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Proceedings

Second Conference on the Management of the Illinois River System:

The 1990s and Beyond

Hotel Pere Marquette, Peoria, Illinois
October 3-4, 1989

A conference for citizens, organizations, industry and government representatives, and resource management professionals

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Association of Illinois Soil and Water Conservation Districts; Heartland Water Resources Council of Central Illinois; Illinois Department of Energy and Natural Resources; Illinois River Coalition/Father Marquette Compact; Illinois Section of the American Water Resources Association; Illinois State Water Plan Task Force.

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State of Illinois

Department of Agriculture, Department of Conservation; Environmental Protection Agency; Department of Transportation, Division of Water Resources; University of Illinois, Cooperative Extension Service; University of Illinois, Water Resources Center.

Organizations

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Proceedings

OPENING COMMENTS

Robert W. Frazee, Cooperative Extension Service

University of Illinois Cooperative Extension Service, Region 4 Office
P.O. Box 118, Peoria, IL 61650

It is my pleasure to welcome you to the second Conference on the Management of the Illinois River System: the 1990s and Beyond. We hope this conference will be informative, educational, and enjoyable for you. It will provide you with the opportunity to broaden your knowledge on what's happening throughout the entire Illinois River System from Grafton to Chicago. The program format will feature panel discussions from representatives of federal and state agencies, our state legislators, and local citizen action councils. This evening we will break away from the conference setting to enjoy the pleasure of a dinner cruise aboard our famous paddle wheeler, the Spirit of Peoria. This evening's dinner cruise will provide an excellent opportunity for each of us to be able to visit informally with speakers, special guests, legislators, and other conference participants to share our knowledge and experiences as they relate to the Illinois River.

The Illinois River is an important focal point for our state, as it provides numerous public benefits for the farmer, industry, and society as a whole. Part of the third largest system in the world, the Illinois River drains nearly 18.5 million acres in three states. The basin occupies 44 percent of the land area of Illinois and includes over 95 percent of Illinois' urban areas.

The Illinois River Watershed has been the focus of public concern and countless research studies for decades. Until recent years, it has seemed that everyone was looking at the Illinois River through tunnel-vision glasses by only seeing what the Illinois River could provide for a specific interest group or agency.

However, in April 1987, approximately 200 people came together here in Peoria for the first conference on the Management of the Illinois River System, which was convened by Governor James Thompson. At that conference, the participants discussed problems of the Illinois River System, indicated priorities, and identified ways to manage a solution. They promoted formation of a post-conference advocacy committee to set goals and objectives, determine a time frame for action, and attempt to estimate costs.

A great deal of progress has taken place throughout the Illinois River Watershed since the first conference. That is what the next two days are all about. This second conference will provide an open public forum for discussion of program thrusts, actions, and solutions since the first conference and promote continuing public awareness and action.

An important partnership has evolved since the first conference which is greatly enhancing the positive efforts of all of our agencies and organizations. The four key elements in this partnership include grass roots citizen action initiatives, our legislators, state agencies, and federal agencies. Our conference agenda for the next two days will feature program updates and future thrusts from each of these four key players.

Before we get into the program, I would like to direct your attention to the program booklet on page 8. Listed there are 6 agencies and organizations which have played a primary role in organizing this conference. They include the Association of Illinois Soil and Water Conservation Districts; the Heartland Water Resources Council of Central Illinois; Illinois Department of Energy and Natural Resources; the Illinois River Coalition/Father Marquette Compact; the Illinois Section of the American Water Resources Association; and the Illinois State Water Plan Task Force. Please join me in thanking these groups for their commitment to holding this conference.

Almost one year's worth of planning has gone into organizing this conference. The real nuts and bolts of developing the program and making necessary arrangements fell onto the shoulders of the Planning Committee, which is listed on page 7. I would like to recognize these individuals because, without their dedication and work, this conference would not have been held.

John Olson	Association of Illinois Soil and Water Conservation Districts;
Henry Holling, Marilyn Leyland, and Bonnie Noble	Heartland Water Resources Council of Central Illinois
Richard Nichols	Illinois Department of Agriculture
Jan Arbise and William P. White	Illinois Department of Conservation
Linda Vogt	Illinois Department of Energy and Environmental Affairs
Gary R. Clark	Illinois Department of Transportation, Division of Water Resources
Richard Mollahan and Scott Ristau	Illinois Environmental Protection Agency
Nani Bhowmik, Richard G. Semonin, and Kris Singh	Illinois State Water Survey
Glenn Stout	University of Illinois Water Resources Center
Bob Frazee	University of Illinois Cooperative Extension Service

Please join me in showing our appreciation to this excellent committee.

This conference brings together many diverse interests which are all concerned about one thing--the long-term management of this important natural resource, the Illinois River. We are very pleased that over 40 different agencies and organizations signed on as co-sponsors to lend their support to this conference. These are listed on page 8 of the program booklet.

On behalf of the Planning Committee, we are very pleased to see the interest and enthusiasm for the Illinois River being generated by your attendance and participation here today. We thank you for coming, and hope that you have an enjoyable conference. At this time, before proceeding with our morning program, we will be formally welcomed by Mayor Jim Maloof of Peoria and Mr. James Christopher, Chairman of the Peoria County Board.

WELCOME

James Maloof, Mayor
City of Peoria

Bob Frazee, Officials, and Friends:

On behalf of our entire community, I want to welcome you to the "Second Conference on the Management of the Illinois River System: The 1990s and Beyond."

The Illinois River and the Peoria Lakes make downstate Illinois and our central Illinois area one of the truly beautiful areas in the midwest. As we assemble today knowing that this tremendous natural resource, the Peoria Lakes, has a life expectancy of only ten to fifteen years, it is frightening to think that this is possible and yet it is. Throughout the years, a tremendous effort has gone into the solution for this problem, but those efforts were not as unified as they are today under the Heartland Water Resources Council. Your presence at the first conference two years ago and getting Governor Jim Thompson to see the problem first hand has focused a whole new attention on this matter.

As public officials or interested groups, it is our responsibility to make certain that every possible means be organized into one massive solid effort to save these lakes. I realize that each of us have many other projects that also need our attention, but when we analyze the effects that this has on people, homes, business, farms, recreation, education, and any lifestyle we can mention within a large radius of central Illinois, we would be failing in our duties if this were not our highest priority.

As we look to the 1990s and beyond, the one legacy we can leave to our children and our children's children, is to ensure this body of water be saved and left for them to enjoy and prosper with. I challenge each of you as I challenge myself, that a partnership of federal, state, and local agencies coupled with those organizations who are equally involved, to work together in this effort. Either lead, follow, or get out of the way.

I hope and pray that in the next two days, you combine your talents and resources into making this one of the most important successful ventures in our lifetime.

Thanks to the Committee. Thank you and God bless.

WELCOME TO RIVER CONFERENCE

James E. Christopher, Chairman
Peoria County Board, Peoria, Illinois

Good Morning.

On behalf of Peoria County—welcome to the second conference on "Management of the Illinois River System." The first conference was held in April of 1987 and served to stimulate interest and action to save the Illinois River, and more specifically the Peoria Lakes, from becoming mud flats, which they certainly will become if we don't do something. What a legacy to leave our children, two big wide mud flats where beautiful lakes had been.

The COE has been working on the river for years to insure navigation so in one sense this is where we start. We will hear more about their plans for the future, including artificial islands, later in the program. There were islands in upper Peoria Lake years ago.

The Soil and Water Conservation Districts have been working with the farming community for years to reduce both field and stream bank erosion and hold the soil on the farm where it will do the most good. This will also keep it out of the Illinois River thereby reducing the rate of siltation, the primary problem that we face today. In the end, it will be the action of the SCS supported by all of us, regardless of where we live, that will be the key. It does no good to "clean up the river" if it is just going to silt in again.

The Peoria County Board recognizes the importance of our river and the urgent nature of our problem. The difficulty has been that we really haven't known what to do. We support the SWCD and Heartland Water Resources Council, but this is really not enough to get the job done. It is our hope, that through conferences such as this one, potential actions can be outlined and focused on the river. The Illinois Department of Agriculture has a proposal to reduce erosion, which we whole heartedly support. What else should we as the government of Peoria County be doing?

I sincerely hope that when this conference is over each of us can go away with a resolve to do some specific thing to help.

Thank you for joining us in this conference.

PROGRESS IN THE ILLINOIS RIVER WATERSHED SINCE THE FIRST ILLINOIS RIVER CONFERENCE

Donald R. Vonnahme, Director
Illinois Division of Water Resources

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At the request of Governor Thompson the Illinois State Water Plan Task Force reviewed the proceedings of the April 1-3, 1987 Illinois River Conference and developed a recommended action plan for State agency response. This action plan reviewed sixteen river related issues and prepared recommendations which were presented at a public meeting on October 5, 1987 at Illinois Central College. The sixteen issues include sedimentation; erosion control; flooding; water quality; aquatic habitat, wildlife and natural areas; Lake Michigan diversion; recreation; navigation; water supply; waste disposal; hydropower; agriculture; urban stormwater management; commercial fishing and musseling; archaeology and historical sites; and economic development.

State agencies are now working towards the implementation of the recommendations specified in the action plan. The State Water Plan Task Force has been monitoring the progress of this implementation. Although shortages in significant new revenue sources has hindered the implementation of many of the recommended action items, significant progress has been made in a number of important areas. In addition the State Water Plan Task force and its member agencies are continuing to evaluate the overall Action Plan and identify areas where new initiatives or revised recommendations are now appropriate. It is quite apparent that since the first conference in April of 1987 there has been a renewed interest by State and Federal agencies in issues and programs concerning large river basins. This renewed interest will help agencies respond better to the water resources management issues of the Illinois River Basin well into the future.

FIRST CONFERENCE ISSUES AND PRIORITIES

The first conference on the Illinois River raised a large number of issues facing the management of the Illinois River system. It was clear to the participants of this conference that the basin should be examined as a total system. All participants recognized that soil erosion and siltation from land use practices threatened the Illinois River , its backwater lakes and associated biota. Additionally , flooding thought to be brought on by increased siltation and subsequent loss of storage in the rivers and backwater lakes was considered by many participants to be a problem and a number of participants indicated that there was a great lack of awareness concerning the impact of siltation on the overall basin. Some concerns were also expressed about the diversion of water from Lake Michigan and the effect that increased flow would have on downstream flooding and destruction of forested habitat along the river. Also, participants of the first conference identified a number of secondary problems which were: 1) that lack of a comprehensive management plan for the Illinois River system 2) the lack of coordination among local, state, and federal agencies, 3) the loss of wetlands and wildlife habitat along the river, 4) the lack of a central organization to deal with the entire Illinois river watershed , and 5) a general feeling of apathy about the Illinois river basin from state officials and the general public.

In general many participants felt the issues discussed at this first conference were of such a magnitude that they needed immediate attention and should be attacked simultaneously. Many interest groups felt that the system had deteriorated to a state that it would be impossible to focus on only one problem at a time. Therefore it was generally concluded at this conference that: 1) a State of Illinois program to oversee the entire Illinois River watershed be formed, 2) long-term changes in agricultural practices receive attention, and 3) focus media attention on the history, economic importance, and recreational uses of the river.

Other areas identified as needing attention included the development of demonstration projects on the river and its tributaries as a means of controlling sedimentation. Secondary suggestions on resolving problems included: 1) the development of a scenic river road or heritage trail to focus attention on the river, 2) the development of linear river park corridors, 3) the promotion of the French heritage associated with the river, and 4) establishing an Illinois river natural resources committee. In general most participants felt that the conference focused local and state attention on a system that will need to be managed from now on in order to maintain its productivity. The conference also helped to identify those individuals and agencies that have the expertise to help direct the salvaging of a very important natural resource.

STATE AGENCY RESPONSE TO THE FIRST CONFERENCE

During this first Illinois River Conference it was announced that Governor Thompson had requested that the State Water Plan Task Force review the proceedings of this conference and prepare a recommended action plan by September 1987. In June of 1987 nine State agencies met to prepare this action plan. This interagency workgroup identified sixteen issues which addressed the problems and concerns raised at the first conference.

ACTION PLAN ISSUES

1) Sedimentation
2) Erosion Control
3) Flooding
4) Water Quality
5) Aquatic Habitat, Forestry, Wildlife and Natural Areas
6) Illinois' Lake Michigan Diversion
7) Recreation
8) Commercial Navigation
9) Drinking Water Supply
10) Wastewater Disposal
11) Hydropower
12) Agriculture
13) Urban Stormwater Management
14) Commercial Fish and Mussel Resources
15) Archaeological, Historical and Paleobiological Resources
16) Economic Development

The State Water Plan Task Force work group assigned to develop the action plan prepared a 200 page report which took a critical look at the State's programs and interests in these issues and generated 104 recommendations for further action. These recommendations also included cost estimates for the increased revenues required to fully implement these recommendations. Full implementation of the cost estimates contained in the action plan report would have required $46 million of new revenues in fiscal year 1989 and $38 million in fiscal year 1990. Long term implementation of the action plan was identified as requiring an average annual expenditure of $30 million.

ACTION PLAN FISCAL IMPLEMENTATION

ISSUE	COST OF IMPLEMENTATION Recommended/(Funded)	
	Fiscal Year 1989	Fiscal Year 1990
1) Sedimentation	$ 1,335,000/($280,000)	$1,050,000/($275,000)
2) Erosion Control	$18,785,000/($3,000,	
000) $15,855,000/($5,184,000)		
3) Flooding	$ 2,275,000/($200,000)	$ 2,275,000/($510,000)
4) Water Quality	$ 350,000/($200,000)	$ 350,000/($ 0)
5) Aquatic Habitat, Forestry, Wildlife and Natural Areas	$14,760,000/($2,349,000)	$14,400,000/($3,024,000)
6) Lake Michigan Diversion	No cost estimates	$ 100,000/($ 0)
7) Recreation	$ 7,000,000/($6,821,300)	$ 2,250,000/($4,717,900)
8) Commercial Navigation	No cost estimates	
9) Drinking Water Supply	No cost estimates	
10) Wastewater Disposal	No cost estimates	
11) Hydropower	No cost estimates	
12) Agriculture	$ 100,000/($ 0)	$ 100,000/($ 0)
13) Urban Stormwater Management	No cost estimates	
14) Commercial Fish and Mussel Resources	$ 200,000/($ 0)	$ 200,000/($5,500)
15) Archaeological, Historical and Paleobiological Resources	$ 1,205,000/($ 0)	$ 1,190,000/($ 0)
16) Economic Development	No cost estimates	
TOTALS	$46,010,000/($12,850,300)	$37,775,000/($19,210,900)

AREAS OF PROGRESS SINCE THE FIRST CONFERENCE

A quick comparison of the presentations of the first conference to the those of the second conference clearly indicate a significant change in the attitudes and responses of local, state, and federal agencies to the problems and issues concerning the Illinois River Basin. The presentations by such agencies as the Division of Water Resources, Department of Conservation, Department of Energy and Natural Resources, Department of Agriculture, Soil Conservation Service, U.S. Environmental Protection Agency, U.S. Army Corps of Engineers should provide a clear indication that these agencies have a renewed interest in the issues and problems affecting large rivers and their watersheds. Research and planning efforts of the last two decades have generally stressed the need to understand the problems and mechanisms of small streams, small watersheds, non point sources of pollution, and urban runoff. The importance of these areas of research cannot be denied but the high level of emphasis to this research has in a sense generated a "small streams mentality" among those in the water resources community. Fortunately activities such as the first conference on the Illinois River Basin and the development of the Upper Mississippi River Basin Master Plan have helped to refocus the interests and priorities of water resource professionals and the general public to resource management issues and problems of large rivers and their watersheds. The following paragraphs describe a number of activities which have been initiated since the first conference and are an indication of the renewed interests of state, federal and local agencies in large river basin issues and problems.

Waterway Modeling - An understanding of the potential impacts of many of the activities of both man and nature along the Illinois Waterway suffers from the lack of a fully developed computerized hydrologic simulation model. The DENR State Water Survey under a project funded by the Water Reclamation District of Greater Chicago is now developing river flow simulation model which will provide an improved understanding of the low and high flows, low and high stages, and variability in water quality in the Illinois waterway with and without the future beneficial impacts of TARP. The results of this study will not only help in understanding the full range of benefits due to occur through implementation of TARP Phase II but also will be very useful in designing more efficient remedial structures and in future water resources planning efforts along the Illinois Waterway.

Further studies by the DENR State Water Survey were undertaken in 1988 to develop the detailed hydraulic modeling required to evaluate the potential placement of artificial islands in the Peoria Lakes. These studies generated the first two dimensional models of the flow patterns, sediment transport and sediment deposition and erosion within the Peoria Lakes. These two dimensional models were eventually prepared for transfer to the Cray Super Computer at the University of Illinois under a project funded by the Illinois Division of Water Resources.

Backwater Lakes Management - The Illinois River Action Plan prepared by the Illinois State Water Plan Task Force placed a strong emphasis on the need to address the problems of backwater lakes degradation. Most of the problems with backwater lakes along the Illinois River concern excessive sedimentation. The Upper Mississippi River System Environmental Management Program (UMRS-EMP) authorized under Public Law 99-662 in 1986 addresses these problems of degradation through various habitat improvement projects. These projects may employ such management techniques as selective dredging, selective dike or levee construction, building of islands to create habitat, opening of closed channels to maintain water flow to backwaters, and developing special aeration and other water quality control systems. Backwater lakes management projects now under consideration along the Illinois River include Banner Marsh, Stump Lake, Swan Lake, Chautauqua Lake and Peoria Lake. The planning, design, construction, and monitoring process of these projects will add significantly to our understanding of how to better manage and rehabilitate our backwater lakes resources.

The Peoria Lake project is now under design by the Corps of Engineers. The Corps is detailing a proposed artificial island project and other habitat improvement projects. This artificial island project received its first significant public review and consideration at the first Illinois River conference.

Data Collection - A number of significant resource data collection efforts have been undertaken since 1987.

The DENR State Water Survey report on its Peoria Lake Sediment Investigation recognized the need for updated hydrographic surveys of the bed of Peoria Lake. Public comments received during a hearing on the Illinois River Action Plan also strongly recommended that new bed profile surveys of the Peoria Lakes be conducted since the most recent surveys were not comprehensive and were over ten years old. Due to these concerns the U.S. Army Corps of Engineers conducted a comprehensive hydrographic survey of the Peoria Lakes during the summers of 1988 and 1989.

The Illinois Department of Energy and Natural Resources has also initiated in 1988 a two and one half year - $100,000 study to monitor the sediment sources of the Peoria Lakes.

In addition, the Water Reclamation District of Greater Chicago has undertaken a comprehensive three year water quality sampling and evaluation program of the Chicago Waterway system, Lower Des Plaines and the upper Illinois River system down to and including the Peoria navigation pool. This extensive data collection effort is estimated to eventually require an expenditure of two to three million dollars. The contribution of this data collection effort will be of great benefit to the much needed development of more flexible water quality models that can be used to predict future water quality in the upper Illinois River basin under more exacting and encompassing future scenarios.

Stream Channel Erosion Controls - Streambed and bank erosion is now becoming recognized as a major contributor to the sedimentation problems being experienced in the Illinois River watershed. The Illinois Department of Conservation, the Illinois State Water Survey, and the Illinois River Soil Conservation Task Force now have aggressive ongoing programs to address the issues and problems particular to streambed and bank erosion. Under this overall program, projects have been initiated in the Partridge Creek, Richland Creek, Court Creek, and Crow Creek watersheds within the Illinois River Basin.

Nonstructural Flood Controls Projects - Since the mid 1980's the Division of Water Resources has maintained a successful nonstructural flood hazard mitigation program in the Illinois River basin. The first conference on the Illinois River identified flooding as one of the more significant problems along the Illinois River and its tributaries. The Division of Water Resources, in recognition that most mainstem flood control projects have already been constructed, has now directed its attention and funding to a cooperative program with both local and Federal agencies to develop community specific nonstructural flood mitigation plans. These plans are often implemented by multiple agencies and contain a variety of flood damage mitigation measures such as flood fighting plans; flood proofing, elevating, or relocating flood prone structures; the public acquisition of flood prone structures and the conversion of flood prone parcels into community parks and open areas. Projects under this program have been completed for Grafton, Kampsville, and the Rome area of unincorporated Peoria County. Additional efforts under this program will include further areas of unincorporated Peoria County and Peoria/Peoria Heights followed by the areas of Spring Bay and Chillicothe. The Division is presently committed to a long term program to continue the planning, implementation and funding of nonstructural flood control projects.

Recreation - The Illinois Department of Conservation has expended substantial funds in improving the recreational resources within the Illinois River Basin. Major capital improvements have been undertaken at the Starved Rock State Park near La Salle/Peru and at the Pere Marquette State Park near Grafton. A recent national conference of water resource administrators which was held in St. Louis spent an enjoyable evening of dining and entertainment at the Pere Marquette State Park Lodge.

These efforts by the Department of Conservation will contribute immensely to the enjoyment and appreciation of the Illinois River Basin and its resources by the general public.

AREAS REQUIRING ADDITIONAL ATTENTION

Erosion Control Programs - A recent special study by the Illinois Department of Agriculture entitled "A Proposal for Addressing Erosion and Sedimentation Problems in the Peoria Lakes Area of the Illinois River" states that a great deal of progress had been accomplished in the Peoria Lakes River Basin in the past 3-5 years, with respect to implementing erosion and sediment control measures. Mention was made to the federal Farm Bill with the conservation compliance requirements and Conservation reserve Program, Agricultural Conservation Program cost-share funds available for Conservation Service, state cost-share moneys through Build Illinois for constructing erosion control practices, and State and local stream bank and gully erosion control efforts have together contributed to reducing the erosion and sedimentation of Peoria Lake. This report went on to conclude that considerable work remains to be accomplished in the Peoria Lakes watershed. The report identified five year - $4,410,000 effort, which would require new funding, to address stream bank stabilization needs and soil conservation practices in this watershed.

The Illinois River Action Plan identified that over $10 million a year would be required statewide in order to assure that appropriate practices could be implemented within the Illinois River Basin to reach the State's goal of reducing soil erosion to tolerable limits by the year 2000 ("T by 2000").

Aquatic Habitat, Forestry, Wildlife and Natural Areas - The Illinois River Action Plan recognized the need to restore State funding for the Wildlife Habitat Acquisition and Natural Areas Acquisition programs which were originally planned for funding at a total cost of $32.5 million. These programs still represent a major need in the Illinois River basin and are not yet funded at an adequate level.

Stream Channel Modification Controls - Although a number of new efforts have been undertaken in this area since the first conference by the Illinois Department of Conservation, DENR-State Water Survey, and the Illinois River Soil Conservation Task Force, substantial work is still required to implement improved management and regulatory practices to protect the stream resources within the Illinois River Basin. Efforts are needed for additional State and local regulatory controls for stream channel modification projects. For example sediment and erosion control ordinances for new construction should be implemented by municipalities and counties along the Illinois River. In addition streamside vegetative buffers need to incorporated into all new and existing developments in both rural and urban areas. These recommendations were all included in the Illinois River Action Plan in 1987 yet little progress has been made towards their implementation.

Archaeological and Historical Resource Programs - The Illinois River Action Plan identified eight new initiatives needed to address the identification and protection of the archaeological and historical resources of the Illinois River Basin. The funding needs for these initiatives have not been met. The Illinois State Museum with the help of volunteers has recently surveyed the shoreline between Pekin and Beardstown and identified over 130 prehistoric sites (some eligible for nomination to the National

Register of Historic Places) many of which were found eroding out of the shoreline. These sites need further identification and protection in the next few years or they will become a resource lost forever.

Backwater Lakes Management Plans - The Upper Mississippi River Environmental Management Program (EMP) will contribute substantially to the States understanding of the measures necessary for the improved management and protection of the backwater lakes resources of the Illinois River Basin. The lessons learned from the EMP program will need to applied basin-wide to the improved protection and management of these backwater lakes and wetland resources of the Illinois River Basin. The Illinois River Action Plan identified numerous new initiatives to address the growing problems of backwater lakes deterioration along the Illinois River. These initiatives have not yet received adequate attention or funding.

Peoria Lakes Management Program - Numerous studies have been completed and are still underway to help better identify the problems and possible solutions to the problems of the Peoria Lakes. The Illinois River Action Plan strongly recommended that these studies and possible solutions be evaluated in consideration of feasibility, public acceptance, and true benefits and costs. This evaluation would be directed towards the identification of a comprehensive management program for the Peoria Lakes area. This program would realistically identify the costs and responsibilities (local, state, and federal) of implementing the various projects and programs needed to manage the uses and problems of the Peoria Lakes. This major recommendation of the Illinois River Action Plan has not yet been funded or initiated.

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THE ILLINOIS DEPARTMENT OF CONSERVATION'S CHANGING ROLE IN THE ILLINOIS RIVER BASIN

John W. Comerio, Illinois Department of Conservation
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I appreciate the opportunity to be part of this conference. Since the last Illinois River Basin conference, held in April of 1987, much has been accomplished along the Illinois River and within its basin. The Illinois Department of Conservation has played a significant role in these accomplishments.

This morning, I would like to briefly highlight some of the things the Department is doing which reflects the Department's changing role in the Basin. Finally, I would like to identify what we see as needed action for the future.

Thanks to the $80 million Park and Conservation Fund program, created by the Illinois General Assembly in 1984, the Department was afforded the opportunity to upgrade and expand facilities especially historic lodges at Starved Rock and Pere Marquette State Parks.

Pere Marquette Lodge in Pere Marquette State Park, at the confluence of the Illinois and Mississippi Rivers, underwent a $10.5 million renovation and expansion and was reopened last Fall. The lodge now features 50 lodge rooms, 22 cabins, a full-service restaurant, meeting space, a lounge, an indoor pool, tennis courts, and other facilities. The park now serves as a major tourism attraction in the region, and the nearby community of Grafton is already experiencing an economic revitalization.

Starved Rock, reopened this past Spring, now has 72 lodge rooms, 22 cabins, an expanded restaurant, meeting space, a lounge, an indoor pool, tennis courts, and other amenities. Like Pere Marquette, Starved Rock is now seen as a tourism "magnet" that will bring people into the Illinois River Valley.

If you haven't visited these two parks, I urge you to see the dramatic change that has taken place. They demonstrate that careful State investments in tourist facilities--tourism infrastructure--can foster economic development.

This is a new role for the Department. Traditionally, we have been viewed as a natural resource conservation and recreation provision agency, with little impact on the state's economy.

However, our relationship to Illinois' tourism industry and the state's quality-of-life is becoming more obvious.

The General Assembly continues to recognize this fact. Last Spring, they passed an even more ambitious tourism development program. Dubbed "Park and Conservation II," this $120 million program will continue the upgrading and expansion of tourism facilities at Department sites, including additional major projects for Starved Rock and Pere Marquette.

PC II includes expansion of overnight accommodations at Department sites with several possible new public-private joint ventures if economically warranted, development of visitor centers and visitor information facilities, development of swimming pools and beaches, campground expansion and the addition of shower buildings, development of day use facilities and trails, and basic infrastructure improvements. With PC II, over two dozen Department sites, including Pere Marquette and Starved Rock, will become true destination parks.

The Department has also made some internal changes to strengthen its economic development role. We have formed an Office of Resource Marketing and Education to better promote Conservation sites, facilities, and programs. Perhaps some of you have seen some of our new television commercials or our new lodge magazine.

We are excited about this change in our mission. Tourism is one of the state's fastest growing industries and a vital part of Illinois' economic development and we take our role in this effort seriously. We also view this new mission as a way to strengthen our traditional mission of natural resource conservation. If the state's natural resources are not protected and wisely managed, then recreation opportunities, tourism, and, ultimately, Illinois' quality-of-life will suffer.

Since the last conference here in Peoria, the Department has made an increased financial and staffing commitment to more fully participate in the federal Environmental Management Program for the Upper Mississippi River basin. Bill Donels, our EMP Coordinator, will discuss the EMP Program later this afternoon.

EMP includes several projects along the Illinois River such as the Peoria Lake "Island" Project. The Island Project is of interest to us for two reasons. First, it will test an innovative technology to address the Lake's serious sedimentation problem. Secondly, it will improve fishing opportunities at the Department's Woodford County Conservation Area.

Within the next seven years, the State of Illinois will receive $28.5 million in federal funds to complement $3.2 million in State funds for Mississippi and Illinois River habitat improvement projects through EMP. The first construction contract, for a project at Andulusia Slough on the Mississippi River, has just been awarded.

One of the most interesting aspects of EMP is that even though it is billed as a habitat development program, it has multiple benefits--habitat, recreation, water quality, and flood control. This aspect is becoming increasingly important as single purpose federal funds diminish.

Since the last conference, the Department has increased its participation in federal and Departmental programs to better manage the Illinois River Basin's watershed. A federal program of much interest to us is the Conservation Reserve Program. To date, Illinois has enrolled over 546,000 acres in "CRP", with 16,000 acres planted in trees. Our Divisions of Forestry and Wildlife have been instrumental in signing up this acreage. Much of the CRP land will provide important habitat and timber for the state as well as control erosion.

A program of which we are particularly proud is the Department's Watershed Planning Program which is at the forefront of developing new, environmentally sensitive stream management techniques. The Program includes on-going research/demonstration projects at Court Creek and Crow Creek (West) in the Illinois River Basin.

These projects are testing non-traditional streambank erosion control techniques such as tree revetments, dormant cuttings, and biotechnical approaches. One of the most significant findings so far is that these stream management techniques often work better and cost less than traditional methods such as channelization. Therefore, habitat improvement can go hand-in-hand with stream channel maintenance.

In addition to these accomplishments, last Spring's session of the Illinois General Assembly produced some significant new legislation. House Bill 2780, passed by the legislature and signed by the Governor, recognizes the many values of Illinois' wetlands and mandates State agencies to protect wetlands through a "no net loss" policy. Wetland protection will improve flood control and water quality, two of the more persistent problems in the Illinois River Basin.

Funding was provided to expand "Kids for Conservation," a statewide conservation education program for pre-school and primary and secondary age children, which now has over 40,000 members. A more environmentally aware public is crucial to solving the persistent and pervasive resource problems in the state.

Senate Bill 787, passed by the General Assembly and signed by the Governor at ceremonies at Pere Marquette, will fund a bicycle trail acquisition and development program. One of the first projects under this program will be extension of the Sam Vadalabene bike trail along the Mississippi River through Grafton to Pere Marquette.

At the federal level, several new initiatives show promise for improved protection for Illinois' natural resources. Discussions on the 1990 federal farm bill include strengthening the conservation provisions of the 1985 Food Security Act such as Swampbuster and Conservation Compliance. Others, however, may want to weaken these important provisions. Please work with your Congressional representatives to maintain their awareness of the importance of these conservation provisions.

Senate Bill 804 would help implement the North American Waterfowl Management Plan by providing funding for wetland protection and restoration.

While these accomplishments, new programs, and new legislation are significant, much remains to be done. The Illinois River Basin's natural resources are still suffering. Watershed land use is still reducing wildlife habitat and causing erosion. Too many highly erodible fields are in cultivation. Too many fencerows and woodlots are being cleared. Too many streams are being straightened and cleared.

The Basin's recreational opportunities still need attention. Too often sites are acquired and facilities are developed, but funding is not available to operate them.

These challenges can not be tackled by the State alone. They will require a partnership between all levels of government and the private sector. I am pleased to see that many of the strategies for the Illinois River Basin to be discussed at this Conference reflect this partnership approach.

These problems will also require innovative, but realistic solutions. The island project and the new streambank management techniques represent some of these innovative solutions.

On a larger scale, we must consider alternative futures for Peoria Lake and the Illinois River Basin. We must carefully consider the effort and investment required to achieve these alternative futures. We must identify which alternatives are realistic in terms of their benefits when costs are considered. We must agree on which alternatives can achieve the most support in the General Assembly, county board, cities. A benefit-cost analysis of alternative futures may lead to the conclusion that we can not completely return the River to its past condition. We must be willing to agree on an achievable future.

We must also work to develop the consensus, both local and statewide, to work toward this achievable future. To do what is necessary to preserve Peoria Lake and the Illinois River as a viable natural, economic, and recreation resource will require the efforts of all of us working toward a single, shared goal.

We are excited about working with all of you to achieve a Peoria Lake and Illinois River that this and future generations can be proud of. I hope that this conference is part of this process of developing a vision of the future and a consensus to work toward that vision. We applaud the efforts of the Heartland Water Resources Council and the many other organizations and agencies dedicated to this goal.

Thank you.

WATER QUALITY IMPACTS OF ILLINOIS RIVER COMMERCIAL NAVIGATION

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ABSTRACT

The Illinois Waterway is subjected to heavy commerical barge traffic. The opportunity to study the possible effects this traffic has on water quality was presented during two months of the summer of 1987 when the U.S. Army Corps of Engineers shut down operations at the Peoria and LaGrange dams for lock repairs. Physical, chemical, and biological data were collected prior to the shutdowns, during the shutdown, and after reopening during 1987 and during the summer of 1988. The data was rigorously analyzed using mathematical statistical procedures. The results revealed that, in general, barge traffic does not appear to affect long term water quality.

INTRODUCTION

The Illinois Waterway is one of the nation's most heavily used inland waterways in terms of commercial barge traffic. It has been at the top or near the top relative to water borne commercial tonnage for many years. The waterway has been physically reconstructed and altered for decades to facilitate commercial barge traffic and associated interests. Overall this has been detrimental to other interests, especially those related to aquatic and riparian ecology and water quality.

The rapid increase in both commercial and recreational river traffic has prompted the Corps of Engineers to initiate studies on the Mississippi and Illinois Rivers to determine means of relieving lockage delay times. Studies relative to traffic patterns and navigation habits will begin in November on the Mississippi and in March on the Illinois. Over the years assumptions have been made by some scientists, as well as by some casual observers, that the heavy barge and tow traffic creates water quality problems or at least affects long-term water quality conditions.

An opportunity occurred during the summer of 1987 to study the possible effects of commercial traffic on Illinois River water quality. The Peoria an LaGrange dams were closed to lockage from July 13 to September 5, 1987, for rehabilitation of the lock chambers. This situation reduced commercial navigation to an insignificant level in a 151-mile reach of the Illinois River from below Beardstown to Starved Rock. A study was designed by the Water Survey and funded by the Department of Energy and Natural Resources to determine if changes in water quality could be detected in this reach of the river during the dam closings. The study was designed to cover a two-year period. The first year included intensive sampling one month before the closing, during the closing, and one month after the closing. Heavier than normal traffic was expected during the preclosing and postclosing periods. Sampling was conducted during similar 1988 periods, when normal river traffic conditions were expected. Physical, chemical, and biological parameters were examined.

METHODOLOGY

The study was designed to try to scientifically identify and quantify the effects of commercial barge traffic on Illinois River water quality. Specific questions that were addressed are:

- Does barge traffic contribute to the substandard dissolved oxygen levels routinely observed?
- What effect does barge traffic have on biological activities such as algae and benthic macroinvertebrate growths?
- Can ways be found to mitigate undesirable effects of future increased commercial traffic which may be fostered by future structural alterations along the waterway?

Study Plan

A sampling plan was developed whereby the data generated would be in a form and disposition readily amendable to statistical analysis and testing. This plan is shown schematically as figure 1.

The water quality parameters and their sampling frequencies are presented in table 1.

The original study plan had to be modified because of the occurrence of an adverse natural phenomenon, which in turn affected the approach required for the data analysis. Between the evening of August 13 and noon on August 16, 1987, the Chicago area officially received 12.84 inches of rain. The runoff from these storms created near-flood conditions throughout the study area from mid-August through the first week of September, encompassing the last half of the dam-closing period (figure 2). Consequently, the close-down period had to be bracketed into low- and high-flow conditions for data analysis. To confuse the

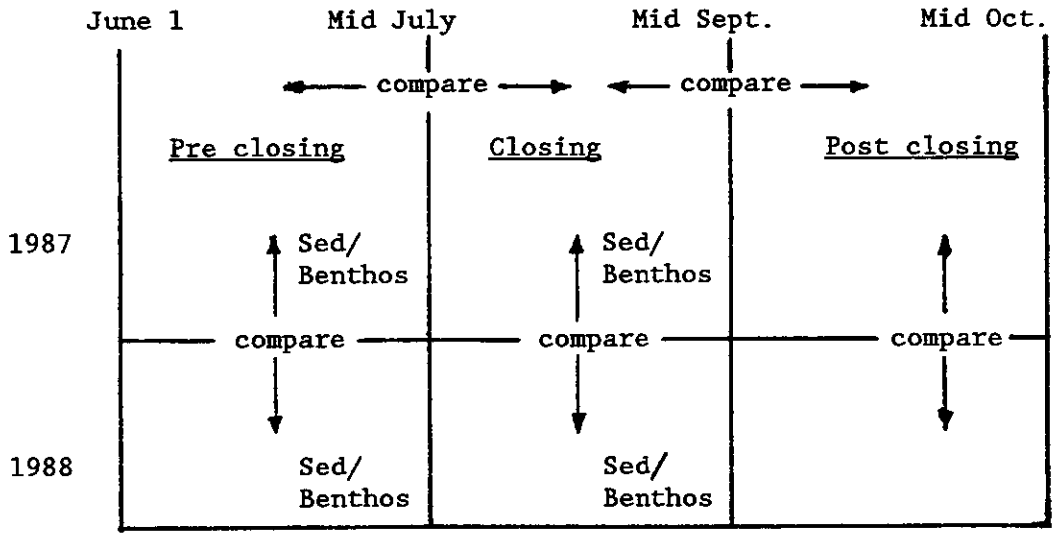

Figure 1. Schematic of study plan.

Table 1. Water quality paramters and their sampling frequencies.

	Type			Analyses		Sampling Frequency Per Week			2 per
Parameter	Phy.	Chem.	Bio.	Field	Lab	1	2	2-3	Summer
Dissolved Oxygen	X			X				X	
Temperature	X			X				X	
Secchi Disk	X			X				X	
Turbidity	X				X	X			
Suspended Solids	X				X	X			
pH		X		X				X	
Alkalinity		X			X	X			
Hardness		X			X	X			
Ortho Phosphate		X			X	X			
Dissolved Ammonia		X			X	X			
Algae Counts			X		X		X		
Benthos			X		X				X

situation even more, a severe drought hit the Illinois River basin during 1988, causing persistent low-flow and extreme warm-water conditions during the study period, June 1 through October 4 (figure 2).

Dissolved oxygen (DO) and temperature readings were taken at the surface, 3-foot depth, middepth, and bottom at verticals in the centerline of the channel at 29 locations in the LaGrange pool and 28 locations in the Peoria pool. Other chemical, physical, and biological parameters were sampled or measured at 10 of the locations in each pool. Algae samples and laboratory water quality samples were collected at 3-foot depths. All barge traffic movement was recorded as to location, direction, name of tow, and number of barges in tow.

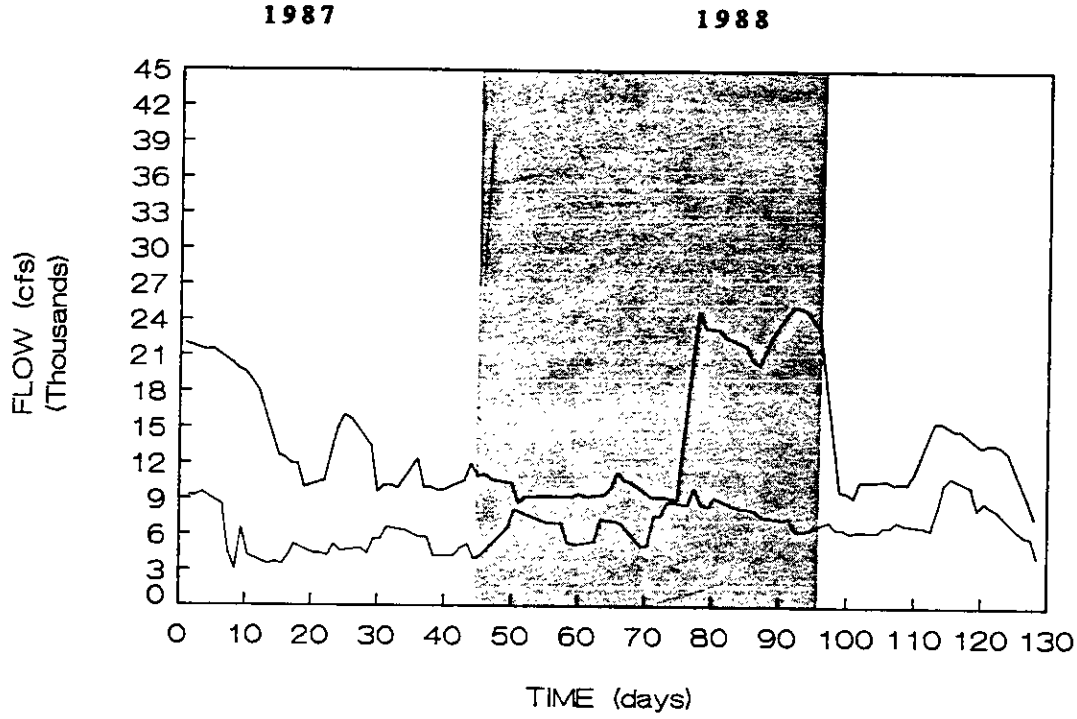

Figure 2. Flow conditions at Peoria during sampling periods.

Data Reduction

Mathematical statistical testing was used as the primary tool for developing criteria for passing judgment as to whether commercial barge traffic has any lasting effect on water quality. The variance and means for each parameter listed in table 1 were compared between periods as outlined in figure 1. Analysis of variance (ANOVA) was used as a screening tool for discerning if any difference did exist within the overall grouping of data. If the ANOVA test indicated a difference or differences did exist at the 95 percent confidence level, the Student's *t*-test was used at the 95% confidence level to isolate these differences. A one-way ANOVA test with unequal sample sizes was employed and referenced to tabular "two-tailed" F-values. The *t*-test results were referenced to tabular "two-tailed" *t*-values.

Both the ANOVA test and *t*-test involve the computation of a test value, a (calc.)F-value for the ANOVA and a (calc.)*t*-value for the *t*-test. These are compared to theoretical (theo.) tabular values. If at some confidence level, the computed value exceeds the theoretical value the hypothesis that the means are equal is rejected, or conversely, if the computed value is less, one can confidently conclude that the means are equal.

RESULTS

Because of the high flows experienced midway during the shutdown of the dams the sampling schedule was partitioned into four periods, and

the results were analyzed and presented accordingly. Table 2 presents the period time-frames and the number of sampling days included in each.

Table 2. Completed sampling schedule.

Pool	Sampling Period	Period Description	Days Sampled	Inclusive Sampling Dates 1987	1988
Peoria	1	Commercial navigation	14	6/02-7/10	6/02-7/11
	2	Nonnavigation-low flow	12	7/14-8/13	7/13-8/12
	3	Nonnavigation-high flow	7	8/17-9/03	8/16-9/01
	4	Commercial navigation	10	9/08-10/05	9/06-10/04
LaGrange	1	Commercial navigation	14	6/01-7/09	6/01-7/08
	2	Nonnavigation-low flow	13	7/13-8/14	7/12-8/15
	3	Nonnavigation-high flow	7	8/18-9/04	8/27-9/02
	4	Commercial navigation	10	9/09-10/06	9/07-10/03

Table 3 summarizes the barge traffic which was incurred during each period. The preclosing rush of commercial traffic materialized as anticipated as shown by the average per day (Avg/day) figures. However, a pentup demand did not result from the closings since the post closing period average daily use figure for 1988 was essentially equal to that of 1987 for the Peoria pool, while the period-4 usage figure for 1988 for the LaGrange pool was actually much higher than that of 1987. No commercial barge traffic was observed in the LaGrange pool during period 2 of 1987, however, with the advent of high flows, the wickets were lowered and a few tows ventured into both pools. Most of the small volume of movement observed in the Peoria pool during shutdown was due to local traffic in the Peoria and Lacon-Henry areas.

Table 3. Summary of observed barge traffic.

Period	Barges	Peoria Pool 1987	Peoria Pool 1988	LaGrange Pool 1987	LaGrange Pool 1988
1	Total Number	106	81	121	81
	Avg/day	7.6	5.8	8.6	5.8
2	Total	9	68	0	79
	Avg/day	0.8	5.7	0	6.1
3	Total	10	35	5	41
	Avg/day	1.4	5.0	0.7	3.2
4	Total	48	46	43	64
	Avg/day	4.8	4.6	4.3	6.4

Overall 48,292 field measurements, including DO, temperature, pH, and Secchi disk readings, were taken. Approximately 2,460 laboratory analyses were completed for the appropriate parameters listed in table 1. The mean values for each parameter are presented in tables 4 and 5 by sampling period for both years for the Peoria pool.

Readily apparent from table 4 is the fact that, within the sampling time frame, significant temporal variations in physical and chemical characteristics occur as indicated by the long list of hypotheses rejections. Some of the extreme changes are caused by hydraulic conditions, others by weather, and at times a combination of both. The high flows experienced during period 3 of 1987, suddenly reversed the trend toward clearer water which was occurring near the end of period 2. The large natural increase in water turbidity and suspended solids, along with reduced Secchi disk readings, caused by the high flows which occurred during period 3, completely overshadows any turbidity increases or reduction in water clarity which could ever be imposed by barge traffic.

Table 5 summarizes the ANOVA results for the biological parameters and benthic sediments. These parameters showed considerably more stability within the time frame of both yearly sampling periods than did the physical/chemical parameters presented in table 4. The failure of the ANOVA test to signify a statistically significant difference in the grouped means strongly indicates barge movement (or at least the lack of it during 1987) had or has little if any effect on these qualitative or quantitative indicators of water and sediment conditions.

The results of the *t*-test comparing 1987 and 1988 period 2 data shown in table 6 clearly indicate that barge movement probably has no lasting or long term affects on water clarity. In fact, close examination of the data in table 6 reveals that water clarity as indicated by turbidity, suspended solids, and Secchi disk readings was better during 1988 when normal barge movement was in progress than during 1987 when the Peoria pool experienced normal flows and was subjected to little transient commercial traffic. The significantly lower DOs experienced during 1988 can be attributed to the record high temperatures and persistent low flows (figure 2) which occurred during the summer of 1988 and not to the return of normal summer barge traffic.

Barge traffic does not appear to have a marked effect on bottom dwelling (benthic) macroinvertebrates (benthos) since organism densities, diversity, and species numbers were greater or better during period 2 of 1988 than during period 2 of 1987. Overall pool sediment conditions appeared comparable during both years, however, some localized changes may have occurred, particularly in the deep channel areas immediately above the two dams. The possibility of localized changes in sediment composition will be looked at in deatil.

At this point in the data analysis and data reduction, only algae densities appear to be affected to some degree by barge traffic. Note from table 6 that the geometric mean of the algae densities during 1988 was less than half of that encountered during 1987. Why such a reduction would occur without a commensurate reduction in water clarity

is unclear at this time. However, if barge movement intrinsically keeps algal growth down this could be looked upon somewhat as a benefit and not a detriment.

Table 4. Summary of ANOVA results - physical and chemical data - Peoria Pool.

