and litters the banks.

Toledo is building storage tunnels for the downtown and along Swan Creek. These are big underground pipelines that hold the sewage until it can be treated. Otherwise this water area would go into the stream. Toledo's combined sewer project is nine phases, to be finished in 1996. The downtown tunnel is done. The tunnel for Swan Creek between the mouth and Hawley Street is near completion. The later phases include more tunnels, and some sewer separation.

When the Swan Creek CSO projects are done, the next priorities should be the Ottawa River, and then the remaining Maumee River overflows. In all, Toledo may have another twenty years of CSO projects.

The 1982 studies of Maumee and Perrysburg combined sewer overflows showed that rainfall as low as 0.05 inches resulted in overflows. These overflows lead to violations of the fecal coliform standards for the Maumee River.

RAP recommends that the City of Maumee follow their plan, approved by OEPA, to eliminate their combined sewer regulators. A twelve-year program will build *separate* storm and sanitary sewers in four areas. The first two parts have been completed and the third is in the design phase.

RAP recommends that Perrysburg separate their combined sewer system, which would reduce CSO volume to the Maumee River by 90 percent. The first three phases of construction are underway.

The Village of Swanton that discharges effluent to Ai Creek should move forward to eliminate its four overflows. Ohio EPA has issued orders for Swanton to upgrade its sewer system.

Combined sewer abatement will be expensive; it is estimated at \$273 million for these communities.

This price does not include any Toledo CSO projects after Swan Creek is done in 1996.

### **Industrial Dischargers**

The RAP identifies seven "*problem dischargers*" who should upgrade their systems. All industrial discharges will have to monitor their effluent discharges to meet toxicity limits. Ohio EPA is switching from its present renewal system to a new watershed approach. Some dischargers will be given short term permits (1 to 3 years) with the new limits and others will have their permits renewed early. Toxic Control Strategy requires all dischargers to comply with water quality standards by June 13, 1993.

Even as the RAP report was being prepared, several industrial dischargers were improving their treatment systems. As these projects are completed, these industries can come off the list of "problem dischargers." The cost of industrial treatment improvements is put at \$22 million, which the industries will pay.

### **Urban Runoff**

Urban runoff control will improve water quality by keeping heavy metals, oil and grease from getting to the stream. Ohio EPA will require NPDES permits for storm sewer systems serving more than 100,000 people.

The RAP recommends that Ohio EPA base stormwater permits on watersheds, not political jurisdictions. Stormwater does not respect city limit lines. Toledo is only 54% of the urbanized area. The other 46%, in fifteen different cities, villages, and townships, will be missed. This is where most of the new development ) ) and construction site erosion ) ) comes from.

The cost for the City of Toledo to file stormwater permits will be \$1.2 million. The RAP does not include cost figures for *cleaning up* any stormwater problems. There are too many unknowns to predict that, such as what will EPA require?

### **Agricultural Runoff**

The Maumee is the biggest source of sediment and phosphorus going into Lake Erie. Most of that comes from crop land, where farmers apply fertilizer to increase crop yields. The annual sediment load is 1.2 million metric tons. The sediment blocks sunlight in the water. Muddy lake water is also more expensive for Toledo and Oregon to treat for use as drinking water. When it settles, it covers stream-bottom habitat and fills shipping channels. Dredging this unwanted sediment out of Toledo Harbor costs the government about \$3 million per year.

Only a small part of this enormous sediment load originates inside the Area of Concern. As Figure 4 shows, the Maumee has a large drainage basin, which includes parts of Indiana, Michigan, and fifteen Ohio counties.

Phosphorus and nitrates contribute to the eutrophication of Lake Erie by encouraging algae blooms. When the excess algae dies off at the end of the season, it settles to the bottom of the lake, and begins to decompose. In doing so, it competes for oxygen with fish.

The concentrations of nitrate in the Maumee River have exceeded the drinking water standard, causing communities that draw municipal water from the Maumee River to issue drinking water alerts. From 1983 to 1989, Maumee River water at Waterville was over the US EPA advisory levels for Atrazine and Alachlor 13% and 7% of the time, respectively. These are agricultural chemicals used to kill weeds. The advisory levels are based on lifetime exposure in drinking water.

To reduce phosphorus loads to Lake Erie, erosion and sediment delivery must be cut. Conservation tillage is a method of farming that leaves a residue on the soil surface to reduce wind and water erosion.

