

FEDERAL WATER QUALITY STANDARDS A VEHICLE FOR
ENHANCEMENT AS APPLICABLE TO MICHIGAN

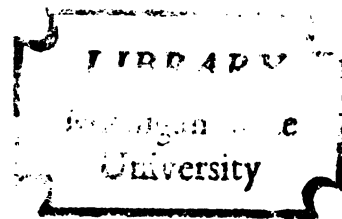
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ABSTRACT

FEDERAL WATER QUALITY STANDARDS: A VEHICLE FOR ENHANCEMENT AS APPLICABLE TO MICHIGAN

by John M. Bohunsky

With an increasing population and higher productivity, the nation's rivers and lakes are being polluted at an increasing rate. The Federal Government has for years attempted to remedy the misuse of water, but has never achieved complete success. At long last, it appears that a new device called water quality standards will enable a realization of the objective of controlling water pollution. A unique feature of the program is the provision for each state to develop its own standards and enforcement plan. An acceptable state program must meet the requirements of, and be acceptable to, the U. S. Department of the Interior prior to adoption.

The standards proposed by the State of Michigan provided for seven broad use categories. Among these categories are listed such uses as domestic water supplies, fish, agricultural, recreation, and, in general, all legitimate uses for which protection is needed. Over the years, indiscriminate use of surface waters for disposal has eliminated many beneficial uses. Waters which have been gradually reduced to the single purpose use of waste transportation must be enhanced to a level suitable for multiple use.

The problem of developing parameters for the protection of the various uses is complicated by substances which are naturally contained in the water. These substances may be chemical, physical or biological

and can be present in sufficient concentrations to cause undesirable effects to one or more water uses. There are virtually dozens of parameters that could be used to control water quality, but the eleven that were selected have a significant bearing on the use, and display other characteristics suitable for rapid and accurate assessment of quality.

Public hearings were an essential step in the process of developing and proposing a system of water quality standards. Through hearings, everyone was provided an opportunity to express his views relative to the standards desired for water quality enhancement. Hearings conducted throughout the state revealed to the decision-making body where additional attention was necessary. Regardless of the final decision on standards, everyone could not be satisfied because of the distinctly different quality requirements demanded of the different uses.

In summary, standards formulated by the State of Michigan have provided a much needed foundation for quality control. This program established a policy insuring water quality to permit uninterrupted present and beneficial uses consistent with the highest standards. Both the indiscriminate and conscientious water users now know in advance what is expected of them.

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CHAPTER I

INTRODUCTION

Pollution and the Need for Control

The famed poet, Byron, aptly described the importance of water to man when he wrote:

*"Til taught by pain
men really know not
water's worth"*

We can conclude from this quotation that man does not measure the true value of water. As long as he is present on earth, man will continue to be a wanton user of all natural resources---water included.

The nation's increasing population and higher productivity are polluting the water in our rivers and lakes at an increasing rate. We can no longer, in many instances, look upstream for the pure and uncontaminated flowing water which we were once accustomed to enjoying. For man, through his activities, particularly in populous regions, has impaired that purity that once was bountiful.

Water has an infinite number of uses, yet all of these uses will be impaired to various degrees by pollution. Many of the uses made of water are compatible with one another. A flowing stream for example, can provide a community with a water supply. It can also support numerous recreational activities and it can represent aesthetic beauty. But when the stream becomes burdened by the waste products of man, it will be void of these values.

Water pollution is very comparable to the weather in that it is often a topic for conversation. People, however, seem to know a

great deal more about the weather than they do about water pollution. Children, for example, in this day and age know only that when they flush the toilet, the contents merely disappear. The general public seems to acknowledge dirty water only when it interferes with their private enjoyment. Waste disposal is not the personal problem it was decades ago. When the home accommodations consisted of a two-seater in the back yard, the olfactory senses and inconvenience made man aware of his waste products. Now, to the enjoyment of all, we merely switch on the garbage disposal or depress the flush lever and our waste products disappear.

Through the years there has been an ever-growing awareness of man's waste products in the flowing stream. It is not uncommon to hear middle-aged people tell of swimming in a nearby favorite water hole which can no longer be used for that purpose. Is it because of water pollution that people have detoured from these favorite swimming holes or because we have become more health conscious? It is probably a little of each.

What is pollution? Very simply, it is the used and unwanted waste water from our cities, our industries, and the silt washed from our land.

The degradation of a watercourse to a serious pollution condition is usually a slow process. At first, the stream served as a receptacle for a small number of inhabitants along the shoreline. The effects of this small amount of waste were hardly noticeable after traveling a few feet down the stream. As the population grew, so did the quantity of the waste flow. Then as the nation began to prosper,

industry added its burden. Deforestation, which resulted in erosion, and intentional land drainage for agricultural purposes also contributed to the destruction of this living resource. The watercourse, grossly turbid, void of life-giving oxygen, carried a slick coating of oil, and became known in layman's terminology as a "stinking mess".

As the endless cycle of decay, pollution and purification in our nation's lakes and streams grew, it became a matter of national concern. After years of dodging or ignoring the waste problem, the condition grew in magnitude to the point where pollution created in one state caused a nuisance in a bordering state. The offended state, in most instances, was helpless in controlling the situation. There is no doubt that incidents such as this prompted the passage of a Federal law for the control of pollution in interstate waters.

Throughout the years, there have been many attempts by the Federal Government to control pollution of the nation's waterways. The most recent in a series of programs to achieve this goal was the requirement of water quality standards. This program is most unique from the standpoint that each state is required to establish its own standards, together with a plan of enforcement.

The purpose of this report is to describe the quality standards the State of Michigan submitted to fulfill its obligation in this national effort. It will relate and describe the groups which participated in formulating quality controls for the selected parameters. It will relate who was concerned over the establishment of standards, what groups dominated, and finally, review some of the statements made at the public hearings.

CHAPTER II

FEDERAL LEGISLATION FOR WATER POLLUTION CONTROL

Historical Review of Legislation

The Federal Government has a long history of legislation with aims to preserve the nation's water resources. The initial legislation for pollution control was probably the enactment of the Rivers and Harbors Act of 1899, which, among other things, prohibited the discharge or deposit of any refuse matter, other than that which flowed in a liquid state from streets and sewers, into navigable waters. This legislation, like many others that were to follow, lacked rigid enforcement authority needed to be effective in the control of pollution.

A review of major legislation since the beginning of the century indicates that for many years the Congress could not decide on a firm national policy for water.

In 1912 Congress made a decision to limit the Federal Government's interest in pollution control to research and technical assistance.¹ This program offered virtually nothing to formulate a policy at the national level. The states, as before, were left to assume the major role in controlling pollution. Thus, each state went its own way, some working out fairly effective programs, some entering into interstate compacts with their neighbors, and some just not caring.

¹L. B. Dworsky, "Analysis of Federal Water Pollution Control Legislation", Journal American Water Works Association, June 1967, 59: 651-668.

Water pollution control programs were in effect going in forty-eight different directions, simultaneously.

It seems that the U. S. Congress has always recognized the severity of interstate pollution, for almost annually they have considered a variety of bills aimed at pollution control. During the period of 1912 to the late 1930's, Congress continued with the policy of research and technical assistance. In the late 1930's there was a dramatic shift in policy, continuing to the present. That was the financial assistance in the construction of sewage treatment facilities. Federal works programs financed construction of sewage treatment works during that period at a rate not exceeded until the late 1950's.² Actually, the financial assistance program provided during this period was fundamentally designed to assist the economy rather than control pollution, for it was during this period that the United States experienced the great depression. Programs initiated during this period were more for the purpose of providing jobs to inspire the economy, rather than a policy to control pollution.

A major series of actions began in Congress in 1946 to provide strong Federal action programs for the control of pollution. These proposals included provisions for large financial aid and enforcement. From these bills evolved the passage of the Water Pollution Control Act of 1948, which represented a new decision on the part of Congress to control pollution. The 1948 Act included the basic elements of financial, technical, and research planning contained in the earlier

²Ibid.

1938 Act. It further provided for a modest form of enforcement.³ The 1956, 1961, 1965 and 1966 amendments have added and extended these basic programs in a continued search for greater effectiveness. It is quite clear that the end of this search is not yet in sight in deciding on a firm national policy.

Amendments to the 1948 Water Pollution Control Act

The legislative authority under which the Federal Government now functions relates back to the 1948 Federal Water Pollution Control Act (FWPC Act). This statute, which has been amended four times, continues to serve as the legal foundation with which Congress continues to struggle with the water pollution problem.

The Federal Water Pollution Control Act, as amended in 1956 and 1961, provided for grants to state and interstate agencies for water pollution prevention and control programs. Large sums of money (\$100 million a year) were granted for the construction of municipal sewage treatment works for the years 1964-1967. Besides the granting of funds, the amendments of 1956 and 1961 established the following programs: conduct research and the collection and dissemination of data relating to the prevention and control of water pollution; establish Federal laboratories and research facilities; establish comprehensive river basin programs. In addition, the Act as amended, established Federal jurisdiction to enforce the abatement of both interstate and intrastate pollution of navigable waters. It was under this latter amendment that the Federal Government at the request of the Governor of Michigan, then John B. Swainson, was able to proceed with comprehensive studies of the Detroit River and Lake Erie.

³The Federal Water Pollution Control Act of 1948 (P.L. 80-845).

Under the 1948 FWPC Act as supported by the 1956 and 1961 amendments, some 4,000 waste treatment projects were approved and constructed at a cost of \$300 million in Federal grants. Twenty-one enforcement proceedings were begun between 1961 and May 1965, involving 1,000 communities. Also, during the period 1961-1965, the Department of Health, Education and Welfare's direct water pollution control research budget increased from \$1.6 million to \$3.7 million.⁴

Despite the progress that was made under the Act as amended in 1956 and 1961, Congress in 1965 decided to commit the Federal Government more directly to pollution control. The amendment of 1965, commonly referred to as the Water Quality Act, is merely a reorientation of earlier legislation. Major provisions of the 1965 amendment are:

1. A Federal Water Pollution Control Administration (FWPCA) is established within the Department of Health, Education and Welfare, later shifted by administrative order to the Department of the Interior to administer the Act.
2. The Act increases the dollar limit of Federal grants for construction of individual city sewage treatment works.
3. The 1965 Act provides, for the first time, for grants to states, municipalities or interstate agencies for the purpose of assisting in the development of techniques to control sewage pollution. A total of \$20 million a year is appropriated for the forgoing purposes through the fiscal year ending in June 1969, of which at least 75 percent must be granted to the states.

⁴Barco, et al, "The Timetable for Federal Control of Water Pollution", Seminar Proceedings Sponsored by Southwestern Engineering Company, New York, November 1965, pp. 7-9.

4. And, of course, the Act requires that each state establish water quality standards for interstate waters.

The 1966 amendment, commonly referred to as the Clean Waters Restoration Act increases the amount of grant moneys for waste treatment systems. This amendment provides monetary incentive on the part of the states for compliance with the Act. For example, if a waste treatment construction project is a part of an approved plan for water pollution control in a river basin, it is eligible for an incentive grant of 10 percent above the basic 30 percent grant which now has no dollar limitation. The federal grant is thus 40 percent of the total cost. The grant may be increased by another 10 percent, making a total of 50 percent, if the state agrees to contribute 25 percent of the project cost.

A major thrust of the 1966 amendment to the Federal Water Pollution Control Act is its continuing and increasing emphasis on comprehensive planning and coordination. Although financial incentive is provided, it is closely tied to comprehensive planning. This appears particularly important at the Federal level, since the government's jurisdiction cannot otherwise extend to intrastate waters.

Water Quality Act of 1965

In signing the Water Quality Act of 1965 (P.L. 89-234), President Johnson asserted that: *"Today, we proclaim our refusal to be strangled by the wastes of civilization. Today, we begin to be masters of our environment . . . water pollution is doomed in this century".*⁵ While there is no assurance that the act will provide this objective, it is

⁵President Johnson, Speech upon signing the Quality Act of 1965, October 2, 1965.

a significant step toward a national policy to abate pollution.

It is perhaps too soon, at this juncture, to judge how instrumental the Federal Water Quality Act will be in abating pollution. Someday history may accord the act a prominent position in the management and control of our water resources. At present, however, there can only be speculation as to what progress, if any, lies ahead.

Legislation by itself cannot solve a problem that has been in the making since man inhabited the earth. A total solution to waste control is analogous to the construction of our vast interstate highway systems. Here, for example, was a program scheduled for completion in 1972 that was to serve our needs for many years to come. Now, we are learning that some of the earliest routes constructed are already obsolete. Pollution abatement, as with our overland transportation system, will be a constant struggle to show any degree of progress. To maintain the status quo, especially in view of the unprecedented and continuing population and economic growth, is certain to pose an ever-increasing task.

When the Water Quality Act of 1965 was signed into law by President Johnson on October 2, 1965, it culminated many years of hearings, debates, and opposition, but received overwhelming public support and sentiment. The most controversial provision of the act was the section requiring the establishment of water quality standards. The Congress, in its constant struggle to improve and enhance water quality, agreed that such a device was necessary. There was almost unanimous decision in both houses that standards would provide the reliable and sound guidelines needed to fulfill these objectives.

There are several basic premises underlying the Federal Water Quality Act of 1965 that admittedly will assure a degree of success

in controlling pollution. The act, and especially the standards establishment requirement, is a clear trend away from the old policy of controlled degradation.⁶ Under the Act, the disposal of waste material into a stream for dilution and dispersion is no longer considered a beneficial use to the receiving waters. This change reflects a new attitude in thinking, from one in which water pollution was an accepted way of life, or a necessity to modern living, to the belief that it is no longer necessary. The objective of the Act is clearly one of insuring a degree of water purity to permit uninterrupted present and future beneficial uses consistent with the highest standards.

The standards provision of the new Act is significant in two major respects. First, it encourages compliance with pollution control requirements by letting conscientious water users know in advance what is expected of them. Now, the discharger has more assurance of a uniform application to the law. Secondly, it gives the Federal Government the authority it has long been seeking to regulate water quality instead of instituting enforcement action to abate pollution after the health and welfare have been endangered. This provision of the Act should be a substantial help in preserving the quality of water and in progressively restoring polluted waters toward a degree of reasonable purity.

