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Michigan Water Use and Development Problems A. Allan Schmid

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MICHIGAN WATER USE AND DEVELOPMENT PROBLEMS

By A. ALLAN SCHMID

INTRODUCTION

M^{ICHIGAN IS A WATER WONDERLAND} with more than 36,000 miles of rivers and streams, 11,000 inland lakes, and 3,000 miles of Great Lakes shore line. How then can Michigan have water use problems? The problem is not one of absolute shortage but rather of not enough water at the right place, in the right quantity, at the right time, and at a reasonable cost.

Water is an important ingredient in the Michigan economy. The growth of population, a rising standard of living, and new water using technologies have placed increasing demands on water supplies. The growth in withdrawals of water in Michigan is shown in Table 1. This increased demand for agricultural, industrial, municipal, and recreational use has created conflicts which will require Michigan citizens to make new policy decisions on how they want to use their water resources and how people with different interests can live together.

Michigan water use problems involve conflicts between irrigation and other uses such as recreation. It involves waste disposal conflicts, problems in establishing lake levels, and urban and industrial conflicts. This bulletin is a discussion of some of the actual problems faced by Michigan people and what is being done to solve them both by informal agreements and by formal law. It includes consideration of the effects of water laws and whether they cover current problems. Out of this experience questions can be asked to guide the formulation of new water use policies.

The information in this bulletin was obtained by field interviews of various water users in counties in the lower half of the lower peninsula of Michigan in 1959 and 1960. Examples for the rest of the state were drawn from secondary sources.

3

	1950	1955
	(million gallons a day)	
Public Supplies	160	1 190
Surface Water	590	640
TOTAL	750	820
Rural		
Ground Water	140	73
Surface Water	10	8
TOTAL	150	81
Irrigation		
Ground Water	5.3	5.3
Surface Water	17.8	43.0
TOTAL	23.1	48.3
Self-supplied Industrial		
Ground Water	300	315
Surface Water	4,700	5,700
TOTAL	5,000	6,015
Total Excluding Water Power	5,923	6,964
Water Power	54,180	60,000
Recreation, Navigation, and Waste Assimilation	(a)	(a)

TABLE 1-Estimated withdrawal use of water, Michigan, 1950 and 1955

Source: Estimated Use of Water in the United States, 1955, U.S. Geological Survey Circular 398, and for 1950, Circular 115.

(a) These important uses of Michigan water are not withdrawals but are a part of the total water use situation.

WATER USE CONFLICTS WITHIN AGRICULTURE

Irrigation has been increasing in Michigan. As of April, 1958, there were 2,476 systems irrigating 68,481 acres (5). One-fifth of this acreage was for nonfarm purposes such as for cemeteries, parks, and golf courses.¹ We get 55 percent of the water for irrigation from surface waters, 29 percent from ground water, and 9 percent from city water with combined sources making up the rest.

Irrigation is practiced over most of the state with Berrien, Van Buren, Ottawa, and Kent being the leading counties. Irrigation is largely limited to high value per acre crops such as strawberries, tree

¹ This does not include domestic lawn and garden irrigation which uses a significant amount of water.

fruits, potatoes, and truck crops. Irrigation in Michigan is used to supplement normal rainfall and contributes not only to increased production but also to a higher quality product which is vital in a competitive agriculture.

Let's take a closer look now at the sources of water for irrigation starting first with the kind of problems that can arise with the use of streams. One irrigator's use may interfere with another irrigator using the same stream if it is of insufficient size for both to pump at once. Such a conflict is not covered by any statutory law and can be settled only by private court action under the common law. However, this has been solved informally several ways.

One method used by two farmers in Montcalm County is to irrigate alternate years each one having another source of supply. Two other farmers in Montcalm irrigate from the same stream at different seasons of the year, one using it for frost control in the spring and the other for potatoes later on.

Two farmers in Ottawa County use the stream on different days. Another alternative is to develop a storage system so that all are not withdrawing directly from the stream at the same time. On Hog Creek in Van Buren County three farmers dug pits beside the stream to solve their local problem of possible interference. Two of these pits are beside the stream and connected to it by tiles while the third is directly in the stream bed.

Farmers are doing many things to conserve and store water. For example, in 1958 under the Agricultural Conservation Program 296 irrigation water reservoirs were built in Michigan.

Under this program the federal government shares in the construction costs and the Soil Conservation Service provides technical and engineering service. Cost sharing practices vary between counties with some paying only for surface runoff ponds while others pay also for ponds constructed directly in flowing streams or drains and for ponds depending on ground water for recharge.

Attempts to provide more usable water by construction of dams and storage reservoirs are not without problems. A farmer in Mason County is concerned about the construction of a dam on a small stream above his property to be used for irrigation of fruit. He uses the stream to water his livestock, but since the dam was built no water flows past his farm. He hopes that he can reach a workable agreement with his neighbor. This particular case illustrates one of the problems involved when no statutory law is available to cover the conflicts that arise. The farmer or another riparian landowner cannot refer to a written law to determine his rights but must hire a lawyer to advise him on the basis of past court decisions if they exist and to take the case to court if informal agreement cannot be reached. This can be costly and may prevent the average farmer from seeking relief.

Chapter 46.22 of the Michigan Statutes does require a permit from the county board of supervisors for construction of dams in navigable streams. However, there are no standards specified for granting the permit and the law was passed in 1851 primarily to protect use of streams for navigation. It provides no guide for solution of the present conflicts of interest over consumptive use when withdrawals do not find their way back to the stream.

The law is seldom used today and a case in Kent County of a dam built for irrigation and recreation purposes illustrates what sometimes happens in practice. The project involved a 24-foot high earth-fill dam on a small stream with an estimated average summer flow of about .75 cubic feet per second. The owner was concerned that the dam might be objectionable if the stream were a trout stream. The owner checked with the Michigan Department of Conservation which did not object in this particular case. No statutory law exists which would allow the Department to take official action on such cases with the exception that they can require provision for the free passage of fish over or through the dam.

