

RECOMMENDATIONS

- 1) The Commission recommends the creation of a water rights and use management statute that incorporates the following major principles and elements:
 - a) A determination and declaration that, based upon sound and accepted principles of natural laws and hydrology, the water resource of Indiana is in fact, and shall henceforth be regarded as, a single resource composed of the major interrelated elements of atmospheric moisture, precipitation, soil moisture, evapotranspiration, diffused surface water, water in lakes and water courses (surface water), and ground water; and that the said resource is both renewable and finite.
 - b) Recognition that the water resource of the state must serve a multiplicity of human, social and economic uses and needs; that specific uses and needs may, from time to time, either wax or wane; and that new uses and needs may vary both as to human, social and economic utility and their compatibility with one another.
 - c) Recognition that while short-term water resource availability is highly variable in both time and space as a result of natural factors, the overall long-term resource is adequate to meet the general spectrum of perceived human, social and economic uses and needs, *given proper planning and management*.
 - d) Assertion that the economy and the general health, safety, and welfare of the people of Indiana require that the water resource of the state be utilized for beneficial purposes; that waste, non-beneficial use and degradation of the resource be prevented; and that the resource be utilized so as to provide the best possible accommodation and balance as among beneficial uses and needs, including multi-purpose use where feasible.
 - e) An express declaration that the public policy of the State of Indiana is to manage, regulate, and control the water resource because: a) water is a natural and public resource; b) water plays an essential and pervasive role in the human, social and economic well-being of the people of Indiana; and c) it is of vital importance to the general health, safety and welfare of the people of Indiana.
 - f) An assertion that the State of Indiana does not forfeit any responsibility for water rights and the management and regulation of the water resource within the boundaries of the state.
 - g) Establish a state system of water use permits with the following major features:
 - 1- Full recognition of the rights of riparian owners and of the owners of overlying lands for domestic household uses and of the rights of capture and use of diffused surface water by land owners without a permit.

- 2- Riparian owners and owners of overlying lands may, but shall not be required to, obtain a permit for non-domestic use on riparian or overlying land not to exceed 100,000 gallons-per-day.
- 3- Any withdrawal, diversion, impoundment, or consumptive use of water of more than 100,000 gallons-per-day must have a prior water use permit from the state.
- 4- The proposed use of water must be such as is necessary for economic and efficient utilization, not interfere with any existing legal use of water, and be consistent with the public interest.
- 5- Define essential terms, including “watershed”, “watercourse”, “domestic use”, “riparian lands”, “overlying lands”, and “beneficial use”.
- 6- That the state may permit the holder of a water use permit to take, transport, and use surface water beyond riparian land and beyond the watershed from which it is taken; and to take, transport and use ground water beyond overlying land and beyond the watershed in which the aquifer is located.
- 7- That the issuance of a water use permit will be based upon full consideration of the overall public interest, including protection for the basin of origin and for instream flows and uses.
- 8- That a water use permit and rights thereby granted may be assigned or transferred and may not be revoked or suspended for any reason other than termination of use or non-compliance with reasonable conditions imposed at the time of issuance.
- 9- That all existing withdrawals, diversions, impoundments or consumptive uses of more than 100,000 gallons-per-day may be continued with a water use permit for which application must be made within, say, three years. Such permits will be granted provided that the use is reasonable and beneficial. Failure to so apply will create a rebuttable presumption of abandonment.
- 10- That non-domestic ground-water users whose withdrawals create substantial adverse effects upon the domestic household wells of others shall, as a condition precedent to a water use permit, either restore such wells to their former relative capability, provide a reasonable alternative source of supply, or pay proper damages.
- 11- Provide by law for the protection of a reasonable level of low streamflow in the interest of instream uses; for consideration of such protection as one element of the public interest in consideration of water use permits; and for recognition of the policy that the impoundment of water for the purpose of low flow augmentation for instream uses is a legitimate public purpose.

- h) Provide a clear definition of public rights for such instream uses as boating and fishing, based upon consideration of the navigation servitude and/or the public water concept, and of the rights of riparian owners.
- 2) It is the view of the Commission that the development of a water rights and management statute should be accomplished under the guidance and direction of a representative group conversant with the water resource and the uses and needs of the people of Indiana. The Commission has developed a broad base of such knowledge and insight during the past three years. It is therefore recommended that the Commission be continued and assigned the task of developing a statute on water rights and management for consideration by the General Assembly.
 - 3) The necessary resources should be provided to the Department of Natural Resources for the development of a comprehensive plan for the development and utilization of the water resource of the state to serve the goal of meeting the needs of the people of Indiana in timely fashion by both public and private efforts.
 - 4) Accepted technical procedures should be developed by the Department of Natural Resources for consistent assessment of the yield capability of the several sources of public water supply as an aid to water utilities in the planning and development of additional supplies in timely fashion.
 - 5) The Department of Natural Resources should be provided with the necessary resources to conduct and report upon continuing periodic inventories of water use in the state as an aid in assessing the further demands upon the water resource, and in determining any further public policy actions with respect thereto.



Flooding

All streams in Indiana react to excessive precipitation within their watershed. Heavy precipitation and the resulting rapid diffused surface water contribution to streamflow will occasionally cause all stream levels to rise, spill out of their banks, and occupy adjacent lands. On frequent occasions, runoff may be so intense that the stream spreads out and flows across an entire valley floor.