Pro and Con of Standards

Water quality standards unquestionably offer definite values to the water pollution control effort. They identify precisely what

⁶C. A. Rambow and R. O. Sylvester, "Methodology in Establishing Water Quality Standards", Journal of Water Pollution Control Federation, July, 1967, 39:1155-1163.

concentrations of the various constituents are acceptable, thereby providing waste disposers with the firmest possible guide as to permissible waste loadings. Also, a standard for each constituent provides a sharp reference point for the determination of unlawful acts. If a given constituent exceeds the specified standards, the basis for enforcement to provide corrective action is clear.

Obviously then, standards are also arbitrary. Few pollutants would have exactly the same injury potential under all conditions of water temperature, velocity, turbidity, depth, or in combinations with other pollutants. Nevertheless, each must be ascribed a specific value, insofar as the particular pollutorial substance is, in fact, identifiable in numerical terms. And, under the fundamental requirements of our constitution that every law be reasonable, the value must be painstakingly and soundly arrived at. It is not enough to say that cyanide, for example, is a deadly poison and must therefore be kept below the point of any possible toxicity. Instead, the cyanide tolerances of various significant organisms must be identified from the best information available and the standard set on the basis of what minimum concentration is necessary to avoid destruction or demonstrable injury to organisms, be they fish, fish food, or other biota of definite value.

Since the values to be protected vary from section to section of a stream, it will be necessary to establish different sets of standards for different locations.

Although the standards must be established on the basis of reasonableness with respect to the prevention of injury, effective implementation of standards cannot await the actual occurrence of injury before corrective measures are undertaken. The exceedance

of a standard must, in itself, be actionable. The State laws may need to be strengthened by making it unlawful to create a condition which exceeds an established standard, rather than await a pollution condition which eventually causes definitive damage.

Consideration of the enforcement process will show that where several waste disposers are making use of the same stream, effluent standards will be necessary in addition to stream standards. The effluent standards will, in effect, allocate waste constituent quotas among the several users, and violation will then be based on exceedance of the quota rather than of the total stream standard. Establishment of the effluent standards will call for very cautious decisions, which take into account all equities and the realities of the full situation. Continued industrial expansion, when stream standards go into effect, can proceed only on the basis of periodically reappraising the individual effluent standards.

The issuance of effluent standards will need to be via some formal vehicle, such as an order from the pollution control agency. An instrument that has been found very useful in Michigan is a stipulation, under which the agency agrees to hold order proceedings in abeyance, and the waste disposer agrees to comply with specified requirements for waste restriction without awaiting issuance of an order.

Defining an effluent standard as a basis for maintaining a stream standard is beset with certain complications. The stream standard must be set in terms of concentrations. The effluent standard, however, must generally be in absolute terms, such as pounds per unit of time, and must either be based upon a minimum streamflow of

reasonable infrequency or must be conditioned to varying rates of streamflow. This is an extremely complicated procedure considering the exigencies of disposing of given quantities of biochemical oxygen demanding substances while maintaining a specified dissolved oxygen concentration in the stream. Obviously, the waste can't be dumped in a slug, or it will overload a moving segment of the stream as it moves downstream. Obviously, too, the stream can't assimilate as much during low flow as during normal or high flow while maintaining the required oxygen levels. In such a case, the waste producer may be forced to utilize all the stream capacity available to him by storage and regulated release. Where diurnal variations in oxygen are large, due to aquatic vegetation, it may be necessary to further regulate the permissible discharge rate during the summer to take account of that variable. From this we can conclude that standards are beset with complicating factors that will need eventual resolution prior to the enforcement process.

Policy Guidelines for Establishing Standards

Contrary to some early misconceptions, Congress did not intend a national standard, but rather a national policy, for setting standards tailored to the needs of watersheds in all parts of the nation.

In May, 1966, the governor of each state received from the Secretary of the Interior policy guidelines for the establishment of standards. The guidelines outlined for the states the procedures they were to follow in fulfilling this obligation.

The policy guidelines prepared by the U. S. Department of the

Interior appear to have evolved almost as an afterthought, considering their release date, which was eight months after adoption of the Act.

The guidelines without dispute provided the type of guidance the states needed to generate a satisfactory national program. Without them, an orderly national program would not have been possible.

The State of Michigan, in development of its standards program, made every effort to comply with the guidelines. The main points of the twelve guidelines⁷ are quoted below, followed by pertinent comments regarding compliance.

1. *Water quality standards should be designed to "enhance the quality of water. In no case will standards providing for less than existing water quality be acceptable".*

This guideline refers to waters which are presently polluted or where potential pollution may pose a problem. In Michigan there are many waters, such as streams in the northern part of the state and the Great Lakes where water is of excellent quality. In such cases, this guideline is applicable to the prevention of any further pollution. If the Congressional intent was to maintain high quality water in its present condition, then future growth and development of the nation would be completely prohibited. A more logical interpretation of this policy guideline, it would seem, would be the enforcement of standards to prevent conflict between the many water uses, and to enhance waters which are now seriously degraded.

The enhancement of water quality will be achieved in Michigan through the construction of new treatment systems at locations where

⁷U. S. Department of Interior, Guidelines for Establishing Water Quality Standards for Interstate Waters, (pamphlet) May 1966, pp. 5-10.

problems are known to exist. Enhancement is also impending by proposals requiring the removal of nutrient materials in waste effluents and the separation of storm and sanitary sewers, as specified by the State enforcement plan.

2. *No standards of water quality will be approved which provide for the use of any stream or portion thereof for the sole or principal purpose of transporting wastes.*

All interstate waters were designated for multiple uses. No waters were designated for the sole purpose of transporting wastes, however this was considered a legitimate use. Effluent disposal to surface waters will continue insofar as this practice does not interfere with other designated beneficial uses.

3. *Water quality criteria should be applied to the stream or other receiving water or portions thereof.*

Quality standards for interstate waters were applied to the streams for the protection of five broad use categories with provisions for eleven different parameters. Numerical limitations were established for the parameters; temperature, dissolved oxygen, total dissolved solids and others. Where numerical values were not appropriate for the parameter, a detailed verbal description such as, "no visible film of oils or globules of grease", was provided.

4. *The measure of time period and limiting values which will govern for purposes of the criteria should be defined (e.g., annual arithmetic mean concentration, single daily maximum concentration).*

The accepted design streamflow to which the standards will apply are those equal to or exceeding the ten-year recurrence of minimum low flow average of seven days duration. The establishment of a minimum streamflow serves as an important guide to the design of

treatment facilities. Presumably, if the streamflow declines below the designated minimum, then the standards are no longer applicable. In such a case, lower water quality should be directly proportioned to the severity of the drought, however, there were no details provided in the State plan regarding this matter.

5. *Water quality criteria should be accompanied by a description of present water quality and uses, together with uses expected in the future and the water quality required to make those uses possible.*

This guideline was complied with by providing five regional reports for interstate waters entitled, "*Water Resources Uses, Present and Prospective*".⁸ Each report provided a description of existing water quality with chemical data from all available sources. With regard to future uses, the demands for public water supply, recreation, and other uses were in many cases projected to 1980. Where projections were not possible, as was the case with commercial fishing, historical data was furnished to indicate the present trend.

6. *The plan for implementing and enforcing water quality criteria should be submitted in sufficient detail to describe the nature of the actions to be taken to achieve compliance, a time schedule for such compliance, the controls and surveillance for measuring compliance, and the enforcement authority and measures for ensuring compliance.*

In those areas where noncompliance with the standards was determined to exist, a specific timetable of schedules was provided. The enforcement plan requires that industrial waste problems be abated before June 1,

⁸Michigan Water Resources Commission, *Water Resources Uses, Present and Prospective for the St. Joseph River Basin in Michigan and Water Quality Standards and Plan of Implementation*, (Typed) Rev. June 1967.

1970 and municipal waste problems prior to June 1, 1972. Pollution caused by storm water and nutrients must be abated prior to June 1, 1977.

Surveillance of surface waters and effluents is accomplished by many programs now in existence. Such programs as water quality monitoring, river studies, plant visitations and industrial surveys will provide the necessary information needed to insure compliance with the established standards.

7. *The plan should include consideration of all relevant pollutional sources, such as municipal and industrial wastes, cooling water discharges, irrigation return flows, and combined sewer overflows.*

The plan of enforcement has dealt with other relevant pollutional sources. For example, control of waste disposal from watercraft is now nonexistent, and the State plan has recommended that a program be implemented to control watercraft pollution by June 1, 1970.

The State of Michigan is now in the process of conducting public hearings on rules and regulations relative to watercraft disposal. Presumably, the control of pollution from this source will be realized in the very near future.

8. *No standard will be approved which allows any wastes amenable to treatment or control to be discharged into any interstate water without treatment or control regardless of the water quality criteria and water use or uses adopted.*

Standards proposed by the State of Michigan did not comply with this policy guideline. Consequently, the plan of enforcement was rejected by the U. S. Department of the Interior. A mild proposal to satisfy this requirement was attempted by stating, "*In most instances secondary treatment will be required as a minimum at all municipal*

wastewater treatment plants by 1980 to meet the adopted water quality standards".⁹ By law the Water Resources Commission has authority to abate pollution which is or may become injurious. It is unlikely that they have the vested power to implement a program of secondary treatment as a matter of policy. There is perhaps, some fear that a policy of secondary treatment would eventually involve the intervention of the Federal Government for enforcement. Since the states oppose Federal intervention, they dislike the adoption of a program which they cannot enforce. On the other hand, it is unlikely that any court in the land would enforce secondary treatment without proof that a lesser degree of treatment caused an injury. So in effect, the Federal Government is seeking from the states an enforcement plan, which in all probability is not enforceable. The Federal Government, it appears, is insistent on a plan which prescribes the best practical treatment possible irrespective of future legal consequences. For the present, it is very unlikely that they will compromise their position.

The State of Michigan has altered its original proposal on secondary treatment in hopes of gaining approval of its standards. The new policy of secondary treatment is now as follows, "*Secondary treatment will be required as a minimum at all municipal wastewater treatment plants to meet the adopted water quality standards unless it can be demonstrated that a lesser degree of treatment or control will provide for water quality enhancement commensurate with present and proposed future water uses.*"¹⁰ This proposal was recently submitted

⁹ Ibid., p. 85.

¹⁰ Michigan Water Resources Commission, Loc. cit., n.d., n.p.

to the Department of the Interior for consideration, and if acceptable, Michigan's standards will most likely be approved.

9. *Public hearings are required to be held by States establishing standards in accordance with the provisions of the Act.*

This guideline requirement was observed and fulfilled by scheduling four public hearings at locations throughout the state. A legal notice was sent to industry, sportsmen and civic groups, local government and many others announcing the public hearings. Key newspapers throughout the state were also used to provide notice of the public hearings.

A verbatim transcript was made for each hearing and submitted to the U. S. Department of the Interior in fulfilling the requirements of this guideline. Other supporting information included a summary of all public statements, names of individuals attending the meetings and affidavits of publication of notices in newspapers.

10. *State standards will be reviewed in terms of their consistency and comparability with those for affected waters of downstream or adjacent States.*

Standards proposed by the other Great Lake States are in general agreement with those of Michigan, except in some instances where certain specific numerical limits are different.¹¹ In general, there was not any major effort on the part of the states to coordinate standards to assure some degree of consistency. Each state was extremely busy with its own program and quickly developed the

¹¹Michigan Water Resources Commission, "Summary of Comments on and Corrections to Proposed Water Quality Criteria and Plan of Implementation for Michigan Waters", May 1967, pp. 26-38.

attitude that the problem of inconsistency was something the Federal Government would need to resolve.

It appears that the Federal Government has chosen to ignore the demands of this policy guideline. Indiana, whose standards were approved by the U. S. Department of the Interior, was not required to meet with Michigan to resolve inconsistencies. The St. Joseph River, which is interstate to Michigan and Indiana, has some notable inconsistencies, among them temperature requirements. In Michigan the maximum temperature limit for warm-water intolerant fish is 85 degrees Fahrenheit, while Indiana adopted 93 degrees for the same purpose. This eight degree difference could cause some problems in the future.

11. *The use or uses of the waters concerned, the water quality criteria to provide for such use or uses, and the plan for implementing the water quality criteria should be in conformity with any comprehensive water pollution control program developed pursuant to Section 3 of the Federal Water Pollution Control Act.*

The State of Michigan has complied with this guideline and in fact, has used data available from enforcement studies by the Federal Water Pollution Control Administration to develop its own standards. Recent water quality goals established by mutual Federal-State enforcement action in Southeastern Michigan for the Detroit River and Lake Erie were not violated by the established standards. The State plan of implementation specifically states that where prior comprehensive programs were established as the result of a joint Federal-State effort, the use designations shall be consistent with the previous enforcement effort.

12. *To meet the goals established by the Act, water quality standards must be adequate to protect and upgrade water quality in the face of population and industrial growth, urbanization, and technological change.*

The plan proposed by the State of Michigan has been judged adequate for the stated purpose. The Michigan plan of implementation states, *"Persons proposing to make a new or increased use of waters of the state for waste disposal purposes will be required to utilize such technology and processes which are known".*¹² This statement, although not specifically touching on the requirements of this guideline, does imply that current processes must and will be utilized.

Procedure at the State Level

The U. S. Department of the Interior, Federal Water Pollution Control Administration, published a booklet in May of 1966 setting forth specific policy guidelines for the establishment of quality standards. Much of the policy set forth in the guidelines is not generally mentioned in the Act, but rather reflects expressions of policy by the Congress in enacting that legislation.

Certain rules of procedure at the state level were required in fulfilling the responsibility of establishing standards. A timetable of occurrences and important events in sequential order are listed below.

1. The governor of each state was required to file a letter of intent prior to October 2, 1966. Governor Romney wrote a letter to the Secretary of Health, Education, and Welfare, then John Gardner, that it was the intent of the State of Michigan to adopt criteria applicable to interstate waters. A copy of this letter is contained in Appendix A.

¹²Michigan Water Resources Commission, Water Resource Uses Present and Prospective for the St. Joseph River Basin in Michigan and Water Quality Standards and Plan of Implementation, Rev. June 1967.