Parameter (units)		Year	Mean values (x) for periods 1, 2, 3, 4 x(1)	x(2)	x(3)	x(4)	F-values Calc.	Theo.	Hypothesis: x(1)=x(2)=x(3)=x(4) Accept	Reject
Turbidity (NTUs)		87	66.50	40.40	86.63	51.46	34.15	3.19		✓
		88	38.95	38.60	41.63	47.86	3.11	"	✓	
Suspended Solids (mg/l)		87	71.67	40.30	94.30	53.28	28.30	"		✓
		88	39.47	38.58	37.00	46.14	2.21	"	✓	
pH, lab (pH units)		87	8.18	8.35	7.98	8.27	50.11	"		✓
		88	8.67	8.42	8.29	8.39	25.14	"		✓
Alkalinity (mg/l)		87	185.55	168.32	155.53	196.84	102.22	"		✓
		88	174.97	149.52	137.80	140.02	138.94	"		✓
Hardness (mg/l)		87	261.43	230.18	207.70	259.48	97.44	"		✓
		88	275.17	231.82	214.83	216.34	106.67	"		✓
Ortho-PO_4 (mg/l)		87	0.15	0.19	0.19	0.23	15.67	"		✓
		88	0.16	0.22	0.24	0.24	17.12	"		✓
NH_3-N (mg/l)		87	0.18	0.09	0.12	0.08	6.13	"		✓
		88	0.05	0.12	0.08	0.07	13.70	"		✓
NO_2-N (mg/l)		87	0.30	0.20	0.18	0.15	46.19	"		✓
		88	0.11	0.10	0.10	0.06	25.26	"		✓
NO_3-N (mg/l)		87	4.19	2.16	2.51	2.83	78.14	"		✓
		88	2.18	1.96	2.37	2.69	13.70	"		✓
pH, field (pH units)		87	8.09	8.10	7.62	8.11	51.88	2.09		✓
		88	8.46	8.25	8.23	8.35	13.98	"		✓
Secchi disk (in)		87	8.76	11.17	8.86	11.28	14.72	"		✓
		88	13.07	13.74	13.39	11.86	3.03	"		✓
Temperature (°C)	0 ft.	87	26.33	28.65	23.53	20.65	659.76	"		✓
		88	24.60	28.82	26.75	21.60	760.82	"		✓
	3 ft.	87	26.26	28.39	23.44	20.56	657.30	"		✓
		88	24.25	28.55	26.60	21.40	853.13	"		✓
	mid	87	26.20	28.24	23.40	20.52	644.42	"		✓
		88	23.96	28.35	26.45	21.25	906.18	"		✓
	btm	87	26.21	28.16	23.35	20.50	639.49	"		✓
		88	23.85	28.28	26.39	21.17	902.06	"		✓
DO (mg/l)	0 ft.	87	6.81	7.57	6.65	8.35	101.21	"		✓
		88	9.21	7.08	7.85	9.00	69.09	"		✓
	3 ft.	87	6.65	6.91	6.57	8.19	106.99	"		✓
		88	8.32	6.25	7.34	8.55	106.13	"		✓
	mid	87	5.59	6.51	6.51	8.14	127.07	"		✓
		88	7.43	5.68	6.89	8.30	133.90	"		✓
	btm	87	6.59	6.48	6.50	8.13	128.29	"		✓
		88	7.14	5.50	6.73	8.22	146.49	"		✓

Note: The statistical analyses were based on the following number of results for respective periods 1, 2, 3, and 4: 1987 and 1988 lab analyses - 60, 50, 30, 50; 1987 and 1988 pH and Secchi disk - 140, 120, 70, 100; DO and temperature (1987) - 392, 336, 196, 280, (1988) 392, 392, 196, 280.

Table 5. Summary of ANOVA results - biological and sediment data - Peoria Pool.

Parameter	Year	Mean value (x) for periods 1,2,3,4 x(1)	x(2)	x(3)	x(4)	F-values Calc.	Theo.	Hypothesis: x(1)=x(2)=x(3)=x(4) Accept	Reject
Total algae									
Density (no./ml)	87	6839.1	17741.9	8749.8	9015.7	0.81	3.50	√	
	88	15523.9	8511.3	14190.5	6668.1	3.28	3.51	√	
No. taxa	87	30.4	30.5	31.5	31.7	0.13	3.50	√	
	88	30.6	28.9	33.7	32.9	2.19	3.50	√	
S-W DI	87	3.5	2.9	2.4	2.7	9.30	3.50		√
	88	2.9	3.0	3.4	3.6	11.07	3.50		√
Benthos									
Density (no.m^2)	87	-	-	201.0	125.3	2.93	6.04	√	
	88	-	-	724.0	475.5	0.62	5.98	√	
No. taxa	87	-	-	3.1	3.5	0.63	6.04	√	
	88	-	-	4.9	3.8	1.86	5.98	√	
IEPA MBI	87	-	-	7.8	7.0	1.63	6.04	√	
	88	-	-	7.4	8.4	3.55	5.98	√	
S-W DI	87	-	-	0.9	1.1	0.76	6.04	√	
	88	-	-	1.5	1.1	5.75	5.98	√	
Sediments									
% moisture	87	-	-	35.3	39.1	0.29	5.98	√	
	88	-	-	39.8	41.7	0.04	5.98	√	
% volatile	87	-	-	4.2	4.4	0.03	5.98	√	
	88	-	-	5.1	5.3	0.02	5.98	√	

Note: Log_{10} transforms were used to analyze the algae data, therefore, algae means are geometric. The statistical analyses were based on the following number of results for respective periods 1, 2, 3, 4: Algae (1987) - 240, 200, 60, 180 (1988) - 220, 220, 100, 160; 1987 and 1988 Benthos- 0, 0, 10, 10. S-W DI = Shannon Weiner diversity index; IEPA MBI = IEPA macrobiotic index.

Table 6. Results of t-Test for Period 2 - Peoria Pool.

Parameter	Mean x(87)	Mean x(88)	t-value Calc.	t-value Theo.	Hypothesis:x(87)=x(88) Accept	Hypothesis:x(87)=x(88) Reject
Turbidity (NTUs)	40.40	38.60	1.80	1.99	✓	
Suspended Solids (mg/l)	40.30	38.58	0.55	1.99	✓	
pH, lab. (pH units)	8.35	8.42	2.00	1.99		✓
Alkalinity (mg/l)	168.32	149.52	9.04	1.99		✓
Hardness (mg/l)	230.18	231.82	0.50	1.99	✓	
Ortho-PO_4 (mg/l)	0.19	0.22	3.96	1.99		✓
NH_3-N (mg/l)	0.09	0.12	1.41	1.99	✓	
NO_3-N (mg/l)	2.16	1.96	1.47	1.99	✓	
NO_2-N (mg/l)	0.20	0.10	9.67	1.99		✓
pH, field (pH units)	8.10	8.25	3.99	1.99		✓
Secchi Disk (in)	11.17	13.74	5.01	1.99		✓
Temp (^oC) - 0'	28.65	28.82	1.55	1.99	✓	
- 3'	28.39	28.55	1.57	1.98	✓	
- Mid	28.24	28.35	1.05	1.98	✓	
- Btm	28.16	28.28	1.13	1.98	✓	
DO (mg/l) - 0'	7.57	7.07	3.49	1.98		✓
- 3'	6.91	6.25	5.80	1.98		✓
- Mid	6.51	5.68	7.95	1.98		✓
- Btm	6.48	5.50	9.40	1.98		✓
Algae						
Density (no./ml)	17,741.89	8,511.38	3.20	2.11		✓
No. taxa	30.50	28.89	1.16	2.11	✓	
S-W DI	2.91	3.04	0.68	2.11	✓	
Benthos						
Density (no./m^2)	201.00	724.00	2.28	2.11		✓
No. taxa	3.11	4.90	2.48	2.11		✓
IEPA MBI	7.80	7.42	0.58	2.11	✓	
S-W DI	0.94	1.45	3.86	2.11		✓
Sediments						
% moisture	35.33	39.84	0.64	2.10	✓	
% volatile	4.21	5.11	0.75	2.10	✓	

CONTROLLING SOIL EROSION IN THE ILLINOIS RIVER BASIN

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The Illinois River Basin encompasses nineteen sub basin areas containing a combined total of 15,646,100 acres. The Basin also contains all or a portion of fifty-two Soil and Water Conservation Districts (SWCD's). Of the fifty-two SWCDs, six have limited acreages included within the basin's boundaries, ten have significant amounts of their territory contained within the basin and thirty-six SWCDs have all or the major portion of their territory located within the boundaries of the Illinois River Basin.

Information concerning the location of conservation practice application is not readily available without extensive research. It was determined that the research effort necessary to identify activities occurring within the basin's boundaries in the sixteen districts was beyond the scope of this paper. For this reason, this paper will deal only with the thirty-six SWCDs.

The thirty-six SWCDs that have all or the major portion of their territory extant within the Basin's boundaries have a combined total of 3,755,800 acres of agricultural land that is eroding at greater than tolerable soil loss levels.

Soil erosion and deposition of sediment into surface waters is a natural process that has been accelerated by land altering changes brought about by man. Intensive agriculture, land clearing, 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, the Illinois River and its backwater lakes and sloughs.

The impacts of intensive agriculture became particularly apparent in the mid to late 1970's when Federal Farm policy was to plant every available acre. Many farmers turned to the production of commodity crops

on land that had previously been in set-a-side, pasture or some other protective cover. The situation led to the eventual enactment of the erosion and sediment control amendment to the Illinois Soil and Water Conservation Districts Act in 1977. The amendment charged the Department of Agriculture with the responsibility of developing and adopting a program with guidelines for districts to use in developing their individual standards for erosion control.

During the period since the adoption of the State's erosion and sediment control program guidelines in 1980, and the completion of the development of district's standards in 1982, Soil and Water Conservation Districts have intensified their efforts to protect erosion prone lands and to reduce the resulting runoff and eventual deposition of sediments in streams, rivers, lakes and other low lying areas.

As a part of their effort to reduce erosion, each of the state's 98 SWCDs undertook the task of identifying the status of the resource base within their respective boundaries. The resulting inventory became the basis for each SWCD's "T by 2000" plan whereby the District identified the various strategies and accomplishments that would require implementation in order to reduce erosion to tolerable levels by the year 2000. The plans for the thirty-six districts showed that conservation practices would be needed to control erosion on 4,534,947 acres on 22,424 farms. The total cost for the installation of those practices was estimated to be slightly less than $327 million. That cost also included an estimated 2,866 staff years needed to accomplish the task.

The discrepancy between the 3,753,800 acres of cropland that earlier in this paper were identified as eroding at greater than T and the 4,534,947 acres needing treatment is accounted for by the fact that less than an entire field may be eroding at greater than T but, the entire field must be planned and is therefore counted as part of the total acreage that districts will need to address.

The information generated by districts was combined in a statewide summary plan and presented to the Governor and the Illinois General Assembly in 1985. The result was that a component of Build Illinois included an erosion control Cost-Share Program. The Build Illinois cost-share program, begun in 1986, provided funds for SWCDs to use as incentives to encourage farmers to install soil conserving practices and thus reduce the amount of erosion occurring on agricultural lands. A total of $15 million in Build Illinois funds has been allocated to the 98 Soil and Water Conservation Districts. Of that amount, $5,981,139 has been allocated to the 36 SWCDs to be spent on conservation practices within the Basin. The funds were divided between two cost-share programs.

The Conservation Practices Program (CPP) was developed to allow districts to address the needs of landowners wishing to apply enduring conservation practices on their land to reduce erosion. These enduring practices include such things as terraces, grass waterways, grade stabilization structures and sediment retention structures among others. When cost-sharing is provided for any enduring practice, the landowner is

also required to implement conservation tillage practices to reduce all erosion on the field to tolerable limits as well as to protect the practice from sedimentation or other damage. During the four year period, $2,943,373 has been used on 356 projects benefitting more than 26,000 acres and saving nearly 162,000 tons of soil annually (Table 1).

The Watershed Land Treatment Program (WLTP) was developed with the intent to provide funds to treat identified critically eroding areas that were contributing to sediment related water quality problems in streams, rivers and lakes. The same requirements for conservation tillage that apply to the Conservation Practices Program also apply to the Watershed Land Treatment Program. Within the boundaries of the basin, thirty-seven WLTP projects have been identified and have received a total of $3,069,624 in Build Illinois cost-share funds (Table 2). This funding has enabled SWCDs to thus far complete 760 individual projects resulting in the reduction of 334,937 tons of soil erosion on 36,158 acres, an average soil loss reduction of 9.26 tons per acre per year.

Because of reduced levels of revenue for the Build Illinois Program, it was discontinued as a source of funding for the cost-share program at the close of fiscal year 1989.

The Illinois General Assembly, noting the high level of success of the cost-share program, turned to the General Revenue fund and appropriated $2,000,000 for fiscal year 1990. Both CPP and WLTP will be continued for FY 90 under the new source of funds. Allocated funds for both programs total $760,946 for the thirty-six districts. That figure includes $358,000 for the Watershed Land Treatment Program and $405,946 and the Conservation Practices Program.

Soil and Water Conservation Districts statewide are taking the goal of accomplishing T by 2000 very seriously. Those districts in the Illinois Drainage basin are among the most determined to achieve the stated goal. As you will learn from other speakers on the program, there are many innovative approaches being used to help reduce soil erosion levels. Among these are some stream stabilization activities and the concept of sustainable agriculture. State and federal programs are also having a significant effect on the activities of districts as well as providing new incentives for farmers to control soil erosion on their lands. The 1990 Farm Bill is currently being drafted and will undoubtedly build upon the soil conservation provisions of the '85 Farm Bill.

One alternative approach, currently being proposed by the Illinois Department of Agriculture, is a demonstration project involving one of the major hydrologic units which drains directly into Peoria Lake.

Peoria Lake is the largest and deepest bottomland lake in the Illinois River Valley, and provides numerous public benefits. Sedimentation has reduced lake volume by 77 percent and now threatens the existence of the Lake. Approximately 2 million tons of sediment is deposited in Peoria Lake each year. At the current rate of volume loss of 1.5 percent each year, the Lake will fill with sediment in less than 15 years.

TABLE 1

CONSERVATION PRACTICES PROGRAM FUNDS
ALLOCATED TO THE THIRTY-SIX ILLINOIS RIVER
BASIN SOIL AND WATER CONSERVATION DISTRICTS

SWCD	1986	1987	1988	1989	TOTAL
Brown	13,219	9,914	16,524	9,914	49,571
Bureau	28,084	21,063	35,105	21,063	105,315
Cass	10,000	7,500	18,720	7,500	43,720
Christian	16,108	12,081	20,324	12,081	60,594
DeWitt	14,497	10,873	18,121	10,873	54,364
Fulton	28,820	21,615	38,115	21,615	110,165
Greene	21,116	15,837	27,390	15,837	80,180
Grundy	10,000	7,500	12,500	7,500	37,500
Iroquois	32,917	24,688	61,146	24,688	143,439
Jersey	19,522	14,641	24,403	14,641	73,207
Kane-DuPage	20,906	15,679	13,673	15,679	65,937
Kankakee	19,735	8,309	38,941	14,839	81,824
Kendall	10,000	7,500	14,459	7,500	39,459
Knox	27,156	20,367	50,917	20,367	118,807
Lake	10,000	7,500	12,500	7,500	37,500
LaSalle	38,345	28,759	47,931	28,759	143,794
Livingston	27,997	20,998	52,494	20,998	122,487
Logan	16,616	12,462	20,770	12,462	62,310
McDonough	19,575	14,681	36,590	14,681	85,527
McLean	69,547	52,160	86,934	52,160	260,801
Macon	20,135	15,101	25,169	15,101	75,506
Macoupin	23,585	17,689	29,481	17,689	88,444
Marshall-Putnam	30,606	22,954	38,258	22,954	114,772
Mason	10,000	7,500	12,500	7,500	37,500
Menard	12,379	9,284	15,474	9,284	46,421
Morgan	29,713	22,285	40,468	22,285	114,751
North Cook	10,000	7,500	0	7,500	25,000
Peoria	22,692	17,019	28,365	17,019	85,095
Piatt	10,000	7,500	12,500	7,500	37,500
Sangamon	25,055	18,791	31,319	18,791	93,956
Schuyler	19,487	14,615	30,491	14,615	79,208
Scott	10,593	7,945	15,115	7,945	41,598
Stark	17,194	12,895	22,859	12,895	65,843
Tazewell	22,499	16,874	28,124	16,874	84,371
Will South Cook	28,014	21,010	26,507	21,010	96,541
Woodford	21,431	16,073	26,789	16,073	80,366
	767,543	569,162	1,030,976	575,692	2,943,373

TABLE 2

WATERSHED LAND TREATMENT PROGRAM
FUNDS ALLOCATED TO THIRTY-TWO PROJECTS
WITHIN THE ILLINOIS RIVER BASIN

SWCD	PROJECT	1986	1987	1988	1989	TOTAL
Brown	Mt. Sterling	8,738				8,738
Brown	Camp Creek	57,500		25,000	20,183	102,683
Champaign	Upper Salt Fork	20,300	42,525	56,700	54,129	173,654
Christian	Cottonwood & Locust Creeks	28,000	34,950	55,900	26,412	145,262
Fulton	Canton Lake	15,000	15,000	20,000		50,000
Greene	Greenfield Lake	20,344	13,106			33,450
Iroquois	Pigeon Creek	48,560		50,000		98,560
Jersey	East Otter Creek	37,014	27,760	5,000		69,774
Kane-DuPage	Mill Creek	50,000				50,000
Knox	Court Creek	85,000	83,206	36,819	30,000	235,025
LaSalle	Crotty Creek	39,308				39,308
LaSalle	Matthiessen Lake	23,500	17,625			41,125
Lee	Four Mile Grove Creek	22,500		40,000		62,500
Logan	Middle Lake Fork	32,700		50,512		83,212
Macon	North Oakley	48,225	58,500	94,125	64,050	264,900
Macoupin	Palmyra-Modesto Lake	25,500	11,391			36,891
Marshall-Putnam	Lower Crow Creek	20,000	17,667	25,000	28,557	91,224
Marshall-Putnam	Senachwine Creek			25,000	30,000	55,000
Mason	Sleepy Hollow	41,000	40,200	99,869	40,700	221,769
Menard	Cabiness-Grove-Pike Creek	5,667		29,920		35,587
Morgan	Waverly Lake	28,450	38,625	35,900	21,625	124,600
Morgan	Jacksonville Lake	21,400	28,798	33,173	33,173	116,544
McDonough	Vermont Lake	24,000	18,000	6,000		48,000
McHenry	Dutch Creek	10,000				10,000
McHenry	Wonder Lake	20,000				20,000
Peoria	Senachwine Creek			21,000	30,839	51,839
Piatt	Upper Sangamon (Goose Creek)	48,600		48,265		96,865
Sangamon	Lower Sugar Creek	40,000	43,500	41,511	85,000	210,011
Schuyler	Schuy-Rush Lake	29,000	49,000	58,000	39,000	175,000
Tazewell	Dillon Creek	36,000	45,750	61,000	61,000	203,750
Warren	Swan Creek			29,920	25,000	54,920
Woodford	Eureka Lake	41,995	17,438			59,433
		928,301	603,041	948,614	589,668	3,069,624

The Illinois River and Peoria Lake area have been the focus of concern and attention regarding erosion, sedimentation and other natural resource issues, for many years. The support for action regarding the protection and enhancement of the Illinois River and Peoria Lake area is evidenced by a multitude of initiatives, including: the formation of several committees and organizations, the preparation of several reports and research studies, the convening of a Governor's Conference on the Illinois River and a Legislative Task Force, and substantial news media coverage.

The six Soil and Water Conservation Districts in the Peoria Lake river basin drainage area of the Illinois River have together received $1,169,854 in state funds in fiscal years 1986-1989, for cost-sharing with farmers, the construction of soil conservation practices under the Build Illinois program. Thus far, over 200 projects benefitting nearly 9,000 acres of land is saving approximately 70 thousand tons of soil annually.

The federal Conservation Reserve Program has to date retired 19 thousand acres of land on 562 farms in the six SWCD's adjacent to Peoria Lake. From 1986 to 1989 the U.S. Soil Conservation Service also reported that 1.7 million tons of soil per year was saved on 315 thousand acres, as a result of conservation measures in the same six SWCD's.

To date, $150,000 in state funding has been received by the Illinois River Soil Conservation Task Force to demonstrate low-cost streambank and gully stabilization techniques for controlling erosion.

In addressing environmental concerns in Peoria Lake the highest priority for sediment input control must be given to the tributary streams which discharge directly into the lake. The "Peoria Lake Sediment Report" by the Illinois State Water Survey, (Demissie and Bhowmik) indicates that 800,000 tons per year or 40 percent of the total sediment entering Peoria Lake is from tributary streams draining directly into and above the Lake area. Approximately 15 small watersheds comprising about 343,320 acres make up the drainage area immediately adjacent to and above the Lake. Since the land area contained in these tributary watersheds is contributing to 40 percent of the sediment delivery, it is clear that soil erosion control efforts should be concentrated in this area first. The remaining 60 percent or 1.2 million tons of the sediment delivered from the Upper Illinois River watershed would take longer to treat, and require more resources.

The estimated cost for treating approximately 88 thousand acres of highly erodible land near Peoria Lake is about $5.2 million. This includes the cost for land treatment practices such as grassed waterways and terraces, as well as stabilization of 92 miles of eroding streambanks.

The current estimated soil loss in high priority tributaries totals about 1.6 million tons per year. The soil savings possible by installing needed conservation practices is 844 thousand tons per year, which represents about 52 percent of the annual soil loss. The reduction in

soil erosion could result in stopping an estimated 294 thousand tons of sediment from entering Peoria Lake each year. In turn, this could result in a 37 percent reduction in annual sedimentation.

The Department of Agriculture believes that the level of interest demonstrated by the people in the six district area surrounding Peoria Lake makes this area a prime location for a demonstration project involving the protection of the resource base through the application of standard soil conservation practice while at the same time implementing non-traditional/innovative techniques for controlling the flow of sediment into the lake as well as stabilizing the streams that are importing that sediment.

The Department believes that the success of a demonstration project must rest with the desires and interests of the persons who will most directly be affected by the project. In that vein, the following recommendations are provided for consideration.

- Utilize the technical, financial and educational assistance delivery mechanisms already in place. This includes utilizing the local soil and water conservation districts and U.S. Soil Conservation Service for technical assistance, the programs of the U.S. Agricultural Stabilization and Conservation Service, the Illinois Department of Agriculture and other state/federal or local programs for financial assistance, and the Illinois Cooperative Extension Service for educational assistance.

- Organize local resource planning committees in each small hydrologic unit within the larger river basin. The Soil Conservation Service initiated hydrologic unit planning process is an effective means for identifying and implementing resource goals. It is designed to encourage local input and support for soil and water conservation activities and other resource issues, and to design plans for addressing local concerns.

- Concentrate soil conservation efforts in the watershed areas above and surrounding Peoria Lake. As the Illinois State Water Survey report suggests, a large portion of the sediment entering the Lake is coming from this area, and therefore it deserves a higher priority.

- The highest priority for erosion control should be given to highly erodible lands with steep slopes and areas with excessive streambank erosion. These are the areas where the best results in reducing soil erosion could be attained for the least amount of effort and money. Furthermore, it should be pointed out that reducing soil erosion in the areas with close proximity to the lake will result in the greatest reduction of sediment delivery to the lake.

- The federal Conservation Reserve Program (CRP) should be encouraged on highly erodible ground as a means for retiring land that may be contributing significantly to erosion and sedimentation

in Peoria Lake. Permanent vegetative cover, tree planting and filter strips are eligible practices which can be approved under the CRP.

- Expand streambank stabilization projects on highly susceptible streambanks of tributaries to Peoria Lake. Streambank erosion adds many tons of sediment directly to Peoria Lake. Reducing the flow and velocity of water in the watershed uplands in combination with streambank stabilization work can significantly reduce sediment deposition. State cost-sharing for low-cost bank stabilization should be made available.

- Encourage the voluntary adoption of soil conservation practices by landowners in the watershed farming highly erodible land. The T by 2000 program and the Federal conservation compliance requirements, along with other state, federal and local efforts should be instrumental in long-term soil loss reduction.

- Designate the Illinois River Soil Conservation Task Force as the local organization for coordination of watershed resource planning committees, prioritization of watersheds for cost-share funding and educational efforts aimed at landowners within the Peoria Lake tributary watersheds.

Soil and Water Conservation Districts will continue to make progress in reducing soil erosion and the resulting sedimentation but, if we are to continue to succeed in controlling erosion in the Illinois River Basin, we must evaluate alternatives and make recommendations which will enable land users to more easily comply with the State T by 2000 program, the Federal conservation compliance requirements and other state, federal and local efforts to keep the soil in its place.

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WATERWAYS--THEIR RECREATIONAL POTENTIAL

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"We always had plenty; our children never cried from hunger, neither were our people in want . . . The rapids of the Rock River furnished us with an abundance of excellent fish, and the land being very fertile, never failed to produce . . ."

"If a prophet had come to our village and told us that the things were to take place which have since come to pass, none of our people would have believed him." In 1833 these were the words of Chief Black Hawk speaking of his village that had stood on an Illinois river bank for more than a hundred years.

The Indians knew how to live and enjoy their life in harmony with nature--they saw no virtue in imposing their will over the environment. There was a reverence for the everyday environment, an environment that was integrally interwoven with their way of life.

When the white man came, he plowed up the ground and scattered the rocks. Everywhere the white man has touched the earth, it is sore (Illinois Resources, 1987). Whether it was from a lack of wisdom and vision or an insensitivity to the way of nature or perhaps the misplaced values of our American society, we somehow did not understand that the rivers were the "lifeblood" of our continent--great biological systems which support diverse forms of life.

The rivers and streams that nourished the earth and those living on it, became the natural corridors for transportation. Through transportation, explorers and settlers were introduced; they in turn recognized the advantages of building on the rivers and inland lakes where all their needs could be met. These early settlers crowded the rivers and streams and reshaped them to suit their immediate needs.

As towns and cities grew, they followed their lifeblood, the river, to explore new areas, tame new lands, and create greater and larger settlements.

The history of mankind is inseparably linked to water and to this day, rivers and streams are not only used as transportation routes, and as irrigation sources but for industrial, commercial and recreational uses as well.

The earliest settlers of the Illinois River Valley used the rivers simply--that is, for exploration and migration . . . simple commerce. They made their living by fishing, cutting ice and harvesting mussels. Mussels were first harvested with the hope of finding pearls, but more earnestly to supply the button making industry with its raw material (Illinois Resources, p. 4, 1989).

Today, however, we find ourselves reaping the bitter harvest of our forefathers who saw our rivers as useful and necessary to their way of life. In satisfying our immediate needs, we failed to recognize our responsibility to protect the river and the land to preserve them for future generations. In fact, we used our rivers as the disposal systems for the byproducts of our industrialized society.

A case in point was the opening of the sanitary canal in 1900 which diverted Chicago's sewage from Lake Michigan to the Illinois River. This act of man intervening with nature had a negative impact upon our river. At first the sewage promoted fish population, but later began to deplete the oxygen supply and actually caused the aquatic life to diminish (Illinois Resources, p. 5, 1989).

As farming expanded and became more competitive, the interest of profiting from the rich low-land soils caused the farmers to construct levees along the river, closing off the backwater areas and the floodway. The contained waterways flooded more severely and more frequently resulting in subsequent sedimentation which reduced the depth of our river (Illinois Resources, p. 5, 1989).

With the alarming encroachment from agriculture and other industries on our wetlands and rivers, we saw a real impact on wildlife.

Throughout history, the Illinois River has always been an important migration route for ducks, rivaling and actually exceeding the Mississippi flyway to earn the reputation as the choice duck hunting area in the United States.

Yet, due to siltation, the river's aquatic plant supply and other natural foods were reduced and the annual migration of mallards and other ducks diminished from over a hundred million to a count of sixty-six million in 1987. This number continues to decrease today (American Outdoors, 1987 and Lee).

Nationally, our wetlands are being lost at an alarming rate currently estimated to be about 450,000 acres per year (Thomas, 1989).

However, public concern over the loss of our nation's wetlands is growing. A 1982 Harris Poll found that 83 percent of its respondents were aware of this loss and felt it "very important to protect remaining wetlands" (American Outdoors, p. 158, 1987).

Fortunately, our nation is blessed with over 3.3 million miles of rivers and streams, 13,000 of which are located in the State of Illinois. These rivers and streams not only help us provide for our commerce and transportation needs, but provide necessary aquatic habitat areas as well as help meet the recreational needs of millions of Americans.

Hundreds of millions of dollars are spent annually by the millions of Americans who use our river and waterways for pleasure boating, swimming and other water based activities.

Water, as Forest Service Researcher David W. Lime points out, "is a magnet for recreation and 'liquid' gold for a seemingly ever-expanding commercial tourism and service market." For many Americans, though, the passive enjoyment from water as a backdrop is just as important for

their leisure activities. Throughout our country, many communities have at least one river which does or could serve as a visual centerpiece (American Outdoors, p. 159, 1987). In fact, not only have some of those rivers started to reach their recreational potential, but we are also using them as catalysts for economic revitalization. For instance, with the passage of Senate Bill 787, we will be able to provide seven million dollars for construction of future biking and hiking trails. Much of that construction will follow our railroads which aligned their system along the shorelines of our rivers. The Peoria Park District will pursue this funding with a goal of further developing our trail system not only to serve our residents, but to draw tourists to central Illinois.

The Pleasure Driveway and Park District of Peoria is Illinois' oldest park and recreation agency, founded in March, 1894. The agency serves not only as Peoria's Park District but in an unofficial capacity as a conservation and forest preserve district. Upon the election of the first Board of Trustees in May, 1894, a commitment was made to acquire park sites to meet the recreational needs of our residents. Among Peoria's early parks were Glen Oak, Grand View Drive and Detweiller Parks--parks located along the bluff lands of the Illinois River and set aside in perpetuity for the enjoyment of Peoria residents. The commitment to preserve our unique bluff lands was extended by subsequent Park Boards to protect and conserve acreage adjacent to the Illinois River.

Among the more recent additions to the land holdings of the District have been properties purchased in cooperation with the Federal Emergency Management Agency. FEMA works with the state and local communities to identify and remove the obstructions in the floodway of the Illinois River by purchasing the homes that have been continually flooded and rebuilt with federal insurance funds in excess of 50 percent of the property values.

The Peoria Park District accepted free title to the federally purchased properties and provides long term stewardship with the return of the land to flood plain, restricting it from further building. The areas acquired are contiguous to other parkland previously purchased and available to the general public for river access.

The Peoria Park District is committed to doing its part in meeting the President's Commission on Americans Outdoors' mandate of protecting and enhancing our nation's waterways and providing trails for public access along such waterways. The Park District's efforts are indicative of efforts being made across our country by local, state and federal agencies--efforts that will improve the quality of life in our communities.

In Peoria, the Illinois River has the potential of becoming the focal point of our community. The two expansive "lakes" of the Illinois provide not only visual enhancement, but help to serve the aquatic recreational needs of people living throughout Central Illinois. Galena Marina and Detweiller Marina, managed by the Park District for the Detweiller Trust, offer the general public direct access to the river in Peoria. In addition, a nature preserve, the development of a Riverfront Park and Constitution Gardens in conjunction with the City and the private sector, as well as a shoreline golf course and other park and open space opportunities are available for public access.

We have found Peorians becoming particularly sensitive to the value of the Illinois River, utilizing the waterway for power boating, sailing, water skiing and fishing while sharing this important corridor with the barge traffic shipping raw materials up and down the river.

Sensitive to the needs of our local community, the Peoria Park District, with the aid of the Forest Park Foundation and federal and state matching funds through the State of Illinois Department of Conservation, has preserved over 4.2 linear miles of riverfront in the City of Peoria and Village of Peoria Heights. In recent years, several large donations from the private

sector have been received for the upgrade of facilities and land adjacent to the river. The Peoria Park District will continue to pursue our goal of preserving riverfront and the bluffs of the Illinois River to the extent our resources allow. We recognize, however, that much of the success of this effort is in the formation of partnerships with our other local governmental entities. Even more important, the key to continued preservation and enhancement of the Illinois River is cooperation between national, state and local governments and the private sector.

A great example of public-private partnership in Peoria, the City and Park District joining forces with the River Station Restaurant, D. James Jumer's Boatworks and the Economic Development Council to enhance our riverfront.

Jumer's Boatworks draws tens of thousands annually who tour the Illinois on the Spirit of Peoria. This partnership offers public access to the river, a historical museum, restaurants, tourism opportunities to Starved Rock State Lodge and Park by way of the Illinois River and future biking and hiking trail opportunities.

The Peoria Park District, in conjunction with the City of Peoria and Detweiller Trust as well as the D.O.C. are working together on the development of a hiking/biking/jogging trail now in the initial stage of construction. This trail, envisioned to be a connecting link between the existing Rock Island Trail and East Peoria, Morton and Pekin, has become a distinct reality due to the I.D.O.T. and federal government designing a walkway in conjunction with the planned new Franklin Street Bridge. The Peoria side of this trail has a potential length of 48 miles. This planned trail will parallel the river corridor for a portion of its length due to local governmental efforts in acquiring the former railroad switching yards and other riverfront lands previously owned or leased to the private sector.

The State of Illinois, Department of Conservation, has partially funded the first section of the trail which will run from Jumer's Boatworks to the Park District's Woodruff Field site which abuts the Komatsu-Dresser plant site.

Bielfeldt Park, located along Route 29 north and west of the Ivy Club, will serve as a trail head to the Peoria Trail which runs above Bielfeldt Park and below Grand View Drive and Prospect Road.

Biking and hiking has also become a popular pastime along other Illinois rivers. Along the Fox Valley River in northern Illinois for instance, the communities of South Elgin, St. Charles, Geneva, Batavia, North Aurora, and Aurora have joined together to successfully develop a linear trail which parallels the Fox River and serves as a tourist attraction adding millions to the local economy annually.

On the federal level of study, the Report of the President's Commission on Americans Outdoors made several significant recommendations concerning America's water corridors.

The Commission advised us to Protect 2,000 rivers and stream segments by the year 2000. The Commission further advised that our cities and towns should clean up and revitalize their stream corridors and that States should set up river protection programs to compliment local action (American Outdoors, p. 159, 1987).

The Commission also advised that emphasis should be placed on the public-private partnership opportunity made necessary by the abundance of privately owned river shoreline which so often precludes the enjoyment of the river by the general public.

Unfortunately, when people developed different uses for the river and extensively exploited the riches of the land bordering it, little was done to maintain and improve the environmental and ecological integrity of the river.

Therefore, as we move toward developing the best possible management programs for the river and its lakes, we need to remind ourselves about the historical development of the different problems and realize that they cannot be solved in a short time. The attainment of full solutions to these problems may take as long a time as it took the problems to reach their present stage.

Third, Peoria Lake is part of the Illinois River and cannot be seen in isolation from the whole system. Peoria Lake is the largest lake on the river, and whatever we do in the lake has a major impact on the Illinois River and vice versa. Therefore our programs for management of the lake should be compatible with our programs for the entire Illinois River.

And finally, any successful management program for the Illinois River and Peoria Lake will require the support and participation of many state, federal, and local agencies, and public and private organizations.

It is most important that we develop a management plan for the entire river basin - and that we do it soon.

To exemplify the need and the direction that such a plan should take, we only need to look at the Peoria Lake issue. For Peoria Lake we must develop a **Comprehensive Management Plan** that is realistic in terms of its potential for implementation and also in terms of expected results.

It would be unethical for me to promise unachievable results by underestimating the complexity of the problem and the powers of nature. Our studies, and those of other agencies, show that there is no one solution for Peoria Lake. The solution has to be multifaceted and multidisciplinary. Furthermore, the citizens who are directly affected should be provided opportunities to review and comment on any major undertaking related to the management of the river in general, and Peoria Lake, specifically. This is the only sure way of developing a long-lasting and effective program for managing the river and the lake.

A **Comprehensive Management Plan** for Peoria Lake must include two major components:

First, control of sediment input to the lake is essential.

Second, the disposition of the sediment in the lake and along its shoreline must be carefully considered.

Selecting just one of these two components will not solve the problem in Peoria Lake. Because about 75 percent of the lake has filled up with sediment, applying the best known erosion control measures in the watershed will not increase the volume or the depth of Peoria Lake. As a matter of fact, if we were to say that the only measure that should now be implemented is erosion control, we are in effect abandoning Peoria Lake (especially Upper Peoria Lake). By the time soil erosion in the Illinois River is brought under control, most of Peoria Lake will not exist as a lake.

On the other hand, if we dredge the whole lake to 1903 conditions, or raise the dam, but do not implement any sediment input control measures, it will just be a matter of time before the lake fills up with sediment again.

Therefore, a realistic and beneficial management plan for the sedimentation problem in Peoria lake must include a program to deal with sediment in the lake and a program to reduce the input of sediment from the watershed.

When we evaluate different management alternatives, the environmental impacts of each alternative should also be thoroughly evaluated. We have to consider and evaluate the impacts of all alternatives on:

Aquatic life

Water quality

Navigation

Recreation

Flooding

Commerce

Industry

Tourism

In summary, it is very important that we develop a **Comprehensive Management Program** for Peoria Lake that is both realistic and effective. The management program must include the two components, in-lake sediment management and sediment input control.

A management program should be multifaceted and multidisciplinary. A management program should also provide for monitoring the sediment budget in the future to evaluate the effectiveness of solution alternatives on the lake environment and its use.

Lest I leave you with the impression that little has been or is being done to help solve the problems of the river and Peoria Lake, I would like to enumerate a few studies and investigations that have led us to what we know today.

First, we have surveyed and analyzed the sedimentation rate of Peoria Lake. The major findings of the study were:

1. The lake had lost 68 percent of its 1903 capacity by 1985.
2. The average depth of the lake was reduced from 8 feet in 1903 to 2.6 feet in 1985.
3. The sedimentation rate in Peoria Lake is the highest among large reservoirs and lakes in Illinois.
4. The sedimentation rate in recent years has been higher than in earlier years.
5. The sedimentation rate in the upper lake is higher than in the lower lake.
6. The annual capacity loss is 2,000 acre-feet.
7. The annual sedimentation rate is 2 million tons of sediment.

Second, we have identified the major sources of the sediment and developed a sediment budget for the lake.

Third, we estimated that about 40 percent of the sediment in the lake originates from local tributaries that make up less than 3 percent of the drainage area of the Illinois River upstream of Peoria.

Based on this finding, ENR has funded several streambank stabilization projects around Peoria lake and has funded a three-year sediment monitoring project of the local tributaries that discharge directly into Peoria Lake.

Fourth, we evaluated 19 different management and rehabilitation alternatives from "doing nothing" to hydraulically manipulating the Illinois River to flush out the sediment in the lake.

After evaluating the various alternatives in terms of their advantages and disadvantages, we developed recommendations for inclusion in a **Comprehensive Management Program** consisting of only five alternatives that had good potential for success. These were:

Selective dredging

Creation of islands with the dredged sediment

Raising of the dam

Creation of marshy areas and wetlands

Controlling the input of sediment into the lake

After we developed the recommendations, we obtained funding from ENR for further and more detailed analysis of the selective dredging and island alternatives.

We evaluated the feasibility of the concept and identified the benefits and problems.

We completed a report that identified locations of islands and side channels that can be constructed in the lake.

We recommended that a demonstration project be initiated under the EMP program of the Upper Mississippi River System. We are very pleased that this project is moving forward under the Corps of Engineers.

In cooperation with IDOC, we have been developing procedures for establishment of vegetation in shallow parts of the lake to improve fisheries, and for low-cost streambank stabilization techniques.

We believe we have made significant progress in developing the management tools for Peoria lake. However, we need a much more coordinated and concerted effort to effectively establish the management plan for the Illinois River and develop the details of a **Comprehensive Management Program** for Peoria Lake.

The 1987 special report of the Illinois Water Plan Task Force and our 1986 Peoria Lake report are still the best starting points for developing a **Comprehensive Management Program** for Peoria Lake.

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In concert with the Governor's office, several state agencies are drafting an initiative to fund the Water Survey at $250,000 to prepare the Comprehensive Plan and a $4.4 million IDOA proposal to reduce erosion in the watersheds of the local tributaries.

I have focused on the fact that we have accomplished much, but much remains to be done. If you have approval from the governor in your pocket, and a broad base of support from the people as represented in the legislature, much can be accomplished to preserve the Illinois River and its lakes for the enjoyment and livelihood of future generations of Illinois citizens.

PEORIA LAKE SEDIMENTATION AND PROPOSED ARTIFICIAL ISLANDS

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ABSTRACT

Peoria Lake is the largest and deepest bottomland lake in the Illinois River valley. It is located on the Illinois River between River Miles 162 and 182. The lake is subdivided into two parts, Upper and Lower Peoria Lakes, by a narrow constriction at River Mile 166. It covers a total surface area of 15,000 acres, and in 1903 it had a capacity of 120,000 acre-feet at the present mean pool elevation of 440 feet above mean sea level. As of 1985, the lake had lost 68 percent of its 1903 capacity as a result of the continuous accumulation of sediment over 82 years. The average depth of the lake was reduced from 8 to 2.6 feet in the same period.

Sedimentation in Peoria Lake has occurred at two distinct rates For the period from 1903 to 1965, the sedimentation rate for Peoria Lake was 0.63 percent per year, which is relatively high but within the range of sedimentation rates for other large lakes and reservoirs in Illinois. The sedimentation rate for the period from 1965 to 1985 was 1.44 percent per year, which is more than double the rate of the previous period and by far the highest sedimentation rate among the large lakes and reservoirs in Illinois. The sedimentation rate is higher in Upper Peoria Lake than in Lower Peoria Lake. The lake gets shallower in the upstream direction, and much of the upper end of the lake has practically filled up with sediment. At present, much of the lake outside the 300-foot-wide navigation channel is shallower than 5 feet.

As sedimentation continues at the present rate, much of the lake outside the navigation channel will be transformed into mudflats and wetland areas that will be flooded annually. The transformation of Peoria Lake into a narrow navigation channel with bordering wetlands and mudflats not only will reduce aesthetic values but also will have negative impacts on recreation, real estate, and tourism.

The need for rehabilitation of Peoria Lake is therefore apparent. After evaluating many alternatives, the Illinois State Water Survey recommended a comprehensive plan, the creation of artificial islands by selective dredging of certain areas, which has become one of the most promising alternatives to be carried out as part of a long-term solution. The U.S. Army Corps of Engineers, Rock Island District, determined that artificial island construction in Peoria Lake has a benefit/cost ratio of over 4 based on recreational benefits alone, without taking any of the environmental benefits into consideration. The major benefits of selective dredging and island construction in Peoria Lake could include:

- Improved and diversified aquatic and riparian habitats
- Dredged material disposal sites for both navigation channel maintenance and selective dredging
- Reduction of wind- and navigation-induced resuspension of sediment and turbidity
- Reduction of sedimentation rates in the areas where islands are constructed
- More suitable water-based recreational sites in Peoria Lake

Sedimentation

Peoria Lake is located in central Illinois on the Illinois River between River Miles (RM) 162 and 182 (figure 1). Peoria Lake is one of the most important water resources in central Illinois. It provides many benefits to the citizens of Illinois, such as opportunities for recreation, fishing, and boating, and a channel for navigation. Most of the benefits of the lake have been taken for granted because the lake is a natural lake. However, the continuous accumulation of sediment over the years is threatening its existence.

The volume of Peoria Lake at different times is shown in Table 1 and Figure 2. The corresponding average depths of the lake are given in Table 2 and Figure 3. In 1903, the lake volume below 440 ft mean sea level (msl) was calculated to be 120,000 acre-feet. For all practical purposes the 1903 volume can be assumed to be the original volume of the lake, even though the original volume of the lake would actually have been somewhat greater than the 1903 volume. Elevation 440 ft msl is used in calculating the lake volumes at different times because it provides a consistent reference point for all computations. It should be noted, however, that the low-water lake level prior to 1939 was about 436.7 ft msl, which is 3.3 feet below the current mean pool level.

In 1965, the lake volume was 72,900 acre-feet. Thus in 62 years the lake had lost slightly less than half of its volume. By 1976 the lake volume was further reduced to 56,600 acre-feet. In the 11 years from 1965 through 1976, the lake lost approximately 14 percent of its original volume or 22 percent of its 1965 volume as a result of sediment accumulation.

In 1985 the lake volume was estimated to be only 38,300 acre-feet, which was about one-third of the 1903 volume. The lake volume lost in the nine years from 1976 through 1985 was about 15 percent of the original volume, which was almost the same as that lost in the preceding 11 years. However, the loss amounts to 32 percent of the 1976 volume.

As of 1985, the lake had lost 68 percent of its 1903 volume due to sedimentation. The situation is even worse when the navigation channel, defined as that part of the lake which is 9 feet or deeper, is excluded from the lake volume calculations. Outside the navigation channel, Peoria Lake had lost 77 percent of its 1903 volume. In 1985, the average depth of the whole lake (upper and lower) was only 2.6 feet, and the average depth of Upper Peoria Lake was only 2 feet (Demissie and Bhowmik, 1985, 1987).

Peoria Lake has the highest sedimentation rate among all the large lakes and reservoirs in Illinois (Demissie and Bhowmik, 1985). The sedimentation rates for the lake were distinctly different in the periods from 1903 to 1965 and from 1965 to 1985. For the period from 1903 to 1965, the sedimentation rate was 0.63 percent per year, which is high but within the range of sedimentation rates for other large lakes and reservoirs in Illinois. The sedimentation rate for the period from 1965 to 1985 was 1.44 percent per year, which is more than double the rate for the previous period and by far the highest sedimentation rate among the large lakes and reservoirs in Illinois.

The severity of the sedimentation in Peoria Lake is illustrated by figure 4, in which the 1903 and 1985 lake bed profiles are compared at four locations along the lake. As can be inferred from this figure, much of the lake has filled up with sediment. The sedimentation rate is higher in the upper lake than in the lower lake. The lake gets shallower in the upstream direction, and much of the upper end of the lake has filled up with sediment.

