Quest for Clean Waters

Where We Stand:

IN WISCONSIN

Progress Report

1

PUBLICATION 1101–71

DEPARTMENT OF NATURAL RESOURCES
MADISON, WISCONSIN 53701

TABLE OF CONTENTS

Although the early log drives have been glamorized in our folklore, they caused serious damage to streambeds and water quality.

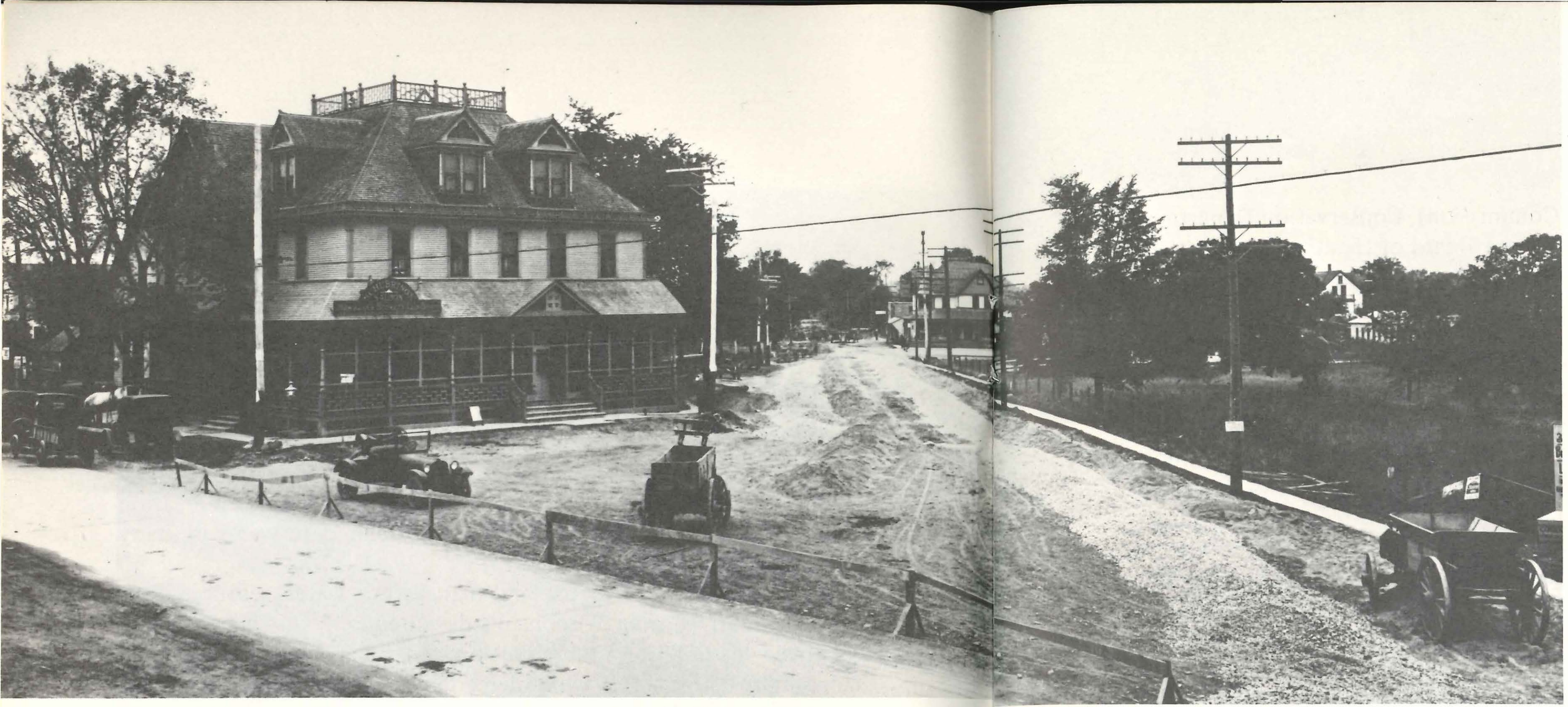
HISTORICAL BACKGROUND

Water has played an important part in Wisconsin's development from the time of the earliest settlers. Most of our major cities are located near large lakes and streams. Industry, farming, recreation and the everyday lives of all citizens are related to water in many ways.

The ways in which we use and manage our water resource have changed greatly during Wisconsin's development. This paper briefly traces the history of water pollution control in Wisconsin, emphasizing important changes which have taken place in public attitudes, governmental action, industrial activity and waste treatment techniques.

In order to measure progress one has to examine conditions as they were sometime in the past, evaluate those conditions, and then try to show just how the improvements have been accomplished. Common views among early Wisconsin settlers were that natural resources were to be converted into cash. Development of an industrial economy was of paramount importance. Restrictions on private activities or laws which would slow industrial development were few and attempts to enact such laws were largely unsuccessful. Understanding of public health, sanitation, disease transmission, and immunization was at a low level.

Rivers were considered important mainly for power generation and transportation. One of the main uses was for transportation of wastes. Early industries made little use of by-product recovery and wastes represented a much greater proportion of the product than they now do. Slaughterhouses used only edible meats, while bones, blood and internal organs were flushed into the nearest stream. Sawmills dumped sawdust, bark, shavings, and scraps into the nearest water. Cities discarded ashes, earth removed from excavations, rubbish and garbage in streams. Sewage treatment was nonexistent. So great were the volumes of wastes reaching some streams that early



Imagine yourself as part of this scene at Hales Corners in 1917. What were the water conditions at this time? What would be your understanding and attitudes about water pollution?

laws to regulate waste dumping were in part prompted by a need to maintain the stream channels for navigation.

State water regulations enacted in the 1800's were mainly for the purpose of granting powers to cities or local boards for construction of sewers, provision of public water supply, or maintenance of stream channels.

During the late 1800's concern developed over water born disease. The State Board of Health, after conducting a series of tests in 1877, concluded that most water supplies in the state were polluted. However, attempts to require improved sewage or water treatment were met with overwhelming public opposition. At this time interest also developed in the condition of fish and wildlife in these polluted waters. A few sportsmen and conservationists became vocal, but were met with the same public hostility or indifference which faced sanitarians.

Early in the 1900's there was a growing belief at both the state and national level that government had a right and a duty to protect natural resources. Wisconsin, the home of the progressive movement, set up a natural resources policy commission in 1908. Recommendations from this commission led to legislation requiring licensing of mill dams by the state railroad commission and establishment of a conservation commission. The conservation commission was given similar responsibility in conservation activities as was given to the board of health for health activities. This brought three state agencies directly into the water regulatory field and during the ensuing years serious conflicts developed as to how water pollution should be regulated.

In 1925 a tremendous number of fish were killed in the Flambeau River due to pollution. This prompted the legislature to appropriate $10,000 to be used jointly by the conservation and health agencies on water pollution problems. The State Board of Health, in cooperation with the Conservation Department, made studies and presented a report called "Stream Pollution in Wisconsin" to the 1927 legislature.