There are a wide variety of flooding conditions encountered in Indiana. In areas of high relief, the smaller streams are characterized by narrow valleys, rapid rates of rise, and high floodwater velocity. Streams exhibiting these characteristics are found in south-central Indiana. In areas of low relief, floodplains are generally wide and shallow, rates of stream rise are slow, and floodwater velocities are low. There are several areas in Indiana where major streams are confined to deep narrow valleys. Examples of these areas include the region north of the White River in Martin County and the Ohio River upstream from Tell City.

The most extensive floodplains are located along the Wabash River below Terre Haute, along the East Fork of the White River above Bedford, the West Fork of the White River below Muncie, the Kankakee River, and the Ohio River below Tell City. Most of these floodplains are used as cropland.

The damages resulting from flooding are segregated into urban and rural categories. Rural damages consist of loss of crops, erosion or deposition of soils, and damage to fences, livestock, agricultural buildings, equipment and roads. Average annual-rural flood damages, in 1978 dollars, are estimated at \$83.5 million (IWR: AUN, p. 68). Urban damages include losses in commercial, industrial, and residential areas. Average annual urban damages, in 1978 dollars, are estimated at \$43.2 million (IWR: AUN, p. 68). There are some 238 cities and towns in Indiana that are exposed to some degree of flooding. The most serious urban flooding potential occurs along the Little Calumet River in northwestern Indiana and in the cities of Indianapolis and Fort Wayne. A number of other cities, such as Anderson, Kokomo, Noblesville, Shelbyville, Columbus, Evansville, Rushville, Plymouth, and Marion also contain significant risk areas.

Flooding problems are aggravated by sediment carried into streams from soil erosion. The resulting deposits may significantly reduce stream capacity to discharge floodwaters, cause urban flood losses and reduce the fertility of the floodplain. While soil erosion is a natural and continuing process, it can be greatly accelerated by poor land use practices. There are certain soils, associated with areas of moderate to high relief, that are subject to particularly severe erosion if not properly managed. In Indiana, these soils are generally found on the rolling to hilly lands south of a line extending from Warren County to Bartholomew County to Union County.

FLOODPLAIN MANAGEMENT

Floodplain management in Indiana is composed of a variety of structural and non-structural methods to minimize the damage caused by flooding. Both the state and federal governments participate in floodplain management in Indiana, as the following discussion indicates.

Structural Methods

Structural methods involve the construction of some type of facility designed to exclude flood waters from lands that are of economic concern. These methods include the construction of small dams or detention structures, the construction of large dams for flood water storage, the construction of levees or flood walls, and the construction of channel modifications intended to reduce flood heights. With rare exceptions, these projects do not provide for complete and total protection against all possible levels of flooding but instead are designed to strike a balance between project costs and level of damage prevented. Another structural approach is to relocate the property subject to flooding. Both the federal and state governments have supported structural methods as a way to alleviate flooding.

The Federal Program The Federal government has spent in excess of \$260 million for structural flood control facilities in Indiana. The largest single source funds has been the flood control programs of the U.S. Army Corps of Engineers. Although there are a large number of Corps programs available, they are generally divided into two broad categories, the so-called "local protection" projects and the "national interest" projects. A local protection project is designed to benefit one specific locality, such as a levee around the city. The Corps of Engineers requires some financial contribution by the area to be benefitted. The benefits of a national interest project exceeds any one local geographic area. The federal government bears all costs of national interest flood projects. Examples include the large reservoirs in Indiana that have control benefits not only on Indiana streams but also on the Ohio River.

During the 1950's, the U.S. Department of Agriculture commenced a flood control program under Public Law 566. Among other objectives, this program was to provide flood control benefits for small agricultural watersheds. A typical project might consist of a series of small dams, channel modifications and levees.

Many flood control projects are actually multiple purpose projects. The Monroe Reservoir, for example, provides not only a high degree of flood protection on the East Fork of the White River, but also provides a regional water supply and a significant recreational facility attracting more than one million visitors annually.

The public usually expects flood control projects to solve the regional flood control problem. However, this is not usually the case. Most of these projects are designed to decrease both the severity and the frequency of flooding, not to eliminate it. Only urban levees and flood walls are designed to provide a high degree of total protection from floods. The federal projects constructed in Indiana are well maintained and have generally performed as expected.

The State Program The Indiana General Assembly enacted a number of statutes related to structural flood control methods. These statutes authorize state agencies, local governments and a series of special districts, to construct flood control works. Some of the special districts are simply intended to overlay existing political units of government. Other districts, such as the Conservancy District, can constitute special multi-county taxing units for flood control purposes.

The 1945 session of the Indiana General Assembly enacted a statute known as the Indiana Flood Control Act (I.C. 13-2-22). This act has two purposes, the first of which is to promote structural solutions to flooding problems in the state. The second purpose is to provide a mechanism for the control of encroachments (construction in floodways which would aggravate flooding problems by impeding the passage of flood water). This act has since been broadened to include consideration of non-structural methods.

The Flood Control Revolving Fund was created in 1959 (I.C. 13-2-23) for the purpose of providing low interest loans to cities, towns, counties and special taxing districts for the implementation of flood control projects. The amount of any outstanding loan to any one municipality is limited to \$100,000. By virtue of the amount of the fund (\$2 million) and the maximum loan limitation, the program is oriented toward small projects. This is exacerbated by the substantial increases in project costs since the program was initiated in 1959.