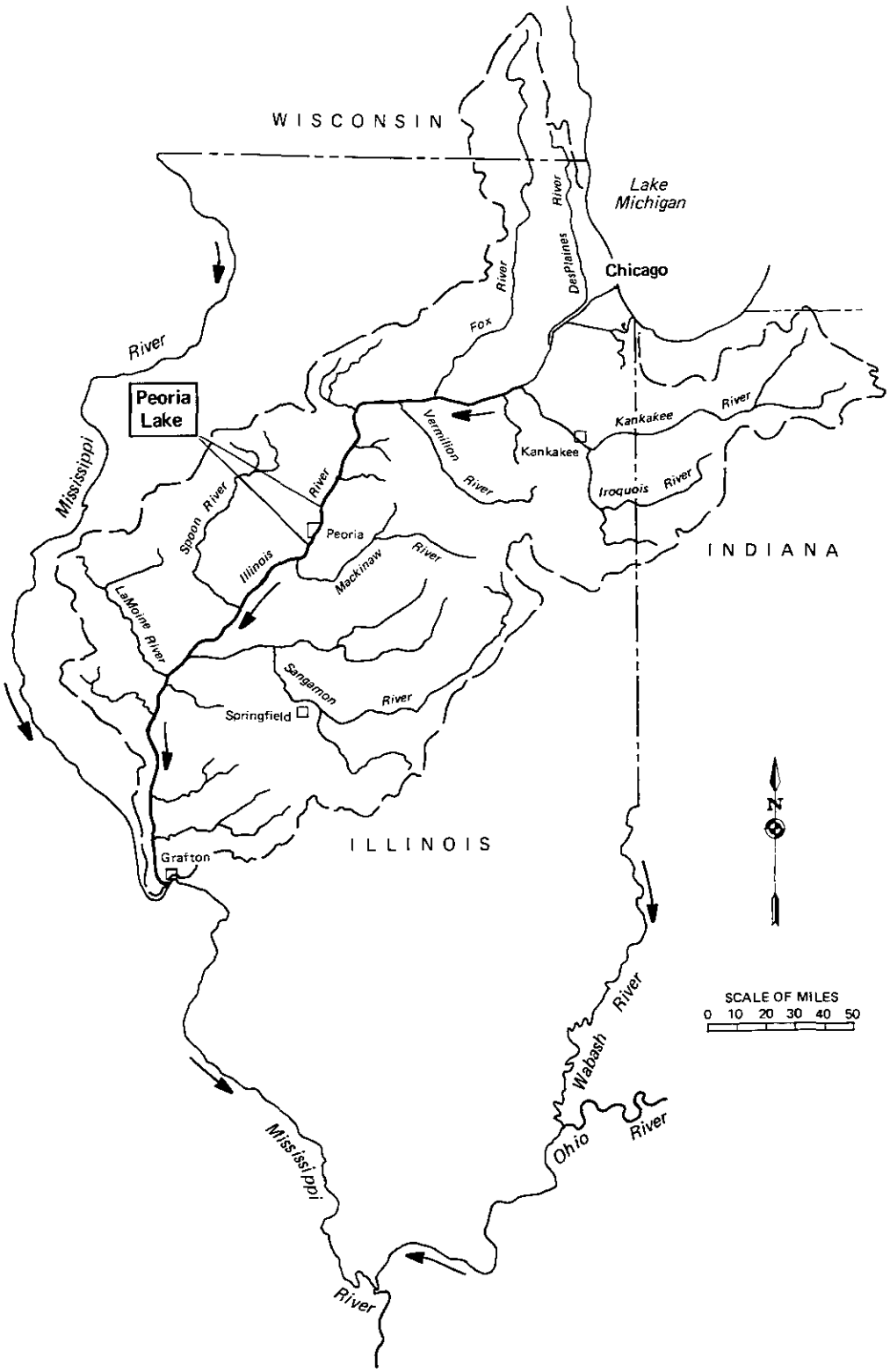


Figure 1. Location of Peoria Lake on the Illinois River

Table 1. Volume of Peoria Lake at Different Times at 440 feet msl

Year	Volume in acre-feet		
	Upper Peoria Lake	*Lower Peoria Lake*	*Upper plus Lower*
1903	96,000	24,000	120,000
1965	55,200	17,700	72,900
1976	42,200	14,400	56,600
1985	26,500	11,800	38,300

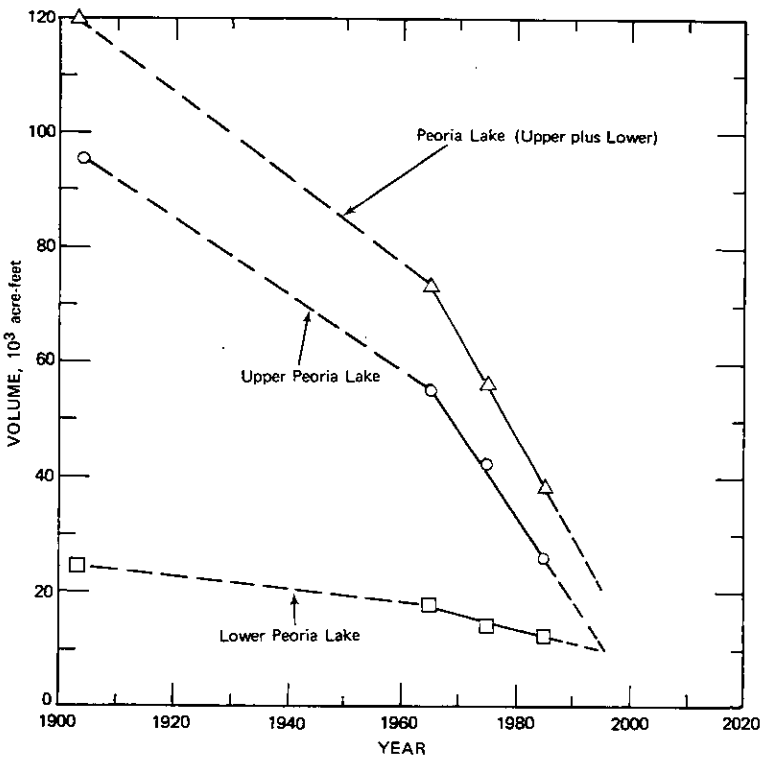


Figure 2. Volume of Peoria Lake at different times

Table 2. Average Depth of Peoria Lake at Different Times at 440 feet msl

	Average Depth in feet		
Year	*Upper Peoria Lake*	*Lower Peoria Lake*	*Upper plus Lower*
1903	7.6	9.8	8.0
1965	4.4	7.2	4.8
1976	3.4	5.9	3.8
1985	2.0	5.3	2.6

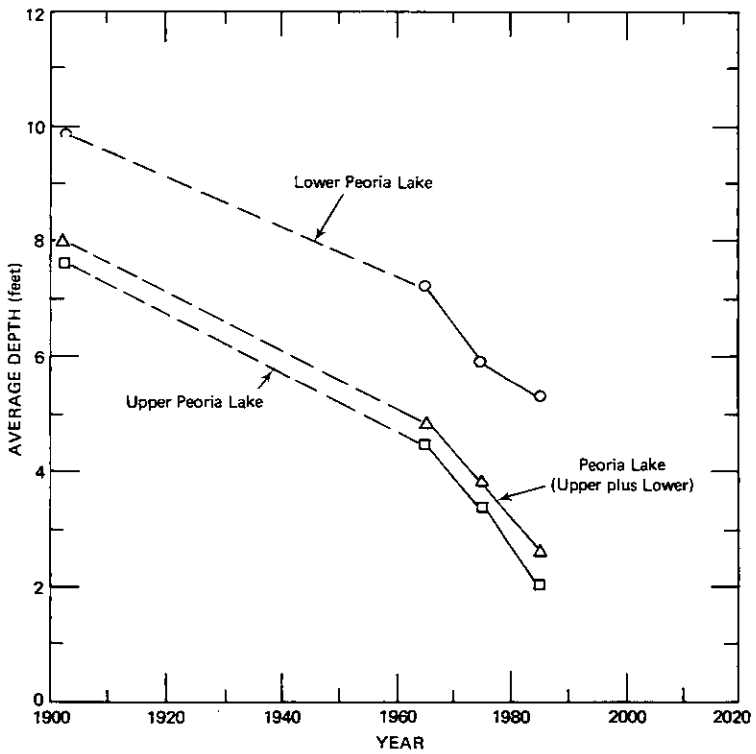


Figure 3. Average depth of Peoria Lake at different times

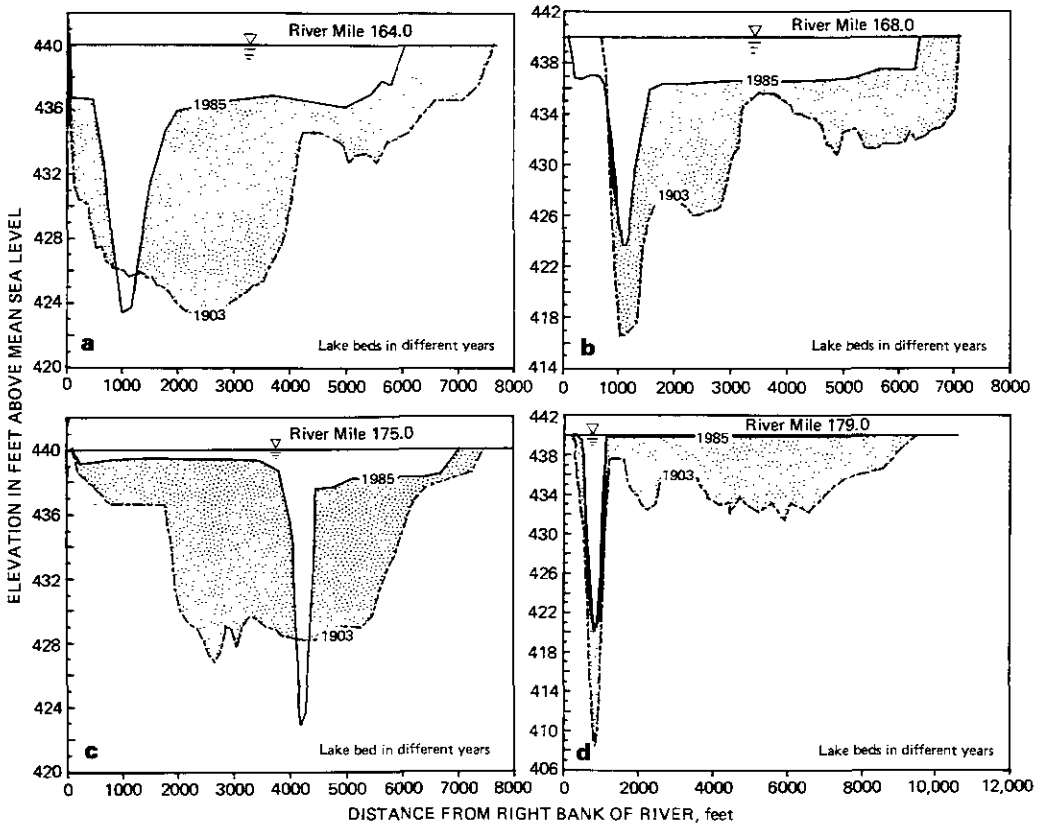


Figure 4. Comparison of 1903 and 1985 lake bed profiles for Peoria Lake

The net result of the sedimentation pattern in Peoria Lake is the shrinking of the deep parts of the lake. This is illustrated in figure 5, where the portions of the lake deeper than 5 feet are compared for 1903 and 1985. In 1903 much of the lake would have been deeper than 5 feet under present-day normal pool conditions, while in 1985 much of the lake was shallower than 5 feet, with a narrow navigation channel in the middle of the lake. As sedimentation continues and the shallow flat areas start supporting vegetation, much of the lake will be transformed into a wetland area that will be flooded regularly. The transformation of Peoria Lake into a narrow navigation channel with bordering wetlands and mudflats not only will reduce aesthetic values but will also have negative impacts on recreation, real estate values, and tourism.

Alternative Solutions

One of the main objectives of the 1985 Illinois State Water Survey study was to investigate a range of alternative solutions to the sedimentation problems and make recommendations as to the best alternatives. After information was gathered on a number of alternative solutions, the alternatives were grouped into the following four major categories, including the "do nothing" alternative.

1. Control sediment input into the lake
2. Manage the in-lake sediment
3. Hydraulically manipulate the Illinois River through Peoria Lake
4. Do nothing

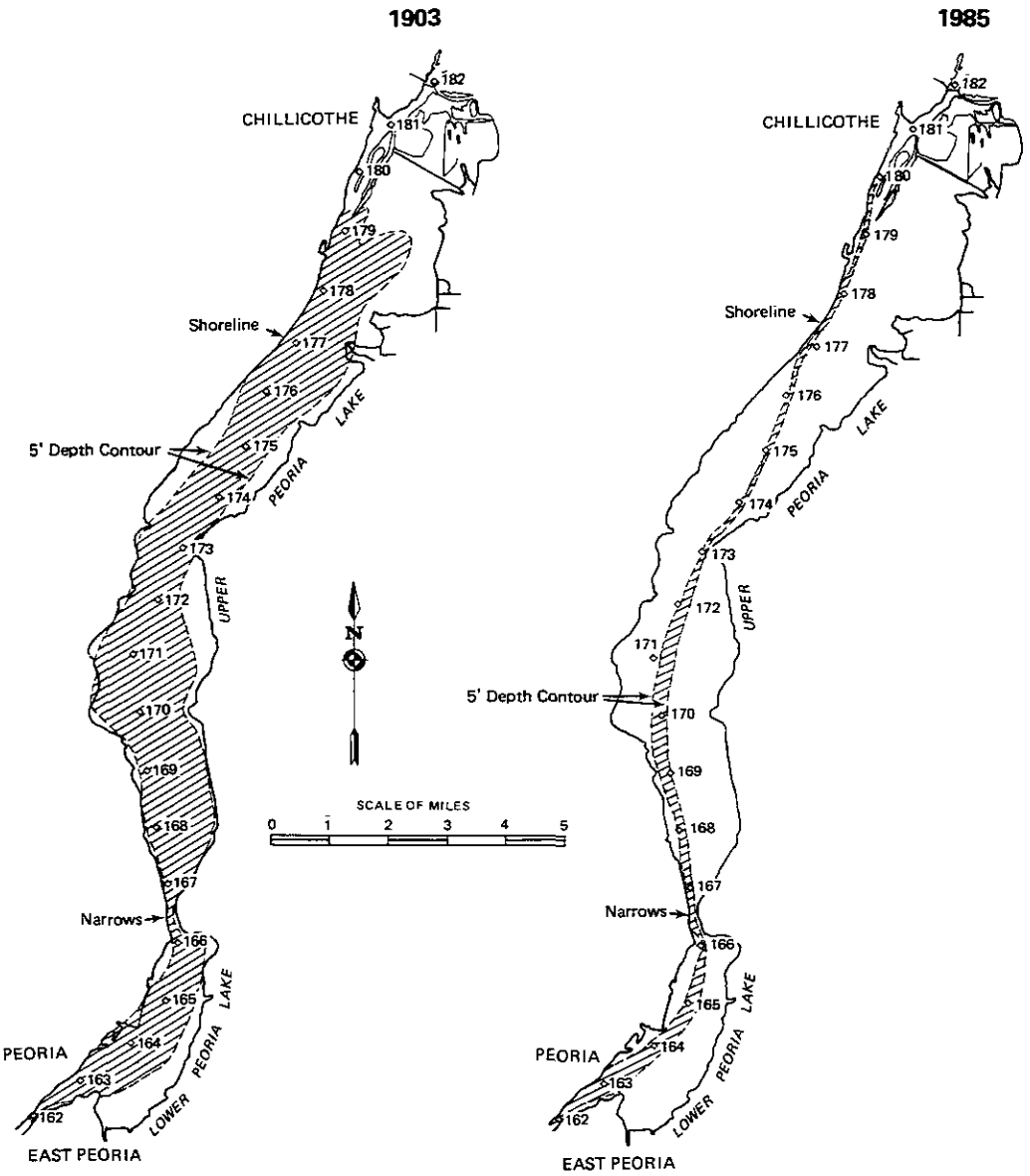


Figure 5. Lake area deeper than 5 feet in 1903 and 1985

Under each of the three major categories of alternatives (excluding the "do nothing" alternative), numerous alternatives were considered in the report of the study (Demissie and Bhowmik, 1985). For purposes of completeness and clarity, a complete list of the alternatives considered in the original report is presented below.

1. *Control sediment input*
    a. Control sediment input from tributary streams which drain directly to the lake.
    b. Implement best management practices (BMPs) on the Illinois River watershed to reduce erosion.
    c. *Implement a shoreline protection program for* Peoria Lake.
    d. Establish marshy areas to prevent bank erosion and resuspension of bottom sediment.
    e. Construct a dam upstream of Peoria Lake to trap the sediment from the Illinois River.
    f. Provide upstream storage for high flows to reduce the sediment input into the lake.

2. *Manage in-lake sediment*
    a. Dredge selected areas of the lake.
    b. Lower the lake level to compact the sediment by drying.
    c. Lower the lake level for dry dredging.
    d. Dike part of the lake for dry dredging.
    e. Create artificial islands in the lake to form braided side channels, increase flow velocities, and reduce wave action.
    f. Experiment with thalweg disposal of dredged sediment.

3. *Hydraulically manipulate the Illinois River through Peoria Lake*
    a. Raise the Peoria dam.
    b. Build an in-lake dike (levee) to confine the Illinois River flow.
    c. Redirect the main flow of the Illinois River to the shallow parts of the lake.
    d. Relocate the sailing line periodically.
    e. Widen and deepen the Narrows.
    f. Build a check dam at the Narrows.

After all of the above alternatives were evaluated, a comprehensive lake management plan was recommended (Demissie and Bhowmik, 1985). It was recommended that the plan include all or some of the following alternatives:

- Selective dredging
- Creation of artificial islands
- Raising of the dam
- Creation of marshy areas
- Sediment input control

Artificial Islands

Among the components of the recommended comprehensive plan, the creation of artificial islands by selectively dredging certain areas has become one of the most promising alternatives to be carried out as part of a long-term solution.

The U.S. Army Corps of Engineers, Rock Island District, made an economic analysis of the construction of islands in Peoria Lake as a follow-up to the Water Survey study. They assumed groups of islands in Lower and Upper Peoria Lake and estimated construction costs

and recreational benefits. They did not include any other benefits (such as environmental enhancement) in their benefit calculations. With the above assumptions, they estimated that groups of islands in Lower and Upper Peoria Lake would have benefit/cost ratios of 4.3 and 5.0, respectively. On the basis of such high benefit/cost ratios, they concluded that the islands are economically justified. However, the Corps of Engineers could not pursue the project further because the project would not have flood control benefits. They recommended that the project be pursued by local and state groups (USACOE, 1987).

Construction of artificial islands is not a new concept, even though this is the first time it is being proposed for lakes in the Illinois River valley. Artificial islands have been constructed in offshore areas as shore erosion control measures and as drilling platforms (Keith and Skjei, 1974; Garratt and Kry, 1978; Schnick et al., 1981). Numerous artificial islands also have been created by disposal of dredged material in coastal waterways, the Great Lakes, and the Upper Mississippi River (Soots and Landin, 1978; Schnick et al., 1981).

Artificial islands are also being constructed in Weaver Bottoms in Pool 5 of the Mississippi River (USACOE, 1986a,b). The artificial islands in Weaver Bottoms are part of a major habitat rehabilitation program in the Upper Mississippi River being conducted by the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service. Weaver Bottoms is a 4,000-acre backwater lake which had problems associated with increased velocities, sedimentation, and turbidity (USACOE, 1986a,b). Artificial islands were selected as part of the project to reduce wind fetch and thus sediment resuspension and turbidity. Another benefit of the islands, in addition to improvement of the habitat, is that they serve as disposal sites for dredged material from maintenance of the 9-foot navigation channel in the Mississippi River.

Benefits of Artificial Islands in Peoria Lake

In Peoria Lake the construction of islands would serve many purposes. The main benefits would include the following:

1. **Providing improved and diversified aquatic, riparian, and terrestrial habitats.** The dredging of lake sediment at selected areas would create variable water depth habitats in areas which are presently very shallow. The dredged areas and the shoreline of the islands can be contoured so that they provide the desired water depth at selected locations during different water stages in the Illinois River. Such an arrangement should provide improved and diversified aquatic habitat for fish and other animals.

Because of the variable stages of the river, different parts of the islands would be inundated at different times. Some of these areas would behave like natural wetland areas and provide a different form of habitat that would enhance the aquatic habitat. Further up at higher elevations on the islands, there would be areas that would not be inundated by water every year. These areas could be designed to provide riparian and terrestrial habitats to supplement the aquatic and wetland habitats. This should benefit both waterfowl and shore birds that are found in the Illinois River valley. In addition, the island habitat could provide a refuge to migratory and nesting birds.

2. **Serving as dredged material disposal sites for both navigation channel maintenance and selective dredging.** At present, frequent dredging is not required in the Peoria Lake area to maintain the navigation channel. However, that will not be the situation in the near future as the deeper portion of the lake keeps shrinking because of continuous sedimentation in the lake. In some locations where the tributary deltas are very close to the navigation channel (for example, as in the case of the Tenmile and Blue Creek

Deltas), navigation channel dredging will be needed sooner than in other areas. Therefore, it would be to the long-term benefit of navigation interests to have sites at which to dispose of dredged material in Peoria Lake.

A large part of Peoria Lake needs to be dredged if it is going to provide deep water for fish and wildlife habitat and for recreation. If no dredging is performed, a large part of the lake will be transformed to mud flats and wetlands. However, dredging a large part of the lake would be expensive and will not likely happen. Therefore, with the limited financial resources available for lake rehabilitation, only selected areas could be dredged. If some selected areas are going to be dredged, there is a need to find a disposal site for the dredged material. It is very unlikely that the necessary state and federal permits could be obtained for disposing of dredged material in the river channel and flushing it downstream, as is popularly believed. Thus islands would be an advantageous addition to the proposals for dredging in Peoria Lake.

3. **Reducing wind- and navigation-induced resuspension of sediment and turbidity.** One of the major environmental problems in Peoria Lake is the resuspension of fine sediment due to wind- and navigation-induced waves. The problem is aggravated by the shallowness of a large part of the lake and the fine unconsolidated sediment at the bottom of the lake. Peoria Lake is more than a mile wide and even as much as two miles wide (west to east) at many places. Lower Peoria Lake is about 4 miles long, and Upper Peoria Lake is more than 14 miles long in a south-to-north orientation. These dimensions and the prevailing wind direction in the area, (southwesterly) provide long fetches for wind to generate waves sufficient to resuspend the sediment in the lake frequently. Navigation and recreational boating also generate significant waves that resuspend sediment in the lake. Therefore the construction of islands that reduce the fetch of the wind would reduce the generation of waves in the protected areas and the resuspension of bottom sediment into the water column. At the same time, constructing islands between the navigation channel and some parts of the lake would shelter the area on the opposite side of the navigation channel from waves generated by tows and pleasure crafts. This would reduce the negative impacts of navigation and recreational boating in some areas of the lake.

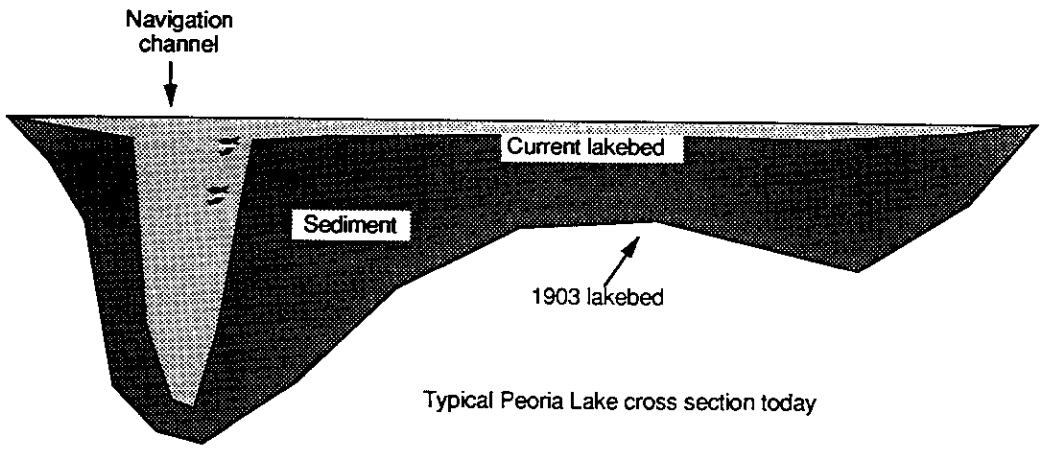
4. **Reducing sedimentation rates in the areas where islands are constructed.** Constructing islands in Peoria Lake should create slightly reduced flow areas, thus increasing the flow velocity through the area. In Peoria Lake, the flow areas are so large that the velocities under existing conditions are very small, resulting in high sedimentation rates. Increasing the flow velocity would reduce the sedimentation rate in the areas where the islands are built.

5. **Providing more suitable water-based recreational sites in Peoria Lake.** At the present time only a small part of the lake is used for recreation. These areas are limited to Lower Peoria Lake and the lower part of Upper Peoria Lake. The availability of suitable recreational areas will continuously diminish as the lake fills up with sediment. At the same time, the need for water-based recreation is expected to increase. Selective dredging and island construction would provide some relief to the shrinking recreational areas in the lake by increasing areas for water-based activities such as boating, sailing, and water skiing.

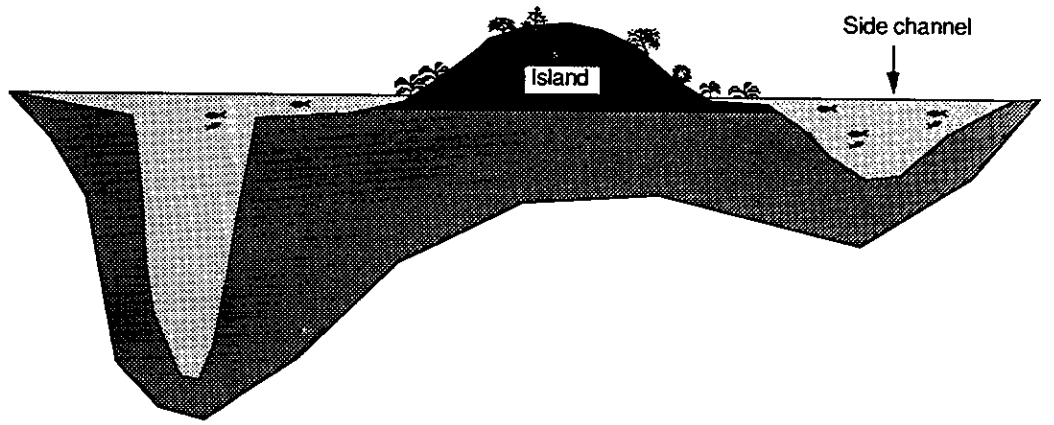
6. **Providing a side channel away from the navigation channel for safe recreational boating.** One of the concepts developed in this project is the inclusion of a side channel along the islands on the opposite side from the navigation channel. The side channel, in addition to providing an improved aquatic habitat to that provided by the shallow channel border areas, would provide a safe recreational boating and sailing channel away from the navigation channel and its large commercial navigation crafts.

Conceptual Considerations

The selection of the dredge sites and the location of islands is an important consideration in implementing a long-term lake rehabilitation and management program. The dredge sites and the islands have to be located such that the new environment created can be integrated into the river and lake environment and sustained for a long period of time. The best method for achieving such an environment in Peoria Lake is to establish a side channel by dredging and to use the dredged material to partially build the islands, as shown in figure 6. If properly designed and constructed, this arrangement of islands and side channels should maintain and sustain itself and blend in with the natural environment very well. In fact, the presence of a side channel and an island or groups of islands is a common feature in the Illinois River valley in areas where the river does not flow in constricted reaches. Therefore, the selection of island and side channel locations in Peoria Lake should be based on establishing an environment that functions and looks like a natural environment and that improves the overall quality of the lake for fish and wildlife habitat and for recreation.



Typical Peoria Lake cross section today



Peoria Lake cross section after island construction

Figure 6. Artificial island concept for Peoria Lake

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SEDIMENT MANAGEMENT PROBLEMS OF BACKWATER LAKES AND ALTERNATIVE SOLUTIONS

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ABSTRACT

Construction of locks and dams along the Illinois River, especially in the reach extending from Grafton to the Lake DePue area, has created a large number of backwater areas within the main floodplains of the river. These backwater areas are called backwater lakes, and they are subject to natural variations in water depths and sediment deposition. Moreover, over the last 100 years or so all the river basins in Illinois have been subjected to intense human activities and alterations. As a result of these natural and human interventions, the Illinois River valley has experienced a tremendous amount of sediment deposition in recent years. Many of the 53 or so backwater lakes along this river have lost 30 to 100% of their capacity to sediment deposition. Peoria Lake, a bottomland lake, has lost 68% of its 1903 capacity, and upper Peoria Lake will eventually attain the appearance of an incised river with broad and shallow wetlands on both sides. On the average, about 20.6 million tons of sediment is deposited annually over the entire valley, with a deposition rate of 0.81 to 2.1 inches per year. Recently implemented nonpoint source pollution control measures are showing their impacts on the receiving bodies of water through substantially lower concentrations of trace elements within the recently deposited sediment.

Numerous alternative solutions can be considered for managing these backwater lakes, including constructing closing structures, periodic and selective dredging, using dredged materials to create artificial islands, diverting high flows, installing management practices on the watershed, and converting some of the backwater lakes to marsh and wetland habitats. A concerted effort, in which various physical, biological, and environmental factors are considered, is needed for the development of an acceptable management scenario for these backwater lakes.

BACKGROUND

The lower portion of the Illinois River above Henry to Grafton, Illinois, occupies a valley that was the home of the Mississippi River before the Wisconsinan glaciation occurred (Willman, 1973). 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 River 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 the Peoria pool to the river mouth near Grafton (Fig. 1). The gradient of the river at this location is extremely small (32 mm km^{-1}), which also accelerates the deposition of sediment on the river bottom.

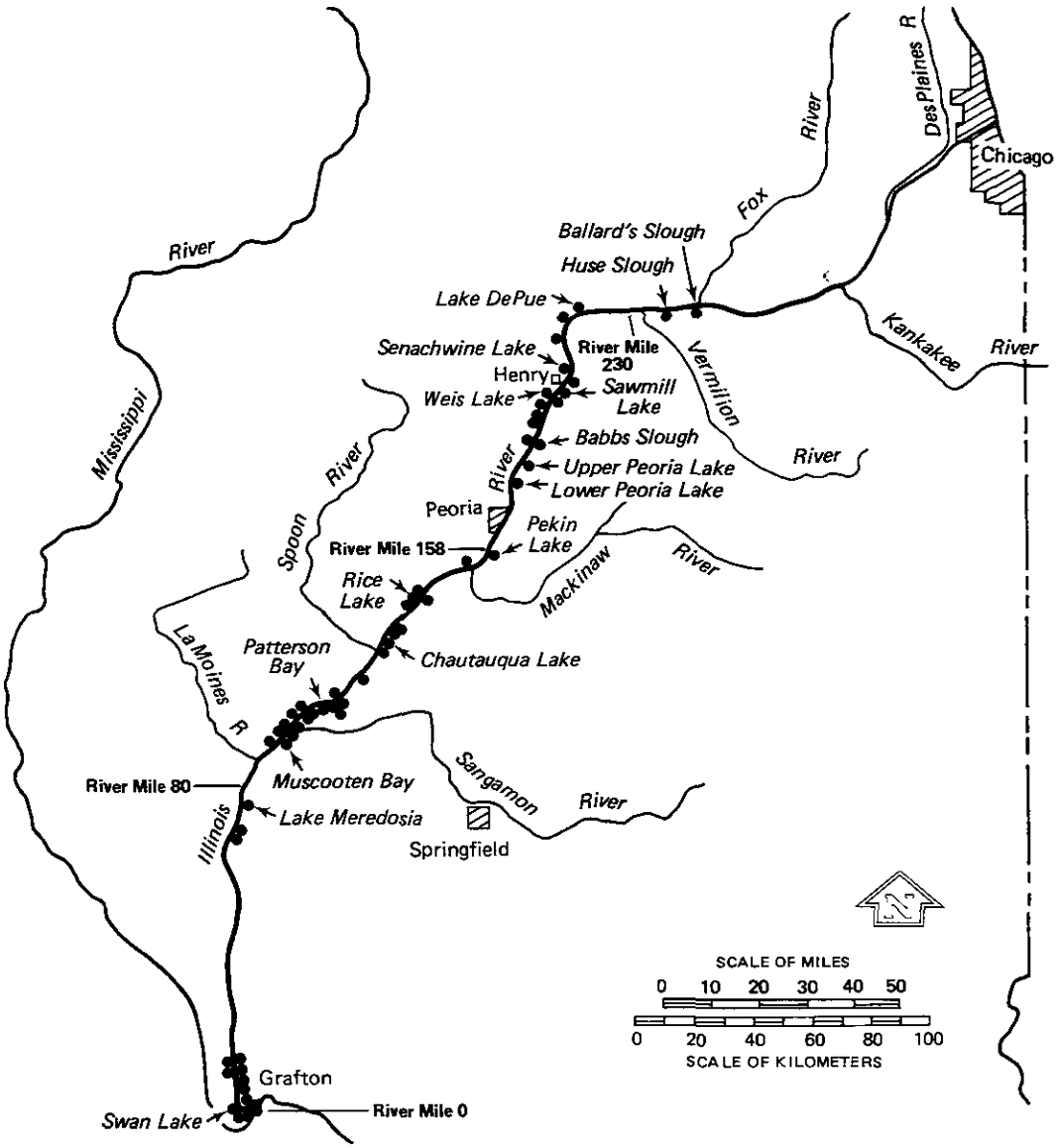

Figure 1. Illinois River valley and the backwater lakes, River mile 0-230
After Bhowmik and Demissie (1989).

In addition to these natural events and natural morphology, human interventions have accelerated the sediment rate in the Illinois River valley. Early in the 1900s, the bottomland areas of the Illinois River were in fairly pristine condition (Bellrose et al., 1983). 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 permanently changed. 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 - 1922) many drainage districts were formed, especially below the 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 2.7 m. 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, which initiated a significant alteration 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 man-made 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 Havera and Bellrose (1965), Demissie and Bhowmik (1985, 1987), Bhowmik et al. (1986b), Bhowmik and Demissie (1989), and Bhowmik and Adams (1989) have shown that the river has changed drastically and that revitalization will require substantial monetary commitments.

BACKWATER LAKE SEDIMENTATION

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. If no drastic measures are taken, many other reaches of the river may attain this fate in the next 30 to 50 years (Bhowmik et al. 1986a).

The majority of the man-made lakes in Illinois are losing their capacities at the rate of about 0.5% per year. However, most of the backwater lakes and bottomland lakes such as Peoria Lake have substantially higher sedimentation rates than most Illinois reservoirs. As of 1975, there were approximately 53 backwater lakes along the Illinois River, with a combined surface area of 21,520 ha. The locations of some of these backwater lakes are shown in Fig. 1. Research results indicate that sedimentation of the backwater lakes is not an isolated problem and that it extends all over the basin. Except for Peoria Lake, where recent sedimentation data have been collected (Demissie and Bhowmik, 1985, 1987), no new data on the sedimentation rates of these backwater lakes have been collected since 1979, (Bellrose et al., 1983).

During the drought of 1988, a field trip was made along many of the backwater lakes to get a first-hand look at these lakes. Even though the summer of 1988 was an extreme case, still many of the backwater lakes were nothing more than mudflats or dry lakebeds. Some of the backwater lakes such as Pekin Lake, a portion of Swan Lake, and Weis Lake were covered with tall weeds, and the transformation from a lake-like appearance to wetland and finally to upland-type habitats had already taken place. Figures 2 and 3 show such changes for Sawmill Lake north of Peria and Worley Lake near Pekin.

Sawmill Lake (figure 2) is now in the process of changing from a wetland-type habitat to an upland-type habitat. However, Worley Lake (figure 3) completely dry in 1988, and a few more dry seasons such as in the summer of 1988 may eventually transform this lakebed into a habitat similar to the one that is now present in Pekin Lake.

Figure 2. Sawmill Lake, July 28, 1988.

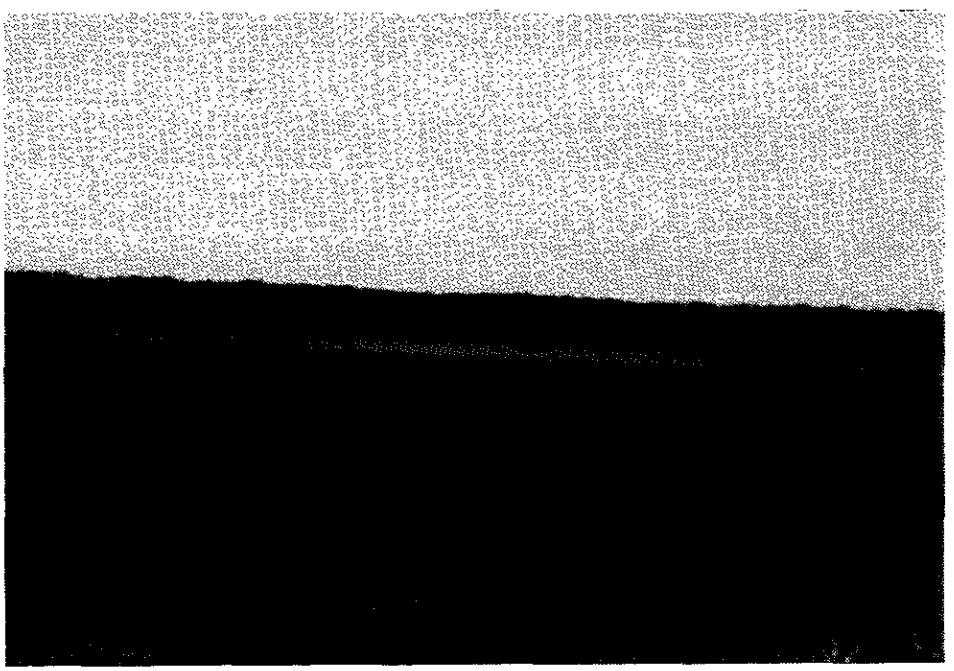

Figure 3. Worley Lake, July 27, 1988.

No new sounding data have been collected from these lakes during the last 12 to 15 years since the data collected by Lee and Stall (1976) and Bellrose et al. (1983). New and up-to-date sounding data will be useful in determining the present capacity of the backwater lakes and how those lakes should be managed. Even though no new data are available, trends in sedimentation rates in 15 backwater lakes were determined on the basis of old data and some newer sounding data from Peoria Lake, and an estimate of their capacities as of 1985 was made (Bhowmik and Demissie, 1989). Table 1 shows these values as of 1985. It is apparent that many of the lakes are almost full of sediment and that they will no longer be lakes by the mid-1990s or early 21st century.

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

Lake	*Capacity ($m^3 \times 10^3$) 1903*	*Estimated capacity ($m^3 \times 10^3$) 1985*	*Percent capacity loss*
Swan Lake	5,984	3,084	48
Lake Meredosia	9,606	4,573	52
Muscooten Bay	1,799	~0	100
Patterson Bay	334	31	98
Chautauqua Lake	17,623	13,289	25
Rice Lake	3,778	1,047	72
Pekin Lake	398	261	34
Peoria Lake	147,960	47,224	68
Babbs Slough	1,698	642	62
Weis Lake	555	78	86
Sawmill Lake	2,600	174	93
Senachwine Lake	11,393	1,883	83
Lake DePue	3,498	607	83
Huse Slough	312	28	91
Ballard's Slough	175	26	85

SEDIMENT QUALITY

Research conducted by Demissie and Bhowmik (1985, 1987) and Cahill and Steele (1986) on the quality of the deposited sediment along the Illinois River valley shows a trend of generalized improvement. The sediment layer deposited since the 1970s is generally of better quality than the sediment deposited in the 1950s and 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 4 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 (Cahill and Steele, 1986). At most locations, the top layer has a lower arsenic concentration than the middle layer deposited in the 1950s and 1960s. Similar variations for other compounds such as aluminum, chromium, lead, and zinc have also been observed. These variations indicate that the input of inorganic compounds to the Illinois River has decreased in recent years.

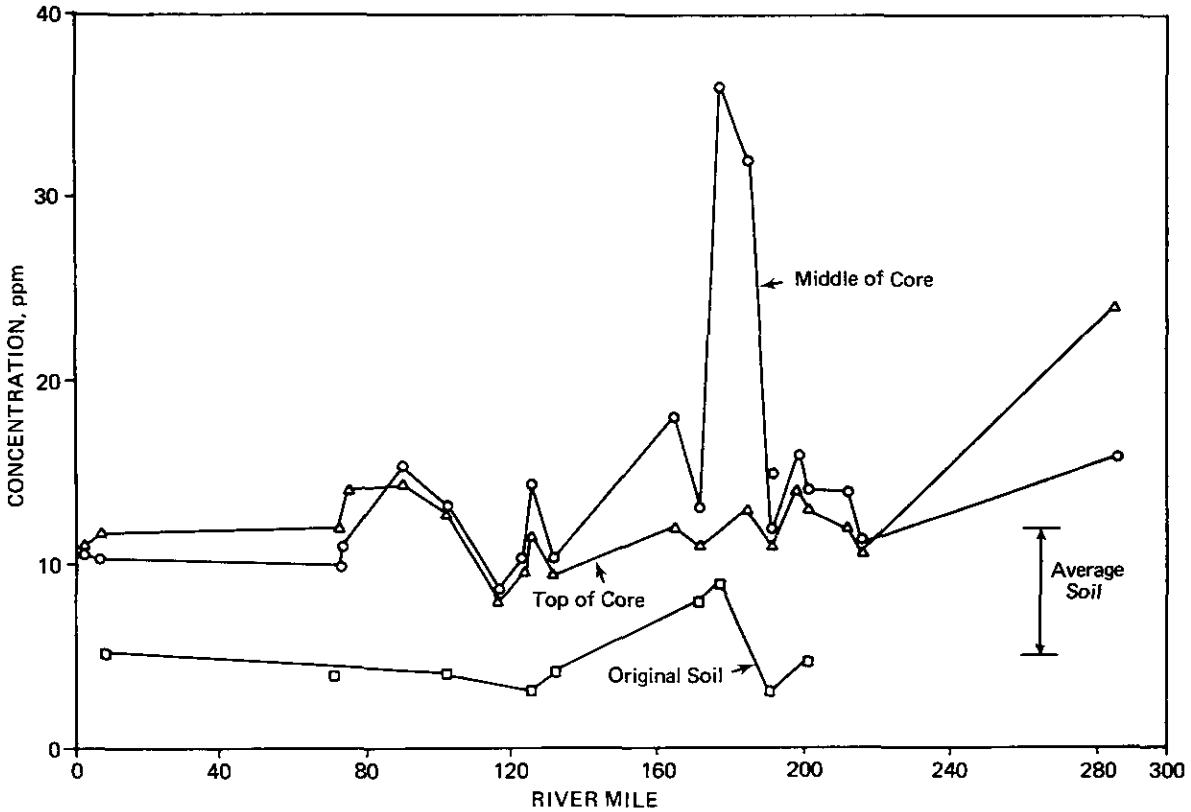

Figure 4. Arsenic distribution in sediments of lakes sampled along the Illinois River After Cahill and Steele (1986)

REMEDIAL MEASURES

Revitalization of the backwater lakes will require a considerable amount of resources and commitment by all concerned agencies, including state, federal, and local entities. Initially a detailed sedimentation survey of all the backwater lakes must be done to determine the present capacities of these lakes. Based on these data and other available data on hydrology, geology, sediment quality, and physiography of the basin, comprehensive management alternatives for these lakes must be developed. These management alternatives must be based on recognition of the fact that many of the backwater lakes can no longer be considered for revitalization as backwater lakes. More appropriately, they should probably be considered for conversion into wetlands or upland habitats.

Other alternatives that should be considered for the management of these lakes may include but not be limited to selective dredging; construction of artificial islands with dredged materials; management of dredged areas so that excessive sediment deposition within these areas is either reduced or completely eliminated; isolation of high-demand areas against excessive sediment deposition; construction of control structures to reduce the flood flow to these areas; diversion of floodflows with high sediment loads; construction of water control structures; complete conversion of sediment-filled backwater areas into wetlands, marsh areas or shallow water habitats; control of sediment input from local tributaries through installation of best management practices on the watersheds including the construction of detention basins and diversion structures; and finally, the alternative of doing nothing and letting nature take its course of action.

The backwater lakes are a valuable resource that should be managed and protected. However, management and protection of these backwater lakes will require solid data before "remedial measures" can be designed, developed, and implemented. Prompt action by various concerned agencies and entities can and will result in the development of proper management alternatives that can have measurable influence on this highly valuable resource along the Illinois River.

ACKNOWLEDGMENTS

Research results presented in this paper are based on the contributions of many engineers and scientists from the Water Survey. A special thanks goes to Mike Demissie, Ming Lee, and Bill Bogner of the Water Survey and Rich Cahill of the State Geological Survey for their contribution to this research on backwater lakes along the Illinois River.

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HABITAT RESTORATION FOR FISH AND WILDLIFE IN BACKWATER LAKES OF THE ILLINOIS RIVER

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ABSTRACT

The Lake Peoria Habitat Restoration project was sponsored by the Illinois Department of Conservation with Sport Fish Restoration funds to create fish habitat. The Illinois River and Lake Peoria were the greatest fishing and hunting areas in Illinois. Excessive rates of sedimentation are destroying Lake Peoria and all backwater lakes of the Illinois River. Concurrently with increased sedimentation, much of the aquatic vegetation disappeared between 1950 and 1965. High rates of sedimentation buried aquatic vegetation beneath thick layers of fluid sediments. Wave action prevents natural revegetation by uprooting young plants from the fluid sediments. When the aquatic vegetation died off, populations of waterfowl and gamefish declined quickly.

The Lake Peoria Restoration project has developed lowcost techniques to restore aquatic vegetation. When placed behind a tire breakwater, arrowhead and pondweed plantings have been successful in 1987, 1988, and 1989. Both the breakwater and plant beds have survived two winters after the initial plantings. The breakwater also serves as an artificial reef. Gamefish response has been quick and dramatic. The number of fish species has doubled and the numbers of fish have quadrupled. The vegetated area serves as a nursery for young bluegill, channel catfish, and bass. In 1989, large bluegill were found on the vegetated site only. In fact, the number and total weight of bluegill and channel catfish in the vegetated area exceeded the number and total weight of all fish (mainly carp) in the control area.

The Major Illinois River Problem Unresolved:

The major water quality problem of the Illinois River is the non-point pollution problem of sedimentation. There are 53 backwater lakes along the Illinois River with a combined surface area of 5,187,000 acres. These backwater lakes have had such severe sedimentation that many are only broad shallow wetlands. Examples are Weis Lake and Sawmill Lake with volumes losses of 86 percent and 91 percent respectively. It is believed that over 20,000 acres of backwater lakes have been lost. Recent sedimentation studies have indicated an increase in the rate of sedimentation between 1960 and 1980 in Peoria Lake (DeMissie and Bhowmik, 1985).

Corresponding with the increase of sedimentation has been a decrease in the amount of aquatic vegetation, which supports fishery and waterfowl resources. While the filled backwater lakes have been called wetlands, aquatic vegetation is extremely limited so that wave action constantly resuspended sediment. While highly turbid waters adversely affect many species of plants (Bellrose et al., 1979), even emergent species as arrowhead are absent from most of the filled backwater lakes. As in Chesapeake Bay with the increased sedimentation and loss of aquatic vegetation, sport and commercial fisheries declined, particularly centrachid species. Numbers of waterfowl migrating through the Illinois River valley dropped precipitously also (Mill, et al., 1966).

Field Test Design:

With Sport Fish Restoration funds from the Illinois Department of Conservation, the Non-Point Pollution Control Program of the Water Quality Section began a 3 year project to test methods of aquatic revegetation and their affects on gamefish populations. Three areas of experimentation were established in a bay of lower Peoria Lake. This bay lies just downriver from the delta of Ten Mile Creek. One area is a control area without any type of revegetation attempted. A second area would be revegetated without any wave protection. The third area would have revegetation behind a tire breakwater. All revegetation methods were lowcost approaches, which could be utilized over a large area.

During 1986 baseline data was established on all three areas. Aquatic plantings were attempted in both areas to be revegetated. Laboratory studies had found even weighted tubers of arrowhead or sago pondweed would pull loose from the fluid sediments without any type of wave action. The plant tubers were therefore placed deep into the sediment so that the developing root system would be in a more cohesive sediment layer.

All plant beds required grazing protection from waterfowl during initial spring growth. Orchard netting was placed around all plant beds. All plant beds were uprooted with the exception of one site behind a 40 ft. floating log. This bed regrew during the spring of 1987.

Revegetation and the Tire Breakwater:

During the winter of 1986-87, a 700 ft. tire breakwater was constructed in 112 modules and transported to the bay area. During May of 1987, the 25-ton breakwater was towed into the bay from the delta of 10 Mile Creek. The breakwater was held in place by nine steel pilings. The pilings were 11 feet long and 5 inches in diameter. A gasoline water pump and nozzle were used to jet the pilings eleven feet into the sediment. The breakwater was attached to the pilings with 18 ft. lengths of 3/8 inch diameter chain. With such construction, the breakwater has survived the ice of two winters.

In June of 1987, arrowhead plantings were again made in the two areas of vegetation. Orchard netting was again required to prevent overgrazing of the developing plant stems by waterfowl. In the vegetated area without breakwater protection, only the bed of vegetation behind the floating log survived to flower in August.

All beds of arrowhead behind breakwater survived to flower in August. The plants died back rapidly in September after flowering. The breakwater was left in place through the winter of 1987-88. All the 1987 plant beds regrew more densely in 1988. New beds of arrowhead were also established behind the breakwater in 1988. Sago pondweed was also planted with the arrowhead beds. Sago plants were visible through August of 1988.