2. The state establishes criteria together with a plan for the implementation and enforcement of the criteria. The State of Michigan commenced its standard development program during January 1967. Very little was done prior to this time because of the vigorous state effort to abate raw sewage discharges to public waters.

3. Public hearings on the standards and plan of enforcement were required of each state. To fulfill this requirement, a series of four public hearings were held at monthly intervals beginning on February 23, 1967.

4. The state adopts standards and a plan of enforcement. The Water Resources Commission convened on June 15, 1967 for a one-day session to evaluate testimony received at the public hearings.

5. The standards and plan of enforcement adopted at the state level were delivered to the U. S. Department of the Interior in Washington for review on June 28, 1967.

6. On August 7, 1967, Governor Romney was advised by Secretary of the Interior, Stewart Udall, that significant issues of the enforcement plan needed resolution before approval of the state's criteria could be granted. The Secretary, in his letter, listed three items that needed further attention. This letter, together with correspondence from the State of Michigan, in reply to the issues mentioned in the Secretary's letter, is contained in Appendix B.

7. Once approval of the standards by the Secretary of the Interior is granted, the final phase is the monumental task of enhancing interstate waters. There is speculation that approval of the standards will be granted in the very near future.

The 1965 Act was very specific in its requirement of standards

for all interstate waters. If the states had failed to provide standards by June 30, 1967, the Secretary of the Department of the Interior had the authority to develop such standards as were deemed necessary. The U. S. Department of the Interior reports that all but two of the states submitted standards prior to the deadline date. Considering the limited time available (21 months) to develop such a program, the submission of standards by forty-eight states was indeed a significant achievement. Actually, the program was a one hundred percent success from the standpoint of participation as the two laggards did eventually submit standards. In Michigan, the standards development program occurred at a very inopportune time. At about the same time the Federal act was adopted, Michigan amended its water pollution law to enable enforcement of raw sewage discharges to public waters. Enforcement proceedings resulting from this amendment involved nearly two hundred governmental units.

CHAPTER III

WATER USES

Introduction

In the development of standards, the first task at hand is to determine which uses will be protected. Water, being a universal solvent, is used in thousands of different processes and probably has an equal number of physical uses. Obviously, if standards were to apply to each separate use, the job would be a never-ending task and probably never would be accomplished. Almost from the beginning, there was a common understanding among all concerned that the uses needed to be specified in broad categories. The question that needed resolution was, which categories?

Doctrines Governing Water Rights

There is a long history of disputes over the uses of water in the United States. In the Western States, where water is scarce, the Appropriation Doctrine is the law governing the rights to water. The rule under the Appropriation Doctrine, *"he who beneficially uses the water first"*, establishes a right to a specified amount.¹³ What remained of the excess quantity was appropriated by the next user, and so on. In the Eastern States where water is more plentiful, the law governing the rights to water is referred to as the Riparian Doctrine. The rule of the Riparian Doctrine governs in most of the humid area states. Under this doctrine, the owner of the land adjoining a stream

¹³Clark, Robert E., Water and Water Rights, Vol. I, The Allen Smith Company, Publishers, 1967, pp. 33-34, 60-61, 74-75.

or lake has the right to use the water for beneficial purposes on his land. There are usually no limits specified as to the amount that can be withdrawn for a beneficial use.

Many states abiding by the Riparian Doctrine are guided by the "reasonable use" theory in the protection of their water resources. Under this theory, emphasis is placed on a full and beneficial use of the advantages of the stream or lake, while the rights of the riparians are recognized as being equal and correlative.¹⁴ In Michigan, the natural purifying capabilities of a flowing stream have been recognized as an economic asset. Disposal is considered a primary right of the riparian insofar as such a practice does not interfere with the reasonable use of others. Although the theory of reasonable use tends to promote optimum utilization of water resources, emphasis is placed on controlled degradation rather than sustained quality. This theory now stands contrary to the policy of the Federal Government which demands maintenance of water of high quality at its present level of purity.

Multiple Uses of Water

The conflict of multiple use of water causes more disputes than the rules governing the principles of these two doctrines. Michigan has an abundant supply of water, although shortages will occur on occasion. Demands for a specified quantity of water is not the principle factor of concern in Michigan as it might be in the Western States. The major disputes result from the attempt to simultaneously use the water for several purposes. An example of a common type of discord

¹⁴Gindler, Burton J., Waters and Water Rights, Vol. 3, The Allen Smith Company, Publishers, 1967, p. 55.

resulting from the multiple use of water is the dual use of the water for discharge and recreational activities. Sports fishermen, boaters, and bathers can often be heard making disparaging remarks about waste disposal spoiling their favorite activities. The waste discharger may be sympathetic toward the views of the recreational user, but out of necessity, is required to make a more objective evaluation of the situation. The state, in obeying the requirement of distinguishing the waters for which standards will apply, has been placed in a very unpopular position of satisfying each of these users. Obviously, no matter which approach is decided upon, some user will be dissatisfied with whatever arrangement is provided.

Water is called upon to serve many purposes ranging from internal consumption by living organisms, agricultural and industrial uses, to generating electricity and serving as a mode of transportation. The many purposes that water serves in promoting the economic good and the well-being of mankind are known as beneficial uses.¹⁵ It is for these types of uses that standards must be specified. At this stage we encounter the question of whether or not the transportation and assimilation of waste is a beneficial use of water. We have generally become accustomed to thinking that our flowing streams could be used for transporting and assimilating waste. If the answer is affirmative, then what standards could be written to protect such a use. Obviously, when water has been overly burdened with man's waste products, there is not much else that it can be used for.

¹⁵McKee, J. E. and H. W. Wolf, Water Quality Criteria, State of California Water Quality Control Board, Pub. No. 3-A, 2nd ed., Sacramento, 1963, p. 88.

Guidelines provided by the Federal Government mentioned earlier in this report provide a response to this question. It stated that *"No standards of water quality will be approved which provide for the use (emphasis added) of any stream or portion thereof for the sole or principal purpose of transporting wastes".*¹⁶ This must therefore be interpreted as meaning that all of our interstate waters must be classed as multiple-use streams or lakes. Effluent disposal after adequate treatment would be permissible, provided that other legitimate uses were also possible. Since waste disposal has the lowest priority among all the uses, there was not any need for its designation. Waste disposal may be a legitimate use but rarely could it be classed as a beneficial use.

It is an interesting phenomenon that in Michigan there exist distinctly different attitudes toward the use of various bodies of water. Certain types of water are held in much higher esteem than others. The three distinct categories existing are (a) oligotrophic lakes, (b) trout waters, and (c) marginal or degraded waters. The oligotrophic lakes and trout waters are highly regarded because of their existing or potential recreational value. All measures are taken to keep harmful waste materials out of these waters. For instance, there has been recent action underway to remove all waste effluents from certain of these waters at a number of locations in the state. The Au Sable River is a recent example of this type of action.¹⁷ Tremendous interest by

¹⁶U. S. Department of the Interior, Guidelines for Establishing Water Quality Standards for Interstate Waters, (pamphlet) May 1966, p.5.

¹⁷Water Resources Commission, (Commission Conference Records), Saginaw, Michigan, March 1967.

sportsmen and civic organizations in the preservation of these waters can be attested to by their increasing demands for continued water purity. Generally, the attitude toward rivers is almost the opposite, where through the years rivers have been commanded to carry man's waste products without regard to the final consequence. This variation in attitudes does indeed pose a problem when formulating standards on the basis of reasonableness rather than use.

Authority to Develop Use Standards

Prior to 1965, there was not much done by the states to develop water pollution control standards similar to those available for drinking water. McKee and Wolf, in their study of state laws, indicated that nearly all the states had authority to establish standards or use classifications.¹⁸ Usually the authority to promulgate such standards are stated in the following manner, as taken from the Georgia Water Quality Control Act:

*" . . . is authorized to establish such standards of quality for any waters in relation to the reasonable and proper use thereof as it deems necessary."*¹⁹

Minnesota is a state which chose to classify its waters rather than establish standards, and wording to promulgate classification of waters is as follows:

" . . . is empowered to make such classification of waters as it deems advisable, and to establish and alter such

¹⁸McKee and Wolf, op. cit., pp. 28-63.

¹⁹Ibid., p. 36.

*reasonable pollution for any waters of the state in relation to the public use to which they are or may be put."*²⁰

In the Michigan Act, the wording relating to the establishment of standards is more forceful, in that it commands such standards.

Section 5 of the Act states, in part:

*"The Commission shall establish such pollution standards for lakes, rivers, streams and other waters of the state in relation to the public use . . ."*²¹

In the review of state laws relating to pollution control, it would appear that it was the intent of most state legislatures that quality standards be adopted. Terminology such as, "*charged with the power*", "*shall establish and enforce*", "*is authorized to establish*", "*is powered to adopt and enforce*", "*shall establish*", and "*is responsible for establishing*" would indicate that this was the case.²² A few of the states did comply, and in fact established water pollution standards. Their approach, for the most part, was not effective in achieving success for a number of reasons. Among these reasons are: (a) the failure to designate uses for the standards adopted, (b) establishing effluent standards by concentration levels and not specifying absolute quantities, (c) failure to enforce adopted programs, and (d) establishing standards for the protection of a given water instead of a use. The latter practice was arbitrary and usually placed emphasis on existing conditions.

²⁰*Ibid.*, p. 43

²¹*Ibid.*

²²McKee and Wolf, *op. cit.*, pp. 28-63.

One fact is very obvious in the state laws relating to the adoption of standards. Invariably, the laws specify that the standard of purity shall be adopted for the protection of its reasonable and beneficial water use.

Water Uses Established in Michigan

On January 20, 1967, the Water Resources Commission, at its regular monthly meeting, reviewed the staff's recommendations for use categories. This meeting was not intended as a public hearing, but as an opportunity for the members of the Commission to review the staff's proposals. Use categories discussed at the meeting consisted of eight broad use areas and were for the most part extracted from Michigan's Water Pollution Law, Public Act 245, as amended. These are enumerated as follows:

1. Water Supply - Domestic
2. Recreation - Total Body Contact
3. Natural Environment
4. Agricultural
5. Recreation - Partial Body Contact
6. Water Supply - Industrial
7. Commercial
8. Public Health

It was the staff's intention to specifically cover the uses listed in the State Act. This approach was fundamentally sound from the standpoint of observing the State law. Then too, since the Commission has authority only as prescribed by law, it would be within their best judgment to restrict use categories within the boundaries expressed by the Act.

Section 6 (a) of the State Water Pollution Act identifies the water uses for which protection shall be provided. Repeated here in its entirety, it reads as follows:

*"It shall be unlawful for any person directly or indirectly to discharge into the waters of the state any substance which is or may become injurious to the public health, safety, or welfare; or which is or may become injurious to domestic, commercial, industrial, agricultural, recreational, or other uses which are being made of such waters; or which is or may become injurious to the value or utility of riparian lands; or which is or may become injurious to livestock, wild animals, birds, fish, aquatic life, or plants or the growth or propagation thereof be prevented or injuriously affected; or whereby the value of fish and game is or may be destroyed or impaired."*²³

The outcome of this meeting resulted in further grouping of two categories, some word changes in the identification of one category, and the exclusion of still another. The use category "Water Supply" in its original form was treated as two categories, which allowed coverage of water supply for domestic and industrial supplies separately. It was the conclusion of the Commission, because of the likeness in quality specified for each category, that they be grouped together and identified separately by minor subscripts.

The "Recreation Use" category was treated in a similar manner to the "Supply" category in that it was also grouped together. Subscripts were used to distinguish partial body contact from total body contact recreational activities.

Considerable discussion evolved from the designation of "Natural Environment". It was the consensus of most of the members of the Commission that this terminology was all inclusive, but would not be

²³State of Michigan Water Resources Commission Act, Act 245, Public Acts of 1929, as amended.

easily understood by the public. This category was reworded to read, "Fish, Wildlife and Other Aquatic Life" and following this in parenthesis stressing growth and propagation.

The category designation for the protection of "Public Health" was discussed at considerable length and then discarded. There was particular objection to this use category for several reasons. First, because it called for the enforcement of nuisance conditions such as odors. Secondly, it was felt that such a category was not within the purview of the State Act. If a nuisance condition as the result of odor occurred, it would need to be enforced from the injury standpoint. In addition, this use category, in all probability, did not receive acceptance because it was aimed at the protection of the utility of riparian lands. It had the connotations that the water chemistry of a stream was seriously degraded if it received this designation. In review of standards proposed by the Great Lakes States, it is important to note that there was not a similar use proposed. It is perhaps fortunate that this use category was discarded, for it would have created suspicion and apprehension. Then too, it would not have been fitting for a state, which prides itself as a leader in the management of its water resources, to set forth such an unusual category.

The January meeting resulted in the designation of use categories which were to stand in the final form at the completion of the public hearings. These categories are as follows:

- A. Water Supply
 - 1. domestic
 - 2. industrial
- B. Recreation
 - 1. total body contact
 - 2. partial body contact

- C. Fish, Wildlife and Other Aquatic Life
- D. Agricultural
- E. Commercial

The designation of the above uses for the protection of water was well received at the public hearings. Numerous people from all parts of the state commented, both favorably and unfavorably, about the parameters established to protect the uses, but rarely were the use categories a matter of controversy. Some correspondence and telephone conversations were received from individuals in the St. Joseph River basin about the commercial designation of a reach of the navigable portion of the St. Joseph River. Their interpretation of this use was one of permitting inferior water quality by the dumping of trash and other polluting material. Apparently, this interpretation resulted from misleading information in local newspapers. This misunderstanding was clarified during a special informal meeting at Benton Harbor, Michigan on April 5, 1967. It was explained at this meeting that the commercial use would not result in degradation of the St. Joseph River. The written explanation of the Commercial use in a Water Resources Commission booklet explaining the standards further clarified the intended purpose of this use. As explained in this booklet, water designated for this category is not directly involved in a process and thus not degraded.

The booklet, Water Quality Standards for Michigan Waters,²⁴ was intentionally written in a clear, precise, simple manner so that the

²⁴State of Michigan Water Resources Commission, Water Quality Standards for Michigan Waters, appendix A, Feb. 1967, rev. June 1967.

lay public could understand its contents. From the beginning, it was the aim of staff members to prepare material which could be easily understood in hopes of stimulating greater public interest. The portion of the report dealing with the definition and explanation²⁵ of water uses is repeated here to reiterate the point in question.