Due to basic policy conflicts which had arisen between agencies, the legislature established a Committee on Water Pollution made up of representatives of several agencies which had an interest in water pollution. These agencies were the Wisconsin Railroad Commission, (renamed the Public Service Commission), Conservation Department, State Chief Engineer and the State Board of Health through its state Health Officer and the State Sanitary Engineer. The State Board of Health was designated as the administrative agency for the Committee on Water Pollution.

The Committee on Water Pollution, made up entirely of officials or employees of state agencies, began doing its work without finances. The state was divided into 28 major drainage basins and meetings were held in each to establish programs leading to the construction of sewage treatment facilities.

Initial efforts emphasized municipal sewage treatment because of the public health hazards involved. However, the Committee was also authorized to work with industry in the solution of industrial waste problems, and to conduct industrial waste treatment research.

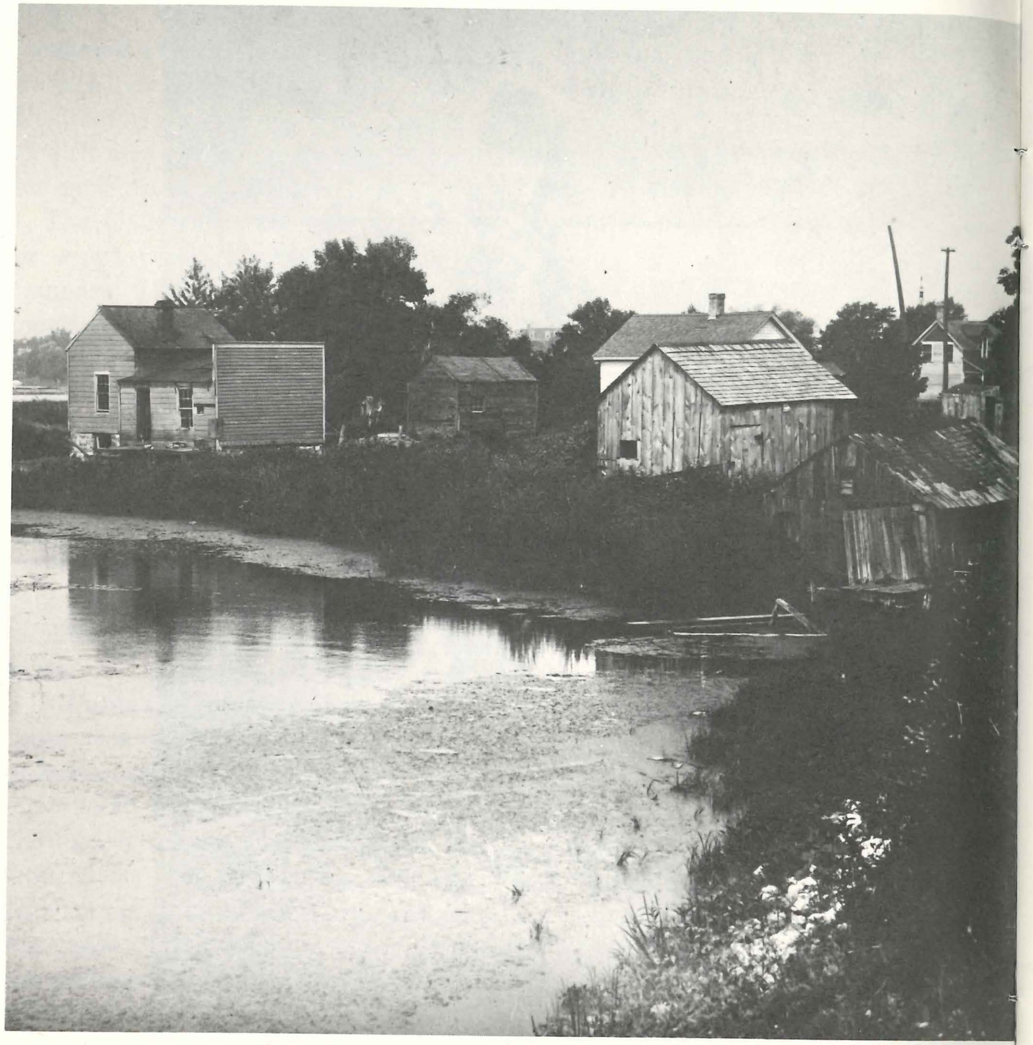
The public works program of the 1930's had a great effect on water pollution control. With the help of this program, which provided funds for the construction of sewer systems and treatment facilities, many municipal sewage treatment plants were built in the State.

Although many treatment plants were constructed in the 1930's, there was still a lack of basic knowledge about many aspects of pollution abatement.

In 1938 and 1939 an important study was made on Green Bay, the Fox River and the East River. It established that the odors rising from these rivers were mainly due to spent sulfite liquor from the paper mills. Prior to this study there had been much speculation as to the cause of these odors. Some people thought they were caused by the garbage which was dumped on the river's ice in winter, since that was the practice followed in those years. It was also speculated that sludge blankets from the sewage discharged in previous years were the cause.

Sugars in spent sulfite liquor provide energy food for microorganisms. This supply of food causes rapid growth of the microorganisms and a resulting heavy demand for dissolved oxygen from the stream water. The liquor also contains sulfur compounds which are reduced by bacteria when there is insufficient dissolved oxygen in water. One of the resultant products is hydrogen sulfide gas, well known for its "rotten egg" odor. The gas was emitted from these rivers in sufficient amounts to discolor the paint on boats and

Pollution-caused fish kills in the 1920's presented dramatic evidence of a problem and were important in stimulating corrective action.



Weed growth in lakes is not a new problem. This is how Brittingham Park on Madison's Lake Monona looked about 1900.

houses, and made it generally uncomfortable for people to be near the water. After it was established that the nuisance was caused by spent sulfite liquor the industry was required to develop new methods for sulfite liquor disposal.

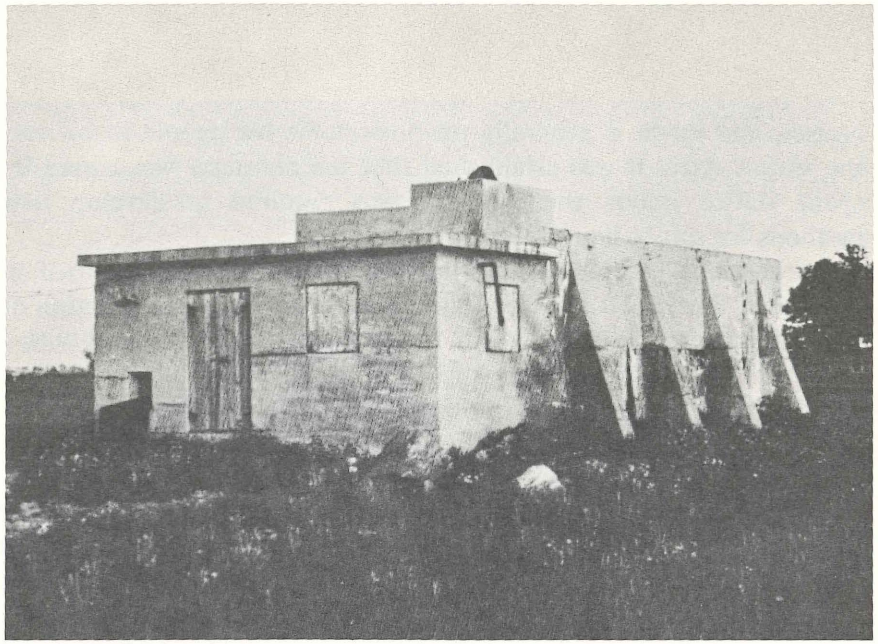
International events also influenced water pollution control in Wisconsin. During World War II there was very little construction of waste treatment facilities except for those that could be built with a minimum of materials. Industries contributing to the war effort could not be effectively restrained from polluting streams. Much of the impetus in pollution abatement gained during the 1930's had been lost by the end of the war in 1945.

