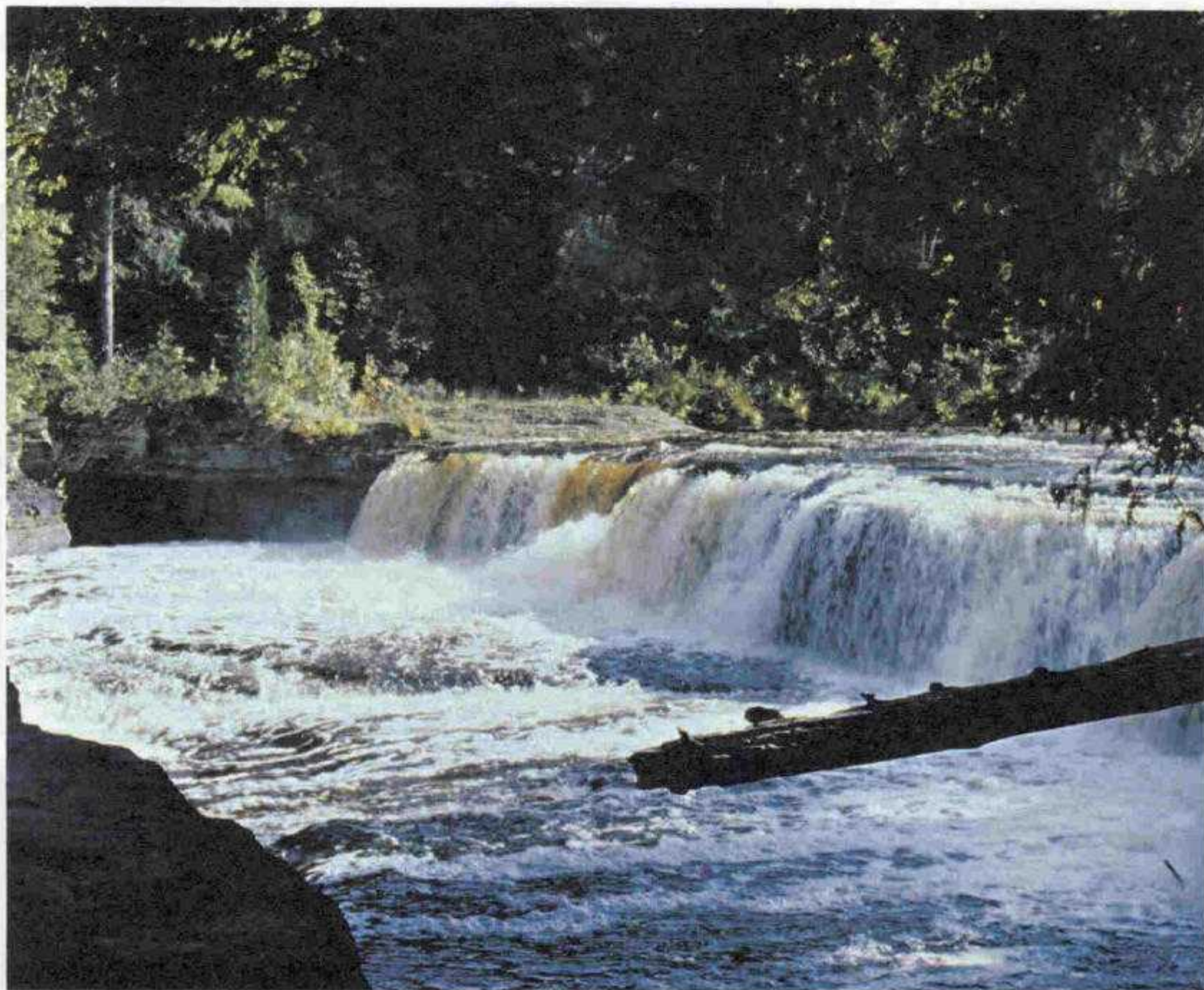


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# THE MICHIGAN RIPARIAN

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## EDITORIAL



Donald Winne

## Good Local Government Depends Upon Citizen Involvement

The constitution of the state of Michigan has attempted to protect the citizen against inefficient, improper and corrupt government. To do so, it requires, among other things, that (1) local government cannot adopt budgets of estimated revenues and expenditures without a public hearing; (2) that all financial records, accounting, audit reports and other reports of public moneys shall be public records and open to public inspection; and, (3) political subdivisions of this state CANNOT "grant or authorize extra compensation to any public officer, agent or contractor after the service has been rendered or the contract entered into."

These guarantees mean little if those in power desire to disregard them, or are ignorant of these provisions. There are some individuals elected to positions of power who search for loop-holes to do things which may be legal but which are ethically questionable. Other elected officials may make decisions or take actions which run counter to the provisions of the state constitution or state law through ignorance. They rarely seek citizen involvement so that they can be better informed, and thus, be better able to do the best kind of job possible for their constituents.

Citizen attendance and participation in local government meetings is a MUST if we want to see the provisions of the constitution designed to guarantee good government carried out. It is also important to attend local government meetings to make sure that state laws and local ordinances do not take away rights which have served the public well and have become traditional approved practices.

In order for governments to remain sensitive to the needs and desires of their constituents, the people must constantly remind those at the top of the ultimate source of their power. Jefferson wrote, "The people are the only censors of their governors....and if once the people become inattentive to the public affairs....judges and governors shall all become wolves with governments preying on the people and the rich on the poor."

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# LAKE EUTROPHICATION

## causes, effects and remedies

*This paper is a condensed version of the conference workbook: Inland Eutrophication: Causes, Effects, and Remedies. Material for this booklet was obtained from papers written by Drs. Darrell King, Thomas Burton, Ray White, and Eckhart Dersch of Michigan State University; Dr. John Gannon of the State University of New York; Cecile Harbour and Donald Winne of Michigan Lake and Stream Associations; and the Michigan Department of Natural Resources.*

### INTRODUCTION:

The nation's lakes are a vital resource in providing water, food and recreation for humans as well as a habitat for many species of plants and animals. In order to understand the water quality problems associated with lakes and possible solutions in overcoming these problems, an explanation is needed of the physical, chemical and biological processes governing lake waters.

A lake ecosystem includes the adjacent drainage basin that supplies water to the lake. Under natural conditions, nutrients and sediment are washed into the lake from its watershed. This process of the filling in of the lake is one that occurs in all lakes. The degree to which it occurs depends on the ecology of the basin, the extent of erosion, and the amount of nutrient enrichment, and is important in determining the rate of natural aging of a lake or natural eutrophication. If left undisturbed by human influence, lakes may retain a high water quality for thousands of years.

Human occupation and perturbation within the lake drainage basin, however, can affect the water quality and alter the lake ecology over a much shorter time span. This alteration in lake dynamics, brought about by increased inputs of sediment and nutrient materials associated with human activity, is the result of a process termed cultural eutrophication.

Three basic problems associated with cultural eutrophication and generated by nutrient enrichment are: (1) too many algae (single celled plants), often the wrong type; (2) too many macrophytes (rooted or weedy multicellular plants); and (3) too little dissolved oxygen in the lake. Excessive growth of algae or larger aquatic plants can restrict the recreational use of a lake by interfering with boating or fishing. Algal blooms reduce the clarity of the water and can form scums and mats on the water surface resulting in malodorous waters and decaying organisms. Bacterial use of the decaying matter leads to decreased oxygen levels in the lake often resulting in the loss of fish.

While the described problems are symptoms of eutrophic lakes, the rate and extent of development of these undesirable characteristics are not equal in all lakes. The ability

of a lake to maintain quality conditions while undergoing abnormal sediment input and nutrient loading will be a function of the drainage basin and various lake parameters such as alkalinity, nutrient supply, depth, volume, and the water throughput rate. Potential for reversing eutrophic conditions is also dependent on individual lake characteristics.

### LAKE RESPONSE TO NUTRIENT ADDITION:

In order to develop management strategies for lakes, it is important to have a basic understanding of how lakes are formed. Many lakes were formed by some geological mishap. For example, in Michigan most of the lakes resulted from depressions left in the landscape following glacial retreat. Other lakes have been formed by volcanic action, by wind action, by earthquakes, or by deposits of soluble rock that have been slowly dissolved by percolating water.

Since a lake is nurtured by its watershed, the natural chemical character of the lake water reflects the geology, soils, and vegetation of the drainage basin. Under natural conditions, lake sediments have some capacity to bind phosphorus, the nutrient that most often limits aquatic plant production. The amount of phosphorus that the sediments can bind and the amount required to promote problem conditions in the water is a function of the geology of the drainage basin. Continued addition of phosphorus will eventually remove the phosphorus limit to plant production and lead to carbon and nitrogen limits. The rate of the process is largely dependent on the alkalinity of the lake water.

If the basin is dominated by sand and granite, alkalinity will be low and only very small amounts of phosphorus are required before undesirable algae, such as blue-greens, begin to dominate. In these lakes, blue-green algal dominance may occur before any significant oxygen depletion at the lake bottom is observed. Where lakes are of limestone origin, a much higher alkalinity exists and much more phosphorus can be tolerated by the system. However, in these hard water lakes, oxygen depletion in bottom waters may develop prior to blue-green dominance at the lake surface. In shallow

lakes, macrophytes, which increase in density with phosphorus addition, may dominate with plankton activity limited.

Larger aquatic plants respond positively to phosphorus addition. They grow over large portions of the lake bottom and may dominate the shallow areas of the lakes where sufficient light is available, often interfering with recreational activities. During late summer when they expire, they are also consumed by bacteria placing an oxygen stress on the system and leading to an increased probability of winter kill. Attempts to remove plants by poisoning often results in oxygen stress, as the poisoned plants decay, and/or in heavy algal blooms.

In any case, if phosphorus addition to a lake is not curtailed, the lake will eventually support a sufficient production of some aquatic plant to allow the lake to be classed as eutrophic. With an abundant phosphorus supply, nitrogen or carbon may become limiting. When either of these nutrients is limiting, the more desirable algal species such as diatoms and green algae cannot effectively compete with the noxious blue-green algae.

Bouyed up by their gas filled vacuoles (air sacs), the blue-green form large populations on the water surface. They are not eaten by many organisms in the lake and face virtually no competition from other algal species. The solar energy they fix is not distributed through the aquatic food chain to fish, but is instead used by oxygen consuming bacteria. Blue-greens are notorious for reducing water clarity and for causing malodorous and foul-tasting water. Under some conditions they form toxins which are extremely lethal to animals.

Since carbon dioxide can be supplied from the atmosphere at a rate sufficient to cause excessive plant growth, and nitrogen from the air can be converted by some blue-green algae to a form they can utilize, the best practical method to arrest or reverse the excessive increase in plant material and the eutrophication process is to control the phosphorus supply to the lakes.

### SOURCES OF NUTRIENTS:

Nutrient inputs into a lake are usually classified as either point (identifiable) sources coming from such human activities as sewage disposal or industrial waste disposal



or as non-point (diffuse) sources. The diffuse sources can be classified as meteorologic, biologic or geologic inputs depending upon how they are transported into a lake.

Meteorological inputs include precipitation, dry fallout such as dust particles, aerosol impaction and wind borne materials such as leaves blown into the lake. These inputs are usually beyond the control of the local lake manager.

Biological inputs are those associated with movement of organisms into the lake from other areas. With the exception of bird inputs in some local situations and upstream migration of fish for spawning, these inputs are usually relatively small and not very amenable to human control.

The only major sub-group of non-point sources that are amenable to control are termed geologic inputs or the materials transported in surface or groundwater. In addition to nutrient runoff from non-point sources, other pollutants may be present including pesticides, heavy metals or other toxic and inhibitory substances. While some of these substances can injure or kill plants, fish and other aquatic biota, others are concentrated into the aquatic food chain. They are passed on from prey to predator, including humans, with potential harmful effects.

Control of eutrophication can be achieved if inputs of limiting nutrients or other factors are reduced to low enough levels. Recent studies of phosphorus inputs to the Great Lakes give information of major sources of nutrients to lakes. Although each lake is unique, data for the Great Lakes offers some insight as to what may be important to look for in local situations.

For the four Great Lakes with Michigan shoreline, phosphorus from point sources, including municipal effluent and industrial discharge, contribute over 40 percent of inputs to Lake Erie and Lake Michigan while less than 15 percent of total inputs into Lake Superior and Huron are derived from point sources. The latter two lakes have the least problems with excessive nutrient loading and plant growth.