The only question of effect on downstream owners in this case was the hazard of the dam going out. This particular dam was designed by the Soil Conservation Service and adequate emergency spillway and other safety factors were provided. However, in cases where competent engineering service is not used such water development can be a hazard to downstream owners.

Irrigation From Drains

Drainage ditches provide a source of irrigation water in many parts of the state. Irrigators often construct dams in these drains to raise the water level at the point of intake. These dams can conflict with upstream drainage of farm land and also with downstream use for stock water and other uses.

On the Remy Chandler drain in Ingham County, a concrete dam was built to irrigate pasture. Lower property owners complained because it affected the flow that they were using for stock water while upper owners complained that the higher water level impeded flow from their tile outlets. After the property owners had complained to the drain commissioner a petition was filed and permission for the dam was granted. A maximum height for the dam was set and by mutual agreement the problem was solved for the moment by less frequent irrigation and allowing more water to pass through the dam.

A section of the Michigan drain code originally passed in 1909 applies to dams in drains.² Legally established county drains cannot be obstructed without approval of the drain commissioner. Upon the written petition of 50 percent of the landowners on the drain above the proposed dam, the drain commissioner may make an order of determination and designate the dimensions of the dam. This procedure protects the upstream drainage interests but does not provide a guide to a conflict between consumptive users.

If more than 50 percent of the upper owners refuse to sign the petition, they can prevent obstruction of the drain. However, the lower owners who may be interested in watering their stock from the ditch have no legal standing under the drain code. The drain commissioner may refuse permission for the dam but any recognition of the interests of the lower owners is by informal agreement and not by legal requirements in the drain code.

A farmer in Ottawa County reported that he took turns irrigating from a drainage ditch with another irrigator. This was an informal arrangement and there is no statutory guide if irrigators could not reach agreement on how the water should be shared.

A number of cases were found in southwestern Michigan where irrigators placed temporary dams made of sandbags or boards in a drainage ditch without official action on the part of the drain commissioner. These dams may go unnoticed unless someone is harmed and makes a complaint.

While discussing drains as a source of irrigation water the problem of conflict affecting the development of more usable water supply should be considered as well as the problem of the division of the available supply.

There is a vegetable growing area next to Saginaw Bay in Bay County that is drained by ditches discharging to the bay. These ditches are a source of irrigation water for some of the growers.

² Compiled Laws 1948, § 274.1.

Those on the lower end of the ditches closest to the bay always have water available as it is backed up in the ditches according to the bay level. Those farther up the ditches only have water during certain times of the year.

Some people in the area have suggested that the ditches be dammed where they empty into the bay with pumps to pump bay water into the ditches so that water would be available to all growers along the ditches. A conflict of interests and the lack of well defined water rights have kept this development from being seriously considered.

The growers on the lower end of the ditches who always have water standing in the ditches would not be interested in paying for the project and might object that the purpose of the ditches is drainage and not irrigation. However, the water level in the ditches is often above the level of the lower owners' fields so that pumping from the tiles into the drainage ditch is a common practice. Another interest is that of the county road commission which might fear increased maintenance costs of county roads which are often located along side the ditches and which might be damaged by higher water levels.

In addition, there is the problem of the property right in the water made available by the development. If one property owner located on the ditch did not want to become a part of the cooperative enterprise how could he be prevented from using and benefiting from the higher level in the ditch along side his land with existing legal arrangements? This example is included to show how problems of conflicting interests must be solved as well as those of economic and engineering feasibility.

PROBLEMS BETWEEN IRRIGATORS AND OTHER USERS

Streams

Withdrawal of water for irrigation can affect other uses. One of these uses of streams is for dilution and assimilation of treated industrial and municipal sewage. There is a direct relation between the amount of flow of a stream and its ability to assimilate sewage so that a nuisance or unlawful pollution will not be created. In areas such as the Paw Paw River Basin in southwestern Michigan, where heavy concentration of irrigation withdrawals are occurring, the effect on the waste assimilating capacity of the stream may cause problems.³

This is also a potential problem in the Huron River Basin and other areas. There are two sides to this problem. Withdrawal for irrigation which is not returned to the stream affects its waste assimilating capacity and as more wastes are added less water can be withdrawn without running the danger of inadequate sewage assimilation. A basic policy question is involved concerning which users must pay the cost of maintaining adequate waste assimilation if withdrawals increase.

Irrigators can develop new supplies and storage facilities. Industry can build better sewage treatment plants. However, there are technical limits to treatment and in areas where this limit has been reached further treatment is not an alternative. In that case, industry through upstream water management can supplement low summer flows. Perhaps all users can work together to provide multiple use storage reservoirs which can be used for maintenance of stream flow for sewage dilution, for irrigation, and for recreation.

Future attempts at water management will have an effect on rural people. Efforts to maintain the summer flows of streams used for municipal and industrial waste disposal by building storage reservoirs are necessarily going to have an effect on landowners whose property might be purchased and flooded by a reservoir. Such a plan was considered by the Battle Creek-Kalamazoo River Intermunicipality Study Committee to maintain flows in the Kalamazoo River by construction of a reservoir on Rice Creek in Calhoun County which would have required about 13,000 acres of land.

Property owners and the local people from Albion and Marshall were concerned about the effect of the reservoir on their interests. The plan was never initiated because it was too costly at that time. One of the difficulties of water storage in the future is going to be the high cost of acquiring reservoir sites which have been developed for other purposes.

Another point of conflict over the use of streams is between irrigation and recreational uses. Some have been fearful that withdrawal from streams for irrigation in the future might reach the point where it seriously affected the environmental conditions necessary for fish and wildlife.

³ Regulation of stream flow for hydroelectric power generation has a similar effect during periods of low flow and many conflict with the interests of downstream users. This problem has been noted on the Tittabawassee River. See, Water Resource Conditions and Uses in the Tittabawassee River Basin, Lansing: Water Resources Commission, 1960, p. 70.