Gamefish Response to Revegetation and the Breakwater:

By the fall of 1988 and spring of 1989, the number of fish species in the area of the vegetated breakwater area was double the number of species in the untreated control area. The number and weight of all fish in the breakwater area were quadruple the number and weight of all fish in the control area. The control area fish numbers were similar to the breakwater area before revegetation and breakwater installation.

During the May fish survey of 1989, bluegill and channel catfish exceeded all fish in the control area in both numbers and weight. While bluegill were never found in the control area, they did become numerous in breakwater area. The vegetated area served as shelter and forage base for young channel catfish and striped bass.

Waterfowl Grazing:

Both second year and newly established beds of arrowhead flowered behind the breakwater in August of 1987. Orchard netting was removed after flowering to determine the effects of grazing on the beds. Even though arrowhead is not considered to be a prime waterfowl food source, the effects of grazing were immediately apparent. While openings in the orchard netting below the water surface allowed carp into some of plant beds, the activity of rough fish did not compare with the grazing of waterfowl and aquatic rodents.

None of the aquatic beds had protective netting until June of 1989. The broods of both mallard and geese young around the breakwater required the establishment of protective fencing around the remaining plant beds. Waterfowl seem to prefer the vegetated areas, which are separated from the predators on mainland. Protective fencing will be kept in place until late fall of 1989. The protective fencing will be placed around vegetative beds early in 1990. In this manner, recovery of first and second year plants can be determined. The major problem in conducting this field trial was a major reason for revegetation - the limited supply of wetland plants for migrating waterfowl in the Illinois River valley.

Wetland Restoration to Reduce Sedimentation:

The project has demonstrated the advantages to the fisherman and waterfowl hunter to recreate the wetland areas in those thousands of acres of barren, mud-filled backwater lakes. Both video and slide presentations vividly demonstrate the response fish and waterfowl. But how does the restoration of wetlands benefit the power boater or sailor in deeper waters?

One of the primary concerns of both local recreationists and researchers in the revegetation project was increased sedimentation of the vegetated area. This is a valid concern and the primary reason for locating the field site in the shallow bay, which is not deep enough for sail boats or power boats. Indeed most of the Illinois River backwater lakes are too shallow for pleasure boating and too barren of vegetative cover for fishing or waterfowl hunting. Presently river fishing is concentrated in the main river channel.

This project outlines the feasibility of increasing fishing and hunting in backwater areas while increasing the effectiveness of sediment entrapment of these shallow areas. The entrapment of the nutrient-rich fine sediments increases the fertility of the marsh while reducing sedimentation of the deeper river areas. Such wetland areas should concentrate in shallow areas and deltas, which mark the entrances of tributary streams. The wetland areas need not be confined to backwater areas but should extend up into the valleys. These valleys must delay and contain floodwater so the sediment will be dropped on land - wetlands, riparian borders or rowcrop fields.

The highest rates of sedimentation should occur in the stream valley because sediment is cheaper and easier to handle on ground than underwater. The process should promote the overflow of floodwaters so that the floodwaters spread and slow. Such a

process simulates the stream patterns before agricultural drainage cleared and straightened floodplain streams.

Wetland restoration on wooded stream deltas has been accomplished by Fonseca et al., 1989. The borders of the stream and delta remain wooded but the interior area is planted in thick marsh grasses to provide waterfowl habitat and trap sediment. Zones of deposition in stream valleys need to be reclaimed because land and stream management has not increased erosion but increased rates of floodwater runoff and sediment delivery.

Wetland restoration will buy time for upland soil conservation to reduce erosion and floodwater runoff before deep water areas of the river are filled. Both soil erosion, floodwater runoff, and sediment delivery rates must be drastically slowed even if all backwater lakes are filled. While the main river channel will always be present, what will water quality be like when streams drop all the sediment directly into the main river channel? If the resuspension of sediment by commercial barge traffic is a problem now; in the future, millions of tons of sediment will be constantly resuspended by barges in a river that acts like a lake.

Wetland restoration provides buffer areas between sediment sources in the watershed and the deep river areas. Wetlands have public support groups as hunters, fishermen, and environmentalists, who will actively campaign against wetland destruction. If water quality and deep waters are to be protected in the river, then the best protective strategy is an actively defended buffer between the river and its streams, which carry the sediment.

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BENEFITS OF TARP TO THE ILLINOIS RIVER

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ABSTRACT

The Chicago Tunnel and Reservoir Plan (TARP) was conceived for eliminating combined sewer overflows to Metropolitan Water Reclamation District of Greater Chicago waterways by storing the runoff from rainfall in underground tunnels and reservoirs and then gradually releasing it through the existing wastewater treatment plants. The benefits of TARP have been considered for the project area, which covers about 375 square miles; however, the propagation of these benefits to the Illinois Waterway downstream of Lockport to its confluence with the Mississippi River has not yet been investigated. A study is in progress to determine the reduction in peak flow and improvement in water quality with TARP Phase 1 (nearing completion) and Phase 2 (which includes reservoirs), and to investigate the propagation of these effects downstream of Lockport to Meredosia. The reduced peak flows and stages will provide some relief from severe flooding, thus reducing flood damages and posing less danger to the levees along the river. The runoff from the urbanized Chicago area of about 375 square miles will be treated at the wastewater plants before it is released to the waterways. This will lead to significant improvement in water quality in the Illinois River.

INTRODUCTION

The city of Chicago began building its first sewers in 1850, mainly to drain stormwater away from the dirt roads of those days. After the Chicago fire of 1871, new brick sewers were constructed to replace the old wooden conduits. By the late 19th century the stormwater sewers had been turned into combined sewers, carrying both storm runoff and sanitary sewage directly into the rivers and into Lake Michigan. In the early 1900s, the construction of sewage treatment plants began, and by 1930 Chicago and its suburbs were almost completely developed to cover an area of 375 square miles. New intercepting sewers were constructed to capture the combined sewage during dry weather, but the interceptors and the plant capacities were be exceeded during high runoff periods. Separate sewer systems have been constructed since 1930 for storm runoff and sanitary sewage. However, the combined sewers built before 1930 still remain. Because of these combined sewers and the increasing concentration of people and industries within the 375-square-mile metropolitan area, about 100 spills of raw sewage and storm water enter the Chicagoland waterways every year, causing major pollution problems (Robison

1986). The more intense storms cause residential and business flooding, and may even cause backflows into Lake Michigan.

The TARP, or the Chicago Tunnel and Reservoir Project, was conceived by the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC, formerly known as the Metropolitan Sanitary District) primarily to eliminate the pollution and flooding caused by the combined sewer overflows (CSO) to the Chicagoland waterways. To reduce the overflows from combined sewers into the waterways, runoff from rainfall is stored in tunnels, ranging in size from 9 to 33 feet in diameter, and then gradually passed through existing wastewater treatment plants before being discharged to the waterways. TARP will also significantly reduce the sedimentation in the waterways.

TARP is one of the largest public works projects ever undertaken and has the following goals: 1) protection of Lake Michigan; 2) cleanup of rivers and streams; and 3) flood control. Because of the immensity of the overall project, TARP has been designed in two phases. TARP Phase 1 will primarily control pollution, and TARP Phase 2 will provide for flood control. The total cost of TARP is about $4.14 billion (in 1989 dollars). The cost of Phase 1 is about $2.59 billion and the cost of Phase 2 is about $1.55 billion. TARP Phase 1 primarily consists of tunnels, and TARP Phase 2 will have tunnels and storage reservoirs. A simple diagram of TARP showing both phases is presented in figure 1. Within the service area, the TARP has been subdivided into four separate subsystems: Mainstream, Des Plaines, Calumet, and O'Hare (or Upper Des Plaines) systems.

The expected benefits of TARP have been considered only for the project area, which covers about 375 square miles. The propagation and attenuation of these benefits for the Illinois Waterway downstream of Lockport have not been considered.

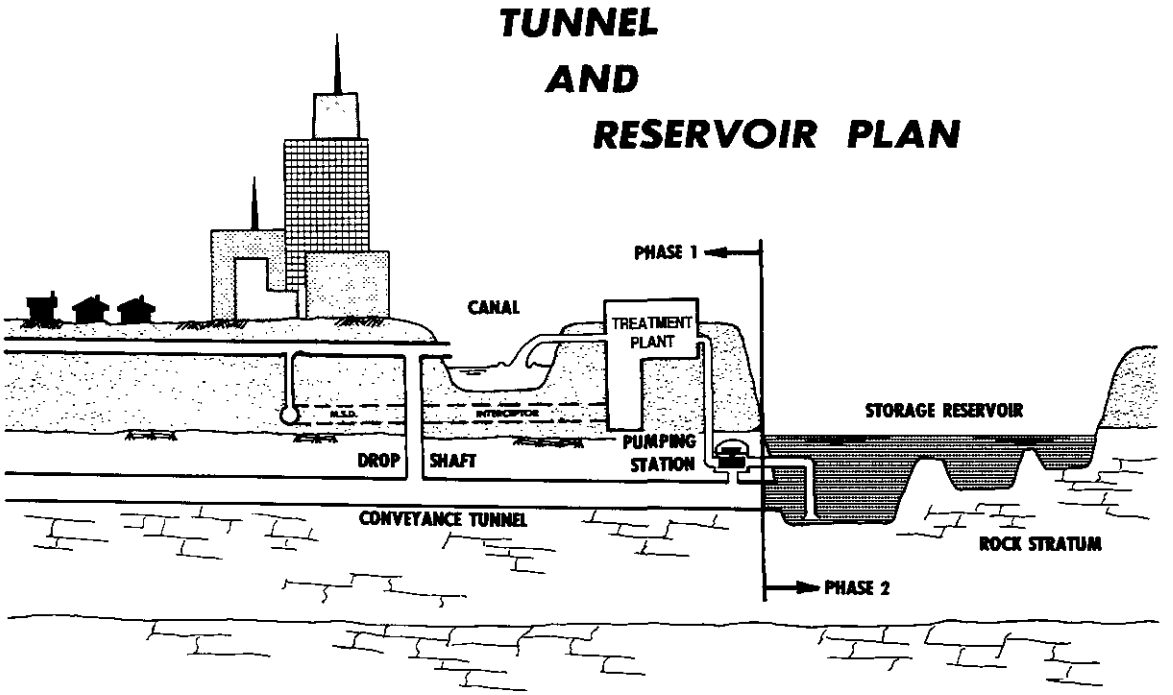

Figure 1. Components of Phase 1 and Phase 2 of TARP (Courtesy of MWRDGC)

TARP PHASE 1

The components of TARP Phase 1 consist of collecting structures, drop shafts, tunnels, and pumping stations. TARP Phase 1 will capture CSOs from a service area of 375 square miles, containing about 13,500 miles of sewers (U.S. Army Corps of Engineers 1986; MWRDGC personal communication 1989). The drop shafts range in diameter from 4 to 17 feet, depending on the required inflow capacity. The tunnels range from 9 to 33 feet in diameter and are bored 150 to 350 feet below ground. Of the 109.4 miles of completed and proposed tunnels comprising TARP Phase 1, the largest is the Mainstream tunnel (see figure 2), which conveys the combined sewer flows to the pump station located at the end of the tunnel. The pump station operates at a dewatering rate that allows a full tunnel to be emptied within two to three days (U.S Army Corps of Engineers 1986). The Mainstream System has 40.3 miles of tunnels with 31.2 miles completed so far (MWRDGC personal communication 1989). The Des Plaines System consists of 25.8 miles of tunnels. Currently 3.5 miles of the Des Plaines tunnels have been completed and 13.4 miles are under construction (MWRDGC personal communication 1989). The Des Plaines System is also dewatered by the Mainstream pumping station. The Calumet System consists of 36.7 miles of Phase 1 tunnels, of which 9.2 miles have been completed (MWRDGC personal communication 1989). The Calumet pumping station is located at the Calumet Sewage Treatment Works in Chicago. It is designed to handle the total Phase 1 Calumet System discharges. When all of its six pumps are in operation, the Calumet pumping station will have a capacity of about 500 cubic feet per second (cfs), which can dewater the Calumet System in two days (U.S. Army Corps of Engineers 1986). Phase 1 of the O'Hare System is complete and consists of 6.6 miles of tunnels.

In summary, TARP Phase 1 consists of 109.4 miles of tunnels. As of now, 63.9 miles of these tunnels are either completed or under construction, with 45.5 miles remaining to be constructed. When TARP Phase 1 is completed, it will have 6,815 acre-feet of tunnel storage capacity (MWRDGC 1987). The distribution of the capacities with respect to the subsystems is as follows: Mainstream System = 3,697 acre-feet; Des Plaines System = 1,267 acre-feet; Calumet System = 1,638 acre-feet; and O'Hare System = 213 acre-feet.

TARP PHASE 2

TARP Phase 2 has initially been planned to consist of additional conveyance tunnels (Mainstream and Calumet Systems), an on-line reservoir, and three terminal reservoirs located at the downstream ends of the Mainstream/Des Plaines, Calumet, and O'Hare tunnel systems. The purpose of the terminal reservoirs is to capture a greater quantity of combined sewer overflow volume for flood control. The Mainstream/Des Plaines reservoir will be located in the McCook quarry, and the Calumet System reservoir will be located in the Thornton quarry. Both quarries are still being mined by their owners, but MWRDGC has begun acquiring land. The storage capacity proposed by the District is 84,000 acre-feet for the McCook reservoir, 40,000 acre-feet for the Thornton reservoir, and 3,550 for the O'Hare reservoir. However, a U.S. Army Corps of Engineers study has recommended significantly reduced storage capacities for the TARP Phase 2 reservoirs (U.S. Army Corps of Engineers 1986).

The recommended plan for the McCook reservoir involves constructing a 32,100-acre-foot reservoir that will provide 30,100 acre-feet of flood storage for the Mainstream System and 2,000 acre-feet of flood storage for the Des Plaines System.

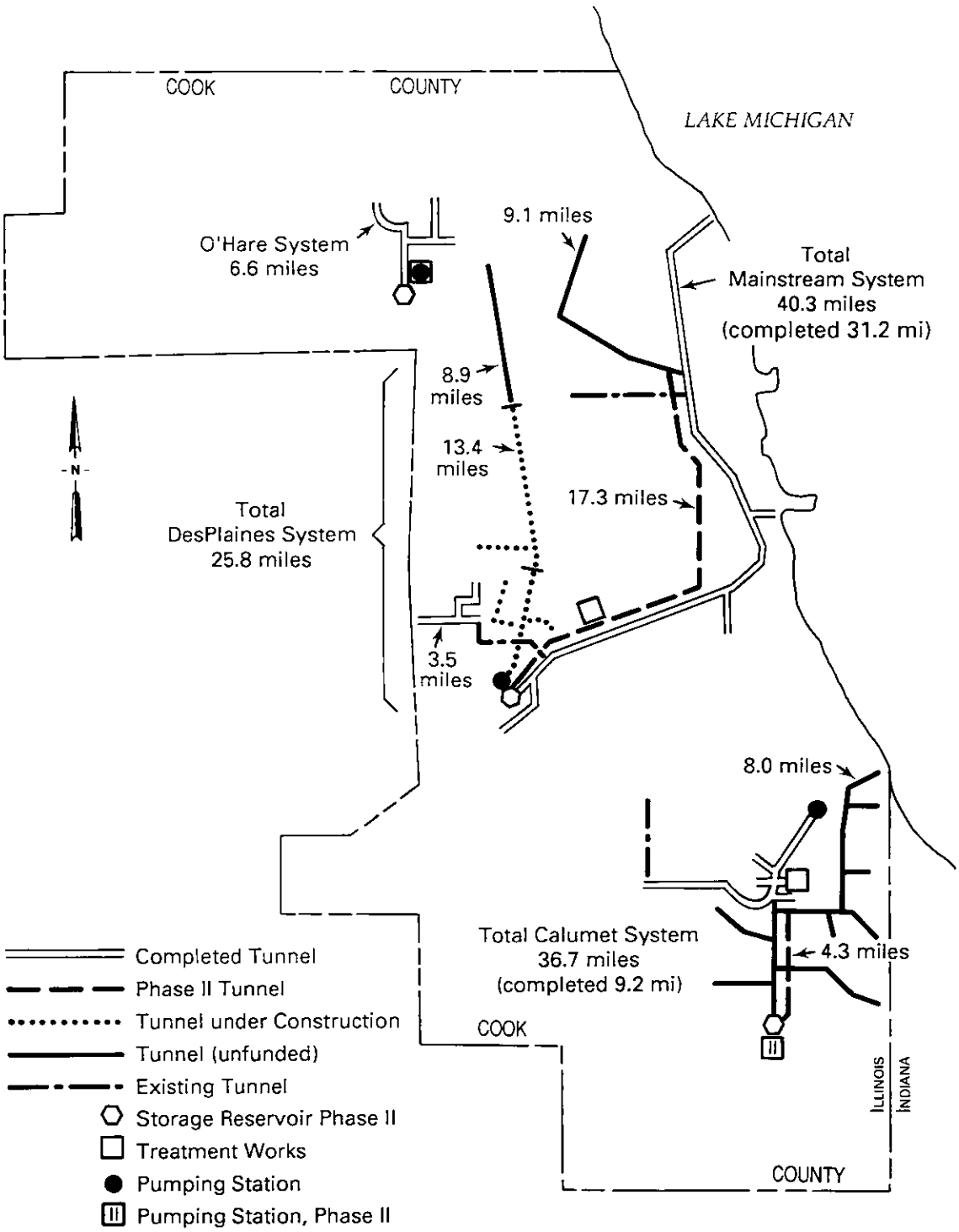

Figure 2. Tunnel and Reservoir Plan Project Status

The recommended Thornton reservoir is only 14,600 acre-feet, and only 1,050 acre-feet of reservoir storage is recommended for the O'Hare System. Therefore, the total reservoir capacity of 127,550 acre-feet proposed by the MWRDGC is reduced to 47,750 acre-feet by the recommended Corps of Engineers plan. In addition to the reservoir storage, there will be 2,342 acre-feet of storage due to 21.6 miles of Phase 2 tunnels. The Mainstream System will have 17.3 miles of Phase 2 tunnels (1,984 acre-feet), and the Calumet System will have 4.3 miles of Phase 2 tunnels (358 acre-feet).

WATER QUALITY IMPROVEMENTS

When Tarp Phase 1 is finally completed, combined sewage overflows from approximately 80% of the storms will be captured and diverted to tunnels for temporary storage and treatment. This will reduce the pollution of the Chicagoland waterways by approximately 85%. In the first year of operation the Mainstream System has eliminated 80% of the combined sewage pollution problems throughout most of Chicago and 15 nearby suburbs, an area of 204 square miles (Robison 1986). Combined sewage overflows from the Chicago area appears to negatively impact the dissolved oxygen (DO) resources and general water quality to some degree. TARP Phase 1, although only partially completed, has had a significant effect on improving downstream DO resources.

The water quality data collected by the MWRDGC for a period before the TARP operation began (January 1983-December 1984) and a period after the TARP operation began (January 1986-June 1988) indicate that DO levels at all six locations monitored in the TARP area have increased since the TARP operation began (Lue-Hing et al. 1989). An increase of up to 25% in DO levels at one station and a decrease of 53% in BOD levels at another station were observed. Total phosphorus, total iron, and phenol levels have also showed consistent decreases at all six locations.

Significant improvements in daily average DOs have been realized downstream of Lockport since the operation of TARP Phase 1. These improvements can be attributed primarily to a higher degree of treatment of point source wastewaters. Average daily DO values in the Peoria pool (figure 3) appear to have increased significantly because general water quality improvements in the Chicago area and in some problem areas along the waterway have provided an environment conducive to sustaining primary productivity. Photosynthetic oxygen production has become an important and somewhat reliable DO resource in the Illinois River below Starved Rock. This fact has been documented and reported upon by Butts et al. (1987) and Butts and Schnepper (1989). Present water quality conditions above Starved Rock still appear to retard photosynthetic oxygen production in terms of magnitude and sustained yield. Limited data over the last few years indicate that this may be changing. The long-term effects of the implementation of TARP could possibly hasten this phenomenon to the benefit of Illinois Waterway water quality.

A significant portion of the DO depletion in the Illinois Waterway has historically been caused by sediment oxygen demand (SOD). A comparison of SOD data before and after TARP Phase 1 operation began indicates that SOD had decreased at three of the seven stations monitored (Lue-Hing et al. 1989). A reduction of as much as 61% was observed at one station. Completion of TARP should effectively reduce SOD values, especially in the Brandon Road and Dresden Island pools, over the next three to five years. More detailed and definitive information on the water quality improvements will be forthcoming from field studies and monitoring currently being conducted by the Illinois State Water Survey.

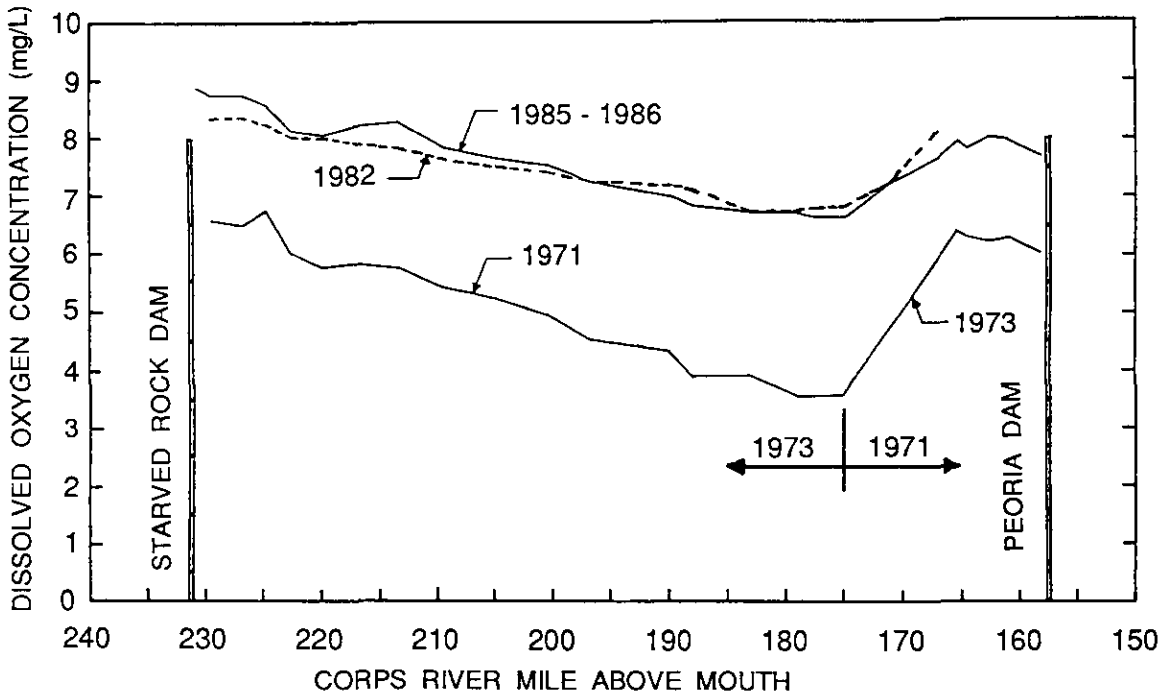

Figure 3. Comparison of 1971-73, and 1985-86 Average DO Profiles in Peoria Pool

FLOOD CONTROL

The flood control portion of TARP will be achieved by the Phase 2 reservoir storages. With the Corps of Engineers' recommended plan, 47,750 acre-feet of reservoir storage and 2,342 acre-feet of additional Phase 2 tunnel storage will be available for floodwater retention. The 32,100-acre-foot McCook reservoir would be sufficient to capture runoff from a 30-year, 24-hour storm on the Mainstream System, plus a 9-year 24-hour storm on the Des Plaines System (U.S. Army Corps of Engineers 1986). In the Calumet System, the 14,600 acre-feet Thornton reservoir and the available tunnel capacity should be able to contain a 7-year, 24-hour storm. Expected overflow volumes and their frequencies in the Mainstream, Des Plaines, and Calumet Systems without TARP Phase 2 (Phase 1 completed) and with TARP Phase 2 (recommended plan) are shown in table 1. A continuous period analysis was used to evaluate these volumes and frequencies, based on the 28 years of data for the period 1949 through 1976. The Corps of Engineers' continuous-record analysis also shows that the backflows to Lake Michigan would be reduced from 91 to 11 for the period of analysis at the three control points (Wilmette Pumping Station, Chicago River Controlling Works, and O'Brian Lock and Dam).

A significant amount of reduction in flood peaks, especially due to TARP Phase 2, is expected downstream of the TARP service area. An analysis of the annual peak discharges at the Sanitary and Ship Canal at the Lockport Powerhouse by the U.S. Army Corps of Engineers (1986) indicates that the implementation of the TARP Phase 2 recommended plan may significantly reduce the peak flood levels, especially at higher return periods (table 2). According to this analysis, reduction in peak flood discharges due to implementation of TARP Phase 2 is about 35%. Considering that the TARP service area (375 mi^2) covers only about one-half of the total drainage area (740 mi^2) above Lockport, reduction in peak flood discharges from the TARP area may near 70%. These lower flood peaks will significantly reduce the frequency

and duration of residential and business flooding in the TARP service area. What remains to be investigated is the attenuation of the beneficial effects of these reduced peak flows (and improved water quality) downstream in the Illinois Waterway down to Meredosia.

Table 1. Overflow Volumes and Their Frequencies in the Mainstream, Des Plaines, and Calumet Systems, with and without Recommended TARP Phase 2 (from U.S. Army Corps of Engineers 1986)

	Mainstream System		Des Plaines System		Calumet System	
	Without Phase 2	With Phase 2	Without Phase 2	With Phase 2	Without Phase 2	With Phase 2
Number of Overflows	214	4	47	7	466	6
Duration of Overflows (hr)	2,080	311	631	24	10,205	336
Average Duration of Overflow (hr)	9.7	77.8	13.4	3.4	21.9	84.0
Overflow Volume (ac-ft)	693,629	34,775	29,087	4,087	781,528	33,124
Max. Overflow Volume (ac-ft)	36,167	15,086	3,896	2,568	30,569	25,696

Table 2. Peak Discharge Values at Lockport without TARP Phase 2 and with TARP Phase 2 (from U.S. Army Corps of Engineers 1986)

Return Period (years)	Flood Peak without TARP Phase 2 (cubic feet per second)	Flood Peak with TARP Phase 2 (cubic feet per second)
1	4,500	2,790
2	12,000	7,800
5	17,000	11,100
10	20,600	13,400
25	25,400	16,500
50	29,200	19,100
100	33,300	21,800

MODELING STUDIES

Research is currently being conducted to investigate the propagation and attenuation of favorable conditions (improved water quality and reduced flood peaks) downstream of Lockport in the Illinois River Waterway. Lockport flows are being adjusted to bring the historical flows (reported by the MWRDGC) in line with the

new acoustic velocity meter (AVM) measurements, which have been recorded since June 1984. A flow simulation and prediction model is being developed for the Illinois River that can effectively simulate the variations in the daily low and high flow conditions. The Lockport flows will be input to this model. The adjustment of the historical Lockport flows will eliminate any bias that may exist due to different measurement techniques used at different times.

Flow conditions and stages at four stations (Lockport, Marseilles, Kingston Mines, and Meredosia) along the Illinois River will be generated by using the adjusted historical flows at Lockport, with both TARP Phase 1 and Phase 2 storage and dewatering capacities. Statistics on high and low flows will be computed for three scenarios: 1) base condition (historical flows); 2) with TARP Phase 1 conditions; and 3) with TARP Phase 2 conditions. Determination of new flood stages along the Illinois River due to TARP will also be useful in estimating accrued benefits (or reduced damages) due to lower flood levels. Lower flood levels in the Illinois River are expected to result in less pumping at the levees, less risk to the levees, less flooding of urban and agricultural lands, and sustained water supply.

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ENVIRONMENTAL MANAGEMENT PROGRAM PROPOSALS THE ILLINOIS BASIN

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ABSTRACT

The Environmental Management Program was established by Congress in 1986 to protect the environmental resources of the Upper Mississippi River Basin which includes the Illinois River and provide a sound basis for the future management of the river system. The Environmental Management Program is composed of five program elements which are (1) Habitat Improvement Projects (2) Long Term Resource Monitoring (3) Recreation Projects (4) Recreation Economics Study and (5) Navigation Traffic Monitoring. The U.S. Army Corps of Engineers implements the Environmental Management Program through a coordination process with the U.S. Department of Interior, the Upper Mississippi River Basin Association, and the Five states in the upper basin. The Illinois Department of Conservation is the lead State agency for the coordination and implementation of the program in the State of Illinois.

At least nine major Environmental Management Program Habitat Improvement Projects are recommended for design and eventual implementation in the Illinois basin. These projects include the Peoria Lake island construction and habitat improvement project, the Banner Marsh Habitat Rehabilitation and Enhancement Project in the La Grange Pool, the Rice Lake Complex Habitat Rehabilitation and Enhancement--Phase I Project in the La Grange Pool, the Chautauqua Lake Project in the La Grange Pool, the Sanganois Wildlife Area project, the Alton Pool Side Channels near at the mouth of the Illinois River, the Stump Lake Project near the mouth of the Illinois River, the Swan Lake Refuge, and the Calhoun Point project. The present status of final design and implementation of these projects is summarized.

INTRODUCTION

For those of you that are not familiar with the Environmental Management Program, I would like to provide you with some background of how the program came about and its mission.

With the authorization of the replacement of Lock and Dam 26, Congress directed the Upper Mississippi River Basin Association to prepare a Comprehensive Master Plan for the

Management of the Upper Mississippi River System. This system includes the entire Illinois River from Grafton to Lake Michigan. The Master Plan recommended a second lock at L&D 26 and the Environmental Management Program with an initial 10-year time frame. The environmental recommendations were tied to past, present and future deterioration of the fish and wildlife habitat of the river system.

A General Plan for the implementation of the Upper Mississippi River System-- Environmental Management Program was completed by the North Central Division, U.S. Army Corps of Engineers in January, 1986. The U.S. Fish and Wildlife Service, Region 3, and the five affected states (Illinois, Iowa, Minnesota, Missouri, and Wisconsin) participated through the Upper Mississippi River Basin Association in developing the General Plan.

Habitat Rehabilitation and Enhancement Projects (HREP), Long-term Resource Monitoring, Recreation Projects (LTRM), An Economic Impacts Study on Recreation and Navigation Traffic Monitoring are the five elements of the EMP General Plan. Approximately 95 percent of the authorized 191 million dollars for EMP is the HREP and LTRM elements of the plan.

Although annual funding levels have fallen short of the annual authorized amount, the program has received increased funding every year with this years funding at 75 percent of the authorized amount.

At this time I would like to provide you with an overview of what Habitat Rehabilitation and Enhancement Project activities taking place along the Illinois River. Some other EMP activities will be described in more detail by other presentations in this conference.

Habitat Rehabilitation and Enhancement Projects are proposed by States and the U.S. Fish and Wildlife Service, and are engineered and constructed by the Corps of Engineers. Most of these projects are designed to counteract side channel and backwater sedimentation. The projects may involve dredging and alteration of flow patters by channel structures, construction of enclosed levee systems with pumping facilities for water level control, island construction, bank stabilization, wing dam modifications, and vegetation manipulation.

PROPOSED PROJECTS IN THE ILLINOIS BASIN

Peoria Lake: The general design phase was started in June 1988 and is scheduled to be completed in March 1990. The project scope has three elements, a barrier island, removing a silt plug at the end of the East River and constructing a forested wetland management area all at the Woodford County Conservation Area. This project has received support from Heartland Water Resources Council and the Tri-County Regional Planning Commission, the designated Metropolitan Planning Organization. September 7, 1989 was the date of the latest of two information meetings held in Peoria. The public has shown support for this project. It is anticipated that some elements of this project may provide insights to solutions to the overall problems at Peoria Lake. Estimated project cost is $4,000,000.

Banner Marsh: General design work was started in July 1989 and scheduled to be completed in January 1992. The project scope includes all major elements of the Master Management Plan to complete restoration of Banner Marsh to a fresh water marsh habitat for fish, wildlife and migratory waterfowl as outlined in the Banner Marsh Natural

Resource Management Plan is the primary objective of this project. Projects costs are estimated to be $4,575,000.

Rice Lake:

The 5,592 acre backwater area at Rice Lake is scheduled for general design work for sometime after FY 92. The proposed project would involve re-establishing the Hate Levee to function as the major water control facility for the entire complex. A pumping facility would be located on the Illinois Waterway. Later phases could include the excavation of channel for water supply to management areas, upgrading of the riverside access road/levee for flood and sediment control, interior levees for moist soil management, island construction in the lakes, and creation of additional mudflats. The estimate for this project is $1,891,000.

The proposed project's primary purpose is habitat improvement for migratory waterfowl. Re-establishing the Hate Levee and installation of the pumping facility would reduce sedimentation and enable manipulation of the water level necessary for moist soil management. Food supply for waterfowl will be more stable due to greater water control capabilities. Habitat would be improved for herons, egrets, shorebirds, eagles, cormorants, and other endangered species which utilize the area.

Chautauqua Refuge:

The proposed project includes the construction of a pump station with road access and electrical connection; repair of the existing cross dike to include installation of a water control structure; dredging of Liverpool Ditch, and potentially Meyer's Ditch; and channel dredging and island construction within the lake itself. Cost estimate is $1,380,000.

The project will create a moist soil management unit that will provide reliable submergent and emergent vegetation and shallow-water aquatic habitat for migrating waterfowl, wading birds, and other wetland dwelling wildlife species. Channel dredging within the lake will allow for effective dewatering and provide material for the creation of several islands. The islands will be oriented and of sufficient height and length to decrease wind fetch, thereby reducing turbidity. Ditch dredging will not only increase available water for the pump station, but also provide deeper channels and holes to benefit the local fisheries.

Sanganois Wildlife Area:

This proposed $1,886,000 project of levee and water control structures will restore water to the backwater areas as proposed in the departmental Master Management Plan. Once completed, it will be the largest single waterfowl area (11,695 ac.) within Illinois, using contour levee systems for water level management and will provide food and water capabilities for up to 5 percent of the waterfowl in the flyway.

Alton Pool
Side Channels:

The side channels within the Alton pool of the Illinois River afford a protected riverine habitat conducive to the feeding, spawning, and resting of fish. The channel banks are largely unprotected and bank erosion with resulting sediment deposition has damaged fish habitat.

This project would provide installation of various erosion control measures in several of the major side channels that are experiencing the most severe erosion problems. Cost estimate is $925,000.

Stump Lake Complex:

The general design phase was started March 1989 on this backwater area in pool 26 of the Illinois river. The Fowler Lake element of this project was removed from the scope because the Department of Conservation decided to accomplish this project element sooner with their heavy equipment program. Low levees and water control structures at Stump and Flatt Lake will allow maximum management of habitat conditions for this heavily used wildlife area. Construction is anticipated to tart in March 1992. Estimate of cost is $2,276,000.

Swan Lake Refuge:

Three low level riprapped dikes with stop log structures and pumping facilities would be provided so that water levels could be manipulated as required for moist soil and fisheries management. The two upstream compartments would be managed for waterfowl. The downstream compartment would be managed for fisheries. Deeper channels would be dredged to improve water characteristics and to provide a winter fish refuge. Wing dams would be constructed to extend into the lake, thereby reducing the fetch and decreasing wave action and also providing shelter for juvenile fish. General design work has started on this $2,929,000 project.

Some 2,400 acres would be restored to prime fish and wildlife habitat. Under pre-existing conditions, the luxuriant plant growth nourished many species of marsh and water bird. The fish population included goodly numbers of bass, crappie and channel catfish. The area was also an important feeding ground for bald eagles.

Calhoun Point:

The proposed project would: (1) provide a low elevation perimeter levee to substantially reduced sediment deposits from the more frequent flood events and (2) provide low elevation interior levees, connecting ditches, swale blockages and selected deep water dredgings, and gated water control structures to form four independent management units: a riverine fish unit, two wildlife units, and a combination fish and wildlife management unit. We estimate this project to be in the four million dollar range.

Rehabilitating and enhancing these wetland and aquatic habitats would provide breeding, nesting, and feeding habitats for many forms of waterfowl, mammals, and reptiles, and would furnish productive spawning and nursery areas for riverine fishes.

THE ILLINOIS RIVER BASIN: LIFEBLOOD OF OUR STATE

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Good afternoon, ladies and gentlemen. I want to invite you to come with me to look at an old friend - the river that gave our state its name, the illustrious, industrious Illinois.

The Illinois River is 273 miles long. It stretches from its headwaters in the region of Chicago and Lake Michigan and winds southwest toward its confluence with the Mississippi River at Grafton, only about 20 miles from St. Louis as the crow flies.

The Illinois River Basin occupies about half of the land area of Illinois. It extends north into Wisconsin with the upper portions of the Fox and Des Plaines Rivers and east into Indiana with the Kankakee and Iroquois Rivers. The Illinois River Basin includes almost half of our state's agricultural land, more than a quarter of our forest land, more than a third of our surface waters and streams, and 95 percent of the urban areas of Illinois.

In the course of the ages, Nature recast the river from its original form. The present-day Illinois is the remnant of the much larger Mississippi River which carved out the Illinois Valley. By the time the early settlers arrived, natural reductions in the river's drainage areas and changes in the flows had made the Illinois much smaller and more sluggish than its prehistoric ancestor.

The early settlers made the Illinois work for them just as we have in this century. In times past, the river served as the primary inroad to the Illinois portion of the Northwest Territories, transporting settlers and their goods. It was their main source of water and an important source of food and raw materials for a fishing industry and even a button industry that

relied on the mother-of-pearl taken from the mussel shells once plentiful in the river.

For a long time, the Illinois River has been the backbone of Illinois commerce and industry. As early as 1679, coal was discovered on the river. Steamboats first plied the river in 1828, a mere ten years after Illinois was admitted to the Union. Today, over two hundred industrial and agricultural processing and transport terminals are situated in the Illinois River Basin.

The waterways of the Illinois River Basin are as economically important to us as the interstate highways. They carry 60 percent of the state's annual commodities tonnage; almost one-quarter of all the grain produced in the United States; as well as petroleum, chemical products, coal, sand and gravel, and salt. Nationally, the Illinois River waterways carry 9 percent of the total barge shipments transported on our nation's inland and intracoastal waterways. Transport of crude petroleum products, chemicals, and fertilizers has increased in recent years, and we expect to see this trend continue.

In addition to serving our state's economic and commercial needs, the Illinois River also serves as the source for public water supply systems throughout a vast region of the state. Peoria is the largest user, but the cities of Elgin, Kankakee, Pontiac, Streator, Decatur, Taylorville, Springfield, Jacksonville, and Canton also use water from tributaries of the Illinois River. Moreover, the Commonwealth Edison Company uses Illinois River water for cooling purposes.

At the same time, the Illinois River is home to a variety of fish populations, and side channels and backwaters serve as nurseries and spawning areas. Sport fish at home in the Illinois include white bass, largemouth bass, bluegill, and black crappie; there are also channel catfish, carp, buffalo, bullhead, walleye, sauger, and many other warm-water species.

Commercial fishing today isn't what it was in the early 1900s, when carp and buffalo were a major source of income for fishermen along the middle and lower reaches of the river. Today, about one million pounds of carp, buffalo, catfish, drum, and other commercial fish are taken from the river each year. Still, their wholesale market value comes to more than a quarter million dollars annually.

Sport fishing is even more lucrative. Over two million angling days per year are spent on the Illinois River and its backwaters. When you figure that the estimated average spending for each angling day is $12, the value of angling on the Illinois River comes to about $25 million a year.

The Illinois River has also been important historically to a multitude of avian species. The river valley is a major wintering ground for the endangered bald eagle. In recent years

as many as 375 bald eagles have been counted annually, which represents about 3% of the total wintering population of bald eagles in the lower 48 states. The endangered double-crested cormorants migrate through the valley in fall and spring, and the endangered great egrets and black-crowned night herons nest with the common great blue heron in rookeries throughout the valley. Wading shorebirds, ducks, geese and other waterfowl rest and feed in the various wetlands associated with the river in both fall and spring.

In addition to fishing and hunting, the activities of boating, water skiing, hiking, and camping and the pleasures of the scenic and historic sites and parks along the river draw thousands of visitors to the banks of the Illinois each year -- and Illinoisans spent more than six billion dollars on recreation in 1985, which generated just under two billion dollars in tax revenues.

Although the Illinois ranks among our state's top recreational resources, it has also been a primary channel for the transport of human, animal, industrial, and agricultural wastes. From its headwaters near Lake Michigan to its confluence with the Mississippi near St. Louis, the Illinois River has absorbed the wastes of the industries, the farms, the stockyards, and the people who have inhabited its banks and basin for more than a century.

Needless to say, the major contributor is and always has been Chicago. With the city's growth in the late nineteenth century came the problems that always accompany progress. Manufacturers, slaughter houses, and families all dumped their wastes into the small, sluggish streams along the Lake Michigan shores, and these in turn carried the city's wastes into the lake.

Even as early as 1848, Chicago had a waste pollution problem, and the city attempted to remedy it by opening the Illinois and Michigan Canal, which carried wastes into the Illinois River via the Chicago and Des Plaines Rivers.

Twelve years later, however, even this was not sufficient for Chicago's growing waste load. Eventually, the Chicago Sanitary and Ship Canal was built in 1886 and served as a new conduit to the river for untreated wastes.

The beginning of the twentieth century marked the beginning of a new era for the Illinois River - and not a very healthy one. In January of 1900, the Illinois River received the first water to be diverted from Lake Michigan and the Chicago and Calumet Rivers through the new Chicago Sanitary and Ship Canal. The new canal was bigger, deeper, and more hydraulically efficient than the I&M Canal, and it carried massive volumes of untreated sewage into the Illinois River, along with water from Lake Michigan. By also raising the average flow of the Illinois River, the increased

volume provided excellent navigation from Lake Michigan to the Mississippi.

From that time until the 1920s, the water quality of the Illinois River was at its worst, and conditions along the river progressively deteriorated. Fish and other aquatic organisms disappeared or were reduced drastically in numbers. High flows brought problems of flooding and sedimentation as well.

Conditions started to improve when Chicago built highly efficient sewage treatment plants in the early 1920s. By the late 30s, successful sewage treatment in Chicago made it possible to reduce the amount of water diverted into the Illinois River, and the average flow was reduced by half.

Since that time, many aspects of water quality in the Illinois River have improved, and a more or less steady rate of flow has been maintained. Stringent water quality standards imposed in the early 1970s have also helped improve the quality of the water in the Illinois River. Nevertheless, the Chicago area still contributes more than 95 percent of the domestic and industrial wastes that now pollute the waters of the river.

The influx of Chicago's wastewater and the diversion of water from Lake Michigan at the turn of the century also increased flows, making it necessary to construct levees. While these levees created more farmlands, they also channeled the river, removed 185,000 acres of land from the river's floodplains, and eliminated many of the river's backwater lakes, which comprised some of our state's richest wildlife habitats.

The creation of the navigational channel constitutes another historical chapter for the Illinois River. As towns and industries became established along the banks of the Illinois throughout the nineteenth century, it became necessary to forge a navigation channel and to control flooding. The solution was to construct dams at critical locations along the course of the river, beginning in 1873.

The year 1919 marked the beginning of the final step in the river's transformation. In that year, construction began on the Illinois Waterway, an ambitious project designed to create a 9-foot navigation channel with a minimum width of 300 feet that would extend all the way from Lake Michigan to the Mississippi River.

Five major locks and dams were constructed along the Illinois River in the 1930s. These navigational dams permanently altered the nature and character of the Illinois River and its bottomland lakes, changing it from a true river to a series of pools. The Illinois River became in fact a man-made channel, and a new set of problems arose: The flow characteristics of the river changed once again, resulting in higher water levels, decreased velocities, and even greater sedimentation rates.

While I don't want to paint a picture that is unnecessarily bleak, neither do I want to minimize the serious consequences of the problems now surrounding the health of the river. Paramount among them are the issues of wastewater and pollution. In 1922, a low point for the river, the Illinois carried the equivalent of all the waste that would be produced by a population of over six million people. Improvements have been carried out over the years which have reduced this amount to 9 percent of the original volume, but it is still equal to the waste produced by a population of over 500,000 people.

Commensurate improvement has also been shown in the volume of ammonia nitrogen carried by the river, derived from raw domestic waste flows. The ammonia nitrogen measured at Lockport is now only a third of what it used to be in 1970.

On the other hand, overall improvements in water quality have not measured up to these specific reductions. In this regard, it seems that our meddling has caught up with us. The damming, *diking, draining, diverting, and deforming of the Illinois Basin* have actually reduced the river's ability to assimilate natural wastes. Basic to the river's regenerative abilities are the oxygen levels in the waters. Today the minimum standard for dissolved oxygen in the river is 5 milligrams per liter, but during extremely warm, low-flow periods, such as during last summer's drought, levels in the lower river still fall far below that number.

According to our state scientists, there are now virtually no freshwater mussels left in the river above Peoria Lake; all the river-bottom fauna, that is, benthic species, are seriously degraded; the diversity of fish and wildlife species and their abundance have declined; and sediments are increasingly toxic to fingernail clams and larval fish. They have succumbed to a lack of dissolved oxygen, to increased contaminants, and to a loss of aquatic plants.

The improvements that have occurred in the river's water quality have come about in spite of massive point and nonpoint waste discharges. All significant point discharges of specific wastes into the river receive some sort of water treatment, and domestic wastes receive secondary treatment. However, even this level of treatment does not completely remove phosphorus and nitrogen, two plant-growth nutrients essential to the growth of algae. These nutrients remain in all the wastewater discharged from Chicago treatment plants, and in the last decade or so, this has resulted in dramatic increases in algae growth and related water quality problems in the river, especially in its upper reaches.

The algae problem is further aggravated by increased row cropping in the Illinois River watershed and the runoff of agricultural chemicals and fertilizers. At this point, the long-term effects of algae in the river are still unknown.

Furthermore, as the watershed becomes more urbanized, development practices can contribute to increased amounts of nutrients, heavy metals, and various toxic substances from urban sources finding their way to the waters of the Illinois River.

Flooding is also a major consideration. The locks and dams on the Illinois fulfill navigation purposes, but they also function in flood control, along with levees that were constructed early in this century, and they protect crop land.

Additional flood control measures are needed immediately, because, since 1978, the Illinois River has flooded at least once a year. Precipitation has been higher in the last 20 years than it was in the previous 60 years, and this has resulted in significantly higher flow levels in the river. Nonstructural flood control measures for the Illinois, such as sound agricultural management practices, floodplain zoning, land use regulations, and development of protected streamflow standards to regulate the level of the river's flow, could be tried.

Among our most urgent concerns for the quality of the Illinois River water is the threat of contamination from hazardous material spills. Last summer's Exxon Valdez disaster brought home to us the importance of being in a constant state of preparedness for such an event.

Barge shipments of petroleum and chemical products now amount to almost half of all shipments on the Illinois, and overall, about 80 percent of the commodities transported on the upper reaches of the waterway can be considered hazardous materials. Approximately 200 accidental spills were reported in the Illinois Basin from 1986 through 1988, and the majority of these occurred in the areas of Joliet and Chicago. Petroleum was the main commodity involved, and, fortunately, most of the spills were minor. But we should be prepared for major spills.

The most serious consequence to the health and welfare of the Illinois River is the problem of sedimentation. Although sedimentation has been a natural process through the ages, increased row-cropping and the construction of hydraulic structures has exacerbated the problem throughout the river basin. Sedimentation has been responsible for the disappearance of entire backwater lakes, and it has changed many portions of the river from lake-like expanses to narrow, incised channels.

Many of the backwater and bottomland lakes should no longer be called lakes. They are now really broad, shallow wetlands.