A. Water Supply

1. Domestic

This is the raw water source which is intended for use as a potable supply. It can be treated by presently acceptable treatment methods to yield a finished water suitable for human consumption. Some examples of the uses to which this water could be put after treatment are: 1) drinking water, 2) food processing, such as cooking, 3) a liquid ingredient in such items as carbonated beverages and beer, and 4) possibly livestock watering without treatment.

2. Industrial

This is the raw water source which is intended for use in manufacturing processes other than food processing. It is not expected that this water will be used as a potable supply and it will not be protected for this use. The qualities required for industrial processes vary greatly and only an "average" industrial use is represented here. Since most industries will accept municipal water as a source for industrial water the standards are similar to domestic raw water sources, except from the public health standpoint. Some examples of the uses to which this water could be put are: 1) cooling water, 2) a liquid ingredient in other than food products, and 3) equipment washing.

B. Recreation

1. Total Body Contact

This is the surface raw water source which is intended for uses where the human body may come in direct contact with raw water to the point of complete submergence. The raw water may be accidentally ingested and also certain body organs, such as the eyes, ears, etc., will be exposed to the water. Although water may accidentally be ingested,

²⁵Ibid., pp. 2-3.

it is not intended that this source be used as a potable supply unless treatment is applied. Some examples of total body contact recreation are: 1) swimming, 2) water skiing, and 3) skin diving.

2. Partial Body Contact

This is the surface raw water source which is intended for uses where the human body may come in direct contact with the water but not normally to the point of complete submergence. In addition, this water is not likely to be ingested nor will critical organs (eyes, ears, nose) normally be exposed to the water. Some examples of partial body contact are: 1) fishing, 2) boating, 3) hunting, 4) trapping, and 5) equipment cleaning.

C. Fish, Wildlife and Other Aquatic Life

This is the raw water source which is intended for use by fish, wildlife, aquatic life and semi-aquatic life as their natural habitat in which they not only exist, but propagate and grow. Some examples of the uses of these sources are: 1) intolerant fish - cold water species, 2) intolerant fish - warm water species, 3) wildfowl habitat, and 4) tolerant fish - warm water species.

D. Agricultural

This is the raw water source which is intended for general agricultural usage. It is directly used for the growing of livestock and crops and is not intended for direct human consumption. Some examples of agricultural uses are: 1) livestock watering, 2) irrigation, and 3) spraying.

E. Commercial

This is the raw water source which is intended for uses such as navigation. It is distinguished from industrial use in that the water is not used directly in a process. Some examples of the uses are: 1) hydroelectric power generation, 2) commercial shipping, and 3) electric power generation from steam.

The selection of uses for which protection was to be provided, and subsequent explanation of each category was termed an absolute success. Except for the unfortunate misunderstanding of the "Commercial" use category, the public appeared to understand what the engineers, chemists, and biologists were discussing. The use categories stood the test of all

the public hearings and the exacting scrutiny of the many interest groups. There were no changes recommended relative to the use categories at any of the public hearings.

CHAPTER IV

THE PARAMETERS

Introduction

The problem of developing quality parameters is complicated by the imposing number of substances which are naturally contained in the water. These substances may be chemical, physical or biological, and can be present in sufficient concentrations to cause undesirable effects on one or more water uses. In Michigan, water can often be identified by the environment through which it passes. For example, in mid-Michigan, where numerous oil wells once existed, the strata is still saturated with chlorides which leach to the streams causing elevated chloride concentrations.

The staff of the Water Resources Commission sought the advice of many experts in the selection of suitable quantitative and, where applicable qualitative statements to cover the parameters. These groups of experts included a committee of specialists from Michigan State University for the requirements on agricultural uses of water. The Michigan Department of Public Health made recommendations for Domestic Water Supplies and Recreation. The Fish Division of the Conservation Department lent assistance in the establishment of parameters for Fish, Wildlife and Other Aquatic Life. Several industrial specialists were consulted for recommendations on Industrial Supply. It can be said that not one single parameter was established without countless hours of discussion, appraisal and eventual compromise on a value or statement that would be appropriate and adequate. While a compromise

was not always agreeable and an impasse on occasion occurred, expressions of quality whether numerical or qualitative needed to be resolved.

Problems Related to Establishing Parameters

The appearance properties of water will be used here to illustrate the complexity of establishing a standard. From the viewpoint of an individual who desires to go fishing or swimming or water skiing, or even just desires to sit and look at a stream, the appearance of water involves a much broader range of observation than just color or turbidity. Floating solids and debris, an oil slick, islands of foam, or shoals of unsightly sludge are even more likely to arouse this individual's anger.

While the above manifestations may be objectionable to the recreational user, they could also be specifically objectionable to other types of users. Turbidity and color can easily be expressed in numbers. These numbers, it suffices to say, are relatively unimportant to many users, but are extremely vital to a few. Turbidity in the form of suspended solids can be undesirable in many respects. Suspended solids cause turbidity which interfere with light transmission and impairs aesthetic enjoyment. Under quiescent conditions, solids can settle out, causing the formation of unnatural and unsightly bottom deposits which in turn blanket the bottom of a stream, destroying fish eggs, fish food organisms and spawning beds.

A clear, colorless water is essential to many industrial processes. Photographic processes, the manufacture of fine paper, various steps in the production of synthetic fibers and the processing of synthetic fibers into textiles are a few examples of where clear and colorless water

is important. Preparation of food and drink are still further examples of the need for clear and colorless water. McKee and Wolf report in their study that the units of color and turbidity for water used in baking, brewing, food canning and food processing should not exceed 10 units.²⁶ Table 1 illustrates the wide recommended limiting values for turbidity as compiled from the literature.

The example of turbidity is an illustration of the type of problem one encounters when establishing a standard. Source material for almost any parameter is abundant, but seldom do any two sources agree on a similar value for the protection of a particular use. How is anyone expected to reduce the numerous criteria available to a meaningful number? The answer to date is that you don't. Instead, you write a general statement to cover the parameter. Here are some examples of recent efforts to cope with this problem, with key phrases emphasized,

*"There shall be no visible oil in the stream. There shall be no man-made deposits of solids either organic or inorganic in nature on the stream bed."*²⁷

*"No person shall discharge into class 'D' waters any wastes which result in any slicks, floating solids, or sludge deposits in said waters which are readily visible, or which result in an appreciable change in color of said waters, . . ."*²⁸

²⁶McKee and Wolf, op. cit., p. 290.

²⁷State of Missouri Water Pollution Board, Water Quality Criteria for Interstate Waters Between Missouri, Oklahoma, and Arkansas (tentative), Jefferson City, April 1966.

²⁸Utah State Department of Health, Code of Waste Disposal Regulations, Part II, Standards of Quality for Waters of the State, Salt Lake City, Utah, May 1965.

Table 1

**Recommended Limits of Turbidity for
Various Industrial Uses of Water**

<u>Industrial Use</u>	<u>Turbidity Units*</u>
Beverages	5
Food Products	10
Breweries	10
Paper and pulp	
Alkaline pulps	25
High-grade paper	5-25
Fine writing and book paper	10
Unbleached kraft paper	100
Bleached kraft paper	40
Groundwood paper	50
Textile	
Nitrocellulose	0.5
Rayon	1
Cotton	25
Baking	10
Cooling water	50
Ice making	1-5
Tanning	20

*Turbidity is measured in standard units, defined in terms of the depth of water to which a candle flame can be clearly distinguished.

*"No objectionable unnatural turbidity, color, or deposits in quantities sufficient to interfere with the designated use."*²⁹

*"Substantially free of visible floating oil."*³⁰

To qualify expressions like substantial, readily appreciable and visible is an utterly impossible task. The mere selection of a proper identifying word can cause considerable head-knocking. How then, in all honesty, could a numerical value be selected on the particular parameter in question? In the opinion of the members of the staff of the Water Resources Commission, it could not.

Methodology for Standards by Other Groups

The election of suitable parameters for the protection of the use categories needed resolution prior to working with individual parameters. Earlier work done by the Pacific Northwest Pollution Control Council³¹ and the New England Water Pollution Control Commission³² were examples of the type of standards the staff of the Water Resources Commission strongly favored (Tables 2 and 3). The Pacific Northwest Pollution Control Council, in its standards, provided twelve (12) parameters and seven (7) use categories. The use categories selected by the State of Michigan very closely parallel

²⁹State of Michigan Water Resources Commission, Water Quality Standards for Michigan Waters, Appendix A, Lansing, Michigan, rev. June 1967.

³⁰State of Indiana Stream Pollution Control Board, Water Quality Standards for Waters of Indiana, Indianapolis, Indiana, March 1967.

³¹Pollution Control Council Pacific Northwest Area, Water Quality Objectives, November 1966.

³²New England Interstate Water, Classification and Standards of Quality for Interstate Waters, Oct. 1, 1959.

Table 2

WATER QUALITY OBJECTIVES AND MINIMUM TREATMENT REQUIREMENTS

Water Quality Objectives, Applicable to Receiving Waters, for Salt and Fresh Surface Waters and Underground Waters

Water quality → water uses →	Organisms of the coliform group	Floating, suspended & settleable solids	Taste- or odor- producing substances	Dissolved oxygen	pH	Toxic, colored, or other deleterious substances	Phenolic compounds	Oil	High temperature wastes	Minimum treatment requirements for domestic sewage
A. WATER SUPPLY, DRINKING, CULI- NARY & FOOD PRO- CESSING Without treatment other than simple disinfection and removal of naturally present impurities	Most probable number coliform bacterial con- tent of a representative number of samples should average less than 50 per 100 ml. in any month	None attributable to sewage, industrial wastes, or other wastes or which, after reason- able dilution & mixture with receiving waters, interfere with the best use of these waters for the purpose indicated	None attributable to sewage, industrial wastes, or other wastes which, after reasonable dilution & mixture, will increase the thresh- old odor number above eight (8)	Greater than five (5) parts per mil- lion except for underground waters	Hydrogen ion con- centration ex- pressed as pH should be main- tained between 6.5 and 8.5	None alone or in combination with other substances or wastes in sufficient amounts or of such nature as to make receiving water un- safe or unsuitable for use indicated (U.S.P.H.S. Stds.)	Less than five (5) parts per billion	None	Not in sufficient quan- tities alone or in com- bination with other wastes to interfere with the use indicated	Sedimentation and effective disinfection
B. WATER SUPPLY, DRINKING, CULI- NARY & FOOD PRO- CESSING With treatment equal to coagulation, sedimenta- tion, filtration, disinfec- tion and any additional treatment necessary for removing naturally present impurities	M.P.N. coliform bac- terial content when as- sociated with domestic sewage of a represen- tative number of sam- ples should average less than 2000 per 100 ml. and should not ex- ceed this number in more than 20 per cent of samples examined in any month	Same as for use "A" above	None attributable to sewage, industrial wastes, or other wastes which, after reasonable dilution & mixture, will interfere with the best use of these waters for the purpose indi- cated	Greater than five (5) parts per mil- lion except for underground waters	Same as for use "A" above	Same as for use "A" above	Less than five (5) parts per billion	None alone or in com- bination with other substances or wastes as to make receiving water unfit or unsafe for the use indicated	Same as for use "A" above	Sedimentation and effective disinfection
C. BATHING, SWIM- MING AND RECREATION Note: When waters are used for recreational purposes such as fishing & boating, exclusive of bathing & swimming, the number "1000" may be substituted for "240" in statement of coliform objective	Coliform bacterial con- tent of a representative number of samples should average less than 240 per 100 ml. and should not exceed this number in more than 20 per cent of samples examined when associated with domes- tic sewage (see note under "C" at left)	Same as for use "A" above	None attributable to sewage, industrial wastes, or other wastes which, after reasonable dilution & mixture, will interfere with the best use of these waters for the purpose indi- cated	Greater than five (5) parts per mil- lion	Same as for use "A" above	Same as for use "A" above	Less than 25 parts per billion or none in sufficient amounts such as to impart a residual taste to recrea- tional or commer- cial fish, shellfish, or other aquatic forms	Same as for use "B" above	Same as for use "A" above	Sedimentation and effective disinfection
D. GROWTH & PROPAGATION OF FISH, SHELLFISH & OTHER AQUATIC LIFE	Coliform bacterial con- tent of a representative number of samples should not have a median concentration greater than 70 per 100 ml. in waters used for the growth & prop- agation of shellfish	Same as for use "A" above	None attributable to sewage, industrial wastes, or other wastes which will interfere with the marketability or propagation of rec- reational or commercial fish, shellfish, or other edible aquatic forms	Greater than six (6) parts per million	Same as for use "A" above	None alone or in combination with other substances or wastes in sufficient amount or of such character as to make receiving waters un- safe or unsuitable for use indicated	Same as for use "C" above	Same as for use "B" above	None in sufficient quantity as to be in- jurious to or interfere with the normal propa- gation of fish, shellfish, or other aquatic life	Sedimentation for all uses under this group but disinfection re- quired in addition only if discharged in the waters used for the growth & propagation of shellfish, either com- mercial or recreational
E. AGRICULTURAL AND INDUSTRIAL WATER SUPPLY Without treatment ex- cept for the removal of natural impurities to meet special quality re- quirements, other than those classified under "A" above. Note: For agricultural water supply, salinity and sodium hazards are determined by electrical conductivity (EC X 10 ³) and sodium adsorption ratio (SAR). Waters high in both salinity and sodium are generally un- suitable for irrigation purposes. (See "classifi- cation waters", circular No. 809, U.S. Depart- ment of Agriculture, November, 1955)		Same as for use "A" above	None attributable to sewage, industrial wastes, or other wastes which will adversely affect the marketability of agricultural or in- dustrial produce	Greater than three (3) parts per million	Hydrogen ion con- centration ex- pressed as pH should be main- tained between 6.0 & 9.5	Same as for use "A" above	None in sufficient quantity as to make receiving water unsuitable for use indicated	Same as for use "B" above	Same as for use "A" above	Sedimentation and effective disinfection

Source:

McKee, J. E., and H. W. Wolf, Water Quality
Criteria, State of California Water Quality
Control Board, Publication No. 3-A, 2nd ed.,
Sacramento, 1963., p. 63.