This problem is not serious now. One instance was reported in Macomb County on the Middle Branch of the Clinton River. During a low water period during the summer of 1959, rural residents along the stream complained to the Michigan Conservation Department alleging fish kill due to irrigation withdrawals. No official action was taken. It would be important to know if the stream were navigable, for the public has a legal interest only in navigable streams according to past court decisions (8).

The riparian property owners might start a court proceeding claiming the withdrawals were a violation of their riparian rights and such use was unreasonable compared with their use of the stream and its affect on their property values. There have been no court cases which raise these particular questions and the water rights involved need clarification. Though this problem involving streams is not widespread at present, it will require some policy decisions on how to settle such conflicts in the future.

Lakes

At present most of the concern between irrigation and recreational uses has arisen over lakes. Instances of complaints of lake shore property owners who felt an irrigator was responsible for the lowering of the lake level have been reported in several counties. These irrigators include such uses as golf courses as well as farmland.

Most of these complaints when checked by the Water Resources Commission have turned out to be unfounded. So far an irrigator usually hasn't taken enough water to lower the lake significantly and frequently the low lake levels were due to low rainfall and ground water tables.

An illustration of such a case was the Water Resources Commission's investigation of a complaint that an irrigator was causing low lake levels on Halls Lake in Isabella County in 1958. The lake is 80 acres in size and the amount of land irrigated was 40 acres with 5 inches of water applied per acre. The Commission staff computed that such a withdrawal would lower the lake a maximum of $2\frac{1}{2}$ inches assuming no recharge to the lake.

This case shows the important role that an administrative agency can have in solving water problems. Though the Water Resources Commission has no specific authority to settle lake use problems or issue permits, it can alleviate apparent conflicts by providing factual information on the exact consequences of various uses. If diversions from lakes increase rapidly, the problem will become harder to solve in the future.

A conflict between lake shore property owners on Hutchins Lake and an irrigator was settled in the circuit court of Allegan County in 1959. The case of *Hoover* vs. *Crane* involved the complaint of the property owners that the irrigator was lowering the lake which interfered with their use and affected cottage rental reservations. The court restricted the irrigator's use to a given amount which it felt would not interfere with the uses of the cottage owners. The court also recognized that the noise of the pumping engine created a disturbance and pumping was prohibited between 11 p.m. and 7 a.m.

The factor of noise disturbing neighboring residents is as important as the effect of the water use itself in many cases. Examples of this complaint were found in several counties.

Michigan does have a law which sets up a procedure for the determination and maintenance of normal lake levels which will be discussed later. This law has been used to stabilize the level on many lakes by construction of appropriate outlet controls. However, the law was not written with the problem of withdrawal of water from lakes in mind so it does not provide a specific procedure for settling conflicts between irrigators or other consumptive uses and lake shore property owners.

Ground Water

One partial solution to the problem of conflicting uses of surface water is to use ground water. However, withdrawal of ground water can also have an effect on stream flow if wells are located too close to small streams or if ground water use becomes very heavy. There is a trend toward more use of ground water for irrigation. This may shift the problem to one of well interference.

Such a problem is not widespread as yet but cases have arisen where water tables were low in a dry year and domestic well owners may blame the first nearby ground water irrigator they see. This problem also goes both ways and other users such as industrial and municipal can interfere with irrigation wells. The possibility of mutual interference is reduced, however, by the relative isolation and separation of irrigation wells. It is difficult to determine the effect of complaints and threatened court action on irrigators using surface water. However, several cases were reported where these factors caused farmers to abandon irrigation plans or to switch to wells as a source of water. One farmer in Montcalm County sold off part of his farm on a lake shore to be used for homes. After the homes were built the owners complained about the farmer's use of the lake for irrigation and rather than dispute the issue the farmer put in a well for his irrigation system.

WASTE DISPOSAL CONFLICTS

Waste disposal is an important claimant on Michigan water resources. Our growing population not only requires more direct consumption of water but it indirectly consumes more water in the disposal of its wastes. Waste disposal is a type of consumptive use of water in much the same way that a withdrawal of water for irrigation is. In the case of waste disposal the water is still in the stream but the effect it has on other users of water is much the same as an actual withdrawal for a limited portion of the river.

The Water Resources Commission has the statutory responsibility in the control of water pollution.⁴ An analysis of the experience in this area would be the subject of a separate study in itself. Another state agency, the State Department of Health is also involved in the pollution picture as it supervises and issues permits for construction of municipal water supplies and sewage treatment plants in the interests of public health.

Briefly, some of the kinds of pollution problems can be indicated. The problem created by rapid municipal and industrial growth is illustrated by the problems of the Huron River Basin. The State Department of Health has noted that the expected population of Ann Arbor in 1980 will require the entire flow of the river at times of critical low flow for domestic water supply in addition to available ground water.

This would mean that there would be no significant stream flow between the water supply intake and the outlet of the city's sewer. Below the sewer outlet the river would be composed almost entirely of effluent from the sewage treatment plants. The Health Department has asked the governmental units in the Huron River Basin to agree on

⁴ Act 245, P.A. 1929 as amended by Act 117, P.A. 1949. The State Health Department is also involved under Act 98, P.A. 1913 as amended.

basic future water use patterns to be used in the issuance of future permits for municipal water supplies and sewage treatment plants.

Pollution also affects recreational use. One example occurred in 1959 in Branch County where zinc cyanide leaked into Marble Lake. The offending company paid the State Conservation Department \$1,001 for the fish that were killed. The payment was based on commercial fish hatchery prices. Another example occurred in the spring of 1960 in the Detroit River where an estimated 10,000 ducks died from oil pollution. Cases like this are investigated by the Water Resources Commission and after certain legal hearings and proceedings are held the offenders are ordered to make appropriate corrections in their disposal operations.

Water pollution also affects agriculture in several ways, some of which are covered under existing pollution control laws and some which are not. Industrial pollution can create a nuisance for rural domestic ground water supplies. An example occurred in Muskegon County where several farmers claimed that the operations of an oil bulk tank storage operation contaminated their wells. A court suit was started but was settled out of court.