The most common structural flood control facility in the state is the private agricultural levee. These levees are constructed by individual farmers or by groups of farmers acting in concert. They are quite common along the wide, productive floodplains of the Wabash River, the East and the West Forks of the White River, the Eel River in Clay County and the Blue River in Shelby County. The most extensive system of private levees lies along the Kankakee and Yellow Rivers in northwestern Indiana. These levees were originally built as spoil banks when these rivers were dredged in the period between 1890 and 1916. Some of these spoil banks have been properly maintained while others have been allowed to deteriorate to the point of ineffectiveness. Private levees range in effectiveness from very well designed, well maintained structures to ineffective spoil banks. Usually, these projects are capable of providing protection only from smaller floods.

A number of cities and towns in Indiana have constructed some type of works for flood control within their borders. The Eagle Creek project in Indianapolis is the outstanding example of such a facility. In some cases, cities have taken over the maintenance of old levees built under the Works Progress Administration or other depression era agencies. The protective works constructed by cities and towns range in effectiveness from very good and well maintained to poorly maintained and dangerous structures. Again, one of the most serious problems associated with these structures is the public perception that they prevent all flooding.

Problems With Structural Programs Public support for structural flood control projects is usually in the form of reaction to disaster, at which time "instant" solutions are preferred. The public is generally apathetic to predisaster planning and development of flood control projects.

An examination of the current status of federal structural flood control programs in the state reveals that, by and large, they no longer receive general public support. Thus, the major structural programs of both the U.S. Corps of Engineers and the Soil Conservation Service of the U.S. Department of Agriculture are at a virtual standstill for the indefinite future. This situation stems from a number of causes, including the extensive "red tape" and long planning times involved, rapidly increasing costs, the general aversion to the acquisition of large amounts of land, and either real or supposed environmental impacts.

Another problem in Indiana is the lack of a coordinated comprehensive plan for flood control works and programs. While there were a number of regional planning efforts in the past two decades, they have largely been conducted by federal agencies and usually consist of a list of projects that might be built under then-existing federal authorities, criteria, rules and regulations. The state has never developed a plan which would focus on relative needs and priorities from the state's perspective, even though such a plan was authorized in the 1945 Flood Control Act. The lack of such a plan has also inhibited the coordination of the construction of flood control facilities.

Probably the most serious problem affecting the construction of flood control facilities in Indiana is the lack of funds. This is undoubtedly due in substantial measure to the perceived priority for such projects in comparison to other funding needs. Structural flood control projects have also been plagued by rapidly escalating construction costs, as well as those for lands and rights of way. Long extended planning periods tend to aggravate these cost pressures.

Non-Structural Methods

The non-structural approaches to flood control all involve the imposition of some form of restrictive land use controls intended to prevent urbanization of floodplains. By implication, the use of these methods implies that society is unwilling to accept the levels of economic and social damage resulting from the urbanization of floodplains. Examples of restrictive ordinances include floodway encroachment statutes, building codes, subdivision ordinances, zoning ordinances, and the restrictive land use controls built into the National Flood Insurance Program.

The National Flood Insurance Program has, for all practical purposes, a basic requirement which forces communities to engage in some form of floodplain zoning. Perhaps ten percent of the floodplains in Indiana are now regulated by ordinances passed as a result of this national program. The National Flood Insurance Program has created a situation where local officials can no longer ignore flooding problems in their zoning ordinances. The program also represents a public classification of flood prone lands.

Indiana planning and zoning legislation dates back to 1947. Local communities are permitted, but not required, to place restrictions on developments within their boundaries if they so choose. These communities may give special consideration to floodplains but are not required to do so.

The 1973 Flood Plain Management Act (I.C. 13-2-22.5) established minimum standards for all local floodplain zoning ordinances in Indiana. All communities adopting such ordinances after July 1, 1974, must meet the minimum standards promulgated by the Natural Resources Commission. This law assures that floodplain land use restrictions will be consistent from community to community.

The state encroachment control program under the 1945 Flood Control Act is generally considered to be successful in regulating potential encroachments caused by construction of major public and private works, largely because of the fact that the sponsors of such works are familiar and generally supportive of the law. The program has been much less successful in regulating encroachments by private individuals on private property. This is probably due to widespread public ignorance of the law and a lack of precise delineation of the land subject to regulation.

Problems With Non-Structural Methods The effectiveness of local land use restrictions varies from effective tightly run programs to "paper only" programs. In many smaller communities, floodplains are not under development pressures. In some of the larger communities, many flood prone areas are already highly developed, and the zoning ordinances have little practical effect.

The Indiana Flood Control Act contains some awkward and almost unworkable conditions with regard to the public identification of floodways and also has some severe restrictions on habitation in such areas. Local resistance to land use regulations has kept some local ordinances very weak or poorly enforced. In some cases, this local resistance has prevented the adoption of ordinances altogether. The National Insurance Program also has a tendency to present itself as an insurance program and hence to deemphasize effective land use regulations.

CONTROL OF SEDIMENT

Erosion is a process whereby minute particles of soil are carried from their original position by either wind or water. Runoff from land carries these small particles into streams. This is a natural and continuous process.