Table 3

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION
CLASSIFICATION AND STANDARDS OF QUALITY FOR INTERSTATE WATERS
(As Revised and Adopted October 1, 1959)

CLASS A		CLASS B	SUITABILITY FOR USE		CLASS C	CLASS D
	Suitable for any water use. Character uniformly excellent.	Suitable for bathing and recreation, irrigation and agricultural uses; good fish habitat; good aesthetic value. Acceptable for public water supply with filtration and disinfection.	Suitable for recreational boating, irrigation of crops not used for consumption without cooking; habitat for wildlife and common food and game fishes indigenous to the region; industrial cooling and most industrial process uses.	Suitable for transportation of sewage and industrial wastes without nuisance, and for power, navigation and certain industrial uses.		
STANDARDS OF QUALITY						
Dissolved oxygen	Not less than 75% sat.	Not less than 75% sat.	Not less than 5 p.p.m.	Present at all times		
Oil and grease	None	No appreciable amount	Not objectionable	Not objectionable		
Odor, scum, floating solids, or debris	None	None	None	Not objectionable		
Sludge deposits	None	None	None	Not objectionable		
Color and turbidity	None	Not objectionable	Not objectionable	Not objectionable		
Phenols or other taste producing substances	None	None	None	Not in toxic concentrations or combinations		
Substances potentially toxic	None	None	None	Not in objectionable amounts		
Free acids or alkalies	None	None	None			
Radioactivity	Within limits approved by the appropriate State agency with consideration of possible adverse effects in downstream waters from discharge of radioactive wastes; limits in a particular watershed to be resolved when necessary after consultation between States involved.					
Coliform bacteria	*Within limits approved by State Department of Health for uses involved.	Bacterial content of bathing waters shall meet limits approved by State Department of Health and acceptability will depend on sanitary survey.				

* Sea waters used for the taking of market shellfish shall not have a median coliform content in excess of 70 per 100 ml.

NOTE: Waters falling below these descriptions are considered as unsatisfactory and as Class E.

These standards do not apply to conditions brought about by natural causes.

For purpose of distinction as to use, waters used or proposed for public water supply shall be so designated.

Source: McKee, J. E., and H. W. Wolf, Water Quality Criteria, State of California Water Quality Control Board, Publication No. 3-A, 2nd Ed., Sacramento, 1963, p. 61.

those of the council. Actually, there are only minor differences in the two plans. The Pacific Northwest Pollution Control Council has as one of its use categories "Shellfish Growth and Propagation" which, of course, would not be applicable in Michigan, while another difference is in the recreational use. Michigan distinguished recreational uses by "Whole Body" and "Partial Body" contact activities, while the Pacific Northwest Pollution Control Council grouped the recreational activities into one category.

The New England Interstate Water Pollution Control Commission provided protection by the so-called classification-standards technique. This method of providing protection to water resources was adopted by one of the Great Lakes States . . . namely New York. The other Great Lake States elected to use the use-standards approach. On a nationwide basis, only a few states adopted the classification-standards technique, while the majority favored the use standards approach. Opponents of the classification-standards method argue that such standards are difficult to formulate and define, and more difficult to administer. This approach is also said to be extremely complicated and generally results in an extremely cumbersome task for the administrative body.

The other approach to maintaining water purity, which apparently was not acceptable to the Federal Government, was the effluent standards technique. This technique restricted the strength and/or amount of substance that could be discharged to a watercourse. Pennsylvania has been credited with pioneering the effluent standards approach. Their program, established for industries and processes, specify standards for effluents. In addition to specifying limitations,

the program requires a percentage removal of each waste constituent. A program such as this possesses merit, but receives tremendous opposition by dischargers, who argue that the full assimilative powers of the receiving waters are not utilized. The best feature of this type of program is that it encourages good housekeeping and penalizes inefficient operation.

The states, in the adoption of standards, were not provided with the choice of selecting effluent standards. The Water Quality Act of 1965 did not specifically say that effluent standards would be rejected, however, guideline number 3 indicated a preference. This guideline, in part, states that:

*"Water quality criteria should be applied to the stream or other receiving waters or portions thereof. The criteria should identify the water uses to be protected and establish limits on pollutants or effects of pollution necessary to provide for such uses."*³³

It was interpreted from the above guideline that the Federal Government was advocating the establishment of stream standards. This guideline further stated that the uses must be identified for which protection was to be provided. Thus, it would appear that effluent standards would be contrary to the Act. This meant that the states had two alternatives: 1) establish use-streams or 2) classification-standards. Because the classification-standard uses the zoning approach and is cumbersome and time consuming to establish, the states favored the use-standard approach. Then too, it appears to

³³Department of the Interior, Guidelines, p. 5.

be the most preferential method because standards are directly related to the uses.

Selection and Discussion of the Parameters

The selection of suitable parameters was the next step in the sequence after the establishment of the use categories. This was a formidable task in view of numerous chemical and waste constituents known to be detrimental to water uses. To be able to cope with the task, the parameters needed reduction to a reasonable number of broad categories, which would provide protection to all uses. "Toxic and Deleterious Substances" is an example of a broad base parameter. Under this parameter, cyanide, chromium, herbicides, pesticides and other deleterious substances could be stated with appropriate numerical values or quality statements.

The specific parameters for measuring the suitability of water for each use observed the following rules:

1. It must measure a quality characteristic which has significant bearing on the suitability of water for the particular use.
2. It must be capable of measurement by standardized techniques which will yield comparable results, under conditions reproducible at different times and places.
3. Its value should be capable of reasonably rapid determination.
4. Its level of toxicity (numeral values for toxicants) must be a well established fact and have a reasonably tight range of reproducibility relative to effects.
5. Its specified level must not only provide protection of the water use, but should also contain a certain safety factor.

Detailed below is a review of the parameters which were considered significant to water quality for the categories of water use under consideration. The parameters are identified by both their common

names and conventional abbreviations. Their effects on water uses and other related problems are summarized.

Dissolved Oxygen (D.O.)

Dissolved oxygen is one of the most important indicators of water quality. Adequate dissolved oxygen levels are necessary to support desirable fish and aquatic life. Significant introductions of decomposable organic material will lower dissolved oxygen levels to the point of serious degradation. If the quantity of oxidizable material is substantial, it can cause a stream to take on the characteristics of an open sewer.

Substantially zero dissolved oxygen in the ground water withdrawn from a well is actually a boom as far as reducing the tendency toward localized corrosion by pitting in steel piping and equipment. For this reason, industry would be pleased to have little or no dissolved oxygen in the water they use for a supply.

Dissolved oxygen is not an essential requirement for any of the uses except for the protection of the biota. Insofar as it was an indicator of quality, it was necessary to prescribe quantity concentrations, and in some cases quality statements, to protect the uses. For the use categories, Supply, Recreation and Commercial, the qualitative statement, *"Present at all times in sufficient amounts to prevent nuisance"* was selected. This meant that oxygen was to be present in sufficient quantities to prevent septic conditions.

A minimum value of 3.0 milligrams per liter (mg/l) was prescribed for agricultural use to insure adequacy in surface water used for stock watering. This relatively high concentration was to insure that odors resulting from decomposition would not render the water unsatisfactory for this purpose.

The standards prescribed some level of dissolved oxygen for each use, even though in some instances it was not a necessary requirement for the use. This same pattern was followed with all parameters to insure complete coverage of all parameters exclusive of the eventual use of a particular body of water. If, for example, a stream was designated for only one use such as agricultural, then a level of dissolved oxygen would be prescribed.

The use category controlling the level of dissolved oxygen in surface water is, "Fish, Wildlife and Other Aquatic Life". Insofar as all of the waters were to be designated for the protection of some species of fish, which incidentally require higher levels of dissolved oxygen than other uses, this category would control the levels of dissolved oxygen in the surface water.

Dissolved oxygen for fish was established according to species classification as follows:

Intolerant fish - cold water species: Not less than 6 mg/l at any time.

Intolerant fish - warm water species: Average daily DO not less than 5 mg/l, nor shall any single value be less than 4 mg/l.

Tolerant fish - warm water species: Average daily DO not less than 4 mg/l nor shall any single value be less than 3 mg/l.³⁴

Coliform Group

By definition, the coliform group embraces several varieties of bacteria which differ in biological characteristics, as well as in natural sources and habitats. Coliform bacteria are found in the

³⁴State of Michigan Water Resources Commission, Water Quality Standards for Michigan Waters, June 1967, pp. 18, 19.

fecal matter of all warm-blooded animals, including man. Some varieties abound in nature, such as in soils or plants. Pathogens, or disease-producing organisms of intestinal origin, may also be present in fecal matter. Therefore, the presence of the coliform group has long been used to indicate the possible presence of pathogenic bacteria.

The fecal coliform test, which indicates with more certainty the evidence of recent contamination, is gaining wider acceptance as a quality control parameter. Density levels for fecal and total coliform organisms was established for each use category. The most restrictive limits apply to total body contact recreation due to the public health hazards by direct skin and mucous membrane exposure and possible direct ingestion of untreated water. Average density level for ten consecutive samples for coliform and fecal coliform was set at 1000 and 100 organisms per 100 milliliters of sample, respectively.

The use categories of Water Supply (industrial), Recreation (partial body contact), Fish, Wildlife and Other Aquatic Life, Agricultural and Commercial received lower levels of protection. Coliform density, prescribed for these categories, is identical to that adopted by the U. S. Public Health Service for domestic water supply. Water suitable for these uses must not exceed an average of 5000 organisms per 100 milliliters of sample for any 10 consecutive samples. If two of the ten samples exceeded 10,000 organisms, it could also be ruled as inadequate for these particular uses. The fecal coliform densities prescribed for these same use categories was set at 1,000 organisms per 100 milliliters of sample.

A slightly different set of numbers was applied to the use category, Water Supply (domestic). For this category, inland waters

were distinguished from the Great Lakes and connecting bodies. Density levels established for the latter were much more restrictive because of the desire to maintain high levels of purity in these waters. Separate standards for the protection of the same use would presumably indicate that this was the case. It would appear that if this level of protection was necessary for Great Lakes water, then this same standard should also be appropriate for inland waters.

Suspended, Colloidal and Settleable Materials

The presence of excess suspended, colloidal and settleable materials in surface waters is objectionable for numerous reasons. In the case of water used for supply, high concentrations of solids have an abrasive effect on pipes and can result in extensive wear. Color in water is usually associated with high solids content which may be the result of waste discharges, decaying vegetation, leaching from organic deposits of peat or humus or from naturally occurring metallic ions such as iron or manganese. Color characteristics of water are difficult to remove, usually requiring costly special treatment processes in preparation for domestic use.

The objection to these substances in excessive quantities in waters used for recreational purposes is quite obvious. Primarily, these substances alter the appearance properties of water and in general destroy the appealing qualities required for this use. Also, when cloudiness develops as the result of solids, under-water visibility is reduced, and hazardous objects may be hidden.

Solids and turbidity are particularly objectionable to many sports fish which are sight feeders. In turbid waters, they are at a disadvantage with coarse fish, many of which employ a vacuum-filter type of feeding. Further difficulty is encountered with solids as

the result of settling and the formation of deposits on the stream bed. Such action interferes with fish spawning by clogging the interstices of gravel and by inhibiting the exchange of gases at the egg wall. Also, deposits on the stream bottom will cover important fish food organisms causing an imbalance in the food chains with a resultant reduction in the size and population of fish.

Surface waters with a high concentration of solids will render waters unsuitable for livestock watering. However, clogging of spray nozzles of irrigation equipment seems to be of more concern to agricultural interest.

Over a period of time, the deposition of solids will occur at such a magnitude as to interfere with navigation in channels and harbors. This is evidenced by the continuous dredging operations conducted by the U. S. Army Corps of Engineers. Presumably, natural siltation contributes the bulk of this material. However, where excessive siltation is the result of domestic, industrial or other water uses it should be controlled to the fullest possible extent.

The general statement covering this parameter was partially discussed earlier in this report where an explanation was provided concerning the difficulty in establishing standards for the selected parameters. A numerical value for this parameter is generally acknowledged as difficult to establish because of the wide range of solids and turbidity naturally occurring in water. In many of Michigan's streams, especially in the lower peninsula, high levels of suspended materials result from erosion and dense algae blooms.

Residues

The following statement covering residues was applicable to all of the established uses:

*"Floating solids: None of natural origin. Residues: No evidence of such material except of natural origin. No visible film of oil, gasoline or related materials, no globules of grease."*³⁵

Residues, oil and debris constitute a very definite source of pollution and one which is readily apparent to the public at large. Pollutants described for this parameter may impede navigation, create fire hazards, cause unsightly scums, impede water flow at intake structures, clog or reduce efficiency of filters, affect light penetration, restrict swimming or other recreational uses, and have a detrimental effect on fish and other aquatic life. Since these materials are, for the most part, amenable to treatment, the Water Resources Commission has specified that none would be permitted except for natural causes.

Toxic and Deleterious Substances

Standards for this parameter was handled in three different ways, by (1) adopting U. S. Public Health Service Standards for domestic water supply, and also setting limits on two toxicants, (2) a bio-assay for the protection of fish, (3) and a phrase stating concentrations shall be below levels causing injury for the remaining uses.

The U. S. Public Health Service is a recognized authority on standards for water supply. Citing the standards of a Federal agency not only guaranteed approval, but also offered a method for keeping abreast of modifications recommended by this authority.

³⁵Ibid., p.4.

As now proposed, the Water Resources Commission will be guided by the U. S. Public Health Service Drinking Water Standards irrespective of what changes may be made in these standards in the future. For domestic supply, cyanide and chromium were intentionally mentioned at the request of the Michigan Department of Public Health to emphasize their undesirable presence. Although the 0.2 mg/l limitation for each of these ions is identical to that proposed by the U. S. Public Health Service Drinking Water Standard, the Michigan standard proposal was intended to be more restrictive. The state limitation of normally none detectable, with specified maximum upper limit differs markedly from the Federal requirements, which set the limits as the maximum permissible.