Following the war, efforts were directed toward redeveloping the civilian economy. The people, who had been deprived of automobiles and appliances during the war, began demanding these in great numbers and most of our materials went into the production of such commodities. Priorities had to be secured in order to get authority to build any structures, and water pollution structures were not very high on the list. This stimulated conservation groups and clubs throughout the state to demand that something be done about water pollution control.

The 1949 legislative session proved to be a significant turning point in the history of pollution abatement. Public opinion polarized into two extremes, with the conservationists demanding sweeping change in administration of pollution control and the industrial interests resisting any change. The legislature, caught between two influential groups, compromised by granting the committee on water pollution a substantial increase in budget for the 1949-51 biennium. The public made it plain that the prevailing values were no longer those of the "roaring twenties".

At the same time the legislature made certain modifications to the water pollution control law. They provided higher penalties for violation of orders issued by the Committee on Water Pollution and authorized the Attorney General to enforce the orders. A fulltime staff in water pollution control was hired starting in 1950.

Field engineers were assigned to collect information on conditions of streams, to make industrial waste surveys, and to collect information on the effects of wastes on streams. It required about seven years to cover the entire state with detailed drainage basin surveys. As each survey was completed the information was compiled



The first municipal sewage treatment plants were primitive installations such as this 1928 Imhoff tank at Lake Mills.

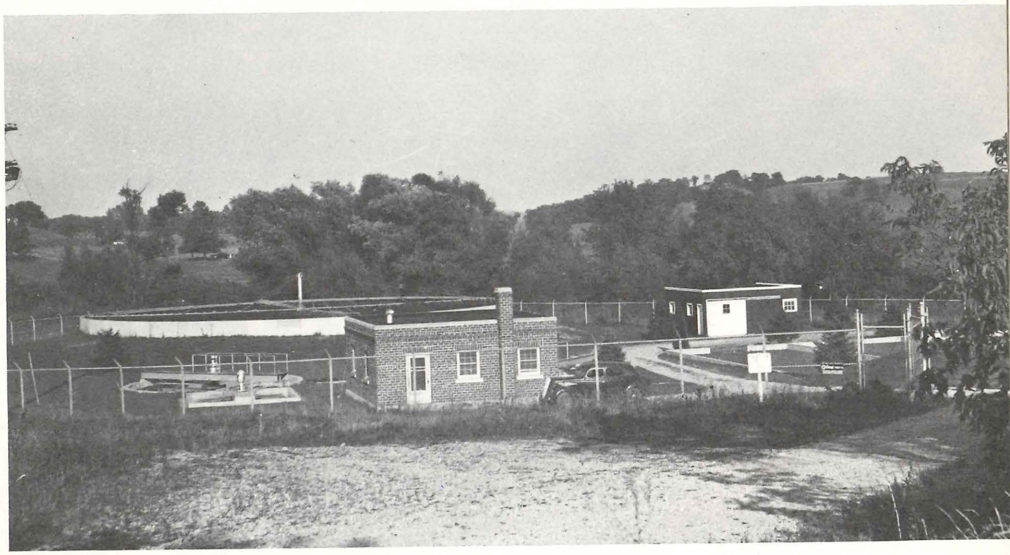
into a comprehensive report on conditions in the river basin. Each report was presented at a public hearing where all waste dischargers were given an opportunity to tell what they were doing about abating pollution. After the hearings, necessary orders were issued requiring abatement. During the 1949 to 1965 period, 925 orders were satisfied.

PRESENT ORGANIZATION FOR WATER POLLUTION ABATEMENT

A major change occurred in Wisconsin with the passage of the Water Resources Act of 1965 which combined the water management activities of many agencies into one department and created new water management functions and powers. Water-related functions of the State Board of Health, the Committee on Water Pollution and the Water Power Section of the Public Service Commission were formed into the reconstituted Department of

Resource Development. Subsequent reorganization by the 1967 legislature merged most of the functions of the Department of Resource Development with those of Conservation into a Department of Natural Resources, charged to conserve our land, water, air, wildlife and other natural resources.

New functions created by the Water Resources Act include development of water quality standards and use designations, flood plain and shoreland management, creation of a state financial assistance program for municipal sewage abatement facilities, and creation of administrative regions within the state. There are 5 districts in Wisconsin, each having an 8-member advisory board and a staff of engineers, sanitarians and public health biologists.



This 1947 view of the trickling filter plant in Lake Geneva shows the greater complexity of more recent facilities.

Division functions continued from earlier agencies are drainage basin pollution surveys, now on a 4-year basis; monitoring the water quality of streams at 38 stations; review of plans for water, sewage and industrial waste treatment facilities; regulation of navigable waters; licensing of well drillers and pump installers; an aquatic nuisance control program, and research.

Three important aspects of the surface water quality program are: (1) water quality standards and use designations, (2) drainage basin pollution surveys, and (3) issuance and enforcement of orders.

Water Quality Standards

Recognizing that waste assimilation is one of a number of necessary uses of our surface waters, it is important to have a reasonable procedure for regulating it. By proper use of water quality standards and stream classification, it is possible to minimize conflicts with other uses.

There are many types of water pollutants; living organisms, thousands of chemical compounds, dissolved or suspended solids, radioactivity, colors, odors, tastes, and even heat. Some pollutants decompose rapidly and others persist for long periods of time. Some are very harmful and others represent only mild nuisances. A pollutant may represent a serious restriction for certain uses and have little effect on others.

There is no simple way to measure water pollution. When organic materials decompose in water, dissolved oxygen is utilized. The measure of how much oxygen will be required to stabilize a waste is termed "biochemical oxygen demand" or BOD. Although BOD is not a complete measure of pollution, it is one of the most commonly used measures of waste strength. The dissolved oxygen content is an indication of how much of a waste loading has been placed on a stream.