In a local lake management plan, an elimination or reduction of point source input is a high priority. The next step is some control of land run-off. It is not coincidental that Lakes Superior and Huron have the greatest percentage of their watershed in forests. Forests lose the least amount of phosphorus per unit area of any major land use due to low soil erosion, low native fertility of many forested soils, low runoff per unit area, and high rates of evapotranspiration. Crops and urban areas, on the other hand, contribute a large amount of the total phosphorus load to the lakes. Lake Erie has over 50 percent of its watershed as urban or crop areas. Thus, major control efforts should be directed toward reducing runoff from urban areas and croplands.

## CONTROL OF NUTRIENT INPUTS:

Nutrient inflow must be reduced in order to stop or reverse the eutrophication process and can be accomplished by control of point and non-point sources. Through advanced treatment of municipal and industrial sewage effluent, nutrients are substantially reduced.

### Sewage Treatment

One source of overabundant phosphorus is sewage discharge, particularly from human waste and detergents. A lake catchment basin with several hundred or thousand households will annually generate tons of phosphorus. Of course, not all this phosphorus reaches waterways, but the amount that does should be an important consideration in any decision on sewage treatment for a lake community.

Septic systems, most often used in rural areas for homesite wastewater treatment are designed primarily to minimize the spread of infectious diseases. Their ability for phosphorus removal depends on: (1) the soil types in the area; (2) depth of the groundwater table; (3) setback distance of the system from the water's edge; (4) the age of the system; (5) the number of persons using the system; and (6) the design and construction of the septic tank and tile field.

Sewage collection and treatment facilities are probably the most effective and frequently considered alternative to individual septic systems but not all types are effective in removing phosphorus. Such facilities are very expensive, consume much energy in construction and maintenance and are impractical in small, isolated communities. Also, if this alternative is not fully evaluated, negative consequences may offset advantages in the attempt to control phosphorus. Treatment facilities that do not remove phosphorus are probably not solving the problem but transferring it to downstream areas. Such factors should be part of any evaluation for treatment facility planning.

### Land Use Treatment

Land use practices also have a tremendous effect on nutrient and sediment runoff, and some land use changes may be essential in reducing nutrient and sediment loading to lakes. Since massive land use changes are probably not practicable, control of urban and agricultural runoff will be emphasized. These two land uses contribute a much greater load per hectare of land than do any other major land use categories.

Erosion control practices can be implemented that will reduce sediment and nutrient inputs to lakes. Some of these practices include stabilizing and protecting banks of streams by vegetation or structural means; no till or minimum tillage farming; sod-based rotations; improved soil fertility; contour farming; planting trees, shrubs, grasses, etc., in critical, highly erodible areas; use of grassed or legume filter strips and waterway outlets; timing of field operations or ridge planting;

and by use of detention basins. Reduction in runoff is highly variable using any of these practices and may range from 0-50 percent reduction by soil fertility improvement to 50-100 percent reduction through no-till planting. Losses of nutrients from urban areas can be controlled by adopting stringent sediment control ordinances during construction, by strict zoning to limit numbers of houses along streams and floodplain areas, by regular sweeping of streets and parking lots to reduce particulate runoff, by the use of detention basins, or by using grass or forested greenbelts along surface waters to increase infiltration and reduce runoff.

In the removal of phosphorus from urban or agricultural runoff, the most common techniques employed involve some form of settling basin or filtration through vegetation or soil. Other techniques for controlling nutrient loss from agricultural lands include crop rotation, timing fertilizer plow-down, incorporating surface applications of fertilizer into the soil, or changes in land use.

The elimination of excessive nutrient inputs into culturally eutrophied lakes will not only begin to reverse the course of eutrophication in some lakes, but will also prevent recurrences in future years. While removal of nutrients actually treat the cause of eutrophication, local managers and lake owners may determine that this solution is not feasible due to excessive costs or uncontrollable non-point sources.

Direct in-lake schemes for maintaining a lake in a usable condition are available as short term corrective measures. However, these methods treat only the symptoms, therefore, they only provide temporary relief of cultural eutrophication.

## SHORT-TERM CORRECTIVE MEASURES:

Permanent control of eutrophication by reducing nutrient flow may cost less in the long run with the initial expense very great. Temporary relief by chemical, biological, or mechanical means may be desirable to ease the worsening conditions but should not be allowed to detract from efforts towards a genuine solution.

The following table summarizes many of the long-lasting and temporary remedies for management and control of nutrients. Some of the management schemes listed under Part A have been discussed under "Control of Nutrient Input." Parts B and C are short-term remedies that may be implemented for temporary symptomatic relief.

TABLE 1

- A. **Restricting nutrient inflow** - the only true remedy. Lets self-healing power of lakes take effect. Phosphorus is usually the nutrient to control.

(Continued On Next Page)



# LAKE EUTROPHICATION...

(Continued From Page 5)

1. Domestic waste treatment and use:
    - (a) Municipal sewer and treatment--disposal in water ways after phosphorus removal; on-land; solid waste containment, reuse.
    - (b) On-site systems--outhouse (despite drawbacks, does not mix wastes with water); septic tank/drain field (leaks phosphorus to lakes); composting toilet; other self contained toilets; kitchen and garden waste composting.
  2. Industrial wastewater treatment.
  3. Agricultural wastewater treatment.
  4. Wastewater diversion--may just put the problem somewhere else.
  5. Overland runoff treatment--made difficult by large surges and dilute concentration.
  6. Runoff diversion--puts problem elsewhere.
  7. Reducing soil erosion.
  8. Minimal use of phosphate fertilizer.
  9. Using non-phosphate cleansers.
  10. Modifying industrial products for less content and loss of phosphorus.
- B. Managing consequences of over-enrichment** - of temporary effect. These are "cosmetic" procedures, as appearances are dealt with, not the nutrient sources of the problem.
1. Aeration and/or mechanical mixing.
  2. Lake deepening--dredging, damming or drawdown to consolidate sediment.
  3. Plant harvest--weakens plant growth.
  4. Waterlevel fluctuation--unfavorable for some plants.
  5. Lakebed sealing--hinders rooting.
  6. Shading with dyes--reduces light needed for plant growth.
  7. Poisoning the plants--herbicides tend to give very short-term relief and more undesirable plants may take over.
  8. Biological control--biomanipulation by selection of size selective carnivores and use of herbivorous fish may offer some possibilities by controlling plankton populations through selective grazing.
- C. Hindering in-lake nutrient cycling and accelerating nutrient outflow**--may speed remedy; but if done without reducing nutrient inflow, may not keep up with problem.

1. Lake deepening--dredging or damming for more "nutrient-using" volume.
2. Chemical inactivation/precipitation of phosphorus--moves it to lake bed.
3. Lake aeration--keeps mud surface oxidized, phosphorus insoluble.
4. Lakebed sealing--blocks diffusion of nutrients from mud.
5. Biotic harvest--removes nutrients in form of plants or animals, but often inefficient.
6. Waterlevel drawdown to expose sediment in air, light, and drying.
7. Lake dilution/flushing.

## Mechanical Harvest

A major problem resulting from increased nutrient input is a dramatic increase in aquatic vegetation. Mechanical harvest or the physical removal of the vegetation is a temporary approach in the control of aquatic weeds. In situations where reduction of nutrient input to low enough levels for controlling excessive plant growth is not feasible, harvesting every season from one to several times may be necessary to keep water open for recreational boating and to reduce fish kills due to low oxygen conditions associated with plant decay.

Harvesting is appropriate during spring or summer when it will result in the maximum amount of plant material removal and still allow full recreational use of the lake. Such timing depends on knowledge of the growth characteristics of the species in question and on experience with the lake's recreational pattern.

Harvesting plants can make good garden mulch, soil conditioner, and composting material. The thin cell walls of aquatic plants break down rapidly. Some lakeside communities make harvested material available to farmers, landscapers, and homeowners who pick it up just about as fast as it is brought to shore. This eliminates the cost of disposal by truck to landfill sites.

## Herbicide Treatment

At present, the choice in temporary stop-gap managements is chiefly between harvest and the use of herbicidal chemicals (although there are other alternatives such as nutrient-precipitating chemicals).

Use of aquatic herbicides can have an advantage of convenience and may be the only alternative if plant production is dominated by algae, but it has the following drawbacks which mechanical removal does not share including killing plants without removing them from the water; being non-selective by killing beneficial plants as well as nuisance plants; and drifting beyond their point(s) of application. There is also risk of chemical side-effects hazardous to humans and the ecosystem. Certain disadvantages common to both mechanical removal and chemical

herbicides are that the killed or removed plants are often quickly replaced by other undesirable vegetation, and treatment costs and efforts are recurring, in many cases annually or more often. The expenditures must be repeated for as many years as control is desired until the nutrient sources of the problem are abated by some other means.

As for cost of treatment, harvest by motorized equipment was comparatively expensive during the early years of its development. But by about 1974 harvesting gear had improved to the point that cost was comparable to chemical herbicide treatment costs.

## Aeration

Another alternative to temporary management of aquatic systems is through the use of artificial aeration. Various methods are available to add dissolved oxygen to waters and to circulate the water. For lakes only a few feet deep, agitators and aerators inject air into the surface water to help fish through periods of low oxygen concentration which accompany hot weather and/or the oxygen demand of decaying organic material such as vegetation and feces. In deeper lakes where wind cannot circulate surface water to the bottom all summer or in small lakes or bays of lakes--or in any waters where excessive oxygen reduction below the ice occurs in winter--injection of air at the bottom and creating an upward stream of bubbles will circulate water from bottom to the surface where it can take on oxygen from the atmosphere, as well as give off waste gases.

In addition to providing better conditions for fish, maintaining oxygen in the depths of a lake can help hold the critical plant nutrient, phosphorus, locked in the bottom mud by keeping it in a chemical form that is relatively insoluble, and unavailable for plant growth.

Artificial aeration should not be considered a substitute for reducing inflow of nutrients. If energy costs to run the system are included in estimation costs, aeration can be a very expensive temporary solution.

## SOURCES OF ASSISTANCE

The first step in solving water quality problems is to identify the source of the problem. Since every lake is unique, the management of a lake must be specific to its needs. A study of the lake and its drainage basin will provide information on the best strategy for lake management.

Several sources of technical assistance are available to lake associations or individuals seeking advice on lake problems or evaluating their lake's condition. Specialized information might be obtained from limnologists, fish managers or biologists who work for a university, a state conservation program or an environmental agency. A readily available source of information can be obtained from the county extension



office.

#### **Cooperative Extension Service**

Michigan State University and the Federal government jointly implement a statewide Cooperative Extension Service. Each county has an extension director and a staff that work directly with people within the county. District agents, specializing in a particular area are also available through the Service. Many of these specialists have extensive training and research experience in lake management. They can be called upon by a county extension director to help analyze a lake problem, identify alternative solutions, help prepare and conduct educational programs, and help to identify other technical and financial sources that may be used to solve an individual lake problem.

#### **Regional Planning Commissions**

The 208 Regional Planning Commissions are developing region-wide water management plans which include the control of point and non-point source discharges. They may have specific information concerning a particular lake or watershed within a region and can assist local agencies and lake associations in developing lake and stream management plans.

#### **Department of Natural Resources**

The Land Resource Programs Division of the Department of Natural Resources assists local agencies and lake associations in the evaluation of lake management problems. While this division cannot conduct extensive field investigations to study individual lakes,

it will assist citizens in answering questions and will supply information that will assist lake associations in protecting their aquatic resources.

The Inland Lake Management Unit of the Land Resource Programs Division provides information on the Township and Village Public Improvement Act 41 of 1955. Under this law any township board in Michigan can appropriate money from their general fund to pay for lake or lakeshore improvement programs on public inland lakes.

#### **U.S. Soil Conservation Service**

This federal agency is responsible for assisting citizens in controlling erosion and sedimentation problems. Each Soil conservation District is usually composed of one county and assists county residents in developing and implementing erosion and sedimentation control programs.

#### **U.S. Environmental Protection Agency**

This agency awards funds under the "clean lakes" section (314) of the Clean Water Act. Grants have been established for rehabilitation and protection of lakes in many areas of the country. Funding has also been provided for activities related to lakes such as construction of sewage treatment plants and area wide planning for wastewater management.

Under the Federal Water Pollution Act Amendments of 1972, the U.S.E.P.A. is authorized to enter into contracts with or make grants to private agencies, organizations, and individuals for the purpose of

developing and demonstrating methods and procedures for restoring lake water quality. Grant funds are available on 50/50 matching basis so a source of local funding must also be obtained.