Because excessive erosion is caused by poor land use, it follows that the solution to excessive erosion is proper land management. Such practices as contour plowing, grassed terraces, minimal tillage and the control of erosion at construction sites can all be used to reduce erosion to reasonable levels.

Problems With Current Sediment Control Programs A limited amount of federal assistance is currently available through the state and federal Agricultural Conservation Practices Program for farmers to undertake land use practices to help control erosion. These funds are available on a first come-first served basis and are not concentrated in areas where excessive erosion problems can occur.

A limited number of urban areas have adopted and enforced ordinances which regulate erosion control practices at construction sites, but most construction takes place in areas not covered by such ordinances.

POST-DISASTER ASSISTANCE

Post-disaster assistance usually involves two distinct stages. The first stage consists of emergency action to provide food, shelter and clothing to flood victims and assistance to restore essential public services such as utilities, hospitals and transportation facilities. The second stage involves a series of loans and grants used to restore the impacted area to its former economic viability.

Under current conditions, post-disaster assistance usually involves the expenditure of a certain amount of federal funds in an area which has been stricken by disaster. Ample amounts of money are usually available to provide emergency food and shelter for disaster victims, and to quickly restore essential public services such as streets and utilities. In the longer term, disaster assistance takes the place of individual grants and loans to affected businesses and homeowners. The object is to make the victim "whole", or restore him to his original pre-disaster condition. The problem with the federal assistance program is the tendency to make the victim "whole" again in the floodplain that caused the problem in the first place. However, this does not apply to the restoration of the agricultural productivity of farm land.

DISCUSSION AND CONCLUSIONS

The Commission examined information on the extent of productive floodplain lands subject to periodic flooding, the approximate 238 Indiana communities subject to some degree of flood hazard, and the very substantial level of average annual flood damages sustained in the state, together with the hazard of the loss of life during flood events. The Commission concludes that Indiana does have flood problems of substantial magnitude that impact upon the state and its economy, public health and welfare. It is further concluded that these problems warrant the continued and expanded involvement of both the public and private sectors.

The Commission recognizes that it is neither physically, technically nor financially possible to eliminate all flooding in the state. It further recognizes that there is no universal panacea or ready made solution for those problem areas where

action is warranted. Thus, while there are advocates of reservoirs, levees and channelization on the one hand, and equally fervent advocates of non-structural methods on the other, the appropriate solutions are highly site specific and will most often be found to be some mix of structural and non-structural methods. It is deemed essential that the public policy maintain the various options that may be needed in specific cases.

It is desirable to consider the flood situation from two major perspectives, namely: 1) from the standpoint of actions designed to prevent the creation of new flood problems; and 2) from the standpoint of actions designed to alleviate flood damages in existing problem areas, where feasible. With respect to the first of these perspectives, the Commission finds that, in general, the public policy, the institutional mechanisms and the technical information needed to accomplish this objective are available. The major element for concern is the lack of public support necessary to execute the programs on a long term continuing basis.

This objective can and will only be attained through the implementation and continued administration of land use controls in areas subject to flooding. Under the present system, floodplains and floodways are delineated by the state (or by others subject to state approval). The state retains primary jurisdiction over all construction within the designated floodway with respect to the impacts of such construction on the efficiency and capacity of the floodway and on fish, wildlife and botanical resources. The jurisdiction is retained because the effects of construction may well extend beyond the boundaries of local zoning authorities and because of the high level of technical resources and expertise required for analysis of proposed projects. The local zoning authority exercises total jurisdiction in the floodplain area outside the floodway, while its jurisdiction within the floodway is also total except with the respect to the state's jurisdiction in the specific aspects outlined above. It is concluded that this system is appropriate and should be continued.

The Commission does find that the "due notice" provisions of that section of the Flood Control Act which authorizes the Natural Resources Commission to establish Commission Floodways (I.C. 13-2-22-14), as now interpreted, are so unwieldy as to seriously inhibit that provision of the Act. Implementation of this section of the Act would be particularly useful in that the public would have an effective means of knowing precisely what areas are deemed to be floodways and thereby subject to regulation.

The second perspective on floods relates to actions designed to alleviate existing problems, where feasible. The Commission finds that the development of a master plan for the control of floods, authorized in the Flood Control Act, would serve a useful function in providing a comprehensive overview of the several flood problem areas in the state; a general analysis of the nature and causes of the problems; an evaluation of their relative severity and hazard; and an indication of the most probable feasible and cost-effective solutions, considering both structural and non-structural alternatives. Such a plan would serve both to define in detail the nature and extent of the flood problem, and to provide guidance as to priority of effort. The plan should be developed generally without regard to who or what agency should construct a project, but should provide that overall priority and guidance that would enable a variety of construction-agency options for specific projects which would fit within the overall plan.

The Commission has examined the Flood Control Revolving Fund loan program and concludes that it is a useful tool in providing assistance to local communities in solving local problems. The program suffers from a lack of having been kept current with the cost trends since its inception in 1959. There is need to substantially increase both the capital amount of the fund and the limitation on the maximum loan amount, together with the clarification of whether the loans may be used to pay project planning costs.

The remaining basic question is that of direct state construction of, or direct state grants for, flood control projects. In general, it might be stated that direct state construction of flood control projects should be limited to those which contribute to the solution of regional flood problems, with generally wide-spread benefits, and to those where state properties or direct state interests in other aspects of water resources are involved.

