ILLINOIS RIVER BASIN ACTION PLAN

SPECIAL REPORT NO. 11

OF THE

ILLINOIS STATE WATER PLAN TASK FORCE

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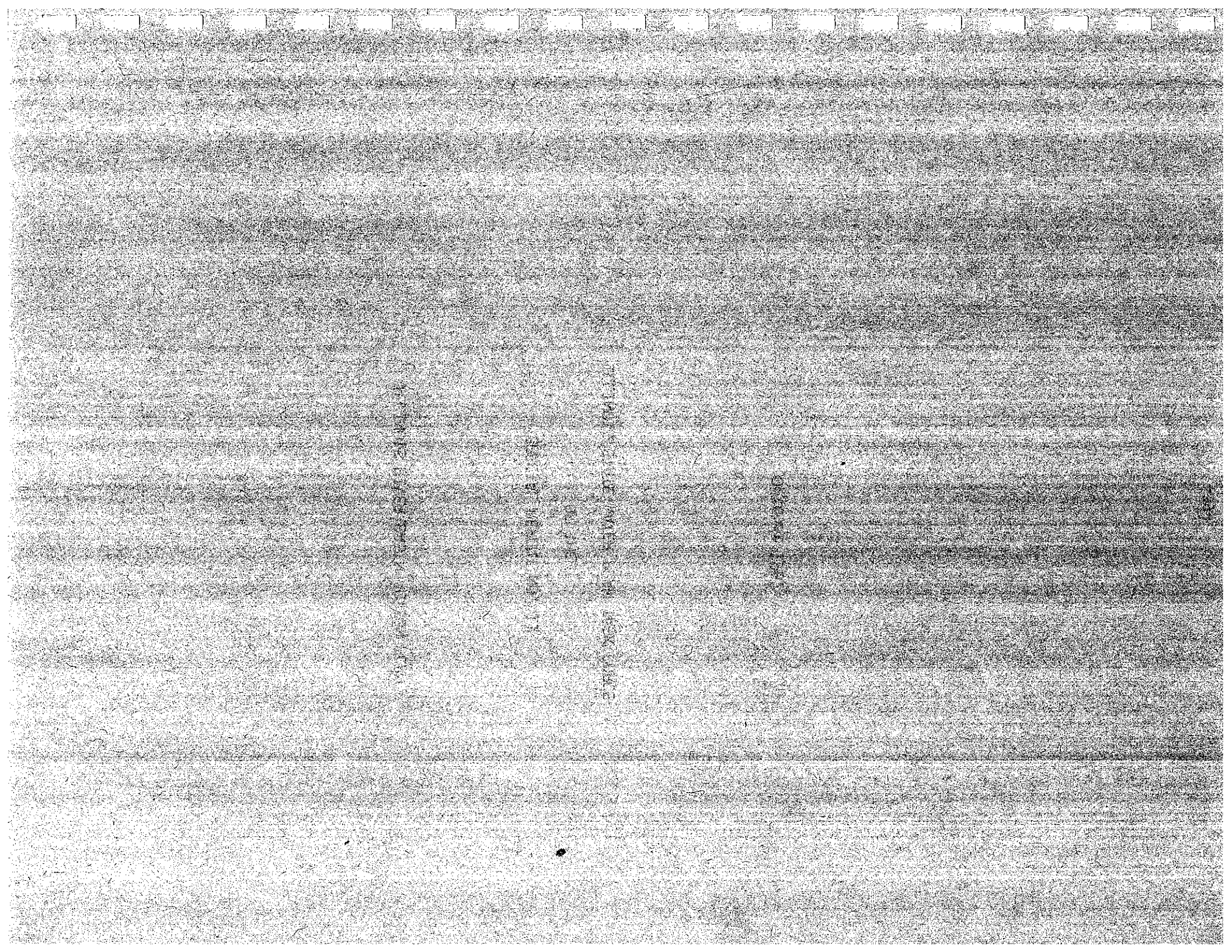

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ACTION PLAN INTRODUCTION

This is a report from Illinois State agencies operating through the Water Plan Task Force. It deals with management of the Illinois River and its watershed, and it responds to grass-roots concerns for the basin, as expressed by an April 1-3, 1987 conference and its published proceedings.

This report summarizes the expressed problems and priorities of the April conference as reported in the Proceedings "Management of the Illinois River System: The 1990's and Beyond", as well as sponsorship and planning events leading to the conference. The conference was also designated "A Governor's Conference", and Governor Thompson attended on the first day and cruised Peoria Lake. It was also announced that the Governor had requested the State Water Plan Task Force to review the Conference Proceedings and prepare a recommended action plan.

The body of this report consists of 16 issue papers covering the important topics of concern. These constitute the requested action program of solutions in response to the concerns raised at the April conference.

An Executive Summary of the report is intended for widespread public circulation for information and as a basis for discussion leading to refinement of the proposed action programs.

Governor's Conference on Illinois River Management

An indication of the widespread concern for future management of the Illinois River and its watershed is that the Governor's Conference in Peoria on April 1-3, 1987 was sponsored by more than 50 organizations. These represented local, regional, state, and federal agencies; a wide variety of resource and environmental organizations; and industries.

Planning for the conference began with a meeting of representatives from 34 organizations who met on September 12, 1986. A planning committee of 22 people met on several occasions to develop and formalize the program.

Approximately 250 people attended the conference in Peoria on April 1-3, 1987. The conference was divided into three subject areas dealing with (a) physical and engineering aspects, (b) natural resources and biological, and (c) economic aspects. Within each of the subject areas state of the art papers were followed by discussions in 11 workshop groups. Each of the workshops under a chairman and reporter sought a consensus on the problems and their relative priorities. Possible solutions were also identified.

Welcomes and Keynote Addresses

The conference was opened by Dr. Glenn E. Stout, Director of the University of Illinois Water Resources Center and Conference Chairman, who outlined the nature of the meeting. The mayor of Peoria and the chairwoman of the Peoria County Board welcomed the participants and pledged their support in working toward solutions of the water resource management problems of the basin.

The first keynote speaker drew upon historical and global examples to illustrate the consequences of neglect of adequate water resources management with emphasis on erosion and sedimentation. He stated that scientists, engineers, and the political leaders know the problems and a range of solutions, but are uncertain of priorities with respect to the numerous other problems of society.

The second keynote speaker is Director of the Center for Research in Water Resources at the University of Texas. He drew upon experience with active state leadership in programs for Texas, and emphasized the importance of coordination. He stated that "Texas has learned to give more attention to improved management of its existing water supplies. It is apparent that more benefit can accrue from existing water resources than many have thought possible."

The final keynote speaker was from the Office of the Assistant Secretary for Water and Science in the U.S. Department of the Interior. She spoke of the trend away from centralized government in Washington toward increased emphasis on state and local authority and responsibility. She reviewed recent legislation and current cost sharing. She also spoke of integrated systems management and illustrated this with an example of innovative water management. She concluded by saying that "it is especially auspicious" that the present conference grew from leadership at the local level.

A Historical Background on the Illinois River

A number of speakers began with a geological, engineering, or ecological background to their paper. Actually such background knowledge is essential to an understanding of the complex problems of the Illinois River and its watershed.

A concise background statement follows as taken from the abstract of the conference paper by Dr. Stephen P. Havera of the Illinois Natural History Survey.

> Historically, the Illinois River was one of the most productive rivers in North America, its fish and wildlife populations virtually unequaled. Today, even after experiencing drastic changes brought about by human intervention, the Illinois River remains our state's most important river system. Its basin and tributaries total 32,081 square miles and include over half of the area of

Illinois as well as parts of Wisconsin and Indiana. Accordingly, the Illinois River is affected by and affects the majority of our state's citizens.

Five major changes have been imposed by our society on the Illinois River system since the turn of the century. An appreciable volume of water diverted from Lake Michigan entered the Illinois River in 1900 when the Sanitary and Ship Canal was opened at Chicago. Shortly thereafter, vast quantities of untreated domestic sewage and industrial wastes from Chicago were flushed through the Canal into the Illinois River and away from Lake Michigan, a source of the city's water. Thirty-eight organized drainage and levee districts and three private levees were developed for agricultural purposes between 1902 and 1929, and they greatly modified the hydrology and landscape of the valley. Six dams--five along the Illinois and another below its mouth at Alton on the Mississippi--were constructed during the 1930's to create a channel 9 feet in depth for commercial navigation. In recent decades, sedimentation has dramatically affected the river and its adjacent waters.

Sedimentation, today's major pollutant of our nation's agricultural waterways, is the primary obstacle in preserving some semblance of the historic Illinois River for future generations. Restoration of portions of the river valley by reclaiming selected drainage and levee districts is one plausible approach; however, any alternative must be accompanied by a land-use policy that is both economically sound and ecologically intelligent.

Physical and Engineering Aspects

The following sections continue the summary of inputs from papers and discussion at the Peoria Conference. Emphasis in these summaries is placed on those problems of greatest perceived severity.

Commercial Navigation - The State of Illinois offers a distinct geographic and economic advantage to shippers due to its midwest location at the confluence of the Great Lakes and the inland waterway system. Therefore, the subject is of great importance, yet it does not constitute a major problem calling for immediate action programs to correct serious problems. It is also true that although state and local governments have roles to play, considerable responsibility for the management of commercial navigation resides with the federal government.

Management of the Illinois River system requires an understanding of barges, fleeting, and tows; the role of ports, dams, and locks; and the economics of navigation and competing rail and truck transportation.

Perhaps of greatest importance is the necessity to operate the navigation mode in harmony with other resource values of the river so that environmental values are maintained.

Lake Michigan Diversion - High water levels on the Great Lakes with widespread flooding and shoreline erosion and damage has again renewed interest in increasing the diversion from Lake Michigan to the Illinois River among other possible responses. The International Joint Commission is currently studying these options.

Most readers are familiar in a general way with the long history of diversion into the Illinois River which currently is limited to an average of 3200 cubic feet per second (cfs). Any modification in this rate will require a change in the current U.S. Supreme Court order or an Act of Congress.

The most recent information on the impacts to Lake Michigan and the Illinois River is a 5-year Corps of Engineers study completed about 1981. It concluded that during a dry year diversion could be increased to approximately 8700 cfs on an annual average basis, while during a wet year the increased diversion would be only about 5000 cfs.

It is the opinion of the Division of Water Resources that any federal legislation calling for an increased diversion at Chicago should contain the following key elements:

1. Any authorization for an increased diversion at Chicago should be part of a recommended plan of action between Canada and the U.S.

2. The recommended plan of action should include all existing control measures which can be used to reduce water levels on the Great Lakes. This includes not only an increased diversion at Chicago but also stopping or curtailing the diversion of water into Lake Superior at Long Lake and Ogoki, maximizing flows out of the Niagara River and the Welland Canal, including increasing the flows to the Black Rock Lock during the non-navigation season.

3. The recommended plan of action should be implemented only during periods of high lake levels.

It is too early to predict what Congress might do in response to the problem of high water levels on the Great Lakes. The International Joint Commission is expected to complete an interim report this August on existing measures which can be implemented to reduce the adverse consequences of high water levels. Included in their report will be a discussion on increasing Illinois' diversion. One of our most important tasks is to continue to collect information on the potential impacts of an increased diversion and to work with the Corps of Engineers in drafting a revised operating plan so that if an increased diversion is authorized, Illinois' interests are adequately protected.

River Forecasting - It is clear that efficient management of all aspects of the Illinois River system requires advance knowledge of flow conditions. This is termed river forecasting, which involves the application of numerous precipitation and river measurements in a hydrologic model. Usually it is possible to produce accurate forecasts for 24 hours in advance, and accuracy declines for longer periods with little ability beyond about three days.

River forecasting is the responsibility of the National Weather service. For the Illinois basin hydrologic data from manual and remote observations are collected through their offices at Peoria, Springfield, and Chicago. The office at Chicago is responsible for issuing river warnings and statements for public release, but it receives guidance from the River Forecast Center at Minneapolis where the actual forecasts are produced.

River forecasting for the Illinois River is not easy because of the large basin size and variability. The slopes vary from flat to rolling, and the land use from urban to cultivated and forested. For these and other reasons the forecasts have at times been less precise than desirable or possible. Improving the forecasts through enlarged data networks or greater agency attention may be a problem to consider.

The Flooding Problems - Discussion at the April Conference confirmed that flooding remains a serious problem in the Illinois River basin. Since 1978, the Illinois River has flooded at least once a year, and was severe enough to be declared a disaster area in two or more counties in 1979, 1982, 1983, 1985, and 1986.

Flood insurance claims paid since 1978 exceed $26 million. From this it is estimated that federal and state disaster assistance was $50 million. Adding the cost of lost business and other expenses brings the cost of Illinois River flooding during the period 1978-1985 to over $200 million or more than $25 million per year.

The available approaches to reducing flood losses are well known and were described to the conference attendees. These approaches are outlined briefly in the following paragraphs.

Flood control measures keep water from getting to damageable property. They are often called "structural" measures because they involve construction of man-made structures such as levees and floodwalls, reservoirs and detention basins, channel improvements, control gates and back-up valves, and terracing and runoff controls. Each has its advantages and disadvantages and appropriate applications.

Rather than keeping water off the land, property protection measures modify the buildings exposed to damage. Included in this category are building relocation or acquisition, raising a building, or floodproofing by sealing the walls and closing all openings. Included in this category is flood insurance, which although it does not reduce flooding, does help the flood victim.

Emergency services are primarily to protect people, and include flood warning, sandbagging, evacuation and rescue, and public health and safety maintenance.

Floodplain management measures focus on the future, and are designed to keep the problems from getting worse by ensuring that future development does not increase the flood damages. Usually included in this category are planning and zoning, development regulations, open space acquisition or easements, stormwater system management, erosion and sediment control, and stream maintenance.

It seems clear that a full menu of alternative measures are available and administrative procedures are clear. What seems necessary is a resolve on all levels to devote adequate resources to adopt and implement program to reduce the large, annual flood losses.

Chicago Region Impact - The greater Chicago area represents one of the largest urban centers in the United States, with a population of over five million people in an area of about 900 square miles. Obviously, such a population concentration and the attendant industrial and commercial enterprises require a complex and extensive water quality management program. It may be equally clear that even with extensive controls and treatment, the Chicago area location at the head of the basin, will have numerous impacts on the Illinois River downstream.

The principal water management agency in the Chicago area is the Metropolitan Sanitary District of Greater Chicago (MSDGC). Its actions over the past 100 years are cited here in the briefest fashion, but they have been so innovative, extensive, and effective that there appeared to be no division at the Peoria conference between upstream and downstream interests. A more complete accounting of the MSDGC history and activities is contained in the Proceedings of the conference.

The District was created in 1889 to protect the source of the city of Chicago's drinking water which is Lake Michigan. Although earlier steps were taken, reversal of the Chicago River to dilute the waste load and direct it down the Illinois waterway in 1900 was an early and truly major feat. Through the subsequent years congressional and court actions resulted in changed diversion and dilution, and the level of waste treatment continued to be improved. Today, the diversion is limited to 3200 cfs, and sewage receives at least secondary treatment. The District maintains programs of stream aeration, land disposal of removed solids, and control of industrial waste.

A major problem of the Chicago area has resulted from the combined sewers. During storm periods runoff mixed with untreated sewage frequently exceeded the system capacity, resulting in both basement and local street flooding. Excessive storm flows require the release of polluted waters to Lake Michigan, threatening the water supply and bathing beaches. A solution to this problem is being implemented in the Tunnel and Reservoir Plan (TARP). When completed, this tunnel system of

110 miles, with pipe diameters of 13 to 33 feet which is 240 to 300 feet below ground will intercept, transport, and store the combined flows so that they can be treated before release.

TARP was divided into two phases of which the first phase will reduce the BOD load by approximately 85 percent, and Phase II by 99.8 percent. Phase I will reduce floodwater damage by 10 to 15 percent and Phase II by about 65 percent.

The MSDGC maintains an extensive system of monitoring on the waterways and Lake Michigan. It conducts a considerable program of research to find ways of improving its treatment and other programs.

Natural Resources and Biological Aspects

The Illinois Department of Conservation is a major agency in the natural resources and biological areas. Its mission is to protect and manage the State's natural resources and provide outdoor recreation opportunities. The Department has major interests in the Illinois basin which contains some of the State's most productive fish and wildlife habitats and important outdoor recreation assets. It manages 29 separate properties along the Illinois River encompassing over 70,000 acres of land.

The Departments' interest extends beyond the land it manages to problems of water pollution, erosion, and land use which influence the overall environment. It is conducting an inventory of wetlands, and it supports research on such problems as streambank erosion and aquatic vegetated areas to decrease shoreline erosion.

Fish and Wildlife - Aside from aesthetic values of fish and wildlife, there are important economic considerations. The Illinois River and its backwaters provide about 2.1 million angling days. Based on an average of $12 spent by fishermen per day this amounts to $25.2 million annually. In 1985 over 1.0 million pounds of carp, buffalo, catfish, drum and other commercial species were harvested from the Illinois River with a wholesale value of $276,000. In addition, 741 tons of mussels worth $402,000 were taken.

Hunting and trapping also contribute to the Illinois River economy. Peak fall migrations often exceed one million ducks on the River. It is estimated that waterfowl hunters expended a total of $4.6 million in 1985. Deer hunters in counties along the Illinois River spent an estimated $2.6 million. Small game hunters spent $6.8 million. The value of furs is estimated at $800,000 for the 1984-85 season.