#### **Other Agencies and Non-Profit Organizations**

Various associations will assist in seeking solution to lake problems. The Michigan Lake and Stream Associations, Inc. for example, encourage formation of lake associations by riparian owners and discuss problems associated with the lake environment. Universities throughout the state also provide detailed information. Private consulting firms are available to develop and conduct extensive lake surveys and rehabilitation programs.

#### **CONCLUSIONS**

Analogies can be drawn between human health and water quality conditions (health) of inland lakes. Lakes get old, the natural process of eutrophication. But the rate of eutrophication can be greatly accelerated by cultural influences. Cultural eutrophication is an illness that can be cured. Either short-term therapy or long-term treatment can be applied to restore lakes and reverse the trend of eutrophication. The best preventive medicine is a long-term water quality management program. This program includes monitoring of a lake with a commitment to continue efforts toward its care and maintenance.

# **Shingle Creek Polluted Florida creek seen as a symbol of statewide problem:**

THE HOLLAND SENTINEL Thursday, February 19, 1981

**KISSIMMEE, Fla. (AP)** - Shingle Creek, a puny sliver of water that sloshes through the teeming developments of Orange and Osceola counties, is sick - infected with phosphorous, nitrogen and other damaging wastes it is fed by man.

Environmentalists call the ill-fated creek a symbol of statewide malaise, a "growth at any cost" mentality common among developers and politicians.

The torrent of sewage pouring into Shingle Creek, which feeds Lake Tohopekaliga, the magnificent, fish-rich body of water known as Toho, has prompted the Florida Environmental Regulation Commission to warn cities and counties that such pollution can lead to state-ordered restrictions on growth.

Moratoriums on hookups to overtaxed sewage treatment plants have already caused long delays in development of housing and tourist attractions.

"Nobody ever dreams that something like this can happen until the moratorium hits them," said Bill Frederick, chairman of the Florida Department of Environmental Regulation.

The Florida League of Anglers, a statewide group claiming some 10,000 members, has chosen Shingle Creek as "a horrible example" on which to concentrate its fight to halt growth that ignores environmental concerns.

"There are many Shingle Creeks in Florida," group founder Lyman Rogers of Ocala said, "But this was the most highly identifiable, in the heart of Florida and at the headwaters of the Kissimmee-Okeechobee basin.

"We cannot expect to get anything done at the bottom of the system if we have state agencies allowing that degree of pollutants to be put at the top," he said.

Shingle Creek once rose from a swampy,

southwestern corner of Orlando, meandered into Osceola County, entered its historical channel and, just before emptying into Toho, became a small stream filled with fish.

But the swamps that nurtured it were drained and bulldozed. Upland canals were dredged so runoff water from the new residential areas could drain into the creek.

From a gentle, winding stream, Shingle Creek became a straight-line ditch filled with sewage wastes which nurture plants but poison fish and other aquatic life.

Hydrilla, an exotic weed, and water hyacinths feed on the pollution and form dense mats on the lake bottom, blocking sunlight and threatening the aquatic food chain. Blue-green algae blooms choke fish breeding areas. Trophy-sized bass could eventually give way to tough trash fish such as gar and shad.

(Continued On Page 22)



# Don't Do It In The Lake!



First of two articles  
By Paul Todd

In 1973, Michigan State University concluded studies of shoreline home sewage systems at Houghton Lake. Among the study team members was Dr. Boyd G. Ellis, whose article on septic systems previously appeared in the *Riparian*.

The findings were eye-opening:

- 1) Nitrates in one case moved over 300 feet through the soil, from the septic system, to seep into the bottom of Houghton Lake.
- 2) Phosphates in one case moved over 100 feet into the lake bottom.
- 3) The homes with substantial movement of these nutrients, from the septic systems, were year-around homes.

In earlier studies at Gull Lake near Kalamazoo, M.S.U. investigators estimated that 65 per cent of the phosphorous entering the lake came from shoreline septic systems. This was, we should note, before the Michigan Natural Resources Commission banned the sale of high-phosphate laundry detergents.

This type of nutrient pollution probably is occurring at your lake, and it is encouraging weeds and algae to grow faster. Recently at Long Lake, at Portage, lake residents suffered from recurring intestinal illnesses. Wells and lake water were found to be contaminated by seeping sewage.

Too often, I've heard someone say: "Show me I'm polluting. Prove it to me. then I'll do something about it." Our lake association leaders recognize it isn't the government's job to prove we're polluting. We must be responsible for ourselves. Studies of the type mentioned earlier are costly, and it's unlikely that your lake association or local government can afford this type of investigation.

## Those Sewer Need Studies

In recent years, federally-funded "studies" of sewer needs have been carried out across Michigan. In many lake areas, the consultant reported that the Health Department knew of numerous septic system "failures," and concluded that municipal sewers were the answer. And that was that.

Many lake residents rejected those proposals as too costly, or not needed. In some cases, they were right. Unfortunately, there has been no systematic follow-up to improve the performance of on-site sewage systems where needed.

One problem is that a septic system "failure" may only be identified when the sewage backs up into the home, or surfaces in the yard. A septic system also has failed when it contaminates the ground water (especially the well), or the lake. But this type of contamination may not be quickly recognized.

"Invisible" failures often occur when the soil is coarse-textured. Gravels and sands dispose of septic system effluent (effluent is the water flowing out of your sewage system into the soil) rapidly. But the water seeps away so quickly that the soil cannot treat it. Research has shown that almost no purification will occur once the effluent reaches the ground water; and the ground water almost always seeps toward the lake.

Even without costly environmental studies, we can find when conditions are likely to lead to pollution. We can correct the major problems, usually for less money than the cost of building municipal sewers.

## Better Soil Disposal

A few conditions in your soil are keys to making a conventional soil absorption system (the generic term for a tile field) work:

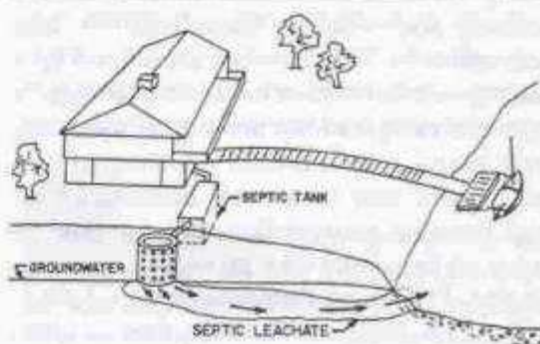
**\* SEPARATION FROM GROUND WATER**  
On lake properties, the bottom of your soil absorption system should be at least four feet above the seasonal high ground water table (the spring level).

**\* TYPE OF SOIL** -- Loam soils, with a mixture of smaller (clay, silt) and larger (sand) particles, do the best all-around job of purifying effluent from your septic system.

**\* AERATED SOIL** -- The soil receiving the effluent needs to have millions of tiny air pockets in it for purification to take place. Excessive home water use, will make the soil too soggy. Never build a driveway or

building over the absorption area; this closes the soil pores.

**VOLUME OF SOIL** -- The more soil the effluent contacts as it seeps downward, the more it will be purified. Seepage pits (dry wells) must not be used on lake lots; the distribution area is too small. A large distribution system is best.



Excessive Loading of Septic System on Porous Soils causes plumes of poorly-treated effluent which move with ground water flow and may discharge into nearby lakes.

## How to Stop Doing It

To prevent, reduce or stop pollution from your home sewage system going to the lake, take action. The "Big Ten" steps you can take are listed below.

**1. BE FEINDLY TO YOUR LOCAL SANITARIAN** -- Your Health Department has knowledge you need. Its sanitarians want to help protect your lake, too. Develop a good working relationship.

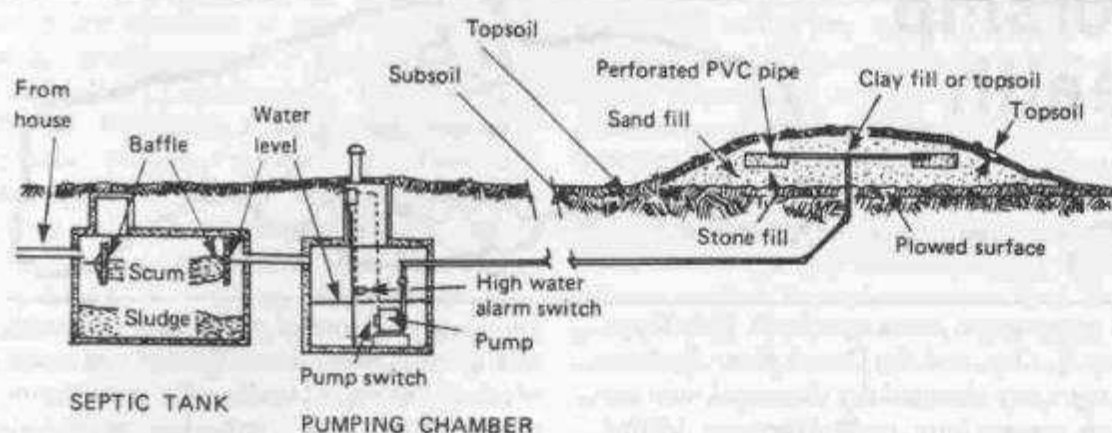
**2. LOCATE YOUR SEWAGE SYSTEM** -- Find the septic tank if buried. Locate the soil absorption system. Measure distances, and map the locations related to your lot lines and house.

**3. CHECK THE SOIL AND GROUND WATER** -- Cooperating with your sanitarian, dig a pit or trench near the soil absorption system. Ask the sanitarian how good the soil is for purifying sewage effluent, when he can come to the site. Have the sanitarian determine the seasonal high ground water level (usually the spring level) from soil mottling or other evidence.

**4. HOW DEEP ARE YOU DISCHARGING?** -- Still working with the sanitarian, find out the depth of the bottom of your soil absorption system under the seasonal high ground water level. If you can't provide this protection for your lake (which may be more than required by law), plan to rebuild your soil absorption system.

**5. CONSIDER DOSING** -- If your soil absorption system is high enough above ground water level, but the soil lets the effluent seep down too fast, consider pressure-dosing the effluent. This lets the soil dry out, and uses all available soil. Your sanitarian can explain the system.





Plain view and cross section of mound system for problem soils.

**6. YOU MAY NEED A MOUND** -- If you can't provide 4 feet of separation between the soil absorption system and seasonal high ground water, you should have an elevated (mound) soil absorption system with pressure-dosing of effluent. A "bump" in your yard may not be pretty, but it'll keep your lake clean due to the greater depth of soil. Discuss with your sanitarian and septic installer.

**7. USE LESS WATER** -- Never use a garbage grinder. Wash clothes outside the home; or at least wash full loads. Wear fewer light colored clothes to reduce laundry. Hand wash dishes with minimum rinse water. If using an electric dishwasher, use as little detergent as possible (it's high in phosphorus); wash full loads. Bathe away from home when possible; take quick showers; use bath water for two persons. Don't flush toilet every time for urine. Turn sink water on and off as needed, don't let stream run.

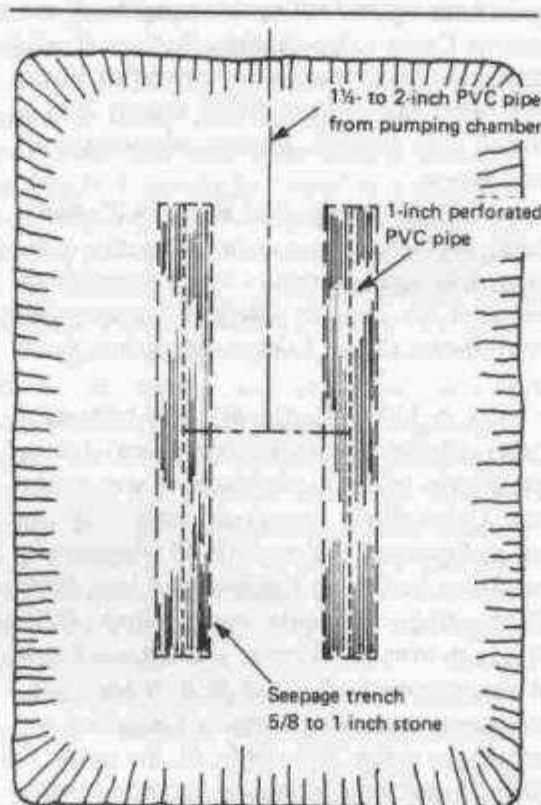
**8. NEED A WATER-SAVING TOILET?** -- Ordinary toilets use 5 or 6 gallons a flush; smaller water-saver models use 3 1/2; adapt to manual action (flush stops when handle is released). Cut water use from toilet over 75 per cent with an air-assisted 2-quart-flush toilet (Write: Microphor Inc., P.O. Box 490, Willits, CA. 95490).