The characteristics used in Wisconsin's water quality standards are: bacterial concentration, pH, dissolved solids, dissolved oxygen, temperature, and presence of materials which may be unsightly, toxic, create a nuisance or be harmful to health. Five sets of water quality standards have been developed to cover the requirements of different types of use. These standards are based on the best information available as to minimum safe requirements for these uses. The following five categories of standards established are:

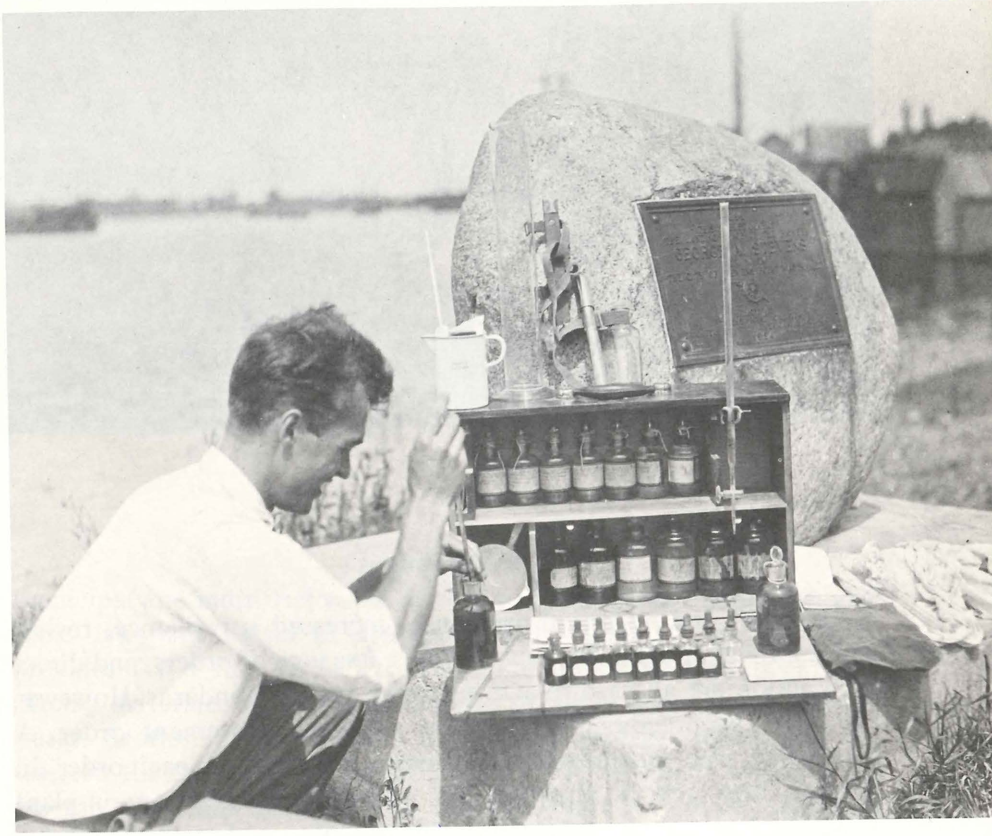
1. Minimum standards
2. Standards for public water supply
3. Standards for fish and other aquatic life
4. Standards for recreational use
5. Standards for industrial and cooling water use

To make the standards a working tool, all Wisconsin surface waters have been classified according to the uses designated in the standards. Minimum standards apply to all surface waters. In addition, most waters are also classified for Fish and Other Aquatic Life and Recreational Use. These standards are the requirements which apply to any segment of a water so designated. Provisions are made for periodic review and revision of the standards and designations to reflect changing technology and needs.

Standards and use classifications generally require an upgrading of the existing water quality. In no case do they allow a lowering of the water quality. The standards in all cases are to be interpreted to protect the general public interest where potential uses of water conflict.

Stream Surveys

A stream survey program has been devised whereby each of the 28 major drainage basins is studied once every 4 years. Basically, a stream survey consists of locating all possible sources of waste discharge, obtaining pertinent information on the sources, taking samples of the waste discharge and of the stream both above and below the source, and preparing a formal report to be presented at a public fact finding hearing. In addition to stream sampling, 24-hour surveys are conducted at municipal treatment plants and work day surveys are conducted at industrial treatment plants to determine treatment efficiency. Testimony presented at the public hearings, including findings from the stream survey reports is used as a basis for issuance of orders.



Accurate evaluation of water conditions has always been an essential part of water management.

This experimental trickling filter was one of many research projects which were helpful in improving waste treatment technology.

Enforcement

Financial and technical assistance, increased surveillance, review and approval of plans for new facilities, issuance of orders, and direct legal action are all used to achieve water quality standards. However, the basic enforcement tool is the pollution abatement order. A reasonable time schedule for compliance is included in each order. In general, one year is adequate for providing disinfection, in-plant controls and minor treatment adjustments, and two years for development of a complete secondary treatment system. Separation of excessive clear waters from sanitary sewerage systems may require from one year for disconnection of roof leaders to 10 years or more where combined sanitary-storm water sewers are involved. Failure to comply with these orders within the specified time period can result in heavy fines.

Most of the state laws concerning water pollution control are in Chapter 144 of Wisconsin Statutes. These laws provide a basis for operation of the pollution control agency and regulation of most municipal and industrial waste discharge. In addition, certain fish and game laws are useful in protecting water quality. Section 29.29 provides for a fine of $10 to $200 and up to 30 days in jail for placing materials which are deleterious to fish or game in any surface water. Section 29.65 provides a listing of damages which may be assessed for the illegal killing of wildlife. The minimum charge is $2 per gamefish, and extensive fish kills can result in fines of thousands of dollars. The fish and game laws are enforced by Conservation wardens. They are used to regulate sporadic discharges such as oil spills, careless dumping of industrial materials, or even littering.

The foregoing discussion has centered mainly on state government organization and programs. Although this is important, the measure of progress in water pollution abatement is how much reduction there has been in the wastes entering our waters from all sources. The following sections point out some of the changes which have taken place in the last forty to fifty years through the combined efforts of industries, municipalities, and regulatory agencies.

INDUSTRIAL WASTE TREATMENT

Since each industry has unique characteristics and has attacked pollution in a different way, each major type of waste producing industry is discussed separately below.