One of the aims of the Commission staff in developing use-standards criteria was to specify definite limits for toxic substances which have been found by experience to be injurious to aquatic life. However, when it was impossible to agree upon a quantity limitation, there was no other recourse but to state the standard in general terms.

The members of the Fish Division of the Conservation Department gave a great deal of thought to the problem of numerical limits for toxic substances. They proposed that concentrations for copper, zinc, cyanide, nickel and many other toxic metals be limited to one-tenth the TLM (median tolerance limit--that concentration at which 50 percent of the test animals died) for all of these substances. This approach was considered inadequate because all waters have widely different natural characteristics, which is a definite factor in determining the 50 percent TLM level. For example, concentration limits for some toxic substances established for very soft water would be unreasonable and too restrictive for waters of high hardness. It is important to remember that the

many TLM limits carried by the literature were not determined under standardized procedures, thus represented an individualistic approach to a problem. Until better kill limits are established, individual toxicant limits should not be established. The Water Resources Commission staff chose a bioassay procedure for the establishment of limits for toxic and deleterious substances as follows:

*"Not to exceed 1/10 of the 96-hour median tolerance limit obtained from continuous flow bioassays where the dilution water and toxicant are continuously renewed except that other application in specific cases when justified on the basis of available evidence and approved by the appropriate agency."*³⁶

There was not an objection to the 1/10 application factor for converting the TLM to safe concentrations, but merely opposition to applying this factor to the minimum kill limits stated in the literature.

This standard has provided a definite standards procedure by which safe toxicant concentrations can be specified. Although this test appears adequate, there are certain unfavorable features, which should be mentioned. The continuous renewal of dilution water and toxicant has removed the test from the laboratory. Required amounts of the toxicant and dilution water for a 96-hour period would, as a matter of necessity, place the test at the site under investigation.

Total Dissolved Solids (TDS)

Total dissolved solids is the popular term for the total amount of dissolved material, organic and inorganic, contained in water.

³⁶Ibid., p. 4.

Substances identified by this parameter consist mainly of carbonates, bicarbonates, chlorides, sulfates, nitrates of calcium, phosphates, potassium and traces of iron and manganese. Frequently, the electrical conductivity of water is used as a convenient indicator of the TDS present in water.

Total dissolved solids have a direct effect on water supplies, varying with the type of minerals. At the higher levels of 1000 mg/l or more, the water is unpalatable and may not quench thirst. There is not any proof that water high in dissolved salts causes harmful physiological effects, however, laxative action to new users has been reported.

The Water Resources Commission used the U. S. Public Health Service Drinking Water Standards as a guide for maximum limits in establishing TDS limits for domestic supply. Values established for the supply category (domestic and industrial) were set at 200, 500 or 750 mg/l, with the most restrictive level applicable to the Great Lakes and connecting waters. TDS content of the Great Lakes, which is below a level of 200 mg/l, was a strong influence to the selection of this value. There was a desire by all concerned to keep the level of minerals in the lakes at its present low level.

Chlorides, which vary over a wide range in natural waters and is a significant portion of the TDS, was set at levels of 10, 50 and 125 mg/l. Levels established for chlorides, as with TDS, was influenced by the present levels observed in Michigan watercourses.

Information regarding the harmful effects of TDS to recreation and commercial use is not clearly established. Consequently, a statement limiting concentrations to levels that are or may become

injurious was selected. As for aquatic life, little information is known about the deleterious effects to this use. Again, a statement was used to cover the TDS parameter. This statement called for the establishment of concentrations when information became available on the deleterious effects.

There is documented evidence that excessive mineral content, especially sodium, calcium, magnesium and potassium, can cause injury to crops. The literature indicates that deleterious effects of salts to plant growth can result from: (a) direct physical effects of salts in preventing water uptake by plants (osmotic effects); (b) direct chemical effects upon metabolic reactions of plants (toxic effects); and (c) indirect effects through changes in soil structure, permeability, and aeration.³⁷ Because of this, limits for TDS and sodium according to the following formula were selected:

Less than 700 mg/l of dissolved minerals, maximum
percentage of sodium, 40% as determined by the
formula:

$$\frac{(\text{Na} \quad 100)}{(\text{Na} + \text{Ca} + \text{Mg} + \text{k})}$$

when the bases are expressed as milliequivalents per
liter.

Nutrients

Nutrient materials in water have become a major concern to regulatory agencies charged with the responsibility of water quality control. The presence of this material, especially the phosphorus

³⁷D. W. Thorne and H. B. Peterson, Irrigated Soils, Their Fertility and Management, P. Blakistan's Son and Co., 1949.

element, fosters an abundant production of aquatic plants and algae, causing accelerated aging of a body of water. These growths and subsequent die-offs nourish objectionable noxious odors, interfere with water treatment, are toxic to fish, and can impart undesirable tastes to water.

The only authoritative criteria available for application of these elements result from Sawyer's 1947 study of Wisconsin Lakes.³⁸ He determined that when concentrations of inorganic phosphorus (orthophosphate) and inorganic nitrogen equal or exceed 0.01 and 0.30 mg/l, respectively, at the start of the growing season, nuisance algae conditions can be expected.

In the early stages of drafting the criteria, Sawyer's concentrations were proposed for Michigan waters. During ice-out of 1967 and at the time of spring mixing, a sampling survey of sixty Michigan lakes was undertaken. One of the purposes of this work was to determine if application of Sawyer's nutrient concentration levels for nitrogen and phosphorus could be applied to Michigan waters. The results of this study³⁹ indicated that further work was necessary. In some lakes, a measureable amount of nitrogen and phosphorus was not detected, and prolific blooms occurred during the summer season. In other cases, nitrogen and phosphorus were observed at levels above Sawyer's recommended limits, but these waters did not experience blooms. As a result, it was decided that until we could be more certain through

³⁸C. N. Sawyer, "Fertilization of Lakes by Agricultural and Urban Drainage", Jour. New Eng. Water Works Assn., 61:109-127, 1947.

³⁹State of Michigan Water Resources Commission, "Study of Phosphorus in Michigan's Surface Waters", Unpublished, 1967.

investigation and research, the application of numerical limits for phosphorus and nitrogen were inappropriate for Michigan waters. It was for this reason that the following statement was selected:

*"Nutrients originating from industrial or municipal sources shall be limited to the extent necessary to prevent the stimulation of nuisance growths of algae, weeds, and slimes."*⁴⁰

Under the parameter heading of Nutrients, sugars were mentioned with the nitrogen and phosphorus elements as nutrient materials requiring control. At several locations around the state, noxious slime growths of sphaerotilus natans have been nourished by excessive sugar materials. Waste discharges from paper mills, beet sugar plants and fruit processors contain sufficient carbohydrates to create slime growths in water.

Taste and Odor Producing Substances

Taste and odors in water can originate from many sources, such as chemical substances, organic growths and certain inorganic materials. Once again it was necessary, for the most part, to consider a quality statement rather than quantitative limits for taste and odor. Because of the close interrelationship of taste and smell, it is logical that they be considered as a unit. Usually when an individual detects an unpleasant smell, the taste buds cannot distinguish between good and bad.

The establishment of specific numerical limits for taste and odor was never considered because of the complexity of the problem. First of all, the list of chemicals and their admixtures which cause taste and odors in water would be extremely extensive. Then, too, it would

⁴⁰State of Michigan Water Resources Commission, loc. cit., p. 4.

be necessary to identify all of the microscopic organisms, for example decaying vegetation and algae, that cause taste and odor. It was simply considered an impossible task, and therefore, never attempted. A second consideration would be the selection of a suitable threshold limit. An individual's threshold of taste and odor varies over a wide range and what might be disagreeable to one person could prove satisfactory to another.

There was, however, a specific limit established for the hydrocarbon compound phenol, which is prevalent in water because of its many origins. Detectability of this substance by the taste and smell senses becomes more sensitive in the presence of chlorine. This unique feature of phenol illustrates the difficulty encountered in specifying concentration limits. Nevertheless, a concentration limit of a monthly average of 0.002 mg/l and a maximum of 0.005 mg/l for a single sample was established for domestic water supply use.

The concentration limit expressed for phenols by the proposed standards is a two-fold increase over the limit recommended by the U. S. Public Health Service Drinking Water Standards. A few water supplies in Michigan have, on occasion, experienced phenol limits slightly above 0.002 mg/l without any complaint of peculiar tastes. Limits for phenols at the 0.002 mg/l level have been used in previous enforcement action. Inasmuch as experience indicated that a 0.002 mg/l was not objectionable, a standard was preferred at this previously recognized limit.

Temperature

Temperature has a marked effect on the sanitary and ecological characteristics of a stream. Oxygen, which is so important to a

balanced aquatic habitat, is present in concentrations inversely proportional to temperature. Temperature increases influence the growth of algae, slimes and aquatic vegetation that accelerate the rate of oxygen utilization. Abnormally high water temperatures are detrimental to fish and aquatic life. The efficiency of cooling processes decrease as temperature increases. These were some of the issues needing resolution in the selection of criteria for the temperature parameter.

Temperature was one of the most difficult parameters to resolve. There were numerous changes made to this parameter before any firm decision on values were ever solidified, particularly with regard to fish. The first recommendation for temperature control was to allow surface waters to increase ten degrees Fahrenheit above the maximum natural temperature for all use categories. This limitation was not modified for the "Supply" or "Commercial" use categories and was eventually adopted in this form for these purposes. As for agricultural uses, temperature control was not considered to be applicable to any of the uses under this category. In the final staff document, temperature criteria was presented as not applicable and remained listed in this form through the standards developing procedure.

An increase in the temperature in recreational water will obviously not be detrimental in all cases. A major consideration for most individuals who desire to bathe or frolic in water is the warmth of that water. Insofar as man's activities tend primarily to elevate the water temperature by the introduction of thermal heat loads, an upper limit needed to be established. Water with an artificially induced heat load, causing temperatures in excess of ninety degrees

Fahrenheit is generally considered as unacceptable to most people for swimming. It was for this reason that this maximum upper limit was carried,

Temperature standards for the protection of fish received extensive study and review. A review of the Water Resources Commission files indicated that slugs of hot water are rarely responsible for fish kills. Wastewater temperatures change gradually, usually with operational fluctuation. Although slug thermal loads to waters in Michigan to our knowledge have not caused fish kills, the effects to lower aquatic life have never been totally and satisfactorily assessed.

Fish have optimum temperatures for growth and production. Their bodies absorb the heat of the surrounding water and there is no way in which it can be lost. Water temperatures will vary over a wide range, even for a particular species, at which they function at peak efficiency, at which they function inefficiently, and at which they die. Because of the uncertainty of increased temperature effects to the stream metabolism, hatching of insects, spawning and other factors, a fairly restrictive limit of ten and fifteen degrees Fahrenheit increases were established for colder temperature salmonial and warm water species, respectively. At higher temperatures a maximum increase of ten degrees Fahrenheit was established for all species with a maximum upper limit specified according to three fish classifications.

Hydrogen Ion (pH)

The pH of water is a measure of the hydrogen ion concentration and may range from 0 to 14 units. This wide range indicates whether waters are acidic, neutral or basic. A pH of 7.0 is the neutral point. A value below 7.0 is an indication of acidity and higher values indicate alkalinity.

Hydrogen ion concentration is important in that it affects taste, corrosivity, and efficiency of chlorination and coagulation in water treatment systems. Extreme values of pH, especially toward acidity, are to be avoided due to the corrosive effect and possible lethal effect on fish and other aquatic life.

Most natural waters in Michigan have a pH range between 6.5 and 8.8, which is identical to proposed criteria for this parameter. A change in the pH over the full scale of the recommended range would require a large quantity of acid or alkaline material. To avoid the potential shock or possible stress to fish and other aquatic life, artificially induced limits of 0.5 units was recommended for all uses except for fish, where a 1.0 unit change was recommended. In some respects, the 1.0 unit tolerance for aquatic life is more restrictive than the 0.5 unit tolerance for the other uses because the change must be toward neutrality. For example, if the pH of a surface water source was 6.9, it could not be lowered to 6.5 as this would be toward further acidity, and not acceptable.

Radioactivity

Radioactivity in water is especially significant in relation to human health, first through the direct consumption of water, and second through the ingestion of agricultural products, stock and aquatic or marine life that have accumulated radioactivity. Insofar as radiation has an accumulative effect to humans, consumptive dosage rates must be established at very low levels.

Most state agencies charged with the responsibility of water quality control do not have trained personnel to provide guidance for nuclear radiation. Consequently, they turn to an authoritative source such as the Atomic Energy Commission for exposure limits of artificial

radiation that can cause damage. The use of radioactive materials by private concerns is strictly regulated by the Federal Government.

The radioactive standard was not difficult to establish, nor was there much comment regarding the adequacy of the standard provided. Actually the very strict controls maintained by the Federal Government and the lack of understanding by the general public of the great danger of radioactivity would account for the apathy toward radioactive materials.

The standard originally adopted to provide protection against radiation made application of effluent qualities prescribed by the U. S. Atomic Energy Commission. This method of control, although more than adequate, was a switch from the standard procedure of establishing limitations in the surface water. Prior to the adoption by the Water Resources Commission, this standard was changed, with emphasis placed on the surface source. The standard adopted for this parameter was the 1962 U. S. Public Health Service Drinking standard for Radium - 226, Strontium 90, and gross beta activity, based on the recommendation of the Federal Radiation Council. This standard reads as follows:

*"An upper limit of 1000 picocuries/liter of gross beta activity (in absence of alpha emitters and Strontium-90). If this limit is exceeded the specific radionuclides present must be identified by complete analysis in order to establish the fact that the concentration of nuclides will not produce exposures above the recommended limits established by the Federal Radiation Council."*⁴¹

⁴¹Michigan Water Resources Commission, loc. cit., p. 4.

CHAPTER V

THE PUBLIC HEARINGS

Introduction

The public hearings were an essential step in the process of developing and proposing a system of water quality standards. It provided every individual or group with an interest in water an opportunity to openly express his wishes. Actually, the state was not provided an alternative regarding public hearings, as the 1965 Water Act specified that standards could not be adopted without public hearings. However, the decisions regarding the number of meetings and the administrative procedure remained with the states. Normally, hearings such as required for the setting of standards are in accordance with procedures established by state laws.