Another type of problem occurred in Allegan County where a commercial waste disposal company leased part of a farm for disposal of industrial wastes. The farmer was not aware of the kind of wastes involved. Some of the wastes contained hexavalent chromium which could move through the ground and constituted a threat of contamination to the local ground water resources including those supplying the farmer's well.

Pollution of surface waters also cause problems for farmers. An illustration is the dewatering of a mine in Keweenaw County in the Upper Peninsula. This mine water contained salt and affected a stream used by farmers for stock watering. The mining company reached an agreement with the farmers and fenced off the stream and put in wells where the farmers had no other source of supply.

Use of polluted streams for irrigation is another problem. Polluted water has caused crop losses to gardeners and greenhouse men on Tonquish Stream and the lower Rouge River in Wayne County and the Clinton River in Macomb County. These examples fall under the jurisdiction of the Water Resources Commission.

One problem that is not effectively covered by present state-wide laws is the protection of pure drinking water from private domestic wells. An example of this problem occurred in the summer of 1959 in the Village of Posen in Presque Isle County. An infectious hepatitis epidemic due to contaminated water hit 168 of the 350 people in the community. The cause of the contamination appeared to be inadequate isolation of wells from sources of sewage and improper or poor well construction. The Michigan Department of Health administers a statute regulating cities with a public water supply system but there is no such regulation of private wells in rural communities.

Some individual counties have ordinances setting up standards for private well construction which are to be used for drinking water. Eaton County requires the well owner to secure a permit before a well is constructed. The ordinance specifies certain standards for location of the well in relation to septic tanks and other sources of contamination and construction requirements with reference to depth, casings, pumps, platforms, and other items.

Sanilac County goes further and requires all water well drillers and contractors working in the county to register with the county health department and to furnish logs and other information about wells upon completion.

Muskegon County has a county-wide ordinance which does not require construction permits but does specify certain construction standards. The Muskegon County Health Department which administers the law reported that since the regulations were approved in 1956 the proportion of well water samples submitted to the Michigan Department of Health for testing and found to be unsafe has dropped from about 25 percent to 5 percent.

Some other counties such as Oakland do not have county-wide ordinances but do have well location regulations in some townships. Saginaw County does not have a well construction law but individual townships have building codes which control the location of wells in relation to septic tanks but do not contain other construction standards.

Still other counties have no laws regulating wells constructed for drinking water, but the county health department is in a position to require minimum standards before approving homes built with FHA loans and to make voluntary suggestions to others.

Several bills have been introduced in the legislature to protect the public health by regulating well construction. None have passed. The latest of these bills was Senate Bill No. 1321 in 1958 which provided for a new state water well control board which would regulate and register persons engaged in well construction. The board would have been authorized to provide specifications for well construction and certain minimum experience and other qualifications for well contractors and drillers.

Another purpose of the bill, in addition to the protection of health, was to secure information on the ground water resource. It required well contractors to file records with the Conservation Department on each well drilled including information on well location and depth, water levels, and geologic materials penetrated.

In evaluating future well construction regulation bills several things can be considered. First, for complete protection against possible avenues of contamination of water supplies the need to regulate pump installation as well as well construction should be examined. There is also the problem of who is to administer the law. Past bills have suggested a new agency.

In many states the law is administered by the State Health Department which emphasizes the public health aspects of well regulation (7). Another consideration is the requirement to file records for each well drilled. This information is badly needed but records on every well may only swamp the collecting agency as well as cause much extra work for all well contractors who are not expert in the recording of the necessary data.

Another alternative would be to require that the collecting agency be informed of intentions to drill and then the agency could require the driller to file a log or send out a man to record that data if it was needed in that particular area of the state. One of the possible points of contention in supplying data of this kind is that the driller may regard this as private information which might help competitors if they were not familiar with the local geology.

LAKE LEVEL SETTING AND ARTIFICIAL LAKE CONSTRUCTION

Inland Lake Levels

Fluctuating lake levels affect the value and use of lake shore property. High levels cause flooding and disruption of septic tank systems while low levels damage boating and fish habitat. With the exception of pollution control the problems examined so far in this bulletin are not covered by written statutory law. However, there is a legal procedure for the determination and maintenance of the normal level of inland lakes. The basic legislation is Act 194 passed in 1939. Upon petition by 51 percent of the owners of land abutting a lake, the county board of supervisors must direct the county prosecuting attorney to petition the circuit court for proceeding to determine the normal level. The county board may initiate such action on its own. The county board may request assistance from the Michigan Conservation Department. If the lake is available and accessible to the general public, the Department will make a detailed field survey and engineering report to determine the most desirable height above sea level and improvements that are necessary for maintaining it. This report is available to the court.

The court sets a date for a public hearing which is advertised in a local paper. Notice is sent to all frontage owners by registered mail. After hearing all interested parties, the court sets the normal lake level. The county board then causes the dam or other control structures to be built and establishes a special assessment district including all benefited property to cover the project costs.

The basic legislation was broadened to authorize the drilling of wells and the pumping of water to maintain water levels by Act 319 of 1941. A special procedure was made available to counties having a population of not less than 100,000 nor more than one million by Act 276 of 1945. The drain commissioner plays an important part in the procedure since counties of that size can be expected to have professional engineers on the drain commission staff.

Upon resolution of the county board of supervisors the county drain commissioner establishes the high and mean levels. A temporary order is issued containing the established levels which becomes permanent unless challenged within five years. If the order is challenged the circuit court holds a hearing and a final determination is made. This procedure facilitates setting of lake levels in the more populous counties.

The important question in these proceedings is the criteria used in determining the legal level. The statute requires that the level be established considering what level will provide the most benefit to the public, best protect the public health, welfare and safety, best preserve the natural resources of the state, and preserve and protect the values of properties developed around the lake. These criteria are very broad and to see just how they are employed in practice two actual cases will be examined.