**9. CUT SHOWER WATER** -- Visit a plumbing supply firm and install a flow-restricting device, in pipe or in a new shower head. Cut flow to 1/2 gallon per minute with air-assisted system (Write: Minuse Systems, P.O. Box 310, Mokelumne Hill, CA. 95249).

**10. IN EXTREME CASES** -- You may have to completely separate toilet wastes from the soil absorption system. Talk to your sanitarian about composting toilets; vacuum toilets with holding tanks; air-assisted toilet (see -8) with holding tank; mineral oil or biological recirculating toilet with holding tank; or combined waste holding tank.

#### Other Thoughts

Another common method to prevent clogging or back-up of your septic system is checking the sludge level in your septic tank, and pumping it out when it's close to the



Plain View

outlet pipe. This may have little to do, though, with preventing lake pollution.

Above all, lake residents need to be interested; they need to ask questions; and they need to gather information. They need to be positive; and lead the way for others in protecting their lake. Those who browbeat their neighbors will not have an audience. They need to be persistent; Rome wasn't built in a day.

Next issue, we'll provide a few more thoughts for clean lakes, and listings of products, manufacturers and publications.

Paul Todd was employed for 3 years by the water quality planning program of South-central Michigan Planning Council near Kalamazoo. Previously, he was a reporter for the *Kalamazoo Gazette* for 10 years. He recently completed *Don't Do It In the Lake*, a book on home sewage disposal on Michigan inland lakes. *ML & SA* is reviewing the book for possible publication.

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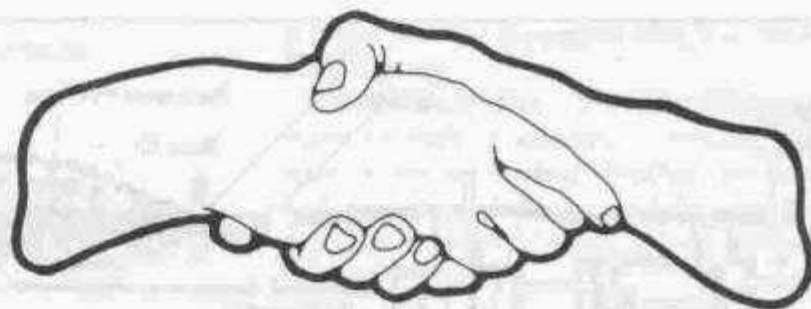
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- WATER, STORM AND SANITARY SYSTEMS



# A Unique Partnership: Water and Health

James Lampky  
Department of Biology  
Central Michigan University  
Mt. Pleasant, Michigan 48859



Although we Michiganders are in a very unique position with regard to the seemingly generous amounts of good, fresh water, other areas of the U.S. and other land masses of the world look upon us most covetously. With our present knowledge of the actual finite supply of water on earth, we are indeed in no position to hasten the course of nature by causing the premature death of a lake or other water supply.

From the point of view of human need for good health, each one of us require about three liters of water per day. This is true of an individual living a normal life in the temperate zone. But, if one lives in a more tropical or arid setting, more water is necessary for maintenance of health. Water serves as the basic material of all living things, microorganisms, plants and animals—including man.

Water participates in countless biochemical reactions occurring in every living cell. If water were not available, all such reactions would soon grind to a halt for a short time preceding death. Historically, one can relate mankind and the relationship to water:

- 5000 years ago, people of mid-east built dams for drinking and irrigation water;
- Jacob's well is reported still in use;
- the Greeks and Romans built aqueducts and public baths;
- Ponce DeLeon sought the "fountain of youth" in the New World to prevent aging;
- numerous references in the Bible made to water regarding cleansing and healing both the body and soul.

We have been aware of the fact that water quantity, as well as quality, plays a large role in daily living. On the average, each person utilizes more than 200 liters daily for normal living, such as bathing or washing, toilet facilities, cooking, dishwashing, etc. All of these aspects of living require good water for health purposes. The 200 liters daily is irrespective of the water used of production of goods and material we purchase and use daily. Indirectly, we use water to irrigate many of the crops we grow, and it is of necessity that irrigation water is of high quality lacking chemical and biological contaminants. It is the goal of this paper to attempt to bring into focus some of the recent problems, and also solutions that have seemed successful.

## Chemicals in Water:

In 1969, elemental mercury was discharg-

ed by industrial plants into the St. Clair River, Lake St. Clair, and the Detroit River. Bacteria in the water changed the elemental mercury to an organic form, methyl mercury. Methyl mercury is toxic and absorbed by living organisms. Fish then were found to be contaminated with mercury and a ban was put upon keeping and eating fish caught in these eastern Great Lakes waters. Further, it was found that persons who had eaten fish which had been taken from these waters had a higher than normal amount of mercury in their blood.

In 1970, Dow Chemical at Sarnia (Canada) stopped discharging mercury into the river. Since that time, mercury levels have dropped and the ban on taking and eating fish from those Great Lakes waters has been lifted.

Then in 1973, shortly after the release of Coho salmon in the western Great Lakes, specifically in Lake Michigan, it was found that Coho flesh contained high level of polychlorinated biphenyl (PCB). Apparently industries bordering the lake had long been discharging effluents containing PCB. Although from that time to present, we know of no untoward effects of PCB in Michigan, however, in Japan multiple casualties are known to have occurred. At the time in 1973-74, persons eating the fish were warned about removal of fat from the fish prior to preparation and also to limit oneself to only one meal of the fish per week.

Presently, PCB levels in Lake Michigan salmon have dropped to a safe level and the 1974-1977 fish eating restriction has now been removed.

In the latter part of 1977, in Hemlock, a village in Saginaw County, residents complained of health problems of themselves and of their farm animals. It was claimed that a variety of illnesses were higher than for the average population and charges were leveled that the illnesses were due to contamination.

No less than ten separate public and private agencies have tested the ground water for pollution. To this time, none of the agencies have been able to confirm that the illness is due to contamination by chemicals, Pesticides, or bacteria. The case is still open and the EPA is currently investigating.

An even more of a hazardous situation regarding ground water contamination remains with us. In Muskegon County, a number of chemical concerns have legally

and illegally disposed of noxious chemicals and residues thereof into the soil and water of that county. Legally, the companies dumped into sludge disposal lagoons; illegally, the wastes were dumped wherever possible.

The net result of the disposal program, legally or illegally, is that waters of Muskegon Co. have become polluted with such chemicals as: dichlorobenzene (human carcinogen), Hexachloropentadine, brine, mirex, hexachlorobenzene, PCB, and DDT. All of these chemicals are life-threatening. The chemicals do not belong in aquifer water, and state agencies are attempting to force the companies to clean-up the waste chemicals.

## Microorganisms in Water:

First, water has long been known as an agent of disease transmission. Microscopic life forms in water are a problem in any water; surface water and in water from the soil depths in regard to water and health.

We use water for a wide variety of things, for example, swimming, fishing, and boating. Each of the activities entail contacting the water in one way or another. We use water for drinking, cooking, bathing, cleaning and for washing our utensils and clothing. Each of these uses, although not exactly the same, requires water to be of a purity for drinking purposes.

By purity, I mean to be free of bacteria, viruses, and other forms of microscopic life. We obtain our water from wells (generally in the rural setting) or from wells or other water sources (in the municipal setting). Wherever we obtain water, we expect it to be pristine and pure!

But this is not always the case. Water has been known to be contaminated from old wells long forgotten, from poorly designed sewage systems, backups from farmyards, from floods, and from just about any other source imaginable.

We further know that even if our water supply is contaminated, it may possibly **not** contain pathogens. But I certainly wouldn't wish to chance drinking water that might be contaminated, would you? At present we are still using and relying upon testing methods developed some 67 years ago (1914). Most of the tests currently used are changed only slightly from the original test methods. We still use *Escherichia coli* as the reference organism; because it is normally from the digestive tract of warm-blooded animals.



The bacteria that concern us with regard to health are members of the enterobacteria group, enteropathogenic **Escherichia**, **Edwardsiella**, **Citrobacter**, **Salmonella**, **Shigella**, **Klebsiella**, **Enterobacter**, **Hafnia**, **Serratia**, **Proteus**, **Yersinia**, and **Erwinia**. Also some organisms of **Pseudomonas**, **Vibrio** and **Streptococcus** are of considerable importance with regard to water and health. In addition, and as I tell my students, any bacterium has the potential of becoming a pathogen when taken out of its normal environment and placed in a situation where conditions for growth and reproduction are conducive.

As noted above, the methods we currently use to test water for purity were developed more than 60 years ago. Very few changes have been instituted since then. One test, not commonly used, is to test for fecal streptococci using a special agar. Although this test is one which is not universally accepted, it is one which does indicate probable pathogens.

Human viruses appear to be becoming more and more important in regard to water and health. Of the more than 100 known water borne viral types, those which cause infectious hepatitis, polio, respiratory, and digestive tract infections, are of prime importance, for they cause great human misery and suffering. Although viruses are well diluted in water, it is often difficult to diagnose a viral disease and even if it is diagnosed, there is no known chemotherapy treatment available, as is known for bacteria to be treated with antibiotics. The only means of treatment of a viral disease or infection is bedrest and plenty of fluids.

In addition, there are no simple, relatively quick means of viral identification. There are methods of viral identification, but usually it takes several days or more of intensive work and preparation to determine with which virus one is working. The most reliable means of isolation and identification of viruses is by monolayer tissue culture and resulting plaque formation. One major problem that arises here is that of which tissue should one use for assay. Another problem is that many, if not most, labs are not equipped to do such specialized and/or exotic types of testing. Further, even if we are able to do basic viral testing, how can we be assured that we are not missing certain viral types?

Finally, before I end this section on "microorganisms in water", I wish to bring to your attention the fact that we depend, almost entirely, upon microorganisms (the "good" ones) in helping to aid a clean water supply. Bacteria are actually indicators of the chemical make up of the water at a particular location. Certain species flourish under the influence of choice chemical environments. This then serves as a clue to the scientist of a specific kind of water contamination. Of course, we can then add bacteria (or they are

there naturally in small numbers) to biodegrade almost any kind of compound. Examples are those such as bacteria that aid in the degradation of phenols in phenol sludge disposal lagoons of several chemical concerns in the state, as well as a recent granting of patent rights to a bacterial species for oil degradation (Supreme Court, 1980).

Therefore it seems relatively clear that without bacteria in water systems such as ponds, lakes, streams, rivers, and other water-ways, organic compounds would never be degraded and would only accumulate. This then leaves us with both "good" and "bad" bacteria in water. The "good" bacteria aid in clean-up of water, while the "bad" bacteria cause human health problems.

#### **Some solutions (conclusions):**

In order to keep the wide and varied problems of water and health in line and in check, we must have some form of regulated approach. It would be "nice" if it could be done by individuals, but an individual is, frankly, **powerless**. Therefore, we must have a surveillance system with the authority to relegate responsibility, to draw up new rules and regulations as needed, and to enforce them. Of course we do have such a surveillance system at present. At the federal level, the EPA is a watchdog. At the state level, the Department of Public Health serves as the environmental health agency with a division known as the Chemicals and Health Center coordinating the activities of the Department with that of other state agencies including:

Department of Agriculture that monitors foods, chemicals in foods, and pesticide use. The DNR monitors industrial water discharges, industrial air emissions (acid rainfall), and disposal of toxic and hazardous wastes. And finally the District Health Departments monitor various aspects of local pollution problems. At a local level, we have both county and municipal government agencies which monitor and protect the local citizenry with regard to water supplies and sewage disposal facilities.

Although none of us really like to pay for such governmental agencies, they, the agencies, are an absolute essential and integral part of water and health. The role of the persons in these agencies to force business, industry, and each and every individual to obey is necessary if we are to continue to keep an even balance with that limited resource - water. These governmental agencies - federal, state, and local - all have field laboratory persons keeping tabs on pollution problems.

In addition to governmental surveillance, there are, in Michigan, several private environmental concerns which also serve to protect our water, and hence, our health. These businesses are an important link between the public and governmental agencies

because they are able to rapidly respond (unlike most governmental agencies) to an immediate problem or situation. In my opinion, these businesses will most certainly gain more respect (and work) from the public and governmental sectors.