In general, it is concluded that opportunities for those projects that contribute to the solution of regional flood problems are somewhat limited and, in some cases (i.e., major reservoirs), are neither acceptable to the public nor within the reasonable financial capability of the state. Nevertheless, this possibility should not be totally excluded, especially pending completion of the master plan discussed previously.

With respect to the matter of direct state grants for local flood control projects, there have been, in recent years, some cases of direct legislative appropriations in response to local initiatives to the Department of Natural Resources for pass-through to designated local agencies for implementation of specific projects. To date, such projects have included levee repair, clearing and snagging, and the upgrading of urban levees. The pass-through agreement between the Department of Natural Resources and the local sponsor provides for state review and approval of the projects.

This process appears to be one which is satisfactory in its operation. First, the local initiative for financial assistance generally assures that sufficient local interest exists to assure that local costs and leadership to implement the project will be forthcoming. Secondly, the requisite action by the General Assembly assures that the project is in accordance with public policy and commands a degree of priority with available funds. Thirdly, the utilization of the Department of Natural Resources as the grant agency assures that the project will be coordinated with other water resources concerns, will not have unreasonable adverse impacts on other public interests, and will be environmentally acceptable.

This process would be enhanced by development of the master plan for flood control referred to earlier, in that it would provide the Administration and the General Assembly with better information as to overall needs and priorities.

RECOMMENDATIONS

Based upon the foregoing discussion and conclusions the Commission recommends:

- 1) That the existing policy of Indiana with respect to flood control, as expressed in the Indiana Flood Control Act (I.C. 13-2-22) and related statutes, continue to constitute the official public policy of the state.
- 2) That legislation be submitted to the General Assembly which would provide a more workable procedure for the "due notice" provisions of that portion of the Indiana Flood Control Act (I.C. 13-2-22-14) relating to the establishment of Commission floodways. It is proposed that "due notice" be patterned after that in existing zoning legislation; that is, by published legal notice, opportunity for public inspection of maps and other pertinent information, and public hearings.
- 3) That local zoning authorities should enact and maintain effective floodplain zoning ordinances.
- 4) That necessary financial resources be provided to the Department of Natural Resources for the development of a master plan for flood control in the state, to serve not only as a source of guidance and information for local efforts but, importantly, to provide information on relative priorities and needs for use in state and other programs for alleviation of flood hazards.
- 5) That the General Assembly amend the Flood Control Revolving Fund Act (I.C. 13-2-23) so as to increase the amount of the loan fund to approximately \$5 million; to raise the maximum loan amount to \$500,000; and to make planning costs an eligible item for loans.
- 6) That the direct construction of flood control projects by the state be handled on an individual case basis, being limited generally to those projects which either afford relief on a regional basis, provide protection to state properties, or in which flood control can be incorporated in other state water resource projects. It is suggested further that this policy be reexamined upon completion of the master flood control plan, when the relative scope, urgency and need for solutions to the problem on a statewide basis are more clearly apparent.

- 7) The relatively new practice of line-item appropriations by the General Assembly for specific local flood control projects through the Department of Natural Resources should be recognized and encouraged. The Department should be the overall coordinating agency to ensure that such projects are technically and environmentally sound. Completion of the previously recommended master plan for flood control would provide valuable guidance to the Administration and the General Assembly in acting upon such local funding requests.

- 8) That priority be given to those areas having high erosion potential in the disbursement of: a) any available state funds, b) the federal Agricultural Conservation Practices Program, and c) agricultural non-point pollution control programs.



Drainage



Drainage is defined as the removal of diffused surface water and excess ground water. The process of removing diffused surface water is known as *surface drainage*, while the removal of excess ground water from soils (most generally, from the root zone) is known as *subsurface drainage*. Many drainage systems are made up of both surface and subsurface drains.

The two fundamental types of drainage systems in Indiana are classified as *agricultural* and *urban*. As the name implies, the primary function of an agricultural drainage system is to remove excess water from both the surface and the soil itself so as to create and maintain favorable soil moisture conditions for plant growth. The urban drainage system is directed primarily toward the rapid and efficient removal of surface water to provide favorable conditions for residential, commercial, industrial and transportation activities. The three general categories of drainage problems are those relating to agricultural drainage, those relating to urban drainage, and those involving the agricultural and urban drainage interface.

AGRICULTURAL DRAINAGE

The general soil associations found in Indiana have been classified as to their soil wetness characteristics, as shown in Table 5.

TABLE 5
The wetness characteristics of Indiana soil associations.

Wetness Characteristics	Criteria	Number of Acres
Slight	Less than 30 out of every 100 acres need drainage	9,128,000
Moderate	30 to 69 out of every 100 acres need drainage	6,372,000
Severe	More than 70 out of every 100 acres need drainage	7,326,000

Approximately 60 percent of the soil associations possess moderate to severe wetness characteristics, and hence have a rather extensive need for drainage to maximize crop yields.

The legal authority for agricultural drainage works is the Indiana Drainage Code (I.C. 19-4-1), enacted in 1965. The Code provides for county drainage boards to be created in each county of the state to have jurisdiction over all *legal drains*.