The RAP recommends that farmers use conservation tillage systems and other Best Management Practices ("*BMPs*"). Some of the *BMPs* the RAP recommends are:

- & Plant grasses, legumes, or small grains to provide seasonal protection when the major crops are not in the field.
- & Establish strips of trees or shrubs between fields as a wind break.
- & Establish vegetation along all streams to filter out sediment from runoff water.
- & Plan fertilizer applications carefully to prevent nutrient loss. Consider timing and placement. Don't apply chemicals where they can easily wash into a ditch, or just before a thunderstorm.
- & Local agricultural non-point source steering committees should encourage farmers to adopt *BMPs*, and give up the practice of fall plowing.

The RAP also recommends developing a certification program for commercial fertilizer and pesticide applicators. Farmers should keep current soil tests for their fields, and base applications on actual nutrient requirements.

Preserving and restoring wetlands would help reduce agricultural runoff pollution. Wetlands are nature's way of holding rain water so it can slowly seep back into the ground to be used by plants when water is not so plentiful. The infiltration process in wetlands is a natural filtering system for dirty water.

The costs for addressing agricultural runoff pollution aren't for building treatment facilities. It will take money to help farmers improve conservation. The RAP estimates an *annual* cost of \$1.75 million to support these programs.

In 1982, phosphorus reduction targets were set for all pollution sources. This phosphorus reduction strategy called on Maumee basin farmers to cut their phosphorus export by 627 metric tons per year. Conservation has improved, and by 1990, 37% of the goal had been met. That's definitely progress, but there's a long way left to go.

### **Landfills and Dumps**

The RAP includes a listing of landfills, dumps, pits, ponds, and lagoons ) ) places where our society has dumped its refuse. It covers everything from places along country roads where people used to dump household trash to old city dumps that include what we now consider hazardous waste. There are 58 dumps on the list. The RAP targets 33 for action. That means work should proceed to find out whether these dumps *are* leaking pollutants to the environment, and if so, clean them up.

Pits, ponds, and lagoons, or "impoundments" are a related category. The RAP lists 36 in the area, and recommends action on 17. The Ohio EPA Division of Emergency and Remedial Response Section is in charge of the discovery, prioritization, and oversight of remediation of uncontrolled, unregulated, or abandoned hazardous waste sites.

The remedial work to be done in the Toledo area is extensive. Cleanup is a long-term process. Even if we know *how* to clean up a problem, implementation may take years. It may require on-going work, such as pumping and treating contaminated groundwater.

Several of the worst old dumps are on the Ottawa River. Dura, North Cove, Stickney, Tyler, and DuPont in particular need action. Ohio EPA has a detailed investigation of the Ottawa River dumps planned. Other serious problem sites are King Road, Millard Avenue Overpass site west of Duck Creek, Treasure Island, and Manhattan.

Dumps were one of the major reasons the Maumee Basin is an AOC. *"Toxic discharges have been linked to sediment toxicity in the lower Maumee River and Bay. A fish consumption advisory is in effect for carp and channel catfish from Lake Erie because of PCB contamination."*

The RAP says cleaning up the old dumps will cost \$200 million. It's hard to predict how expensive the clean-up finally be, since we have no experience to draw on in Northwest Ohio.

However, two different ways of cleaning up Dura are estimated at \$25.8 and \$34.8 million. On the other extreme, a site in Wood County where three transformers had been buried cost \$50,000 to clean up.

Many of the old dumps are along streams. The public used some without official operation or sanction. It seemed convenient to use waste material to fill in these low-lying areas. At the time, these were considered worthless areas. Today we call them wetlands.

### **Contaminated Stream Sediments**

Industrial wastewater discharges have also helped contaminate sediments. These chemicals reached the streams through the industrial waste outfalls. These discharges went either directly into the stream, or to the stream via the combined sewer system. Urban runoff is another source.

Sediments in the lower Maumee River (the Toledo Harbor) are heavily polluted with organic solids and metals, including zinc, lead, arsenic, nickel and chromium.

The lower reaches of Swan Creek and the Ottawa River have severe sediment contamination, from past and current discharges.

A recent study showed that the most contaminated sediments were usually near point source discharges, especially between Maumee River miles 1 and 3.5. *"The effluents discharged by outfalls associated with these locations are a potential source of contaminants for the water column and sediments in downstream areas of the Maumee River and the near shore area of the western basin in Lake Erie."*

The RAP recommends that toxic discharges be "virtually eliminated." RAP also suggests an improved water quality monitoring program. It should include more chemicals than current programs, and sediment samples. The University of Toledo, Toledo Division of Environmental Services, US Army Corps of Engineers, and Ohio EPA should cooperate in this effort.