Education is finally responding (in the past few years) to recognizing its responsibility to the environment and to the public by making everyone more aware of the importance of water and health. At the higher education level, we have been teaching about water purity and cleanliness for a long time. Only relatively recently has such education "leaked" down to the high school and grade schools levels. This means that only a small percentage (perhaps less than 50%) of our citizens are aware of the fact that water is really a limited resource. If indeed this is true, would it not be a good idea to spread the "aquagospel" further? By this I mean, to teach at all levels of education, repeatedly, that water is indeed a limited resource and that indeed, good water and good health is a true partnership. In conjunction with the eight purposes listed by ML and SA, I would propose that the Michigan Lake and Stream Associations finance regional seminars, perhaps two days, to update teachers in order that they may teach about water quality and health.

And finally for the future, trained persons must constantly seek out new and more streamlined method of testing and monitoring water supplies. Perhaps some of the current methods will remain, but with technological advances made in the past few decades, we certainly ought to be able to monitor problems in the field and locate the source of the problem much more quickly and with more accuracy than we have in the past. As I see it in future years, we will be able to put a few milliliters of water into a computer based machine that will be able to tell us in microseconds the chemicals and microorganisms in that given sample. We can then act quickly to prevent megacontamination, as has been the case in the past.

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# ML&SA NEWS

By Cecile Harbour

## NEW ML&SA MEMBERS

### Region II

Lake Leelanau Association, Leelanau County  
Wayne Wunderlich, President

**The Birch Lake Association, Inc.,** Antrim County, William Holland, President

**Idlewild Lake Association,** Lake County  
Arthur R. Parks, President

### Region IV

Greater Wall Lake Association, Barry County  
John S. Woods, President

Crockery Lake Association, Steve Menn, President

Birch Lake Millpond Association, Hubert Getzinger, President

### Region V

Coon Lake Hills, Livingston County, Tom Augustus, President

Hi-Land Lake Property Owners Association, Roger Maczura, President

**ALGONQUIN LAKE COMMUNITY ASSOCIATION,** The association conducted its 10th annual roadside spring cleanup March 28th. Following the winter draw-down for work on the dam, it is expected that the lake should be back to normal levels by May 21.

**BIRCH LAKE ASSOCIATION,** Cass Co. "Fourteen Things You Can Do To Keep Any Lake Cleaner" were published in the April newsletter. Emphasis was placed on careful lawn fertilizing, preferably none, and the use of a buffer zone (greenbelt) to stabilize the shoreline and to prevent runoff.

**BROOKS LAKE ASSOCIATION,** Newaygo Co. Annual dues have been increased so that the association can better carry out its goals and provide better service to its members. Fund raising activities include a flea market, rummage sale and bingo.

**COREY LAKE PO ASSOCIATION,** St. Joseph Co. High praise was given to the membership committee for signing 122 properties to membership during the first year of organization. Even though the Self-Help Monitoring Program has assisted the association to determine the water quality, there is indications that vigilance must be maintained to evaluate the changing conditions from year to year.

**ELK-SKEGEMOG LAKES ASSOCIATION,** Antrim, Grand Traverse & Kalkaska Co.'s. This is the 30th anniversary year for the association. Among the projects for 1981 is a re-survey of all shores for algae to determine any changes, detrimental or beneficial, and to use the results for further improvement.

**KEARSLEY LAKE ASSOCIATION,** Genesee Co. A plan to provide movies and pictures of previous activities on the lake is being discussed. An effort is to be made to encourage limiting fertilizer runoff from the municipal golf course adjacent to the lake. Water clarity has diminished in the past 2 years. There will be a fish survey in May, and the DNR will continue to plant Tiger Muskies.

**LAKE CHARLEVOIX PO ASSOCIATION,** Charlevoix Co. Following is a quote from the newsletter, "A greenbelt is an easy, economical and attractive way to do something positive to protect the water quality." It describes what a greenbelt (buffer zone) is and encourages the LC POA members to work toward such plantings.

**LAKE FENTON PO ASSOCIATION,** Genesee Co. The association has researched a Wetlands and Floodplains Control Ordinance. It is being studied and appraised by the Fenton Township Planning Commission. A fish survey this spring will provide information as to how the association can best improve fishing. Members are again urged to **not** feed the geese, which may alter their natural migrating habits and encourage them to remain in the area.

**LAKE LEPEER ASSOCIATION,** Lapeer Co. CPR classes were offered in March, at no cost. Erosion is a major problem and members are urged to help to correct the problem. A Carp Shoot is planned for June.

**LAKES PRESERVATION LEAGUE,** (Devil & Round Lks.) Lenawee Co. The monthly newsletter is full of information of much interest to the members. The association is studying fish stocking; the effects of the construction of an alcohol producing plant with the projected use of 500,000 gallons of water per day; is active in township politics and has observers at all meetings; reports special activities such as the Ice Festival in February that attracted 6000; and conducts quarterly membership meetings.



**PROPERTY OWNERS OF LINCOLN LAKE,** Kent Co. ML&SA legal counsel, Joseph Hollander, reported at a special meeting in February, on the status of the litigation in which the association is involved. They have joined this suit with the neighboring Land O' Lakes Association against Spencer Township and Lincoln Pines Resort. A very active fund drive includes a successful weekly bingo party and an auction. The joint effort of the two associations is worthy of comment.

**OSTEGO LAKE ASSOCIATION,** Otsego Co. A water quality survey conducted last summer and the results summarized for members is an excellent cooperative effort by the association, the U of M Biological Station at Pellston and the Northeast Michigan Council of Governments (NEMCOG).

**PINE LAKE PO ASSOCIATION,** Oakland Co. Lake users are being urged to voluntarily exercise common courtesy to other users so that all may enjoy the lake. The lake has about 396 acres of water and there are about 500 families with lake privileges. Peak use on summer week-ends and evenings demand that users consider the safety and pleasure of all users.

**PORTAGE & BASE LAKES PO ASSOCIATION,** Livingston Co. Wetlands adjacent to Little Portage Lake are in jeopardy of development for access to back lots. The association is on record in opposition to the filling. Dedicated public access strips are being located and efforts made to make them available to only affected subdivisions in the immediate neighborhood. The Dexter Township Board has formed a Lakes Management Committee with P/B President as Co-Chairperson. Lake related ordinances such as keyholing and runoff from developed land will be considered.

**THREE LAKES ASSOCIATION,** (Bellaire, Clam, Torch) Antrim Co. There are over 100 miles of shoreline on the 3 lakes. It is pointed out in the Winter 1981 Newsletter that the Water Quality Program has provided most of the information needed on algae — that what is really needed is more active participation by the membership so that they will understand the water quality testing completely and report problems promptly.

**THE GREATER WALL LAKE ASSOCIATION,** Barry Co. We wish to welcome this association to ML&SA membership. A law suit has been instituted to stop construction of a channel for which the DNR approved a permit.

**THE WOODBECK CHAIN OF LAKES ASSOCIATION,** Kent Co. Four members of the association were elected to positions in 2 townships of the chain. These people have May, 1981

also been active in association activities. A major project has been the production of a lake directory, which will soon be ready for distribution.

### Composting Toilets Are Legal In Michigan

Act #241\* which was signed by Governor Milliken on January 13, 1981 and which became effective on March 31 provides that, "a person may install and use in a structure an acceptable innovative or alternative waste treatment system or an acceptable innovative or alternate waste treatment system in combination with an acceptable greywater system."

Such a system shall be subject to regulation by the local health department. The local health department may inspect each waste treatment system at least once each year to determine if it is being properly operated and maintained.

Before such a system may be installed, the property owner must make application for and receive from the health department an approval permit and secure information on the appropriate installation of such a system.

Even though the Act permits local units of government to charge construction fees for available public sanitary sewer systems, local units of government are empowered by the Act to exempt the owner of an acceptable innovative system from **connection and user fees.**

Some of the arguments in favor of composting waterless toilets include: (1) They conserve water use; (2) Promote nutrient recycling by creating usable humus; (3) Reduce energy demands; (4) Reduce costs for waste treatment; (5) A viable substitute for septic-tank drain field systems.

For more information, consult with your local health department and with companies that produce and market acceptable systems. (Editor's note:) please see the article by Rose Houk entitled "In Praise Of The Privy" that appeared in the August, 1979 Michigan Riparian.

\*Act #241 is the legislation which grew out of Senate Bill No. 979 which was introduced in the Regular Session of 1980 by Senators Sederburg, Geake, Arthurhult, Monsma, Pierde, Faust, Vanderlaan, Engler, DeGrow and Irwin.

### GRATITUDE

Michigan Lake & Stream Associations (ML&SA) is happy to report that two of its member associations have voluntarily assessed their members \$1.00 for 1981 as dues to ML&SA. The PORTAGE & BASE LAKES POA, Livingston County with 240 members, and the POA OF LINCOLN LAKE, Kent County with 85 members have added \$134.00 to their regular dues of \$130.00.

ML&SA wishes to acknowledge the action taken by these associations and to express our appreciation.

The ML&SA Board of Directors has formed a  
(Continued On Page 20)



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# ACID RAIN

## DOES MICHIGAN HAVE AN ACID RAIN PROBLEM?

According to an article in the November December 1980 Michigan Natural Resources Magazine, "In Michigan, the west end of the Upper Peninsula is particularly vulnerable (to Acid Rain) and brook trout found in the lakes and streams there have been affected by the rain".

By Dr. Ellis Cowling

The following information is from an abstract entitled "An Historical Resume' of Progress in Scientific and Public Understanding of Acid Precipitation and Its Biological Consequences", which was presented by Dr. Ellis B. Cowling, Chairman, National Atmospheric Deposition Program and Associate Dean of Forest Resources of North Carolina State University, at the conference on the "Effects of Acid Precipitation on Ecological Systems" which was held at Michigan State University April 1-3, 1981.

Some years ago the terms "acid precipitation" and "acid rain" were bits of esoteric jargon used almost exclusively by scientists in certain specialized fields of ecology and atmospheric chemistry. During the last few years, these terms have become worrisome household words in many countries around the world.

### Early Awareness of Acid Precipitation

Many features of the acid rain phenomenon were first discovered by an English chemist named Robert Angus Smith in the middle of the 19th century. In 1852, Smith published a detailed report on the chemistry of rain in and around the city of Manchester in England. In this account, Smith (1852) called attention to the changes in precipitation chemistry as one moves from the middle of a polluted city to its surrounding countryside: "We may therefore find three kinds of air, -- that with carbonate of ammonia in the fields at a distance, -- that with sulphate of ammonia in the suburbs, --and that with sulphuric acid, or acid sulphate, in the town". Smith also pointed out that the sulfuric acid in city air caused the fading of colors in textiles and the corrosion of metals.

### Modern Awareness of Acid Precipitation

Modern understanding of acid precipitation and its environmental consequences had its origins in three seemingly unrelated fields of science: limnology (the study of lakes), agriculture, and atmospheric chemistry.

During the first half of this century, several scientists in Europe and North America

studied certain isolated aspects of atmospheric and surface water chemistry. Occasionally interactions were demonstrated, but it was Evile Gorham, now Professor of Ecology at the University of Minnesota, who, in a long series of papers, developed the major foundations for our present understanding of the causes of acidity in precipitation and its impact on aquatic ecosystems (Gorham 1955, 1957, 1958a-c, 1959, 1961, 1965). On the basis of research both in England and in Canada, Gorham and his colleagues demonstrated the following principles:

- 1) Much of the acidity of precipitation in industrial regions can be attributed to atmospheric emissions produced during combustion of fossil fuels;

- 2) Progressive loss in alkalinity of surface waters and increase in the acidity of bog waters can be traced to atmospheric deposition of acidic substances in precipitation;

- 3) Much of the free acidity in soils receiving acid precipitation is due to sulfuric acid;

- 4) The incidence of bronchitis in man can be correlated with the acidity of precipitation; and

- 5) Fumigation with sulfur dioxide and resultant acid rain contribute to the deterioration of vegetation, soils, and lake-water quality around metal smelters.

### The Present Status of Knowledge Concerning Acid Precipitation

During the summer of 1979 a Cooperative Agreement was established between the U.S. Environmental Protection Agency, the National Atmospheric Deposition Program, and North Carolina State University for the management and coordination of research on the Effects of Acid Precipitation on Aquatic and Terrestrial Ecosystems. One of the major responsibilities specified in this Agreement is synthesis and integration of knowledge about acid precipitation and its ecological effects. Accordingly, an effort was made to summarize in a few statements of fact, the present status of knowledge in this area of science. The most recent version of this Status Report is presented in Table 2.

These summary statements are providing a part of the background upon which scientists in various institutions and organizations in the United States and Canada will continue to build a scientific foundation for understanding the phenomenon of acid precipitation and its important ecological effects.