A legal drain is a natural or artificial open channel or subsurface drain, or a combination of the two, that has been constructed or modified under the Indiana drainage statute. The county drainage board (county commissioners or appointed board) is responsible for construction, reconstruction, and maintenance of legal drains. More than 500 miles of legal drains have been constructed in each of thirty-five Indiana counties.

In addition to the drainage board, each county has an elected County Surveyor whose duties are to investigate, evaluate, and survey all legal drains and prepare reports, plans, and profiles necessary for proposed improvements. Furthermore, it is the duty of the county surveyor to classify all legal drains in the county as to whether they are in need of reconstruction or maintenance, or should be vacated. The drainage code also provides for the establishment of new legal drains.

If it is necessary to construct a legal drain in such a way that an owner of land is deprived of ingress or egress, the board will award damages to the owner in an amount equal to the cost of constructing a proper crossing. Private drains may be connected with legal drains if permission is granted by the county surveyor.

The Commission concludes that an adequate system of drainage is essential to maintain a high level of productivity on extensive areas of agricultural land in Indiana. It further concludes that the system of legal open drains, which are the major outlets for the mutual and tile drainage sub-systems, is essentially in place. That is to say that, on an overall basis, no major additions to the system in the way of new legal open drains is anticipated.

The Commission also concludes that the Indiana Drainage Code provides a reasonable institutional basis to accomplish drainage work at the local level *in an agricultural drainage area*. At the same time, the general public interest is recognized and considered through the review and approval process of the Stream Pollution Control Board (where appropriate) and of the Department of Natural Resources pursuant to the provisions of the Flood Control Act and the several laws relating to the public fresh water lakes.

However, the Commission recognizes the following problems related to agricultural drainage, namely:

- 1) The lack of general public recognition and acceptance of the essential role of adequate drainage;
- 2) The lack of adequate maintenance of the drainage system;

- 3) The lack of general recognition and acceptance of the fact that drainage is only one of a number of instream uses, and of consequent need for accomplishing the drainage function in a manner reasonably consistent with other uses and values, and;
- 4) The issue of who bears the additional financial costs of supporting the multiple uses of a drainage system.

These problems and issues and the conclusions of the Commission are discussed separately as follows:

Public Recognition

The Commission senses a wide disparity of public viewpoint as to the need for drainage works. These views seem to range from the idea on the one hand that drainage work, particularly stream "channelization", is so disruptive of other instream uses that it should be prohibited. At the other extreme, there is the view that drainage should be provided without regard to impacts on other uses and values.

As noted previously, the Commission concludes that the installation and proper maintenance of an adequate system of drainage is essential in vast areas of highly productive agricultural lands in Indiana. The value of agricultural production in human, social and economic terms is beyond debate, and it is clearly apparent that a very large proportion of Indiana's agricultural output is dependent upon adequate drainage.

The Commission therefore concludes that there is a need for all sectors of the public and of government to recognize and accept the role of drainage as essential to Indiana's well being.

Adequate Maintenance

The major components of Indiana's drainage systems, principally the legal open drains, are in place and relatively little expansion of that portion of the system may be reasonably anticipated. However, it is apparent that these existing systems are generally characterized by a lack of adequate maintenance. Cases where no significant maintenance has been done for long periods of time, ranging upward from twenty to fifty years, are by no means uncommon. When remedial work is finally undertaken, it is often of the nature of "major surgery", very costly, and possessing the potential for major conflicts with other instream uses. There is also, of course, the progressive deterioration and impairment of the drainage function over these long periods of time.

The Commission maintains that regular and continuing maintenance of drainage works, once installed, is in the best interest not only of the benefited lands, but of other instream uses as well. Moreover, such a program would serve

to greatly alleviate the magnitude and severity of environmental conflicts, as opposed to the past practice of major rehabilitation after long time intervals of little or no maintenance.

Multiple Uses for the Agricultural Drainage System

Given the necessity for drainage systems and for adequate and timely maintenance, there remains the goal of accomplishing the drainage function with due recognition of other instream uses. Many streams or legal drains (which in most cases were originally natural water courses) must serve multiple uses or functions, including drainage, water quality, fish and wildlife habitat and, in some cases, recreational uses such as boating.

The Commission recognizes that most of the major drainage systems were constructed in the latter 1800's and the early 1900's, when these other instream uses were a matter of little or no public interest or concern. Such is no longer the case. The Commission further recognizes that in cases of multiple uses, no single use, whatever its nature, can be ideally served. There must be some sacrifice or adjustment between all uses in order that all may be reasonably served. The Commission concludes that the drainage function can be provided and maintained, as appropriate to the particular case, in a reasonable manner through utilization of a number of practices. These include: 1) the practice of one-sided construction in the interest of providing cover for wildlife and shade to hold down water temperatures; 2) early and adequate revegetation of disturbed banks to reduce erosion and consequent sedimentation and provide wildlife cover; 3) the use of pipes or other erosion control structures to drop surface water into the drain; 4) provision of at least some minimum vegetated buffer strip along the disturbed bank in the interest of erosion control and wildlife cover; 5) the installation and periodic cleaning of sediment traps; and 6) where appropriate, the provision of fish pools for maintenance of the fishery during periods of low flow. It should be noted that some of these practices, notably those related to erosion and sediment control, accrue benefits directly to the drainage interests.