An example of the sedimentation process is shown by Peoria lake. It is the largest and deepest bottomland lake in the Illinois River Valley. But it has lost 68 percent of the capacity it held in 1903, and is now little more than an incised navigation channel near its upper reaches. The rate of loss has increased

substantially since 1965, and what's more, we know that Upper Peoria lake will probably lose most of its capacity outside the navigation channel by the year 2000 unless drastic sediment control measures begin immediately.

The development of hydroelectric generating plants along the river also deserves very serious and thorough attention. Hydroelectric plants are currently being considered at three dam sites between Starved Rock and Lockport, and an existing hydropower plant is operating at the Lockport Dam.

Hydropower plants typically use a dam to direct water through a powerhouse that contains mechanical and electrical generating equipment. They can affect water quality by reducing aeration and thus dissolved oxygen, whereas water usually experiences an increase in oxygen content as it flows over a dam. The feasibility of developing hydroelectric plants on the Illinois River should be examined in light of hydrologic considerations, operational constraints, and environmental impacts, as well as in light of economics.

So far, I've directed your attention to past and present concerns about the Illinois River. Now, I'd like to speak to the concerns of our state's scientific community.

The sedimentation of the Illinois River has cost us much more than the deepwater lakes along the river. Sedimentation has resulted in the loss of aquatic habitat that attracts and supports both fish and wildlife populations.

The bottom line is the vegetation, and the future ecological health of the river depends on it. Aquatic vegetation is easily uprooted in loose sediment or cannot grow at all because of turbidity. It's a circular problem: without lakebed vegetation, there is no anchor to stabilize the moving sediment; at the same time, the flowing sediment and turbidity prevents vegetation from rooting and growing. The results are shallow, bowl-shaped lakes whose beds are composed of loose sediment. Lake water is murky, and these conditions further reduce plant growth and shift the balance of the fish populations to rough species such as carp which do not depend on sight to catch food.

Waterfowl also have suffered serious setbacks because the backwater lakes of the Illinois were once some of the richest habitats in the nation. Although some lakes have been levied, in many cases, the levees have broken during major floods, and much of the fish and wildlife habitat they protected has been washed away.

In the effort to save such seriously endangered lakes, the State Water Survey have developed some low-cost methods to restore aquatic vegetation. Our scientists have erected a breakwater in Peoria Lake to protect the planting area from the damaging waves that can uproot delicate young vegetation. Plantings have

survived two winters. The new vegetation acts as a nursery for young bluegill, channel catfish, and bass, and actual numbers of fish have quadrupled since testing began.

The only problem with the re-vegetation project is that it has proved too popular to waterfowl, who love to graze on the young plants. The vegetated beds around the breakwater are such an attractive haven that we have to protect the young plants with orchard netting to prevent overgrazing by waterfowl.

Alongside our hopes and plans to restore aquatic habitats are our concerns for the continued operation of commercial navigation on the Illinois River. Commodities travel on the Illinois in massive barges that take their toll on the Illinois River. When a typical convoy of fifteen barges moves along the river, it disturbs the flow characteristics by altering velocity and pressure and creating waves and drawdown. The barges wreak havoc with the sediment - they scour the riverbed and riverbanks. The sedimentation buck stops, of course, in the backwater lakes - the ultimate victims. Here, as well as along the river channel proper, the barge traffic interrupts important biological habitats, such as fish spawning areas, macrophyte beds, and the ichthyplankton that supports so much aquatic life.

Illinois cannot afford to lose any of the commercial opportunities we enjoy by access to such an extensive waterway system. But we also cannot afford to lose any element of the delicate ecological system that survives along the river.

Our state scientists tell me that the Illinois is the most studied river in the world, and their efforts throughout this century have done much to reclaim a highly degraded waterway. But too many of their studies have been short-term, fragmented, and perhaps somewhat uneconomical, in that they were initiated to put out brush fires, as opposed to being part of a concerted, long-range plan.

The Illinois River is central to our state's geography, our history, our economy, our ecology, and I would like to think, our hearts. We are now at a crossroads as far as its future is concerned. To do nothing now or to continue with fragmented, albeit principled and well-meaning, efforts will seal the fate of our state's river. It will die. And along with it will go a great portion of the natural health and wealth of Illinois--and without doubt, some of the pride we take in the river whose name we have adopted as our own.

The organization of this conference presents a positive step in grappling with the future of the Illinois River. In addition, the gradual in-filling of Peoria Lake has become a call to action on the part of the people of Peoria and surrounding counties, and their efforts have acted as a catalyst for many of the discussions now occurring about the future of the Illinois River.

Their efforts have continued through the formation of the Heartland Water Resources Council in 1988, which encompasses 22 groups and organizations. Significant help has been received from private sources, such as Caterpillar.

These people have spent many years learning about the resource in their own back yards and ensuring its future. I commend the work and concern of all of these organizations and individuals. It is the type of community concern that can be built into a solid state, federal, and local partnership which can create realistic and doable solutions. We hope to see this kind of local interest grow all along the banks of the Illinois River.

The Department of Energy and Natural Resources has also long been active in studies on the Illinois River. Out of our Water Survey office in Champaign has come studies on the management of Peoria Lake, the effect of climatic changes on the Illinois River, flow studies, the feasibility of artificial islands for Lake Peoria, and monitoring in-stream sediment levels in Peoria Lake tributaries. In Peoria, the Water Survey has been involved in analyzing the effects of barge traffic on water quality, on rehabilitating aquatic plant communities, on studying the manipulation of gate flow controls for maximum aeration and in stabilizing stream banks to reduce erosion. The Natural History Survey has also been a concerned partner in research on the Illinois River. The Forbes Biological Station at Havana has conducted a multitude of fish, sedimentation, and aquatic biology studies since 1876. In Champaign, the Natural History Survey is presently studying the causes of toxic sediments in the Upper Illinois River. From a cultural perspective, the State Museum in Springfield has been involved in conducting studies on archeological and cultural resources along the Illinois River corridor. A traveling riverboat exhibit, "Harvesting the River", has created a unique history of life and work on the Illinois River.

As we have seen, the early days of the Illinois River emphasized creating a navigation channel, controlling floods, and managing waste disposal. These activities were in step with nationwide trends of harnessing the resources of rivers for social and economic benefits to the human inhabitants of the land.

Times have changed, however. With many of these direct benefits in place, new trends are emerging and public perception of water works projects is changing. Now, the public may be more interested in managing rivers for their environmental benefits. Fish and wildlife resources and water quality are considered legitimate resource values to be factored into a management plan. And, in fact, all rivers need to be managed for the many purposes which they can serve. Organizationally, the task is no longer to engineer bigger and better systems, but to involve all constituents affected by the river and to give credence to local government concerns. And finally, trends in large river

management call for an integrated approach that views a river as a system of interconnected waterways.

We in Illinois would do well to embrace these trends in decisions regarding the Illinois River. However, the degradation of its waters and riparian habitat has occurred over many years; its revitalization for ecological purposes will take many years. A new management perspective points to the need for a long-range, comprehensive plan which addresses the many management goals on the Illinois River. With solid planning, we can begin to address:

> Challenges such as the reestablishment of aquatic and wetland habitats for fish and wildlife;
>
> Challenges such as balancing our state's agricultural and industrial needs with our environmental needs;
>
> Challenges such as the rejuvenation of recreational resources in the river and along its banks;
>
> Challenges such as preparedness in the event of a hazardous materials disaster;
>
> Challenges such as flood control and maintenance of water levels; and
>
> Challenges such as the rehabilitation of the backwater and instream lakes. . .

Cooperation among state, federal and local agencies; the agricultural community; citizens; and private organizations is necessary to meet these challanges and to ensure that the Illinois River survives as a long term resource for the people of Illinois. The Department of Energy and Natural Resources is committed to being a partner in this effort.

UPDATE OF TRI-COUNTY RIVERFRONT PLAN

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ABSTRACT

The following comments are a progress report on the update of the Tri-County (Peoria, Tazewell, Woodford Counties, Illinois) Riverfront Plan. The Tri-County Riverfront Plan was originally prepared by Scruggs and Hammond, Inc. in 1968, under contract to the Tri-County Regional Planning Commission. The current assignment is being done by Scruggs and Hammond, Inc. for the Tri-County Riverfront Forum. The comments discuss the current riverfront plan being developed, the major problems of twenty years ago, a comparison of then and now, a look into the future, and challenges to be faced.

INTRODUCTION

Twenty years ago Tri-County Regional Planning Commission with Scruggs and Hammond, Inc. prepared the Tri-County Riverfront Plan. This was an extensive undertaking for at that time there were far fewer people who realized the then untapped potential of the river as an amenity which could add considerably to the quality of life of Tri-County residents. At the same time there were few people who gave an ear to the problems on the horizon, most of which are more understood today now that the horizon is here.

I would like to address the riverfront plan now being developed in comparison with the riverfront plan of twenty years ago in terms of format, approach, problems then as compared to now, and what we see for the future.

THE CURRENT RIVERFRONT PLAN BEING DEVELOPED

Whereas the 1968 Tri-County Riverfront Plan was a review of the problems and potential of the river and riverfront in the late 1960's, and reported in some detail covering a wide variety of issues, the current plan will have a three-way orientation. It is our goal that the plan now being developed should have three overriding objectives: a status report of where we are today, what has happened in the past twenty years, and where we go in the future. We do not intend to do indepth reporting on the technical studies and analyses being presented here but rather to touch on them in a brief "overview" manner.

Our purpose for the present plan is to aim at a somewhat different audience. While we do hope the plan will be accepted and utilized by various agencies, it is our intention that the current plan when completed will be oriented to a broader cross-section of the general public. In order for local governments and local agencies to undertake programs and projects to enhance the value of the river and its fronting lands to the public, there must be understanding that such programs and projects are part of an overall process.

We intend that the format of the plan now being developed be structured so that the plan document is graphic, concise, and very readable. If we achieve our objective, the plan will be produced in a folder format suitable for ease of distribution by the Tri-County Riverfront Action Forum including direct mailing to the great number of people the Forum has found, over the years, to be interested in the better appreciation and enjoyment of the river.

THE MAJOR PROBLEMS OF TWENTY YEARS AGO

Its a real opportunity for a consulting firm to work on the same project over an interval of this time. Its even more of an opportunity for me as an individual to be involved in this project after also being involved in the initial effort some twenty years ago. This is an opportunity which provides me some insight. I will be the first to admit, however, that any such insight is more due to the passage of time and my maturing age than any great in-depth technical knowledge of the complexity of forces at work on the Illinois River determining how its future will be decided. I hope this insight will be imparted to the plan.

The three major problems identified twenty years ago by persons knowledgeable about the river were pollution, siltation, and turbidity. Pollution and siltation are generally understood. Turbidity relates to the lack of clarity of water which in turn has an adverse effect on the ability to sustain fish and wildlife. The list of primary problems noted at that time were---

Water Pollution
Siltation
Turbidity
Limited Waterfront Recreation
Lack of Public Access to Waterway
Poor Shoreline Maintenance
Certain Unattractive Urban Waterfronts
Inattention to Visual Values
Poor Earth Borrow Practices Along the Bluffs
Random Filling of the Floodplain for Development

A COMPARISON OF THEN AND NOW

Some observations are warranted of certain select factors, then and now to give some insight as to meaningful trends as to what is happening to the river and riverfront lands and also, and very importantly, what is happening to the attitudes of people about the river.

1. Public Interest

Then (in 1968) there were fewer persons with a more narrow focus interested in the river. Today there is a considerably greater interest in the river by people and agencies with a wide and diverse range of interests.

2. Public Access to the River

Then there was very little opportunity for public access. Today considerable land has been acquired or transferred to public agencies for recreational use. There has been good participation by the communities and the park districts, much of which was accomplished with the assistance of Forest Park Foundation, Riverfront Action Forum and grant assistance from the state.

3. River as Focus for Quality Development

In 1968, the challenge was in getting people to believe that desirable development could occur on the riverfront. Today, its not if, but when and how quality development will occur.

4. Protection of the Flood Plain

Twenty years ago there was filling in of the flood plain with relatively little control. Today all counties and waterfront communities have flood plain zoning which prohibits filling in the flood plain. The program has resulted in flood insurance, the protection of the flood absorbing capabilities of waterfront lands and has made possible relief for flood prone developed properties through acquisition and conversion of such properties to permanent open space.

5. Tributary Erosion Control

In 1968, the emphasis was to channel tributaries and keep them clear of vegetation, so as to drain floodable natural areas for their conversion to farmland or development. Today we are embarked on a national program addressing practices oriented to highly erodable farmlands. Also instead of channelling and clearing streams, there are pilot programs underway to revegetate stream banks so as to slow or stop stream bank erosion.

A LOOK INTO THE FUTURE

We believe that a continuing level of interest and past and present efforts of the various local, state, and federal agencies could create an expanding awareness and use and appreciation of the waterway and riverfront lands. This in turn should create a greater public constituency for the proper use and management of this resource of the Illinois River and its riverfront lands. Such activities as the Riverfront Forum's Riverfront Awareness Cruises and the Jumers Boatworks and its Spirit of Peoria cruises have aptly demonstrated the appeal for thousands of people to both an educational and recreational experience few would have thought possible twenty years ago.

There is another potential development on the horizon which will further strengthen the public's exposure to the riverfront. The development of a regional bikeway and jogging trail connecting the communities of Pekin, East Peoria and Peoria is now in varying stages within the three communities ranging from discussion to preliminary planning to actual phases of construction. Much of that bikeway once constructed will parallel the Illinois River. We believe such a project will provide another great exposure of the waterfront to people, again strengthening the constituency to whom good waterfront usage has appeal.

Other potentials exist. Almost all of the following have good potential, though all face obstacles of one form or another---

Use of Levees for Trails
More Linear Parks Paralleling the Waterway
Expanded Efforts for Spot Restoration of Fish and Wildlife Habitat
Island Projects to Manipulate the Flow of the River and Improve Fish and Wildlife Habitat
Expansion of Stream Bank Erosion Control Efforts
Continuing Development of Urban Waterfronts to Open Space and Compatible Commercial Recreational Uses

CHALLENGES TO BE FACED

Some of the major challenges to be faced are expected to include the following---

Ways to Allow Public Recreational Access Along the Water's Edge Through Non-Public Lands
How to Continue Waterfront Acquisition for Permanent Open Space
How to Balance Waterfront Real Estate Development with Public Open Space Interests in a Harmonious Way
How to Achieve a Truly Coordinated and Strongly Supported On-Going Working Partnership Between the Hosts of Various Federal, State, and Local Agencies, and the Public at Large that has the Continuity and Commitment Necessary for Quality Development of the Riverfront

IN CLOSING

This should give you an understanding of the direction of the current Tri-County Riverfront Plan now underway. We feel these are exciting times concerning the waterway. There are various forces in motion setting the course for how we live up to our responsibilities in protecting, managing and utilizing this magnificent resource. Some will succeed, and unfortunately some may fail. My only regret is probably that I won't have the opportunity to take another look at where we are in another twenty years. I have confidence, however, that we will make much greater strides in the future than we ever would have thought possible in the past.

INTRODUCTORY COMMENTS

Barbara Mantz Drake, Associate Editor

Peoria Star Journal, 1 News Plaza, Peoria, IL 61643

In February of 1979 readers of newspapers throughout the country awoke to news that Susan Ford, daughter of the ex-president, was marrying her bodyguard (remember that?), that huge pools of oil had been discovered beneath Mexico and that the United States was on the verge of trading with China. Big news, all of it. But readers of the Journal Star newspaper, here in Peoria, had a front-page story of a different sort. "The Dying Illinois," the headline read, accompanied by a picture of disturbingly stark backwater mudflats.

A portion of the first article, part of a three-part series, should be in front of you. The author is Tom Edwards, an environmentalist and former Journal Star reporter. I know many of you know him.

The article begins like this:

"Within the lifetime of children now living in Peoria there may no longer be a Peoria Lake. Or an Upper Peoria Lake. Or Lake DePue, Senachwine, Chautauqua, or any other of the backwater lakes and sloughs of the Illinois River. All of them are gradually disappearing, filling in with soil washing mainly from farm fields, according to scientists at the Illinois Natural History Survey laboratory at Havana. Unless soil erosion is stemmed, they say, in a relatively short time the McClugage and Baker bridges will cross not a lake but a narrow ribbon of muddy water, a two-way street for barges."

Pretty powerful words, weren't they. Well, that's why they struck many of our readers. The lake was a given. Like the land, it had always been there and always should. How could it be otherwise; it was too much a part of us. Besides, the lake looked great from atop Grandview Drive—wide and expansive, like always. To believe otherwise was to be deceived by one's eyes.

And so I suspect that many Peorians wondered if we weren't being unduly alarmist. After all, there were so many things in the world to be alarmed about—nitrates in bacon, red dye no. 2, asbestos in schools. It seemed as if there wasn't enough room in the should for any more alarm. Besides, how do we separate the genuine cause for worry from the latest panic fad? After the initial shock, I think many readers went back to sleep. The lakes of the Illinois gone

in 50 or 75 or 100 years? Probably just another exaggeration brought to you by the folks who sell newspapers.

One of the people to treat this article with the seriousness it deserved was a man who is now our executive editor. At that time Tom Driscoll was managing editor, in charge of news operations. It was he who purchased the story from Tom Edwards because he knew a good story when he saw it.

Driscoll came to Peoria to work at the Journal Star 40 years ago. I was speaking to him yesterday as he recalled drive down Rt. 116 for an interview and seeing over the bluff Upper Peoria Lake spread before him in all its grandeur. He was a Chicago boy and had expected nothing like this in the flatlands and cornfields of Central Illinois. He was astounded at the spectacle, and it made a deep and lasting impression. It may help explain why saving the lakes has become an impassioned campaign of this newspaper over the last decade. But I'm getting ahead of myself.

About six months after the Edwards' article appeared, Tom Driscoll moved from the news department to the commentary section. As editor of the editorial page, he was responsible for the opinion content of the paper. And in view of what I've told you, it's not surprising that he wasted little time in writing about the threat to the lakes.

You have in front of you the first editorial we ran on the issued, dated September 15, 1979. It was prompted by a news story that some Pekin residents out in a motorboat had gotten stuck in the river's mud and spent 14 frightening hours awaiting rescue. Driscoll was quick to associate this with the lake siltation reported months earlier and tied the two together in this editorial. The motorboat incident, he said, "is another reminder that this great natural resource is gradually disappearing...You can't see it happening, because when you look out across the river and across these backwater lakes, you still see water. What you can't see is that the bottom gets closer to the top every year."

Over the next tow months, Tom Driscoll wrote two more editorials on the river. And over the last decade, he—and more recently I—have written more words than we can count on the subject. Like the federal deficit, good schools and economic development, readers of the Journal Star have come to expect a periodic harangue on the river in our editorial pages. It has and will continue to be one of our ongoing campaigns. Why? We are keenly aware that Peoria and the other nearby communities are here because the lakes are here. They are the reason the metro area exists. And we—this newspaper—exists because Peoria exists. We cannot envision separating the newspaper from the community or the community from the lakes. We believe it is in the utmost interest of all of us who live here to preserve them.

As it turned out, Tom Edwards' initial article was not unduly alarmist. If anything, it failed to be alarmist enough. The initial prediction of 50 or 100 years for the lakes was entirely too optimistic. As people began to better understand what was taking place, the experts began to talk of a 15- or 20-year lifespan.

And as time went on, the alarms many of you out there were sounding, and we were sounding in print, made believers of a lot of people. Folks in Tazewell, Woodford, and Peoria counties began to take seriously the potential loss of the lakes. And at the hands of activists like you, the campaign to save the lakes began.

The day in 1979 after our first editorial ran, suggesting that farming practices were to a large extent responsible for what was happening to the river, Tom Driscoll go a call from an angry farmer.

"What do you want to save it for, the barge companies?" he asked.

Driscoll responded as you might expect—in print—and I think what he said then pretty much represents the philosophy with which we pursue this issue now. Here is an excerpt:

"No, we don't want to save it for any special interest group. We want to save it for our children and our grandchildren and for their grandchildren, so they can enjoy all of the benefits—both economic and recreational—that will derive from this magnificent and historic stream. The same goes for the riverfront from one end of Peoria to the other, and, indeed, on both sides of the river from as far up and down its banks that we might be able to inspire anyone who will listen to our plea for preservation of this river, gently flowing."

Well, now we have moved from inspiration to perspiration. With that in mind, I am pleased to present your first panel this morning. The subject, appropriately, is local initiatives.

THE ILLINOIS RIVER AND PEORIA LAKES: IT'S TIME TO ACT

Michael Reuter, Caterpillar Inc.
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ABSTRACT

In June 1988, the Heartland Water Resources Council of Central Illinois was formed to manage the issue of saving the Illinois River and Peoria Lakes from sedimentation. A number of studies had documented the river's loss of volume--77 percent since 1903--and other changes, but the time had come for action.

In this slide presentation, the HWRC attempts to build awareness of the sedimentation problem and broaden the base of support for the challenge to keep soil on the land and manage the sediment already in the Illinois River and Peoria Lakes. Causes are varied, but the two critical sources of erosion mentioned include crop land which slopes less than 5 percent--simply because so much of that land exists in Central Illinois--and stream banks. The solution presented is multi-dimensional but not conclusive: selective dredging, construction of islands for a sediment depository and improved wildlife habitat, and enhanced erosion controls on stream banks and farmlands. Some of these projects could begin within two years. The cost? Maybe $200 million. The alternative?

INTRODUCTION

It was October. The summer's humidity had relinquished to deep blue skies and sometimes chilly breezes. A few miles from town, along a dirt road, a car rolled to a stop as a young boy named Jim leaped from the passenger doorway. His dad hurried to catch up, cautioning him to be quiet as they began their journey down a dirt path, overgrown with grass and quite uneven.

Jim's mind raced. He thought of the book he'd been reading, the book that had fueled his imagination with talk of ducks and geese, their migratory flight, their cries that could be heard echoing over their watery habitats.

"It's just like dad said it'd be," Jim whispered as they arrived at an old hunting blind, although the green paint was chipping badly and a wooden plank that had been fashioned into a bench now lay on the ground. His dad put his finger to his lips as they sat, and they began to wait.

Jim fingered his pocketknife as he studied the hundreds of names which had been carved into his seat. "So many people have been here," he said to himself. "How beautiful the geese must be to have such an audience."

A faint honk through the crisp air arrested his thoughts. His eyes darted to the northern sky. Way up high Jim saw them--maybe 50, maybe 100 geese in perfect form. Tense with excitement, he watched, but they didn't circle, didn't seem to slow or even look down.

The afternoon held only similar discouragement. "I don't understand it," said his dad. "They've been landing right over those trees there for years. It's the only lake for miles."

Jim and his dad climbed out of the blind and walked to the edge of the trees. They stood motionless; the lake was gone. Only reeds and grasses filled the basin which once had teemed with wildlife. They said nothing to each other, but turned and walked toward the car. It's over, Jim thought, as he slid the knife back into his pocket. Nothing's left but the stories.

Jim sat in his room holding the book. He opened it up to the page he had marked and began reading. He imagined how the geese would have acted--squabbling among themselves, rummaging their long necks below the water's surface in search of seeds and grasses. Then he gently closed the book and placed it on the shelf, just behind *Huck Finn* and *Call of the Wild*.

PROBLEM ASSESSMENT

About 18,000 years ago, the Ice Age ended for most of Central Illinois. Flat, fertile plains and a wide river extending from the Great Lakes to the Mississippi Valley were its gift to present times. The river formed two pools and a series of narrows along one bend, making it an ideal site for the series of settlements that would eventually become Peoria.

French explorer Father Jacques Marquette, along with Louis Joliett and five assistants, first visited this area in 1673. He described it as "a scene of enrapturing beauty." Three hundred years later it seems unlikely that he would choose the same words.

The Illinois River, which has nurtured Peoria and other river communities for decades, is sick, possibly dying. Because of decades of sedimentation, an eight-foot average depth in 1903 has decreased to about 2½ feet today. Water volume has decreased 77 percent outside the navigation channel. Aquatic plants and animals simply are choking, sure to have dramatic effects on other forms of wildlife.

The cause is widespread. The majority of the sediment--about 60 percent--enters the river from lands that drain north of the Peoria area. We inherit a large amount of that sediment because of the river's relatively low slope between Starved Rock and Peoria. As the water slows, silt and clay particles drop out. A very slow current through Upper Peoria Lake makes that area one of the most severely affected. Water depth there has been reduced to about 18 inches in many places.

The remaining 40 percent of sediment comes from local streams in nearby counties--Marshall, Peoria, Tazewell and Woodford. From those streams, an average of 800,000 tons of soil enter the lakes every year--enough to fill the Pere Marquette hotel in Peoria more than 14 times. It's ironic, the loss of one infinitely valuable resource is causing the loss of another.

Although moderately and severely sloping crop land can be a major contributor, the largest amount by far--estimated to be more than 70 percent--comes from crop land that slopes less than 5 percent, simply because so much of that land exists in Central Illinois. Another major source is the erosion of stream banks that feed into the river.

The ramifications are immense. With the present rate of sedimentation in Peoria Lakes--about 2 million tons every year--they will disappear in less than 15 years. The view from Grand View Drive in Peoria will be that of a mud flat, a common ditch. If a transportation channel could still exist at that point, it would be surrounded by marsh. Flooding would be common; fishermen and outdoor enthusiasts would not.

WHY WE NEED TO ACT

It's not a pretty picture, but it's real. Saving the river needs to be of immediate and primary importance to Central Illinois. We stand to lose something immeasurable in common dollars.

What's it worth to us, the residents of Central Illinois, to have our cities sit nestled within the arms of such a beautiful and important river as the Illinois? Is it the value of a trip to watch a flock of ducks drop into a lagoon as night falls? And the sight of a bass leaping after a mayfly at sunrise? And the value of a sun setting over the water, seen from atop a bluff, trees streamed yellow and gold?

The aesthetic value of the Illinois River cannot be measured. But its economic value can be. Industries from fur trading to agriculture originally came and flourished here in part because of the readily available transportation. It also attracted stockyards, distilleries and manufacturers. Presently, the river is used to transport chemicals, coal, sand and gravel, raw materials for manufacture. In fact, the Illinois River accounts for more commercial barge traffic than does the Upper Mississippi. Total tonnage exceeded 56 million in 1988.

The river also serves as a stable water supply for many of us, both as residents and businesses. One only has to read the newspaper to realize how many communities don't have that luxury. Water problems in California and Arizona are well documented. But even our closest neighbor, Bloomington/Normal, has expressed concern. Community leaders there have even considered tapping the Illinois River.

Central Illinois agriculture benefits significantly. It is estimated that corn and soybean producers in this area, for instance, receive increased revenues of anywhere from 10 to 20 cents per bushel because of the lower cost of marketing through barge traffic than through rail or trucking.

And recreation, in many forms, exists here only because of the river. Thousands of people are drawn to our area every year--hunters, fishermen, boaters, hikers and tourists. As Midwestern land lovers, we don't always realize how valuable a resource water is. So a complete study of the revenue impact felt here is under way. We know revenues are in the millions of dollars. Studies have shown that revenues from hunting and

fishing alone, along the Illinois River, stand at about 39 million dollars annually.

We also mustn't forget that the Illinois River is more than a river to Peoria and other area cities. It is so much a part of our culture. Steamboats and vaudeville entertainment made us known to the world in the 1800s and early 1900s. And, in the words of Jerry Klein, author of *Peoria!*, "as long as people hear, or even remember, that rhythmic slap of the paddlewheel...the era will never end. Not completely."

The Spirit of Peoria riverboat may still be able to run on merely a transportation channel, but could we, the men and women of Central Illinois, run on such a narrow path through life? Economically and aesthetically, the Illinois River is as important today as it ever was. It's our front door. If we can't take care of our front door, what can we do?

CAUSES OF SEDIMENTATION

Soil erosion is a natural geological process. Research shows that when the Wisconsin Glacier melted and began to recede, its drainage streams were laden with silt. In fact, the sediments deposited then, redistributed by violent wind storms, were the basis for the fertile soil we find in this area today. What has happened, however, is that man has sped up this natural process to a rate that the river cannot cope with anymore.

We cleared forest lands, drained wetlands and developed urban areas at the cost of increased runoff. We constructed dams and levees at the cost of increased sedimentation. All had a compounding effect on the river. But the greatest impact came from an intensified agriculture. During the 1960s, '70s and early '80s, we thought we'd never be able to produce enough food to feed the people of the world. Fences were pulled to make larger fields. Cereal grains as well as hay and cover crops were plowed up in favor of the higher-yielding corn and soybeans. Grass waterways were eliminated and marginal land was brought into production.

With bigger machines and new hybrids requiring earlier planting, fall tillage--often with a moldboard plow--became the norm, an answer to the lack of time available in the spring. But when the rains came, the bare soil was easily dislodged. Flowing waters transported and deposited it into the streams. The annual sedimentation rate from 1965 to present is double that of previous decades largely for these reasons.

The second largest contributor to Illinois River sedimentation is stream bank erosion. Many small streams were "straightened" over the years to accommodate urban development and more intensive farming. At the time, most people believed a by-product of the directed flow would be *reduced* soil erosion. A straighter path, they thought, would mean the stream would not cut into the banks as much.

We found out that just the opposite occurs. Without natural bends in a stream, water flows at a faster pace, and with more force. Then, when the bank finally does curve, the current meets it with greater force and erodes it severely. A single heavy rain storm has been known to cause streams to cut 30 to 40 feet into a bank. If someone had asked to buy that land, we'd have charged several thousand dollars per acre, yet we watched it wash away for free.

So although erosion from construction sites, urban areas and steep hillsides do contribute to Peoria Lakes sedimentation, we can identify

crop land with less than a 5 percent slope and stream bank erosion as the major causes by far.

THE HEARTLAND WATER RESOURCES COUNCIL, STATE AND FEDERAL GOVERNMENTS

We all benefited from the intensive agriculture of the '60s, '70s and '80s--altruistically because of the food we were able to provide to the world and economically because of the cheaper food prices we were asked to pay at home. But the land suffered greatly. It is now more highly erodable. And the loss of topsoil and natural nutrients has lessened its overall productivity.

We all benefited from the series of locks and dams which were built into the river. Without them, Peoria and other river communities could not have been settled as they are today. But the dams slowed the water, increased sedimentation, reduced the river's ability to cleanse itself.

We all benefited when marshlands were drained, forests cut to make room for our cities. But the land lost its ability to effectively absorb water. Wildlife was crowded out, increasing the burden on other areas.

The bottom line is we all benefited. The river brought a richness to our corner of the world that is unequaled in most other places. But it's tired, as if it is saying, "I've had enough, I can't give you anymore."

Since we reaped the benefits, and in the process caused the problems, we also must be part of the solution. Locally, we have a responsibility to form a partnership to develop a unified, coherent strategy to save the Illinois River and Peoria Lakes. The Heartland Water Resources Council was formed in June 1988 to undertake that role. It's made up of individuals, public and private companies, and various other organizations from Marshall, Peoria, Tazewell and Woodford counties with an aim to coordinate the various lake- and river-saving ideas and to manage their implementation.

But the success of any local rescue efforts greatly depends on the success of efforts up and down the river. Long term, we have to reduce the amount of sediment entering the river. And since 60 percent of it received locally originates on land areas north of Peoria, it will require a cooperative effort from those areas. In turn, we have a responsibility to consider the effects of our actions on our downstream neighbors.

The Illinois River Coalition/Father Marquette Compact was recently formed to serve that larger purpose. Members come from the 22 counties which border the Illinois River. The Coalition will ensure communication, so that what happens on one part of the river doesn't negatively affect another.

The next tier of responsibility is the state government. There are at least 13 state agencies which have some concern for water in the Illinois River and Peoria Lakes. The Illinois State Water Plan Task Force was formed to focus all those agencies the way the Heartland Water Resources Council is focusing local efforts. We are very optimistic about the State of Illinois being a large part of the solution.

Finally, there is much support available at the federal level. The Corps of Engineers, U.S. Coast Guard and Department of Agriculture will all help some aspects of the river project. Our elected officials have been quite successful at securing their attention and potential funding. But we cannot tap those resources until we present a local, coherent strategy. That brings us back to the Heartland Water Resources Council.

The council will furnish that strategy, in conjunction with the thoughts of the Illinois River Coalition and the state and federal governments. It's a management challenge--a challenge to bring together many varied interests. We'll need to appeal to the farmer, to the boater, to the fisherman and to the executive.

RECOMMENDED SOLUTIONS

By the nature of the problem, the solution must be two dimensional. First, it must keep the soil on the land. Second, it must manage the sediment already in the lake.

As far as erosion control, signs of change are already evident, particularly in agriculture. The Soil and Water Conservation districts at the county and state level, and the Soil Conservation Service on the federal level foretold the inevitable effects of soil loss, both on- and off-site, long ago. And today, primarily because of their efforts, we are witnessing nothing less than a revolution on the farm.

According to extension specialists at the University of Illinois, conservation tillage practices are being adopted by farmers at a rate faster than any other new technology in our history--faster than conversion from the draft horse to the internal combustion engine, faster than adoption of hybrid seeds, chemical pesticides or fertilizers. Will the effects be as great? We think so.

Erosion from land farmed with conservation tillage and other sustainable practices can be up to 90 percent less than that from land farmed conventionally. Again, since this land contributes the largest amount of sediment by far, any reduction in its soil loss will ease the river's sediment burden dramatically. Benefits will be felt by the farmer as well, most certainly that of sustained soil productivity.

The Illinois Department of Transportation has made a great effort to reduce erosion from construction sites. A biodegradable layer of fibers is replacing the use of straw for cover on bare ground. Once tacked down, it lasts from two to three years as erosion protection. By that time, a healthy stand of vegetation will have become established.

Studies to reduce stream bank erosion are under way. Critical streams are being identified so that erosion controls can be put into place on a top-priority basis. The Illinois River Soil Conservation Task Force, primarily made up of soil and water conservation district directors, already is installing erosion controls on many small streams in Central Illinois. Osage orange branches, for example, are being placed along critical stream banks to reduce the water's impact and redirect its flow. The trees will last for 50 to 75 years.

All of these efforts, provided similar efforts are undertaken upstream, will sharply reduce the amount of sediment entering the Illinois River. Managing the sediment currently in the river will then be possible through a combination of programs.

Ideas already reviewed by the Heartland Water Resources Council include selective and complete dredging, construction of islands as a sediment depository as well as for improved wildlife habitat, hydraulic manipulation of the water level to affect the river's velocity and increase its natural cleansing ability, redirecting barge traffic to stir up the sediment and force it downstream.

All the ideas have been well received but some aren't economically feasible or in line with the system-wide approach. Estimates for draining

and dredging the entire lakes, for instance, run into hundreds of millions of dollars. And flushing our portion of the river might solve our problem but it only creates one for Havana and other communities south of here.

The council will continue to hear suggestions for some time. Then a comprehensive strategy will be compiled. Implementation of some preliminary projects to save the river could begin within two years.

A COMPREHENSIVE STRATEGY

The cost of these solutions is uncertain at this point. But estimates developed by civil engineers and others suggest that implementing a variety of the solutions will cost about $200 million. It could be spread over five years and would encompass all efforts, including selective dredging and construction of islands as well as implementation of enhanced erosion controls for stream banks and farmlands. It seems like a huge expense, but in comparison with other U.S. water projects the cost isn't out of line. And considering what's at stake, it's more like an investment.

Once the council can put forth a strategy, state and federal monies will be secured. Locally, we estimate $1½ million to $2 million would be needed per year, for five years. It seems most appropriate to create a river conservancy district, as a successor to the council, to raise those funds. The district, probably three years into the future, would act as a large-scale, independent and permanent steward of the river. Like other governmental units, the district also would be given limited authority to levy taxes. They would be placed on property at a very low rate. The taxes are vitally important because local monies are the only means to obtain state and federal monies, since they will be awarded on some form of matching basis.

IT'S TIME TO ACT

As individuals, businesses, organizations, we must support the *Heartland Water Resources Council and its agenda with an acute awareness* of the situation. Sedimentation originates from a myriad of places, so the responsible management of soil resources throughout Central Illinois is critical. We also must support the council financially. A yearly budget of about $130,000 will be needed for the next two or three years until a river conservancy district can be established. That will pay for the professional staff the council is hiring to closely manage river developments.

Saving Peoria Lakes is most likely the most monumental natural resource challenge this area will ever face. There is 40 percent more sediment at the bottom of those lakes than what the Chinese will move over the next 18 years to build the world's largest hydroelectric dam. We've waited long enough to begin.

The Illinois River is our front yard. We must tend it, trim it, nurture it like we would our own. What could we say to our sons and our daughters if we didn't? What could we say to ourselves?

ILLINOIS RIVER SOIL CONSERVATION TASK FORCE

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The Illinois River Soil Conservation Task Force was formed at a meeting on June 28, 1985. However, the history of the Task Force goes back much further. The Marshall-Putnam Soil and Water Conservation District passed a resolution in the fall of 1983 asking the Soil and Water Conservations Districts (SWCD) along the river to support them in their effort to focus on the problem of huge silt loads in the Illinois River. As a result, the Association of Illinois SWCD's (AISWCD) passed a similar resolution at their annual meeting in Springfield, Illinois on August 1, 1983. A similar resolution was passed by the Eighty-third General Assembly of the House of Representatives as House Resolution Number 548 on November 2, 1983. The following year, the National Association of Soil Conservation Districts adopted a modified version of the House Resolution at their annual meeting in Denver, Colorado. These resolutions led to several planning meetings prior to the June 28 formation meeting of the Task Force. Through the efforts of the AISWCD, the Tri-County Planning Commission, and many others, the Task Force was established.

This not-for-profit, 501C3 Corporation was made up of elected Soil and Water Conservation Districts directors from seven Soil and Water Districts, as well as agency, industry, and organizational advisors. The Districts--LaSalle, Bureau, Marshall-Putnam, Peoria, Tazewell, Woodford, and Livingston--have provided an action program to stimulate, accelerate, and implement conservation practices on the Illinois River water shed. As an action group, the Task Force has the districts working together to build support for a combined local, state, and federal effort aimed at reducing farmland erosion to the lowest practical levels. The Task Force supports traditionally funded erosion control practices such as conservation tillage and terraces. The development and funding of alternative erosion control methods such as low-cost stream bank and ravine stabilization practices are also a concern of the Task Force. The Task Force's current demonstration project is concentrating on these practices. In the near future, the Task Force hopes to expand its efforts to areas north of Peoria Lake. Since these are demonstration projects, the Task Force looks for the most highly erosive site with good visibility.

The Task Force operates on grant monies. The first one was received from Caterpillar, followed by funding from the Illinois Department of Energy and Natural Resources. State Senator Richard Luft, Pekin, was instrumental in the passage of legislation to appropriate these funds.

The project co-ordinator and construction supervisors are self-employed consultants to the Task Force. Through the Public Aid Program, Project Chance people are used as the labor force. Over twenty of these volunteers have found permanent employment this year, with the skills and recommendations offered by the Task Force, relieving the Government payroll. Caterpillar has donated the use of two excavators, a D 6 dozer and a 953 truck loader on the sites as needed. The State Water Survey Division of the Illinois Department of Energy and Natural Resources monitors some of the sites.

As the Task Force completes its fourth project this fall with low cost stabilization of gullies and streambanks, their desire would be to have landowners become involved in their projects. As most Task Forces are organized to do a specific job, then disband, this Task Force is no exception. Hopefully, legislators will see the need for cost share in this type of program to further curtail the erosion of our soils into Peoria Lake and other bodies of water. When we get water to walk down hills instead of run, then our efforts will be rewarding.

FOSTER SITE (Senachwine Creek)

Install about forty revetments. Revetments were trees cut from the adjacent woods, mostly hedge trees, which were anchored at the toe of the banks using LaConia earth anchors driven about six feet in the bank with 7000 pound test cable attached.

Install about 900 cuttings on the site, consisting of mostly willow trees three to five inches in diameter and eight to ten feet long. There were several soft maple and cotton wood cuttings and two hackberry cuttings. The willow cuttings came from this farm, about one quarter of a mile downstream and the rest of the cuttings came from the woods adjacent to the sites. Cuttings were placed in rows two and one-half feet apart with the cuttings set five feet apart in the row. The rows were staggered so the cuttings formed a pattern like the number five on a domino. Three to five rows were used depending on conditions.

Treat three consecutive sections with bank erosion problems.

Section 1: About 375 feet long with a wide sweeping curve on the upstream end of the site with banks about 6-8 feet high, about 25 revetments and about 350 cuttings were used. Revetments were placed at right angles to the bank with top ends in the edge of the channel. The butt ends were on the toe and side of the bank. Cuttings were placed in and between the revetments.

Section 2: About 300 feet of bank with sharp curves on both the upstream and downstream ends and high (10-12 feet) steep banks, 7 revetments and about 150 cuttings were used. Revetments were placed with the tops upstream and the butt ends downstream. Cuttings were used on the upstream and only for this section.

Section 3: About 250 feet long with a sharp bend at the upstream end and a relatively straight section downstream. This was the farthest downstream of the three sections with 8 foot banks. Fifteen revetments were placed with the butt ends upstream and about 400 cuttings were placed in and between the revetments.

This site was infested with willow leaf beetle and required several treatments to avoid complete defoliation of the new leaves as they emerged. In mid-July, we had about 80% survival on this site. There has not been sufficient rainfall to test the concept on this site to date.

PEORIA GUN CLUB (Ten Mile Creek)

This site is adjacent to and just downstream from the Caterpillar, Inc. Proving Grounds. We installed a structure about 100 feet downstream of the outlet structure which Caterpillar built on Ten Mile Creek nearly twenty years ago. The structure has about a 4 foot overfall and is about 60 feet long, with a 36 x 6 foot notch. The area between this structure and the apron of the upstream structure was filled with broken concrete which should make a good energy dissipator.

A gabbion basket structure will be built about 500 feet downstream from this one with about the same overfall and notch size. These baskets will be filled with broken concrete, and the area immediately upstream from this structure will also be filled with broken concrete.

Caterpillar, Inc. has furnished all material used on this site including the broken concrete delivered to the site. This winter, we will be putting two or three rows of willow and cotton wood cuttings along both banks of this stretch of Ten Mile Creek.

FANDEL SITE

Install 48 tire structures.
Install 4 living willowing structures.

Materials Used:	Tires	1900
	Willow Cuttings, greater than 1/2 inch	300
	Willow Cuttings, two to four inches	154

Main Channel:	1001 feet long	19 tire structures
Four side ravines:	737 feet total	29 tire structures
		4 willow structures

Treated Area Statistics:

Main Channel:	1,001 feet long	50 foot drop	19 tire structures
Side Ravine #S1:	113 feet long	45 foot drop	12 tire structures
Side Ravine #S2:	246 feet long	50 foot drop	8 tire structures
	1 willow structure		
Side Ravine #N1:	130 feet long	25 foot drop	2 tire structures
	1 willow structure		
Side Ravine #N2:	248 feet long	55 foot drop	7 tire structures
	2 willow structures		

Total length treated = 1,738 feet @ $10.65/foot.

Cost per structure:	tire structures	$347.00
	willow structures	$463.00

HECK SITE (Richland Creek)

This was the most interesting and diverse of the sites worked on to date. It is being monitored by the Illinois State Water Survey. The U.S.D.A. Soil Conservation Service cooperated on the site and assisted in setting up four different conservations trials for evaluation.

Trial 1. Install about 1,300 cuttings on the downstream site, which was on a long curve with banks from six to ten feet high. The cuttings were eight to ten feet long and three to six inches in diameter and placed in holes about four feet deep. The holes were made with a Cat excavator equipped with an eight foot long 6 x 8 inch pointed probe. They were placed in the

same pattern and spacing as the larger cuttings used on the Foster site. There were four to ten rows with a few hedge tree revetments anchored in critical spots. The cuttings were about 70% willows, 20% cotton wood, and the rest were soft maple except for six or eight mulberry cuttings which are doing fairly well so far. This trial looked very good in mid-July.

Trial 2. Install about 1,200 cuttings below a ford on the main creek. This trial is about 500 feet long. The cuttings were thirty to thirty-six inches long and one and one-half to three inches in diameter. Those on the upper half were placed in holes almost as deep as the length of the cutting. Those in the lower half were driven with a gas powered jackhammer to within four inches of their length or the point of refusal. This appeared to damage many cuttings and the top few inches were sawed off. These cuttings were about 50% willow and 50% cotton wood. The pattern was the same as other cuttings, but the spacing was about eighteen inches between the four to six rows. All seedlings were furnished by the Soil Conservation Service. The rhizomes were obtained from the State Department of Conservation and the see was purchased from the La Fayette Home Nursery. Many of these were stressed or dead in mid-July.

Trial 3. This trial is located on the south bank of the south branch of Richland Creek, just upstream of the ford. It consisted of shaping a bank to about two hundred feet long to a 3:1 slope and seeding it with three different grasses. We used Eastern Gamma grass seed, Prairie Cord Grass rhizomes, and Reed Canary grass seed. A light straw mulch was spread and secured with erosion net. By mid-July there was little evidence of any growth of any of the grasses. They may come with some good rains, but the drought has been very hard on this entire site.

Trial 4. The fourth trial is a 500 foot reach on the upstream end of the south branch of Richland Creek. One hundred each of five species were used in this trial. They were Streamco Willow, Bankers Willow, Cotton Wood, and Dogwood seedlings and native willow cuttings. The cuttings were about two feet long and up to one-half inch in diameter. They were placed in holes made with a tree spade. Each species is in a 100 foot reach of the south bank, which is about 8 feet high. There are about five rows, two on the creek bed, one at the toe of the bank, and two or three on the bank. Survival on this trial was low in mid-July.

Stream bank stabilization and the Illinois River Soil Conservation Task Force

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Abstract

The Illinois River Soil Conservation Task Force provides an action program to stimulate, accelerate, and implement conservation practices on the Illinois River watershed. In June of 1985, the Task Force was formally organized by seven Soil and Water Conservation Districts from watersheds along the Peoria Pool segment of the Illinois River. This action group is working together to build support for a combined local, state, and federal effort, which will reduce farmland erosion to the lowest practical level. The Task Force supports traditionally funded erosion control practices as conservation tillage and terraces. The Task Force also supports the development and funding of alternative erosion control methods such as lowcost stream bank and ravine stabilization practices.

The Task Force supports alternative erosion practices where massive streambank or gully erosion sites are transporting high percentages of such farmland erosion to Peoria Lake. Streambank stabilization practices were applied first near Galesburg by the Department of Conservation. The Galesburg Watershed had demonstrated the high sediment yields resulting from stream bank erosion. With ENR funding and technical assistance from the Soil Conservation Service, the Task Force has applied the vegetative stream stabilization techniques at additional field conservation trial sites on Richland, Senachawine, and Partridge Creeks, which flow into Peoria Lake.

In the presentation video such conservation practices demonstrate their effectiveness in reducing erosion and sedimentation. Labor for application of the conservation practices was volunteers from the Project Change program of the Illinois Department of Public Aid. Over 20 of the volunteers have found employment after demonstrating an ability to work under difficult conditions.

The Task Force seeks to expand the soil conservation efforts to areas north of Peoria. These areas also contribute a significant amount of sediment to Peoria Lake and the Illinois River. The willingness of state legislators to sponsor these efforts has been very helpful and will be necessary for continued expansion of soil conservation practices.

Bank Erosion and Sediment Yield

The ENR non-point pollution study revealed that stream bank erosion constituted over 50 percent of the sediment yield. In fact, erosion of the stream channel into floodplain rowcrop fields was the primary flood damage to landowners (figure 1). Previously landowners had increased the rates of stormwater runoff by converting steep woodlands to rowcrops and pastures. In addition, streams were channelized to move erosion sites away from rowcrop fields. The largest bank erosion sites occur where landowners had channelized (removed) stream meanders. These channelization practices had increased the velocity of floodwaters so that bank erosion was a major sediment source.