Thus the Illinois River continues to be a valuable economic resource despite the number of negative impacts to water quality. Of these, excessive siltation has been termed the number one pollution problem. Suspended silt affects the ability of bass, bluegill, and crappie to feed. Deposited silt also smothers fish eggs in the spawning habitat.

The erosion problems which produce silt will be discussed separately. In addition to silt the river is impacted by a variety of industrial pollutants, and by municipal sewage which can reduce oxygen levels and cause fish kills. Agricultural chemicals, both fertilizers and pesticides have caused a variety of problems.

Water Quality - Many will be surprised to learn that on an organic waste load basis, the Illinois is in the best condition of more than 100 years. Carbonaceous waste loads have been reduced 91 percent since 1922, and in the Peoria area there has been a 97 percent reduction in organic waste discharges since 1925. This has been achieved by municipal and industrial treatment, particularly during the past 15 years. Reductions in the Chicago region through treatment and the TARP program are particularly notable.

Reductions in the organic loadings result in improved levels of dissolved oxygen (DO) which raises the aesthetic quality and the environment for desirable aquatic life. The DO's in the upper waterway above Peoria have increased steadily from near zero conditions in 1922 to values persistently above 5 mg/l presently. Some undesirably low concentrations occasionally occur in localized areas and near zero levels often occur above Lockport, but overall, a tremendous improvement as been evident.

The potential for further reductions in organic waste loads is limited. Therefore, physical factors which influence DO will have greater influence. These include such possible steps as increased Lake Michigan diversion, hydropower development, increased dam aeration with gates, and increased pool elevations.

Soil Erosion - A number of Illinois River management problems point to erosion and siltation as a serious problem. The nature and source of the erosion problem is documented in the Proceedings of the Peoria Conference and in various other sources. It is established that the bulk of erosion products is from crop land in the form of sheet, rill, and gully erosion. A variety of means for reduction of erosion are available through conservation methods. Streambank erosion has more recently come to be recognized as an important source of erosion products at least in some areas. Methods for control of streambank erosion have been suggested.

Active erosion control programs date back to about 1934, but progress has been slow. Currently, programs for the Illinois basin are striving to reach "T by 2000". These are levels of soil loss that can be permitted but still maintain long-term productivity of the soil resource. Such levels would also eliminate many of the off-site problems which have been cited. Unfortunately, mid-course checks indicate that the programs to achieve T by 2000 are behind schedule.

Innovative Ideas for Water Management - In contrast to conventional approaches to waste treatment and discharge of drainage and flood waters,

closed systems are proposed by some. Used water can be sent through the natural cleansing systems of soil, plants, air and sunshine for reclamation and reuse.

A closed land treatment system at a facility will typically include a gravity sewer collection system, deep aerated lagoon pretreatment, a storage lagoon, disinfection, irrigation of turf and landscaped areas during appropriate seasons, and monitoring wells.

Several examples of such closed systems which are located within the Illinois basin were described and discussed.

Demographic and Economic Aspects

Since the stream systems of the Chicago area form the headwaters of the Illinois River system, Cook County is included here among the 21 counties immediately adjacent to the Illinois River.

Population and Personal Income - With the 5,212,000 persons in Cook County the region contains 55 percent of the State's population. Cook County is nearly 100 percent urbanized, while Morgan, Tazewell, Peoria, La Salle, and Will counties are also heavily urbanized.

The region accounted for 56 percent of the State's total personal income, with the largest share in Cook County. Per capita personal income ranges from a high of $14,328 in Grundy County to a low of $9,409 in Schuyler County. These compare with a state average of $13,705.

Agriculture and Industry - The region is an important agricultural area with livestock receipts of $419,875,000 or 18 percent of the states' total. Crop receipts were $1,001,739,000 or 17 percent of the states' total.

The region is an important industrial area with about 58 percent of the construction and manufacturing employment of the state. Transportation and public utility employment is concentrated in the region with 64 percent of the state total. Wholesale, retail, finance, and service industries are also heavily concentrated in the region. Travel income is very significant in Cook, Tazewell, Peoria, La Salle and Will counties.

Peoria: A Model Development - Life in early Peoria was oriented to the river as settlers arrived and grain and other products were shipped. Great breweries and distilleries, as well as other industries prospered by the water. Eventually industrial growth virtually closed public access to the river.

In more recent times circumstances permitted the city of Peoria to acquire 37 acres of riverfront property with support from a state grant. Combined with other property the city now controls about 1 1/2 miles of land along the river.

A plan for the property was developed with three areas, one of which is to be a riverfront drive. Two separate areas are planned for high density use with office buildings and retail shops. Other areas will include green space and a marina.

It is of critical importance to the riverfront development that Lake Peoria remain an attractive and open body of water. If siltation were to convert the area to mud flats the reason for the development would be lost.

Priorities and Recommendations

The Peoria conference was structured so that each technical session presenting papers was followed by workshops divided into eleven groups. These were provided with a moderator and reporter, and the following four discussion topics:

1. List problems dealing with the management of the Illinois River.

2. Prioritize the above problems.

3. Which of these problems need immediate action.

4. Identify means to resolve these problems.

Dr. Bill Mathis of Bradley University carried out the heroic task of consolidating responses to the four questions from the eleven groups. For present purposes questions one and two can be combined to show a consensus of top priority problems as:

1. Soil erosion and siltation
2. Flooding
3. Lack of public awareness
4. Diversion of Lake Michigan

Some 33 additional problems were sufficiently discussed to be reported in the Proceedings. There was a consensus that all the top problems require immediate action. With regard to means to resolve these problems, attention was directed first to organizational frameworks. These included focused bodies varying from steering committees to an authority with taxing power. Demonstration projects by existing agencies and strong leadership from the Governor's office were asked.

As to the question of who pays the bill, opinions included taxes at all levels of government, user fees, tax incentives, and cost sharing.

Recommendations - The statement of recommendations suggested by the conference leadership is brief, and is repeated here in its entirety:

1. The formation of a post-conference advocacy committee to set goals, objectives, determine a time frame for action,

and attempt to estimate costs. This committee would also maintain contact with regional planning commissions and with those legislators that were present at the conference and offer suggestions for legislative action through them.

2. Interact closely with state and federal agencies that deal with the management of the Illinois River Systems and its environmental condition, e.g. Illinois Environmental Protection Agency, Department of Energy and Natural Resources, Department of Conservation, Department of Agriculture, Department of Transportation, Corps of Engineers, U.S. Geological Survey, etc.

3. Organize an annual event to exchange information on solving problems, but choosing the site of the meeting at other prominent cities of places along the river, e.g. Joliet, Starved Rock, Havana, Beardstown, Pere Marquette State Park, etc.

4. Continue to focus media attention on the Illinois River system.

SEDIMENTATION

INTRODUCTION

Erosion and sedimentation are natural processes that can be neither stopped nor eliminated. Human interventions can and will accelerate both of these processes, resulting in diminished capacity and use of the receiving bodies of water. These processes are impacting all the rivers and streams in Illinois, including the Illinois River. The lower portion of the Illinois River from above Henry to Grafton, Illinois, occupies a valley that was the home of the Mississippi River before the Wisconsinan glaciation occurred. This former Mississippi valley inherited by the Illinois River was broadened and deepened by the pre-Wisconsinan glacial melts, which had substantially larger flows than the present flow of the Illinois River. Thus the normal flows of the Illinois were unable to transport all the sediment delivered to the river by its tributaries. Because of this altered morphology associated with glacial sediment deposits within the large valley, accelerated sediment deposition occurred all along the Illinois River, especially within the reaches of the river from Peoria Pool to the river mouth near Grafton. The gradient of the river at this location is extremely small (0.17 ft per mile), which also accelerates the deposition of sediment on the river bottom.

In addition to these natural events and morphology, human interventions have also accelerated the sedimentation of the Illinois River valley. Early in the 1900s, the bottomland areas of the Illinois River were in fairly pristine condition. However, when the Sanitary and Ship Canal was opened in 1900 and Lake Michigan water was diverted through the Illinois Waterway, the structure and morphometry of the Illinois River changed permanently. This changed regime eventually increased the average water depths of the river, with an associated increase in sediment deposition within the floodplain areas. Moreover, during this early period (1909 to 1922) many drainage districts were formed, especially below Peoria Pool, and the river lost most of its floodplains to agriculture. Starting around the 1930s, locks and dams were constructed all along the river to maintain a minimum water depth of at least 9 feet. This human intervention again permanently altered the river-floodplain interactions. Many of the original marsh areas became open water areas, only to experience substantial sedimentation due to slack waters created by the dams. The open waters created by the dams thus started to fill with sediment, which initiated their destruction process. Moreover, starting around and after World War II, intense row cropping became the common practice, altering the land use and land cover of the Illinois River watershed. This change of land use substantially increased the gross erosion rate of the Illinois River watershed.

The Illinois River thus has experienced both natural and manmade constraints that have resulted in higher than average sedimentation rates. Almost all the alterations have been permanent in nature and are irreversible. Investigations and evaluations of these problems by researchers from the Illinois Department of Energy and Natural Resources have shown that the river has changed drastically but that some alternative solutions can be implemented to revitalize some sections and reaches of the river and its backwater lakes.

BACKGROUND

Sedimentation of the many backwater lakes, side channels, and sloughs along the Illinois Waterway has been a chronic problem for many years. Construction of hydraulic structures has increased this problem, especially in and around the backwater areas. Sedimentation of the waterways has been instrumental in transforming some of the reaches of the river from a lake-like appearance (because of locks and dams) to a fairly narrow and incised river-like appearance. Many other reaches of the river may attain this fate in the next 30 to 50 years if no drastic measures are taken.

Capacity losses of most of the manmade lakes in Illinois are shown in Figure 1. Capacity losses of some of the major lakes are also given in this histogram for comparative purposes. An examination of this figure shows that the majority of the manmade

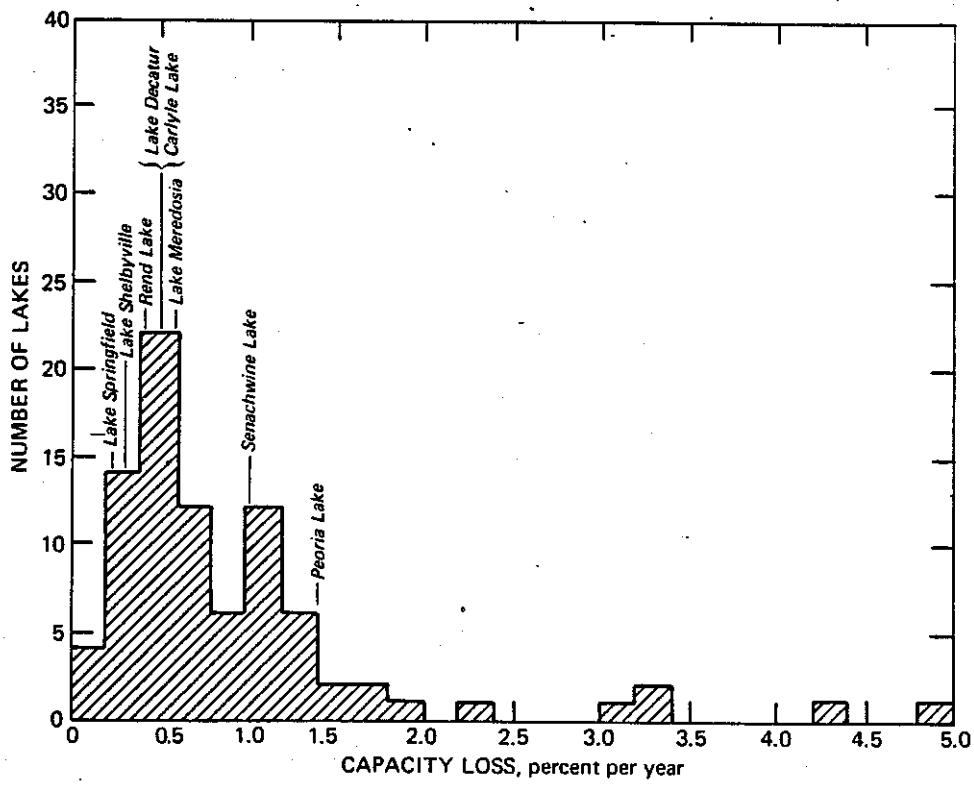


Figure 1. Capacity losses of Illinois lakes.

lakes in Illinois are losing their capacities at the rate of about 0.5 percent per year. However, the two backwater lakes (Lake Meredosia and Senachwine Lake) and Peoria Lake shown on this figure have substantially higher sedimentation rates than Illinois reservoirs. This observation is true for most of the backwater lakes along the Illinois River. Thus a general comparison between manmade lakes on the tributary streams and the backwater lakes is not always feasible even though the physical processes of the sedimentation are essentially identical.

For most backwater lakes with a distinct low-water connection to the Illinois River, the loss of capacity starts from the mouth of the lake near the connecting channel and then proceeds progressively toward the main water body of the lake. Such an example is shown in Figure 2 for Lake Meredosia. The distinct formation of a delta at the river-backwater interface is quite evident here, and it is suspected that the lake has lost much more capacity since this photograph was taken in 1968. Technology is now available to retard the sedimentation of such backwater lakes where a defined connecting channel is present.

Sedimentation of waterways reduces aquatic habitats, impedes the operation of commercial navigation and recreational traffic, constricts the conveyance channel, and transforms these water bodies into wetlands and mudflats. Many riverfront communities may ultimately face the prospect of losing their access to the water except through small dredged channels.

A number of research projects that have been completed by researchers from the Illinois Department of Energy and Natural Resources (ENR) and other agencies are now discussed.

ACTIVITIES, PROGRAMS, AND STUDIES

The three Illinois Scientific Surveys -- State Water Survey, Natural History Survey, and State Geological Survey -- have been active in studying and evaluating the Illinois Waterway for many years. Research has been conducted on bank erosion and erosion control, effects of navigation on resuspension and transport of sediment to the channel border areas and side channels, sedimentation of backwater lakes, sedimentation and potential solutions for Peoria Lake, sediment sources, and quality of the deposited sediment. Some of these research projects are still being carried out by ENR researchers.

Bank Erosion and Navigation Impacts

An evaluation of bank erosion of the Illinois River showed that at many locations the Illinois River has severe bank erosion problems. A detailed evaluation of 20 bank erosion reaches showed that the bank erosion is caused by the movement of water and actions of waves. These physical forces in conjunction with the geotechnical characteristics of the bank materials determine the amount and

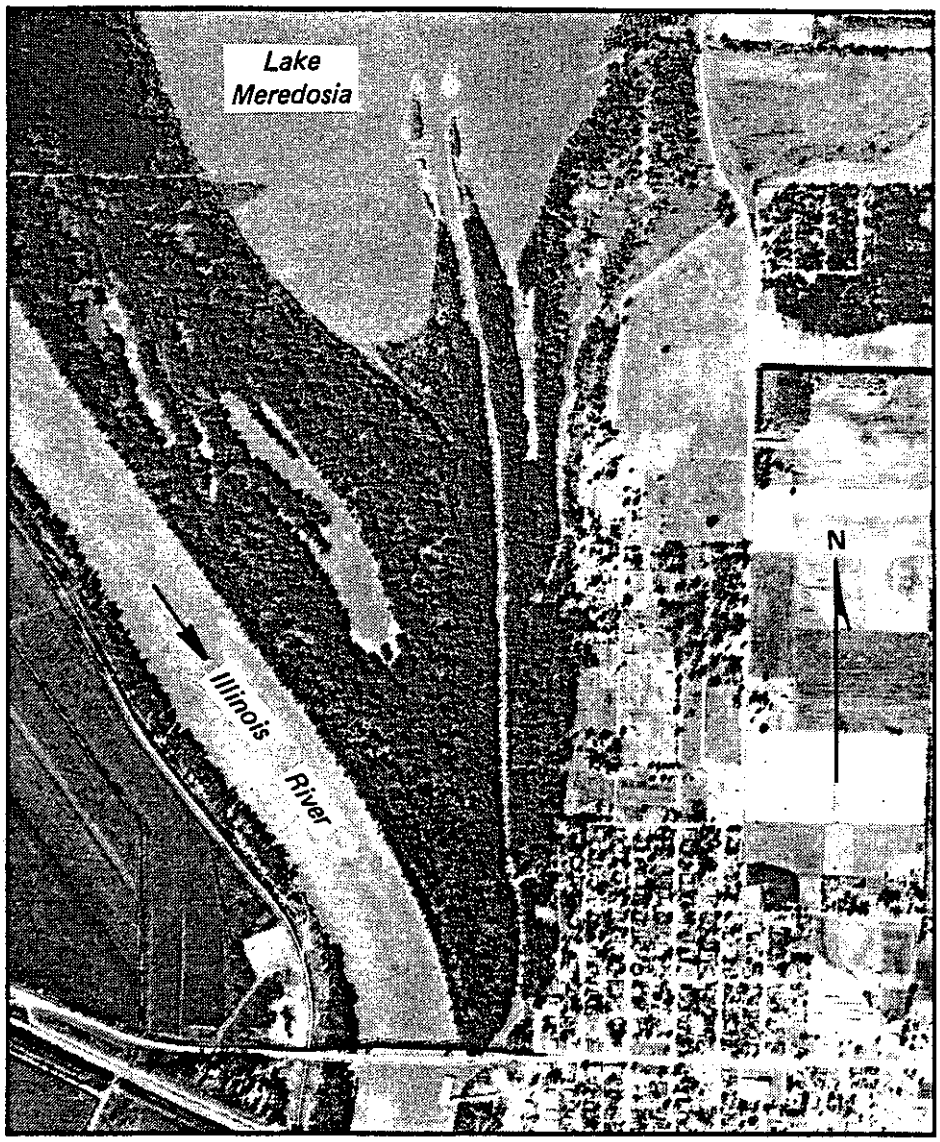


Figure 2. Mouth of Lake Meredosia at the Illinois River.

potential of bank erosion. It is estimated that about 70 to 75 percent of Illinois River banks are impacted by erosion caused partially by wave action.

