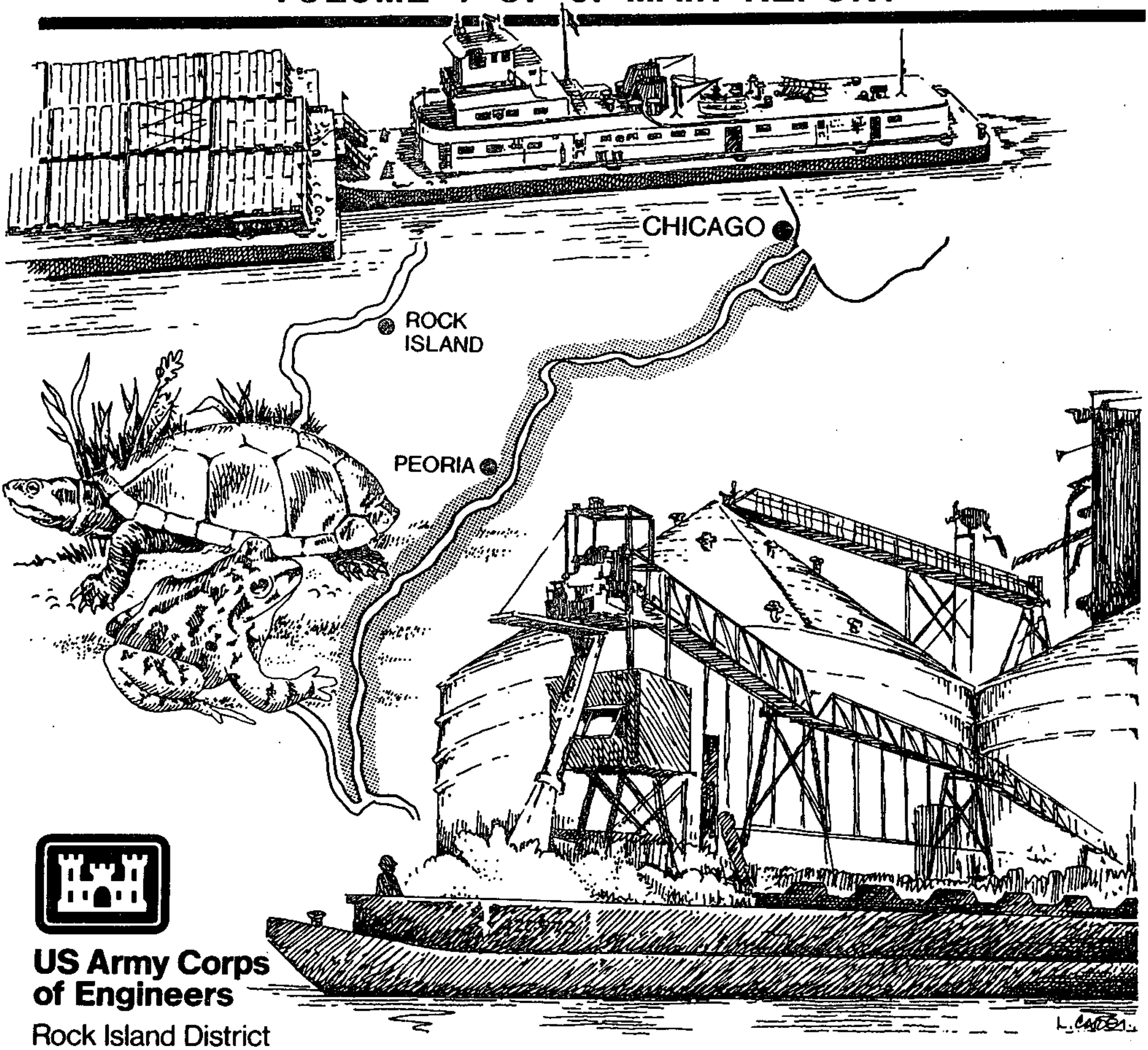
ILLINOIS WATERWAY NAVIGATION STUDY

RECONNAISSANCE REPORT (FINAL)