The significance of bank erosion was illustrated by comparing the amount of bank erosion during a flood with the amount of sediment transported by the flood. The monitored bank sites had erosion rates equal to 15 percent of the sediment yield. The monitored bank erosion sites represented 20 percent of the major bank erosion sites in the 62,000 acre watershed. Landuse changes, stream channelization, bank erosion, and sediment yields are detailed in the final ENR report on Court Creek.

Figure 2 shows the segment of Court Creek between bank erosion site five and bank erosion site two during 1940 and 1979. The upper half of figure 2 shows the stream segment as it existed in 1940. In 1948, channelization of the stream meander at bank erosion site 5 increased channel erosion so that the downstream field at bank erosion site 3 was eroded away by 1979. This loss is documented in the lower half of figure 2. For 40 years, an average of 2000 tons of soil were eroded annually from this one bank site.

As a result of the 1948 channelization, four major bank erosion sites occur by 1979 (figure 2). Bank erosion site 5 is shown in figure 1. Since 1981, stream surveys have measured the stream channel moving over 80 feet into the rowcrop field along 500 feet of bank at site 5.

District Fisheries Biologist Ken Russell of IDOC correlated a loss of gamefish (smallmouth bass and channel catfish) with the loss of stream habitat. Sediment deposits of silt and sand were filling in pools and covering rocky riffles. The ENR study found the eroded bank soils were largely composed of silt and sands and therefore bank erosion was also a major cause of instream habitat destruction.

Stream bank protection was a difficult problem because (1) the expense of earthmoving and riprap prevented widespread application by private landowners and government agencies, (2) most stream stabilization measures are not widely supported by conservationists, and (3) the rate of erosion was severe.

The Water Survey designed a watershed program to slow the rate of floodwater runoff with (1) water detention structures and soil conservation practices on the steep lands and (2) by utilizing the large floodplain valleys as detention basins. Information from the ENR study was utilized by the Illinois Department of Agriculture (IDOA) to fund a Build Illinois watershed program to reduce erosion from upland rowcrop fields with water detention structures and other soil conservation measures. The watershed received $85,000.00 per year between 1986 and 1988 for such practices.

Vegetative Stream Stabilization by the Watershed Planning Program

Unlike the Watershed Land Treatment Program Of IDOA, the propose of IDOC's Watershed Planning Program was not the protection of rowcrop field productivity but was the reduction of sediment delivery from all land uses to Illinois lakes and streams. The Watershed Planning Program utilized the research findings of the ENR Court Creek study in the development of lowcost erosion control for watershed areas with high rates of sediment delivery. Control of stream bank erosion does not significantly alter rowcrop productivity but does significantly reduce sediment delivery.

In 1986, the Watershed Planning Program began testing two lowcost methods of vegetative streambank stabilization: (1) tree revetments and (2) dormant willow posts. Both methods are designed to slow floodwater velocity by increasing flow resistance in the high flow portions of the stream channel. Slowing floodwaters will reduce channel erosion throughout the stream length by reducing floodwater velocity. Slowing the floodwaters will

also allow sediment to be deposited in floodplain fields during high stream flow. Such practices require the floodplain fields to remain submerged longer but the duration of flooding is usually less than one day. Landowners prefer the occasional replanting of young crops to the severe streambank erosion along floodplain fields.

Vegetative bank stabilization restores riparian areas and is supported by most environmental groups and agencies. The techniques are relatively lowcost and therefore are supported by landowners and governmental agencies. Over the last three years, both tree revetments and willow posts were tested at severe bank erosion sites during flooding, drought, and winter ice-out.

With funding from the Watershed Planning Program, the Illinois State Water Survey has monumented a series of stream transects to document the effectiveness of the vegetative techniques at major bank erosion sites. The degree of erosion control is determined by comparing the amount of erosion at treated bank sites with the amount of bank erosion at untreated bank sites. The untreated sites occur in control segments of Court Creek, which lie immediately upstream and downstream of the demonstration area. The Division of Fisheries is monitoring the response of stream fishes to the bank stabilization methods. The Illinois EPA is monitoring changes in stream habitat and macroinvertebrate populations.

A private contractor from Ohio (George Palmiter) was hired by IDOC to place tree revetments along bank erosion sites in a 3-mile demonstration segment of Court Creek (figure 3). Approximately 1 mile of large bank erosion sites occur within the demonstration area. The Soil Conservation Service (SCS) in Arizona was consulted concerning willow post bank stabilization since SCS personnel in Illinois were not familiar with the technique in 1986. The willow post technique was tested on two stream reaches, which are 2 miles upstream of the tree revetment demonstration area. With funding from IDOC, the Knox County Soil and Water Conservation District (SWCD) adapted both bank stabilization techniques to withstand local stream conditions.

Selection of Bank Erosion Sites

Erosion control practices were only applied to severe bank erosion sites. At these sites, bank soils were void of vegetation. Streambank erosion into floodplain fields had doubled and tripled the stream width when compared to stream reaches with well developed riparian zones. The severe sites had large sand point bars on the inside of stream meanders. The location of low sand bars allows for the expansion of floodwaters in the overly wide channel if the site undergoes an unusually severe flood after stabilization of the outer streambank.

With both stabilization methods, prevention of erosion around the upstream end of construction has extreme importance. Tree revetments and willow posts are started in stable upstream banks. Usually smaller bank erosion sites occur on the opposite stream bank - immediately upstream and downstream of the major erosion site. Either tree revetments or willow posts should be applied to the smaller erosion sites. This will further stabilize the present channel configuration and increase the life of the bank protection.

The success of either method will be reduced if the cross-sectional area of stream channel is decreased below the average area of stable stream segments. Excessive reduction of stream's width will speed the floodwaters at the site of channel constriction. At severe bank erosion sites, the stream channel has usually eroded far into the field so that channel width is much greater than necessary.

Tree Revetment Stabilization

The Palmiter application of tree revetments has been successful on moderately eroding banks, where 1-3 feet of bank were eroded each year. The best example of an effective Palmiter structure occurs at bank erosion site 1 near Sugar Creek. The tree revetments have protected the bank so that small willows and cottonwoods have revegetated the eroding soils. Even when damaged by floods, the tree revetments have sharply reduced bank erosion rates when compared with bank sites in control areas (table 1).

Table 1. Amounts of Soil Eroded From 11 Tree Revetment Sites and 4 Control Sites

Year	*Stabilized sites (4,910 feet of bank)*	*Control sites (1,570 feet of bank)*
1986		
Total tonnage	5,872	2,127
Tons of soils/foot	1.19	1.35
1987		
Total tonnage	1,297	782
Tons of soils/foot	0.26	0.50
1988		
Total tonnage	1,170	1,308
Tons of soils/foot	0.24	0.83

Before stabilization, bank erosion rates were 11.9 tons per linear foot in the demonstration area and 13.5 tons per linear foot in the control area. Therefore bank erosion in the demonstration area was about 88 percent of the erosion rate in the control area. These averages are based upon 4,910 feet of bank in the demonstration area and 1,570 feet of bank in the control areas.

In 1987, the bank erosion rate in the demonstration area was 53 percent of the erosion rate in the control area (Figure 4). In 1988, the bank erosion rate in the demonstration area was 29 percent of the erosion rates in the control area. During 1987 and 1988, 80 percent of the bank soils eroded from the demonstration area came from 5 sites. These five severely eroding sites equal 2,630 feet of the 5,000 feet of major bank erosion in the demonstration area. At these five bank erosion sites and two additional sites, the Palmiter revetments were heavily damaged or removed by flooding and ice floes (figure 5).

A stream crew from the Knox County Soil and Water Conservation District has replaced the damaged Palmiter revetments with a more durable type during 1989. The SWCD tree revetments are hedge trees held in place with Laconia earth anchors (figure 6), which were developed for the military. In addition, the SWCD stream crew hastened revegetation of the earth banks by placing small willow whips through the revetments and

into the bank soils. The SWCD tree revetments have withstood a severe June flood when over 3.5 inches of rain fell in one hour. Only four of 118 tree revetments were lost at the five erosion sites.

With tree revetments, the branches should extend into the stream channel to deflect floodwaters away from the fence posts and Laconia anchors in the earth banks (figure 7). The use of hedge trees maximizes the durability of the tree branches so that woody riparian vegetation can be established before the revetments deteriorate. The establishment of riparian vegetation has been hastened with bank plantings of small tree seedlings (green ash, american plum, grey dogwood, bald cypress) and small cuttings of willows. The willows, bald cypress,and green ash have been successfully established with a minimum of maintenance. The more desirable tree species will shade out the willows when fully grown.

Dormant Willow Post Stabilization

The Knox County SWCD stream crew, the Illinois Department of Conservation, the Illinois State Water Survey and the Soil Conservation Service are testing a second bank stabilization technique, which utilizes dormant willow posts. The willows are cut in winter or early spring and transported to the bank erosion site. Dormant willow posts are placed into holes formed by a 6 ft metal ram, which is attached to a Caterpillar excavator (figure 8). Since the posts holes are over 5 feet deep, undercutting of the willow posts is prevented. On larger river systems the posts should be placed deeper into the stream bank. At smaller sites costs are minimized by digging holes with a gasoline powered auger. Ninety five percent of the willow posts survived and have withstood the floods and ice floes of 1987 and 1988.

Undercutting of willow posts are reduced by placing one row of willow posts directly into the stream. Most of the willow posts in water will die after two months of regrowth. However this outer row of willows will deflect floodwaters while the root systems and branches of the remaining willow posts develop during the first year. Survival rates can be increased by placing small tree revetments among the willows. The small revetments will trap sediment and speed revegetation at the base of the bank.

The SCS willow post technique is more successful on severe erosion sites, where 5 to 25 feet of bank are eroded each year. These willow post sites have had no erosion under summer and winter floods, which removed Palmiter structures at severe erosion sites. This older SCS method is more expensive because more trees are needed but the successful application will immediately reforest an eroding stream bank. The willow post technique method proved to be more resilient to ice floes than the Palmiter tree revetments. Only thirteen of the 612 willow posts were broken off by ice floes (figure 9). The live willow posts have the added benefits of regrowth when damaged by floods.

Willow posts must be placed deep into the bank soils so that the ground water table does not drop below the newly developing root system during the first year. The willow posts are under stress during initial regrowth and will die out if water is not readily available. At erosion sites along the Richland Creek, the Illinois River Soil Conservation Task Force lost all the shorter willow whips (18 inches long) and willow stakes (40 inches long) when the water table in a sandy streambed fell below the lowest level of the cuttings. Even some of the larger willow posts (7 - 10 feet long) died out in the dry streambed.

At one site, a Court Creek landowner removed a stream meander after the bank had been stabilized with willow posts. The landowner placed the spoils from the new channel as a dike to block stream flow from the old stream channel (figure 10). The

landowner hoped to establish more willows in the old channel and move the stream farther from his field at a cost of $1,500.00. During the next flood (June of 1989), the upper end of the dike was broken and floodwater flowed perpendicularly into the willow post site. No erosion occurred - even at the point of maximum turbulence (figure 11). Without the willows, over one thousand tons of soil would have been lost. The new channel (500 ft long x 40 ft wide x 10 ft deep) was completely filled with sand and gravel.

Cost Effectiveness of Tree Revetments and Willow Posts

The total cost for one year of Palmiter construction and maintenance was $40,000.00. When distributed over the approximately 5,000 ft of eroding bank in the Palmiter demonstration area, the price was $8.00 per linear foot. Based upon Palmiter's submitted expenses; labor, materials, and equipment costs were $3.73 per foot of bank. Technical assistance from the Palmiter Company had a cost of $4.27 per foot.

Without technical assistance, the three-man SWCD stream crew restored the damaged Palmiter revetments on 5 bank erosion sites. The SWCD crew cut and transported 118 hedge trees from a bluff pasture 4 miles away. They purchased 50 Laconia anchors and aircraft cable for $1050.00. An additional 70 fence posts were also used to anchor the hedge trees at a cost of $210.00. The crew cost $6,000 dollars for labor. Approximately $1,500.00 in labor and equipment was donated. Total cost was $8,760 for 2,910 linear feet of stream bank - approximately $3.00 per foot.

At a cost of $3.10 per foot of bank, the willow post method is more costly than the tree revetment method. Labor to cut, transport, and place willows was 65 percent of the cost. Use of the excavator and an operator was 35 percent of the cost. Expenses can be minimized by use of the gasoline auger. If large willows are located near the construction site, labor and transportation costs will be reduced by 20 percent. The profit margins of private contractors are likely to raise the cost of both tree revetment and willow post stabilization to $4.00 per linear foot.

In the Court Creek watershed, streambank protection with bank sloping and riprap would be much more expensive. If streambanks were graded to a 1:3 slope, the cost would be $7.60 per foot if the soil could spread in the immediate vicinity. Streambanks are 10 to 15 feet high. Riprap of 10 inch diameter would cost $5.20 per foot of bank when delivered to the erosion site. The cost for equipment, materials, and labor on bank sloping will be $12.80 per foot. The cost of technical assistance has a wide range of values. If done by the Soil Conservation Service, the cost would be minimal. Technical assistance from a professional consulting firm will range from $1.00 to $5.00 per foot, depending upon site difficulties. Costs of tree revetment, willow post and riprap bank stabilization are summarized in Table 2.

Table 2. Cost of Bank Stabilization Practices

Method	Cost per Linear Foot of 12-Ft High Streambank
Palmiter Tree Revetments	$8.00
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Stream Fisheries and Water Quality

Stream fish populations are varying markedly at the four fish survey sites in the Tree Revetment demonstration area. In part the fish population have resulted from the removal of large logjams during the Palmiter construction phase. At the upper Dahinda site, smallmouth bass weights fell from 1250 grams (7 fish) to 302 grams (25 fish) when logjams were removed. Palmiter was unable to hold the larger tree revetments, which form deep water pools along eroding stream bends (figure 11). However at the lower Dahinda site, smallmouth bass increased from 304 grams (3 fish) to 842 grams (16 fish) when some tree revetments remained in the formerly barren stream channel. Table 3 gives the numbers and weight of smallmouth bass in the tree revetment demonstration area before and after Palmiter construction.

Table 3. Smallmouth Bass Populations in the Tree Revetments**

Date of Survey	Fish Survey Sites			
	Dahinda-lower	Dahinda-upper	Bridge	Control
6/26/86 preconstruction	4 (304)	7 (1250)	3 (124)	7 (61)
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*group of 3 large trees eroded into control in Oct of 1986 to form a deep rocky pool - removed during June flood of 1989.

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During the drought of 1988, feedlot runoff killed off the stream fish in the willow post demonstration area. The feedlot runoff depleted oxygen levels resulting in the death of large numbers of fish including smallmouth bass. The survey of dead fish indicated a significant improvement of the fish population. No smallmouth bass were found during 1987 electro-fishing surveys by IDOC streams biologists. The value of fish killed in the improved habitat was apparent to feedlot operator because of the damage assessment ($490.00). Unfortunately the feedlot operator was also landowner of the willow post demonstration area, who had been a strong supporter of the streambank erosion control program.

Feedlot runoff from the Middle Creek tributary lowered dissolved oxygen levels below 4.0 ppm in the control area during the afternoon of August 1,1988. Low dissolved oxygen levels were tracked into the control area but not the downstream tree revetment sites. The 1988 fall fish survey found a drop in the fisheries of the upstream control after August feedlot runoff. Only two smallmouth were found in the control which had 78 smallmouth in July of 1988. Smallmouth bass in the tree revetment sites were 6, 13 and 15 fish. Small isolated storms over feedlot operations may have significant impact fishery during drought periods. No chemical traces of feedlot effluent or a rise in stage were found at the sampling station below the tree revetments. A similar lack of chemical detection was found at the lowest station when 21,000 fish were killed in Middle Creek during June of 1987. Preliminary data indicates severe fishery impacts from pesticide runoff during June of 1989.

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With both lowcost stabilization techniques, the landowners have placed a 30 foot strip along each bank into a conservation easement with the Knox County Soil and Water Conservation District (SWCD). This 30 foot easement has been planted with pin oak, green ash, red cedar, and gray dogwood. While the landowner retains all property rights, the conservation easement area must remain in natural state after reforestation. The conservation easements are given by the landowner to the local county SWCD for administration. The landowner has easy access to the local administrating agency so that flood repairs along the conservation easement area can be made rapidly.

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The fishery data suggests that intense public fishing should be limited on streams, even when habitat and stability have been restored. Stream management should include the establishment of large refuges, where fishing is limited or carefully regulated. The aggressive nature of smallmouth bass in streams would lead to overharvest without refuges or regulation of catch-and-release fishing.

Many private landowners limit access because of concern about property damage. These landowners demand the right to deny access to individuals, who are destructive to their property. The overseeing of stream corridors by private landowners is extremely

valuable to natural resources if properly performed. Most streams in Illinois and stream fishing access are located on private property - similar to the access of Illinois farmlands for hunting. As with hunting habitat development on private lands, the development of riparian habitat to improve stream fish populations increases the angling opportunities even when access is limited. Increases in gamefish and wildlife populations will cause fish population movement to areas with unlimited public access. Limited public access provides refuges for growing gamefish populations and a buffer population if pollution decimates the fisheries over large stream reaches.

The Willow Post Technique Spreads to Other Illinois Streams

The involvement of county agencies, participation by local farmers, color publications, and video presentations are designed to develop a public awareness of stream management and its long term affects. Only through this public awareness will the major problems of non-point pollution be resolved. This approach in the Court Creek watershed has resulted in the spread of both vegetative stabilization techniques to other Illinois streams with funding from other governmental agencies and private foundations.

Combinations of tree revetments and willow posts are presently being tested on major tributaries of Peoria Lake by the Soil Conservation Service and the Illinois River Soil Conservation Task Force with funding from Illinois Department of Energy and Natural Resources. These field conservation trials are supported by the SCS engineering staff in Illinois. The Illinois Department of Agriculture has asked for 1.8 million dollars for stream stabilization on tributaries to the Peoria Pool of the Illinois River.

Adaptions of the willow post technique will be utilized to replace riprap in the construction of instream habitat for smallmouth bass at Franklin Creek State Park this fall. The adaption has already been implemented on Court Creek with Sport Fish Restoration funds from IDOC's Division of Fisheries. The 1989 June flood removed the sand bedload to expose rock rubble but did not erode the underwater habitat and streambank (figure 12).

DuPage County in northeastern Illinois will adapt the willow post technique to suburban streams near Chicago. With a change of landuse to residential housing and business, many small streams have severe bank erosion as a result of higher rates of stormwater runoff. Small dwellings are being undermined and economic resources can not provide the necessary funds for the widespread use of conventional bank stabilization. This problem is not limited to the Chicago metropolitan area but is also occurring in many of the residential areas along the bluffs of the Illinois River.

THE COURT CREEK RESTORATION PROJECT

EXECUTIVE SUMMARY

Within the Illinois Department of Conservation (IDOC), the Watershed Planning Program is developing lowcost stream bank erosion control in the Court Creek watershed near Galesburg, IL. Stream bank stabilization by tree revetment and willow post techniques have been tested under field conditions for two years. Such vegetative erosion control also restores the riparian habitat, which has been severely damaged in most Illinois streams.

Study on the Court Creek watershed began in 1979 when landowners in the Spoon River Watershed Committee went to their state legislators about flood damages along Court Creek. The Department of Energy and Natural Resources funded a 3-year nonpoint pollution study by the Water Quality Section of Illinois State Water Survey in 1980. Landowners were satisfied with a nonpoint pollution study since flood measurement is an essential factor in such a study.

BANK EROSION AND SEDIMENT YIELD

The ENR non-point pollution study revealed that stream bank erosion constituted over 50 percent of the sediment yield. In fact, erosion of the stream channel into floodplain rowcrop fields was the primary flood damage to landowners (figure 1). Previously landowners had increased the rates of stormwater runoff by converting steep woodlands to rowcrops and pastures. In addition, streams were channelized to move erosion sites away from rowcrop fields. The largest bank erosion sites occur where landowners had channelized (removed) stream meanders. These channelization practices had increased the velocity of floodwaters so that bank erosion is a major sediment source.

The significance of bank erosion was illustrated by comparing the amount of bank erosion during a flood with the amount of sediment transported by the flood. The monitored bank sites had erosion rates equal to 15 percent of the sediment yield. The monitored bank erosion sites represented 20 percent of the major bank erosion sites in the 62,000 acre watershed. Landuse changes, stream channelization, bank erosion, and sediment yields are detailed in the final ENR report on Court Creek.

Figure 2 shows the segment of Court Creek between bank erosion site five and bank erosion site two during 1940 and 1979. The upper half of figure 2 shows the stream segment as it existed in 1940. In 1948, channelization of the stream meander at bank erosion site 5 increased channel erosion so that the downstream field at bank erosion site 3 was eroded away by 1979. This loss is documented in the lower half of figure 2. For 40 years, an average of 2000 tons of soil were eroded annually from this one bank site.

As a result of the 1948 channelization, four major bank erosion sites occur by 1979 (figure 2). The bank erosion site 5 is the severe erosion site shown in figure 1. Since 1981, stream surveys have measured the stream channel moving over 80 feet into the rowcrop field along 500 feet of bank at site 5.

District Fisheries Biologist Ken Russell of IDOC correlated a loss of gamefish (smallmouth bass and channel catfish) with the loss of stream habitat. Sediment deposits of silt and sand were filling in pools and covering rockyriffles. The ENR study found the eroded bank

Figure 1. Erosion of floodplain rowcrop fields along Court Creek.

Figure 2. 1979 and 1940 aerial photographs of Court Creek, showing stream channels (solid lines), former stream channels (broken lines, top photo), and monitored bank erosion sites (numerals). Note the complete erosion of a rowcrop field at site 3 between 1940 and 1979.

soils were largely composed of silt and sands and therefore bank erosion was also a major cause of instream habitat destruction.

Stream bank erosion was a difficult problem because (1) the expense of earthmoving and riprap prevented widespread application by private landowners and government agencies, (2) most stream stabilization measures are not widely supported by conservationists, and (3) the rate of erosion was severe.

The Water Survey designed a watershed program to slow the rate of floodwater runoff with (1) water detention structures and soil conservation practices on the steep lands and (2) by utilizing the large floodplain valleys as detention basins. Information from the ENR study was utilized by the Illinois Department of Agriculture (IDOA) to fund a Build Illinois watershed program to reduce erosion from upland rowcrop fields with water detention structures and other soil conservation measures. The watershed received $85,000.00 per year between 1986 and 1988 for such practices.

VEGETATIVE STREAM STABILIZATION BY THE WATERSHED PLANNING PROGRAM

Unlike the Watershed Land Treatment Program Of IDOA, the propose of IDOC's Watershed Planning Program was not the protection of rowcrop field productivity but was the reduction of sediment delivery from all land uses to Illinois lakes and streams. The Watershed Planning Program utilized the research findings of the ENR Court Creek study in the development of lowcost erosion control for watershed areas with high rates of sediment delivery. Control of stream bank erosion does not significantly alter rowcrop productivity but does significantly reduce sediment delivery.

In 1986, the Watershed Planning Program began testing two lowcost methods of vegetative streambank stabilization: (1) tree revetments and (2) dormant willow posts. Both methods are designed to slow floodwater velocity by increasing flow resistance in the high flow portions of the stream channel. Slowing floodwaters will reduce channel erosion throughout the stream length by reducing floodwater velocity. Slowing the floodwaters will also allow sediment to be deposited in floodplain fields during high stream flow. Such practices require the floodplain fields to remain submerged longer but the duration of flooding is usually less than one day. Landowners prefer the occasional replanting of young crops to the severe streambank erosion along floodplain fields.

The vegetative bank stabilization restores riparian areas and therefore is supported by most environmental groups and agencies. The techniques are relatively lowcost and therefore are supported by landowners and governmental agencies. Over the last three years, both tree revetments and willow posts were tested at severe bank erosion sites during flooding, drought, and winter ice-out.

With funding from the Watershed Planning Program, the Illinois State Water Survey has monumented a series of stream transects to document the effectiveness of the vegetative techniques at major bank erosion sites. The degree of erosion control is determined by comparing the amount of erosion at treated bank sites with the amount of bank erosion at untreated bank sites. The untreated sites occur in control segments of Court Creek, which lie immediately upstream and downstream of the demonstration area. The Division of Fisheries is monitoring the response of stream fishes to the bank stabilization methods. The Illinois EPA is monitoring changes in stream habitat and macroinvertebrate populations.

A private contractor from Ohio (George Palmiter) was hired by IDOC to place tree revetments along bank erosion sites in a 3-mile demonstration segment of Court Creek (figure 3). Approximately 1 mile of large bank erosion sites occur within the demonstration area. The Soil Conservation Service (SCS) in Arizona was consulted concerning willow post bank stabilization since SCS personnel in Illinois were not familiar with the technique in 1986. The willow post technique was tested on two stream reaches, which are 2 miles upstream of the tree revetment demonstration area. With funding from IDOC, the Knox County Soil and Water Conservation District (SWCD) adapted both bank stabilization techniques to withstand local stream conditions.

SELECTION OF BANK EROSION SITES

Erosion control practices were only applied to severe bank erosion sites. At these sites, bank soils were void of vegetation. Streambank erosion into floodplain fields had doubled and tripled the stream width when compared to stream reaches with well developed riparian zones. The severe sites had large sand point bars on the inside of stream meanders. The location of low sand bars allows for the expansion of floodwaters in the overly wide channel if the site undergoes an unusually severe flood after stabilization of the outer streambank.

With both stabilization methods, prevention of erosion around the upstream end of construction has extreme importance. Tree revetments and willow posts are started in stable upstream banks. Usually smaller bank erosion sites occur on the opposite stream bank - immediately upstream and downstream of the major erosion site. Either tree revetments or willow posts should be applied to the smaller erosion sites. This will further stabilize the present channel configuration and increase the life of the bank protection.

The success of either method will be reduced if the cross-sectional area of stream channel is decreased below the average area of stable stream segments. Excessive reduction of stream's width will speed the floodwaters at the site of channel constriction. At severe bank erosion sites, the stream channel has usually eroded far into the field so that channel width is much greater than necessary.

TREE REVETMENT STABILIZATION

The Palmiter application of tree revetments (Figure 4) has been successful on moderately eroding banks, where 1-3 feet of bank were eroded each year. The best example of an effective Palmiter structure occurs at bank erosion site 1 near Sugar Creek. The tree revetments have protected the bank so that small willows and cottonwoods have revegetated the eroding soils. Even when damaged by floods, the tree revetments have sharply reduced bank erosion rates when compared with bank sites in control areas (table 1).

Before stabilization, bank erosion rates were 11.9 tons per linear foot in the demonstration area and 13.5 tons per linear foot in the control area. Therefore bank erosion in the demonstration area was about 88 percent of the erosion rate in the control area. These averages are based upon 4,910 feet of bank in the demonstration area and 1,570 feet of bank in the control areas.

In 1987, the bank erosion rate in the demonstration area was 53 percent of the erosion rate in the control area. In 1988, the bank erosion rate in the demonstration area was 29 percent of the erosion rates in the control area. During 1987 and 1988, 80 percent of the bank soils eroded from the demonstration area came from 5 sites. These five severely eroding sites equal 2,630 feet on the 5,000 feet of major bank erosion in the demonstration area. At these five bank

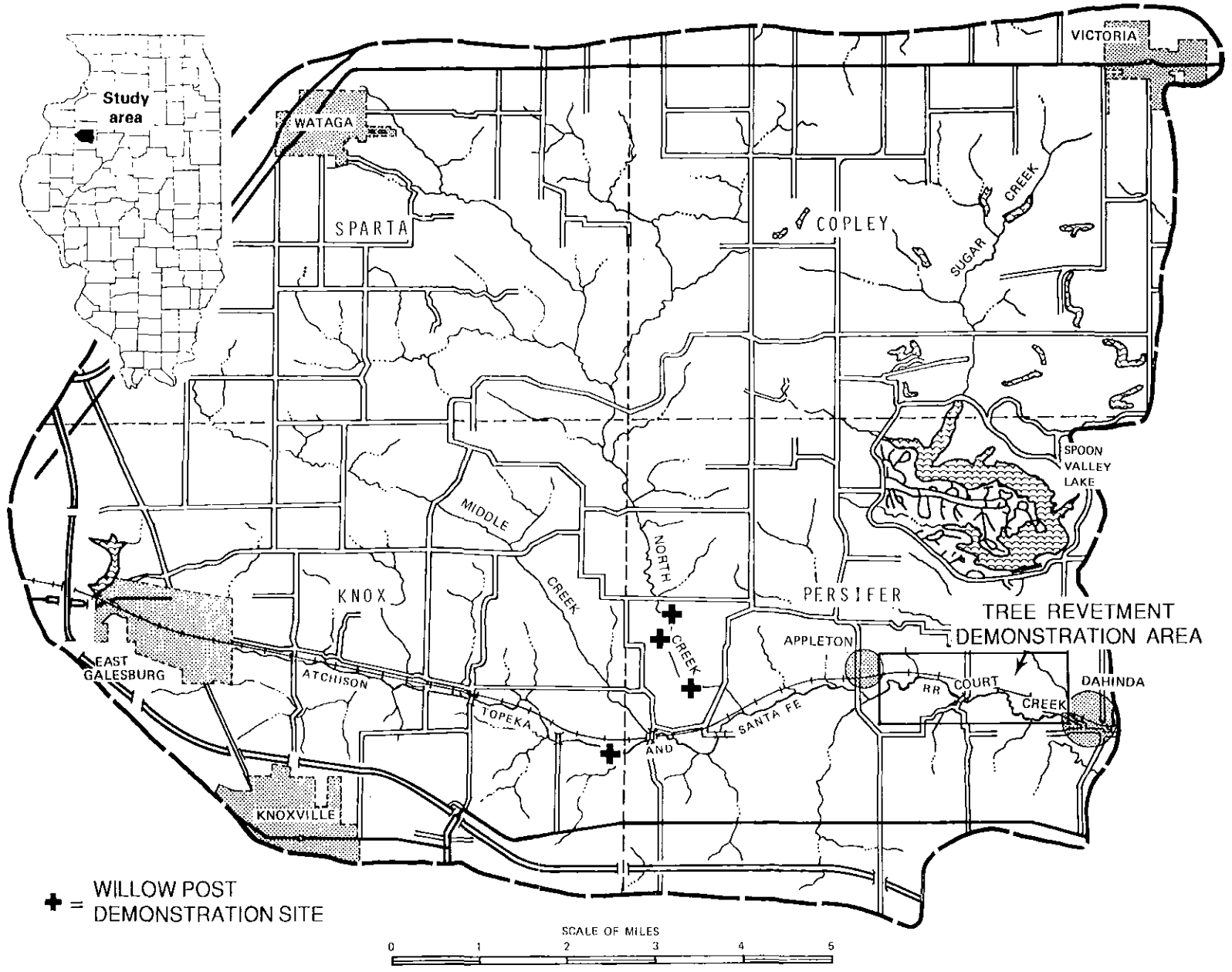

Figure 3. Streambank Stabilization Sites

Figure 4. Palmiter Application of Tree Revetments at bank Erosion Site 5.

Table 1. Amounts of Soil Eroded From 11 Tree Revetment Sites and 4 Control Sites

Year	*Stabilized sites (4,910 feet of bank)*	*Control sites (1,570 feet of bank)*
1986		
Total tonnage	5,872	2,127
Tons of soils/foot	1.19	1.35
1987		
Total tonnage	1,297	782
Tons of soils/foot	0.26	0.50
1988		
Total tonnage	1,170	1,308
Tons of soils/foot	0.24	0.83

erosion sites and two additional sites, the Palmiter revetments were heavily damaged or removed by flooding and ice floes (figure 5).

A stream crew from the Knox County Soil and Water Conservation District has replaced the damaged Palmiter revetments with a more durable type during 1989. The SWCD tree revetments are hedge trees held in place with Laconia earth anchors (figure 6), which were developed for the military. In addition, the SWCD stream crew hastened revegetation of the earth banks by placing small willow whips through the revetments and into the bank soils. The SWCD tree revetments have withstood a severe June flood when over 3.5 inches of rain fell in one hour. Only four of 118 tree revetments were lost at the five erosion sites.

With tree revetments, the branches should extend into the stream channel to deflect floodwaters away from the fence posts and Laconia anchors in the earth banks (figure 7). The use of hedge trees maximizes the durability of the tree branches so that woody riparian vegetation can be established before the revetments deteriorate. The establishment of riparian vegetation has been hastened with bank plantings of small tree seedlings (green ash, american plum, grey dogwood, bald cypress) and small cuttings of willows. The willows, bald cypress,and green ash have been successfully established with a minimum of maintenance. The more desirable tree species will shade out the willows when fully grown.

DORMANT WILLOW POST STABILIZATION

The Knox County SWCD stream crew, the Illinois Department of Conservation, the Illinois State Water Survey and the Soil Conservation Service are testing a second bank stabilization technique, which utilizes dormant willow posts. The willows are cut in winter or early spring and transported to the bank erosion site. Dormant willow posts are placed into holes formed by a 6 ft metal ram, which is attached to a Caterpillar excavator (figure 8). Since the posts holes are over 5 feet deep, undercutting of the willow posts is prevented. On larger river systems the posts should be placed deeper into the stream bank. At smaller sites costs are minimized by digging holes with a gasoline powered auger. Ninety five percent of the willow posts regrew and have survived the floods and ice floes of 1987 and 1988.

Undercutting of willow posts are reduced by placing one row of willow posts directly into the stream. Most of the willow posts in water will die after two months of regrowth. However this outer row of willows will deflect floodwaters while the root systems and branches of the remaining willow posts regrow during the first year. Survival rates can be increased by placing small tree revetments among the willows. The small revetments will trap sediment and speed revegetation at the base of the bank.

The SCS willow post technique is more successful on severe erosion sites, where 5 to 25 feet of bank are eroded each year. These willow post sites have had no erosion under summer and winter floods, which removed Palmiter structures at severe erosion sites. This older SCS method is more expensive because more trees are needed but the successful application will immediately reforest an eroding stream bank. The willow post technique method proved to be more durable to ice floes than the Palmiter tree revetments. Only thirteen of the 612 willow posts were broken off by ice floes (figure 9). The live willow posts have the added benefits of regrowth when damaged by floods.

Willow posts must be placed deep into the bank soils so that the ground water table does not drop below the newly developing root system during the first year. The willow posts are under stress during initial regrowth and will die out if water is not readily available. At erosion sites along the Richland Creek, the Illinois River Soil Conservation Task Force lost

Figure 5. Attendees of a Stream Management Workshop view displaced Palmiter tree revetment at Bank Erosion Site 5.

Figure 6. Large Laconia anchors replace fence posts in the Knox SWCD tree revetment sites. The Laconia anchors are more difficult to pull free from bank soil.

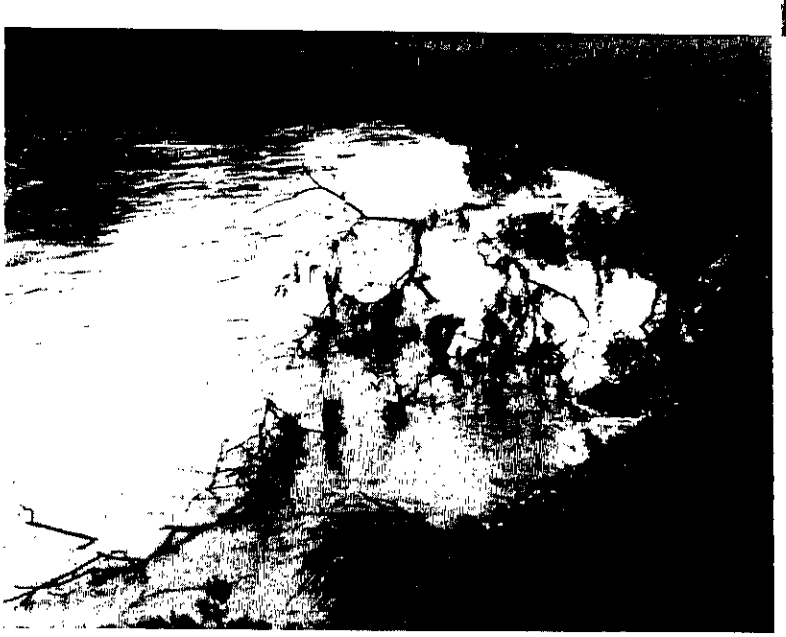

Figure 7. Knox County SWCD tree revetments move high velocity waters to outer edge of tree branches. Scour at outer edge removes sand and silt to expose rocky rubble for smallmouth bass.

Figure 8. Caterpillar excavator drives steel ram 6' into stream bed. Willow posts are placed into holes.

Figure 9. Nine months after installation, ice floes are driven through willow post site by January flood. Only 13 willows broken and no erosion occurred.

all the shorter willow whips (18 inches long) and willow stakes (40 inches long) when the water table in a sandy streambed fell below the lowest level of the cuttings. Even some of the larger willow posts (7 - 10 feet long) died out in the dry streambed.

At one site, a Court Creek landowner removed a stream meander after the bank had been stabilized with willow posts. The landowner placed the spoils from the new channel as a dike to block stream flow from the old stream channel (figure 10). The landowner hoped to establish more willows in the old channel and move the stream farther from his field at a cost of $1,500.00. During the next flood (June of 1989), the upper end of the dike was broken through, so that floodwater flowed perpendicularly into the willow post site. No erosion occurred - even at the point of maximum turbulence (figure 11). Without the willows, over one thousand tons of soil would have been lost. The new channel (500 ft long x 40 ft wide x 10 ft deep) was completely filled with sand and gravel.

COST EFFECTIVENESS OF TREE REVETMENTS AND WILLOW POSTS

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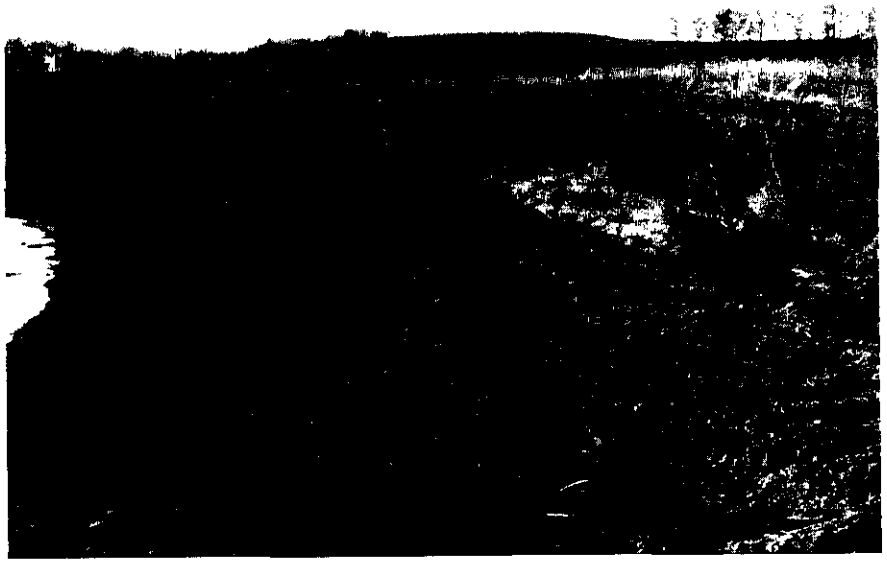

Figure 10. Stream blocked by upper end of new channelization dike

Figure 11. During next flood, floodwaters smash through upper end of channelization dike. No erosion occurred even though floodwaters hit directly onto the willows.

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Figure 12. Willow post replace riprap in "Lunker" fish habitat construction. Cost of structures is reduced by 50 percent.

refuges, where fishing is limited or carefully regulated. The aggressive nature of smallmouth bass in streams would lead to overharvest without refuges or regulation of catch-and-release fishing.

Many private landowners limit access because of concern about property damage. These landowners demand the right to deny access to individuals, who are destructive to their property. The overseeing of stream corridors by private landowners is extremely valuable to natural resources if properly performed. Most streams in Illinois and stream fishing access are located private property - similar to the access of Illinois farmlands for hunting. As with hunting habitat development on private lands, the development of riparian habitat to improve stream fish populations increases the angling opportunities even when access is limited. Increases in gamefish and wildlife populations will cause fish population movement to areas with unlimited public access. Limited public access provides refuges for growing gamefish populations and a buffer population if pollution decimates the fisheries over large stream reaches.

THE WILLOW POST TECHNIQUE SPREADS TO OTHER ILLINOIS STREAMS

The involvement of county agencies, participation by local farmers, color publications, and video presentations are designed to develop a public awareness of stream management and its long term affects. Only through this public awareness will the major problems of non-point pollution be resolved. The use of this approach in the Court Creek watershed has resulted in the spread of both vegetative stabilization techniques to other Illinois streams with funding from other governmental agencies and private foundations.

Combinations of tree revetments and willow posts are presently being tested on major tributaries of Peoria Lake by the Soil Conservation Service and the Illinois River Soil Conservation Task Force with funding from Illinois Department of Energy and Natural Resources. These field conservation trials are supported by the SCS engineering staff in Illinois. The Illinois Department of Agriculture has asked for 1.8 million dollars for stream stabilization on tributaries to the Peoria Pool of the Illinois River.

Adaptions of the willow post technique will be utilized to replace riprap in the construction of instream habitat for smallmouth bass at Franklin Creek State Park this fall. The adaption has already been implemented on Court Creek with Sport Fish Restoration funds from IDOC's Division of Fisheries. The 1989 June flood removed the sand bedload to expose rock rubble but did not erode the underwater habitat and streambank (figure 12).

DuPage County in northeastern Illinois will adapt the willow post technique to suburban streams near Chicago. With a change of landuse to residential housing and business, many small streams have severe bank erosion as a result of higher rates of stormwater runoff. Small dwellings are being undermined and economic resources can not provide the necessary funds for the widespread use of conventional bank stabilization. Urban bank erosion is occurring in many of the residential areas along the bluffs of the Illinois River.

VALUE OF CITIZEN STREAM QUALITY MONITORING AS AN EDUCATIONAL TOOL

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ABSTRACT

Stream Quality Monitoring (SQM) is an educational and data collection tool used by natural resource agencies to promote stream awareness and protection. SQM is based on the analysis of a streams macro-invertebrate population. Aquatic macroinvertebrates are organisms that live in the water and lack a backbone. They are analyzed according to their relative tolerance to pollution. By simply looking at a stream's macroinvertebrate population, one can determine the general health of the aquatic system.

Over the past few years, SQM has gained wide acclaim across the country as an excellent citizen involvement and educational/interpretive program. Concerned citizens, conservation groups, and schools have "adopted" streams or segments of streams to monitor the quality of the water using this method. Networks of groups working throughout a watershed can help determine problem areas and sometimes are successful at finding the problem source. The equipment is inexpensive and the technique simple. There is presently an Illinois SQM program being developed for implementation on a state wide basis and should be available by Spring 1990.

INTRODUCTION

Picture a group of people wading in a stream, turning over rocks and looking for "creepy-crawly" bugs. I'm sure you can well imagine some of the comments, but this is a most unforgettable experience for people today as they monitor the stream health of our waterways.

As part of preserving and managing our river resources, a variety of parks and natural resource agencies around the country are implementing a citizen stream quality monitoring program. Stream Quality Monitoring (SQM) has aided in the establishment of baseline data on a number of streams across the country. Initially, the program was designed to collect data on benthic macroinvertebrates found in streams. The organisms are used as key indicators towards water quality and stream health. As the program grew, it evolved into an outstanding environmental education/ interpretation program. Who primarily collects data for the program? You guessed it-schools!

SQM is described as a citizen-action program where concerned individuals of all ages have the opportunity to get directly involved in protecting and monitoring the water resource. School teachers quickly learn the value of this program and jump at this window of opportunity realizing it is the field experience they are looking for in their curriculum. Not only do the students learn about stream ecology, but they make a direct contribution towards the protection of one of our most valuable resources. Research on SQM indicates that high school biology students do learn a significant amount about benthic macroinvertebrate ecology as a result of participating in the Ohio Scenic Rivers' SQM program. SQM can usually be performed on any suitable stream, therefore, it can be utilized as a field exercise.

The objectives of the SQM exercise are:

1) to introduce the relationships between benthic macroinvertebrates and their physical environment;
2) to introduce a biological method for determining stream health;
3) to introduce sampling procedures using qualitative methods and;
4) to provide the opportunity to directly contribute to the preservation and management of local waterways.

ECOLOGY

SQM uses benthic macroinvertebrates found in the riffles of streams and rivers. Although macro-invertebrates are found in other habitats within streams, they are most highly concentrated in riffles. Dissolved oxygen and available substrates most highly effect this preference. Suitable streams must have water flowing over riffles year around and possess riffle areas large and diverse enough to support a benthic macroinvertebrate population.

Macroinvertebrates are aquatic organisms which are seen with the naked eye and lack a backbone. They are dominated in freshwater streams by aquatic insects in their immature forms, but also include mollusks, arthropods, and annelids. These organisms are divided into groups according to their tolerance to pollution. Organisms that are considered pollution intolerant include mayfly and stonefly nymphs, dobsonfly, caddisfly and water penny beetle larva, riffle beetle, and the gill-breathing snails. The dominance of these organisms usually signify good water quality. Organisms that can exist in a wide range of water conditions include freshwater clams and mussels, crayfish, dragonfly and damselfly nymphs, crane fly and other beetle larva, sowbugs, and scuds. Organisms that are considered tolerant of water degradation include leeches, midge and blackfly larva, aquatic worms, and the lung-breathing (pouch) snails. Their dominance usually signifies poor water quality. Pollution tolerant does not mean they prefer polluted waters or can only live in polluted waters, but rather that they can tolerate some types of water degradation. Their numbers often increase under this condition as pollution intolerant organisms decline. After collecting samples of benthic macroinvertebrate communities, one should be able to estimate the relative health of a stream.

Macroinvertebrates, especially the immature aquatic insects, are one of the best indicators for assessing overall stream health. Since they do not migrate and stay in the same general area, they become adapted to their particular habitats. Thus, their survival is limited through the availability of food, temperature, current, predators, and substrate. Their populations change in response to a change in these limiting factors rapidly enough to provide an early warning signal of stream environment degradation. Since most organisms have multiple-year life cycles and are restricted to their immediate environment, they cannot readily escape changes in stream quality. Therefore, if pollution impacts a stream, a considerable period of time may be required for the natural invertebrate population to fully recover. Based on the diversity and relative pollution tolerance of the organisms that are collected, a stream assessment may be determined.

EQUIPMENT

Fortunately, the equipment required is inexpensive and can probably be obtained locally. Equipment needs are as follows:

1) A piece of 4X4 foot fiberglass or nylon netting with

1/16 inch or smaller mesh stretched between two poles, and weighted at the bottom. This net is used for collecting the benthic macroinvertebrates. Some states may require a scientific collecting permit for the use of a small mesh size;
2) Enamel or plastic pans or other types of containers approximately 8X12 inches and 4 inches deep;
3) Magnifying glasses or "bug boxes";
4) Laminated identification sheets with organisms divided into respective groups, or identification keys;
5) Data forms and pencils;
6) Waders (if needed).

PROCEDURES

The most important part of the exercise is to find an appropriate stream site. The riffle selected should have a bottom composition of mostly cobbles and gravel. All sand or silt and solid bedrock bottoms will not provide the proper habitat and thus will be nearly devoid of macroinvertebrates. Participants should approach the area from the downstream side so as not to disturb the sample area. One or two participants can hold the net slightly angled with the current while the others start in front of the net and begin the collection. All rocks the size of a fist or larger are rubbed thoroughly under the water and in front of the net. Most rocks can be found in the area immediately in front of the net. It is extremely important to dislodge any organisms by rubbing several rocks. The current then carries the organisms into the net. After thoroughly scrubbing these rocks, the final step is to disturb the sampling area in front of the net using the feet and kicking up the stream bottom. This allows for the collection of the remaining organisms which burrow into the substrate. The net should be carefully scooped up, taking care not to allow water to rush over the top, and carried to a clean, flat, dry area for examination.