Illinois State Water Survey researchers with the cooperation of the Department of Conservation and Department of Energy and Natural Resources are at present investigating low-cost bank stabilization techniques within the Court Creek and Crow Creek watersheds. Sediments and nutrients contributed by bank erosion to the total suspended loads of these creeks are being determined to evaluate the effectiveness of these low-cost streambank stabilization techniques.

The objectives of these projects are to reduce the bank erosion of small- to medium-sized tributary streams, which will ultimately have a cumulative impact on sediment delivery to larger streams and rivers. Restoration of vegetative covers and attendant increases in aquatic habitats in these stream corridors are other significant benefits of these streambank stabilization techniques.

In addition to the sediment that is normally carried to the side channels and backwater lakes by the flowing river water, the physical action of commercial navigational traffic also can resuspend and transport sediment in a lateral direction. Research has shown that the ambient sediment concentration of the Illinois River can be increased by as much as 10 to 15 percent by the repeated movement of barge traffic. Tow passages can maintain an increased suspended sediment concentration for as much as 60 to 90 minutes, and the effect of tow passages on the elevated sediment concentration is more pronounced near the channel border areas and in restricted channels, especially during low-flow periods.

Backwater Lakes

Sedimentation of backwater lakes was investigated by DENR researchers. Impacts of sedimentation on aquatic habitats along the Illinois River, sediment transported by the Illinois River, and sedimentation of Peoria Lake have also been investigated. As of 1975, there were approximately 53 backwater lakes along the Illinois River with a combined surface area of 54,173 acres. The locations of some of these backwater lakes are shown in Figure 3. Initial evaluation of the backwater lakes has shown that about 15.4 million tons of sediment are deposited over the entire floodplain of the Illinois River. Most of the backwater lakes experience an average depth loss of 0.1 to 1.0 inch per year.

Research results indicate that the sedimentation of the backwater lakes is not an isolated problem and that it extends all over the basin. Figure 4 shows some typical cross sections selected from seven backwater lakes along the Illinois River. These cross sections show that as of 1975 many of the backwater lakes had lost significant amounts of depth to sediment deposition. As of 1987, many of these cross sections are probably completely full of sediment. Cross section 3 for Lake Meredosia (Figure 4) is just outside of the delta shown in Figure 2.

Except for recent sedimentation data for Peoria Lake, no new data on the sedimentation rates of these backwater lakes have been collected since around 1979. However, an attempt was made on the basis of the old data to estimate the present capacity of 15 backwater lakes and bottomland areas of the waterway. These data are shown in Table 1. Apparently many of these bottomland basins may now be no more than broad mudflats with no appreciable water bodies. For all practical purposes, some of these lakes should no longer be called backwater lakes.

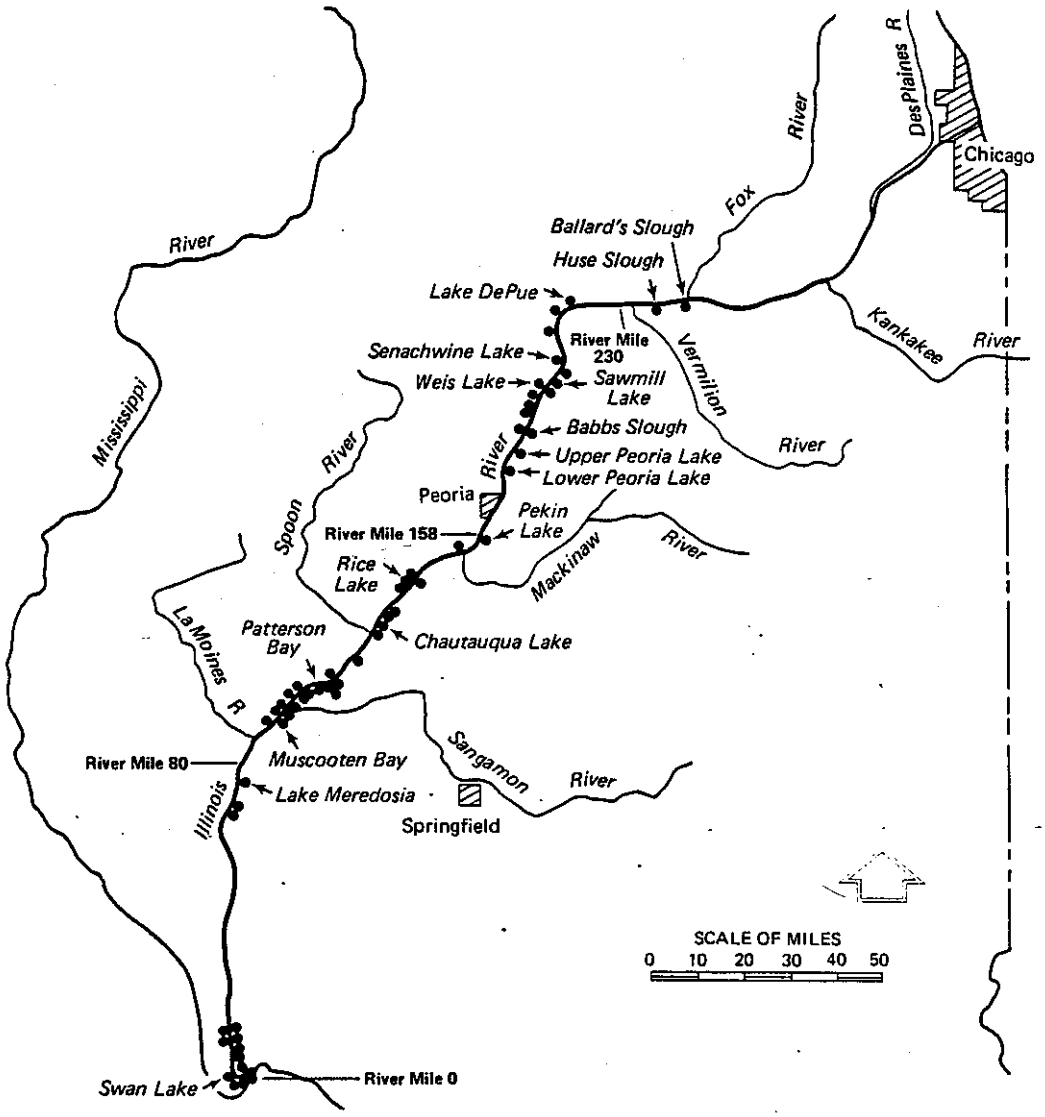


Figure 3. Backwater lakes along the Illinois River, River Miles 0 to 230.

Peoria Lake

A considerable amount of interest and public awareness has been generated on the question of the sedimentation problems of Peoria Lake. Recent research by Water Survey researchers has been instrumental in bringing this problem to full public scrutiny and discussion. Peoria Lake is the largest and deepest bottomland lake in the Illinois River valley. This lake is the remnant of the much larger glacial river that used to occupy this valley. Shifting of

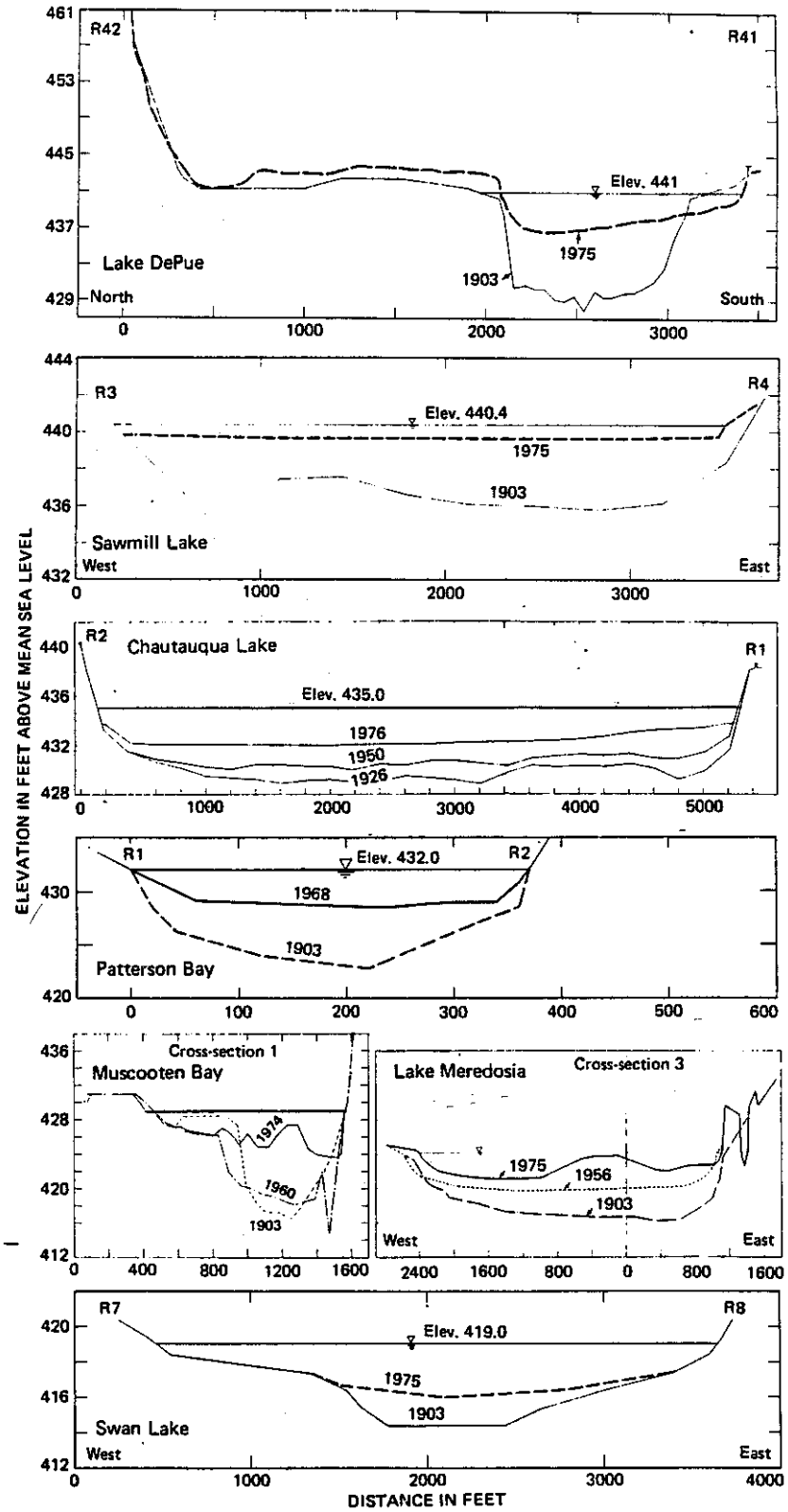


Figure 4. Typical cross sections of backwater lakes along the Illinois River.

Table 1. Sedimentation of the Backwater Lakes Along the Illinois Waterway

Pool	Lake	River mile	Sedimentation rate (in./yr)	Capacity (acre-ft) 1903	Capacity (acre-ft) 1975	Estimated capacity (acre-ft) 1985	Accumulated sediment (acre-ft)	percent capacity loss
Alton Pool	Swan Lake	5	0.38	4,853	2,783	2,501	2,352	48
	Lake Meredosia	72	0.43	7,791	4,207	3,709	4,082	52
La Grange Pool	Muscooten Bay	89	3.12	1,459	184	-0	1,459	100
	Patterson Bay	107	0.31	271	165	5	266	98
	Chautauqua Lake	125	0.33	14,293	11,679	10,778	3,515	25
	Rice Lake	133	0.32	3,064	1,119	849	2,215	72
	Pekin Lake	153	0.08	323	226	212	97	30
Peoria Pool	Peoria Lake	162	0.82	120,000	56,600	38,300	81,700	68
	Babbs Slough	185	0.26	1,377	625	521	856	62
	Weis Lake	191	0.30	450	110	63	387	86
	Sawmill Lake	197	0.47	2,110	381	141	1,969	93
	Senachwine Lake	199	0.30	9,240	2,468	1,527	7,713	83
	Lake DePue	203	0.59	2,837	778	492	2,345	83
	Huse Slough	221	0.96	253	51	23	230	91
Marseilles Pool	Ballard's Slough	248	0.91	142	36	21	121	85

the old glacial river resulted in the sluggish flow of the river, which could neither transport nor shift the sediment brought by its tributaries. Two of the main tributaries to Peoria Lake, Farm Creek and Ten Mile Creek, deposited their sediment load at their confluences with the Illinois River, forming large alluvial deltaic deposits. These deltas essentially constricted the flow of the Illinois River, forming two distinct pools presently known as Upper and Lower Peoria Lakes. These constrictions, when associated with the increased low water depths due to the construction of locks and dams, have accelerated the sedimentation of Peoria Lake.

The lake has not only lost about 68 percent of its 1903 capacity but has also been transformed into an incised navigation channel near its upper reaches. If the navigation channel is excluded, the capacity loss of the lake would be close to 78 percent of its 1903 capacity. An evaluation of the sedimentation rates has also shown that the rate of loss has increased substantially since 1965, and it is suspected that Upper Peoria Lake will lose most of its capacity outside the navigation channel by the year 2000.

This dramatic change in the Peoria Lake planform is illustrated in Figure 5. This figure shows the changes in the areal distribution of the 5-foot-deep contour line within Peoria Lake from 1903 to 1985. As can be seen, at the present time the river has more than 5 feet of water mostly at or near the navigation channel. The sedimentation is obviously worse in Upper Peoria Lake than in Lower Peoria Lake. This is also shown in the four cross sections at River Miles (RM) 164, 168, 175, and 179. Obviously the cross section at RM 179 is at present nothing but a reflection of an incised river with most of its channel area besides the navigation channel filled with sediment. This area has essentially turned into a mudflat.

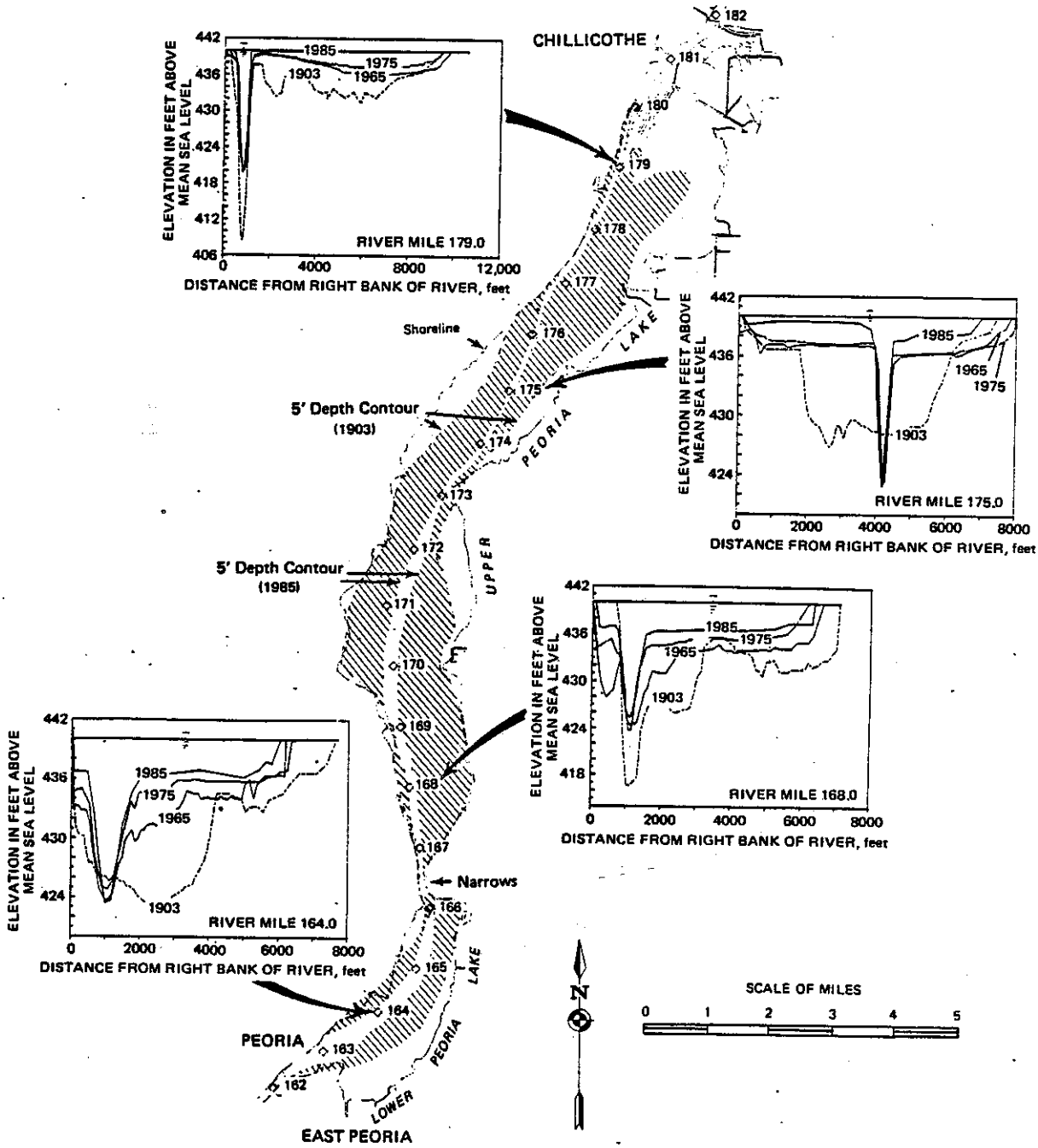


Figure 5. Changes from 1903 to 1985 in the amount of Peoria Lake area with depth greater than 5 feet.