VOLUME 1 OF 3: MAIN REPORT



US Army Corps of Engineers
Rock Island District

OCTOBER 1990

DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
CLOCK TOWER BUILDING—P.O. BOX 2004
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REPLY TO
ATTENTION OF:

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RECONNAISSANCE REPORT

FOR

ILLINOIS WATERWAY NAVIGATION STUDY

OCTOBER 1990

ACKNOWLEDGEMENT

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US Army Corps of Engineers
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WE'RE PROUD TO SIGN OUR WORK

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Section 1 - Introduction

INTRODUCTORY SUMMARY

The Illinois Waterway, a vital segment of the United States Inland Waterway Navigation System, serves as the connecting link between the Great Lakes, St. Lawrence Seaway, and the Mississippi River at Grafton, Illinois. The navigation system is essential to several of the most important economic sectors in the State of Illinois and the Nation, particularly agriculture, construction, and energy.

The Rock Island District, Corps of Engineers, is responsible for the operation and maintenance of eight locks and dams along 327 miles of the system. An 80-mile open river reach, downstream from the first lock and dam at LaGrange, is under the jurisdiction of the St. Louis District, Corps of Engineers.

The Illinois Waterway has been continuously developed for navigational purposes since 1822. The current navigation system, placed into operation in 1933, is made up of the Illinois River from its mouth to the confluence of the Kankakee River (273 miles); the Des Plaines River from the Kankakee to Lockport Lock (18 miles); and the Chicago Sanitary and Ship Canal, South Branch Chicago River, and Chicago River from Lockport Lock to Chicago Harbor (36 miles). A second arm of the waterway leaves the Chicago Sanitary and Ship Canal about 12.5 miles above Lockport and proceeds to the Calumet Harbor on Lake Michigan via the Cal-Sag Canal and the Little Calumet and Calumet Rivers (30 miles). Dams control water levels along the waterway, and locks provide the means for waterway traffic to move from one pool to another. The navigation channel has a minimum depth of 9 feet and currently is regulated by a system of eight locks and dams.

Critical transportation services are provided to the Midwest via the Illinois Waterway. Commercial navigation tonnage amounted to nearly 1.7 million tons in 1935 and grew to a record 45.8 million tons in 1975. Currently, a total of 138 terminals on the waterway ship and receive commodities, which include grain, chemicals, petroleum products, coal, non-metallic minerals, metallic products, and scrap.

The importance of the waterway as a shipping artery is reflected in the continual increase in tonnage shipped. The *Inland Waterway Review* projections are that future traffic growth on the Illinois Waterway will range between 1.0 to 2.5 percent annually (the *1988 Inland Waterway Review*, Institute for Water Resources Report 88-R-7). Three of the eight Illinois Waterway locks have already been identified by the *1988 Inland Waterway Review* as being among the top 20 locks having the highest average delays, total delays, total processing times, lockage times, and lock utilization in the entire inland waterway system. Continued traffic growth will intensify current delays, creating an acute problem.

In addition to providing an economical transportation route, the Illinois Waterway offers a rich habitat for a variety of plant and animal species. In 1985, the Illinois River supported 36,000,000 waterfowl use days, hundreds of wintering bald eagles, and over 60,000 acres of State and Federal wildlife refuges and management areas, most of which are bottom land forest and emergent wetlands. These resources provided an average of 83,400 activity days for waterfowling alone at an estimated value of $2.2 million. The Illinois River accounts for over 2 million sport fishing days yearly and accounts for 5 percent of all fishing in the State of Illinois. The U.S. Fish and Wildlife Service (USFWS) estimates that a total of 2,691,400 outdoor activity days occur annually with an expenditure of $60.2 million for hunting and fishing related activities alone. Many other forms of recreation and the economic impact of these activities are yet unmeasured.

Besides natural resources, the Illinois River Valley is rich in archeological remains which have made a substantial contribution to our understanding of the cultural history of the entire Midwestern United States. Although only a very small sample of the river valley has been studied, over 600 sites are recorded, including the Grand Village of the Kaskaskia (a National Historic Landmark) where Father Marquette and Louis Jolliet first met the Kaskaskia Indians in 1673. National attention along the river is increasing with the designation of the Illinois and Michigan Canal National Heritage Corridor and the potential designation of the Illinois River National Historic Trail.