Ohio EPA should develop a computer database of discharges of pollutants by watershed that would be compatible with the U.S. EPA Permit Compliance System.

POTWs and industries with the potential for discharging toxic materials should be required to test the effect of their effluent on live fish. This procedure is called "whole-effluent toxicity testing."

NPDES permits must contain limits on the concentration (parts per million or parts per billion) in the effluent. The permits also need to limit the total amount of a chemical that can be discharged (pounds per day). At a minimum, discharges of zinc, chromium, iron, copper, mercury, cadmium, lead or nickel should immediately have permits modified to limit these substances. These are the chemicals that violate sediment quality criteria in the river or lake.

Ohio EPA must develop a process for determining whether discharged substances are at "levels of

concern" and, therefore, need to be regulated. This process should determine the impact of loading from several dischargers and the effects of mixing different contaminants.

Sediment clean-up may mean dredging the stream, covering the sediments, or doing nothing. Why is doing nothing an option? Dredging would stir up the sediment, and spread some of the contaminants. Once dredged, it would be necessary to dispose of the sediment. Disposal could mean putting it in a "confined disposal facility" out in the Bay, or even in a landfill. If the cure is as bad as the original problem, nothing may be the best thing to do.

The only cost the RAP gives for addressing contaminated sediments is \$15,000. That only covers the Ohio EPA discharger database. How much will it cost to eliminate toxic discharges and clean up the stream sediments? There's too little information to go on, but every reason to expect the cost to be high.

The City of Toledo has estimated dredging lower Swan Creek at \$1 million, not including the sediment disposal cost.

### **Dredged Disposal**

Agricultural sediment coming down the river fills in the harbor and channel. Dredging removes the sediment, but creates a problem with what to do with the dredgings. This sediment is classified as "moderately" to "highly" polluted.

*"This dredging produces between 800,000 and 1,000,000 cubic yards of dredged material annually. From 1960 to 1985, about 90 to 95 percent of the material was going to a confined disposal facility (CDF) in Maumee Bay. In September 1984, the Corps of Engineers proposed to change operations to open lake disposal of about 60 percent of the dredged material from the Maumee Bay portion of the channel due to cleaner sampling results," with the rest of the material going into a CDF.*

The City of Toledo expressed concerns that open-lake disposal was affecting their drinking water supply. Open water disposal degrades the "benthic ecosystem, increases turbidity and heavy metal concentration in excess of water quality standards."

CDFs are expensive to build, and destroy near-shore fish habitat. The harbor needs a long-term management strategy that includes ways to reuse the sediment, rather than just dispose of it. Since most of the sediment was originally topsoil on farm fields, preventing agricultural erosion is doubly important.

The RAP estimates the dredge disposal recommendations at \$34.4 million. The Toledo-Lucas County Port Authority, the US Army Corps of Engineers, and the State of Ohio would bear this cost.

### **Home Sewage Disposal**

There are 20,000 home sewage disposal systems in the RAP Area, mostly septic tanks. Homeowners are responsible for maintaining their septic tanks. Normally tanks should be pumped out every three years. Many homeowners do not know how to maintain their septic systems. As a result, the systems fail and bypass untreated sewage to streams and ditches.

The RAP has come up with a simple remedy to home sewage disposal problems. The County Health Departments should require home sewage system permits and septic tank pumping records. A permit would be renewed with proof that pumping was done. The benefits of this system would be:

- & Improve homeowners' maintenance
- & Fewer system failures
- & Provide an incentive for hauler cooperation by increasing their business
- & Provide inventory information not otherwise available, and
- & Provide increased revenue through permit renewal charges, that would pay for inspections.

RAP recommends extending sanitary sewer service to areas of high package plant concentration. Where package plants continue to exist, training personnel to run the package plant should be mandatory. Ohio EPA should issue a special *package plant permit*. It would be less than a full NPDES permit, a "middle ground" between a fully regulated POTW and no regulation at all.

The septic system and package plant recommendations would cost \$500,000 and \$31,500 per year, respectively. Both would be financed by permit fees.