The selected summary statements listed below describe the general status of knowledge about acid precipitation and its ecological consequences on aquatic ecosystems and on water quality as of December, 1980. Statements about atmospheric chemistry (#'s 1-13), General Effects on Ecosystems (#'s 14-20), Effects on Agricultural Crops and Forests (#'s 27-30) and Effects on Soils (#'s 31-37) are not included in this summary. In most cases these statements are a synthesis of observations and inferences derived from many independent investigations.

### Effects on Aquatic Ecosystems

21. Acids and other soluble substances contained in polluted snow are released as contaminated meltwater during warm periods in winter or in early spring. The resulting release of pollutants can cause major and rapid changes in the acidity and other chemical properties of stream and lake waters. Fish kills are a dramatic consequence of such episodic inputs into aquatic ecosystems. (Oden and Ahl, 1970; Leivestad et al., 1976)

22. Acid precipitation titrates the acidity/alkalinity of lake and stream water from conditions that are favorable for fish and other aquatic organisms to conditions that inhibit reproduction and/or recruitment of populations of fish and fish-food organisms. (Henriksen, 1979).

23. In oligotrophic lakes and streams at pH's between 6.0 and 5.0, reproduction of certain species of aquatic organisms is inhibited; at pH's below 5.0, populations of many freshwater fish will go to extinction. (Beamish and Harvey, 1972; Dickson et al., 1973; Leivestad et al., 1976; Schofield, 1976)

24. Interference with normal reproductive processes in fish populations is induced not only by acidity itself but also by increased concentrations of certain cations - notably aluminum - in acidified lake and stream waters. (Hultberg and Grahn, 1976; Cronan and Schofield, 1979)

25. Reproduction of frogs and salamanders also is inhibited by atmospheric acidification of surface water. (Pough, 1976; Cronan and Schofield, 1979).

26. As of 1980, hundreds of lakes in the Adirondack region of New York State, and many hundreds of lakes in various parts of southern Ontario and Quebec were showing acid stress in the form of diminished populations or extinction of fish populations. Lakes



and streams in other regions of the United States and Canada also are vulnerable to stress by acid precipitation. These regions include northern Minnesota, Wisconsin, and Michigan; parts of southern Appalachia and Florida; and large parts of Washington, Oregon, California and Idaho and parts of the Canadian Maritime Provinces. (Beamish and Harvey, 1972; Schofield, 1976; Galloway and Cowling, 1978; Altshuler and McBean, 1979)

#### Effects on Water Quality

38. The chemical composition of lake, stream, and groundwaters is determined in part by the chemical composition of precipitation and dry deposition. The chemical composition of precipitation is modified by chemical and biological weathering and exchange processes as precipitation 1) washes over vegetation, 2) percolates through the soil, 3) interacts with the underlying bedrock of the drainage basin in which the precipitation occurs, and 4) runs off over surface. (Braekke, 1976; Oden, 1976)

39. Acid precipitation increases the solubility and mobility of many cations in soil. This increases the concentration of toxic metal cations including Al, Mn, and Zn in the

soil solution. It also increases the leaching of nutrient cations including K, Ca, Mg, etc. These toxic and nutrient ions are transferred from soils into surface and groundwaters. (Braekke, 1976; Oden, 1976)

40. Acidification of groundwaters has been found in western Sweden and attributed to long-term changes in the acidity of precipitation. As a result, hundreds of shallow dug wells and deeper drilled wells for home and farm buildings have shown pH's in the range between 4.0 and 6.0. A strong correlation has been found between the acidity of the well water and the content of metal ions including copper, zinc, lead, manganese, and aluminum. In some cases, accelerated corrosion of copper piping has resulted in the necessity for early repair and/or replacement of copper piping systems. (Hultberg and Wenblad, 1980)

#### The Future of Acid Precipitation Research

We have come a long way since the earliest attempts of Smith, and Gorham, and Oden to alert the scientific community and the public at large to the causes and consequences of acid rain. Much has been learned both in Europe and in North America. But much more remains to be learned about many aspects of the phenomenon and its ef-

fects. The pathway that has led to our present understanding has been illuminated by the remarkable insight of a few imaginative scientists. It has also been illuminated by many others who have filled lesser voids in our knowledge.

Today, public interest in acid-rain research is at an all-time high in many parts of the world. The challenge for us as scientists is to satisfy that interest by providing a still deeper understanding of the atmospheric processes, the soils transformations, the vegetational changes, the alterations in water chemistry, the materials effects, the physiological influences, and the nutrient as well as toxic effects of acid precipitation.

Research is the key to improved understanding. Improved understanding is the key to wiser public and private decisions that relate to the use of energy and to the quality of life in our society.

Let us get on with the job of learning so that the challenge of managing acid precipitation and its effects can begin as soon as possible.

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# Ground Water Recharge

W. Thomas Straw  
Department of Geology  
Western Michigan University

The possibilities for multiple use of water begins when water reaches the ground surface. At this surface water may enter the soil or runoff. The ability of earth materials to accept water that falls on it as rain or snow is generally referred to as the **infiltration rate**.

The process whereby water enters surface materials and moves downward through the soil toward the water table is known as **infiltration**. Such moisture replenishes those deficiencies that exist in the soil moisture, and the excess moves under the force of gravity to the water table and becomes **ground water**. The maximum rate at which earth materials in any given condition can accept water and transmit it to the water table is called the **infiltration capacity**. Water enters the soil at capacity rates only when precipitation intensity is greater than the infiltration capacity. When such conditions exist the excess water flows across the ground surface as runoff.

The infiltration capacity is a major control factor for ground-water recharge. The ability of earth materials to accept water is extremely variable, and the actual value at a given


location and time depends upon the interaction of several variables. Of primary importance is the permeability of the surficial materials. The movement of water through a soil is strongly controlled by the size and distribution of the particles that make up the soil. Known as the soil texture, this factor dominates the infiltration process.

Surficial earth materials have a wide range of textures and resultant permeabilities. Most people are aware that soils exhibit a correspondingly wide range of water absorbing ability. In general, coarser textured soils, composed mainly of sand and gravel are very permeable, whereas soils rich in silt and clay absorb water very slowly. In areas mantled with glacial drift soils developed on moraines and lake beds are generally slowly permeable whereas soils on outwash and dune sand tend to be much more permeable.

The rate at which a soil of any texture can accept water is also controlled by a number of other factors. Since water moves through the connected pore space in earth materials, anything that changes the availability of such

void space affects the infiltration capacity. Moreover, water is moved downward through soil principally by the force of gravity, but if a soil is dry at the beginning of a rain this force is supplemented by a strong capillary force. Consequently, the amount of soil moisture is an important control factor in the infiltration rate. Also, many clays and soil colloids swell when subjected to wetting. If soil moisture content is high, they reduce the initial infiltration rate. If the soil is dry, they tend to reduce progressively the ability of a soil to transmit water through the course of a rainfall, and dry soils with high infiltration capacities may become significantly less permeable some time after it begins to rain. Another factor that tends to lower the infiltration rate as a rain progresses is the inwash of fine materials. "Fines" tend to clog pore space and thereby reduce the infiltration capacity of the soil. Impact of rain drops can also cause compaction and reduce the ability of the soil to transmit water. This is especially true of exposed clay-rich soils. Thus, increases in soil moisture, swelling of clays and soil colloids, the inwash of fine material and compaction due to rain drop impact may all cause the infiltration capacity to decrease during a rain.

Compaction by machinery, pedestrian traffic and animals significantly influences infiltration. Consequently, construction areas, playgrounds, dirt roads and overgrazed areas may be virtually impervious.



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Some factors may increase soil permeability and thereby enhance the infiltration capacity of an area. The presence of a dense vegetative cover such as grass or forest generally increases infiltration. Vegetation breaks the fall of rain drops; provides a layer of partially decayed organic material and promotes the activities of burrowing organisms.

Of the several factors that influence infiltration, soil texture and land use are generally the most important. The texture of soils strongly governs the movement of water from the surface to the ground water, and if all other factors are relatively equal, will dominate the process. In some instances the effect of land use may actually exceed that of soil texture, but only in exceptional circumstances. Earth materials protected by a thick layer of organic material such as forest litter may be loose and permeable, but the same soil barren of vegetation can be hard and compacted due to the impact of rain and the hoofs of animals.

Land use also includes such impacts as urbanization, land drainage by ditch and tile, agricultural practices such as contour plowing, lumbering and mining. In general, change from the original native vegetation to more controlled conditions increases the amount of water that goes into surface runoff and decreases ground-water recharge.

Urbanization combines a wide variety of activities that reduce infiltration. Roads, roofs, playgrounds and parking lots effectively prevent infiltration and thereby recharge of the ground water. Landscaping and recontouring of the land surface combined with the construction of curbs and gutters quickly diverts surface water into major drainage lines and reduces the opportunity for such water to become recharge. In contrast to urbanization, agricultural practices may increase the amount of water that goes into recharge.

Certain farming techniques such as contour plowing and strip or "dry" farming increase the amount of moisture in the soil profile and the amount of water that reaches the water table. Yet, other practices such as surface drainage by ditches and subsurface drainage by tiles are specifically designed to reduce standing water and soil moisture. In humid areas the impact of land drainage generally far exceeds the increases in recharge due to other agricultural practices.

In humid areas ground-water recharge generally occurs through the surface of the land, whereas, lakes, streams and swamps are generally discharge areas for ground water. Streams may add water to the ground water in their banks during floods, but such increases are short lived, and quickly drain after the stream returns to normal stage. A few lakes situated on or near divides may recharge ground water, but few recharge lakes have been shown to exist.

In summary, infiltration and the resulting recharge of ground water sustains supplies of ground water which in turn support the base flow of streams and maintains lakes and marshes. When human activities significantly alter any of the several factors that control infiltration the change will effect the entire ground-water-surface-water system.

Many of the ideas expressed herein are covered in greater depth in the following books which were used for background information.

Freeze, R.A., and Cherry, J.A., 1979. *Groundwater*. Englewood Cliffs: Prentice-Hall, Inc., 604 p.

Luthin, J.N., 1966. *Drainage Engineering*. New York: John Wiley & Sons, Inc. 250 p.

Wister, C.O. and Bruter, E.F., 1967. *Hydrology*. New York: John Wiley & Sons, Inc. 408 p.

## WATER

Source-Atlas of Michigan  
 Edited by Lawrence M. Sommers  
 Published by Michigan State University Press  
 1977

Michigan prides itself as being the nation's "Water Wonderland," an image well deserved. Of the state's official gross water and land area of 61,946,160 acres (25,088,194 hectares), some 40 percent or 24,688,000 acres (9,998,640 hectares) is covered by the Great Lakes, and another 841,000 acres (340,605 hectares) are covered with inland lakes and ponds. The state lies within the drainage basin of the Great Lakes. It has 3,251 miles (5,202 kilometers) of shoreline on the Great Lakes and 36,350 miles (58,160 kilometers) of inland streams. About 35,000 mapped lakes and ponds each cover areas of more than a tenth of an acre (.04 of an hectare.) Including the 20 large inland lakes, Michigan has about 6,500 lakes that each cover ten acres (four hectares) or more and about 15,800 that cover two acres (.8 hectares) or more.

Early explorers found much of the Michigan area swampy or poorly drained. Surface and tile drains have been extensively used, and practically all of the land area of southern Michigan is included in drainage districts. An estimated 50,000 individual drainage projects of varying size are now in operation throughout the state.

Groundwater is readily available from bedrock or from glacial deposits at most sites in the state, although there are places in the western Upper Peninsula and in southern Michigan where well yields are low. There

are also areas in the state where underlying salt deposits make the supplies of ground-water unfit for normal household use.

The Great Lakes are one of the largest freshwater sources in the world. Many coastal settlements and several inland communities depend on the Great Lakes for their water supply. Water supply problems in the state are complicated by the uneven distribution of population. Most of the domestic and industrial need for water is concentrated in the southern third of the state. The Detroit area experiences both the greatest pressure upon surface and groundwater supplies and the greatest threat of pollution of existing sources.



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# Kalamazoo County Takes Steps To Protect Ground Water Resources

Kalamazoo Gazette  
Sunday, March 1, 1981  
By Mike Wagner  
Gazette Staff Writer

The basic life-support system for Kalamazoo County, its groundwater supply, faces a growing threat.

Warning signs have been showing up for years — in Richland in 1977, near the former KL Avenue Landfill in Ostemo Township in 1979 and in the heart of Comstock Township last year.

Then came the most serious "warning" last month, when traces of a man-made chemical were found in two active city water wells for the first time in the history of the Kalamazoo Utilities Department.