The examination containers should be filled with 1-2 inches of clear water and placed next to the net. Organisms should be immediately picked out of the net and placed into the water filled container. Repeat this collection if necessary. Care should be taken not to injure the organisms. After all the different organisms are removed from the net, the net should be thoroughly cleaned and air dried for future use. After the collecting is finished, the next part is to identify all the organisms. This is the most time-consuming aspect of the procedure. To save time, participants should become familiar with the twenty or so types of organisms before the trip is made to the stream. The use of keys

or identification sheets will aid in identification. Organisms are then placed into their proper categories according to their tolerance to pollution. Most books regarding fresh water animals describe benthic macro-invertebrates thoroughly.

The final part is to draw a conclusion as to the relative stream health. This can be performed by simply determining which groups dominate. If pollution intolerant organisms dominate your sample, then the water quality can be determined as good. If pollution tolerant organisms dominate your sample, then the water quality can be determined as somewhat degraded or poor. This latter determination results in pollution tolerant organisms thoroughly dominating the sample. Another method, as employed by the Ohio Scenic Rivers' SQM program, is to assign index values to different taxa in each group and add up cumulative index values. For example, pollution intolerant organisms receive an index value of 3, organisms existing in a wide range of conditions an index value of 2, and pollution tolerant organisms an index value of 1. The higher the cumulative index value, the better the stream environment. Results should be shared with natural resource agencies, conservation groups, other classes, and kept for future reference.

BENEFITS OF FINDINGS

The benefits obtained from this program are numerous. Ideally for the participants, they gain a better understanding of stream ecology and the role macroinvertebrates play in the aquatic ecosystem. In addition, they learn how man's negative environmental impacts on ecosystems affects organisms at the lower levels of food chains. After objectives have been met, benefits extend outside the stream. Participants have learned how they can directly contribute to the betterment of the environment. They enjoy this field experience as they wade through the stream on slippery rocks and swift currents. In schools, students will look forward to another SQM field trip and relay the experience to other peers who will want to participate also. The exercise can be performed during school for classes or anytime for non-school groups wishing to participate.

The benefit to the resource itself cannot be overlooked. Baseline data continually gathered over a period of time will be valuable in determining subtle changes in stream health. Networks of schools and other groups performing SQM at various places along a stream or watershed will provide resource managers,

naturalists, teachers, students, and public officials with an overall picture of the health of a waterway through the continued analysis of its macroinvertebrate population. This experience will introduce citizens to the effects of pollution on organisms and show them how they can get involved in directly monitoring man's environmental impacts.

ILLINOIS STREAM QUALITY MONITORING PROGRAM

There has recently been a small grant awarded to develop an instructional manual for the implementation of the SQM program in Illinois. This document will provide resource managers, teachers, interpretive naturalists, and all concerned citizens background information and the procedures taken to perform SQM. This document will allow for the total development of a state wide SQM network on any suitable stream. It should be available to the public in Spring 1990.

REVENUE SOURCES FOR RIVER MANAGEMENT

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ABSTRACT

Traditional sources of revenue will not be adequate to implement land and water measures necessary to manage the Illinois River. An analysis of alternative sources of revenue and the approximate revenue potential, based on an earlier analysis of revenue sources for lake management, is presented. Recreational license surcharges, user fees for demarcated recreational sites, marine fuel taxes, excise taxes of recreational equipment, potable water surcharges, special tax assessments on property, and assessments on polluters are among the alternatives explored. Some of these alternatives appear to be applicable at the local level, but may require special provisions such as the formation of a new management institution equivalent in this context to the special taxing district. State (or Federal) involvement is likely to be required to deal with the problems in major rivers systems such as the Illinois. New institutional structures such as developed to manage the Columbia River may merit attention.

INTRODUCTION

This paper assesses mechanisms for raising additional funds at the state and local levels to address the problems of the Illinois River. The material presented is taken from a report to the ILDENR which studied the potential of revenue sources for lake management in the State. The mechanisms considered are: general income and sales taxes; recreation license fees; recreation site access fees; recreation equipment fees; potable water surcharges; tax checkoffs; property taxes and special assessments; and taxes on erosion and farm chemicals. No attempt is made to determine the proportion of the revenues generated that would be associated with the Illinois River. The estimates are early, rough approximations which are intended to indicate where one might begin is searching for additional revenue. If a serious attempt is made to pursue any revenue source a detailed analysis will be appropriate.

REVENUE MECHANISMS

General Revenue Mechanisms

Income and sales taxes have the advantage of broad coverage of the population. If one is able to support the argument that the management of the Illinois River benefits all citizens of the

State, the use of these revenue sources is appropriate. There are powerful arguments for using general revenue sources. They are less inexpensive to collect than are special taxes or fees, they are broadly based and the ability to pay is captured by a revenue system with an income tax component. Of course, appropriations from this source implies competing with all of the other claimants on State resources, which may be difficult for a regional effort. A disadvantage of the general revenue source is that it does not engender the accountability which results from relating a tax bill to a particular program.

User Charges

Licenses, permits, entry fees, and excise taxes raise money which is earmarked for particular programs. Such mechanisms promote more accountability than general revenue mechanisms because participants "pay for" programs. They can also promote differentiation among participants where the payments rise with the level of participation, and this has the advantage of matching contributions closely to interest. However, user charges are not sensitive to differences in ability to pay. Such mechanisms make sense where participants or those placing high value on the subsidized programs are easy to identify, and the fees or taxes are inexpensive to administer.

Commercial User Charges

The revenue potential of fees assessed on firms that make commercial use of the river water for shipping, cooling, hydroelectric power generation, commercial fishing or other uses could be substantial. These sources of revenue can be justified on the basis that the firms would be benefitted by the expected improvements due to improved management of the resource. The legality, administrative burden, and economic impacts would need to be assessed.

Recreation and License Fees

Consumers of water-based recreations can reasonably be presumed to have a special interest in protecting and enhancing water quality. Boating, fishing, and waterfowl hunting are licensed activities in Illinois. Thus there is a possibility of raising additional revenues by increasing the charges for these licenses.

Raising the existing fees for boating, fishing, and wildlife hunting has two desirable properties in a revenue system. Those who purchase the licenses benefit from the use of the resource and costly new revenue collection arrangements would not be needed.

Fishing License Surcharges. In 1985, roughly 659,000 fishing licenses, 104,000 combined fishing and hunting licenses, and 9,500 one-day Lake Michigan permits were sold to Illinois citizens for use in-state. Children under 16 years of age, adults 65 and over, and disabled citizens need not purchase licenses; on the order of 665,000 additional participants are estimated to have come from these groups. Total participation, then, was about 1.44 million anglers. Our estimate was that a state wide $10.00 increase in the cost of a fishing license would generate a net increase of approximately $7 million dollars. A fee of $5.00 per fishing trip, assuming 3 trips per year per person, would generate over $35 million dollars, but this assumes, unrealistically, such a fee could be collected in all instances.

Boat License Surcharges. Recreational boaters also can be presumed to have special interests in clean water. In addition to aesthetic values, boat and engine maintenance is probably lower if less sediment and other pollutants are encountered. Furthermore, extreme siltation can impede or preclude boating. About 282,000 recreational boat licenses were sold in Illinois in 1986, for fees of $5.00 to $7.00. In all, about $1.1 million were collected.

The demand for boat licenses is probably quite insensitive to small changes in fee, except for some minor ownership shifts across state lines. If there were no effects on registration, a $2 increase would bring in over $0.5 million. A differential fee based on length, tonnage, engine size, or some other measure of boat value might raise substantially more revenue. No effort was made to estimate the potential revenue from license fees (or increases) on commercial vessels or tonnage moving through the Illinois River.

Waterfowl Stamp Surcharges. Waterfowl hunting is another licensed type of water-based recreation. Nearly 56,000 state waterfowl hunting stamps were sold in Illinois in 1985 at $5.00 each. Whatever the effect on consumption, modest increases in waterfowl hunting license fees would yield little revenue simply because few licenses are sold. Doubling the fee (roughly in line with the scheduled increase in the federal stamp price) would raise at best only about $280,000 per year and probably less after consumption impacts.

Other Recreation Licenses. Swimming and boat launching are occasionally subject to annual, weekly, or daily "licensing" at some sites--for example, at beaches or lakes which are run by park or forest preserve districts. They are likely to be useful only in small sub-watersheds, where the costs of selling and enforcing permits do not outweigh the resulting revenues.

Equipment and Fuel Excise Taxes

Just as the worth of certain types of recreation licenses probably increases with water quality improvements, specific types of recreation equipment also would be more valuable if the quality of water recreation could be improved. This suggests a fee on equipment used in water-based recreation.

The federal government collects manufacturers excise taxes on sporting arms and ammunition, fishing equipment (10%), electric trolling motors and sonar fish locators (3%), and certain archery equipment (11%). Also taxed are imported fishing tackle and pleasure boats. Illinois received about $4.6 million of the 1986 revenues. While there appear to be no legal impediments to states enacting recreation equipment excise taxes, none have done so.

Potable Water Surcharges

Most Illinois citizens consume public water from either private wells or public supply systems, and water bills provide a convenient collection system for most citizens. Public water suppliers serve 88.7% of the state's population, or 10.3 million people, with potable water. Surface water is the source for about 6.1 million people, while about 3.7 million people are served from ground water sources. Combined source water supplies serve about 0.4 million people. A 5% increase in water prices would result in a net increase in revenue of approximately $12 million while a 20% increase would generate approximately $97 million.

Property taxes

Property taxes are levies based on the value, size, or some combination of property attributes. They promote broad participation within the levying jurisdiction. They differentiate among participants insofar as different taxing jurisdictions are established for separate purposes, each encompassing only those properties which are proximate to its specific purpose. Parcel size and value are other criteria used to differentiate participants. Property taxation has much to offer in cases where location or value is closely associated with the public purpose being served, as for instance with drainage and perhaps with agricultural pollution abatement.

Property or Special Assessments. Property located in proximity to a water resource almost universally has a higher market value than equivalent property not so located. The higher value

is due to factors such as access for shipping, cooling, or consumptive use in the case of commercial property and access for recreational use or aesthetic considerations in the case of residential property. Owners of such property have an interest in the maintenance and enhancement of the water resource because of its influence on their property values. Managers of a water resource may justify a property tax on the basis that all land contributes to the water entering the water system. State law provides for the creation of new districts with taxing powers on the vote of a majority of the property owners affected. Also, in the case of new developments with important water management components, management and funding schemes can be established initially. State law provides for the specification of covenants on property so long as other constitutional provisions are not violated.

Pollution Taxes

This revenue source is often supported by economists because it not only generates revenue. It also encourages polluters to reduce the amount of the pollutant released to the environment. The ease with which an agency could develop and administer a tax on the pollutants from the agricultural sector varies by pollutant.

Erosion Tax. The Soil Conservation Service has estimated that 200.7 million tons of soil erode annually from the state's 31.9 million acres of rural land. The average annual soil loss equals 6.3 tons per acre. A charge of 50 cents for every ton of eroded soil above a soil's tolerance rate would produce the highest level of tax receipts, $16.1 million annually. At that rate, producers would spend approximately an additional $12.6 million to reduce soil erosion and avoid the tax. The total cost to producers for a 50 cent tax rate is $28.7 million annually. Higher taxes would yield less revenue because erosion is reduced proportionately more than taxes rise.

Such a tax could be difficult to administer due to the need to keep detailed data on the management of all farmland, it would undoubtedly be unpopular with farmers. It is impossible to monitor actual rates of soil loss on all land in the state. This means that surrogate indicators such as the USLE would have to be used. The chief disadvantage of the USLE is that is presumes that a multi-year management plan is being followed whereas no such long term plan may actually exist. Moreover, it's use as a basis of taxation would require comprehensive monitoring and record-keeping on land uses. While some of this already occurs in support of federal farm programs, the data-base for a tax system would be considerably more difficult to establish and maintain. A somewhat different approach might be to integrate erosion standards with Illinois' system of special property tax assessments for farmland.

Farm Chemical Taxes. Fertilizers and pesticides are also troublesome water contaminants. Nutrients can accelerate algae growth and eutrophication in surface waters and elevate nitrate levels in groundwater. A 1% ($2/ton) tax could raise about $7.8 million per year at 1986 use rates. This suggests that a tax on fertilizers could raise considerable revenues while encouraging greater care in fertilizer use. Taxes on chemicals would be relatively easy to administer at points of wholesale or retail sale.

Tax Checkoff

On their annual income tax returns, Illinois citizens can donate a portion of any refund due them to specific state charitable accounts. However, in 1985, fewer than 25,000 Illinois citizens contributed a total of $730,000 to six check-off funds, suggesting that this is not an attractive alternative.

INSTITUTIONAL ARRANGEMENTS

Policy mechanisms are not equally appropriate for use by different jurisdictions. This goes for mandatory versus voluntary programs as well as for the ways revenues are collected. Local jurisdictions are best able to tailor policies to local needs but least able to prevent individuals from escaping the reach of policies. National policies are least escapable but most difficult to tailor to local needs. Also influencing the choice of instruments are constitutional provisions and the legal authorities of federal, state, and local governments.

Local Mechanisms.

The primary focus of the study of revenue sources for lake management was on sources that can be used by state and local governments; specifically general revenue mechanisms, user fees, and property taxes. This emphasis followed from the recognition that the vast majority of lakes in the state are relatively small and thus amenable to a "local solution." If the Illinois River is conceived as a system of small watersheds, this approach may be appropriate, in which case the property taxes, the most frequently the main source of revenue for local governments, may be the most appropriate. In some instances other sources, the user fees, may by selected at the local level. Recreation access fees and perhaps water utility taxes are examples.

State Mechanisms.

State governments generally rely on income and sales taxes to raise most revenues. Augmenting these are an array of license fees, user fees, and assorted special taxes such as effluent charges; recreation access fees; hunting, fishing, and boating license fees; water utility taxes; excise taxes on recreational equipment; and property taxes levied within special pollution abatement districts. State governments are precluded from using taxes or fees that could impede interstate commerce. The regional character of the Illinois River system makes it unlikely that the state will provide adequate revenues from general (statewide) revenue sources to achieve the goals established.

New Institutions.

The 1987 conference on the Illinois River reports a plethora of problems and competing interests. The summary comments suggest that while numerous entities have a strong interest in the river basin, that collective action is limited to formal and informal discussion. While communication among existing agencies is appropriate, desirable, and positive; and a common vision may emerge from such discussions, implementing that vision will not occur until a mechanism is established to make it happen. This implies that a new institution is needed. An agency such as the Northwest Power Planning Council which is charged by the Federal Law with the management of the Columbia River Basin may be appropriate. Such an agency could be given the power to raise funds through one or more of the mechanisms identified here, to expend funds to implement or encourage more effective land or water management practices, to participate in decisions such as the release of Lake Michigan waters into the river, to allocate water from the river among competing uses, and perhaps even to mandate certain actions for farms and firms in the basin. The creation of a new agencies with some, or all, of these powers obviously means that the powers of other groups and agencies will be diminished or shared. One the other hand, a mechanism to insure local representation or input would be crucial to the success of the agency in the political arena. This could come about through the involvement of politicians elected to office at the local or state level; or from the active participation of leaders of various interests groups.

An alternative model might build on new or existing local institutions such as counties, cities, soil and water conservation districts, or drainage districts. Representatives of such local bodies could comprise a river governing board which would set policy which would, in turn, be implemented by the participating local agencies. In this case the policy could allow considerable

flexibility in the choice of means of achieving the goals established, including the means of raising the funds necessary to support the program.

CONCLUSIONS

There are a number of options for raising funds to support programs in the Illinois River basin. General revenue instruments are broadly based, easy to collect, and positively correlated with ability to pay. However, the legislature allocates general revenues among competing purposes and it may be difficult to secure significant funding for a regional effort. Thus this report has focused on special revenue mechanisms which by be more appropriate for this purpose.

Potable water taxes and recreation license fees offer significant revenue potential with relatively little additional administrative complication or cost. Water taxes could be used by the State or by local governments. Recreation license fees are harder to administer locally except as access fees to controlled-access facilities. User fees for commercial users may be an attractive alternative source of revenue. Increasing the fee levels for State permits requires new legislation under Illinois law.

In some local instances, property taxes or special property assessments may be effective ways of raising funds for abatement programs. Some recreational lake communities in Illinois already levy special assessments to fund agreements with upstream farmers to abate erosion. However, in most rural areas, the taxing authority has not been secured. The enabling legislation does exist to secure the power through the formation of special taxing districts.

For various reasons, income tax checkoffs, recreation access fees, and recreation equipment or fuel excise taxes are not likely to be very useful, except perhaps in local situations where there is limited access for a special use. Use fees assessed on commercial users may have significant potential.

Erosion and agricultural chemical taxes have the advantages of encouraging farmers to reduce activities that give rise to pollution. However, erosion taxes in particular could be extremely difficult to administer. Farm chemical taxes would be easier to administer but would encourage farmers to cross state lines to obtain inputs. Both erosion and chemical taxes would place Illinois farmers at a slight competitive disadvantage unless other states acted in concert with Illinois.

There are, then, some viable mechanisms that could complement general revenues to help support such river basin management programs. Both State and local governments have access to these mechanisms, but legislative action is probably required if their potentials are to be realized. A new entity, specifically charged with appropriate responsibilities and given the necessary authority, may well be needed to develop policies and programs; and to raise the necessary revenues.

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ILLINOIS RIVER COALITION/FATHER MARQUETTE COMPACT

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A blueprint for preserving the Illinois River was fostered by the first conference on "Management of the Illinois River System." At its conclusion, the conference suggested an "advocacy committee" to serve as a common frame of reference for river-related issues. Recognizing that the river system extends more than 300 miles across Illinois . . . and that no single agency, level of government, or office has the authority or resources to save the river from increased sedimentation and misuse . . . a plan was advanced that encompasses local initiatives, regional considerations, and state and federal government responsibilities.

Central to the plan's success is regional (length of the river) cooperation and communication. This is essential because the river is truly a system. What occurs in one part of the river eventually impacts the other parts. The Illinois River Coalition/Father Marquette Compact was formed in February 1988 to serve the advocacy objective on a regional basis. Without a systemwide frame of reference, local actions would only be partially successful. And, efforts to tap governmental resources would fall short of actual needs.

The Illinois River Coalition/Father Marquette Compact was incorporated by interested citizens from Jersey, Peoria, Tazewell, Marshall, and LaSalle counties. The organization embarked on an initial plan that called for a series of meetings in counties bordering the rivers. Purpose of the meetings is to begin a dialogue among those who want to save the water resource. Once dialogue is established, a strategy can be drafted that identifies key problem areas and priorities, suggests resources for addressing the priorities, outlines responsibility for action, and presents a timetable for implementation.

The coalition has conducted two meetings, issued two newsletters, and obtained official resolutions of support from 11 counties. A meeting in Central Illinois (August 1987) contributed to formation of the Heartland Water Resources Council, which focuses on saving Peoria Lakes. Another meeting in Jerseyville (April 1988) produced an appreciation that regional dialogue and understanding are crucial if a coherent strategy for the Illinois River is to be produced. Other meetings are planned for the northern counties along the river. The meeting format consists of status reports on significant river-related matters and discussion of strategies for garnering maximum support from governmental authorities.

The IRC/FMC has no budget. It functions with a volunteer staff. Thus, progress in generating ongoing regional discussions and consensus building has been slow. However, experience to date suggests that the concept of a system-wide advocacy committee is valid and can work. Local concerns for enhancing urban riverfronts, developing recreation areas, saving bottomland lakes, and encouraging adequate habitat for wildlife can be enhanced through an active IRC/FMC. The work program for the next six months calls for three to four regional meetings, publication of a newsletter, and heightened acceptance of cooperation, and communication aimed at saving the Illinois River. The IRC/FMC does not seek to supplant any existing group or effort . . . rather, through better communication and cooperation, it seeks to improve the overall effectiveness of present initiatives.

SEDIMENT MANAGEMENT

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Yesterday, we heard about various plans in which the excess sediments in Lake Peoria were a problem for recreation, sport fisheries, fish harvesting, and the loss of the backwater lakes. It was great to hear that sediment, a soil that contains clay particles, sands, and organic nutrients, is a resource that can be used for constructing islands for recreation and habitat improvement projects. Let's examine other opportunities for utilizing the 20 million tons of sediment that accumulate each year in Lake Peoria. This sediment, inherited from our forefathers, must be examined as a resource. A "resource" means that the sediment is an asset and has an economic value.

Many of you were present at the first conference on the management of the Illinois River System in April 1987 when the lead keynote speaker, the late William C. Ackermann, described how 2000 years ago sediment from surrounding streams filled in the great harbor at Ephesus in Turkey, creating a flat area for subsistence farming. The economic development of Ephesus gradually ceased to exist because of the damage done to the shipping industry by the loss of the harbor.[1] Do the citizens of the twenty-first century want this to happen to Peoria?

So, how can modern societies use sediment?

Land reclamation in estuaries throughout the world has been an active program in the Netherlands, Indonesia, Italy, the United States, and elsewhere for many decades. Much is now known about the building of Polders--the name used internationally for land reclamation projects. I understand sand is already being removed and used in construction projects. The clay in river sediment is used for making building blocks in many parts of the world. The blocks are made through an air drying and heating process. Today, the Germans are exploring ways of making bricks from sediments in Germany's Rhine River. I have seen rocks removed from streams in India and China and cut into pieces for building roads.

[1]Ackermann, William C. 1987. The Illinois River into the 1990's. In Management of the Illinois River System: The 1990's and Beyond. WRC Special Report No. 16. Urbana, IL: Water Resources Center.

These are some of the beneficial uses of sediments. Fortunately, we don't have many rocks in the Illinois River, but they do occur in some streams in Illinois. Dr. Bhowmik and I recently helped the Chinese to organize a special session for an international seminar on the economic benefits of using sediments, which was postponed two weeks before the June 4 uprising. Dr. Bhowmik will travel to China next month, and we hope, will learn what productive uses the rest of the world has found for their sediments.

I believe one of the primary beneficial uses of sediments is to find ways to return it to the land from which it came. The organic enriched material would either rebuild the soil or add depth to existing farm land, enhancing agricultural production. In Massachusetts, sediments from dredging have been used extensively for landscaping and as soil enrichment for lawns. During the past two decades, a number of small lakes in Illinois have been dredged and the sediments have been placed on farm lands. An article in Public Works in November 1969 written by the late W. J. Roberts, an engineer with the Illinois State Water Survey but better known as Mr. Roberts on TV Channel 3 in Champaign, described a unique dredging project on an Illinois water supply lake. In 1975, he published another article in Public Works on "Reclamation of Storage in Water Supply Lakes." During that six-year period, considerable experience was gained in dredging small lakes and data were collected to indicate the general costs for such a project when undertaken by a city water department. Data were presented for Lake Carlinville and a 26-acre lake water supply for the city of Oakland, Illinois. Calculated costs for these two projects and several others ranged from 50 cents per cubic yard to an overall average cost of $1.80 per cubic yard of removed sediment. The sediment was much cheaper than the soil purchased for your lawns in the 1970s. Wheat or corn was then grown on the farm lands where the sediment had been re-deposited. In 1972, a Lake Carlinville farmer reported a yield of 45 bushels per acre of winter wheat (an increase of 25 to 30 percent in yield) even though no fertilizer was added.

In the late 1970s, a quantitative demonstration project was executed by the Water Resource Center and the University of Illinois Agricultural Engineering Department at Lake Paradise, just south of Mattoon. Twenty-one hundred cubic yards of sediment were pumped one mile from the lake to a site which was considered typical of the watershed near the lake. Lagoons were built to collect three feet of sediment with a subsurface drainage system. The land was leveled off the next year and returned to crop production. Corn yields exceeded 25 percent from previous years. Test plots showed that 18 inches of sediment increased yields by 40 percent. The study showed that while returns from corn production was low based on 1982 prices, there was a predicted $100 per acre increase in returns for the test plots with 18 inch sediment treatments compared to the zero sediment treatment. The predicted increase was due to the increased yields and the lower fertilizer requirements of the test plots.[2] The effluent from the drainage system was checked chemically. The test showed that the water from the tiles in the bottom of the lagoon contained less phosphate and nitrogen than did the incoming stream water.

Currently, the town of Springfield, Illinois, is dredging one of the tributaries to Lake Springfield and is applying the sediment to agricultural land. The land will then be leached and returned to crop production. So, let's continue to return a portion of the sediments to the land from which it came.

Many potential uses exist for sediments. The increased heights of flood waters has resulted from the loss of storage capacity in streams and backwater lakes. The placement of sediments

[2]Lembke, W.D., Mitchell, J.K., Fehrenbacher, J.B., Barcelona, M.J., Garske, E.E., Heffelfinger, S.R. 1983. Dredged Sediment for Agriculture: Lake Paradise. WRC Research Report 175. Urbana, IL: Water Resources Center.

with new drainage systems behind the levees can improve the quality of the farm land behind the levee by reducing pumping costs and increasing the fertility of the crop land. The costs of moving the sediment to these lands would be minimal. Sediment material can also be used to cover archeological sites that become exposed from erosion processes along the stream banks in selected areas.

Building islands, sand barriers, and other structures to enhance the environmental habitats in Lake Peoria has considerable merit and I strongly promote these proposals. However, let's do something that will produce a large economic benefit to Peoria, the state of Illinois and the U.S. government. I spent last week in Venice, Italy at a conference on the monitoring and assessment of natural resources for the twenty-first century. Venice is located in a salt-water lagoon that is twenty-eight miles by eleven miles. Since 452 A.D., the Italians have built their city of 118 islands into a complex of 100 canals, 400 bridges, a 342 foot bell tower near S. Marco basilica, and housing for a population of 370,000 and tourists creating a city that is known as "the honeymooner's city" in Europe. Transportation needs are served by all sizes of boats and manually operated carts—there are no automobiles. Arrivals via planes or trains make their way into Venice by water taxis or boats. So, let's plan to build a Venice in Lake Peoria involving hotels, apartments, shops, and office space. It would be known as the "Heartland Venice"—a sister city of Venice, Italy. Income generated would help to support its development and make Peoria a tourism center in the central United States.

This is the era of citizen involvement. Citizens throughout the world are leading government institutions into action programs. The citizens of the Illinois River System can do great things if they really want to accomplish their goal, but they must be willing to work and not just talk.

In summary, remember, sediments in our rivers and lakes are a resource which should be utilized by mankind for its social and economic development through an environmentally sustainable planning process.

COMPARISON OF COMMERCIAL-COMMODITY AND RECREATIONAL USE OF THE ILLINOIS RIVER SYSTEM: THE CASE OF THE ILLINOIS AND MICHIGAN NATIONAL HERITAGE CANAL CORRIDOR

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Urban river corridors provide the opportunity to participate in a wide range of outdoor recreation activities. A substantial portion of the United States population lives within a short drive of one of 18 major river corridors, and these corridors represent the closest opportunity for "wilderness" recreation experience that millions of urban residents will ever have. Yet urban river corridors have become a management concern only within the past decade (Gunn 1977); this is partially due to the use of such corridors for commerce, industry and water supplies.

As Karen Whilter pointed out yesterday, commercial use of America's great river basins goes back to the continent's first human inhabitants, who exploited riverine environments for food and travel. During settlement and development by Europeans, rivers were used to transport supplies to frontier outposts, which allowed the nation to expand westward. As early as 1820, the U.S. government designated the primary function of the major river systems as commercial, and the Army Corps of Engineers was charged with enhancing that use (Madison 1985).

With the support of the Illinois congressional delegation, community and environmental groups convinced Congress to designate the area as a National Heritage Corridor. The stated purpose of the Illinois and Michigan National Corridor is "to retain, enhance and interpret, for the benefit and inspiration of present and future generations, the cultural, historical, natural, recreational and economic resources of the corridor, where feasible, consistent with industrial and economic growth."

In passing the "Natural Corridor" legislation, Congress agreed to: 1) rehabilitate the canal area by preserving natural areas and historic sites and developing a recreation trail along the Des Plaines and Illinois River Valleys; 2) assist local land management agencies, particularly park districts, forest preserves and the state in implementing recommendations of the Park Service to encourage development of a network of park facilities; 3) provide direction and oversight for corridor planning and operations; 4) organize a tourism program for the dozens of museums, parks and historic sites in the ares, and 5) encourage economic development and create jobs. To accomplish these goals, Congress created a 19-member commission to oversee operation of the corridor; five members are from industry, five from counties through which the canal runs, one from the Park Service and the rest representing state, preservation, architectural, historical

and conservation interests.

Besides inventorying the historical, archaeological, biological, geological and recreational resources of the corridor, the National Heritage Corridor Commission asked the Institute for Environmental Studies at the University of Illinois at Urbana-Champaign to complete a study on the impacts of commercial and industrial activity on recreation use in the Upper Illinois Waterway. Our study, collected information on the relationships among the many diverse and competing uses of the Upper Illinois Waterway, and provides information that can be used by planners, managers and politicians interested in encouraging commercial/industrial developments near existing recreation areas and vice versa.

We used interviews with recreation site visitors and managers, state and federal planners, to identify the kinds of problems that corridor visitors encounter when using this industrial/commercial area for recreation. The discussions produced a list of more than 100 problem situations: 75 of these were determined to be of interest to sponsoring agencies and included in a questionnaire for corridor visitors. We next designed a questionnaire that was distributed at five geographically distinct boating areas on the upper Illinois Waterway, three hiking sites adjacent to the Illinois Waterway and the former Illinois and Michigan Canal and two camping and day-use areas adjacent to the Illinois Waterway. Of the 1,067 visitors initially contacted, 1,024 (96 percent) agreed to participate and were given a mail-back questionnaire; 757 questionnaires were eventually mailed in, for a response rate of 71 percent.

One of the goals of the research was to find out what motivates people to recreate in what is primarily a commercial/industrial waterway and what problems, if any, they encounter when sharing the river with non-recreational users. Table 1 presents a listing, in order of rank, of the reasons people visited various recreation sites within the Illinois and Michigan Canal National Heritage Corridor. The items included were adapted from other research instruments designed to measure the "expected and desired outcomes" of the recreation experience, such as escaping daily pressures, enjoying nature and making social contacts. The findings bear a striking similarity to the results from studies in pristine settings (Knopf and Lime 1984). The top five reasons for visiting an urban river corridor -- getting away from urban pressures, getting back to nature, natural scenic qualities, opportunities for privacy and solitude, a safe environment -- are sought by outdoor recreationists everywhere.

Obviously, people using urban recreation areas would probably have more difficulty achieving their "desired outcomes" of the recreation experience than persons in more pristine recreation settings because what people want to escape from is not too far away. The corridor recreation study therefore tried to identify the problems that detract from enjoyable use of urban river corridors.

Table 2 lists the results from questions designed to evaluate the impact of various commercial/industrial activities and related problems on recreational use. The top 15 problems listed shows that water quality and water use problems pose the greatest threat to outdoor recreation use of a commercial/industrial waterway. In fact, nearly two-thirds of the respondents reported that poor water quality and siltation detracted from their use of the area. This is hardly surprising, as was pointed out yesterday, almost 850 million gallons of municipal sewage is released into the Upper Illinois Waterway each day; although treated, the wastewater gives the river a distinct odor, and boaters and fishermen in the area refer to the large number of "white fish" floating downstream from the discharge facilities. Water quality issues have also been identified as a serious problem throughout the corridor by the various state and federal agencies represented here.

Other problems encountered by recreationists include both direct and indirect impacts of the commercial use of the waterway. Direct impacts include the commercial/industrial development

itself, commercial navigation (large vessels), nuclear power plants, industrial encroachment and private ownership of river frontage. Indirect impacts include lack of birds and wildlife and commercial/industrial impacts on the area's scenic and natural qualities.
These results are particularly interesting when viewed in the perspective of some of the responses to a question which asked the recreationists if they believed there was a conflict between the commercial/industrial and the recreational uses within the Illinois and Michigan Canal National Heritage Corridor. More than 58 percent of the respondents indicated that there was a conflict, while 32 percent felt that there was not (10 percent were unsure). The questionnaire also asked the recreationist to explain their reasoning, and nearly one-third did so. The following is a selection of responses representing both viewpoints:

A conflict exists because . . .

- Chemical and power plants have taken over the area, this is a nuclear power plant belt. Odors from chemical plants and their physical plants are within my vision from the canal at too many points.

- Buildup of residential development destroying historic lands and wetlands that were wildlife refuges. It is very disturbing to hear that in the Starved Rock area, historical land is being bought up for residential use - which will destroy a part of our natural resources.

- Pollution of the water from cities and industry.

- The barges and tow traffic are always dangerous with children skiing and tubin. The river is dirty - maybe industrial waste.

- Large industrial plants and factories have not totally realized that the natural resources they use have to be maintained just as their equipment does.

No conflict exists because . . .

- We must not lose sight of the fact that the original purpose of the canal was commerce and industry. I think new or improved industries can coexist with a recreational corridor without disturbing natural areas as long as there is a willingness on both sides to reasonable compromise.

- The canal was designed for commercial/industrial; the benefit is recreational.

- So far, there seems to be a balance between the two.

- We respect each other. If commercial tows and industry were not here, the funding for the building and maintaining locks, parks and launches would not be. Boaters can't pay as industry pays.

- The best fishing has always been by the intake and spillways of nuclear power plants.

The responses to the conflict questions give some insight into the relationship among the diverse uses of river resources. Those people who experienced conflict typically cited a specific problem that interfered with the "desired outcome" of their recreational experience; those who did not experience conflict tended to stress the idea that the primary purpose of the canal/river is commercial.

Urban river corridors can provide the opportunity for a wide range of outdoor recreation opportunities while continuing to support viable local and regional economies. Indeed, it appears that urban river resources are going to be used increasingly as recreation and tourist areas. The research reported in the Commission publication suggests that different activities can coexist. However, proper management of these areas does require understanding of the impacts of various commercial/industrial activities on specific recreational uses. The dilemma posed by management of urban waterways was best summarized by one of the respondents to our study:

There should be an understanding that commercially we need to use the river and recreationally we should be able to enjoy it and that it should be clean regardless. I used to be a weekly visitor during the summer; I don't plan on going back anymore.

Report Citations:

Robert A. Robertson and Rabel J. Burdge. 1989. "A Profile of Commercial/Industrial Activity and Associated Impacts on Enjoyable Recreational Use of the Upper Illinois Waterway," Final Report, Institute for Environmental Studies, University of Illinois at Urbana-Champaign, in *cooperation with the Illinois and Michigan Canal National Heritage Corridor.*

Copies of the final report and the technical appendix may be obtained by writing to the Illinois-Michigan Natural Heritage Corridor Commission, 30 North Bluff Street, Joliet, IL 60435, or by sending a check for $10.00 for printing and postage, payable to the University of Illinois, along with your name and address to: Institute for Environmental Studies, University of Illinois at Urbana-Champaign, 408 South Goodwin Avenue, Urbana, IL 61801.

Table 1. Rank Order of Reasons for Visiting the Illinois & Michigan Canal National Heritage Corridor (Entire Sample, N = 757)

Important Reason for Visiting	Not a Reason (percent)	Minor Reason (percent)	Important Reason (percent)	Very Important Reason (percent)
1. Getting away from urban pressures	16	10	25	40
2. Getting back to nature	15	14	29	42
3. The natural-scenic qualities of the site	15	13	37	36
4. The opportunities for privacy and solitude	20	19	27	36
5. The safe environment the site offers	21	17	37	25
6. The lack of industrial development	28	20	21	31
7. The wide range of things to do and see	19	25	34	22
8. To be near people with similar interests	32	24	26	19
9. Fishing opportunities	47	18	17	18
10. Learn more about the natural environment	49	24	21	8

Rank order based on sum total for all responses, with not a reason scores as 1, minor = 2, important = 3, and very important = 4.

Table 2. Rank Ordering of Problems Associated with Primary Commercial\Industrial Activities Within the Illinois & Michigan Canal National Heritage Corridor (Entire Sample N = 757)

Rank Order/Problems Detracts (mean score) Use	No Problem	Problem Does Not Detract	Problem From Enjoyable
	(percent)	(percent)	(percent)
1. Poor Water Quality (2.6)	26	8	66
2. Siltation (2.4)	24	11	65
3. Use of River for Waste Water Disposal (2.0)	47	8	44
4. Chemical Pollution (1.7)	48	10	42
5. Industrial Use of Water (1.7)	43	15	42
6. Unsightly Developments (1.6)	44	14	42
7. Unpleasant Odors (1.5)	49	12	39
8. Tow Traffic (1.5)	39	19	42
9. Barge Fleeting Areas (1.4)	39	23	38
10. Nuclear Power Plants (1.4)	48	17	35
11. Private River Frontage (1.2)	45	24	31
12. Industrial Encroachment (1.2)	56	13	31
13. Industrial Developments (1.2)	54	15	31
14. Lack of Birds and Wildlife (1.1)	54	16	30
15. Abandoned Industrial Sites (1.1)	57	14	29

Based upon the mean score for each impact variable, with did not encounter problem situation scores as "0", encountered problem situation but it did not detract from enjoyable recreation use scored as "1", slightly detracts from enjoyable recreation use "2", moderately detracts "3", strongly detracts "4", and most strongly detracts from enjoyable recreation use "5".

LONG-TERM RESOURCE MONITORING—A NEW SOURCE OF DATA FOR RESEARCHERS AND RESOURCE MANAGERS

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The Long Term Resource Monitoring Program (LTRMP) is being implemented cooperatively by the U.S. Fish and Wildlife Service; the states of Iowa, Illinois, Minnesota, Missouri and Wisconsin; and the U.S. Army Corps of Engineers.

The objective of the LTRMP is to provide decision makers with an improved information base so that the viability of the Upper Mississippi River System fish and wildlife resource can be ensured, while maintaining the System's multiple-use character. This requires an improved understanding of the interactions of ecosystem components and the long term trends in these resources on a systemwide basis. The need for long term data sets is evidenced by the difficulties of predicting long term impacts of river use activities such as expansion of commercial navigation which is currently under study by the Corps of Engineers.

Measurement of long term trends requires collection of scientifically valid and statistically sound data through time, in order to detect site specific and/or systemwide changes or trends in selected physical, chemical and biological components of the various habitats and biotic communities. The LTRMP is designed to assess these changes at frequent enough intervals to alert decision makers to problems and to provide scientifically valid evidence and quantitative data that will permit problem resolution. This requires close coordination between data collection units, standardization of gear, and sophisticated quality assurance and quality control measures.

As biotic communities change south to north, resource components included in monitoring efforts may change to meet local conditions. However, whenever any specific resource parameter is included in the monitoring program it will be evaluated by the same scientific techniques at all sites where it occurs.

Eight resource components have been selected for monitoring. These include landuse, water and sediments, vegetation, invertebrates, fish, waterfowl, furbearers and public use. Seven major river reaches have been selected for monitoring. These include Pools 4, 8, 13, 19, 26 and one open river reach on the Mississippi and the LaGrange Pool on the Illinois.

Six state operated field stations have been designed to conduct monitoring activities. These include the Bellevue station operated by Iowa on Pool 13, the Lake City station operated by Minnesota on Pool 4, the Onalaska station operated by Wisconsin on Pool 8, the Cuivre Island station operated by Illinois on Pool 26, the Cape Girardeau station to be operated by Missouri on the Open River and the Havana station operated by Illinois on the LaGrange Pool (Illinois River).

In addition to long term trend information, the field stations will collect information for resource problem analysis related to sedimentation, navigation effects, water level fluctuations, lack of aquatic vegetation and reduced fisheries populations; and complete evaluations of habitat construction projects such as the one being constructed at Brown's Lake near Bellevue.

The Field Stations are supported by a staff of scientists and technicians of the U.S. Fish and Wildlife Service operating out of the Environmental Management Technical Center at Onalaska, Wisconsin. The Program is scheduled to run at least thru 1997.

LONG-TERM RESOURCE MONITORING ON THE ILLINOIS RIVER

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In July 1989 the LaGrange Pool (extending from the Peoria Lock and Dam downstream 77.5 miles to the LaGrange Lock and Dam) was selected as the sampling reach in the Illinois River for the Long-Term Resource Monitoring (LTRM) Program. There exists a rich historical data base on fish and wildlife resources in this Pool which has many floodplain lakes and backwaters. Three of these are candidates for major habitat improvement projects (see the paper in this volume by William Donels): the U.S. Fish and Wildlife Refuge at Lake Chautauqua and the 2 state fish and wildlife areas at Banner Marsh and Rice Lake. The center of operations for the sampling program is at Havana, near the mid-points of both the LaGrange Pool and the Illinois River, in rented quarters and in space provided by the Illinois Department of Conservation and the Illinois Natural History Survey.

The Natural History Survey has sampled the Illinois River since 1876, and when the new data from the LTRM are examined in the context of the historical data, it should be possible to detect trends in the living natural resources of the river. These resources are affected by factors which occur either in the river (boat traffic, habitat improvement projects, invasion or release of nonnative species) or on a widespread basis throughout the basin (soil erosion). Fish, wildlife, and vegetation thus are the ultimate indicators of the success or failure of rehabilitation of the Illinois River and its entire basin. Long-term data sets like the LTRM are essential in discriminating between annual, random variability and long-term trends which occur on timescales ranging from centuries (e.g., long-term changes in weather which affect the frequency of droughts and floods) to years (e.g., pollution abatement, habitat improvement).

Apart from detecting trends in the health of the Illinois and Upper Mississippi rivers, the LTRM is expected to indicate thresholds where desirable attributes of these river systems are in danger of collapse. Engineers frequently use destructive testing to determine the limits of materials and structures. Like a beam which is broken in the engineer's laboratory, the Illinois River has to be regarded as something which has been broken by excessive loads of sediment and other pollutants. Unfortunately, the Illinois River was not properly "wired up" and monitored, so we missed the opportunity to measure its limits precisely. LTRM represents another chance to do the job right, only this time we hope to be measuring the thresholds as

the system moves in the opposite direction, from degradation to recovery, and this time the monitoring instruments will be in place.

The Illinois River thus has a unique and important role within the network of monitoring stations established along the Upper Mississippi River. The other sites are on relatively healthy reaches, and while it is good to know that everything is all right, absence of an effect or impact does not tell us what the limits of the system are. We must determine the limits if we are not to exceed the ecological carrying capacity of the rivers for barge traffic, sediment loading, and pollution loading. By retrospective analysis of the existing data sets, by comparison of the Illinois River with the other sites, and by monitoring the LaGrange Pool as habitat rehabilitation and pollution abatement programs take effect, we stand a good chance of determining thresholds which can be put to practical use in the management of large rivers for a variety of beneficial purposes.

PLANNING FOR THE FUTURE OF NAVIGATION ON THE ILLINOIS WATERWAY

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ABSTRACT

This paper summarizes selected management challenges and potential solutions to assure the future of the Illinois Waterway System. Emphasis is placed on the role of the Corps within the context of a three-point management approach for executing navigation responsibilities. The existing condition is described, primarily in economic and environmental terms, and key issues and objectives are identified which fit the "1990's and Beyond" theme. The essential point is that the future will be approached within a strategic planning framework which integrates the concerns of all levels of government, the public, and the numerous organizations and constituencies who share jurisdictions or interests on the Illinois Waterway System.

INTRODUCTION

The Corps, the Congress, shippers, users, and numerous constituencies are mutually concerned about the status of our Nation's inland waterway infrastructure. Based upon historic traffic growth trends, costly delays will occur at several Illinois Waterway locks by the year 2000 and all locks by 2020. Capital improvements and efficiency measures will be required to ensure continued efficient movement of commodities. The Illinois Waterway is part of the nationally significant Upper Mississippi River ecosystem, as designated by Congress. Therefore, it is especially important that environmental concerns and values be considered in the pursuit of a capital investment program.

BACKGROUND

Samuel K. Skinner, current Secretary of Transportation, recently stated in an interview (Skinner 1989:16-18) that "Maintaining America's position as the world leader in safe, efficient, environmentally responsible transportation is one of the President's top priorities." He described the establishment of a national transportation policy with short- and long-term requirements, and explained the importance of making decisions today that will support our transportation needs into the 21st century. Skinner also communicated the emerging philosophy that "... it's becoming clear that our nation's transportation infrastructure must be rebuilt across the board." This position applies to the national inland waterways infrastructure, and the question really is not "if," but "how" rebuilding and improving infrastructure components will be accomplished. Couched within the concept of "how," are the many economic, social, environmental, engineering, political, and financial considerations that must be defined and addressed.

From a national perspective, the Corps manages a complex system of locks and dams which provides an economical, energy saving mode of transportation for moving bulk commodities over long distances. The inland waterway system is especially important for export of U.S. grain, import of petroleum, and the movement of coal, chemicals, and machinery. Secretary of Commerce Robert Mosbacher has stated that his primary challenge is supporting "U.S. economic growth and international competitiveness" (Mosbacher 1989:14). Implicit in this objective is the resolution of transportation infrastructure problems. Clayton Yeutter, Secretary of Agriculture, hopes to expand significantly export activity (Yeutter 1989:19). Clearly, market development activities would be for naught if commodities can not be moved efficiently to their overseas destinations. The Illinois Waterway is a vital component of the national transportation infrastructure, providing critical transportation services for our nation's heartland where grain, a primary U.S. export, is produced and shipped. It is estimated that nearly 70 percent of U.S. grain moved on the national inland waterway system for export originates from the Upper Mississippi River and Illinois Waterway systems. Lock 26 which is just below the confluence of the Illinois and Mississippi Rivers passed 71,380,000 tons of grain in 1988. The transportation savings for this grain were well over $700,000,000.

HISTORIC CONTEXT

Navigation, aided by canals and lock structures, on the Illinois Waterway has a long history. The Illinois and Michigan Canal was completed in 1848, connecting the Great Lakes to the Illinois River at LaSalle. In 1871, the State of Illinois completed locks and dams on the Illinois River at the town of Henry and at Coperras Creek, and by 1893, the United States had constructed locks at Kampsville and LaGrange to complete a 7-foot slack-water system from the mouth of the Illinois River at Grafton to LaSalle. Completion of the Chicago Sanitary and Ship Canal in 1900 resulted in the demise of the Illinois

and Michigan Canal north of Lockport and the dams at Henry and Coperras Creek. In 1927, Congress authorized a 9-foot-deep, 200-foot-wide, federally maintained channel on the Illinois River from Utica to Grafton, and by 1930 the State of Illinois had constructed about 75 percent of the project but was unable to finance the remainder. Therefore, on July 3, 1930, Congress enacted legislation enabling the federal government to assume responsibility for the project, which included construction of locks at Marseilles, Dresden Island, Brandon Road, Starved Rock, and Lockport. Three years later, the Corps of Engineers completed the project and, combining it with the earlier authorized project between Utica and Grafton, opened the Illinois Waterway to navigation in 1933. Further improvements to the Illinois Waterway were made during the years 1936 through 1939 with the construction of two locks and dams at Peoria and LaGrange replacing four outmoded installations between Utica and Grafton.

Today, the Illinois Waterway is approximately 327 river miles long, stretching from Lake Michigan, south, to its confluence with the Mississippi River at Grafton, Illinois. Three Corps of Engineers Districts share management and operational responsibilities. St. Louis District is responsible for the lower 80-mile, unlocked portion of the river from Grafton to the LaGrange Lock near Beardstown. The Rock Island District manages the 8 lock and dam complexes over a 247-mile stretch from the LaGrange Lock to the O'Brien Lock, and is responsible for the Cal-Sag Channel, the Calumet River, and the Sanitary and Ship Canal. The Chicago District has responsibility for Lake Calumet, the North Branch of the Chicago River, and the deep draft portions of the waterway which connect to Lake Michigan.