When all property owners on a lake have the same interests the lake levels can be stabilized relatively easily with the only problem being that of technical feasibility. However, when the owners have different interests growing out of differing elevations of their property, conflicts can develop.

An example of this problem is provided by the Coldwater chain of lakes in Branch County where the level was set in 1959. In the last several years the area had undergone rapid development as a resort and recreational area. Wide fluctuations and high levels had flooded existing development. The Branch County Health Department was interested because existing and planned subdivisions depended on septic tanks for sewage disposal which are adversely affected by high levels.

Upon request of the county board the Michigan Conservation Department made a detailed study of the lake. Data is obtained from United States Geological Survey stream flow records, lake level staff gauges, county health department, fish division of the Conservation Department as to lake bottom and fish habitat, and field surveys by the Department's engineers which determine elevations above sea level. The survey includes typical beach profiles which show the relationship between the level of cottage floors and sewage disposal tile fields and the level of the lake.

At one time the Department conducted a survey of the property owners asking them what level they preferred. This was abandoned because the owners often changed their view when they appeared in court so that data is now only secured of the observable effects of lake levels on various factors. Among the factors taken into account are the effect on bank erosion, flood damage, flooding of domestic sewage disposal systems, swimming beaches, boating, fish habitat, and groundwater levels as they affect marsh hay and pasture.

Construction was just beginning to take place on the low lying frontage of a portion of the lake chain. This construction would demand lake levels not exceeding 982.5 feet above sea level for efficient septic tank operation. However, for most of the rest of the lake chain a level below 984.5 would have been undesirable for boat operation and maximum recreational use. The Department recommended that the level be established at 984.5. The Department felt that it was not reasonable to give major consideration to the low frontage when selecting a level for the lake chain. The Department pointed out that when a level was selected it would be necessary to place certain restrictions on the development of this low frontage requiring a fill to a minimum of 2 feet above the legal summer level.

The county health department felt that the recommended level of 984.5 was satisfactory for existing sewage disposal systems. The fish

division of the Conservation Department also felt that the level was satisfactory to fish habitat.

The court set the level at the point recommended by the Conservation Department. This legal level will become the basis for permits for the installation of sewage disposal systems required by all of the townships on the lake chain. These ordinances are enforced by the county health department. This case illustrates how a water rights procedure can affect both water and land use as well as how a state statute can be coupled with action by local government to achieve water use control.

A petition to determine the normal level of Tawas Lake in Iosco County raised the problem of actual flooding of some of the lake shore property if the apparently most desirable levels were established.⁵ The circuit court noted that the statute and previous court cases were little help on the question of what is to be considered the normal level and how floodage easements may be acquired and how compensation could be made. The court felt that the language of the statute was broad enough to justify the holding that the right to purchase or condemn applies not only to land needed for dams and similar devices but also to floodage easements.

The level set by the court would have flooded some private lands along the shore of the lake and the court ordered that it would be necessary for the county of Iosco to buy the land or floodage easements under its powers of eminent domain. Use of the governmental power of eminent domain allows the selection of the level most advantageous to the most people with compensation for the individuals who might suffer damage.

Artificial Lake Construction

The rapid population growth in Michigan since World War II has had an important effect on land use. The demand for home sites has changed former rural land into subdivisions. One of the most popular home sites is lake shore property which is a scarce commodity in southern Michigan near the population centers. To meet this demand private developers are creating artificial lakes by flooding low and swampy areas, by damming existing streams, or excavation below the water table. The dam site is usually deeded to a civic association with title in each individual piece of property.

After the lake front has been developed, the job of maintenance is left to the civic association which is often ill-equipped to handle it.

⁵ Circuit Court Iosco County, Docket No. 4340, October 6, 1959.

There are no construction standards and no governmental agency to oversee the creation of artificial lakes under present laws. An inadequately constructed and maintained control device may be a safety hazard as well as contributing to seepage, erosion, or road damage. Maintenance costs may be expensive if neglected for a number of years as is evidenced by the case of Pontiac Lake in Oakland County where reconstruction of the dam and levees cost approximately \$100,000 (1). The county advanced \$65,000 to be reimbursed over a five-year period by special assessment on the benefiting area.

Act 156 of 1851 requires a permit from the county board of supervisors for construction of a dam in a navigable stream but this law did not anticipate dams creating artificial lakes and gives no control over non-navigable streams. In addition some of these lakes such as Twin Lakes in Oakland County are maintained by pumping from a nearby stream which raises questions of water rights for such diversions if it should affect other users of the stream.

No governmental agency has any control over such cases and any action for relief from damages would be a matter for private action under the common law. The county may control the level of artificial lakes under the statutes discussed previously, but if they want to control the creation of artificial lakes from their inception new legislation will be necessary. Minimum engineering standards for construction would be helpful and it may be desirable for the regulating body to require the real estate developer to put a certain amount of money in escrow for the future maintenance of the lake control structures.

Other Lake Use Problems

There are several important lake use problems which were not investigated in detail. One of these is the filling or dredging of lake shore frontage to increase its usefulness for industrial and private home building. This filling, dredging and construction of marinas and docks can damage fish habitat, and spawning areas, interfere with navigation, and affect other lake uses. A special legislative committee studied the problems of submerged lands in 1959.

All recreational users do not have the same interests. A problem of growing importance is the motor boat and water skier users versus the fishermen. An example of this occurred on Paw Paw Lake in Berrien County. The problem of lake access for the public is important for the increasing number of people who want to use lakes but who are unable to purchase scarce lake shore property. The public has a legal right to fish in navigable waters but it must obtain legal access over riparian land before it can use this right.

The Michigan Conservation Department has been engaged in buying public fishing sites on lakes and streams since 1939. In 1959 these included 49,000 acres with a total frontage of over 200 miles (4). These fishing sites which are purchased from hunting and fishing license money are also used for boat launching. This provides a source of conflict between the boater and the fisherman.