Canning Industry

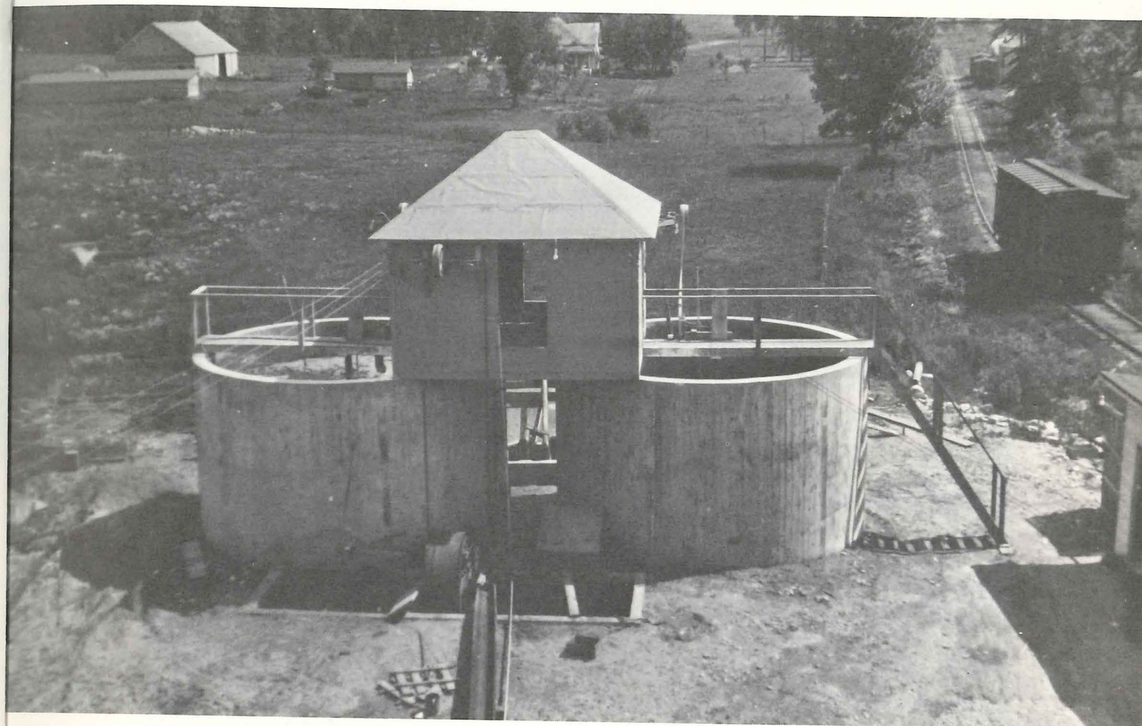
The canning industry, through the National Canners Association and Wisconsin Canners Association, supplied personnel to conduct studies on treatment of canning wastes in the 1920's. Many of the firsts in the treatment of cannery wastes were developed in Wisconsin. The earliest method of cannery waste treatment was chemical precipitation to settle out the solids, with the clear waters being discharged to the streams. This process removed about 50% of the pollutional material.

As the industry grew, treatment methods progressed with the growth. For example, a machine was developed which closed cans 75% faster. This resulted in more cans processed and more waste produced. The chemical precipitation methods became inadequate.

Lagooning was developed and adopted by a large number of canners in the state. This method was not completely satisfactory since some lagoons produced odors. One of the methods of solving that problem was the addition of sodium nitrate. It is possible, with lagooning, to store all of the wastes produced during the season, let them stabilize, and then release them in spring when stream flows are high.

About 1950, irrigation disposal of cannery wastes on land was also developed. The irrigation method is useful to the canners, since they can spray waste waters on hay crops and realize some form of return. Most canners now use spray irrigation either alone or supplemental to lagoons as the most convenient and least costly method of disposal where land is available.

Changing techniques have altered some of the waste treatment problems for the canning industry. Some changes improve the



Chemical precipitation as it was used by the canning factories provided some treatment but it was soon replaced by more efficient methods.

Leaching from pea vine stacks used to be a common cause of both surface and groundwater pollution.

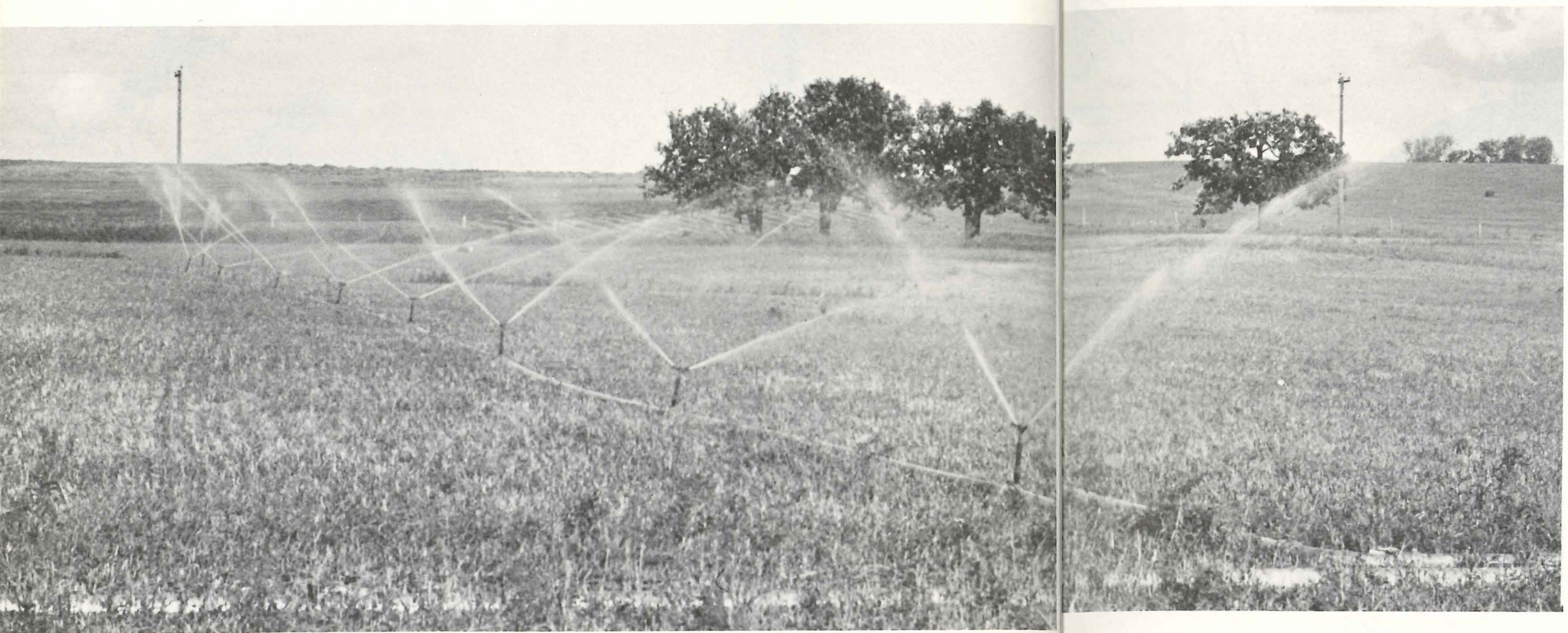
situation and others intensify treatment problems.

Pea vine stacks used to be a source of water pollution as well as an eyesore and a source of unpleasant odors. Fish kills were common when summer rains carried runoff from the stacks into small streams. Present harvesting techniques spread the vines in the field and reduce the nuisance considerably.

Another common process change has been increased use of water for "flumming", whereby the vegetables being processed are carried through the various steps in a stream of water. This may double the consumption of water per unit of output and thereby increase the waste treatment problems.

The treatment and disposal methods available today have largely eliminated water pollution by cannery waste. Of the 100 canneries currently operating in the state, 25 are connected to municipal sewer systems and the remainder utilize one or more of the treatment methods described above. Some canneries do not have fully adequate treatment facilities so pollution abatement orders must still be issued to insure that they upgrade them as necessary.

A change in technology, such as the use of mobile pea viners, can help alleviate water pollution problems.



Soil absorption provides almost complete treatment of milk processing and cannery waste waters.