These cross-sectional profiles can also be used to demonstrate the future planform of the lake and other lakes with similar sedimentation problems. It is quite obvious that the cross section at RM 175 will look similar to the cross section at RM 179 in the very near future, and so on for the cross sections at RM 168 and 164. Similar fates also await other cross sections down the river, including those in Lower Peoria Lake. Thus these cross sections not only give a historical perspective on the past sedimentation rates of the lake but also provide a look at the future condition of the lake.

Sediment Sources

The sediment load of the Illinois River is greater than that carried by the Mississippi River. Soil particles eroded from the watershed and the streambanks are transported to the river; however, not all the soil particles that are eroded from the watersheds are delivered to the river. An evaluation by Water Survey researchers has shown that about 27.6 million tons of sediment is delivered annually to the Illinois River from all of its contributing delivery points. According to this evaluation, about 38 percent of this sediment is generated within the bluff areas and the other 62 percent comes from the upland areas.

Analyses of the deposited sediments at various backwater lakes indicate that for the most part this sediment is composed of equal amounts of silt and clay with insignificant amounts of sand. Thus the major sources of these deposited sediments are the upland areas, especially the agricultural watersheds of the river. However, at a few tributaries and at certain locations such as those at the Court Creek research site, field measurements show that during flood flows about 50 percent of the stream sediment load comes from localized bank erosion sites. A similar percentage has been estimated for other midwestern streams where bank erosion rates are extremely high.

The investigation of the sedimentation of Peoria Lake has shown that about 60 percent of the sediment deposited within the lake comes from the main stem of the Illinois River and the other 40 percent of the sediment load is contributed by the streams draining directly into Peoria Lake. Of this 40 percent, about 2 to 3 percent is contributed by the bank erosion of Peoria Lake.

It should be pointed out that most of the sediment in the Illinois River is transported as suspended load and about 5 to 10 percent of the total load is transported as bed load. Most of the suspended load (approximately 90 percent) is composed of silt and clay, again indicating that the source of this sediment is upland watersheds, especially those close to the river where the travel time is extremely small compared to that from distant points on the watershed.

A sediment budget of the entire Illinois River valley has been made on the basis of data generated by Water Survey engineers. Research shows that about 7 million tons of sediment is delivered annually by the Illinois River to the Mississippi River at Grafton.

On the other hand it has been estimated that 27.6 million tons of sediment is delivered to the Illinois River. Therefore it can be estimated that 20.6 million tons of sediment is deposited annually within the Illinois River valley. If it is assumed that this sediment is spread out uniformly over the entire water surface areas for the maximum overflow conditions of the river (233,700 acres), then the average sedimentation rate is 0.81 inch per year with the unit weight of the sediment assumed to be 60 pounds per cubic foot. However, in general this entire area would not be flooded on an annual basis. Thus if it is assumed that on the average only the river and bottomland lakes are flooded (89,700 acres), then the average sedimentation rate would be about 2.10 inches/per year. Since some of the sediment is deposited within the immediate floodplain areas, the average sedimentation rate of the Illinois River bottom would lie somewhere between 0.81 inch and 2.10 inches per year.

Sediment Quality

Research conducted by Water Survey and the Geological Survey scientists on the quality of the deposited sediment along the Illinois River valley has shown a trend of generalized improvement in the quality of the deposited sediment. The sediment layer deposited since the 1970s is generally of better quality than the sediment deposited in the 1950s or 1960s. Plots of lead and zinc concentrations in deposited sediment from Peoria Lake show a gradual but certain decrease in concentrations since around 1960.

This trend of decreased concentrations of inorganic compounds in the deposited sediment has been demonstrated all along the river valley. Figure 6 shows a plot of arsenic distribution along the river, in which the concentrations of arsenic for the top, middle, and bottom layers of sediment are shown. At most locations, the arsenic concentration in the top layer is smaller than the concentration in the middle layer. Similar variations for other compounds such as aluminum, chromium, lead, and zinc were also observed. These variations indicate that the input of inorganic compounds to the Illinois River has decreased in recent years and that the top layers of the sediment are less polluted than the middle layers which were deposited in the 1950s and 1960s.

Alternative Solutions

Sediment delivered to the Illinois River can be controlled at or before the "input" point or can be managed within the lakes and bottomlands once it has been delivered and deposited within this environment. Concepts and ideas for the revitalization of the backwater lakes were postulated as far back as 1950 in a report for the Illinois Department of Conservation and again in 1969 in another report by the Illinois Division of Waterways. The 1950 report indicated that some of these backwater areas should be managed as conservation lands and others should be converted to become part of the main river. The 1969 report also outlined a plan to manage the

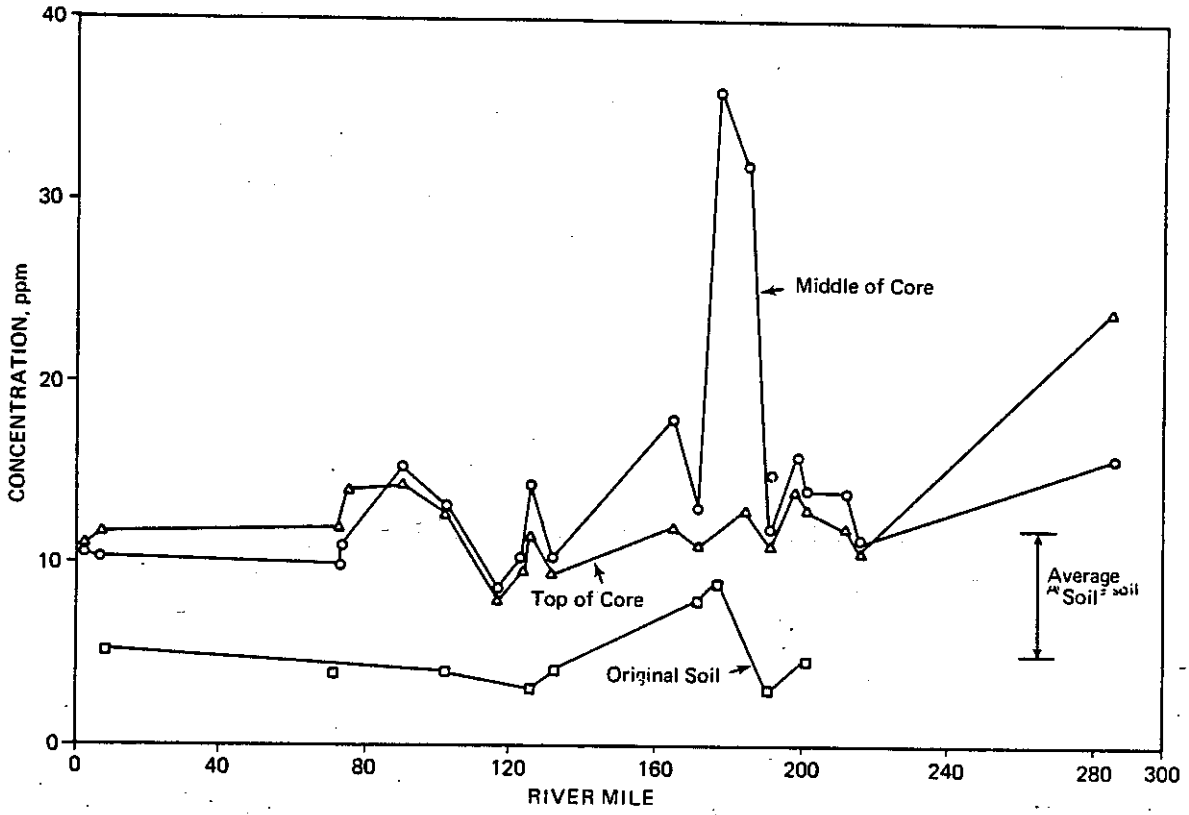


Figure 6. Arsenic distribution in sediments of lakes along the Illinois River.

backwater lakes. However, no positive actions were taken to implement the recommendations outlined in these two reports.

A number of possible and probable alternative solutions for the revitalization of Peoria Lake were outlined in a 1985 Water Survey report. Many of those alternatives should be applicable for other backwater and bottomland lakes. Various alternatives that could be applicable are control of sediment input from tributary streams that drain directly into the backwater lake(s); control of sediment from the Illinois River watersheds through the use of best management practices; conversion of some of the drainage and levee district areas into their original floodplain status; establishment of bank protection measures including those presently in use in the Court Creek watershed; reduction of bank erosion by establishment of marsh plants or use of wave reduction techniques, as is presently being attempted in Peoria Lake by the Water Survey; construction of detention basins to reduce sediment loads; removal of sediment by dredging, especially in selected high-use areas; construction of artificial islands with dredged materials (similar to the Water Survey research project presently being conducted for Peoria Lake); manipulation of the locks and dams either to dry and compact the

deposited sediment or to alter the navigational patterns to cause resuspension and transport of some of the deposited sediment; isolation of some of the areas of backwater lakes for revitalization by dredging; use of some areas of the backwater lakes to recreate wetlands; structural alteration of the locks and dams to increase low water depths; and finally, obviously, "doing nothing" and letting nature decide its future courses of action, turning the backwater and bottomland lakes into marshes, wetlands, and uplands.

POSSIBLE COURSES OF ACTION

Before a course of action is recommended, it must be pointed out that the Illinois River cannot be returned to its original pristine condition. Moreover, some areas of the bottomlands and backwater lakes have undergone almost irreversible changes and can not be altered or revitalized without significant cost and effort. It is essential that a thorough evaluation of the backwater and bottomland lakes be made to determine the area or areas of these resources that are of significant value to Illinois citizens. Once this determination has been made, efforts should be concentrated to revitalize only these high-value areas.

The recently completed Governor's Conference on the Illinois River has identified siltation as the number one problem facing the Illinois River. The following recommendations were developed after consideration of this and other research reports evaluated for this issue paper.

The recommended "courses of action" are divided into two broad categories: resource information and plan of action.

I. Resource Information: Basic information is essential in the development of any management alternative if we hope to have any long-lasting impact. The following resource information is needed:

- Estimated sedimentation patterns of the backwater lakes are given in Table 1. A sedimentation survey of these selected backwater lakes will provide information about the present state of these lakes. Sedimentation surveys of the backwater lakes will require $175,000 per year for three years and these funds should be made available to the Illinois State Water Survey (ISWS), Department of Energy and Natural Resources (DENR). A centralized data bank where physical, chemical, and biological data and information are stored and updated periodically will not only assist us in developing proper management alternatives, but will also enhance our ability to respond to critical issues that will face us during extreme events such as droughts and floods. Cost of this program will be $75,000 per year and the program should be housed at the ISWS (DENR).

- Extremely limited amounts of data and information are presently available on sediment loads carried by streams and rivers that drain directly into the Illinois River. State

natural resources agencies should initiate and support a program of in-stream sediment load measurements including the quality of sediment at selected gaging stations on the tributaries and main stem of the Illinois River. This program would be housed at the State Water Survey (DENR) and would complement the Benchmark Sediment Network presently operated by the Water Survey. This course of action is similar to actions recommended by the State Water Plan Task Force in their Special Report 10 of August 1985. Annual cost for such a program for the State would be $325,000 with an additional first year's cost of $110,000 for the initiation of the program.

II. Plan of Action: The "plan of action" is subdivided into three subheadings: Peoria Lake sediment management, in-lake management, and sediment input control. In-lake sediment management will have immediate impacts or benefits, and sediment input control will probably start to show an impact on the receiving lakes within the next 5 to 10 years. Intelligent meshing of "in-lake sediment management" with "sediment input control" is essential to obtain long-lasting benefits for all the backwater lakes, including Peoria Lake and the backwater lakes along the Illinois River. This plan of action also includes demonstration projects that can be initiated easily.

Peoria Lake Sediment Management:

- The state natural resources agencies under the leadership of the Illinois State Water Survey (DENR) should work with local area interests to develop a comprehensive management program for Peoria Lake consistent with the recommendations made in the "Peoria Lake Sediment Investigation" report published by the State Water Survey. This activity will require $250,000 and these funds should be made available to ISWS (DENR).

- The state natural resources agencies should continue to pursue Corps of Engineers' FY89 environmental management program funding for the island demonstration project in Peoria Lake. Present estimated cost of this program by the U.S. Army Corps of Engineers is $3.3 million. If this project is funded by the Environmental Management Program of the Upper Mississippi river, 25% of the total cost must be cost shared by the State and local agencies. Lead agencies for this program would be IDOC and DENR.

In-Lake Management:

- High-use areas within the backwater and bottomland lakes should be identified by the state natural resources agencies and local concerned officials and citizens. A comprehensive management plan should be developed for these backwater and bottomland lakes. Total cost would be $500,000 for a period of three years.

- Techniques should be developed and implemented for the removal of sediment by selective dredging. Research should be conducted by DENR (ISWS, INHS, ISGS) and the estimated cost for this activity is $100,000 per year for 3 years.

- Concepts should be developed and feasibility studies should be conducted for creating artificial islands (similar to those now being studied by the Water Survey for Peoria Lake), public parks, playgrounds, etc., in the immediate vicinity of the dredging sites with dredged materials. Estimated cost for such an activity would be $100,000 per year for 2 years.

- Techniques should be identified and developed for controlling the sediment input to selected backwater lakes from the Illinois River by using gated control structures. Research for feasibility studies will be needed and should be conducted by ISWS (DENR) and will cost $75,000 per year for 2 years.

- Management techniques should be developed and implemented so that some or portions of the backwater lakes can be managed as marshes, wetlands, and terrestrial habitats. Such work should be undertaken by the State natural resources agencies.

Sediment Input Control:

- Low-cost bank stabilization techniques should be developed and implemented for streams located within the immediate vicinity of the river and backwater lakes. ISWS (DENR) and IDOC should be the lead agencies and annual costs would be $200,000.

- Best management practices should be implemented on the highly erodible areas of the watershed. For cost estimate, see "Erosion Control" issue paper.

- The public must be made aware that a state permit is required for stream channel modification or floodway construction.

- IDOT- Division of Water Resources permit requirements will include provisions to reduce erosion and preserve stream channel stability.

- Concerned state agencies should work with local units of government to encourage the incorporation of streamside vegetative buffers for all new and existing developments in both rural and urban areas.

- Any state or federally funded projects on waterways, streams, rivers, lakes, or wetlands should be reviewed by the state natural resources agencies for determination of their potential impact on the erosion and sedimentation of the concerned bodies of water.

EROSION CONTROL

INTRODUCTION

The overwhelming majority of those persons in attendance at the Peoria Conference recognized soil erosion and siltation from land alterations as the primary problem affecting the Illinois River System.

The 51 soil and water conservation districts who are included wholly, or in part, within the Illinois portion of the Illinois Drainage Basin have, since their creation, been responsible for all activities relating to the application of conservation practices on agricultural lands. With the adoption of the State's T by 2000 Plan in 1985, efforts conducted by soil and water conservation districts, the Soil Conservation Service, and the Illinois Department of Agriculture were increased in the area of erosion control. The T by 2000 plan also led to a commitment from the State for 20 million dollars over a 5 year period for cost-sharing with farmers for the application of soil conserving practices.

The purpose of this paper is to summarize activities being conducted by the Soil and Water Conservation Districts, Illinois Department of Agriculture, and the USDA Soil Conservation Service in addressing soil erosion and siltation/sedimentation concerns.

BACKGROUND

The Illinois River Basin contains 18,048,000 acres, of which 15,646,100 acres are contained within Illinois' boundaries. Cropland acres accounted for 10,402,900 of which 29 percent, or 3,498,700 acres exceed soil loss tolerance rates. "T" or soil loss tolerance, is the level of soil loss that can be permitted but still maintain long term productivity. "T" values in Illinois range from 1 to 5 tons per acre. Table 1 provides a comparison of soil losses by land use for sub basins within the boundaries of Illinois for the Illinois River drainage basin.