Prior to the first public hearing, it was difficult to judge the extent of public interest and expected participation. This matter was disturbing, especially when attempting to arrange accommodations for such hearings. In this respect, difficulty was not encountered because accommodations proved to be ample and at sites easily accessible to the public. The series of four public hearings scheduled around the state utilized the following types of accommodations; the Muskegon County Court House, a conference room at the Holiday Inn in Saginaw, a conference room at the Pick-Fort Shelby Hotel in Detroit, and the Northern University Auditorium at Marquette. The hearing dates, locations, and waters discussed are shown in Table 4. The procedure for the first hearing was typical of what occurred at the subsequent meetings.

At each hearing, the staff presented a document entitled "Proposed Water Quality Criteria for Michigan Waters" and a report on the water resource uses present and prospective for the specific interstate waters involved. Copies of this report for the first hearing, unfortunately, were not available for distribution prior to the time of the meeting. Thus, the public was not provided with an opportunity to study commission proposals and offer comments or statements on the document being presented. Documents prepared for the subsequent hearings were available for distribution several days prior to the hearing and were sent on request to interested parties. Informing the public of hearings was achieved by letters sent to all units of local government, industry, sportsmen's clubs and civic groups. A notice was published in several key newspapers throughout the state (see Appendix C).

Participants in the Hearings

The purpose of the hearings, obviously, was to elicit the citizens views on the proposed standards. If some portion of the plan of implementation or standard was contrary to public wish, then a re-evaluation based on such testimony would be necessary. It was hoped that after all testimony was provided, a firm decision could be obtained for the questionable parameters. What can be done, however, in situations where some say the criteria are "too high" and an equal number say the criteria are "too low"? After all is said and done, a decision must still be made. To be sure, public hearings reveal where additional attention is essential and necessary, though hearings often contribute to the further confusion of the issues.

Table 4

SUMMARY OF PUBLIC HEARINGS

Total Number of Hearings: 4

Hearing #1

Location: Muskegon County Court House
Muskegon, Michigan

Date: February 23, 1967

Waters affected: Lake Michigan
St. Joseph River Basin

Hearing #2

Location: Ramada Inn
Saginaw, Michigan

Date: March 28, 1967

Waters affected: Lake Huron

Hearing #3

Location: Pick-Fort Shelby Hotel
Detroit, Michigan

Date: April 27, 1967

Waters affected: St. Clair River, Lake St. Clair
Maumee River Basin
Detroit River, Lake Erie

Hearing #4

Location: Northern Michigan University
Marquette, Michigan

Date: May 25, 1967

Waters affected: Menominee and Montreal Rivers
Lake Superior, St. Marys River

In Michigan, the total attendance at all the public hearings was 391. This represents less than five thousands (.005) of one percentage of the population of the state. Although this may appear to be a small number, it must be remembered that many individuals acted as representatives of very large groups. By way of example, each meeting was attended by a representative of the Michigan United Conservation Clubs. A representative of this organization would be speaking for several thousand individuals. The same would be true of such groups as the Chamber of Commerce, League of Women Voters and the Lake Erie Clean-Up Committee. With this thought in mind, it would not be possible to determine who was most interested in water solely by the number of individuals who attended. Obviously, attendance numbers will not be a reflection of the support of any particular interest group, meaning that business and industry is not more interested in water because they had 159 representatives in attendance as opposed to educators with their attendance totaling only 12.

Table 5 shows the attendance for all the public hearings for nine different groups. Of these interest groups, as stated earlier, business and industry had the highest attendance, with 195 representatives, or nearly twice the number of the next group, local government. State government, sportsmen's groups and civic organizations followed next with each having approximately 30 people in attendance. These groups were followed by Federal Government, general public, educational groups, with a total attendance of 23, 14, and 12, respectively.

A refinement of the business and industry groups to more specific industries revealed some interesting analogies (see Table 6). First of all, Southeastern Michigan, the most industrialized section of the state, had the greatest representation with the chemical, metal product

Table 5

SUMMARY OF ATTENDANCE AT HEARINGS

	Hearing Locations				Total
	1 Muskegon	2 Saginaw	3 Detroit	4 Marquette	
Federal Government	6	4	10	3	23
State Government	6	8	9	9	32
Local Government	28	11	37	7	83
Business and Industry	34	25	63	37	159
Sportsmens Groups	4	17	9	1	31
Civic Groups	5	8	16	0	29
Educational Groups	0	2	4	6	12
General Public	4	4	3	3	14
Total attendance at hearing	88	85	152	66	391
Percent attendance by meeting	22.5	21.7	38.9	16.9	100.0

Table 6

SUMMARY OF
BUSINESS & INDUSTRIAL REPRESENTATIVES AT HEARINGS

	Muskegon	Saginaw	Detroit	Marquette	Total by Industry
Chemical	7	9	18	2	36
Mining	0	1	0	15	16
Power generation	5	7	9	7	28
Metal Products manufacturing	8	1	17	6	32
Paper	7	1	3	7	18
Petroleum	1	0	7	0	8
Consulting & equipment service	3	1	8	0	12
Commercial fishing	0	2	1	0	3
Food processing	3	3	0	0	6
	34	25	63	37	159

manufacturing, power generation, petroleum, consulting and equipment services industries well represented. Secondly, the Upper Peninsula, which is the least populated section of the state, would have shown the lowest attendance of industrial representatives, if the mining interest had not appeared in such great numbers. Insofar as mining is so vital to this section of the state and has been the subject of controversial legislation involving iron ore beneficiation, we could expect this industrial group to be present in force. Finally, it can be concluded from Table 6 that the geographic location of a dominate industrial activity can be identified from the attendance at the hearings. Mining is a good example of the point in mind.

The presence of educational leaders, and especially the general public, was very low and perhaps understandably so. Without reservation, greater participation by these two groups could have conceivably played a much more important role in establishing standards. University personnel in the fields of chemistry, biology, agriculture and engineering could have offered the type of documentary testimony that would have been helpful in establishing standards. Aside from being experts, members of this group are held in high esteem by all others. The public, industrial representatives and regulatory agencies regard the testimony of this group as unbiased and impartial. The motive of profit or self-interest is seldom attached to this group's position on a controversial matter. How then, do you explain their absence? It could be that they had trust and confidence in the regulatory agency charged with this responsibility.

There are several speculations regarding the minor and insignificant role of the general public in establishing water standards. First of all, they have difficulty in understanding the scientific language relating

to water. Their understanding and consequent expressions of quality are limited to the senses of sight and smell. For example, they can often be heard describing rivers in their locality as a stinking mess, or the river is full of trash and junk, and so on. Because of this difficulty in communication, they apparently rely on governmental agencies to represent their interests. Another reason for the lack of attendance by the public may have been because of the time of the meetings. Each meeting was convened at 10 a.m. and was usually in progress from four to five hours, depending on the number of statements received. A representative of MUCC made this comment at the Detroit hearing,

*"If these meetings were held, just as for instance, at 7:00 or 7:30 in the evening, the paid representatives of industries, of the associations and so on and so forth, would be here because that is their job. . . You are basically a service organization (referring to the Water Resources Commission), you service the public. Try to serve all of the public. Try to hold these meetings at any time that is convenient for the public to be here . . . that is if you want a true dialogue of the people."*⁴²

Although evening meetings would have been more convenient to the day working public, there were reasons why this was not practical. First, the length of the meetings would have required at least two full evenings. Secondly, the Commission members, who give freely of their time, indicated a preference for day meetings. Finally, there are numerous meetings at all levels of government, purposely held in the evening, so that the public can attend. Yet, the number of participants at such meetings are usually disappointingly low.

⁴²State of Michigan Water Resources Commission, "Transcript of Public Hearing for Michigan Waters of Interstate St. Clair River, Lake St. Clair, Detroit River, Lake Erie and Maumee River Basin." Detroit, Michigan. April 27, 1967. p. 60.

Review of the Statements

In all, there were 44 statements presented at the public hearings. Of this total, 17 were given by representatives of business and industry who, in almost every instance, argued that the standards were too restrictive. However, the remaining statements, for the most part, complained that the standards were inadequate and that more restrictive control was required.

Many of the statements were simply to the effect that the criteria were "too low" or called for "better quality" without stating which parameters were involved or suggesting what changes should be made. Statements of this type are not very effective in persuading change, unless they are received in overwhelming number.

From the records of the public hearings, it can be concluded that criticism of the proposed standards ranged from "unduly permissive" to "far too restrictive". The opponents were aligned primarily into two camps. The sportsmen's groups contended that many of the standards were too low and industry expressed its views to the contrary. Arguments provided by each camp were very persuasive, containing numerous quotations from authoritative literary sources.

Most of the statements presented at the hearings focused on the standards for dissolved oxygen, temperature, and total dissolved solids. Two of these . . . namely oxygen and temperature, have an inter-relationship that can be stated in ideal values for the environment of fish and optimum conditions for propagation. When definite number values are proposed, as they were for the three parameters in question, then they immediately become the subject of controversy. Although subject to criticism and compromise, numerical values, when feasible,

are superior to quality statements, because they are more adoptable to enforcement. We can measure, let's say, three milligrams per liter of dissolved oxygen, but how does one interpret a quality control calling for a sufficient quantity (referring to dissolved oxygen) to prevent nuisance?

It must be acknowledged that special interest groups, regardless of their motives, are very influential in the decision of water standards. The standards for dissolved oxygen and temperature (Table 7) are illustrative of the type of changes that persuasion can bring about. In this case, the original proposals for dissolved oxygen for intolerant fish warm water species called for a daily average of not less than 6.0 milligrams per liter, nor any single value of less than 4.5 milligrams per liter. These values were modified to a lower level of 5.0 and 4.0 milligrams per liter, respectively, at the conclusion of the hearing, and adopted in this form. The same was true of temperature values originally proposed for the warm water species of fish, where the maximum limits were increased two degrees Fahrenheit from the original proposal. We can ask, "Did these changes provide a better environment in which fish could live and propagate?" The answer would be negative. If the changes were not for beneficial interest to fish, then they obviously were made to accommodate some other use.

Phenol, under the parameter for taste and odors, was the only other parameter carrying numerical values that were modified at the conclusion of the hearings. Again, the change was one of permissiveness.

The standards adopted by the Water Resources Commission, although still awaiting approval of the U. S. Department of Interior, are now history. Whether they represent good or bad standards can never be

Table 7

PROPOSED VERSUS ADOPTED

TEMPERATURE AND DISSOLVED OXYGEN CRITERIA

	<u>Dissolved Oxygen</u>		<u>Temperature</u>	
	Original proposal	Adopted standard	Original proposal (degree Fahrenheit)	Adopted Standard (degree Fahrenheit)
Intolerant fish - cold water species (such as trout & salmonids)	6 mg/l	6 mg/l	max. 70	max. 70
Intolerant fish - warm water species (such as bass, perch & herring)	daily avg. 6.0 mg/l min. 4.5 mg/l	daily avg. 5.0 mg/l min. 4.0 mg/l	max. 83	max. 85
Tolerant fish - warm water species (such as carp, gar & catfish)	daily avg. 4.0 mg/l min. 3.0 mg/l	daily avg. 4.0 mg/l min. 3.0 mg/l	max. 85	max. 87

resolved, depending on which groups are debating the issue. The important thing to be remembered is that the standards represent a beginning from which we can improve. L. F. Oeming, Executive Secretary of the Water Resources Commission, in a presentation to the Michigan Water Pollution Control Association, very ably expressed the attitude of the state. He said,

*"We do not know all the answers, no one does today. We anticipate that future elevation of some standards will be necessary and plan on taking such action concurrently with the advancement of scientific knowledge on the effects of pollutants and technical know how on treatment processes that will remove more of the offending substances than existing capabilities permit. Standards as they now stand, provide for a substantial upgrading of the quality and when attained will greatly enhance the value of the state's waters."*⁴¹

⁴¹L. F. Oeming, Water Quality Standards in Michigan, prepared presentation for Water Pollution Control Assoc., Boyne Falls, Mich., June 19, 1967, p. 11.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The summary and conclusions of this report will be divided into four categories according to the following: legislation for pollution control, water uses, parameters and public hearings.

Summary and conclusion relative to legislation for water pollution control are as follows:

1. The Federal government has for years attempted to control pollution of the nation's waterways. Most recent in a series of programs to achieve this purpose was its requirement of water quality standards by each state.
2. Early efforts by the Federal Government to control pollution consisted of programs including the basic elements of Federal assistance, technological research and planning. These programs failed to achieve pollution control because they lacked rigid enforcement provisions.
3. The 1965 Water Quality Act with the requirement for water quality standards is a clear trend away from the old policy of controlled degradation. Water pollution is no longer an accepted way of life in our society. Under the provisions of this act, authority is provided to regulate water quality instead of instituting enforcement action to abate pollution after the health and welfare have been endangered.

4. The provision of the 1965 Water Quality Act demanding the best treatment possible without regard to economics and justifiable need may not be enforceable by law. If an injury cannot be proven for a lower level of treatment, it is unlikely that authority could be obtained through the courts to enforce this demand.
5. Water quality standards have provided assurance of a uniform application of the law. Both the indiscriminate and the conscientious water user now know in advance what is expected of them, since standards provide a sharp reference point for the determination of unlawful acts.
6. In complex situations, where several waste disposers are making use of the same watercourse, stream standards will need to be augmented by effluent standards to assure quality control. The effluent standards will allocate the waste constituent among the several users, and violation will then be based on exceedance of a quota.
7. The State of Michigan in proposing and developing a system of standards for interstate waters met all of the exacting requirements of the Federal Government except one. The issue remaining unresolved pertains to the policy of providing treatment regardless of the demonstrable need to do so.
8. Water quality standards represent a significant step toward a national policy to abate pollution. Although legislation by itself is not an assurance of pollution abatement, the element of rigid enforcement, which before was lacking, should make the big difference.