This study was initiated to address the problems, needs, and opportunities associated with maintaining navigation viability on the Illinois Waterway, and protecting its natural resources, while considering its economic importance to our Nation. This reconnaissance report defines the problems, establishes needs, and identifies potential solutions. It presents the determination of Federal interest in navigation improvements, discusses priorities for improvements, and communicates a plan for protecting the environmental resources associated with the waterway.

STUDY AUTHORITY

Authority for the Illinois Waterway Navigation Study is contained in Section 216 of the Flood Control Act of 1970 (Public Law 91-611) which states:

> The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects, the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, which when found advisable due to significantly changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest.

STUDY PURPOSE AND SCOPE

The principal purpose of this study is to determine if there is a Federal interest in making structural and/or nonstructural improvements to the Illinois Waterway Navigation System. The study scope includes considerations for economic, environmental, recreational, engineering, and operational issues. Both site-specific and system-wide navigation issues were examined in a preliminary manner in order to evaluate the impacts of the alternatives. Each issue and potential solution was analyzed for its impact on system navigation, the riverine environment, and economic considerations.

While this document examines several concepts and offers alternatives for capital improvements, it should not, in any way, be construed as a final assessment. Rather, the reconnaissance-level data are intended to indicate typical solutions and the range of costs and benefits which might be expected, and to provide a foundation for additional Federal interest and direction for more comprehensive feasibility level studies.

PRIOR STUDIES, REPORTS, AND EXISTING WATER PROJECTS

Numerous studies and documents have been completed for the Illinois Waterway. It would be a significant task to include here a summary of each Federal, State, and private study about the Illinois Waterway or its navigation system. An attempt has been made, however, to include studies most applicable to this one. A chronology and summary are included in the following paragraphs.

The Rivers and Harbors Act of 1930 assigned the Corps of Engineers responsibility for completing the unfinished improvements to and for management of the Illinois Waterway System. Five of the locks (Lockport, Brandon Road, Dresden Island, Marseilles, and Starved Rock) were completed in 1933, at which time the Illinois Waterway was placed into operation as an inland navigation route. Since that time, resolutions have been adopted by the Committee on Rivers and Harbors of the United States House of Representatives on March 16, 1943; September 21, 1943; and April 24, 1945. In addition, the U.S. House of Representatives Committee on Public Works provided additional authority for the Corps of Engineers to investigate the feasibility of providing a 12-foot navigation channel in a resolution adopted July 10, 1968. By letter dated August 27, 1968, the Chief of Engineers requested that the four cited resolutions be combined into one. This was accomplished and authorized in House Document No. 137, 72d Congress, 1st Session.

An *Interim Survey Report on Duplicate Locks, Illinois Waterway, Illinois*, was published on January 25, 1957, by the Chicago District, Corps of Engineers. The Duplicate Locks project was authorized by the 1962 River and Harbor Act (Public Law 87-874, 87th Congress) as recommended in House Document 31, 86th Congress, 1st session. The report provided the results of an investigation into the advisability of modifying the Illinois Waterway project to provide for a system of duplicate locks. The District Engineer recommended that the existing project for the Illinois Waterway be modified to provide for construction of duplicate locks, 1,200 feet by 110 feet, at 7 of the lock sites on the navigation system (T. J. O'Brien lock was not built until 1960).

The State of Illinois, Department of Public Works and Building, Division of Waterways, prepared a report entitled, *Through and Across Joliet, A Plan for Modernizing the Illinois Waterway for Land and Water Transportation*, dated March 1971. The agency report called for lowering the Illinois Waterway through Joliet, removing Brandon Road Lock and Dam, widening and deepening the channel to Ninth Street in Lockport, constructing twin 1,200-foot by 110-foot locks, and replacing seven movable bridges with low-level fixed bridges. The report enumerated several differences between what the State and municipal agencies viewed as changes necessary for an improved navigation system and those suggested by the Corps of Engineers.