Milk Processing Industry

The milk processing industry did not approach the water pollution problem on an organized basis. For a number of reasons it was difficult to get the various facets of the industry together, so work was done with individual plants. When a survey was made on the disposition of milk plant wastes in 1949, there were approximately 1,500 dairy processing plants ranging in size from less than 5,000 pounds per day intake to over 600,000 pounds per day of milk intake. More than 700 of these plants were in municipalities and were connected to municipal treatment plants. That left approximately 700 in rural areas requiring some form of private treatment. It is estimated that in 1949 about 500 of these plants were discharging untreated wastes directly into streams. Usually they were located on small streams and created a problem because of lack of adequate water for waste assimilation.

Many small dairy plants have gone out of business or have been consolidated with larger plants since 1949. At present there are 859 dairy plants operating in the state. Many dairy plants are located in rural areas where they cannot connect to municipal sewer systems,

but all of these rural plants provide some form of waste treatment. Improved sanitation and processing of by-products have resulted in increased waste volumes, but have virtually eliminated the dumping of spoiled milk, whey, buttermilk and skim milk which was prevalent in earlier days.

Milk plant wastes, such as whey, are very strong and difficult to treat by conventional methods. Over the years, various methods of treatment and disposal have been tried. Soil conditions are not favorable for waste absorption in many of the major dairy areas of Wisconsin. Since dairy plants operate year-around, land disposal is not always as feasible for them as it is for canning factories. Spray irrigation works well during the summer, but during the winter the systems often freeze up. The ridge and furrow system of disposal, which works satisfactorily throughout the year, was developed. This system consists of shallow furrows approximately one foot wide separated by ridges about six feet wide. The ridges are planted with grasses which use water readily and live from the time of thaw in the spring until snow falls in winter. In the fall of the year these grasses die and fold over the furrows, forming an insulation which prevents ice formation. Snow cover over the grasses provides further insulation.

Pulp and Paper Industry

A cooperative program between the state and the pulp and paper industry was one of the initial efforts to reduce industrial pollution in Wisconsin. A program of annual cooperative pulp and paper mill waste surveys in every mill in the State was developed and is still in progress.

Pulp and paper mills have particularly critical waste treatment problems, due mainly to the large quantities of water used in the process and the high percentage of dissolved solids in the waste. Depending on the process, chemical pulp mills generally use 30,000 to 80,000 gallons of water per ton of pulp. Paper mills generally use 10,000 to 25,000 gallons of water per ton of paper produced. Most mills in Wisconsin range from 100 to 400 tons per day of paper production. The contaminants in the waste consist of small wood fibers lost from the manufacturing process, sugars and other organic compounds dissolved from the wood, and chemicals such as sulfur, calcium, sodium, magnesium, and ammonia. Conventional treatment techniques used for municipal sewage do not work well for pulp and paper mill waste.

Two principal methods of pulp production are the sulfite and kraft processes. Other methods include ground wood, semi-chemical, rag and de-inked pulp, or some combination of processes. The kraft process uses sodium sulfate to provide alkaline cooking of the wood. The chemicals from the cooking are recovered and reused; they are not disposed of along with the other wastes. The sulfite process utilizes an acid cooking of the wood and the recovery and reuse of chemicals is not usually feasible. The resulting waste is high in pollutants and difficult to treat.

Much of the research in chemical recovery, by-product development, and waste treatment has been conducted by the Pulp Manufacturers Research League. This nonprofit research and development association has been in operation since 1939 and is now supported by 38 member mills.

Use of spent sulfite liquor for roadbinder is one method of keeping this material out of streams.

One of the first areas of research was that of the utilization of the spent sulfite liquor for production of yeasts. The process was evaluated in the laboratory, in pilot plants, and finally in a full scale experimental plant which was built at a cost of $500,000 at Rhinelander, Wisconsin. This plant was built with funds contributed by the entire industry. The original plant, built in 1948, was designed to produce 8,000 pounds of yeast per day from the spent sulfite liquor resulting from a pulp production of 50 tons per day. Over the years, with minor modifications and adjustments, it was possible to raise the production to about 14,000 pounds of yeast per day. Another plant was built in Green Bay to produce an additional 28,000 pounds of yeast per day.

The yeast, used mainly as a protein supplement for animal foods, provides some return on the process. Since the market is limited and the returns marginal, this process is not a final answer for all mills. Further research was directed toward development of a method of evaporation and burning of spent sulfite liquor.

Evaporation of spent sulfite liquor is a problem because it is very acid and highly corrosive. Originally there were no metals available which would satisfactorily hold the liquor for a sufficient period of time. However, during World War II, a stainless steel was developed which resisted corrosion. It was also necessary to develop a satisfactory evaporator. This was difficult because the high calcium content in the spent sulfite liquor caused heavy scaling inside the evaporators and removal of the scale was costly.

A new process, called the Rosenblad channel switching evaporator, was developed in Sweden and the first one was installed in Wisconsin on an experimental basis in 1949. This particular evaporator consists of several parallel channels in which spent sulfite liquor is passed through half of the channels and steam through the other half. Evaporation continues until the rate slows down, indicating that scale is covering the inside wall of the evaporator. The liquor is then switched into the steam channels and the steam into the liquor channels. A small amount of sulfur dioxide is added to the steam to remove the scale and the evaporator is kept in continuous operation. The spent sulfite liquor is evaporated to about 52% solids and burned in boilers over a coal bed or used for by-product recovery. The mills receive some return in terms of fuel savings by burning the solids.

Many uses have also been found for the concentrated liquor.

Examples are dispersants for oil well drilling muds, adhesives and chelating agents. As a result, the industry is installing spray dryers in some plants so the spent sulfite liquor, after being concentrated, can be dried and sold. One plant has been using part of the by-product to produce vanillin, a food flavoring, since 1937.