"Perhaps it's a good thing," said Utilities Director David L. Wadsworth. "It might give us time to develop protective systems."

"So far I believe we've been fortunate," agreed James E. Akers, director of environmental health for the Kalamazoo County Health Department. But the groundwater contamination problems that have been discovered in recent years demonstrate the need for "closer control over what we discharge into our water," he said.

"If we don't get a handle on it soon we could be in trouble."

Studies by the U.S. Geological Survey show that Kalamazoo County pumps more groundwater than any other county in Michigan — more than 25 billion gallons per year, Wadsworth said.

Michigan itself uses more groundwater for water supplies than 35 other states combined, reports the state's Department of Natural Resources (DNR).

"The entire county is dependent on its groundwater supplies," Akers said. "We also live in a chemical society. When you couple a chemical society with a groundwater supply that often has very little protection, it

points up the need for close cooperation between government, industry and everyone who depends on it" to carefully manage the groundwater system, he said.

Southwest Michigan's groundwater resources are highly vulnerable, Wadsworth said. Sandy soils combined with very shallow aquifers makes our groundwater supplies more accessible, but also more sensitive to impact from waste dumps, chemical spills and discharges into surface water, he said.

The DNR has so far identified 24 former landfills and dumps, 65 wastewater discharge sites, 22 sewage disposal sites and 23 petroleum storage locations in Kalamazoo County which could have an impact on groundwater aquifers, Wadsworth said.

Already there have been nine groundwater contamination problems confirmed in the county, including chromium and copper found in private water wells near Production Plated Plastics Inc. in Richland, traces of several chemicals found in wells near the former KL Avenue Landfill and traces of trichloroethene (TCE) in several wells in the heart of Comstock, he said.

What can be done to prevent further contamination problems in the future?

The key, Wadsworth and Akers agree, is a coordinated effort to manage and monitor our vast groundwater supplies.

Currently, there is very little communication between local governments, state government and industry when decisions are

made about discharging wastes or tapping water supplies, they said.

After the city found traces of the chemical tetrachloroethylene in two wells in its central well field downtown last month, it was decided that a committee should be established to review future developments that could affect the area's groundwater system, they said.

Akers, Wadsworth and Dr. E. Safapour, director of the Kalamazoo County Health Department, met Friday morning to discuss how the committee should be formed.

It was agreed that within two weeks, between 30 and 50 local government and industry leaders will be invited to a "brainstorming" session on water management, Safapour said. Then a committee will be established that will at least review all wastewater discharge permits that are issued in the county, and perhaps coordinate a county-wide water management and monitoring program as well, he said.

"Kalamazoo County has the resources to provide all the water that's needed well into the 21st Century — provided they do not become contaminated," Wadsworth said. "A coordinated effort to manage and protect those resources has been suggested for years, but it's not really been started yet."

Now, thanks to the "warnings" provided by recent contamination problems, the efforts are finally getting off the ground, he said.

## CONTROLLING SUBMERGED AQUATIC PLANT GROWTH IN SMALL LAKES AND PONDS

By Dr. J. Peverly, Cornell University  
Ithaca, N.Y.

Water milfoil (*M. spicatum*) is a very troublesome submerged aquatic plant in the Northeast and other parts of the country. Control by various means has been tried but most have faults. For instance, chemical herbicides are expensive and problems occur subsequent to treatment, including oxygen depletion in the water, effects on non-target organisms and algal blooms. Harvesting has attributes, but regrowth is rapid, and initial and operating costs are high.

The product AQUASHADE seems to offer an alternative to the above, in that it was supposed to only control plant growth by physically reducing their photosynthesis, without quickly killing the plants and causing an oxygen deficiency.

The above type of herbistatic control was indeed observed in field trials at Cornell University initiated in 1978 and continuing through September 1979. AQUASHADE, a combination of innocuous food dyes which filter out the photosynthetically active light, was applied at the recommended rate of 1ppm to two non-flowing ponds infested with milfoil, and growth compared to a

similar control pond. Eight weeks later, the concentration had fallen to 0.5 ppm and an additional 1ppm was made. Stem elongation, dry weight and bulk sample dry weights were measured as indicators of control, and various water quality parameters were monitored, including PH, alkalinity, oxygen level, and chlorophyll for algae.

The results showed clearly that stem weights and growth were reduced by AQUASHADE treatment. However, it was the greater than 90% reduction in total standing crop in the treated ponds by the end of 1979 which showed the effectiveness of AQUASHADE under field conditions for controlling milfoil. This result was observed with no appreciable increase in algae growth, decrease in oxygen, or changes in PH and alkalinity. No effects on other organisms in the pond were observed. In addition, AQUASHADE remained in the water column effectively.

Based on these results, AQUASHADE offers a remarkable effective, simple, non-toxic control program for milfoil and other submerged aquatic plant problems in ponds and small lakes, by not only controlling growth, but also doing it with no ill effects on the pond environment. It can be effective as a growth inhibitor when used alone, or after plant kill with herbicide to keep regrowth down.



# Salmon Bonanza in Grand River

Kalamazoo Gazette Jan. 11, 1981

LANSING—Fishermen in the middle of Michigan won't have as far to travel next fall when their angling targets are Salmon.

An anticipated 55,000 or more coho and chinook salmon will make the trip up the Grand River from Lake Michigan to Lansing.

The Department of Natural Resources says construction of five fish ladders between Grand Rapids and Lansing will be completed by next September, just in time for the fish to make their spawning runs.

Large numbers of salmon — 650,000 chinook and 200,000 coho — were planted by the DNR in the upper Grand River system beginning in 1978. Some 225,000 steelhead (rainbow trout) were also planted in that same Ingham-Eaton-Clinton tri-county area.

"Anadromous fish, such as salmon, go up river to spawn," explains Don Reynolds, DNR watershed management specialist. "We should have some very good fishing the entire length of the Grand River next fall as far upstream as Lansing."

Salmon runs generally start around the middle of September and continue through October. Chinooks weighing about 15 pounds and measuring 36 to 38 inches should be angling targets, while cohos should weigh in at about eight pounds and be approximately 28 inches long.

Steelhead approaching the same size as the coho should be running in October and November.

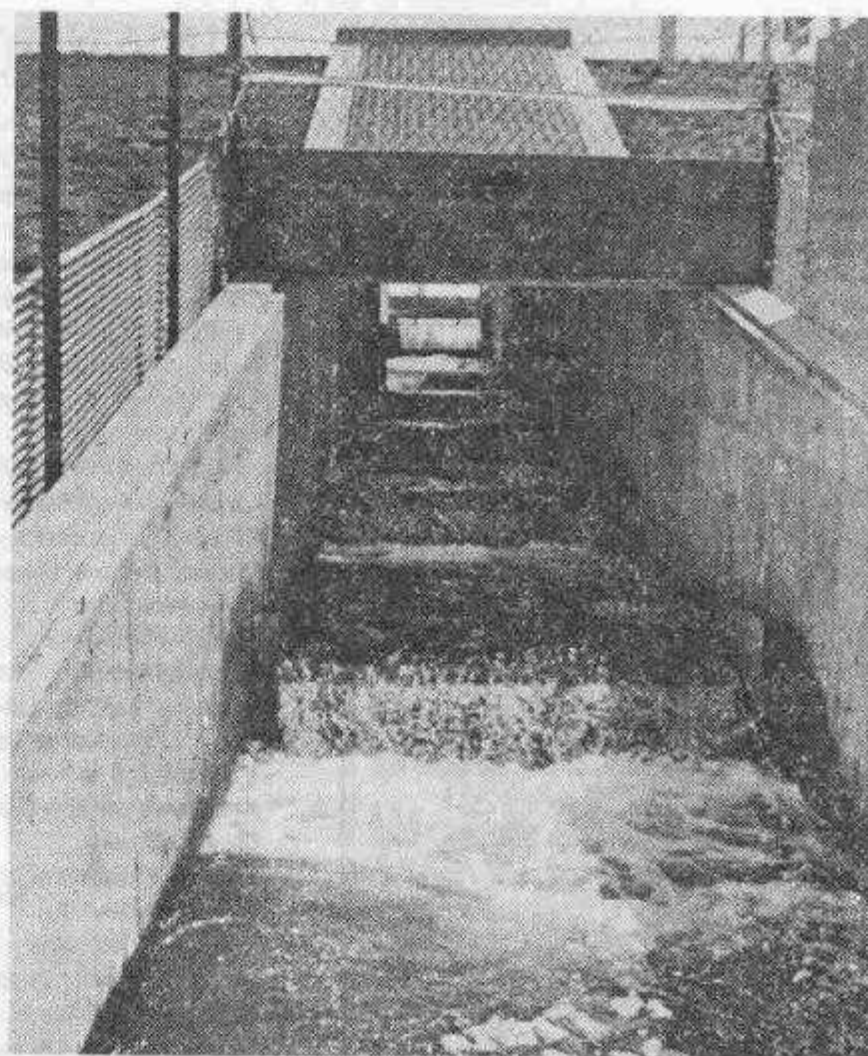
All fish must be caught legally, but the Grand is wadeable most of its length so wading, bank fishing or from boats are options.

Snagging is presently allowed only in a small area below the dam in Grand Rapids. However, the DNR is developing plans to prohibit snagging there in 1982. No snagging will be allowed between Grand Rapids and Lansing.

Salmon plantings in the Grand River began in 1969, but the fish could move no further upstream than Grand Rapids because there were no fish ladders beyond that point. The first fish ladder on the river was completed in 1975.

The Grand River salmon plan cost \$2.2 million and involves the construction of fish ladders — man-made devices to move fish over dams, waterfalls and other barriers to high to jump — at five dams, Lyons, Webber, Portland, Grand Ledge and Lansing.

Funding for the project comes from both the state and federal governments. Half the cost comes from the federal Anadromous Fish Conservation Program and half from the state's Fish and Game Protection Fund, which is supported by hunters and anglers license fee.



Fish ladders such as this are a boon to anglers; fishermen from Grand Rapids to Lansing will benefit.

Gazette photo by John Block



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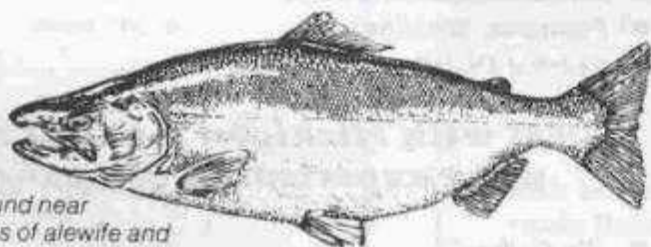
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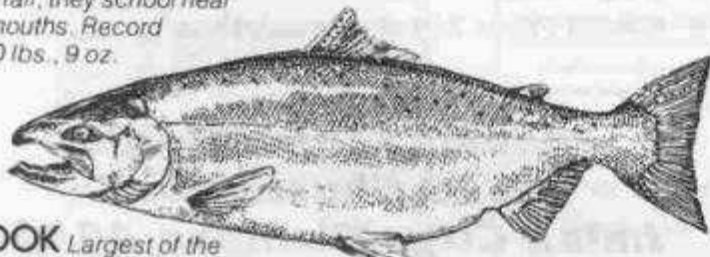
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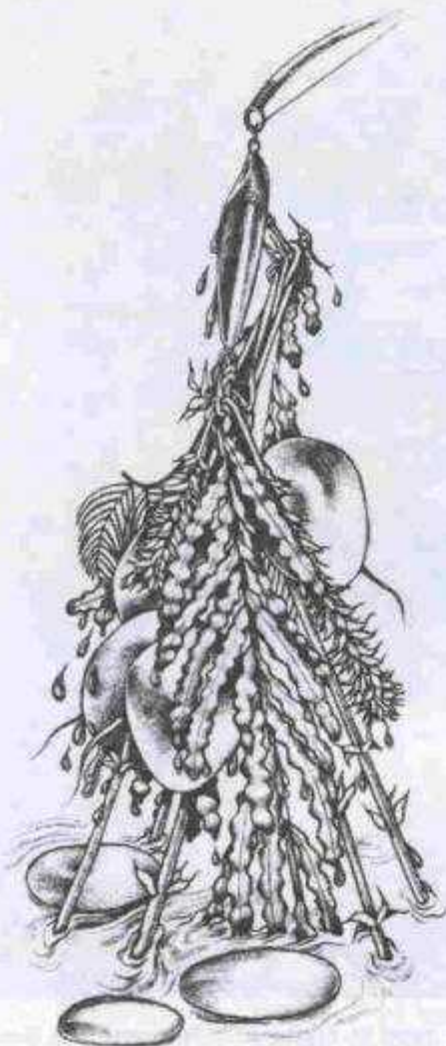


**COHO** Found near concentrations of alewife and smelt. In fall, they school near stream mouths. Record catch: 30 lbs., 9 oz.