URBAN WATER USE CONFLICTS

Municipal Use vs. Private Users

The rapid expansion of the urban population in Michigan has had important effects on land and water use. Municipalities with public water supplies and subdivisions not a part of the central city with public water systems have increased their water use which has affected other private users of ground water.

This is illustrated by the village of Ithaca which drilled a new well several years ago which was close to a farmer who felt that the wells affected his own domestic well. The village offered to let the farmer choose any well expert to check his well and to pay for restoring the well if the village were at fault. No action has been taken.

After World War II the city of Flint was searching for additional sources of supply and drilled a number of test wells in Burton Township. Through the State Department of Conservation, a cooperative ground water investigation was made. Adequacy of the supply was questioned and in addition it was found that if high capacity city wells were installed it might lower the levels in several hundred private wells which would then require deep well pumps. The city instead developed further surface water supplies and built a reservoir on the Flint River.

Development of new supplies for industry can also affect private wells. Some time ago a forge plant near Lansing put in a new well which affected a number of residential wells in the vicinity. These wells were drilled deeper at the company's expense as a matter of public relations. The development of subdivisions with their own common source of supply can interfere with neighboring private wells. Several examples of this were found in Genesee County. Another case occured in Oakland County when a developer found that the only water available on the property he wished to subdivide for 123 lots was salty. An area next to the subdivision was purchased which had artesian wells that flowed constantly into ponds and drains. The residents in the nearby area feared damage to their artesian wells and sought a court injunction to prevent the developer from drilling. The Oakland County circuit court allowed the developer to use the water.⁶

Another problem in the development of new subdivisions is the interruption of natural drainage or artificial drains. If these are legal county drains, interference can be prevented under the drainage laws.

There has not been a Supreme Court case on ground water since 1927 although the opportunity for conflicts in the use of ground water has increased with rapid population growth. Something can be learned from the way the above problems were handled only one of which involved a court case.

Cities, industry, and subdivision developers seem to be reasonable in their relations to smaller ground water users if their planned or actual use might cause damage. In some cases they have either developed other sources of water or they have paid the costs of deepening damaged wells. This is probably done not so much because of their interpretation of the common law and how the courts might rule but as a matter of public relations and good will.

Municipal Supply Problems

All municipal water problems do not involve conflicts with other users but also include the internal problem of meeting the demands of their own residents. The water supply problem of a number of cities is complicated by high peak demand in the summer months due to lawn sprinkling and air conditioning. If the water system were built to meet this demand it would be under-utilized the remainder of the year.

The case of Grand Rapids may be used to illustrate the effect of air conditioning demand. A survey in 1956 showed that nonrecirculating air conditioning units had a demand of 22 percent of the total consumption on maximum consumption days in the sum-

⁶ Docket Number C-27381.

mer and only 4 percent of the total yearly consumption (9). The high costs of designing a water system to meet these demands has caused some cities to in effect engage in various methods of allocating water. Our society places a high value on individual home ownership and the maintenance of beautiful lawns so use for this purpose cannot be completely restricted.

Several cities such as Grand Rapids have ordinances which allow lawn sprinkling only on alternative days. Use of water for air conditioning is much more subject to conservation by requiring recirculation. Such recirculating units individually require only about 5 percent of the quantity of water taken by nonrecirculating units. Grand Rapids regulates air conditioning use and Detroit requires a license for air conditioning installers.

Municipalities also play another important role in water use regulation where they use surface water as a source of supply. The city of Flint presently secures its water supply from Holloway Reservoir on the Flint River. There are many uses which can be made of a reservoir and this creates conflicts.

The reservoir could be used for flood control but the capacity would not be sufficient for this purpose unless the reservoir were drawn down in the winter in order to receive the spring floods. However, to do this would run the risk of not having a water supply if heavy spring runoff did not occur. When the reservoir was constructed an ordinance was suggested to prevent recreational use of the reservoir as such use would add to the algae problem and fluctuating reservoir levels interfere with recreation. This ordinance was not adopted.

The city of Kalamazoo has about 60 acres of water surface which provides recharge to the city wells. These lakes are used for fishing but the city prohibits boating.

The source of supply and the cost of water for municipal use are also affected by other uses of water. The city of Saginaw had obtained its water from the Saginaw River for 75 years but the water eventually became contaminated from industrial and domestic wastes. Although the Saginaw filtration plant produced safe drinking water it had not been able to remove the objectionable tastes.

The city of Midland obtained its supply from the Tittabawassee River which proved to be undependable. The two cities abandoned the rivers as a source of supply and combined their efforts to build a pipeline in 1948 to Lake Huron which would serve both cities. State enabling legislation was required to allow two cities to join for a common raw water supply. This pipeline intake was located at Whitestone Point 63 miles northeast of Saginaw to escape the effects of pollution from the Saginaw River in Saginaw Bay. The pipeline was built at a cost of over 10 million dollars in order to secure an adequate supply and avoid the pollution problem. The Dow Chemical Company which contributes to the waste load of the Tittabawassee River made it possible for Midland to finance its share of the project by guaranteeing to buy not less than an average amount of 7 million gallons daily (3).

Several other cities get their water supply from the Great Lakes and others may in the future. Flint which uses the Flint River is studying the possibility of a pipeline to Lake Huron to meet its future needs.

This discussion of urban water problems has indicated the role of local governments in affecting water use. One of the types of political organization which may play an increasingly important role in the future is the watershed organization which includes various units of local governments.

Some experience with this type of organization has been gained in the Huron River Watershed Intergovernmental Committee formed in 1958 which includes 32 local governmental units (counties, townships, cities, and villages). The committee has the power to study basin problems and recommend solutions but no power to construct or operate facilities. The committee is working on the problems of water supply, sewage disposal, and recreational services in the rapidly growing urban areas of the basin.

The sewage disposal problem is particularly serious since the Michigan Department of Health has withheld permission to expand or construct new municipal and industrial sewage treatment facilities adjacent to the lower Huron River in the last two years. The Department has asked the communities to join in developing an area plan for use of the resource which can be used in granting future permits.