### **Leaking Underground Storage Tanks**

There are 3,997 underground storage tanks in Lucas, Wood, and Ottawa Counties, with 84 leaks reported since 1978. The emergency response office of OEPA reports that 75% have come from gas stations.

The water quality impact from USTs is largely unknown. The RAP notes that the many old tanks in the core area of Toledo, and newer tanks in suburban areas are reason to suspect a problem.

In August 1989, the Ohio Legislature created a program to provide low interest loans for replacing or improving tanks. Owners of six or fewer petroleum tanks qualify. The law also:

- & Requires the Fire Marshal to establish requirements for financial responsibility for petroleum storage tanks. Owners and operators bear liability for harm their tanks cause, and are responsible for the clean-up if they leak.
- & Applies corrective action requirements to suspected *and* confirmed leaking petroleum tanks.
- & Requires special leak detection and containment methods for areas of the state designated

- as sensitive for human health and the environment; and
- & Allows the Fire Marshal to delegate tank inspections to city, village, and township fire safety inspectors.

The RAP recommends that:

1. New tanks and upgrades should include fail-safe equipment to detect and prevent leaks
2. New tanks and upgrades should be double walled
3. USTs should have equipment to prevent overfilling. This should include a high level alarm and an automatic shut-off.
4. New or upgraded tanks should be inspected before approval.

### **Atmospheric Deposition**

Rain washes pollutants out of the air, which become water pollutants. Information on atmospheric deposition has been sketchy, but there is now enough evidence to cause concern.

Northwest Ohio rain *is* acidic: its pH averages 4.1. But it doesn't harm our streams, which are *basic*, with a pH of 7.7. It appears that our soils and limestone bedrock buffer the acidic rain.

What about toxic or carcinogenic chemicals in the air? Does rain water wash them into our streams? We don't know the answer to that. We *do* know what industries discharge into the air. The Ohio Toxic Releases Inventory for 1987-1989 lists 79 industries in the RAP area that discharge 99 different toxic or carcinogenic chemicals into the air. The *RAP Recommendations Report* gives a summary of what is released not only to the air, but to waterways, and land as well.

We *don't* know the concentrations of these chemicals in the air, which is what actually determines risk to the public. We can draw one conclusion: a lot of chemicals are going into the air, and we don't know what we are breathing.

The 1988 Toxic Release Inventory shows Lucas County as the second hardest hit county in Ohio by air toxics.

The RAP recommends that Ohio create an office to provide technical assistance to businesses to reduce toxic chemical releases. It should also serve as an information clearinghouse on waste reduction, and conduct educational programs on toxic chemical reduction.

The RAP also recommends facilities that produce hazardous chemicals conduct waste audits. They should have plans to reduce the amount of waste they produce, and document their accomplishments.

The RAP gives a cost of \$4 million for atmospheric deposition, to create the Ohio Waste Reduction Office.

### **Water Treatment Plant Sludge**

Water treatment plant (lime) sludge has built up, over the years, in four parts of AOC streams. The Maumee AOC has four water treatment plant sludge impoundments: two for Toledo, and one each for the Oregon and Swanton. The City of Toledo has removed the lime sludge beds from Duck and Otter Creeks.

Lime sludge is the solids removed from raw drinking water. As sludge goes, lime sludge is relatively innocuous. It doesn't cause illness, and doesn't have much effect on dissolved oxygen. Lime sludge beds cause a problem when they get big enough to cover the stream bottom, which is an important part of the aquatic habitat. Also, lime sludge is alkaline, and raises the water pH.

Obviously, the first thing to do was remove the sludge beds. This was done. But what to do with all that sludge? The best approach is to *reuse* it, rather than *dispose* of it. Since farm fields often need extra lime, spreading the sludge on agricultural land is beneficial both to the farmer and the city. The RAP recommends reusing lime sludge in this manner. The RAP gives no price for removing lime sludge beds, since the work has been completed.

### **The Challenge Before Us**

The "Great Lakes" are well-named. These enormous fresh-water lakes are a valuable resource unequalled in North America. Not everyone may agree that we need a clean environment for its own sake. Much of our economy depends on clean water for shipping, sport and commercial fishing, recreation, and drinking and industry.

As many parts of the country reach out for water, Lake Erie becomes all the more worth protecting. In the long run, clean water is in our interest for quality of life and the strength of our economy.

Lake Erie is cleaner and more productive than it was fifteen years ago. Fish catches are up, and some species, including the Walleye, are more abundant. Most of the sewage and industrial waste problems have been solved. Today, these are not the "big reasons" that make the Maumee an Area of Concern.