**CHINOOK** Largest of the salmon. Notable for its persistent fighting on the line. Record catch: 46 lbs., 1 oz.





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## ML&SA NEWS...

(Continued From Page 13)

"Forward Planning Committee" to study ways to improve the organization, services and funding. One of the funding measures may be a recommendation to assess individual members of each lake association \$1.00 per year for ML&SA membership. A report of this committee will be made at the 1981 Annual Meeting.

### 1981 CONTRIBUTIONS TO ML&SA

Christie Lake Assn. Van Buren Co.	\$ 30.00
Charles Schamanek	10.00
Portage & Base Lakes Assn.	
Livingston Co.	160.00
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Fred & Dorothy Niebrugge	10.00
White Lake Citizens League	
Oakland Co.	100.00
The Long Lake Assn	
Grand Traverse Co.	58.00

## COMING EVENTS

**May 14 & 15** Natural Resources Commission, Lansing.

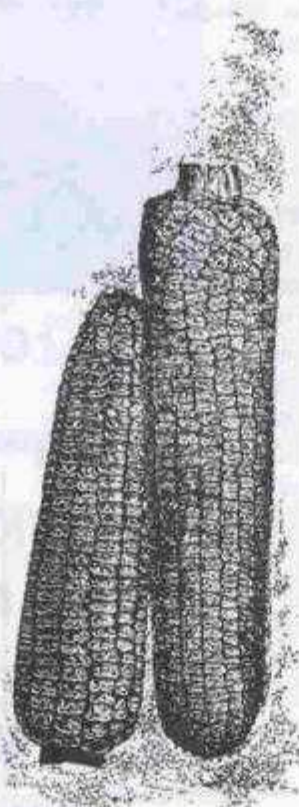
**May 16** Region II Spring Meeting will be held at Blue Lake Township Hall, Kalkaska County. Dr. Cliff Humphrys will speak on the topic, "Lake Management-Update." Registration will begin at 9:30 and the program at 10:00.

**June 11 & 12** Natural Resources Commission, Muskegon.

**July 9 & 12** Natural Resources Commission, Alpena.

**August 13 & 14** Natural Resources Commission, Sault Ste. Marie.

**Sept. 25, 26 & 27** MICHIGAN LAKE & STREAM ASSOCIATIONS ANNUAL MEETING. The meeting will return to Hilton Shanty Creek instead of to Caberfae at Cadillac as announced in the February Riparian. The theme for the meeting will be CLEAN WATER FOR THE 80's. Dr. Straw's knowledge of hydrogeology and his current research of aquifers and groundwater resources of Michigan make him a logical person to speak on the conference theme.



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# 14 THINGS YOU CAN DO TO KEEP YOUR LAKE CLEANER!

The following information from the Southwestern Michigan Regional Planning Commission was included in the April Newsletter to Members of the Birch Lake Association, Vandalia, Michigan.

1. Maintain a zone of natural vegetation between your lake and lawn. If you wish to plant a buffer strip, some trees worth considering are tamarack, red cedar, black willow, red oak, white oak, sugar maple, black ash, and balsam poplar. A buffer strip can help stabilize the shoreline and prevent runoff. Deeply rooted plants can take up nutrients from the soil, instead of allowing them to soak into the lake water.
2. If you are planting a lawn, plant fescue rather than bluegrass. The annual nitrogen requirement of fescue is about 2 lbs. per 1000 square feet, while bluegrass needs 4 to 7 lbs. per 1000 square feet.
3. Use the smallest possible amount (this may be none at all) of nitrogen fertilizer to maintain a good grass cover. Fertilize with nitrogen in the spring using a small amount of soluble form of nitrogen. The principle is

to have the grass use the nitrogen so it will remain vigorous and minimize the amount of undissolved fertilizer on the lawn surface capable of washing into the lake. If the lawn is not growing well, apply a small amount of nitrogen in early summer.

4. Do not use fertilizer containing phosphorus or potash unless a soil test indicates the need for these nutrients and the lawn is not growing well. In most cases no phosphorus is needed on lawns.
5. Water sparingly, especially on sandy soils, to reduce the possibility of leaching nitrogen and other nutrients as the water moves through the soil toward the lake.
6. Avoid fertilizer-weedkiller mixtures. Use weedkillers only if weeds become a serious problem. If weeds are treated, apply the weedkiller in the fall. This will minimize runoff and reduce the chance of injury to trees and shrubs.
7. On lightly fertilized lawns thatch will probably not need to be raked. It will decompose and provide part of the nutrients needed by the lawn.
8. Rake leaves in the fall. This will keep them from "shading" the lawn and from falling into the water where they will add to the nutrient load.
9. Do not cut the lawn too close. Cutting height should be 2" to 2½" so an adequate green area remains on the turf.
10. Don't park your car on the lawn.
11. Don't burn leaves in the gutter. Collect any leaves that fall and use them for compost or mulch.
12. Dog droppings are high in phosphorus, so don't "walk" your dog along the curb. If there is no large area where dog droppings won't be a nuisance, collect the droppings and bury them, compost them or flush them down the toilet. Your neighbor and the lake will appreciate it.
13. Do not clean driveways and sidewalks by hosing the dirt into the street, but sweep it onto your lawn, or collect the dirt for disposal elsewhere.
14. Keep your gutters clean and, if possible, dispose of the water on your property so it can soak into the ground.

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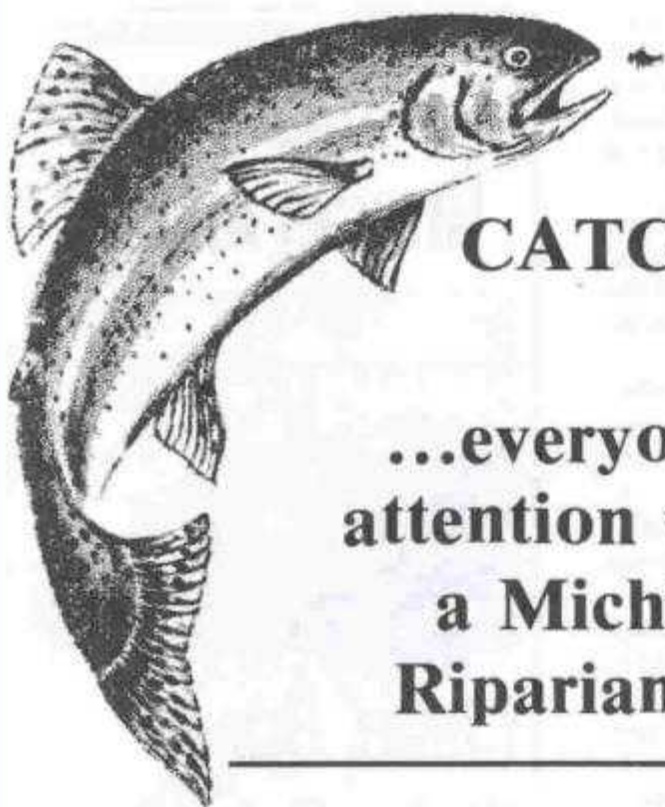
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**Shingle Creek...**

(Continued From Page 7)

Environmentalists point to nearby Lake Apopka in warning.

The 51,000-acre lake once proclaimed "Bass Fishing Capital of the World" is now tainted by years of mucky farm runoff, sewage treatment discharge and citrus processing wastes. Lake Toho is 27 percent smaller than Lake Apopka in surface acreage, but receives twice the amount of phosphorous.

As long ago as 1969, the Florida Pollution Control Commission ordered the Orange County Commission to cease pollution of Shingle Creek.

The U.S. Environmental Protection Agency stepped in with a 1977 order banning discharges by county sewage plants into surface waters.

But negotiations led to an eventual agreement that gave Orange County until 1984 to reduce the level of phosphorous and until 1988 to stop discharges into Shingle Creek.

The agreement cleared the way for construction of a new Western Electric Co. plant and revival of other building projects stymied until then by the state-ordered sewer hookup moratorium.

"Everything was tried and nothing succeeded," Rogers complained. "It was a matter of governments backing down and allowing a county to continue to break the law going into a second decade."

In 1971, the Florida Game and Freshwater Commission "drew down" Lake Toho, lowering the water level to expose the lake bottom to air and sunlight. The process dries up and oxidizes bottom mud and re-establishes natural vegetation, said biologist Vince Williams.

Toho's fish population doubled by 1974.

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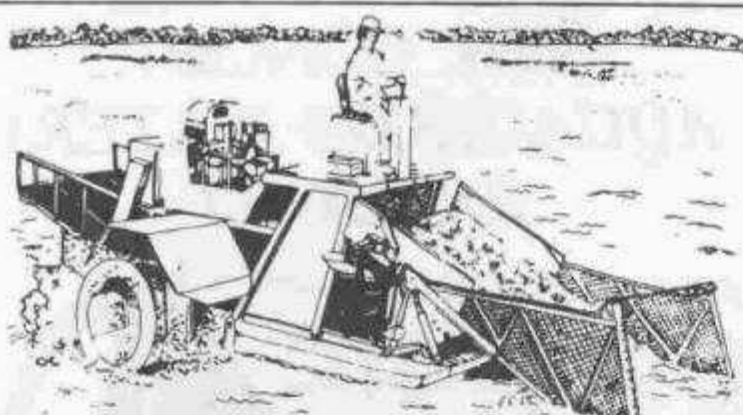
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Pollution mandated a second drawdown in 1979, and the fish population is still working to come back.

But Williams said the process is a treatment, not a cure.

"We are at the point where we would have to draw down so frequently the fish population would have no chance to come back. The possibility of a massive fish kill during drawdown is now very real. The lake might never recover at all. So we've decided not to chance it again unless the water quality is improved.

"If it isn't, the lake has 10 years at most and then it's not going to be worth anything for fishing."

Jim Swan, a Toho fishing guide, has taken the lead among local residents battling to preserve their fishing paradise.

In 1978, when lakeside property owners filed for permits to dredge channels into deep water, for boat usage, Swan fired off letters to the Army Corps of Engineers and took out newspaper ads. His customers and concerned residents began a letter-writing campaign.

The Corps denied the permits.

Now Swan's group, Save Our Lakes Inc., wants to save Shingle Creek.

"We've learned a lesson. Only when the people acquire knowledge and get involved will the government respond," he said. "These are issues I don't think the politicians have a right to decide.

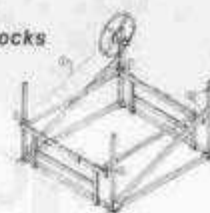
Does Michigan have a "growth at any cost" malaise?



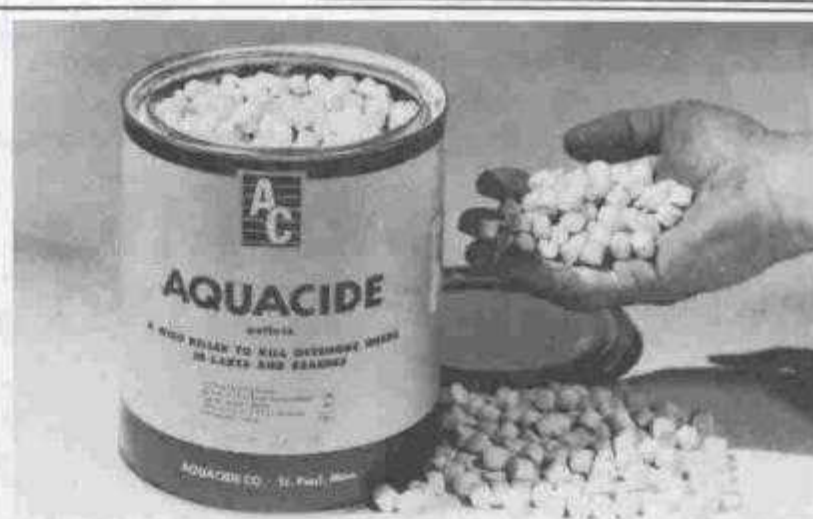
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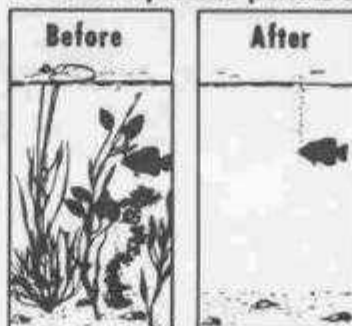


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