Summary and conclusions relative to the designated water uses for which protection must be provided in the standards program are as follows:

1. The use categories established for Michigan's interstate standards program were those specified in the Michigan Water Pollution Law. As noted by the law, any substance which is or may become injurious to fish and game, domestic, commercial industrial, recreational or other uses is prohibited.
2. Standards of quality were specified for all water uses serving an economic good and having beneficial use to mankind. Effluent disposal was considered a legitimate use insofar as it did not preclude the use of surface waters for other beneficial purposes.
3. In accordance with the requirements of the Federal Government, surface waters in Michigan were designated for multiple uses. No water was designated for the sole purpose of waste transportation.
4. In Michigan, major disputes arise from the attempt to simultaneously use the water for disposal and other activities. The general trend of the discharger is to impose a burden of the magnitude that gradually eliminates all other uses. Standards now require that this trend be reversed and water now degraded must be enhanced.
5. Original proposals for uses carried a designation calling for the protection of water for public health. Actually, this category was aimed at the protection of the utility of riparian lands for the control of nuisance. It was wisely

discarded as levels of quality prescribed for this use were extremely low.

6. The State of Michigan was arbitrary in the application of standards to protect water uses. In some instances, where extremely good water quality now exists, restrictive standards were supplied for the protection of the source rather than the use.

7. Although many states had the authority by state law to establish water quality standards, only a few proceeded to do so.

Opponents to the standards procedure to maintain pollution control argue that such programs are difficult to formulate and more difficult to administer.

Summary and conclusions relative to the parameters selected for quality standards are as follows:

1. The choice of parameters needed for quality control is complicated by the imposing number of substances which are naturally present in water. Because of the synergistic effect of naturally present substances, it is difficult to establish definite limits for certain pollutants.
2. The establishment of specific limits for a parameter is beset by certain other factors. Source material on most toxicants is abundant, but seldom is there good agreement in stated values for the protection of a particular use. This wide variation in data appears to be the result of individualistic approaches to a problem, rather than an actual variation in the deleterious effects of a substance.
3. The broad base parameters chosen by the State of Michigan for the protection of water uses are closely related to the earlier

work of the Pacific Northwest Council. In Michigan eleven parameters were chosen to provide protection for the uses. The parameters elected are inclusive of all substances which are or may become injurious to the specified uses.

4. Verbal descriptions employing phrases such as "*substantially free of*", "*no appreciable change*", or "*no objectionable substance*", are beset with problems of enforcement. The interpretation of such phraseology may someday need to be legally resolved in the courts. Measurable numerical values are superior to quality statements because they are more adaptable to enforcement.
5. Dissolved oxygen, total dissolved solids, and temperature were the most difficult parameters to establish. Each of these parameters have in common definite numerical limits for control. Because of the variation by the literature in recommended limitation of these parameters, numerical limits became issues of debate.
6. Parameters selected by the State of Michigan for measuring the suitability of water observed the following rules: (a) measure a significant quality characteristic, (b) must be capable of measurement by standard techniques, (c) must be capable of reasonably rapid determination, (d) toxic values must be valid for numerical limits, and (e) specified numerical limits must contain a safety factor.

Summary and conclusions relative to the hearings on quality standards are as follows:

1. Public hearings are an essential and necessary part of developing and proposing a system of water quality standards. By this method, all interests have an opportunity to elaborate on the quality of water essential to serve their needs.
2. The total attendance at public hearings, exclusive of Water Resources Commission personnel, was 391. This number was inclusive of many and diverse interests.
3. The general public played a minor and almost insignificant role in establishing water standards. The absence of the general public from the public hearing could be interpreted as apathy. A better explanation, however, would be their inability to communicate and understand scientific language associated with water.
4. Business and industrial representatives were the dominate forces appearing at the public hearings. One by one, they asserted that the proposed standards were too restrictive, representing economic hardship to their endeavors.
5. Sportsmen's groups and civic organizations contended that the proposed standards were unduly permissive. Such interest groups seldom have an opportunity, as provided by the hearings, to elaborate on their desires for water purity. These groups took full advantage of the public hearings and stressed the need for clean water to serve recreational interests.

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APPENDIX A
STATE OF MICHIGAN'S DECLARATION OF
INTENT TO ADOPT STANDARDS



STATE OF MICHIGAN

OFFICE OF THE GOVERNOR

LANSING

GEORGE ROMNEY
GOVERNOR

December 17, 1965

The Honorable John W. Gardner, Secretary
Department of Health, Education, and Welfare
Washington 25, D.C.

Dear Mr. Gardner:

Responsive to the provisions of Public Law 89-234 for the establishment of water quality standards on interstate waters, and consistent with recommendations made to me by the Michigan Water Resources Commission, I hereby declare the intent of the State of Michigan to adopt, before June 30, 1967, and after public hearings, water quality criteria applicable to interstate waters or portions thereof within the State of Michigan and a plan for the implementation and enforcement of the water quality criteria adopted.

It is noted in the report of the House of Representatives Public Works Committee, entitled Water Quality Act of 1965 (Report No. 215) that,

"Under the definition of 'interstate waters' in the act those waters that arise entirely within a State and do not flow from that State into another State, and do not form a part of the State boundaries, are not considered to be interstate waters and therefore would not be subject to any requirements with respect to water quality criteria."

The intended adoption of criteria will be effectuated through proceedings by the Water Resources Commission under authority of State law (Act 245, P.A. 1929, as amended) to, "establish such pollution standards for lakes, rivers, streams and other waters of the state in relation to the public use to which they are or may be put, as it /the Commission/ shall deem necessary." Such intention has been affirmed by resolution, duly adopted by the Water Resources Commission on December 15, 1965, a copy of which is enclosed.

Sincerely,

George Romney

RESOLUTION

WHEREAS, Public Law 89-234 provides for the establishment by a State of water quality criteria applicable to interstate waters or portions thereof within such State, which criteria together with a plan for their implementation and enforcement shall, if established in accordance with a letter of intent and if found by the Secretary of Health, Education, and Welfare to be consistent with specified requirements, thereafter be the water quality standards applicable to such waters, and

WHEREAS, it is the belief of this Commission that such establishment of criteria and plan is necessary and in the interests of the people of the State of Michigan, and

WHEREAS, statutory authority for the establishment of such standards by the Water Resources Commission is set forth in State statute,

NOW THEREFORE BE IT RESOLVED, that the Commission hereby records its intention to adopt, before June 30, 1967, and after public hearing, water quality criteria applicable to interstate waters or portions thereof, together with a plan for the implementation and enforcement of the criteria adopted, and

BE IT FURTHER RESOLVED, that the Commission respectfully recommends to the Governor of Michigan, George Romney, that he direct to the Secretary of Health, Education, and Welfare, a letter attesting to the intent of the State of Michigan to adopt water quality criteria applicable to interstate waters or portions thereof within the State of Michigan, in accordance with the provisions of Public Law 89-234.

Unanimously adopted upon motion by Mr. Vogt and supported by Mr. Quackenbush, at the December 15, 1965 meeting of the Michigan Water Resources Commission.

PRESENT AND VOTING

Gerald E. Eddy, for Director of Conservation, Chairman
Lynn F. Baldwin, for Conservation Groups, Vice Chairman
Stanley Quackenbush, for Director of Agriculture
James V. Murray, for State Highway Commission
John E. Vogt, for State Health Commissioner
George F. Liddle, for Municipal Groups
Jim Gilmore, for Industrial Management Groups

APPENDIX B

SECRETARY OF THE INTERIOR'S LETTER INDICATING UNRESOLVED
ISSUES AND A REPLY FROM THE STATE OF MICHIGAN



UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

AUG - 7 1967

Dear Governor Romney:

I am writing to inform you that our review of the water quality criteria and plan of implementation for the interstate waters of Michigan has been completed. We have found that the criteria and plan reflect an impressive effort. In general, these set forth a realistic and workable program for protecting and enhancing the quality and productivity of Michigan's interstate waters in accordance with the intent of the Federal Water Pollution Control Act, as amended.

I would like to give approval to your State's criteria and plan as Federal standards at an early date. However, before this can be done, there are a few significant issues which must be resolved. With the hope of securing agreement on approvable standards, I am asking the Federal Water Pollution Control Administration Regional Director in Chicago, Illinois, to contact your water pollution control staff. Among the items requiring discussion are the following:

1. The degree of waste treatment to be required from both old and new municipalities and industries.
2. A definite commitment in the standards for the reduction of nutrients in waste discharges.
3. Schedules for initiation and completion of necessary treatment measures.

Once again, I wish to congratulate you on a job well done. I sincerely hope that discussion between our staffs will result in standards that I can approve. It is important that an agreement be reached as soon as possible so that the joint State-Federal water pollution control effort can move forward.

Sincerely yours,

Secretary of the Interior

Honorable George Romney
Governor of Michigan
Lansing, Michigan 48913

STATE OF MICHIGAN



GEORGE ROMNEY, Governor

DEPARTMENT OF CONSERVATION

RALPH A. MAC MULLAN, Director

CONSERVATION COMMISSION
 ROBERT C. McLAUGHLIN
 Chairman
 CARL T. JOHNSON
 E. M. LAITALA
 AUGUST SCHOLLE
 HARRY H. WHITELEY

WATER RESOURCES
COMMISSION

JIM GILMORE
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 Vice Chairman
 B. DALE BALL
 GERALD E. EDDY
 ALBERT E. HEUSTIS, M.D.
 JAMES V. MURRAY
 LYNN F. BALDWIN

200 MILL ST., LANSING 48913
 Tel. 373-3560

August 22, 1967

Mr. H. W. Poston, Reg. Director
 U.S. Dept. of the Interior - FWPCA
 33 East Congress Parkway, Room 410
 Chicago, Illinois - 60605

Dear Mr. Poston:

Reference is made to Secretary Udall's letter to Governor Romney dated August 7, 1967, on the subject of Michigan's Water Quality Standards. Pursuant thereto, representatives of your office and the Water Resources Commission met on August 22 to discuss the three issues enumerated in Secretary Udall's letter. As a result of this meeting it is my understanding we have mutually resolved all issues raised in the Secretary's letter. The issues have been resolved in the following manner.

1. The degree of waste treatment to be required from both old and new municipalities and industries.
 - a. Secondary treatment will be required as a minimum at all municipal wastewater treatment plants to meet the adopted water quality standards unless it can be demonstrated that a lesser degree of treatment or control will provide for water quality enhancement commensurate with proposed present and future water uses. Year around disinfection of all final effluents from sewage treatment plants is required.
 - b. Water treatment plant filter backwash discharges will be controlled under either Section 7 or Section 8b of Act 245, P.A. 1929, as amended. A typical time schedule for correction of an existing problem under Section 7, would call for construction plans within 8 months from the date of the adoption of the Final Order; contract awards and construction start within 14 months; and construction completion and abatement within 24 months. Solids removal will be required as a minimum unless it can be demonstrated that a lesser degree of treatment or control will provide for water quality enhancement commensurate with proposed present and future water uses.



2. A definite commitment in the standards for the reduction of nutrients in waste discharges.
 - a. Delete the phrase "except as to nutrients" found in paragraph 5, page 85, of the St. Joseph River Basin Report and like phrase in the appropriate section of the remaining reports. In addition, delete the following wording in paragraph 3, page 86, "to the extent necessary to meet the water quality objectives for the receiving waters . . . to the extent necessary to provide for water quality enhancement of the public waters." Deletions of this wording should be made in all other reports.
 - b. The following to be added as the final paragraph to the section headed "Summary of Program to Control and Abate Pollution" to all reports: "The criteria and plan of implementation are consistent with the recommendations of all Federal enforcement conferences to which the State has been a party."
3. Schedules for initiation and completion of necessary treatment measures.
 - a. Schedules as established at the present time are included in the sections on solving existing problems in all reports. Additional time schedules, when established, will be forwarded routinely to you.
 - b. A legal opinion has been requested from the State Attorney General to determine the extent of the State's authority to control waste discharges caused by mining operations. A copy of the June 14, 1967, letter requesting the opinion is attached.

If the Attorney General's opinion indicates that the State does not have sufficient authority to control waste discharges caused by mining operations, the Water Resources Commission will make appropriate recommendations to the Legislature.

Other issues of lesser importance were also discussed at our meeting and were resolved to our mutual satisfaction.

As evidenced by the attached certified copy of an excerpt from the Minutes of the June 28-29, 1967 meeting of the Michigan Water Resources Commission, the Commission has adopted the Water Quality Standards and Plan of Implementation.

Mr. H. W. Poston

Page 3.

Because I believe this satisfies all matters brought to my attention in the Secretary's letter, I am looking forward to early approval of Michigan's Standards.

Very truly yours,

WATER RESOURCES COMMISSION

Loring F. Oeming
Executive Secretary

LFC:S

cc--Governor George Romney

P.S. Further referring to Item 1, industrial waste effluents will be required to meet the same effluent standards as municipal waste effluents.

APPENDIX C
TYPICAL NOTICE OF PUBLIC HEARING

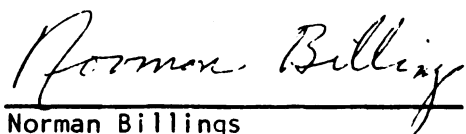
NOTICE OF PUBLIC HEARING

Notice is hereby given that a public hearing will be held by the Michigan Water Resources Commission at 10 a.m., on February 23, 1967, at the Muskegon County Courthouse, Board of Supervisors' Room, Apple Avenue (M-46) Muskegon, Michigan, for the purpose of giving interested persons an opportunity to present evidence and views upon water quality criteria necessary for the protection of designated water uses which the Commission is proposing to establish for the St. Joseph River and its interstate tributaries under authority of Act 245, Public Acts of 1929 as amended.

A copy of the proposed criteria is enclosed. Information on water uses and on proposed designation of stream and lake sectors to which the various use criteria are to apply will be presented and available at the public hearing. It is expected that most waters will be designated as requiring, at the minimum, protection of use for warm water game fish, for agricultural purposes and for partial body contact.

Also to be considered at the hearing will be a proposed plan for implementation and enforcement of the criteria as applied to the various use sectors.

Interested persons are encouraged to file their views and evidence on the proposed criteria with the Commission in advance of the hearing. Opportunity will be provided at the hearing for further expression of views and evidence on the criteria, the designation of use sectors and the proposed plan for implementation and enforcement.



Norman Billings
Assistant Executive Secretary
Michigan Water Resources Commission
February 9, 1967

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