In February 1973, the Illinois Department of Transportation (ILDOT), Division of Water Resource Management, Bureau of Water Resources, published a document entitled, *Illinois' Critique of Corps of Engineers Review Study of Illinois Waterway Modernization Between Brandon Road and Sag Junction*. In this report, the ILDOT expressed disagreement with cost estimates for the alternatives offered in the Corps of Engineers study, the selection of lock sites, the proposed amount of marine excavation, and bridge design.

During the next several years, the Chicago District, Corps of Engineers, performed extensive inquiry into the viability of the Illinois Waterway Navigation System and into the ILDOT's suggestions. A five-volume report, as well as a Final Environmental Impact Statement, subsequently was published in April 1975 entitled, *Duplicate Locks General Design Memorandum Plan I - A Plan for Modernization of the Illinois Waterway*. The report recommended constructing supplemental locks 110 feet wide by 1,200 feet long at Dresden Island, Marseilles, Starved Rock, Peoria, and LaGrange. The Duplicate Locks project was not endorsed by the State of Illinois and was deauthorized in the 1986 Water Resources Development Act.

The Mississippi River-Illinois Waterway 12-Foot Channel Study was a joint effort between the North Central Division, Corps of Engineers, in Chicago, Illinois, and the Lower Mississippi Valley Division, Corps of Engineers, in Vicksburg, Mississippi. Work tasks were accomplished by St. Paul, Rock Island, St. Louis, and Chicago Districts. The study findings were published in a September 1972 report (revised May 1973) which recommended that a 12-foot channel be provided on the Illinois River from Grafton to Chicago, Illinois. This would be accomplished by dredging the bed of the river, as necessary, to obtain and maintain a 12-foot channel. The improvement would have provided for a navigation channel 300 feet wide with additional width at river bends. The project never received congressional endorsement.

A document prepared for the Chicago District, Corps of Engineers, by F. C. Bellrose, *et al.*, entitled, *Fish and Wildlife Changes Resulting from the Construction of a Nine-Foot Navigation Channel in the Illinois Waterway from LaGrange Lock and Dam Upstream to Lockport Lock and Dam*, was published in 1977. This report chronicles the impacts of construction of the 9-foot navigation channel on habitats of the Illinois River. In addition to evaluating construction impacts, it identifies the two most serious causes of habitat degradation now occurring, which are sedimentation and turbidity.

Between 1977 and 1982, the Great River Resource Management Study, conducted by the St. Paul, Rock Island, and St. Louis Districts of the Corps of Engineers, in conjunction with the USFWS and the Upper Mississippi River Basin Commission (UMRBC), investigated several areas of river management. They included dredged material placement, fish and wildlife, commercial navigation, sedimentation, environmental enhancement, and channel maintenance practices. The recommendations and techniques offered in the Great River Environmental Action Teams' (GREAT I, II, and III) reports were approved by the Board of Engineers for Rivers and Harbors in 1982. Most suggestions were subsequently incorporated into the Corps of Engineers' channel maintenance program.

A major rehabilitation effort for the locks and dams on the Illinois Waterway began in 1975. This initiative was launched with the award of contracts for rehabilitation at Marseilles, Dresden Island, and Starved Rock and was undertaken between 1983 and 1986 at Lockport and Brandon Road. Rehabilitation efforts at Marseilles, Peoria, and La Grange locks and dams will be completed in 1990. Typical rehabilitative work included replacement and maintenance of machinery, removal and replacement of deteriorated concrete, reconstruction of dam piers and gate sills, and replacement of electro-mechanical systems.

Under the auspices of the National Waterways Study, the Corps of Engineers' Institute for Water Resources prepared, with the contracted assistance of A. T. Kearney, Inc., an *Evaluation of Present Waterways System*, dated March 1981. The report discusses commodity flow projections through 2003, lock capacity shortfalls, transportation capability of the present system, and potential actions to maintain or improve its capability. After evaluating the 8 regions and 31 separate facility locations in the present waterway systems, the Institute for Water Resources identified LaGrange and Marseilles locks on the Illinois Waterway as the most constraining structures using one or more scenarios or sensitivity analyses.