Cost Sharing for Multiple Uses of Agricultural Drains

The Commission, in concluding that maintenance and reconstruction of legal open drains should be accomplished with due regard for other instream uses, recognizes that additional costs will be incurred in implementing the necessary practices. It is to be noted that the fish and wildlife of Indiana have been declared a public resource by the Indiana General Assembly, and that recreational uses such as boating, fishing and swimming are public uses.

The Commission therefore concludes that, with respect to those legal open drains where the protection or enhancement of these public uses and resources are involved, the public should participate in the determination of the measures to be employed and in the costs of implementation.

URBAN DRAINAGE

The major objective in urban drainage is to remove diffused surface water rapidly and efficiently in the interest of preventing damage to, or disruption of, residential, commercial, industrial and transportation activities. Several characteristics of urban drainage are noteworthy. These are:

- 1) The large amount of impervious surfaces in urban areas results in a higher volume and rate of runoff from a given precipitation event than in rural areas.
- 2) Again, because of the presence of large amounts of impervious surfaces, surface runoff occurs more frequently than in rural areas. That is, precipitation events that are within the infiltration capacity of soils in rural areas will produce runoff from impervious urban areas.
- 3) The higher rates of runoff and the greater potential for economic loss require a higher drainage capacity in urban areas.

Physically, urban drainage systems vary widely as to type and degree of sophistication. The drainage system in a typical rural village may consist only of a network of ditches along the streets and roads, discharging into the nearest surface stream. At the other extreme, metropolitan areas may be characterized by several major storm drainage systems, comprised of a network of combined storm and sanitary sewers (as is almost universally the case for older areas) or of an independent system of storm sewers in more recently developed areas. A few of the newer installations include provisions for temporary detention storage in order to reduce the sewer capacity requirements and to reduce the load on the outlet system. Due to the frequent overloading and by-passing of wastewater treatment plants, combined sewer systems are no longer being constructed. In some areas, the old combined systems are being separated into component units.

The Commission concludes that the major problems of urban drainage are:

- 1) The older systems are generally of the combined sanitary sewer and storm water sewer type, resulting in frequent overloading and by-passing of the wastewater treatment plants and thereby causing water quality problems in the receiving streams;
- 2) The older systems (and, indeed, perhaps many of the new ones) do not have excess water removal capacities commensurate with the expectations of the public;
- 3) The capacity problems of the older systems are intensified by the continuing addition of storm drainage from newly developed areas;
- 4) Inadequate maintenance of the drainage systems, and;
- 5) Storm-sewer separation and the rehabilitation and enlargement of old systems is both disruptive and very expensive.

AGRICULTURAL - URBAN DRAINAGE INTERFACE

The agricultural and urban drainage systems interface in three general areas, namely: an agricultural drainage system may pass through an urban or urbanizing area; an urban drainage system may have an outlet into an agricultural drainage system, and in areas converted from rural to urban land use.

When an agricultural drain enters into or flows through an unincorporated urban area, the Drainage Code requires that all land owners who benefit from a legal drain pay the costs for its construction, reconstruction or maintenance. People in the developing area, who are generally non-farm land owners, perceive no benefit to themselves from the agricultural drain and, in addition, most generally feel that such costs to themselves, if paid at all, should be borne by some unit of government rather than by individual assessment. The Drainage Code provides for cities and towns to pay legal drain costs on behalf of all assessed owners.

When an agricultural drain serves as the outlet for an urban drainage system, the urban drain imposes a greater capacity requirement than that for which the agricultural drain was designed. In this case, it is the agricultural sector that objects to paying assessments for the costs of enlarging the drain capacity to accommodate urban drainage from which they derive no perceived benefit. The Drainage Code makes provision for a city or town to pay the costs of enlarging a legal drain to render it suitable as an outlet for urban drainage.

The third general interface occurs in those areas where a watershed is undergoing a conversion from agricultural to urban uses. The Drainage Code does provide for the special designation of *urban drain* in those cases where the watershed has been, or is being converted from rural to urban land use or where it is found that such a change is pending. In these cases, all the land within the watershed is considered to be benefited, although the question of whether a given tract is rural or urban is a factor in assessing benefits, and hence costs.

The Commission concludes that the Indiana Drainage Code recognizes the various agricultural-urban drainage interface problems and provides procedures in law for dealing with them.

RECOMMENDATIONS

Based upon the foregoing discussion, the Commission makes the following recommendations:

- 1) The policy of recognizing and accepting the vital role and value of adequate drainage systems, both agricultural and urban, should be the continuing policy of the State of Indiana and of its citizens and institutions of government.
- 2) The drainage systems should be properly maintained on a regular and continuing basis and the duty and responsibility for such maintenance should be recognized and implemented by those responsible.

- 3) The policy of the State of Indiana should include recognition of the value of both multiple instream uses and the drainage function. The construction, reconstruction, and maintenance of drainage systems should include suitable practices that promote compatibility with other instream uses.
- 4) The State of Indiana should establish and implement an information and education program designed to assist all interests in a better understanding of the problems and needs of both agricultural and urban drainage, to promote understanding and acceptance of the multiple instream uses of major drainage systems, and to promote regular and continuing maintenance of drainage systems while adopting and utilizing drainage practices and procedures that recognize and protect other instream uses.
- 5) There should be established in law the policy that those practices and procedures in the construction, reconstruction and maintenance of legal open drains necessary for the preservation or enhancement of the public interest for recreation and fish and wildlife, be paid for by the state. A continuing source of state funds and a suitable mechanism for implementation of that policy should be established.