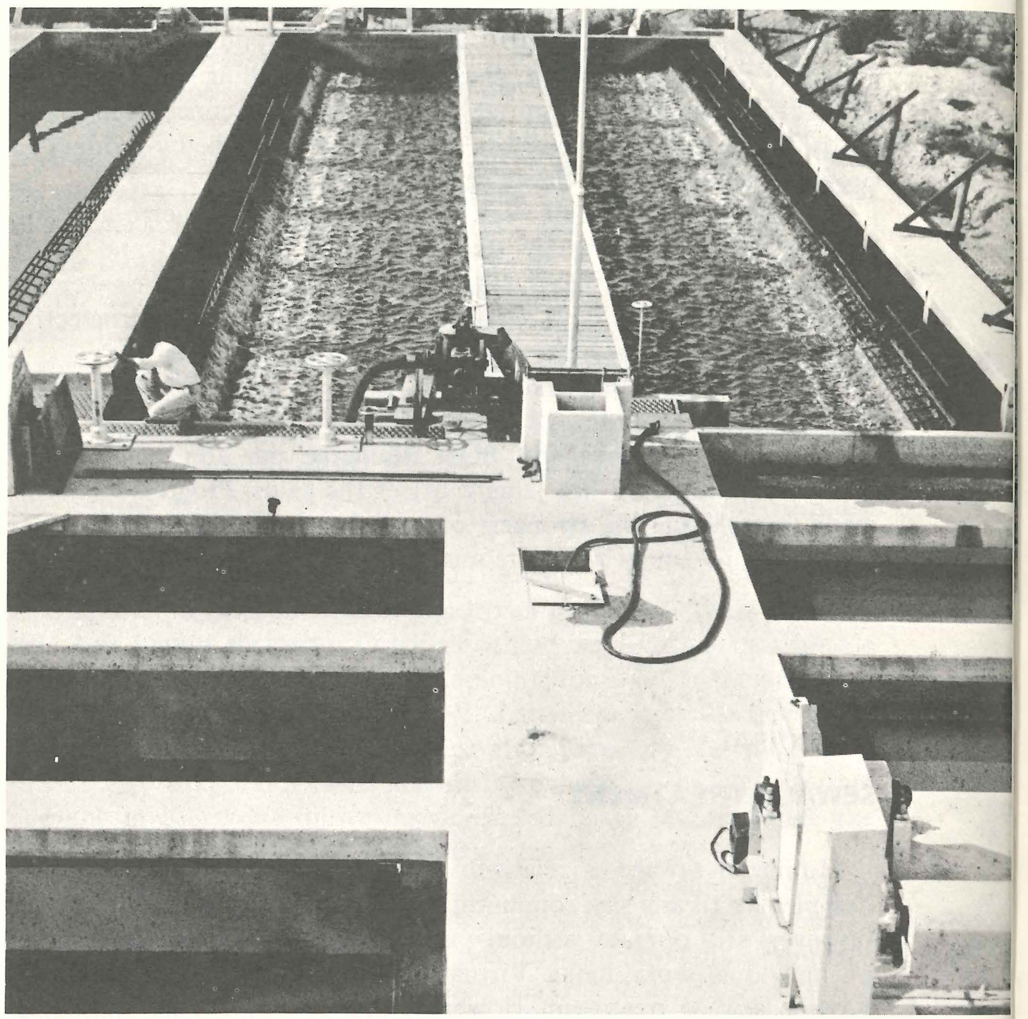
In addition to reducing wastes, the industry also helps alleviate poor stream conditions by stream aeration. The pulp and paper wastes, being high in sugars, reduce dissolved oxygen in the receiving stream. Twenty mills have aeration devices installed in hydroelectric power turbines and at other sites spray aeration is utilized.

The pulp and paper industry, as a group, is the largest waste discharger in Wisconsin. Although significant progress has been made in reducing fiber loss and BOD discharge per ton of product, increased production has largely offset the gains. Progress has been made in removing the strongest part of the waste from streams, but further improvement will be required.

MUNICIPAL SEWAGE TREATMENT

Municipal sewage is relatively easy to treat and plants can be designed to fit any size community. A number of small communities, however, still operate without public sewer systems, relying mainly on individual septic tanks. Virtually all of the sewered communities provide sewage treatment. However, this does not mean municipal sewage treatment problems are solved. For a variety of reasons, many plants do not operate as efficiently as they should. Growing populations and new industries have caused many plants to become overloaded. Many plants were built in the 1930's when primary systems, those using only a large settling tank, were acceptable. Of the 434 sewage treatment plants in the state, 331—or 76 percent—provide secondary biological treatment of these wastes. The remaining 103 still provide only primary treatment.

In many communities sewer systems are old and faulty. Groundwater and even surface water infiltrate such systems and cause



Modern sewage treatment plants, such as this activated sludge unit at Fort Atkinson, are highly complex physical, chemical, and biological processing systems.

overloads on the plants following rains, and in the spring when groundwater levels are high. Even though such waters are clean, they dilute the sewage and volumetrically overload the system. An overloaded plant cannot operate at normal efficiency. Some communities have a combined sewer system in which one sewer carries both sanitary sewage and storm water flow. Following rainfall, overflows from such systems occur, resulting in the discharge of untreated sewage to waterways, as well as in the overloading of treatment plants.

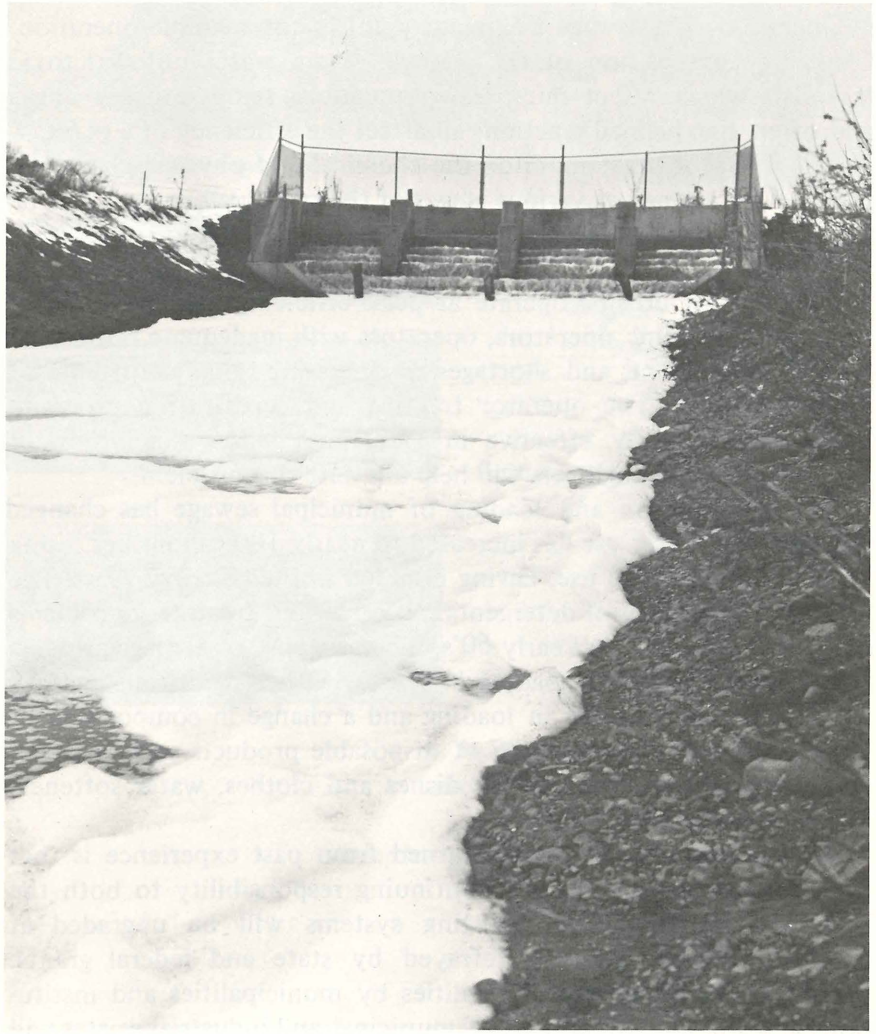
Operation of a sewage treatment plant is not a simple operation. Changing composition of the sewage, storm water inflows, toxic materials which affect microbial populations, temperature changes and often unexplained reactions all affect the efficiency of a plant. A skilled operator must monitor the chemical and physical characteristics of the sewage at various stages of the treatment process and be prepared to diagnose problems and adjust operations to compensate for them.