TABLE 1
ACRES IN SOIL LOSS GROUPS BY LAND
USE FOR EACH WATER RESOURCES COUNCIL
HYDROLOGIC UNIT IN THE ILLINOIS
RIVER SYSTEM (ACRES x 100)

WRC Unit	Soil Loss	Cropland	Pasture	Forest	Minor
07120001	<T	2907	178	102	76
	T-1.5T	688	0	0	0
	1.5T-2T	205	0	0	0
	2T-4T	450	0	0	0
	>4T	89	0	0	0

WRC Unit	Soil Loss	Cropland	Pasture	Forest	Minor
07120002	<T	4881	293	201	132
	T-1.5T	1410	0	0	14
	1.5T-2T	362	0	0	0
	2T-4T	379	0	0	0
	>4T	63	0	0	13
07120003	<T	178	218	110	39
	T-1.5T	49	0	0	0
	1.5T-2T	25	0	0	0
	2T-4T	64	0	0	0
	>4T	60	0	0	0
07120004	<T	1036	621	224	197
	T-1.5T	244	0	0	0
	1.5T-2T	202	0	0	0
	2T-4T	291	0	0	0
	>4T	232	0	0	0
07120005	<T	4152	181	51	91
	T-1.5T	556	0	0	0
	1.5T-2T	194	0	0	0
	2T-4T	176	0	0	0
	>4T	64	0	0	0
07120006	<T	757	301	106	248
	T-1.5T	173	0	21	0
	1.5T-2T	92	0	0	0
	2T-4T	185	0	0	0
	>4T	52	0	0	0
07120007	<T	3549	165	133	126
	T-1.5T	734	0	0	0
	1.5T-2T	246	0	0	0
	2T-4T	449	0	0	7
	>4T	67	0	0	0
07130001	<T	4695	366	271	64
	T-1.5T	1855	0	0	0
	1.5T-2T	635	0	0	0
	2T-4T	896	0	0	0
	>4T	93	0	0	0
07130002	<T	5239	261	125	178
	T-1.5T	1526	0	21	0
	1.5T-2T	381	0	0	0
	2T-4T	452	0	0	0
	>4T	174	0	0	0

WRC Unit	Soil Loss	Cropland	Pasture	Forest	Minor
07130003	<T	3599	469	726	140
	T-1.5T	996	0	0	18
	1.5T-2T	115	0	0	0
	2T-4T	351	0	0	0
	>4T	63	0	0	0
07130004	<T	3266	172	84	57
	T-1.5T	1649	0	0	0
	1.5T-2T	616	0	0	0
	2T-4T	537	0	0	0
	>4T	156	0	0	0
07130005	<T	4710	613	285	135
	T-1.5T	1032	0	0	17
	1.5T-2T	533	0	0	0
	2T-4T	727	0	0	0
	>4T	160	0	0	0
07130006	<T	4508	384	215	58
	T-1.5T	1543	0	0	0
	1.5T-2T	484	0	0	0
	2T-4T	369	0	0	0
	>4T	102	0	0	0
07130007	<T	4955	248	135	132
	T-1.5T	730	0	0	0
	1.5T-2T	148	0	0	0
	2T-4T	332	0	0	0
	>4T	37	0	0	0
07130008	<T	2865	158	166	26
	T-1.5T	508	0	0	0
	1.5T-2T	196	0	0	0
	2T-4T	165	0	0	0
	>4T	63	0	0	0
07130009	<T	6748	332	60	184
	T-1.5T	2058	19	0	0
	1.5T-2T	508	0	0	0
	2T-4T	802	0	0	0
	>4T	107	0	0	0
07130010	<T	3113	550	198	56
	T-1.5T	920	7	0	0
	1.5T-2T	260	0	0	0
	2T-4T	428	0	0	5
	>4T	55	0	0	0

WRC Unit	Soil Loss	Cropland	Pasture	Forest	Minor
07130011	<T	4735	567	488	86
	T-1.5T	1557	38	0	0
	1.5T-2T	547	0	0	0
	2T-4T	1058	0	0	0
	>4T	147	0	0	0
07130012	<T	3149	294	72	52
	T-1.5T	536	0	0	27
	1.5T-2T	183	0	0	0
	2T-4T	331	0	0	0
	>4T	65	0	0	0

Erosion rates on the acreages in the proceeding table yield an estimated 83,372,600 tons of gross erosion each year.

Illustration 1 is a map of the state which shows the locations and numbers of the WRC Hydrologic Units.

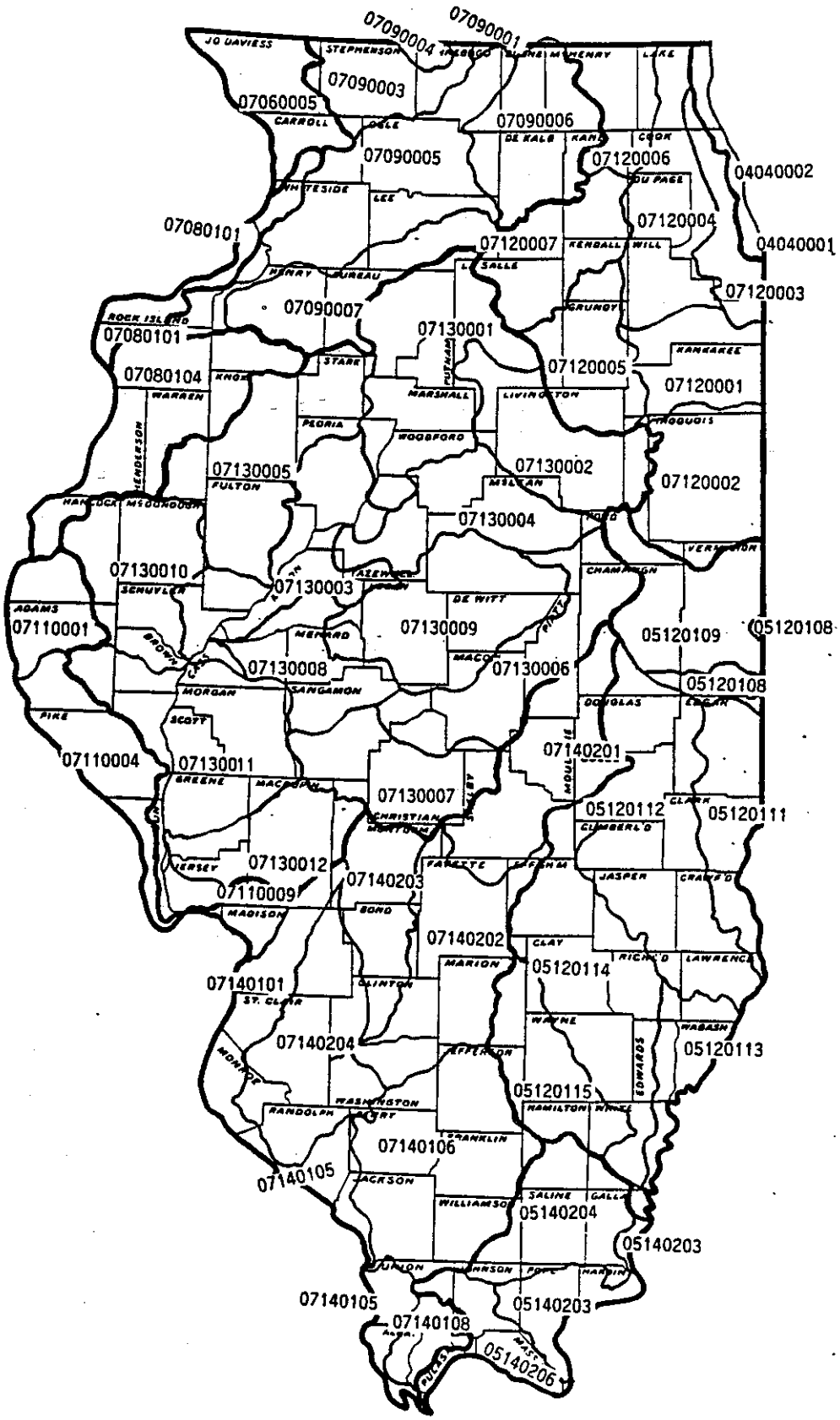
Table 2 summarizes gross erosion for the entire drainage basin within Illinois.

TABLE 2
GROSS EROSION BY HYDROLOGIC UNIT
WITHIN THE ILLINOIS RIVER BASIN

Upper Illinois Sub Basins	Area (acres)	Gross Erosion (tons)	Tons/Acre
07120001	570,200	2,523,500	4.43
07120002	823,300	3,758,000	4.56
07120003	348,300	1,390,000	3.99
07120004	815,900	3,980,600	4.88
07120005	634,600	3,128,500	4.93
07120006	408,200	2,146,400	5.26
07120007	697,800	3,571,200	5.12
Sub Total	4,298,300	20,497,700	4.77

Lower Illinois Sub Basins	Area (acres)	Gross Erosion (tons)	Tons/Acre
07130001	1,295,400	7,152,700	5.52
07130002	842,100	4,146,500	4.92
07130003	986,900	4,812,900	4.88
07130004	722,000	3,703,200	5.13
07130005	1,171,400	6,973,000	5.95
07130006	921,100	4,717,100	5.12
07130007	721,100	4,104,300	5.69
07130008	599,600	3,215,900	5.36

ILLINOIS
ILLUSTRATION 1
WATER RESOURCES COUNCIL HYDROLOGIC UNITS



Lower Illinois Sub Basins	Area (acres)	Gross Erosion (tons)	Tons/Acre
07130009	1,190,000	6,220,400	5.23
07130010	860,300	5,277,100	6.13
07130011	1,423,300	8,377,700	5.89
07130012	614,600	4,174,100	6.79
Sub Total	11,347,800	62,874,900	5.54
TOTAL	15,646,100	83,372,600	5.33

Soil Erosion and deposition of sediment into the Illinois River System is a natural process that has been accelerated by land altering changes brought about by man. Intensive agriculture, land clearing and urban construction, drainage of wetlands, levee construction and alteration of stream segments in the Illinois River drainage basin have significantly increased the rate of erosion and the amount of sediment entering stream tributaries, and the Illinois River. Illinois State Water Survey studies indicate that about 27 million tons of eroded soil enter the Illinois River each year. Of that amount, about 15 million tons remain in the channel and in backwater areas in the form of deposited sediment. To further compound the sedimentation problems, the construction of locks and dams has created an artificial water level, slowing water velocity and allowing more sediment deposition into the wider and slower pool areas. The dams in fact, act somewhat like sediment traps.

Since erosion and sedimentation is a natural process it can never be eliminated completely. It can, however, be reduced if soil conserving practices are installed on agricultural land in the watershed, and other steps are taken to control streambank and construction site erosion. In recent years, high fuel costs and a generally depressed farm economy have had a somewhat beneficial impact on soil erosion and the resulting sedimentation. Farmers have been forced to implement cost saving measures to maintain solvency. Many of those measures have included fewer tillage passes over the field, leaving greater amounts of crop residue, thus shielding the soil surface from the erosive effects of rainfall and rainfall runoff.

The continuation of row cropped corn and soybeans however, will allow erosion to continue at rates above "T" levels on erosion prone slopes. Reduction of erosion rates to "T" levels on the sloping soils will require the installation of one or more structural soil conservation practices or, in many cases, removing the land from the rotation and putting it to less intensive use.

ACTIVITIES, PROGRAMS, AND STUDIES

The Illinois Department of Agriculture (IDOA) is the State agency with responsibility for soil conservation on rural, agricultural lands in the State. IDOA is a partner in erosion control efforts, with the 98 local soil and water conservation districts (SWCD's), and the

U.S.D.A. Soil Conservation Service, as well as other State and federal agencies. The Erosion and Sediment Control Program which is administered by IDOA, was adopted by the Department and SWCD's in 1982. The Program established a mechanism through which persons can file a complaint against land which they believe is experiencing excessive erosion. The complaint is then investigated and if found to be valid, the landowner is offered cost-share assistance to install corrective conservation practices.

To date, 138 complaints have been filed but only 70 have received cost-share assistance. Limited appropriations have necessitated funding those complaints on a priority ratio basis of tons of erosion reduced/dollars spent. The enabling legislation requires that financial assistance be made available before any action on a complaint can take place. Therefore, 68 complaints are currently unaddressable. The program contains no penalties and is a voluntary approach to reducing erosion to "T" or tolerable soil loss levels by 2000. To achieve this end, the State provides SWCDs funding for staff and office operations and to share the cost of completing soil surveys. In addition, in FY 1986, FY 1987, and FY 1988, a total of $12 million has been appropriated under Build Illinois for sharing the cost of installing needed conservation practices with landowners through the Conservation Practices and Watershed Land Treatment Programs.

The 51 SWCD's in the drainage area of the Illinois River have together received $3,367,381 in cost-share funds under the Conservation Practices Program administered by the Department. A total of $6 million was distributed on a formula basis to each of the 98 SWCD's in FY 1986, FY 1987, and FY 1988. In addition, another $6 million was available for cost-sharing conservation practices within a defined watershed area. Under the Watershed Land Treatment Program (WLTP) 32 WLTP projects in 26 SWCD's within the Illinois River Drainage Basin, have been approved to receive a total of $2,762,411 in fiscal years 1986, 1987, and 1988. Selection of these projects was accomplished through the State Watershed Priority Committee. This Committee, made up of representatives from federal, State and private natural resource related agencies and organizations, is responsible for reviewing, prioritizing and selecting all Illinois watershed projects that are funded through State and federal sources.

The Governor has recommended that $20 million be made available for soil conservation cost-sharing over a 5 year period. If this appropriation is forthcoming, a total of $10,846,779 would be available to control erosion in the Illinois River Drainage Basin. Tables 3 and 4 show the dollar amount received by SWCD's to date, and the amount projected over 5 years for the CPP and WLTP programs.

In addition to the Build Illinois cost-share program, other State and federal programs to conserve soil have been initiated in the last couple of years. The 1985 federal Farm Bill includes the Conservation Reserve Program. This is a 5 year program to retire highly erosive land for 10 years or more. In addition, the Farm Bill includes a conservation compliance component that requires all landowners with

highly erodible land to develop and implement a conservation plan to control erosion to tolerable levels by 1995, if they wish to continue to participate in federal farm programs. The Farm Bill and the State's T by 2000 Program will go hand-in-hand in reducing erosion statewide by the end of the century.

TABLE 3
BUILD ILLINOIS EROSION CONTROL COST-SHARE MONIES
RECEIVED OR ANTICIPATED BY SOIL AND WATER CONSERVATION DISTRICTS
IN THE ILLINOIS RIVER BASIN

CONSERVATION PRACTICES PROGRAM

SWCD	FY 1986	FY 1987	FY 1988	Total To Date	5-Year Projected
**Adams	$ 41,847	$ 31,385	$ 52,309	$ 125,541	$ 209,235
*Brown	13,219	9,914	16,524	39,657	66,095
Bureau	28,084	21,063	35,105	84,252	140,420
Calhoun	11,451	8,588	14,314	34,353	57,255
*Cass	10,000	7,500	12,500	30,000	50,000
**Champaign	23,059	17,294	28,824	69,177	115,295
Christian	16,108	12,081	20,135	48,324	80,540
**DeKalb	28,295	21,221	35,369	84,885	141,475
*DeWitt	14,497	10,873	18,121	43,491	72,485
Ford	22,219	16,664	27,774	66,657	111,095
*Fulton	28,820	21,615	36,025	86,460	144,100
*Greene	21,116	15,837	26,395	63,348	105,580
*Grundy	10,000	7,500	12,500	30,000	50,000
**Hancock	29,468	22,101	36,835	88,404	147,340
**Henderson	10,855	8,141	13,569	32,565	54,275
**Henry	37,172	27,879	46,465	111,516	185,860
*Iroquois	32,917	24,688	41,146	98,751	164,585
Jersey	19,522	14,641	24,403	58,566	97,610
Kane-DuPage	20,906	15,679	26,133	62,718	104,530
*Kankakee	19,785	8,309	24,731	52,825	98,925
*Kendall	10,000	7,500	12,500	30,000	50,000
Knox	27,156	20,367	33,945	81,468	135,780
Lake	10,000	7,500	12,500	30,000	50,000
*LaSalle	38,345	28,759	47,931	115,035	191,725

SWCD	FY 1986	FY 1987	FY 1988	Total To Date	5-Year Projected
**Lee	21,326	15,994	26,658	63,978	106,630
Livingston	27,997	20,998	34,996	83,991	139,985
*Logan	16,616	12,462	20,770	49,848	83,080
Macon	20,135	15,101	25,169	60,405	100,675
Macoupin	23,585	17,689	29,481	70,755	117,925
*Mar-Put	30,606	22,954	38,258	91,818	153,030
*Mason	10,000	7,500	12,500	30,000	50,000
*McDonough	19,575	14,681	24,469	58,725	97,875
**McHenry	18,087	13,565	22,609	54,261	90,435
*McLean	69,547	52,160	86,934	208,641	347,735
*Menard	12,379	9,284	15,474	37,137	61,895
**Montgomery	14,182	10,636	17,728	42,546	70,910
*Morgan	29,713	22,285	37,141	89,139	148,565
*North Cook	10,000	7,500	12,500	30,000	50,000
*Peoria	22,692	17,019	28,365	68,076	113,460
Piatt	10,000	7,500	12,500	30,000	50,000
**Pike	31,324	23,493	39,155	93,972	156,620
*Sangamon	25,055	18,791	31,319	75,165	125,275
*Schuyler	19,487	14,615	24,359	58,461	97,435
*Scott	10,593	7,945	13,241	31,779	52,965
**Shelby	25,493	19,120	31,866	76,479	127,465
*Stark	17,194	12,895	21,493	51,582	85,970
*Tazewell	22,499	16,874	28,124	67,497	112,495
**Vermilion	25,300	18,975	31,625	75,900	124,500
**Warren	16,966	12,724	21,208	50,898	84,830
*Will-So Cook	28,014	21,010	35,018	84,042	140,070
*Woodford	21,431	16,073	26,789	64,293	107,155
Total	$1,124,637	$ 836,942	$1,405,802	$3,367,381	$5,621,185

* SWCD is entirely within the boundaries of the Illinois River Basin.