Administration

In addition to analyzing the capability of the water resource to supply projected demands, and evaluating the effectiveness of the current management system to deal with current and potential problems associated with those demands, the Commission also evaluated the administration of the management system.

Based upon an analysis of the administrative structure and authorized personnel levels of both the Indiana State Board of Health and Department of Natural Resources, the Commission makes the following conclusions.


The existing administrative structure is generally adequate to carry out the Indiana water resource programs provided that the staff is maintained at the authorized levels. It is however, necessary to continually review and update these personnel requirements and perhaps shift existing personnel to more productive areas. Further, it will also be necessary from time to time to make certain adjustments in legislation to reflect changes in economic and social conditions, and, in some cases, to respond to federal mandates and programs.

Although the authorized staff levels are generally adequate to administer the programs at existing levels of activity, there are very substantial problems in recruiting and retaining the technical personnel necessary to maintain these staff levels.

These problems stem first and foremost from the lack of competitive salary scales. Secondly, there is a lack of opportunity for further education and training, a perceived lack of career advancement opportunities, and last but not least, a lack of an organized, vigorous and sustained recruitment effort on the part of the State's Personnel Division.

The Commission has collected and published a considerable body of data on the availability and current use patterns of the water resources of the state. This information provides an invaluable source of data for political and civic leaders, engineers, planners, farmers and others. There remains a large body of significant and useful water resource data that has not been compiled and made available for general use. There is definite need for systematic programs to compile and periodically publish data on such aspects of the water resource as surface and ground-water quality, surface and ground-water quantity, and flooding and drainage problems. The Commission therefore recommends that:

- 1) The proper authorities give priority attention to the problem of recruitment and retention of professional and technical staff through improvements in salaries, educational and career opportunities and in recruitment programs;
- 2) Adequate resources should be made available to the agencies for the collection, analysis, interpretation, and periodic publication of basic water resource data and information. Existing legislation that permits this collection and publication activity should be amended so that such activity is mandatory.



*Recommendations
For The Future:
A Summary*



Recommendations

The several recommendations of the Commission with respect to withdrawal and instream uses of water, flooding, drainage, and administration have been presented in the chapters of this report dealing with those subjects. They are reiterated here to present an overall view of their nature and scope for ease of reference.

INSTREAM AND WITHDRAWAL USES

- 1) The Commission recommends the creation of a water rights and use management statute that incorporates the following major principles and elements:
 - a) A determination and declaration that, based upon sound and accepted principles of natural laws and hydrology, the water resource of Indiana is in fact, and shall henceforth be regarded as, a single resource composed of the major interrelated elements of atmospheric moisture, precipitation, soil moisture, evapotranspiration, diffused surface water, water in lakes and water courses (surface water), and ground water; and that the said resource is both renewable and finite.
 - b) Recognition that the water resource of the state must serve a multiplicity of human, social and economic uses and needs; that specific uses and needs may, from time to time, either wax or wane; and that new uses and needs may vary both as to human, social and economic utility and their compatibility with one another.
 - c) Recognition that while short-term water resource availability is highly variable in both time and space as a result of natural factors, the overall long-term resource is adequate to meet the general spectrum of perceived human, social and economic uses and needs, *given proper planning and management.*

- d) Assertion that the economy and the general health, safety, and welfare of the people of Indiana require that the water resource of the state be utilized for beneficial purposes; that waste, non-beneficial use and degradation of the resource be prevented; and that the resource be utilized so as to provide the best possible accommodation and balance as among beneficial uses and needs, including multi-purpose use where feasible.
- e) An express declaration that the public policy of the State of Indiana is to manage, regulate, and control the water resource because: a) water is a natural and public resource; b) water plays an essential and pervasive role in the human, social and economic well-being of the people of Indiana; and c) it is of vital importance to the general health, safety and welfare of the people of Indiana.
- f) An assertion that the State of Indiana does not forfeit any responsibility for water rights and the management and regulation of the water resource within the boundaries of the state.
- g) Establish a state system of water use permits with the following major features:
 - 1- Full recognition of the rights of riparian owners and of the owners of overlying lands for domestic household uses and of the rights of capture and use of diffused surface water by land owners without a permit.
 - 2- Riparian owners and owners of overlying lands may, but shall not be required to, obtain a permit for non-domestic use on riparian or overlying land not to exceed 100,000 gallons-per-day.
 - 3- Any withdrawal, diversion, impoundment, or consumptive use of water of more than 100,000 gallons-per-day must have a prior water use permit from the state.
 - 4- The proposed use of water must be such as is necessary for economic and efficient utilization, not interfere with any existing legal use of water, and be consistent with the public interest.
 - 5- Define essential terms, including “watershed”, “watercourse”, “domestic use”, “riparian lands”, “overlying lands”, and “beneficial use”.
 - 6- That the state may permit the holder of a water use permit to take, transport, and use surface water beyond riparian land and beyond the watershed from which it is taken; and to take, transport and use ground water beyond overlying land and beyond the watershed in which the aquifer is located.
 - 7- That the issuance of a water use permit will be based upon full consideration of the overall public interest, including protection for the basin of origin and for instream flows and uses.