The general legal authority of the Health Department to grant permits with respect to an area water plan following public hearings could probably be used by the Department to promote public health. Instead the plan is to be developed by the local communities in the basin with approval of the Department. This approach bears watching as a possible device to meet a wide variety of water use problems in the state.

Industrial Water Conservation

The President's Materials Policy Commission has predicted a 170 percent increase in water needs for industry and a 50 percent increase in municipal needs in the United States between 1950 and 1975 (6). If this increase materializes in Michigan, the problems that have been discussed here will become much more serious. However, care must be taken in the projection of present rates of use based on expected population growth.

Such simple straight line projections ignore the role of price as it affects the use of a resource. Water has long been considered as a free good like the air we breathe, but the costs of securing and transporting water have increased as the demand for water has increased. Water may not be scarce in the humid eastern states in the sense of absolute shortage or unavailability but it is surely becoming more costly to secure as water tables drop in particular areas, streams become more polluted, or water must be transported greater distances. This increased cost will cause water to be used more cautiously.

To illustrate the effect of increased costs of obtaining water on the amount used, the case of Dow Chemical Company at Midland will be examined (2). Dow is a large water user and has 75 miles of water distribution systems which carry five separate types of water and another 75 miles of sewer systems which carry four separate types of sewage. Several years ago Dow started a program of water conservation. The problem was not a shortage of water but of increasing costs of facilities to pump and distribute water to meet the plant's growing demands. Dow engineers discovered that it was costing more to pipe the water away from a particular use in the plant and to process it before it re-entered the river than it was to bring the water to the plant user originally.

New accounting procedures were used to show the cost of water that was originally considered cheap water because its cost was disguised in plant overhead expenses. To avoid the high capital expenditures of increased facilities to provide water and dispose of sewage the plant began a conservation program. The first step was to meter the water so that information on what the plant was using and could save would be known. Among the devices used to conserve water were: (1) To shut off the water when not in use by placing shut off valves in convenient places; (2) To recirculate where possible; (3) To cascade the outflow from one heat exchanger which becomes the inflow to a nearby heat exchanger of a somewhat higher heat level thus getting more use out of a given amount of water; and (4) To use controllers on the effluent stream of heat exchange equipment or to use temperature recorders which allow the plant superintendent to keep a constant check on this operation and to get the most use out of the water.

These methods have enabled Dow to save \$250,000 over the past two years in direct water pumping costs and purchases of water.

SHALL WE MODERNIZE OUR WATER LAWS?

A picture has been presented of some of Michigan's water use problems. It was shown that Michigan's rapid population growth and increased per capita use of water has created conflicts between people using water for different purposes. Most resources are allocated between competing users in markets with the resource going to the highest bidder.

This procedure is not completely satisfactory in the case of water because some users, such as recreationists, find that they are not organized in such a way that they could make a bid in a market situation. Water differs from other resources in that it is continually on the move which makes it difficult to reduce to possession.

One can obtain the right to use water as it flows by or if found under the ground but not a right to specific gallon or acre foot of water. Water also changes value rapidly. Water can be priceless when it is scarce and at another time floods give water a negative value.

The solution to many of the conflicts noted in this bulletin is not covered by existing laws. A change in the law itself will not necessarily resolve the problem and may even worsen it. This discussion has not included an analysis of the relative merits of the riparian or appropriation doctrines of water rights. The primary concern must be with how the people of Michigan want to use their water resources and how people with different interests in water can come to a decision on wise use. After these policy decisions have been made, the legal procedures to do the job can then be selected from the various water rights doctrines. Because of the nature of water and its importance to life, decisions as to its best use are group decisions and there must be rather solid public agreement on the matter. The problem of allocating water between competing users such as agriculture, cities, industry, and recreation is made much more difficult by the fact that even within each of these uses there are conflicts.

Within agriculture there is possible conflict between the irrigator and the user of water for domestic and stockwatering purposes and for land value maintenance. Within municipalities there is possible conflict between the city supply and the subdivisions and the private well owners. Within industry there is possible conflict between industries with different water requirements, and one industry's wastes may cause problems for another. Within recreational users there is a conflict between speed boaters and fishermen and even between bait and fly fishermen.

With this complex variety of uses it would be a Herculean task to set up a priority list for each use. This does not mean that some public decisions cannot be made on general policy to provide direction in water use matters and to provide some guidelines and boundaries for the solution of conflicts. It is to this task of considering general water use policy that we now turn using the problems and experience learned from the cases in this bulletin as a foundation.

General Water Policy and Economic Growth

Water is an important ingredient of economic growth. Among other things water is used as a source of power, transportation, a solvent, a coolant, a waste assimilator, a raw material, a source of recreational enjoyment; it is a necessity for plant, animal, and human life. To only concern ourselves with which one of these is the most valued is to freeze the state at its present level of development. It would ignore the possibilities of creating more usable water through such means as storage of spring runoff or water conservation which can make it possible to maintain and increase our water using activities which contribute so much to our standard of living.

One possible step in this direction would be to encourage the building of ponds and reservoirs for irrigation, recreation and other uses. This could be done by clarifying the rights to store and use water not being beneficially used by others. As part of this general policy, attention should be given to preventing scarce reservoir sites from being developed for other uses such as housing or roads. On streams where flows are low when the water is needed most, the support of any substantial diversions must lie in the direction of water development, storage, and management.

One of the important considerations for economic growth is the problem of how to enable a city, an industrial corporation, an individual home owner, or a farmer to have a sufficiently secure right to water so that investment in water development and water using facilities is justified. At the same time the public uses of water by groups not well organized or represented in the market must be protected. Care must also be taken to protect against freezing the pattern of water use as it exists today so that advantage could not be taken of new technologies and water use needs.

The need for a secure water right in order to make investments was recognized in the newest piece of water legislation in Michigan passed in 1959 to facilitate the use of water for the operation of low grade iron ore mining property.⁷ Mining of low grade iron ore requires a large investment in processing equipment. To secure this money from investors they must be sure that water will be available until the mine is exhausted, for without water the expensive equipment and plant would be worthless.