Nonetheless, serious problems still face us, as Figure 5 shows. If anything, they will be more difficult, and more expensive to solve than sewage and industrial wastewater were. It will take the concerted, coordinated effort of many agencies, companies, and individuals. Progress will be slow and difficult; it will take long-term commitments to the clean-up to do the job. In the end, all Northwest Ohio will benefit.

**Lower Maumee River Remedial Action Plan  
Recommendations for Implementation**

**COST SUMMARY**

Recommended Action	CAPITAL COSTS			Annual	Costs Borne By
	Low	High	Median		
Basin-wide Programs: Education & AOC Tracking	\$2,860,000	\$3,220,000	\$3,040,000	\$450,100	ODNR, OEPA, COE, Local Governments
Publicly-Operated Treatment Works	\$18,841,000	\$27,094,000	\$22,967,500	\$0	Counties, Cities, Villages
Combined Sewer Overflows	\$125,682,000	\$419,905,000	\$272,793,500	\$0	Counties, Cities, Villages
Industrial Dischargers	\$21,860,000	\$21,860,000	\$21,860,000	\$0	"PRPs", OEPA, US EPA, State of Ohio
Urban Runoff	\$1,200,000	\$1,200,000	\$1,200,000	\$0	Counties, Cities, Villages
Agricultural Runoff	\$0	\$0	\$0	\$1,750,000	Farmers, SWCDs, ODNR, USDA
Contaminated Stream Sediment	\$15,000	\$15,000	\$15,000	\$0	"PRPs", OEPA, US EPA, State of Ohio
Dredged Disposal	\$22,940,000	\$45,940,000	\$34,440,000	\$0	COE, State of Ohio, Port Authority, State of Michigan
Package Plants	\$0	\$0	\$0	\$31,500	Plant Owners
Home Sewage Disposal	\$0	\$0	\$0	\$500,000	Homeowners, FmHA
Landfills and Dumps	\$200,000,000	\$200,000,000	\$200,000,000	\$0	"PRPs", Owners
Leaking Underground Storage Tanks	\$0	\$0	\$0	\$15,000	US EPA, OEPA, Fire Marshals, Owners, Local Governments
Atmospheric Deposition	\$3,000,000	\$5,000,000	\$4,000,000	\$0	Industries, US EPA, OEPA, State of Ohio
Water Treatment Plant Sludge	\$0	\$0	\$0	\$0	Toledo, Oregon, Waterville
<b>TOTALS</b>	<b>\$396,398,000</b>	<b>\$724,234,000</b>	<b>\$560,316,000</b>	<b>\$2,746,600</b>	

## GLOSSARY

<u>Symbol</u>	<u>Element</u>	<u>Symbol</u>	<u>Element</u>
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)

µg/l	- Micrograms/liter (parts per billion)
AOC	- <i>Area of Concern</i> . One of the seriously polluted Great Lakes harbor areas that is preparing a Remedial Action Plan (RAP).
BOD, BOD <sub>5</sub>	- <i>Biochemical Oxygen Demand</i> A water quality parameter that measures of the amount of organic matter (food) available for bacteria in a water sample. In other words, it is the organic strength of a wastewater.
CDF	- <i>Confined Disposal Facility</i> . Diked areas in Maumee Bay for disposal of sediments dredged off the bottom of the shipping channel.
COD	- <i>Chemical Oxygen Demand</i> . A measurement of the amount of carbon (food) in a water sample. This test is similar to the BOD test, in that it measures the organic strength of a wastewater. COD is a chemical test, while BOD uses bacteria.
CSO	- <i>Combined Sewer Overflow</i> . A combined sewer carries both sewage and stormwater. During a rain storm, the combined sewer floods, and bypasses untreated sewage into a stream.
CL,Cl <sup>-</sup>	Chlorine, chloride - Chlorine is a poisonous gas commonly used to kill germs in treated sewage or drinking water. Chloride a "salt" (sodium chloride), and is not a disinfectant.
COE	- 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	- A specific laboratory test the concentration of dissolved electrolytes in water.
DO	- <i>Dissolved Oxygen</i> . 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 of a lake, which is speeded up if a lake receives too many nutrient pollutants, especially phosphorus.
Fecal Coliform	- Bacteria which when found in a water sample, indicate untreated sewage.
ICI	- <i>Invertebrate Community Index</i> . A measure of water quality as reflected by a stream's ability to support aquatic life
IJC	- <i>International Joint Commission</i> . An international agency which is overseeing the Great Lakes cleanup.
kg	- 1 Kilogram=1000 grams. A kilogram is slightly more than two pounds.
LM	- <i>Lake Mile</i> . 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 dump, usually highly contaminated.
MG	- Million gallons
mg	- Milligram=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= a thousandth of a liter. A liter is slightly less than a quart.
MP	- <i>Mile Point</i> . How many miles upstream (above) the mouth of a stream a given point is. See RM.
NH <sub>3</sub>	- Ammonia: a form of nitrogen, which is a pollutant.
Nitrate/NO <sub>3</sub>	- A form of nitrogen, which is a pollutant
Nitrite/NO <sub>2</sub>	- A form of nitrogen, which is a pollutant.
NPDES	- <i>National Pollutant Discharge Elimination System</i> . The permit system that regulates wastewater discharges. This permit dictates how clean the water must be before it can be discharged.
O/G	- Oil and grease.
ODNR	- Ohio Department of Natural Resources.
OEPA	- Ohio Environmental Protection Agency.
PAH	- <i>Polynuclear Aromatic Hydrocarbons</i> .
PCB	- <i>Polychlorinated Biphenyls</i> . Organic chemicals which, during the 50 years they