** Less than one-half of the SWCD is within the Illinois River Basin.

TABLE 4
BUILD ILLINOIS EROSION CONTROL COST-SHARE MONIES
RECEIVED OR ANTICIPATED BY SOIL AND WATER CONSERVATION DISTRICTS
IN THE ILLINOIS RIVER BASIN

WATERSHED LAND TREATMENT PROGRAM

		Funds Approved For			Projected				
SWCD	WATERSHED	FY 1986	FY 1987	FY 1988	FY 1989	FY 1990	FY 1991	FY 1992	TOTAL
Brown	Mt. Sterling Lake	$ 8,738	$ 0	$ 0	$	$	$	$	$ 8,738
Brown	Camp Creek	57,500	0	95,600	94,000	92,100			339,200
Brown	Shelby Creek			115,700	124,700	102,100			342,500
Christian	Cottonwood & Locust Creeks	28,000	34,950	55,900	37,300	18,600			174,750
Fulton	Canton Lake	15,000	15,000	20,000					50,000
Greene	Greenfield	20,344	13,106						33,450
Iroquois	Pigeon Creek	58,691	17,436	103,250					179,377
Jersey	East Otter Creek	37,014	27,760						64,774
Jersey	Dow Hill			17,519	20,000				37,519
Kane-DuPage	Mill Creek	55,000							55,000
Knox	Court Creek	85,000	83,206	85,000	85,000	85,000			423,206
LaSalle	Matthiessen Lake	23,500	189						23,689
LaSalle	Crotty Creek	39,308							39,308
Lee/LaSalle	Four Mile Grove Creek			70,969	76,875	70,500	67,406		285,750
Logan	Middle Lake Fork	32,700	16,051	53,852	61,545	23,080	15,386		202,614
McDonough	Vermont Lake	24,000	18,000						42,000

SWCD	WATERSHED	Funds Approved For			Projected				
		FY 1986	FY 1987	FY 1988	FY 1989	FY 1990	FY 1991	FY 1992	TOTAL
McHenry	Dutch Creek	1,369							1,369
Macon	North Oakley	48,225	58,500	98,325	64,050	34,275			303,375
Macon	Long & Big Creeks			127,500	158,250	171,550			457,300
Marshall-Putnam	Lower Crow Creek	20,000	17,667	25,000	28,557				91,224
Mason	Sleepy Hollow	41,000	40,200	67,600	40,700	23,700			213,200
Macoupin	Palmyra-Modesto	25,500	11,391						36,891
Menard	Cabiness-Grove	5,667	0	19,920	29,620	29,620	29,620	29,620	144,067
Morgan	Jacksonville Lake	28,770	28,798	33,173	33,173	31,631			155,545
Morgan	Waverly Lake	41,450	38,625	35,900	21,625				137,600
Peoria/Marshall-Putnam	Senachwine Creek			21,000	27,465				48,465
Piatt	Upper Sangamon (Goose Creek)	48,600							48,600
Piatt/Champaign	Upper Sangamon River			48,265	96,530	120,663	120,662	96,530	482,650
Sangamon	Lower Sugar Creek	40,000	43,500	80,000	85,000	75,000			323,500
Schuyler	Schuy-Rush Lake	29,000	49,000	58,000	39,000	20,000			195,000
Tazewell	Dillon Creek	36,000	45,750	61,000	61,000	21,750			225,500
Woodford	Eureka Lake	41,995	17,438						59,433
TOTAL		$ 892,371	$ 576,567	$1,293,473	$1,184,390	$ 919,569	$ 233,074	$ 126,150	$5,225,594

CONCLUSIONS

The Soil Conservation Service in Champaign, Illinois, has at the request of the Illinois Department of Agriculture, recently developed some cost estimates for treating the cropland acres exceeding tolerable soil loss in the Peoria Lakes Hydrologic Unit. The cost estimates are based on information presented earlier in this report, primarily: soil loss and acres effected by slope category. In addition, information and the present tillage systems and crop rotations were used to estimate current soil loss and the conservation practices needed to meet tolerable soil loss on this land.

Previous experience in estimating an average number of conservation practices per acre was applied to the Peoria Lakes area. Statewide unit costs for conservation practices installation were used to arrive at the total cost.

Table 5 provides an estimate of the total cost for controlling all types of erosion in the watershed for land that now exceeds "T".

The cost estimate of $21.4 million outlined in Table 5 is for the Peoria Lakes drainage basin only. It does not address urban runoff controls, in-lake rehabilitation nor the conservation needs or costs for other land areas in the upper Illinois River drainage area. The estimate is only for cropland acres exceeding tolerable soil loss. The cost estimate does not address soil losses from pasture, forestland or urban land uses, nor does it include land that is below tolerable soil loss yet may still be contributing to the sediment problem. In addition, an estimate was not made for streambank or gully erosion along tributaries. There are several different methods of controlling this type of erosion, the variety of which prohibit attaching a cost estimate.

The Peoria Lakes drainage basin accounts for about 41 percent of the Illinois River Basin. No intent is made here to draw a comparison between the costs of protecting the Peoria Lakes Drainage Basin with the remainder of the Illinois River Basin. Rather, this information is to provide a comparison between the amount of funds needed to protect the basin above Peoria Lakes ($21.4 million) and the amount of State funds that are expected to be expended in the entire Illinois River Basin ($10.8 million). It is also important to note that even if sufficient funds, staff and landowner cooperation were available to the extent that all erosion on agricultural land could be reduced to tolerable levels, the uncertainty of the sources of the sediment in the Peoria Pool might preclude satisfactory problem abatement.

POSSIBLE COURSES OF ACTION

The annual gross erosion in the Illinois River basin was estimated as 83 million tons. The annual sediment yield delivered to the Illinois River was assessed as 27 million tons and the total annual sedimentation rate in the Illinois River and its backwater lake areas

TABLE 5
CONSERVATION MEASURES AND ESTIMATED COST FOR
CONTROLLING SHEET AND RILL EROSION ON ACRES
GREATER THAN T IN THE PEORIA LAKE WATERSHED

			NEEDED PRACTICES				
ROTATION	TILLAGE	ACRES	GRASS WATERWAY (Ac.)	WATER & SEDIMENT CONTROL STRUCTURE (No.)	TERRACE (Ft.)	GRADE STABILIZATION STRUCTURE (No.)	FIELD BOARDER STRIPS (Ac.)
Corn-Soybean	Chisel/Disk w/30% residue	107,200	670	3,350		70	2,700
Corn-Soybean	Chisel/Disk w/30% residue/contour	105,900	660	3,300		70	2,650
Corn-Soybean	O-Till	95,000	590	2,950		60	2,375
Corn	O-Till	28,100	175	1,050		35	700
Corn-Soybean	Contour	49,400	310	1,625		40	1,250
Corn	O-Till & Contour	3,700	25	150		5	90
Corn-Soybean	Contour/Terraces	3,600			1.1 million		100
Corn	Contour	1,400	10	70		2	50
	Total		2,440	12,500	1.1 million	282	9,915
	Cost/Unit		$ 1,770	$ 1,000	$ 2.00	$ 4,000	$ 150
	Total $ Cost		4,148,000	12,500,000	2,200,000	1,128,000	1,487,250
Total For All Practices			$21,463,250				

Source - U.S. Soil Conservation Service - April 8, 1987

as 15 million tons. Even though a series of government programs have been initiated to reduce soil erosion in the watersheds and sedimentation and water quality problems in the Illinois River system, the following additional actions are recommended.

- State cost-share funding for erosion control should be increased and extended beyond the initial five-year authorization period. Estimates indicate that $160,000,000 will be needed in the next 12 years to meet T by 2000 goals for the Illinois Basin.

- Soil and Water Conservation Districts will require an estimated $5,000,000 per year from increased local as well as state sources of revenue to enable the employment of full-time experienced staff to work on the erosion control program.

- The Illinois Conservation Enhancement Act, approved by the 85th General Assembly, should be adopted and funded at the requested $10,000,000 level. This bill would supplement the federal Conservation Reserve Program, removing highly erodible land from crop production.

- The proposed Bureau of Agricultural Development should be created and funded at $100,000 annually, as a means of providing assistance to farmers in choosing alternative land uses that will keep soil erosion loss at or below "T".

- Legislation needs to be provided which would provide for assessments at one-sixth of the value for farmers who voluntarily take marginal land out of production.

- The Illinois Department of Transportation - Division of Water Resources should be provided necessary authority and $105,000 annually to assure that proper permit authority/management practices are in place to mitigate impacts from stream alteration.

- A continuous research program should be funded to: (1) define the erosion and sedimentation relationship, (2) determine effectiveness of Best Management Practices for controlling water quality degradation, (3) define critical areas for solving downstream sediment and water quality problems, and (4) define biological and water quality benefits/damages of any sediment control techniques.

- During the development of conservation farm plans, soil and water conservation districts and the USDA Soil Conservation Service should provide leadership in encouraging riparian landowners to adopt stream corridor protection measures through the use of critical area seeding, vegetative filter strip, and field windbreak practices.

As it was stated, erosion is the source of sedimentation and its related water quality problems. To be effective in solving all the

river basin-related problems, erosion control is not only for conserving soil resources, but also for other off-site benefits. In addition to the implementation program based on standards for performance, a monitoring program based on field measurements at selected fields, watersheds, streams, and lakes should be initiated and funded. This effort will assure that government spending is matched with the actual reduction of soil erosion and sedimentation. Periodic reevaluations of the programs are needed to guide the implementation program towards the goals.

- A continuous research program should be funded to: (1) define the erosion and sedimentation relationship, (2) determine effectiveness of Best Management Practices for controlling water quality pollution, (3) define critical areas for solving downstream sediment and water quality problems, and (4) define biological and water quality benefits/damages of any sediment control techniques.

- Interagency coordination in terms of program implementation, monitoring, budgeting, research, technical assistance, and program evaluation are needed.

Installing conservation practices on erosive agricultural lands is a proven method of reducing soil erosion, decreasing sedimentation in rivers, lakes and streams, and ultimately benefiting water quality. Installing enduring conservation practices however, is a very expensive undertaking for the farmer. The farmer must pay property taxes on all of the land he owns. If that land is not producing an income for the farmer, it becomes a burden that, if allowed to increase, will eventually bankrupt him. It therefore becomes necessary for the farmer to produce as much as he can on all of his land at the lowest cost possible in order to earn an income sufficient to sustain himself. Enduring conservation practices such as terraces, grass waterways, water control structures, and others will allow the farmer to pursue maximum production while at the same time controlling erosion on his cropland. The short term benefits to the farmer in controlling erosion on his land however are minimal. Minimal to the extent that few farmers will ever recover the cost of an enduring practice.

Cost-share programs, such as the Conservation Practices and Watershed Land Treatment Programs administered by the Department and Soil and Water Conservation Districts are not a new idea. Federal cost-share programs have been in existence for decades and the State has had its own programs over the years. Conservationists believe however, that without additional information and some types of incentive to make the installation of conservation practices attractive to farmers, the problems associated with soil erosion will not diminish. Conversely, it is expected that erosion related problems will increase in terms of depleting the soil resource base, continued siltation, and further degradation of water quality.

It is of significant importance to the economy of the State that current erosion control efforts be strengthened and that new efforts be identified and pursued to the greatest extent possible.

FLOODING

INTRODUCTION

From its beginning at the confluence of the Kankakee and Des Plaines Rivers, the Illinois River travels 270 miles to its mouth at the Mississippi. On its way, it travels next to 19 counties and 36 cities and villages. Periodically the river leaves its banks and flows through those communities. Indeed, the Peoria Conference established flooding as one of the most serious problems of the Illinois River and its basin.

BACKGROUND

Since 1978, the Illinois River has flooded at least once a year. Floods were so bad that two or more counties along the river were declared disaster areas by the President in 1979, 1982, 1983, 1985, and 1986.

Flood insurance claims paid since 1978 exceed $26 million, one-half of all the flood insurance claims paid in the entire state. This number can be doubled to estimate total state and federal disaster assistance of $50 million. State and federal disaster expenditures represent only 1/4 to 1/3 of the total property damages suffered. Adding the cost of lost business and other expenses brings the cost of Illinois River flooding during the period 1978-1985 to over $200 million or more than $25 million per year.

The traditional response to Illinois River floods has been to build levees. A trip along the river will show a substantial investment in levee systems protecting urban, industrial, and agricultural areas. Most of these were built with the advice and financial assistance of the U.S. Army Corps of Engineers. However, there are still a tremendous number of properties left unprotected.

Accordingly, we need to look at other solutions. Rather than focus on only keeping the river off of people's property, we need to think in terms of all the possible ways we can protect property from flood damage. The following pages will briefly review the various measures, used in the Illinois River basin where they are appropriate. They are categorized in four general areas: flood control, property protection, emergency services, and floodplain management.

ACTIVITIES, PROGRAMS, AND STUDIES

Flood Control

Flood Control measures keep water from getting to damageable property. They are also called "structural" measures because they involve construction of man-made structures to affect the flow of surface

water. Because of the size and cost of structural projects, they are typically implemented by government agencies, usually with the help of the Division of Water Resources, the Corps of Engineers, or the Soil Conservation Service.

Levees and floodwalls - Probably the most common flood control measure is to erect a wall of dirt (levee) or concrete (floodwall) between the river and the property to be protected. Levees and walls must be well designed to account for large floods, underground seepage, pumping of internal drainage, and erosion and scour.

Larger levees or floodwalls usually cost so much that they cannot be built without government aid. We can afford to spend a lot of money to protect the major concentrations of flooded property like East Peoria and Beardstown. But when the properties are scattered or aligned in narrow strips along the river as in Rome, we cannot afford to build 15 foot high levees to protect them. In fact there is only one more levee project expected on the main stem of the Illinois River, and that will only construct a 44 year levee for the Village of Liverpool.

Reservoirs and detention basins - These measures control flooding by holding high flows behind dams or in basins. After the flood peaks, water is let out slowly in small amounts that the river can handle. The lake created may provide recreational or water supply benefits and dry basins can double as parks or other open space uses.

Channel improvements - A channel can be made wider, deeper, or straighter so it will carry more water and/or carry it downstream faster. Some smaller channels can be lined with concrete or even put in underground pipes. In a few locations, a diversion or overflow channel can speed floodwaters to another, bigger river.

Control gates and back-up valves - Many smaller ditches and pipes can have gates or valves installed to keep water from backing up. Some are operated manually but others, such as "flap gates", can be automatic. This prevents a larger river above flood stage from backing floodwater into tributaries or sewer lines.

Terracing and run-off controls - The run-off of rain water can be slowed down on the ground by vegetation, terraces, contour plowing, no-till farm practices, and other measures. Delaying surface water on its way to the channel also controls erosion and loss of topsoil.

Property Protection

Rather than keep water off of the land, property protection measures modify the buildings exposed to damage. They are also appropriate where the buildings are scattered or a flood study has concluded that a structural flood control project will not be built. For more informa-

tion, see Protect Your Home from Flood Damage, available free from the Division of Water Resources.

Building relocation or acquisition - The surest and safest way to protect a building from flooding is to move it to high ground. Vacant riverfront property can be converted to public park or open space. Because this is expensive and because many people do not want to own vacant flood-prone lots, there are several government programs that can provide financial assistance or even purchase the building and lot. For more information, see Elevating or Relocating Your House to Reduce Flood Damage, available free from the Division of Water Resources.

Building elevation - Raising a building above the flood level is cheaper than moving it and can be less disruptive to a neighborhood. For more information, see Elevating or Relocating Your House to Reduce Flood Damage, available free from the Division of Water Resources.

Floodproofing - Some buildings can be made floodproofed by sealing the walls and closing all openings. When water reaches the building, it is kept out. Another technique, wet floodproofing, works for garages and unfinished areas; water is let in the building but all damageable property is removed or protected. Unlike acquisition or elevation, floodproofing is relatively inexpensive and does not involve moving or making major changes to the building.

Self-help advice and assistance - Some communities provide help in the form of manuals, "open houses", and direct consultation to property owners. Much property can be protected with inexpensive steps taken by the owner such as installing a sewer back-up valve, moving appliances out of the basement, and considering the flood hazard in remodelling projects. Lives and property can be protected when people know the flood warning signals, evacuation procedures, where to get sandbags, how to clean up, etc.

Technical advice is one of the least expensive measures a community can undertake. Every little step taken by a property owner will reduce flood damages. Manuals and technical assistance, including slide presentations, are available from the Division of Water Resources.

Flood insurance - Although it does not reduce flooding or flood damages, insurance does help the flood victim. The National Flood Insurance Program is strongly supported in Illinois, and is administered by the Federal Emergency Management Agency (FEMA). It makes federally subsidized insurance available for properties affected by surface water problems in communities that have enacted floodplain regulations. Some commercial companies sell sewer backup and sump pump failure policies. All are available through property insurance agents.

Emergency Services

While property protection measures protect buildings when the flood comes, emergency services measures protect people. All counties and many communities have Emergency Services and Disaster Agencies (ESDAs) to coordinate warning, response, and recovery during a disaster. The manual, Flood Fighting, available from the Division of Water Resources or the Illinois Emergency Services and Disaster Agency, covers these measures in more detail.

Flood warning - Providing an adequate warning is the number one way to save lives. Furthermore, much moveable property, particularly vehicles, can be protected, even on very short notice. With a well-prepared response plan, critical facilities such as hospitals and water works, can take protection measures and the limited work force can be used most efficiently. Warning systems are relatively inexpensive, especially on the bigger rivers.

Sandbagging - This term includes all emergency barriers that can be erected on short notice to stop flood waters. Generally, emergency barriers are not as effective, and may even cost more than permanent flood control facilities. Sandbagging does work well as a back-up system to other flood protection measures. It can be a very flexible way to provide protection on short notice.

Evacuation and rescue - Removing people from the flooded area, either before the flood (evacuation) or during (rescue), are vital measures to protect lives. A related measure that must be considered is sheltering and feeding those who are forced from their homes.