Many plants do not operate at peak efficiency due to operator problems. Part-time operators, operators with inadequate training or lack of supervision, and shortages of operating funds contribute to poor operation. The operator training and certification program, which became fully effective in 1969, and closer supervision of plants by regional engineers will help alleviate this problem.

The composition and loading of municipal sewage has changed significantly. Water use has increased to nearly 100 gallons per capita per day for domestic use, having doubled in the last fifty years. The advent of new types of detergents caused serious treatment problems during the late 50's and early 60's. Increasing use of garbage grinders has increased the solids loading in sewage. Other significant changes which cause an increase in loading and a change in composition of the sewage are: increased use of disposable products such as paper diapers, automatic washers for dishes and clothes, water softeners and air conditioners.

An important lesson to be learned from past experience is that waste treatment represents a continuing responsibility to both the state and municipalities. Existing systems will be upgraded at considerable cost, in part defrayed by state and federal grants. Consolidation of treatment facilities by municipalities and institutions and the joint treatment of municipal and industrial wastes will tend to improve over-all efficiency and reduce pollution. The process will not end, but rather continue as needs and conditions change.

This ditch, used to divert Madison's effluent around the lakes, has resulted in better lake water quality. Foaming detergents were still a problem when this picture was taken.



SUMMARY

Wisconsin has long been recognized as a leader among states in water pollution abatement. Much has been accomplished, yet much remains to be done. The public is now demanding cleaner surface water. Concern over recreational potential of lakes and streams is especially high. General prosperity has resulted in increased leisure, often utilized for outdoor recreational pursuits. It has shifted society's concern from subsistence to a wider concern for environmental quality. New and improved techniques are being developed for treatment of both municipal sewage and hard-to-treat industrial wastes.

Many problems which are in the forefront of public thinking today were not even being considered as recently as ten or twenty years ago. We are now concerned about thermal pollution, especially from larger nuclear power plants; the effects of nutrients, mainly phosphorous and nitrogen, in water; radioactivity from power plants and atmospheric fallout; pesticide residues in surface runoff; urban runoff; siltation; and chemicals used in de-icing.

In the past 40 years Wisconsin has moved from an era when almost all sewage and industrial wastes were discharged untreated into surface waters to a point where virtually no wastes are discharged without some pre-treatment. Secondary treatment of sewage, together with disinfection, has become a state standard. Phosphorus removal is becoming a general concern. Industries are expected to either use land disposal methods or subject their wastes to the equivalent of secondary biological treatment.

Despite this substantial progress, much of which has come in the past 20 years, the increasing population and industrialization in Wisconsin will continue to place great burdens on our water resources. The problems already evident in southeastern Wisconsin and along the Fox and Wisconsin Rivers will develop in other areas unless the attention given to proper waste disposal is equal to the encouragement given to population and industrial growth.

An even greater problem is the improvement of existing water quality to the very high levels required for certain public uses. Recreational lakes which have become subject to weed and algae growth will not show immediate improvement even if wastes from all sources are treated to a high degree. Rehabilitation, through silt removal or other techniques, may be required to correct conditions resulting from past neglect. Control over both rural and urban land use may be necessary to prevent recurrences.

The most important element of insuring clean water is an informed and committed public. An understanding of what has been accomplished in recent years is an important basis for charting a successful program for future years.

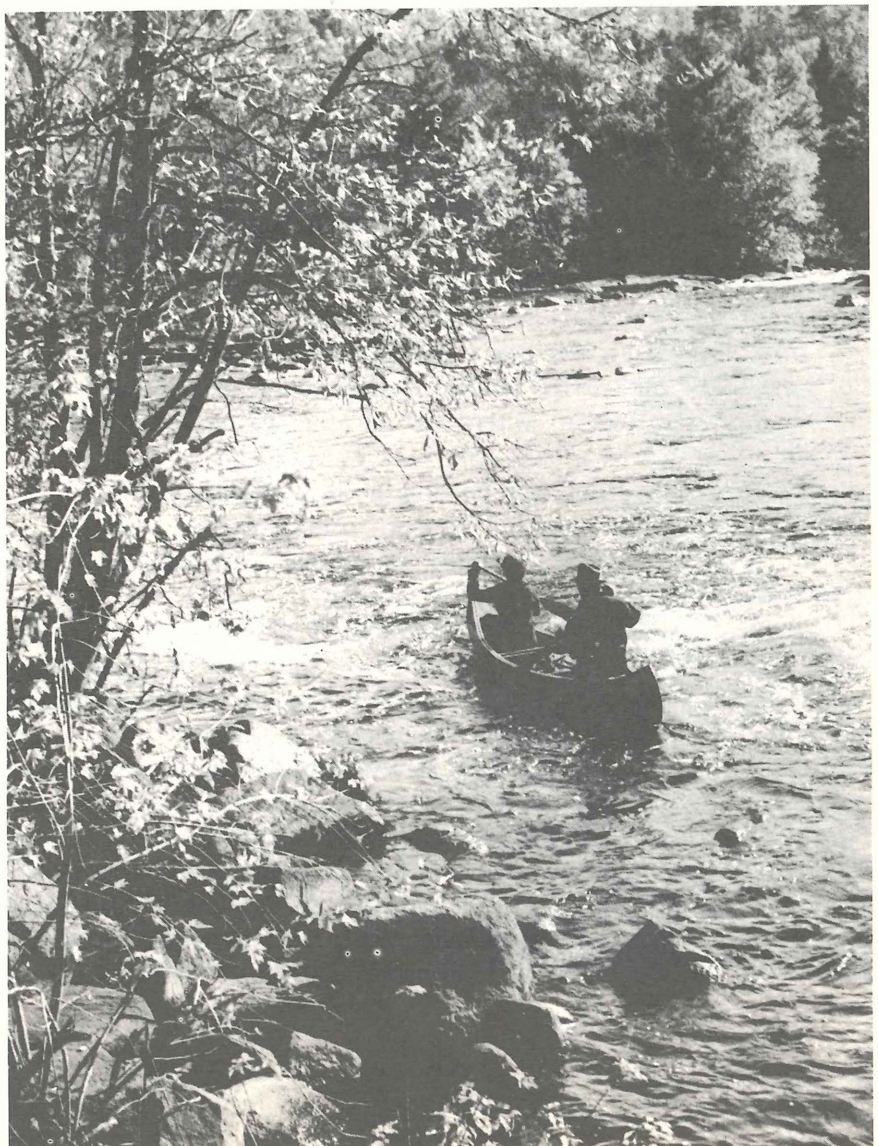


PHOTO CREDITS

Pages 4 and 5 State Historical Society of Wisconsin
Page 8 State Historical Society of Wisconsin
Page 21 Wisconsin Department of Agriculture

20000-7