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	- <i>Publicly Operated Treatment Works</i> . A city, village, or county wastewater treatment plant.
ppb	- Parts per billion (= $\mu\text{g/l}$ )
ppm	- Parts per million (= $\text{mg/l}$ ) PRP <i>Potentially Responsible Party</i> . The individual, agency, or company believed to have caused a pollution problem. This term is often used in connection with hazardous wastes left behind on a piece of property, or placed in an old dump.
RAP	- <i>Remedial Action Plan</i> . The planning and implementation process to clean up our streams.
RM	- <i>River Mile</i> . 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.
SS	- <i>Suspended Solids</i> . In water quality sampling, the weight of solids (in mg) suspended in a milliliter (ml) of water.
TESD	- <i>Toledo Environmental Services Division</i> . A division of the City of Toledo which is responsible for performing air and water quality monitoring in Toledo.
TKN	- <i>Total Kjeldahl Nitrogen</i> . A chemical test for forms of nitrogen in a water sample. It includes organic and ammonia nitrogen, but excludes nitrites and nitrates.
TMACOG	- <i>Toledo Metropolitan Area Council of Governments</i> . 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	- Turbidity: a measure of the clarity of a water sample.
USGS	- United States Geological Survey. Federal agency that prepares detailed maps of the U.S.; and monitors water resources.
WTP	- <i>Water Treatment Plant</i> . Usually a plant for city drinking water.
WWH	- Warmwater Habitat: a stream classification Ohio EPA uses to set the water quality standards. Warmwater standards are not as stringent as Coldwater.
WWTP	- <i>Wastewater Treatment Plant</i> . Usually a municipal facility, and often used interchangeably with "Sewage Treatment Plant."

**Acknowledgments**

The Remedial Action Plan Advisory Committee (RAPAC) has guided the process of identifying water quality problems, and deciding what ought to be done. The RAPAC divided into eight subcommittees to address different aspects of the RAP. The committees, and their chairs, are listed here.

The Maumee River Remedial Action Plan has been the work of dozens of individuals over four years. TMACOG wishes to thank all those individuals, and the agencies and companies they represent, for helping us prepare these reports.

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Floyd Schutte, Wood County Sanitary Engineer  
F. Joseph Cory, City of Maumee, Service Director  
Lee Pfouts, City of Toledo Environmental Services Division

**Agricultural Subcommittee**

Diana Holt, Ohio DNR

**Dredge Disposal Subcommittee**

Jeff Busch, Toledo/Lucas County Port Authority

**Dumps and Landfills Subcommittee**

Jennifer O'Donnell, Ohio Citizen Action

**Education Subcommittee**

Edwin Hammett, Ohio EPA Northwest District Office

**Fish and Wildlife Subcommittee**

Fred Snyder, Ohio State University Sea Grant

**Home Sewage Disposal Subcommittee**

Carl Koebel, Ottawa County Health Department

**Public & Industrial Dischargers Subcommittee**

Lee Pfouts, City of Toledo Environmental Services Division

**Water Quality/Water Uses Subcommittee**

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