The new law allows the Water Resources Commission to grant permits up to 50 years. The permit can be granted only if the use of the water for mining will not unreasonably impair the interests of the public or riparians. What constitutes unreasonable impairment of the public or riparian interests is not stated. This will be discussed in the next section on procedures.

Most people seem to agree that human consumption and domestic use both in the city and in the country have first priority. One idea that has been contained in several proposed bills in past Michigan legislatures and used in several eastern states which protects this basic use is the idea of setting minimum flows below which no withdrawals are permitted.⁸

Other uses that are not organized in the market such as scenic enjoyment and recreation can also be included when a minimum flow is set by the court or an administrative agency. A public decision would be needed stating just what should be included when the minimum flow is set. It should be remembered in this regard

⁷ Act 143, P.A. 1959. ⁸ House Bill No. 559, (1958) and Senate Bill No. 1323, (1959).

that the public has an interest in and benefits from many kinds of water using activity. To include any broad use such as recreation, as one which cannot be violated in any way, is to first of all ignore the fact that recreation has many conflicting uses within it, and secondly that the public derives a benefit from such uses as low grade iron ore mining as well as trout fishing.

The minimum flow criterion can be used to protect the basic human needs and other uses which are important but are not represented in a market situation. Water available above the minimum flow could then be withdrawn by other users. This still leaves the problem of how to settle conflicts between competing users for this water.

An environment of conflict is not favorable to investment and wise use. From the cases listed here it can be seen that although there are no formal laws to cover many situations, people for the most part have been reasonable and have worked out sharing arrangements or methods to store water or have compensated persons damaged by a withdrawal.

In cases where informal arrangements cannot be devised and the consequences are far reaching, then perhaps a governmental agency should be available to suggest compromises between the competing users upon their request. The Water Resources Commission has already played an important role in lake use conflicts by showing the actual consequences of a withdrawal on lake levels.

Adequate water laws can contribute to economic growth and in turn the economic growth of Michigan has created most of the water problems. Concentration of water use in certain areas causes many conflicts. One possible answer is the planned location of water users by publicly controlled land use. In the case of lake level problems, it was seen how local land use and building regulations can be coordinated with the legal lake level.

Zoning of flood plains can also prevent costly property damage from flooding. Planning is becoming especially important in urban areas where the disposal of wastes must be coordinated with the waste assimilating capacity of the streams. It may be possible to move in the direction of planning the location of industrial use so that those that need high quality water are located above those who can use a lower quality water. If location of use is planned, there are possibilities for less argument over which use is the most valuable at a particular location and for reduction of costs for all users. More knowledge of water as a physical resource will be needed to support this planning.

Closely tied to the question of general public policy decisions are the procedures by which this policy is implemented. Such questions as what level of government should administer water use policy and how the interests of various users are taken into account should be considered.

Procedures

A number of governmental agencies are now administering various laws relating to water use. The Water Resources Commission administers water pollution control laws. The State Health Department is also concerned with water use as it concerns public health. The Conservation Department participates in the lake level setting procedures as well as in other areas. In addition we have seen how local governments influence water use through various controls such as zoning and building regulations.

Each level of government plays an important role and is often uniquely suited for a particular job. This is reflected in the administration of pollution control at the state level since it is a matter of state-wide concern. Sometimes the functions of state and local governments are combined. The planning underway in the Huron River Basin is an example. The local governmental units in the watershed have organized to develop an area water use plan which with the approval of the State Health Department can be used in granting municipal water supply and sewage disposal permits.

Michigan's lake level setting law also utilizes several levels of government. The action is initiated by petition of riparian owners to the local county board of supervisors with the actual decision being made by the local circuit court. The state government enters the picture upon request and the Conservation Department lends its expert professional help by providing information on lake levels and the effects of various levels on lake users. Local governments can again enter the picture and can use the legal lake level when making subdivision and building regulations.

As new controls are needed the relevant question is not which level of government is best, but how can the various governments best be utilized to secure the implementation of public policy. The question is one of utilizing the intimate knowledge of the problem situation by the local units along with the expert professional help available in the state agencies so that the public interest is served.

The question of what governmental unit is utilized is closely tied to the question of how facts concerning a water use decision are gathered and how the various interest groups can be represented. The lake level setting law combines a public hearing before the circuit court judge with systematic gathering of data on the effects of various levels on all users by the Conservation Department. In the new taconite law, the Water Resources Commission holds a public hearing to determine if the diversion for low grade iron ore mining will unreasonably impair the interests of the public or riparians.

It is important that all water users have a chance to have their interests considered and weighed in allocation decisions. The public hearing is an important procedure bearing on this problem but the question can be asked as to whether all parties have a chance to appear at public hearings.

The question of the effects on third parties is especially important in water use. The applicant who wants to make a withdrawal, as well as parties directly concerned, will appear at a hearing, but there may be other interests who are not well organized or able to be at a hearing. To further guarantee the consideration of all interests, the governmental agency in charge can supplement information obtained at the public hearing with a systematic investigation of the effects of the water use on all parties.

Water use rules cannot be uniform throughout the state. The supply of water varies widely over the state as do the demands. In one area the prime use could be urban and in another it might be recreation or agriculture. Some areas with critical problems may need more regulation than others where controls would only be so much red tape because of the abundance of water. The question of flexibility should be asked of future rules.

Water is critical to the economy of Michigan. The problems already occurring are likely to become more severe as the state grows. The problem is how to resolve these conflicts to get the most out of the water resource. We must go at this job together and not as separate groups of farmers, businessmen, recreationists, or city officials, each with his own "all or nothing" program.

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Additional background information on Michigan water laws is contained in Circular Bulletin 227, "Evolution of Michigan Water Laws." Write to: Bulletin office, Department of Information Services, Michigan State University, East Lansing; or see your county agricultural agent if you are a Michigan resident.

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