Public health and safety maintenance - Numerous measures must be taken during a flood to prevent dangers to health and safety. These include patrolling evacuated areas to prevent looting, providing safe drinking water, vaccinating residents for tetanus, clearing the streets, and cleaning up debris and garbage.

Floodplain Management

While the three previous categories of mitigation measures are oriented toward dealing with the existing flood problem, floodplain management projects focus on the future. Floodplain management projects are designed to keep the problem from getting worse by ensuring that future development in the floodplain does not increase flood damages, and by maintaining the river system's capacity.

Planning and zoning - Advance planning can match the land use with the land's hazards, typically by reserving flood hazard areas for open space, parking lots, backyards, or similar low-damage activities. A land use plan that proposes appropriate uses can be implemented by a zoning ordinance that regulates private development and by the com-

munity's capital improvements plan that directs extension of roads and utilities, the location of future parks, etc.

Floodplain development regulations - Subdivision ordinances and building codes come into effect after the plans and zoning ordinances have identified where various land uses are appropriate. If buildings are allowed, these regulations ensure that they will not be subject to flood damage and that the development will not aggravate the flood problem.

Building codes also require that when existing buildings are substantially damaged, they are rebuilt protected from flood damage. In addition to preventing flood problems from getting worse, these regulations qualify a community for participation in the National Flood Insurance Program. For more information, see the Division of Water Resource's manual, Floodplain Regulations.

Open space acquisition or easements - Rather than regulate future development, many communities purchase vacant flood-prone lands to prevent hazardous development and/or to obtain attractive sites for parks. While this can be expensive, there are sources of financial assistance for park acquisition or development. Some Illinois communities have been successful in getting owners to donate land for tax purposes or to ensure it is kept open for future generations to enjoy.

As an alternative to public ownership, an easement can be purchased. With an easement, the owner is able to develop the flood-free portion but he is paid to not develop the flood-prone part. In some cases, the owner is allowed to develop his ground for low hazard uses or he can transfer his right to develop other flood-free parcels.

Stormwater management - In the past, developers and communities built gutters, sewers, and ditches to move surface water as fast as possible downhill to the river channels. Not only did this aggravate downstream flooding, it often overloaded the community's drainage system. The alternative, stormwater management, looks at the whole system and identifies where water should be held on-site, in detention basins, or allowed to flow to the river quickly.

Requirements for detention are generally included in ordinances governing subdivisions and new developments. This insures that new developments pay their share of the cost of using the drainage and river system. Many developments utilize wet or dry basins as landscaping amenities.

Erosion and sediment control - Many Illinois rivers are loosing their capacity to carry floodwaters because of sedimentation. As rain hits the ground, especially where there is bare dirt as on farm fields and construction sites, soil is picked up and washed downstream. Sediment tends to settle where the river slows down and will gradually fill in

the channel. Farm practices such as terracing and no-till will help reduce agricultural erosion and keep topsoil where it is needed. Catch basins can be installed downstream of construction sites to slow run-off so sediment will be dropped on-site before it gets to the river.

Stream maintenance - Sediment is not the only thing that restricts a river's ability to carry floodwaters. A stream maintenance program works to clean out blockages of a channel caused by overgrowth and debris. This work is usually done by a community's public works crew. Communities also pass ordinances prohibiting dumping and making riverfront owners responsible for maintaining their areas. For more information, see the Division of Water Resource's manual, Stream Maintenance.

Picking the Best Measures

While some of these measures may appear attractive, the state of Illinois recommends a careful planning process to ensure that the flood damage protection methods chosen are feasible and appropriate to the hazard. Assistance is available from the Division of Water Resources for a three-step planning approach:

1. Reconnaissance. The first step is to collect available data on flooding and survey the affected properties. This may include a detailed building-by-building survey to identify appropriate property protection measures and draw preliminary recommendations. This work is usually done completely at State or federal expense.

2. Detailed plan. The results of the reconnaissance and preliminary recommendations are reviewed with local officials. If there is an interest in pursuing the projects, an intergovernmental agreement will be signed. Typically it will include a requirement that since the state or federal government is going to help pay for reducing flood damages, the community will properly regulate development to ensure damages do not increase.

If the projects will be primarily structural, the state may request cost-sharing on preparing the plans. If the projects are going to be primarily non-structural, a citizens planning committee will be formed and the community will assign a staff person as liaison and floodplain planner. The result of this phase is a detailed plan that is reviewed at one or more public hearings, is adopted by the city council, and forms the basis for applications for state or federal financial assistance.

3. Implementation. At this phase, applications for needed outside funds are submitted. The community will be expected to administer the locally funded projects such as developing a flood warning system or amending its zoning ordinance. There is likely to be cost-sharing

on the major projects. It is recommended that the planning committee be used to monitor and evaluate progress.

POSSIBLE COURSES OF ACTION

As mentioned earlier, most of the Illinois River flood control projects have been completed. Overall basin planning has concluded that reservoirs are not feasible. Channel dredging is still being looked at in the Peoria Lake area, but if it is funded it will probably be for recreational purposes and may not affect flood levels.

Since it is not possible to control the river, the current approach is to look at the circumstances and options for each community. Many communities on the Illinois and its tributaries have had reconnaissance studies. Where structural projects are shown to be appropriate, the state or federal agency has proceeded on to steps 2 and 3. Two examples of this are Pontiac and Liverpool, both of which are having their detailed plans for levees finalized by the Corps of Engineers.

It has been determined that structural flood control projects will not be feasible in most of the remaining communities. Accordingly, we are proceeding with non-structural planning for the rest. Initially, this started with those towns who asked for help. The first town was Grafton. With the help of the regional planning commission and a citizens committee, a non-structural plan was prepared. Due to local concerns and needs, it focuses primarily on emergency services or flood fighting activities.

In 1984, the Division of Water Resources conducted the reconnaissance study for Kampsville. A citizens planning committee worked with State and village staff to develop a comprehensive flood hazard mitigation plan that includes raising the ferry road to ensure access during high water, floodproofing, elevating three buildings, acquiring 50 parcels of land, and converting the flood-prone target area into a community park and village asset. Funding for the work has come from the Division of Water Resources, the Federal Emergency Management Agency (FEMA), the Department of Commerce and Community Affairs, and the Division of Highways.

The next community was the Rome area of unincorporated Peoria County. With funding support from FEMA, the county conducted the phase I reconnaissance with in-house staff and a surveyor. The resulting recommendations could cost over $5 million and would involve purchasing over 100 homes. Rather than wait to do a detailed plan for the hardest hit area, the County is preparing the detailed plan for only one of the potential target areas. Over $2.7 million has been committed to purchase and clear that area with funds from the Division of Water Resources, the Federal Emergency Management Agency (FEMA), and the Department of Commerce and Community Affairs.

The Division developed a preliminary priority list of communities for assistance. Because non-structural projects require a high degree of local interest and potential for FEMA funding, flood insurance claims are being used as a measure of where attention is both needed and likely to bring results. During this fiscal year reconnaissance surveys are being conducted in Hardin, Calhoun County, Jersey County, Woodford County and Spring Bay. Assistance has been given to the City of Peoria to obtain FEMA funding to prepare a mitigation plan for Peoria and Peoria Heights.

Communities, both on or off the Illinois River, can obtain copies of the references and assistance in flood protection by contacting the Division of Water Resources at 310 South Michigan Avenue, Room 1606, Chicago, Illinois 60466.

WATER QUALITY

INTRODUCTION

The words "water quality" denote a standard of acceptable water conditions that is necessary to protect both the users and the streams health. The Illinois River System, utilized for every possible use at one point or another, has been the subject of analysis and monitoring for over a century. This paper will generally discuss water quality conditions, the monitoring efforts currently underway and trends for future monitoring activities.

BACKGROUND

Subtitle C of Title 35 of the State of Illinois Administrative Code provides three use designations for Illinois streams; each category has a specific set of water quality standards. General Use water quality standards protect water of the state of aquatic life, agricultural use, fishing, swimming and most industrial uses. The majority of Illinois streams come under this use designation. A somewhat stricter set of standards applies to public and food processing water supplies. These standards apply at any point at which water is withdrawn for use as a potable water supply or for food processing. A third set of standards applies to streams designated as Secondary Contact and Indigenous Aquatic Life Waters. This is the most limited designated use and applies only to certain streams in the Chicago area. These streams are designated for industrial and non-full-body contact recreational uses. Illinois' water quality standards for the three use designations are presented in Table 1.

General Use water quality standards for Illinois surface water resources were established for protection of aquatic life, primary (e.g., swimming) and secondary (e.g., boating) contact recreation, agricultural, and industrial uses. The purpose of Illinois' General Use Standards is considered synonymous with the "fishable/swimmable" goals of the Clean Water Act. Aquatic life use is generally the most sensitive instream use in terms of water quality requirements. Water quality suitable for protection of aquatic life, therefore, should assure other beneficial uses. Given this sensitivity of use, the IEPA's use assessment methodology focuses on aquatic life uses. The IEPA's Division of Water Pollution Control (DWPC) operates a surface water monitoring program to provide necessary environmental information to meet water quality management needs and objectives. The monitoring program includes collection and analysis of water chemistry, biological, habitat, sediment and fish flesh contaminant information through a number of individual monitoring projects. These projects include both fixed station networks, maintained from year to year, and projects conducted in different areas (nonfixed stations) depending on program needs. Fixed station networks are designed to provide background/ambient, current condition, and long-term trend information on water quality from a broad geographic area. Nonfixed station projects are designed to provide more intensive, site-specific water quality information for surveillance

Table 1

ILLINOIS WATER QUALITY STANDARDS

Parameter	Units	General Use	Public and Food Processing Water Supply	Secondary Contact and Indigenous Aquatic Life
pH	SU	6.5 minimum 9.0 maximum	6.5 minimum 9.0 maximum	6.0 minimum 9.0 maximum
Dissolved Oxygen	mg/l	5.0 minimum	5.0 minimum	4.0 minimum
Arsenic	ug/l	1000	50	1000
Barium	ug/l	5000	1000	5000
Boron	ug/l	1000	1000	--
Cadmium	ug/l	50	10	150
Chloride	mg/l	500	250	--
Chromium	ug/l	1050	50	1300
Copper	ug/l	20	20	1000
Cyanide	mg/l	0.025	0.025	0.10
Fluoride	mg/l	1.4	1.4	15.0
Iron (total)	ug/l	1000	1000	2000
Iron (dissolved)	ug/l	--	--	500
Lead	ug/l	100	50	100
Manganese	ug/l	1000	150	1000
Mercury	ug/l	0.5	0.5	0.5
Nickel	ug/l	1000	1000	1000
Phenols	ug/l	100	1.0	300
Selenium	ug/l	1000	10	1000
Silver	ug/l	5.0	5.0	100
Sulfate	mg/l	500	250	--
Total Dissolved Solids	mg/l	1000	500	1500
Zinc	ug/l	1000	1000	1000
Fecal Coliform	#/100 ml	200	200	1000
Ammonia Nitrogen	mg/l	1.5/15	1.5/15	2.5 April-Oct. 4.0 Nov.-March
Un-ionized Ammonia	mg/l	0.04	0.04	--
Nitrate Nitrogen	mg/l	--	10.0	--
Oil and Grease	mg/l	--	0.1	15.0

mg/l = milligrams per liter
ug/l = micrograms per liter

purposes or in response to known water quality problems. A listing and brief description of ongoing monitoring programs is found below:

Ambient Water Quality Monitoring Network (AWQMN) - A cooperative project with the U.S. Geological Survey to collect water quality information at 205 stream stations (Figure 1). A listing of stations in the Illinois River Basin, and years monitored, can be found in table 2. Percent violations of General Use Standards for 1978-85 are identified in Table 3.

CORE Subnetwork - A subnetwork of the AWQMN consisting of 38 stream stations and three Lake Michigan stations.

Pesticide Monitoring Subnetwork - A subnetwork of the AWQMN which screens for toxic organic substances.

Fish Contaminant Monitoring Program - A cooperative agreement between four State Agencies - Public Health, Conservation, Agriculture, and Environmental Protection. Fish tissue samples are taken from a network of fixed stream and lake stations throughout the State and tested for organochlorine compounds used to make pesticides and polychlorinated biphyenyls (PCB). These toxic chemicals are readily taken up by the fish tested, and can subsequently be taken in by human consumption. Based on U.S. Food and Drug Administration consumptive level standards for humans, sport fish health advisories for Illinois waters are issued yearly, identifying safe levels of consumption for certain fish groups at locations around the State. In 1987, four lakes in the Illinois River Basin and stream reaches on the DesPlaines and Illinois River were included in the Advisory.

A general downward trend has been indicated by the sampling program. However, considering the limited sampling going on (78 fixed stream stations and 18 lake stations), and the influx of new chemicals being utilized, increase sampling of new chemicals would enhance this program's ability to effectively identify trends in contamination and transitions in chemical deposition in Illinois surface waters.

Facility-Related Stream Survey - The collection of macroinvertebrate, water chemistry, stream flow and habitat data upstream and incrementally downstream of a municipal or industrial wastewater treatment facility discharge.

Water Quality Modeling Surveys - Quantifies the effects of one or more discharges on water quality, and utilize predictive modeling to assess the effects of changes in discharge quality on a receiving stream.

Special Survey - Conducted as surveillance or follow-up monitoring in response to a suspected or known water quality problem. Special surveys are often conducted in support of enforcement proceedings.

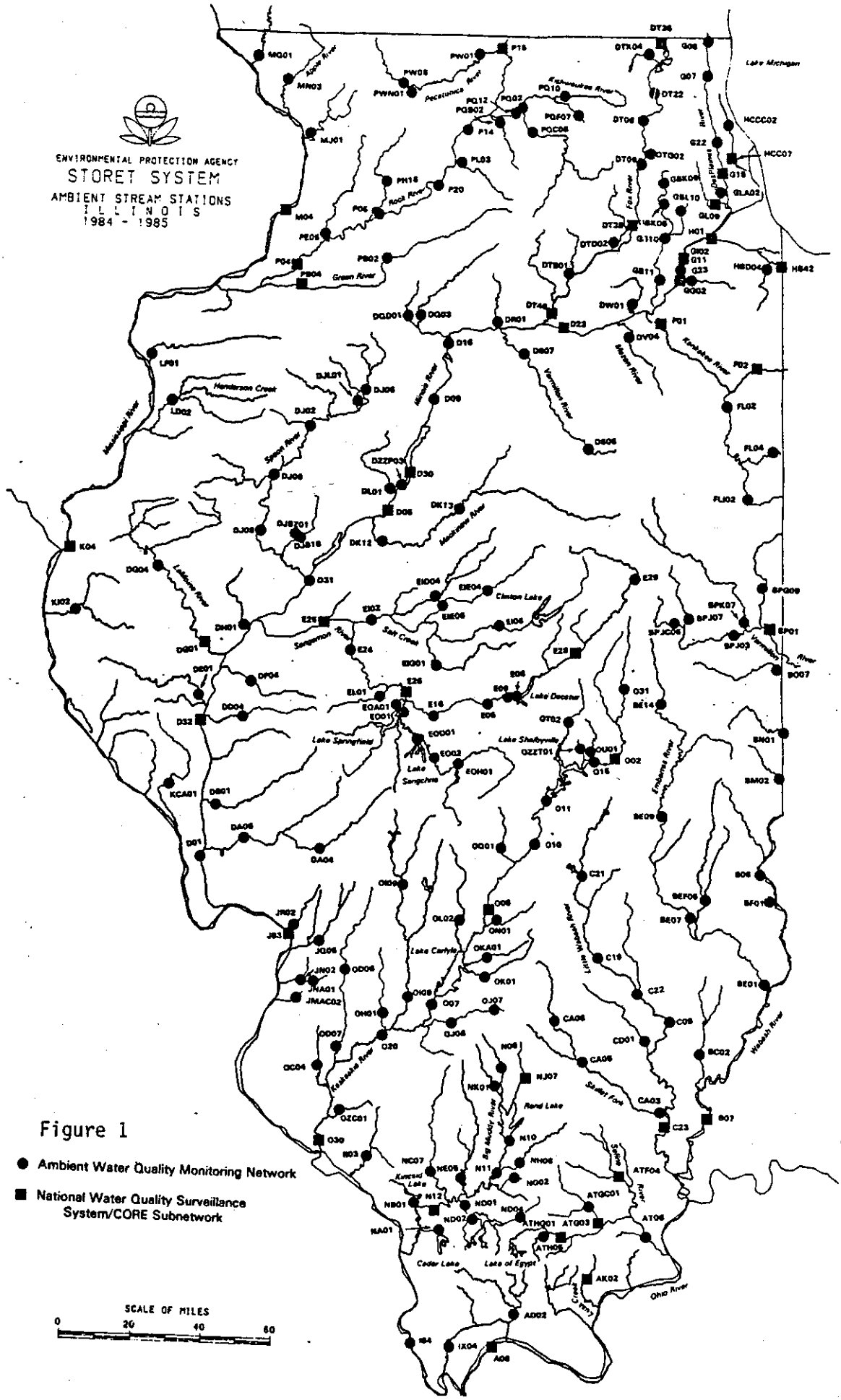


Figure 1

● Ambient Water Quality Monitoring Network

■ National Water Quality Surveillance System/CORE Subnetwork

Table 2

AMBIENT WATER QUALITY MONITORING NETWORK (AWQMN)