The theme "The 1990's and Beyond" has special significance for Corps involvement because there are unique management challenges that must be faced. In 1986, the Congress determined that the Illinois Waterway, as part of the Upper Mississippi River System, is a nationally significant commercial navigation system and ecosystem (P.L. 99662, Sec 1103). Therefore, it is especially important that navigation and environmental objectives continue to be considered together, and that a system-wide perspective be adopted as part of any management approach.

As a designated Navigation System Support Center for the North Central Division, the Rock Island District will compile models and analyze systems data to provide for improved efficiency, consistency, and quality to Corps navigation planning, design, operation, and resource management. The support center concept provides a unifying thread for various coordination, economic, environmental, and engineering activities.

STATUS OF THE WATERWAY

The inland waterways of the United States vary significantly in terms of physical features and uses. These waterways are greatly influenced by a regions' geographic features, as well as by the

regional economic base. The Illinois Waterway is very different from other inland waterway systems in terms of these characteristics and also displays significant variation itself from one end to the other. The gradient of the upper northeastern portion of the waterway is very steep, and the navigation channel is fairly narrow. This upper segment is a primary transportation artery for the Midwestern industrial centers, and the commodities carried on that section of the waterway reflect an industrial focus. Coal, petroleum products, chemicals, iron and steel products, and sand and gravel shipments predominate.

The lower part of the waterway, located below the Starved Rock Lock, traverses topography that is very flat. The gradient is less steep and the channel, at least at several points, widens somewhat. Commodities shipped on this segment begin to reflect the more agricultural nature of central Illinois. Grain, mostly corn, becomes the primary product transported, yet combined with a unique mix of other products moving to and from the Chicago area and intermediary terminals along the Illinois Waterway.

There are 138 terminals located on the Illinois Waterway that ship and receive the wide variety of Illinois products. In 1987, 26,425,000 tons were shipped from these terminals, while they received 15,097,000 tons. The total of 41,522,000 tons moved on the Illinois Waterway is difficult to put into perspective without illustration. In this case, 41.5 million tons equals: 27,684 barges; 1,846 15-barge tows; 415,260 rail cars; 4,153 unit trains; or, 1,597,154 semi-trailer trucks. If all of the tows required to ship 41.5 million tons were placed in a line, the tows would stretch a distance of 462 miles (Chicago to Omaha). The unit trains required to handle the 41.5 million tons would reach 5,072 miles (Peoria, IL to London, England), and the semi-trailer trucks would extend for a distance of 63,687 miles (around the globe 2.5 times).

In addition to the volume of traffic, the importance of the mix of commodities shipped and their origins also must be considered to understand the importance of the Illinois Waterway to the economy. In 1987, about 83 percent of the shipments and 48 percent of the receipts were from below the Lockport Lock. This means that a significant amount of shipping occurs outside of the Chicago metro area. The following table shows commodity movements. The table also shows that the Illinois Waterway serves many interests. The users, shippers, and beneficiaries are a large and diverse group and the economic impact of the waterway is felt throughout the Midwest and across the nation. The multi-commodity character of the Illinois Waterway has economic significance that must not be overlooked. Savings to the State of Illinois, which result from reduced transportation costs over other modes of transportation, are conservatively estimated at $500,000,000 annually. This is a substantial benefit.

While commercial navigation is vital to the State of Illinois, recreational boating also is important. The system of pools created for commercial navigation is utilized by thousands of recreational boaters and several commercial passenger boats. In 1988, more than

35,000 recreation craft used the eight Illinois Waterway locks. This number has been increasing for the past 4 years and is expected to continue to increase. Recent newspaper accounts extoll the virtues of portions of the Illinois Waterway as being undiscovered recreational havens.

SHIPMENTS AND RECEIPTS ON THE ILLINOIS WATERWAY*
(millions of tons)

COMMODITY	SHIPPED	RECEIVED	TOTAL
Coal & Coke	3,212	4,398	7,610
Petrol. Prod.	2,363	3,372	5,735
Stone & Conc.Prod.	0	716	716
Grains	14,793	48	14,841
Chem. & Fertilizers	792	3,778	4,570
Iron & Steel Prod.	160	348	508
Nonmetallic Minerals	2,996	2,179	5,175
Other	2,109	258	2,367
Total	26,425	15,097	41,522

* does not include tonnage above O'Brien Lock
or the North Branch of the Chicago River

KEY ISSUES

There are a number of key issues which must be considered when planning for the 1990's and beyond. Some are on the order of short-term efficiency measures or management approaches, while others apply to long-range strategic planning and resource management. The challenge facing the Corps, as an administration agent and a servant to the public, is to identify short- and long-range objectives, take the necessary actions in a prioritized sequence as authorized by Congress, and ensure that planning for the future benefits includes input from all levels of government, interested organizations, and the public at large. The list of key issues discussed below represents a mixture of economic, physical, environmental, and political concerns. The list certainly is not comprehensive, and will be supplemented and refined as systems management objects evolve.

The first issue is tonnage. Tonnage moved through the Illinois Waterway System peaked during the late 1970's and along with this peak in tonnage came a peak in lockage delays. Tonnage declined between 1974 and 1984, however, more recently, tonnage has started to increase again. Although delays at the locks are not yet critical, there are problems at Peoria and LaGrange when navigable (open) pass is not available. The early 1980's were wet, but the late 1980's are dry. The drier weather conditions are beginning to impact the efficient movement of barge traffic. As tonnage increases and navigable pass is available less, delays increase and become more serious. Even under normal weather conditions, projected traffic growth rates of 3 percent

annually will lead to critical delays by the year 2000 at the Peoria and LaGrange Locks. All Illinois Waterway locks will experience serious delays by the year 2020, except perhaps for the O'Brien Lock on the Calumet River. Given the time it takes to plan, authorize, fund, and implement capital improvements, the time to begin strategic planning for the 1990's and beyond is now. A wide variety of solutions must be looked at that maximize benefits to navigation while also preserving environmental values.

The implications these statistics have for the importance of an efficient inland waterway system are obvious. Although unquantifiable at this time, impacts to existing road and rail transportation systems likely would be staggering if the waterway systems are not maintained or updated to accommodate both current and projected traffic.

Some fundamental changes have occurred in the barge and towing industry which were not foreseen when the locks were built. The locks were built to handle tow sizes up to 600 feet. Today, tow sizes routinely are 1,200 feet long. Average tow size at the LaGrange Lock increased from 7.7 barges per tow in 1978 to 10.1 barges per tow in 1987. Double locking of tows now is a common, time-consuming (thereby costly) process.

An important component of the Illinois Waterway is the Marseilles "Canal," a unique 2.5-mile artery separating the lock and dam. The existing 200-foot-wide canal project is considered incomplete because a 300-foot-wide channel was authorized in the 1930's. The canal is a major bottleneck for safe and efficient navigation. Major concerns include excessive delays in downbound approach, surge/flow problems from canal drawdowns caused by lockages, and tow squat problems in the upstream end of the canal. This problem will have to be resolved in the near future to ensure efficient traffic flow and to avoid unnecessary increases in cost, to the public, of commodities shipped through the Marseilles Lock.

The time to renew strategic planning efforts for the 1990's and beyond is at hand. A genuine interest in preserving environmental values and identifying environmental objectives has emerged across the country. President Bush has stated that the "environment" is a priority item for his administration, and this position recently was echoed by Assistant Secretary of the Army (Civil Works) Robert Page. On August 30, Mr. Page unveiled a new national Corps policy in regards to the environment, using the controversial Yazoo Basin Flood Control projects as examples. He stated that "The Corps had a reputation as an environmental rapist, and that's not tolerable in this world today." Procedures have been established to ensure that environmental sensitivity and projects will be scrutinized more closely with environmental enhancement or impact reduction objectives in mind. The new administration commitment concerning wetlands is an example of the new administration thinking, as is the recent agreement between the Corps and the U.S. Environmental Protection Agency on methods of identifying wetlands which are subject to federal regulation.

PLANNING FOR THE FUTURE

The Rock Island District has developed a three-point management approach to navigation responsibilities on the Illinois Waterway and Upper Mississippi River systems. This approach provides a framework for understanding and executing our navigation mission in a coherent and integrated fashion.

First, the Corps utilizes a complex, day-to-day, operation and maintenance program to keep system components safe and operational. Traffic is moved through the locks, minor repairs and upkeep tasks are performed, and dredging is done to maintain authorized channel depths. These activities are limited in effectiveness when it is a 50-year-old system that must be maintained. Therefore, the North Central Division initiated a "Major Maintenance/Rehabilitation" program in 1975 to keep the existing navigation system running as efficiently as possible, hopefully for another 50 years. This effort, consisting of major structural repairs and replacements of electrical and mechanical equipment, should be completed by about 1995. Neither of these programs, routine maintenance nor major maintenance, addresses the problem of traffic growth, larger barge tow sizes, or difficulties maneuvering in narrow channels with strong currents.

Therefore, the third point of the management approach specifically focuses on strategic planning for the future. In order to accomplish this objective, commercial navigation and environmental objectives are developed simultaneously for the benefit of the nation. This overriding objective provides a clear-cut pathway to the future.

Traditionally, federal management objectives for the nation's inland waterway system have been rooted in the principles of economic efficiency, multi-purpose planning, utilization, and operation. The Corps has recognized the multiple purposes which will play a role in the future of the river. These purposes are not necessarily mutually exclusive; they have the potential to be complementary under a system-wide management approach. While the need to operate the Illinois Waterway system safely and efficiently was a primary objective when initially constructed, current policy is that economic, social, environmental, and engineering considerations be balanced.

Navigation traffic on the Illinois Waterway is again increasing. As traffic increases, the issues described above become more critically in need of solution. The Corps has initiated a strategic approach to sound capital investment planning as recently described in a document referred to as a "Plan of Study" (USAED, Rock Island 1989).

The Corps follows a two-phase planning process for new projects as defined in the document entitled "Principles and Guidelines," comprised of a reconnaissance study phase and a feasibility study phase. The purpose of the reconnaissance phase is to: 1) identify at least one potential solution; 2) affirm federal authority and interest in solving the problem; and, 3) identify, if required, a cost-sharing

partner for any subsequent feasibility study. Under current policy and regulation, navigation feasibility studies are conducted at 100 percent federal expense.

During the feasibility phase, various project alternatives are examined in light of environmental, economic, and engineering principles, without preconceived notions about solutions. The feasibility study process reviews the understanding of the problem, all potentially feasible solutions, and resulting impacts. The resulting feasibility report will contain a recommendation for the administration and Congress to consider, possibly leading to detailed design and construction. In the case of capital improvements for navigation projects, construction costs are cost-shared at a 50/50 ratio with the Inland Waterways Trust Fund, a fund derived from fuel taxes paid by commercial users of the inland waterways. Congress also established the Inland Waterways User's Board to advise them, and the Corps, on capital investment priorities. Hence, any recommendation for capital improvements on the Illinois Waterway would be subject to their review and comment.

In order to accomplish the studies, the Corps will begin to collect, compile, and evaluate the engineering, economic, and environmental data necessary to make sound management decisions. Through system-wide analyses, the Corps will identify and prioritize needs, quantify benefits for any recommended improvements, and establish actions required for proactive environmental resource management. Information available from other sources, such as the Upper Mississippi River Environmental Management Program, will be utilized.

The reconnaissance study is scheduled to begin in November 1989, and, depending upon funding availability, is scheduled to be completed in April of 1991, at an estimated cost of $400,000. Federal and non-federal partners recognize that physical, economic, social, commercial, and environmental conditions and needs have evolved since the Illinois Waterway was placed into operation in 1933 as a 9-foot channel project. Capacity, safety, operational efficiency, cost-effectiveness, and environmental compatibility issues must remain at the forefront of current capital investment planning and decision-making.

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EROSION CONTROL IN THE ILLINOIS RIVER BASIN PAST, PRESENT, AND FUTURE

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My assignment this morning is to describe current erosion control efforts in the Illinois River Basin and to discuss potential new directions for those efforts.

I will start by summarizing the current erosion and sedimentation situation as related to Peoria Lakes. I realize that sedimentation in the Illinois River is not confined to Peoria Lakes, however, it is in the Lakes where sedimentation is causing the greatest problems.

The Soil Conservation Service recently completed a River Basin Study of the Illinois River from Peoria to LaSalle. Of the approximately one million acres in this drainage area, 87.5% are cropland, 10% are woodland, and the remaining acres are pastureland and various urban land uses. We estimate that about 6.2 million tons of soil is eroded in this portion of the basin each year, and that nearly 5.7 million tons of that erosion occurs on cropland.

Approximately 55% of the cropland is adequately treated, by that I mean erosion rates are less than 5 tons per acre per year. That leaves about 400,000 acres of cropland eroding at rates in excess of 5 tons per acre per year. These 400,000 acres lose an average of 4.3 million tons per year.

Sediment delivery to Peoria Lakes has also been studied. Three main sources have been identified; sheet and rill erosion, streambank and gully erosion; and ephemeral gully erosion. These three sources contribute 2.1 million tons of sediment annually to Peoria Lakes. Sheet and rill erosion contribute the largest amount, 1.4 million tons. In other words, if sediment from sheet and rill were effectively eliminated, then two thirds of the sediment problem in Peoria Lakes would be solved.

The question, then, seems to be "how well are we controlling sedimentation caused by sheet and rill erosion?" Our records indicate that about 1,300 landowners install conservation practices on 160,000 acres annually, reducing erosion by 750,000 tons. At that rate, all of the cropland would be treated within 5 years. Since erosion control programs have been on-going for many

years, we should be seeing dramatic reductions in sedimentation rates. That is obviously not the case.

There appear to be several reasons why on-going land treatment programs have not had major impacts on sedimentation rates in Peoria Lakes. Consideration of these reasons can provide some insight into possible future directions for erosion control efforts.

1. The first point to consider is a study completed by the Illinois Water Survey in 1986. This report concluded that 40% of the sediment delivered to Peoria Lakes comes from 3% of the total watershed. This 3% is the combined drainage areas of the direct tributary stream to Peoria Lakes.

In other words, erosion control programs need to be targeted to the most critical subwatersheds in order to achieve significant reductions in sediment delivery.

2. We have estimated that 55% of the sediment delivered to Peoria Lakes comes from sheet and rill erosion on land with erosion rates exceeding "T", or 5 tons per acre per year.

Conclusion; not only should the priority watersheds be targeted, but the most critical fields within those watersheds should be treated first.

3. The watersheds of the direct tributary streams to Peoria Lakes contribute approximately 830,000 tons of sediment per year. If the erosion rate on all of the acres in these watersheds were reduced to "T", there would still be at least 300,000 tons of sediment delivered to Peoria Lakes annually from this area.

Conclusion; an effective sediment reduction program must include both a sediment trapping element, as well as an erosion reduction element.

With these three points in mind, I would like to offer some suggestions for future land treatment programs in the Peoria Lake Basin.

1. Concentrate soil conservation efforts in the watershed areas above and surrounding Peoria Lakes. The Illinois Department of Agriculture has proposed a state funded cost-share program to accelerate land treatment in high priority watersheds. I believe this proposal is sound and would have a significant impact on sediment delivery.

2. Actively encourage and promote the adoption of cropping systems which reduce tillage and increase crop residues. Conservation tillage systems would reduce soil loss to the "T" standard on 87% of the cropland currently eroding at greater than "T". This one practice is not the total answer to erosion control on cropland and conservation systems which include terraces, waterways and other structural measures should be installed where needed. Widespread adoption, of conservation tillage technology is, however, critical to success in achieving significant sediment reductions.

3. In priority watersheds, employ large sediment basins and man-made wetlands to trap sediment before it reaches the Lake. These basins can usually be designed for an effective life span of 25-50 years and must be accompanied by upstream land treatment. Land treatment is essential; however, in certain critical watersheds some provisions for trapping sediment is essential if significant reductions are to be achieved. An example of such a watershed is Senachwin Creek.

4. Utilize a coordinated, multi-county approach to target efforts at the most critical sites. An effort is currently underway to obtain designated RC&D status for eight counties from Peoria to

Livingston. Such a designation would enable funding for a full-time coordinator to assist the many local groups active in this area. This assistance could improve coordination and cooperation on a variety of issues ranging from rural and economic development to erosion control. This application will be submitted to the U.S. Department of Agriculture in January.

5. Erosion control on some steeper cropland adjacent to streams and near the Lake can only be achieved economically by removing that land from production and establishing permanent cover. The Federal CRP program has had limited success in this area. Programs designed specifically to meet the needs of the landowners in this region should be developed to permanently remove critical cropland areas from production.

6. Organize citizen based steering committees in each subwatershed to develop an action plan specific to each subwatershed. These committees establish objectives, evaluate alternatives, and select courses of action. They provide an effective link to landowners and ensure that agencies are pursuing programs which meet the needs of local people and which will be accepted by them. I have made several suggestions for possible future initiatives regarding erosion and sediment control in the Illinois River Basin. I am not suggesting that past efforts have been fruitless or that the existing organizations have not been effective.

Some of my suggestions may not appear feasible, they may seem unnecessary or impractical. I believe, however, that they would improve the effectiveness of on-going programs and should be fully considered.

The Soil Conservation Service is pleased to have been able to assist in this area and we look forward to continued involvement in efforts to preserve and improve the natural resources of the Illinois River Basin.

USEPA PERSPECTIVE ON NONPOINT POLLUTION CONTROL AND WETLANDS FUNCTION

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INTRODUCTION

Historically, the major emphasis of the national water pollution control program has been the controlling and, where possible, the elimination of the discharge of pollutants from point sources (e.g., individual industries and municipalities). This focus has resulted in drastic reductions of a variety of pollutants through direct regulation under the National Pollutant Discharge Elimination System (NPDES) permit program. As a result of point source control successes, nonpoint source water pollution has emerged more clearly as a major continuing source of pollution to the Nation's waterways, threatening or prohibiting full attainment of the water quality goals of the Clean Water Act.

The technical and regulatory basis for nonpoint source pollution control is derived from the authority of states to establish water quality standards (the set of norms used to describe expected water quality) and to set total maximum daily loads (the total amount of pollution that can be assimilated in a waterbody) in order to achieve the water quality standards. This authority stems from Section 303(d)(1)(C) and (D) of the Act and the implementing regulations at 40 CFR 130.7(c). Taken together, the water quality management planning and total maximum daily loads regulations at 40 CFR 130.7 provide a comprehensive, regulatory framework within which states can address NPS pollution.

However, the impetus for using the water quality management planning process to control nonpoint source pollution must largely come from the states. Under the Clean Water Act, much of the focus of water pollution control centered on point sources. It was not until the Water Quality Act of 1987, which amended the Clean Water Act, that nonpoint source pollution control concerns were addressed. In particular, Section 319 of the amended Clean Water Act calls for states to develop nonpoint source assessment reports and management programs, but does not require Federal action in the event a state chooses not to develop or implement a management plan.

The purpose of the assessment report is to describe the nature, extent, and effect of nonpoint source pollution on the waters of the state. Also sources of the pollution and practices for

controlling those sources are to be discussed. The purpose of the management program is to focus state efforts in controlling nonpoint sources so as to attain water quality standards and to prevent future degradation. This program is to contain components that will specify steps needed (including schedules) to address the problems described in the assessment report. Specifically, the management program is to include a list of best management practices; program description; list of Federal programs to be reviewed for consistency with the state management program; schedules and milestone for implementing the management program; description of available funding; and Attorney General certification that the state has proper authority to implement the program.

The Illinois Assessment Report was submitted to the Region and approved in its entirety on February 27, 1989. The Illinois Management Program was only partially approved on August 25, 1989. The significant basis for not completely approving the Illinois management program was the lack of a component for implementing total maximum daily loads.

WETLANDS

The Region V Wetlands program consists of enforcement, public information and education, advanced identification, state program delegation, and public notice and review of proposals to fill wetlands. The Region concentrates its activities in the area to protecting valuable wetlands and major projects. This broad approach will allow this Region to effectively implement the "no-net-loss" wetlands policy. The advance identification program identifies wetlands on an areawide basis that are in need of protection.

Region V manages the only state delegation of wetland program. That state is Michigan. The United States Environmental Protection Agency's (USEPA) responsibilities for the Michigan program include semi-annual review for consistency with Federal regulations; USEPA, however, still reviews the public notices of large projects (calling for discharges of more than 10,000 cubic yards). In non-delegated states, like Illinois, the state pollution control agencies have to certify prior to permit issuance that the project will not cause water quality impairment.

The enforcement component is the foundation of the wetland protection program. The 1987 Amendments to the Clean Water Act strengthened enforcement by giving USEPA the right to process administrative penalties for illegal fill activities, and to order restoration of the wetlands that were destroyed. Last year, Region V became the first Region to utilize this authority. The Region has continued to actively pursue enforcement cases and leads the USEPA nationwide in this area.

WATER QUALITY STANDARDS

The water quality standards program is authorized under Titles I and III of the Clean Water Act is the foundation for the water quality activities covered in the Clean Water Act. Under Title I, specific goals are defined for the nation's waters. These goals include such use designations as waters are to be fishable, swimmable, and protective of human health and aquatic life. Waters are also to be of such quality as to support industrial and agricultural needs. The only use that is expressly prohibited is the use of a waterbody as a sewer. USEPA strongly supports the use of multiple designations for water bodies. In such cases the most stringent water quality standard (or component thereof) would apply.

Title III specifies that it is the states' responsibility to develop water quality standards. USEPA has the obligation to review and approve states' standards. State standards need only to be at least as stringent as the minimum Federal guidelines. As part of the review, USEPA looks at

the technical merit of the proposed standards. USEPA has also issued guidance in the form of two documents: the Water Quality Standards Handbook and the Technical Support Document for Water Quality-based Effluent Limits (published in 1985 and 1985, respectively).

It needs to be noted that water quality standards have been used extensively in the past in the NPDES permitting program for point source discharges. Water quality standards, however, are also are applicable to all water quality conditions. That is, exceedence of water quality standards due to nonpoint sources is considered a violation on par as if the exceedence was due to point sources.

Water quality standards are essentially baseline statements incorporated into state rule which are designed to protect water quality so that the uses designated by the states would be protected. The main components of water quality standards include specific water use designations (e.g., being fishable, swimmable, public water supply), having numeric and narrative criteria, and antidegradation provisions.

Numeric criteria are quantifiable levels of specific pollutants or classes of pollutants. In the past there was typically one number for a particular pollutant that was not to have been exceeded. This approach failed to take into account possible adverse effects from long-term or repeated exposures. USEPA, therefore, has been recently advocating a two level approach for pollutants: a short-term or acute value and a long-term or chronic value.

Narrative criteria are statements which describe water quality conditions which are not to be violated. An example for Illinois is the freedom clause found in 35 Ill. Adm. Code 302. This clause, paraphrased, allows for the freedom from unnatural sludge deposits, odor, color, and other similar factors. The application of such criteria are difficult, but problems such as the sediment concerns in Peoria Lake could be addressed through these criteria.

Recently, narrative criteria have been undertaking another form. Because of changes in scientific knowledge, numeric criteria which were justifiable at the time of promulgation may no longer be justifiable now. A narrative set of procedures may then be called for to develop site-specific numeric criteria. A significant portion of the Federal criteria which were developed for guidance to states were developed using this method. A positive aspect of this approach is that it allows for the development of numeric criteria based on established procedures and reflective of the most current scientific information.

Antidegradation simply put means that water quality can never be degraded so that current use designations will be violated; except that in cases where water quality exceeds designated uses and there are economic or social needs then such uses may be adjusted.

UPPER ILLINOIS CONCERNS

As I previously mentioned, an important concern for Illinois is the development of adequate total maximum daily loads for all limited-use waterbodies. Total maximum daily loads are essentially the amount of pollutant that a specific waterbody can assimilate. These loads are then used to allocate loads to point sources (also known as wasteload allocations) and nonpoint sources (load allocations). It is the Region's belief that a total maximum daily load study needs to be completed on the Upper Illinois River basin. The Region is now in the process of developing an approach for resolving this issue.

CONCLUSION

USEPA role in abating nonpoint source pollution in Illinois for is varied; from direct implementation in the Wetlands program to Federal oversight of state programs in the nonpoint source and standards program. Because of the restrictions and authorities delegated to USEPA under Federal statute, USEPA recognizes that controlling nonpoint sources of water pollution cannot be the responsibility of just one agency. Rather, all Federal, State, and local agencies, and just as importantly, the public need to continue to work together to form effective programs to abate nonpoint sources of pollution in order to meet water quality standards.

THE ILLINOIS RIVER AND THE U.S. ARMY CORPS OF ENGINEERS

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ABSTRACT

We have heard from local organizations, city, state and Federal agencies--all with specific interests in the future of the Illinois river. By virtue of its Civil Works mission involving 268 miles of the Illinois Waterway from Chicago, Illinois, downstream to the LaGrange Lock and Dam near Beardstown, Illinois, the Rock Island District of the Corps of Engineers also shares an interdependent future with the Illinois River. Our interests parallel those already emphasized today in the areas of (1) Environmental management, (2) Commercial navigation, and (3) Recreational concerns.

INTRODUCTION

The Illinois River and its tributaries--or as we know it, the Illinois Waterway--as a part of the Upper Mississippi River System, is a nationally recognized commercial and recreational boating navigation system with a complex ecosystem which needs to be protected. As such, the Illinois Waterway is a part of the Upper Mississippi River Environmental Management Program (UMR-EMP).

UPPER MISSISSIPPI RIVER ENVIRONMENTAL MANAGEMENT PROGRAM

The UMR-EMP is a unique project implemented by the Corps in cooperation with interagency groups including the Fish and Wildlife Interagency Committee (FWIC); the River Resources Coordinating Team (RRCT); the On-Site Inspection Team (OSIT), the River Industry Action Committee (RIAC), and others. The project has no definitive cost-benefit ratio requirement; that, in itself, is unique.

The EMP resulted from the GREAT River Studies begun in the 1970s to deal with the problems of sedimentation and dredged material placement.

The studies specifically concentrated on how the Corps could conduct its channel maintenance activities with, at worst, minimal negative environmental impacts, and hopefully, with positive environmental impacts.

Since GREAT, Operations and Maintenance dredging and disposal activities have resulted in environmental enhancement when able to be accomplished at a cost savings over alternative/traditional methods of channel maintenance.

In 1978 the Upper Mississippi River Basin Commission was directed by public law to develop a comprehensive Master Plan for the management of the Upper Mississippi System, including the Illinois River. A second lock at L/D 26 and the EMP were two items acted upon by Congress out of that Master Plan.

EMP ELEMENTS

The EMP consists of five basic program elements: Habitat Rehabilitation and Enhancement Projects, Long-Term Resource Monitoring, Study of Economic Impact of Recreation, Traffic Monitoring Study, and Recreation Projects.

The Supplemental Budget Act (PL 99-88) of 1985 provided initial authorization for the EMP and the Water Resources Development Act of 1986 (PL 99-662) further elaborated on the program.

Funded as a ten-year program in FY88 at $196 million total, the program is scheduled for a progress report to the Secretary of the Army in 1997.

Currently, 95 percent of EMP funds are used for Habitat Rehab and Long-Term Resource Monitoring, with 60 percent of that going to Habitat Rehab. Long-term resource monitoring is being accomplished by the U.S. Fish and Wildlife Service.

EMP PROJECTS

The Corps recognizes that the navigation pools, side channels, and backwaters of the Illinois Waterway are components of its complex ecosystem, and our Habitat Rehabilitation projects undertaken on a cost-sharing basis with other Federal and state agencies will help provide nesting, food, and cover for fish and wildlife.

Three habitat projects proposed for the future on the Illinois River are in varying stages of planning.

PEORIA LAKE PROJECT

The Peoria Lake Island Project, located in the Peoria Pool, would involve the building of a barrier island approximately 1.3 miles long in upper Peoria Lake, removal of the East River channel silt plug; addition of rock substrate near the upper end of the East River Channel; construction of a forested wetland management unit on Woodford County state conservation area lands, and selected revegetation. The U.S. Army Waterways Experiment Station is providing technical expertise in the design of the proposed project to ensure optimum benefits from the project. Several state agencies, the U.S. Fish and Wildlife Service, and the U.S. Environmental Protection Agency have also been involved. The project would be constructed on Federal navigation project land and land owned by the state of Illinois. First costs and

operations and maintenance will be shared on a 75 percent Federal and 25 percent non-Federal basis. First cost to the non-Federal sponsor, the Illinois Department of Conservation, would be $1,050,000. The state of Illinois has agreed to this expense, and the contract award is now scheduled for December of 1990. Since the local watershed is responsible for about 40 percent of the siltation problem in Peoria Lake, it is important for all of us concerned to realize that this single project will not cure the problem. It will only take care of one of the symptoms and provide incite into the utility of island construction procedure.

CHAUTAUQUA LAKE PROJECT

The second habitat improvement project involving the Corps is that of Chautauqua Lake, also located in the Peoria Pool. This proposal, still in very early planning stages, includes the construction of a pump station with road access and electrical connection; repair of the existing cross dike to include installation of a water control structure, dredging of Liverpool Ditch, and possibly Meyer's Ditch; and channel dredging and island construction within the lake itself. General design and construction costs would be 100 percent Federal; non-Federal sponsor would again be thee Illinois Department of Conservation.

BANNER MARSH PROJECT

The last of the proposed habitat projects I will mention here today is the Banner Marsh Project, located in LaGrange Pool. This would involve development of 40 wetland sites 2-to-20 acres in size with individual water level management capabilities, construction of four 2-acre fish rearing ponds, construction of 100 nesting islands less than one-quarter of an acre in size and lying at least three feet above high water, renovation and gradation of approximately 400 acres of grassland habitat, clearing and stabilizing the existing river levee, and construction of a primary pumping station for overall site water level control. Cost share ratio would be 75 percent Federal, 25 percent non-Federal, with the Illinois Department of Conservation as the non-Federal sponsor.

I must again emphasize that these last two projects are in very early planning stages and all are dependent on the continued availability of funding and cost sharing capabilities.

OTHER ENVIRONMENTAL PROTECTION PROGRAMS

The Corps has other avenues for continued protection of the Illinois River ecosystem; for example, the proposed Liverpool Ring Levee Flood Control Project, and the Corps ongoing regulatory review process.

LIVERPOOL

The village of Liverpool, Illinois, is located approximately 30 miles downstream of Peoria, on the river side of an agricultural levee. In past years, flood damage in Liverpool has been substantial. The recommended plan is to raise the agricultural levee and construct a village levee to tie into the existing one, provide interior drainage piping, construct a 2-acre ponding area, and a pumping system. A flood warning communication system will be implemented by the village. Construction is planned for spring of 1992. I might note here that the Federal Emergency Management Agency (FEMA) prefers a permanent evacuation plan as their alternative. The Illinois Department of Transportation, Division of Water Resources, supports

the levee plan and will financially support the village in constructing the project. Again, a 75 percent Federal, 25 percent non-Federal cost share ratio would apply.

REGULATORY REVIEW PROCESS

The Rivers and Harbors Act of 1899 gave the Corps the responsibility and authority to regulate activities on public waterways. The National Environmental Policy Act (NEPA) of 1968 and the Clean Water Act of 1977 expanded the Corps' regulatory responsibilities.

For the Illinois Waterway, this means that the Corps regulates any work or structure that occurs on or over the waterway, and any discharge of dredged or fill material that would occur in the waterway and adjacent wetland.

The Rock Island District processes between 25 and 50 individual applications annually, requiring public notice on the Illinois River, several more, if you consider all permits on the tributaries in the Illinois Waterway Drainage Basin. Non-controversial individual permits normally take around 60 days to issue.

This process covers a wide range of projects from dredging projects and construction of barge facilities and marinas, to boat docks and riprap for facility or bank protection.

Our public interest review process entails numerous factors, including pollution, fish and wildlife, historical and archaeological significance, cultural considerations, and many others.

For several years now, the five Corps districts in Illinois have utilized joint processing with the Illinois Environmental Protection Agency and Illinois Department of Transportation, Division of Water Resources. Utilizing a joint application packet, applicants are able to concurrently initiate both Federal and state processing of their applications. This coordination of efforts reduces paperwork burdens on the applicant, and assures that all state and Federal requirements for water quality and wetlands protection are addressed.

My final decision to issue or deny a Corps permit is based upon the overall public interest and usually includes review and comment by some or all of the following: U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, National Park Service, State Department of Conservation, State Department of Transportation, State Historic Preservation Officer, Illinois River Carriers Association, American Waterways Operators, and numerous other environmental and navigation industry groups.

NAVIGATION

Corps involvement in the protection of the Illinois River ecosystem and its enhancement must be accomplished in harmony with the Corps navigation mission.

Mr. Smith of Rock Island District discussed the plans for navigation studies. We have a few copies of the Plan of Study and availability statements if you have not already received them.

In view of recent trends in commodity flows on the Illinois Waterway plus the current and future commercial and recreational navigation demands, the need for the study is certainly clear if we are to plan now to meet our needs well into the next century.

For more than 60 years, the Corps has operated the locks and dams on the Illinois River. The state of Illinois, in its effort to build an alternate to the obsolete Illinois and Michigan Canal,

began construction of the existing locks on the Illinois River in 1920 with Marseilles Lock, and continued as follows:

1923--Lockport
1926--Starved Rock
1927--Brandon Road
1929--the approximate start for Dresden Island

The crash of 1929 left the state financially unable to complete the work. When Congress assumed ownership, the construction was 70 percent completed. The U.S. Army Corps of Engineers assumed the responsibility for the Federal government and the waterway was open for traffic in 1933.

The Corps constructed navigable pass locks and dams at Peoria and LaGrange in 1938 and 1939. Thomas J. O'Brien Lock was completed in 1960.

Cooperation of all agencies and organizations with a vital interest in the future of the Illinois River systems will be necessary to establish acceptable databases during the navigation reconnaissance and feasibility studies. From that point, it will take the energies and efforts of all of us (the Corps, commercial carriers, recreational users, environmental and state agencies) to make the plan a success beyond the feasibility stage to the construction of any capital improvements required to meet all our future needs as outlined by the study results.

MAJOR REHABILITATION/MAJOR MAINTENANCE

Of course, we can't discuss navigation facilities without a summary of major rehabilitation and maintenance needs and plans.

The locks and dams on both waterways were constructed mainly during the 1920s and 1930s. Time, weather, and increasing use have taken their toll. As the structures and equipment approach the end of their projected lives, breakdowns plus the failure of mechanical and electrical equipment become more frequent and expensive to the taxpayer with resultant delays and increased costs to commercial shippers and their customers.

The major rehabilitation work on the Illinois Waterway, as well as the Mississippi River is designed to restore lock and dam structures to a condition that will not require major capital expenditures for the next 50 years.

The effort began on the Illinois Waterway with contracts at Marseilles Lock, Dresden Island Lock and Dam, and Starved Rock Lock and Dam, which are now completed. Between 1983 and 1986, contracts were awarded at Lockport Lock, Brandon Road Lock and Dam, Marseilles Dam, Peoria Lock and Dam and LaGrange Lock and Dam.

All work at Lockport Lock was essentially completed in 1987. The last portion of work at Lockport involved replacement of two old vertical lift gate machinery units with a new hydraulic lift system. This system is now complete and operational.

Brandon Road rehab was completed in 1985. It involved replacement of deteriorated concrete, rehabilitation of the tainter gates, replacement of the tainter gate machinery, and replacement of the headgates and headgate hoist system. Work on the Joliet walls involved reconstruction of the gravity structure that helps contain the Brandon Road Pool, and was completed in 1988.

The Marseilles Dam rehab was begun in 1985. The lock is located approximately two miles downstream of the dam and was rehabilitated in 1975. Rehab of the dam involves replacement of the eight existing tainter gates with a new submersible design that will allow passage of ice and debris and prevent damage to the gates. The new gates will improve operation and control of the upper pool and will be remotely controlled by the lockmaster at the lock. Work at Marseilles Dam is scheduled for completion this year.

Rehabilitation of the Peoria and LaGrange Locks and Dams was started in 1986. It involves removal and replacement of deteriorated concrete, rehabilitation of the miter gates, replacement of the miter gate operating mechanism and reconstruction of the upper guidewall. The work is scheduled for completion in FY90. Contracts were awarded at both Peoria and LaGrange in September of 1987 for construction of a single 84' submersible tainter gate at each lock to allow passage of ice and lessen frequency of the wicket changes needed to control the upper pool.

The major rehabilitation/major maintenance program was conceived in an effort to systematically repair and update lock and dam structures, and continued funding is essential in maintaining the navigational infrastructure within the Rock Island District's boundaries.

RECREATION

In the beginning, I stated that the Corps mission
for the future of the Illinois River includes recreation; however, limited Federal funding for recreation, and lack of Federally owned land on the Illinois Waterway allows for minimal recreation planning by the Corps.

Farmdale and Fondulac recreation areas have recently been reopened for non-motorized recreation, such as hiking and day use. These recreation areas are funded for operations and maintenance only. Each lock and dam site on the Illinois River has observation and day use areas. The Corps operates the Illinois Waterway Visitors Center at Starved Rock Lock and Dam. It is a fully staffed Corps facility, receiving approximately 50,000 visitors per year. The Center's slide presentation includes a panoramic history of the Illinois River. There are no Corps camping areas on the Illinois River at the present time.

CONCLUSION

All of us at the Rock Island District Corps of Engineers plan to share in building for the future of the Illinois River in the 1990s and beyond.

CLOSING COMMENTS

Robert W. Frazee, Coopertive Extension Service

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In a few minutes, we will adjourn from the formalized setting of this conference to go "out in the field" to tour new erosion control structures and practices which have been incorporated into Caterpillar's 2550-acre Peoria Proving Grounds.

I feel the Second Conference on the Management of the Illinois River System: the 1990s and Beyond has been a success! The First Conference identified the problems and proposed solutions. This Second Conference has shown that we, as conscientious representatives of agencies and organizations, have accepted the challenge and are now working together to see that action-oriented programs are being initiated and implemented which will affect the long-term management of the Illinois River Watershed.

The holding of this conference is significant in that it demonstrates that true multi-disciplined, inter-agency cooperation can be fostered between local, state and federal units. We are just beginning a long and arduous task of addressing the neglect and abuse which has been allowed to occur for decades with the Illinois River. But this Second River Conference has proved one important point--that, collectively, we can change our destructive and wasteful environmental habits and practices.

But time is of the essence in dealing with the problems of the Illinois River System. This can be dramatically illustrated by sharing the following example. Approximately three weeks ago, portions of the Illinois River Watershed, from Peoria to Starved Rock, received from twelve to fifteen inches of rain in less than a week's time span. Within days, this section of the Illinois River quickly rose to flood stage. Since then, the water level has been rapidly dropping, until over this past weekend the backwater lakes of the northern Marshall County Conservation Area were virtually devoid of water and exposed massive mudflats. From flood to mud in less than three weeks! This example highlights the severity and the need for urgency in dealing with the sedimentation problems associated with the Illinois River System.

It is apparent that we have advanced beyond the rhetoric and planning stages. The accomplishments which have been reported at this conference will not only provide immediate benefits to the Illinois River, but will greatly enhance the quality of our land and water

resources for generations to come. I urge all of the state and federal agencies that have reported the past two days to accept the immense challenge presented by the Illinois River and to "make good" on their future commitments of assistance. I sincerely hope that this Second Conference will not be the last conference on the Illinois River System. Rather, I hope that it will be the beginning of a series of conferences that will focus on accomplishments being made to improve and enhance the quality of the Illinois River Watershed.

We have a tremendous resource with our Illinois River. As we depart from this conference, I would like all of us, whether we represent agencies, organizations or individual concerns, to make a personal commitment to strive even harder to improve the quality of the Illinois River.

Our task awaits us. Let us depart with a firm commitment to return a few years in the future eager to report that, collectively, we have made good on our promises and that the Illinois River System is responding to a comprehensive management plan.

Appendices

Appendix A—Photographs

The two-day conference drew more than 175 representatives from government, academia, industry, and citizen's groups to discuss the future of the Illinois River.

Above: Bonnie Noble, executive director of the Heartland Water Resources Council, highlighted the recreational potential of the Illinois River.

Left: Two members of the planning committee, Robert Frazee (center) and Henry Holling, discussed the meeting with a reporter for the *Peoria Journal Star,* Ann-Perry Washabaugh.

Above: Gary Clark of the Illinois Department of Transportation, Division of Water Resources, was one of four opening speakers. The other three were (left to right): Peoria Mayor James Maloof, Peoria County Board Chairman James Christopher, and Robert Frazee.

Right: State Senator Carl Hawkinson (seated) and State Representative David Leitch responded to questions about *legislative initiatives that* will benefit the Illinois River.

During the session on local initiatives, Henry Holling described one regional effort to save the Illinois River: the Illinois River Coalition/ Father Marquette Compact. Also shown are Glenn Stout, director of the Water Resources Center at the University of Illinois, and Barbara Mantz Drake, associate editor of the *Peoria Journal Star.*

Left. Colonel James Corbin of the U.S. Army Corps of Engineers, St. Louis District, chaired the session on the Federal Perspective. Members of the panel pictured at left include: Richard Sparks from the Illinois Natural History Survey, who stepped in for U.S. Fish and Wildlife Service's Jerry Rasmussen; Bruce Carlson, Corps of Engineers, St. Paul District; and Gary Parker, U.S. Department of Agriculture, Soil Conservation Service.

Below. After the conference, the attendees visited Caterpillar's Proving Ground outside of Peoria to examine on-site erosion control structures and practices.

Appendix B—Conference Program

Tuesday, October 3

8:00	Registration
9:45	Call to Order **Bob Frazee** University of Illinois, Cooperative Extension Service (Heartland Water Resources Council)
9:50	Welcome **James Maloof,** Mayor City of Peoria **James Christopher,** Chairman Peoria County Board
10:00	"Progress in the Illinois River Watershed Since the First Illinois River Conference" **Don Vonnahme** Illinois Department of Transportation, Division of Water Resources
PANEL:	**ILLINOIS STATE WATER PLAN TASK FORCE**
10:30-12:00	Morning Chair: **Don Vonnahme** Illinois Department of Transportation, Division of Water Resources
10:30	"The Illinois Department of Conservation's Changing Role in the Illinois River Basin" **John Comerio** Illinois Department of Conservation
11:00	"Water Quality Impacts of Commercial Navigation" **Tom Butts** Illinois State Water Survey
11:30	"Controlling Soil Erosion in the Illinois River Basin" **Richard Nichols** Illinois Department of Agriculture
noon	**Lunch** Master of Ceremonies **John Comerio** Illinois Department of Conservation Featured Speaker "Waterways—Their Recreational Potential" **Bonnie Noble,** Executive Director Heartland Water Resources Council
PANEL:	**ILLINOIS RIVER WATER PLAN TASK FORCE**
1:45-4:10	Afternoon Chair: **Richard G. Semonin** Illinois State Water Survey
1:45	"Peoria Lake Sedimentation and Proposed Artificial Islands" **Mike Demissie** Illinois State Water Survey
2:05	"Sediment Management Problems" **Nani G. Bhowmik** Illinois State Water Survey
2:25	"Habitat Restoration in Backwater Lakes of the Illinois River" **Don Roseboom, Rick Twait** Illinois State Water Survey **Dan Sallee** Illinois Department of Conservation
2:45	"Benefits of TARP to the Illinois River" **Kris Singh, Tom Butts, Ali Durgunoglu** Illinois State Water Survey
3:05	"Environmental Management Program Proposals in the Illinois River Basin" **Bill Donels** Illinois Department of Conservation
3:30	Featured Speaker "Illinois River Basin: Lifeblood of the State" **Karen Witter,** Director Illinois Department of Energy and Natural Resources
PANEL:	**ILLINOIS RIVER LEGISLATIVE TASK FORCE**
4:10-5:00	Chair: **Henry Holling** Caterpillar Inc. (Heartland Water Resources Council)
6:00-8:00	**Dinner**—Boatworks, Cruise aboard the *Spirit of Peoria* Introductions: **Henry Holling** Caterpillar Inc. "Tri-County Riverfront Forum" **Donald G. Meinen** Tri-County Regional Planning Commission "Update of Tri-County Riverfront Plan" **L. Donald Luebbe** Scruggs and Hammond, Inc.

Wednesday, October 4

7:15	Continental Breakfast at Hotel Pere Marquette (informal basis)
PANEL:	**LOCAL INITIATIVES**
8:00-10:05	Morning Chair: **Barbara Mantz Drake** Peoria Journal Star
8:10	"The Illinois River and Peoria Lakes: It's Time to Act" **Michael Reuter, Henry Holling** Caterpillar Inc. **Bob Frazee** University of Illinois, Cooperative Extension Service
8:35	"Stream Bank Stabilization and the Illinois River Soil Conservation Task Force" **Don Condit** Illinois River Soil Conservation Task Force **Don Roseboom** Illinois State Water Survey
8:55	"Value of Citizen Stream Quality Monitoring as an Educational Tool" **Brook McDonald** Wheaton Park District
9:15	"Revenue Sources for River Management" **Wesley Seitz** University of Illinois, Department of Agricultural Economics
9:35	"Illinois River Coalition/Father Marquette Compact" **Henry Holling** Caterpillar Inc.
9:45	"Sediment Management" **Glenn E. Stout** University of Illinois, Water Resources Center
9:55	"Comparison of Commercial-Commidity and Recreational Uses of the Illinois River" **Rabel J. Burdge** University of Illinois, Institute for Environmental Studies **Robert A. Robertson** Iowa State University
PANEL:	**THE FEDERAL PERSPECTIVE**
10:10-12:00	Chair: **James Corbin** U.S. Army Corps of Engineers, St. Louis District
10:20	"Long-Term Resource Monitoring—A New Source of Data for Researchers and Resource Managers" **Jerry Rasmussen** U.S. Fish and Wildlife Service
10:40	"Planning for the Future of Navigation on the Illinois Waterway" **Chip Smith, Paul D. Soyke, Michael A. Cockerill** U.S. Army Corps of Engineers, Rock Island District
11:00	"Erosion Control Efforts in the Illinois River Basin—A Federal Perspective" **Gary Parker** U.S. Department of Agriculture, Soil Conservation Service
11:20	"U.S. Environmental Protection Agency Perspective on Non-Point Pollution Control and Wetland Functions" **Tom Davenport** U.S. Environmental Protection Agency
11:40	"Economic Impacts of Recreation on the Upper Mississippi River System" **Bruce Carlson** U.S. Army Corps of Engineers, St. Paul District
noon	**Closing Luncheon** Master of Ceremonies **Bob Frazee** University of Illinois, Cooperative Extension Service Featured Speaker "The Illinois River and the Corps of Engineers **John R. Brown,** Commander U.S. Army Corps of Engineers, Rock Island District
1:30	Overview Caterpillar Peoria Proving Grounds
2:00	Loading of buses for tour of Caterpillar's Peoria Proving Grounds to examine on-site erosion control structures and practices
4:30	Arrive back at Hotel Pere Marquette, Peoria

Appendix C—Changes to Program and List of Poster Session Participants

Changes to Conference Program

Tuesday

Gary Clark presented Don Vonnahme's paper.

The two Illinois Congressmen present for the session on the Illinois River Legislative Task Force were Senator Carl Hawkinson and Representative David Leitch.

Wednesday

Richard E. Sparks from the Illinois Natural History Survey replaced Jerry Rasmussen of the U.S. Fish and Wildlife Service on the panel representing the Federal Perspective. Both Mr. Sparks and Mr. Rasmussen submitted papers for the proceedings.

Robert Pepin replaced Tom Davenport as the presenter of the paper he co-authored with Mr. Davenport and Douglas Ehorn.

Poster Session Participants

Raman K. Raman, Coordinator

Heartland Water Resources Council of Central Illinois
Bonnie Noble

Illinois Department of Energy and Natural Resources, Groundwater Education
Harry Hendrickson

Illinois Department of Transportation, Division of Water Resources
Gary Clark

Illinois State Water Survey, Surface Water Section
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