IEPA Station Code	USGS Station Number	Reach File Number	Sampling Agency	Years of Record (to Present)	Stream Name	Drainage Area (sq. mi.)	County	Latitude Longitude	Legal Description	Verbal Description	Parameter Group Code
Illinois River Basin											
D 01	05587060	07130011003	IEPA	59-	Illinois River	28,690	Calhoun-Greene	39 09 37 90 36 55	T10SR2WS26NW	Rt. 100 Br. at Hardin	ASN02
D 05	05563800	07130003018	IEPA	59-	Illinois River	14,585	Peoria-Tazewell	40 34 23 89 39 17	T7NR7ES24SW	Rt. 9 Br. at Pekin	CORE1
D 09	05558995	07130001018	IEPA	59-61, 63-	Illinois River	12,953	Marshall	41 01 30 89 25 02	T12NR9ES13SE	Rt. 17 Br. at Lacon	ASN02
D 16	05556200	07130001025	IEPA	67-69, 72-	Illinois River	12,756	Putnam	41 15 26 89 20 45	T32NR2WS9NW	Rt. 26 Br. at Hennepin	ASN02
D 23	05543500	07120005001	IEPA[1]-USGS	68-70, 75-	Illinois River	8,259	LaSalle	41 19 40 88 45 10	T33NR4ES13SW	Marseilles Downstream from Nabisco Bld.	CORE1 PEST1
D 30	05559900	07130001005	IEPA	70-72, 77-	Illinois River	13,900	Peoria	40 43 30 89 32 58	T9NR8ES26SE	Peoria PWS Intake	CORE1
D 31	05570520	07130003005	IEPA	78-	Illinois River	18,300	Mason	40 16 40 90 04 53	T21NR9WS11NE	Illinois Power Intake Near Havana	ASN02
D 32	05586100	07130011010	IEPA[1]-USGS	75-	Illinois River	26,564	Scott	39 42 10 90 38 40	T15NR14WS34NW	Wabash RR Br.; 1/2 mi. E of Valley City	CORE1
DA 04	05586690	07130012003	IEPA	72-77, 79-	Macoupin Creek	304	Macoupin	39 12 05 89 58 41	T9NR8WS27NW	Macoupin Sta-Plainview Rd. Br.	ASN13
DA 06	05587000	07130012001	IEPA	78-	Macoupin Creek	868	Greene	39 14 03 90 23 40	T9NR12WS11SE	Rt. 267 Br., 3.5 mi. NW of Kane	ASN13 PEST1
DB 01	05586600	07130011005	IEPA	59,61-	Apple Cr.	404	Greene	39 22 11 90 32 46	T11NR13WS28NE	Co. Rd. Br., 6 mi. N of Eldred	ASN02
DD 04	05586040	07130011011	IEPA	78-	Mauvaise Terre Cr.	146	Scott	39 43 53 90 24 26	T15NR12WS23SW	County Rd. Br., 1.5 mi. NE of Merritt	ASN02
DE 01	05585830	07130011026	IEPA	59,62-77, 78-	McKee Cr.	341	Pike	39 49 04 90 39 09	T3SR2WS8SE	Rt. 104 Br., at Chambersburg	ASN02
DF 04	05585275	07130011020	IEPA	78-	Indian Cr.	164	Cass	39 52 40 90 22 38	T17NR11WS31SE	County Rd. Br. SW of Arenzville	ASN02
DG 01	05585000	07130010003	IEPA	59,62, 64-	LaMoine R.	1,293	Brown-Schuyler	40 01 31 90 37 55	T1NR2WS33NE	US Rt. 24 Br. at Ripley	CORE1 PEST1
DG 04	05584500	07130010014	IEPA	75-	LaMoine R.	655	McDonough	40 19 45 90 53 55	T4NR4WS18SW	Rt. 61 Br. at Colmar	ASN22 PEST1
DH 01	05583915	07130003003	IEPA	59,71-77, 78-	Sugar Cr.	162	Schuyler	40 05 49 90 24 16	T1NR1ES17NW	Rt. 100 Br., 2 mi NE of Frederick	ASN13
DJ 02	05568915	07130005020	IEPA	59-62,64-77,79-	Spoon R.	762	Knox	40 54 33 90 05 12	T11NR4ES30E	US 150 Br., 1 mi S 4 mi W of Williamfield	ASN13
DJ 06	05568775	07130005023	IEPA	72-77, 79-	Spoon R.	197	Stark	41 03 47 89 47 43	T13NR4ES34SE	Rt. 17 Br., 2 mi W of Wyoming	ASN13 PEST1
DJ 08	05570000	07130005005	IEPA	77-	Spoon R.	1,636	Fulton	40 29 24 90 20 26	T6NR1ES24NW	Rt. 95, 0.4 mi. NE of Seville	ASN13
DJ 09	05569500	07130005015	IEPA	79-	Spoon R.	1,062	Fulton	40 42 51 90 16 00	T8NR2ES3NE	Br. at North Edge of London Mills	ASN13
DJB 18	05570370	07130005004	IEPA	72-	Big Creek	41.2	Fulton	40 27 32 90 08 00	T6NR3ES35	Co. Rd. Br. 2.0 mi. SW of Bryant	ASN13
DJBZ 01	05570380	Not Avail.	IEPA	75-	Slug Run	7.12	Fulton	40 28 24 90 08 37	T6NR3ES27NE	Private Rd., 2.5 mi NW of Bryant	ASN13
DJL 01	05568800	07130005026	IEPA	77-	Indian Cr.	62.7	Stark	41 01 06 89 50 07	T12NR6ES17SE	Co. Rd. Br., 3 mi. S; 3 mi. W of Wyoming	ASN13
DK 12	05568005	07130004001	IEPA	78-	Mackinaw River	1,092	Tazewell	40 26 51 89 41 28	T23NR5WS17NE	Co. Rd. Br., 4 mi. SSW of S. Pekin	ASN13
DK 13	05567510	07130004002	IEPA	78-	Mackinaw River	776	Tazewell	40 35 12 89 16 42	T25NR2WS36NE	4 mi. SE of Deer Creek at Co. Rd. Br.	ASN13 PEST1
DL 01	05563525	07130003020	IEPA	59-62,64-77,79-	Kickapoo Creek	304	Peoria	40 39 18 89 39 19	T8NR7ES24SE	US 24 Br. N of Bartonville	ASN13
DQ 03	05556500	07130001033	IEPA	77-	Big Bureau Creek	196	Bureau	41 21 55 89 29 55	T16NR9ES18SE	Rt. 6 Br. Near Princeton	ASN13 PEST1
DQD 01	05557000	07130001034	IEPA	72-77, 79-	W Bureau Creek	86.7	Bureau	41 21 57 89 34 07	T16NR8ES21NE	US 6-34 Br. at E Edge of Wyanet	ASN13
DR 01	05555950	07130001031	IEPA	71-77, 78-	Little Vermilion R	125	LaSalle	41 20 00 89 04 51	T33NR1ES14NW	US 6 Br. in LaSalle	ASN07

Table 3

PERCENT VIOLATIONS OF GENERAL USE WATER QUALITY STANDARDS AT AMBIENT NETWORK STREAM STATIONS, 1978-85

Basin	Year	DO	pH	Total Amm-N	Cl	SO_4	F	As	Ba	B	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Ag	Zn	FC	TDS/EC	Hg
Illinois	FY78	3	4	0	0	12	0	0	-	0	0	0	13	63	2	2	-	-	0	61	7	0
	FY79	1	1	1	0	7	0	0	-	-	0	0	9	63	1	9	-	-	0	67	3	3
	FY80	3	0	2	1	7	0	0	0	0	0	0	5	51	1	8	0	0	0	40	5	1
	FY81	2	0	0	0	7	0	0	0	0	0	0	6	51	0	5	0	4	0	54	4	1
	FY82	1	0	0	0	7	0	0	0	0	0	0	6	64	1	3	0	2	1	56	3	3
	FY83	2	1	0	0	4	0	0	0	0	0	0	6	58	3	4	0	3	1	59	4	1
	FY/WY84	3	0	0	0	5	2	0	0	0	0	0	3	62	2	2	0	2	2	51	6	1
	WY85	3	1	0	0	6	0	0	0	0	0	0	9	60	3	4	0	2	1	48	6	1

a FY = Fiscal Year, July 1 through June 30
b "-" = No data collected
c July 1, 1982 through September 30, 1984
d WY = USGS Water Year, October 1 through September 30

Intensive River Basin Surveys - Conducted for the overall characterization of stream resources in a major river basin or sub-basin.

It should be noted that these programs utilize, and are utilized by, several State agencies having extensive research and laboratory skills directed at Illinois water quality issues.

ACTIVITIES, PROGRAMS, AND STUDIES

A State agency with extensive water quality research and monitoring is the Department of Energy and Natural Resources -- State Water Survey (SWS) and Natural History Survey (NHS). Extensive research and data collection/analysis has been completed and new studies are ongoing. Some of the most noteworthy studies in the Illinois River include assessment of the impacts of ammonia discharges from the Peoria area on the Illinois River, D.O. studies evaluating the impacts of River barging, and a multitude of water quality related assessments.

The findings of these programs and studies are categorized and analyzed to identify existing and potential problem areas as well as high quality areas deserving of preservation. Trends in the Illinois River mainstem indicate improved water quality and habitat, but full use support is still hindered. It is often difficult to assign a specific cause of less than full use support to a given stream reach. Physical or chemical evidence may not be present during sampling periods, point discharges may be unknown or have intermitten toxic flows, and number and placement of sampling stations may be inadequate to detect what evidence does exist. In many cases there is probably more than one cause, further compounding the problem.

Trends in the Illinois River

The Illinois River has seen significant improvement in water quality. Although problems such as sedimentation, periodic low dissolved oxygen (DO) concentrations, and toxic contaminants still exist, all historical data point to marked improvement in water chemistry.

D.O. levels, indicative of a waters ability to assimilate organic waste, have improved greatly below Joliet (at I-55 Bridge) with most D.O. standard violations occurring in the Peoria and LaGrange Pools south of the bridge, and in the far upper reaches of the waterway. The improvement in D.O. can be credited to improved removal of carbonaceous and nitrogenous oxygen demanding wastes from municipal and industrial discharges.

These improvements can be credited to the State and local efforts in waste management as described in the issue paper on waste disposal. These programs, along with effective management of the National Pollution Discharge Elimination System (NPDES) permit

process, has significantly reduced waste contamination in the Illinois River. All wastewater sources containing deoxygenating material are required by state regulations to provide the equivalent of secondary treatment as a minimum prior to discharge. Discharges with little available dilution are required to provide additional treatment beyond this level including ammonia reduction in many instances. The larger dischargers along the Chicago River System and the Illinois River are specifically required to provide ammonia reduction as part of the treatment process. Sedimentation, however, persists in aggravating River conditions affecting D.O.

Recent studies completed by the State Water Survey at Peoria Lake (Demissie & Bhowmik, 1986) found that the heavy metal concentrations in sediment deposits have significantly decreased since the mid-1970's. Lead and Zinc especially showed marked improvements in Peoria Lake. The improvements have been attributed to upgrades in treatment of domestic and industrial wastes. Studies such as these are needed throughout the State, but especially on the major Rivers in Illinois. A clear assessment of erosion loading to streams and their basic makeup is needed.

The major cause of less than full use support in The Illinois River Basin is nonpoint pollution. Nonpoint sources are a major contributor of pollutant loadings to surface waters of the State. Activities which create major nonpoint pollution surces in Illinois include: agriculture, construction, coal mining, hydrologic modification, urban runoff, and recovery techniques associated with petroleum products.

As reported in the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) 1985 report title "America's Clean Water: The States' Nonpoint Source Assessment, 1985" agriculture is the single most significant contributor to the degradation of Illinois' surface water resource base. Nonpoint source contributions to streams and lakes are most prevalent during high flow conditions when the significance of point source discharges is reduced (flow ratio of discharge to receiving body of water). Hydrologic modification (i.e. channelization, straightening, deepening and obstruction clearing) is a major problem in agricultural areas with poor drainage, urban areas, flood plains, and coal mining areas.

Of the primary pollutants identified, sediment/turbidity was the most significant. Sediment/turbidity was the primary nonpoint source pollutant for 85 percent of the assessed rivers and 89 percent of the assessed lakes. The most significant nonpoint source category for rivers and lakes was agriculture. of the assessed rivers and lakes, 78 and 97 percent, respectively, were primarily affected by agricultural activities.

These results, when calculated from a more localized level, show clear regional trends. Highly urbanized areas, especially around the Northeastern part of the State clearly suffer from effects of intense population growth and development. Although newer development areas appear to be benefiting from heightened awareness towards construction erosion and soil stabilization, they still suffer from the effects of increased runoff from impervious surface areas and channelized stormwater transport streams.

Along the Illinois River, off-channel and backwater areas suffer from large scale agricultural practices and clearing of land for development.

Soil erosion and sedimentation contribute large amounts of nonpoint pollutants to Illinois water bodies. In an effort to deal with this, the State adopted a Soil Erosion and Sediment Control Program on January 1, 1983. A 17-year schedule ("T by 2000") targeted at reducing erosion levels to T, the soil loss value required to maintain soil productivity, was established. Discussion of this program and its implementation can be found in the issue paper on erosion control.

Since Illinois is faced with serious nonpoint source problems, emanating from several sources, it has been necessary to implement a variety of programs with technical support from State agencies. The continued efforts on the statewide level as well as focusing on priority watersheds will provide further knowledge on the nonpoint source problem as well as indicated effectiveness of ongoing control practices.

The findings of these assessments and programs on control of nonpoint pollution are that nonpoint pollution will continue to impair use of Illinois waterways unless further measures are taken, and that local management is the most effective means of control.

CONCLUSIONS

Based on these conclusions, and in review of ongoing programs, it appears that our Illinois River water quality problems have changed from our primary concerns with Dissolved Oxygen to newer monitoring and study of toxic fish contaminant levels and sediment characteristics as well as focusing on additional point discharges such as storm sewers. However, we should not ignore the continued findings of historical data as they are still the best trends indicators.

POSSIBLE COURSES OF ACTION

. Continue the extensive water quality programs now occurring while expanding assessments into the new generation chemicals.

. Local government must take a more active and agressive role in nonpoint source pollution control through enactment of limited-use zoning, construction ordinances, development of stormwater management programs and creation of local revenue generation strategies for capital projects directed at nonpoint controls.

. The State (Department of Energy and Natural Resources and Illinois Environmental Protection Agency) should establish a statewide sediment monitoring network to evaluate the magnitude of the problem and designate key problem areas in order to assist State and local officals in implementing control measures. Costs are as identified in the sedimentation issue paper.

. The Illinois Environmental Protection Agency will make an aggressive effort to implement the USEPA's program recommendations for management of stormwater discharge consistent with Section 405 of the Water Quality Act.

. Increased fish contaminant monitoring is needed for a more comprehensive evaluation of the problems and to refine the advisory criteria process.

. Best management practices (BMPs) for control of nonpoint source pollution should be implemented at all levels due to the benefits of sedimentation reduction, and their associated contaminants (i.e. Toxics, heavy metals, etc.).

. Since 70 to 90 percent of the pollutant loads conveyed by streams occur during storm events occurring less than 5 percent of the time in a year, it is necessary to monitor the mainstem of the Illinois River and its major tributaries during storm events. This will more clearly define critical areas, enabling the State to utilize limited resources more effectively.

. The State should investigate backwater lakes along the entire stretch of the river, and develop methods to render them more useful and biologically productive as in the past.

The following recent reports or reports in press by the State Water Survey, National History Survey, or the U. of I. Water Resources Center illustrate the rapidly advancing knowledge of Illinois River water quality.

1. 7-Day 10-Year Low Flows for Illinois Streams; ISWS reports expected in August/September, 1987

2. 7-Day 10-Year Low Flows of Streams in Northeastern Illinois; ISWS, 1983.

3. Contributions of surface runoff and flooding to agrichemical pollution in the Court Creek watershed; ISWS Report, in progress

4. The Impact of Greater Peoria Sanitary District Ammonia Discharges on Illinois River Water Quality -- ISWS Contract Report 373

5. Aeration Characteristics of Starved Rock Dam Tainter Gate Flow Controls -- ISWS Contract Report 423

6. Upper Illinois Waterway Water Quality -- a 1982 Study -- ISWS Contract Report; in press

7. Water Chemistry of the Illinois Waterway -- ISWS Circular 147

8. Effects of Wastewater Effluent Chlorination on Bacterial Densities in Receiving Water (Illinois River) -- ISWS Contract Report 376

9. Man's Effect on the Fish and Wildlife of the Illinois River -- INHS Biol. Notes No. 57. 24 pp.

10. The Development of Toxicity Indices for Assessing the Quality of the Illinois River -- University of Illinois Water Resources Center Research Report N. 96

11. Identification of the Water Quality Factors Which Prevent Fingernail Clams from Recolonizing the Illinois River, Phase II and III -- Univ. of Ill. Water Resources Center Report No. 157, 52 pp.

12. Rapid Assessment of Water Quality Using the Fingernail Clam, Musculium Transversum -- INHS, 1977

13. The Role of Contaminants in the Decline of the Illinois River: Implications for the Upper Mississippi in Contaminants in the Upper Mississippi River -- INHS, 1984

14. Distribution of Toxicity in the Sediments of the Illinois Waterway in Proceedings of the Conference on Urban Effects on Water Quality and Quantity -- INHS, 1984

15. A comparison of Illinois River Water Quality During Commercial and Noncommercial Navigation Periods -- Investigation in Progress.

16. An Assessment of the Impact of Combined Sewer Overflows at Peoria on the Waters of the Illinois Waterway -- ISWS Contract Report 330.