Authorized by Section 166 of the Water Resources Development Act of 1976, the Chicago District, Corps of Engineers, conducted a study entitled, *Increased Lake Michigan Diversion at Chicago*. The first portion included a 5-year demonstration program to: (1) increase the average annual Lake Michigan diversion at Chicago, Illinois, and (2) determine the effects of such an increase on Great Lakes levels as well as water quality of and potential flood hazard along the Illinois Waterway. *Information Report II*, containing four diversion plans, was subsequently published in February 1990. The report stated "the information required to quantify the various impacts is lacking" and "additional information on the total system is needed before action can be taken increasing the current annual rate of 3,200 cfs as set forth in the U.S. Supreme Court decree."

The UMRBC, responding to a congressional directive contained in Public Law 95-502, published its January 1981 *Comprehensive Master Plan for the Management of the Upper Mississippi River System*. The 3-year effort, undertaken by Federal, State, and local officials, produced several studies and technical recommendations. The comprehensive plan contains a management framework for resolving differences among competing interests and implementing the technical recommendations. The UMRBC, having completed its task, was terminated by Executive Order 12319 in December 1981. Subsequently, a five-state, inter-agency Upper Mississippi River Basin Association (UMRBA) was formed to coordinate water resource planning and to implement the recommendations of the master plan.

The Upper Mississippi River System-Environmental Management Program (UMRS-EMP) was authorized in the Water Resources Development Act of 1986 (Public Law 99-662). This program, which includes the Mississippi River and the Illinois Waterway, seeks to improve the environmental and recreational resources of both rivers. Several initiatives are currently being adopted to accomplish this mission. They include dredging backwaters to remove sediment, constructing dikes and levees to control water levels, building islands to create habitat for diverse species of flora and fauna, developing aeration and water control systems to improve the quality of habitat, and opening or closing side channels to maintain the flow of water in the main channels or backwaters.

A *Final Environmental Impact Statement (FEIS), Second Lock at Locks and Dam No. 26 (Replacement), Mississippi River, Alton, Illinois and Missouri*, was published in July 1988. It was the opinion of the St. Louis District that overall system-wide impacts of the second lock were minor. However, the district could not unequivocally state whether or not the system-wide incremental navigational impacts were negligible, minor, or significant. Consequently, a Plan of Study (POS) is being prepared to identify studies needed to better quantify navigation impacts on the Upper Mississippi River System due to the operation of the second lock. Results of the POS will be used to prepare a mitigation plan, if appropriate. The draft POS has not been circulated for review, but should be in the fall of 1990.

The *1988 Inland Waterway Review* (November 1988) was prepared by the Institute for Water Resources for the Chief of Engineers. While this document does not constitute a system plan, it does provide a 10-year outlook as to the priority needs for planning, design, construction, and operation of the entire inland waterway system. The review addresses the physical system, traffic levels, system/lock performance, transportation savings, investment needs, and financial resource availability for waterways investment.

The Rock Island District Navigation System Support Center, established in 1988, prepared a *Report on the Upper Mississippi River and Illinois Waterway Navigation System* in 1989. The report is a historical and statistical overview of both navigation systems. It also forecasts growth and performance capability at each navigation structure.

The states of Illinois, Iowa, Wisconsin, Missouri, and Minnesota with the U.S. Department of Agriculture and U.S. Maritime Administration investigated low-cost measures to maximize efficiency and productivity of the Upper Mississippi River Navigation System. A six-volume report was published in April 1989 entitled, *Upper Mississippi River Transportation Economics Study*. The primary product of the study was a computer evaluation model called Waterway Efficiency Evaluation Model (WEEM) which encompasses all aspects of barge operation and could be adapted for future use on other waterway systems. Study findings and recommendations included uniform application of fixed barge/tow rigging, fuel monitoring systems, stacking of empty backhaul barges, hull treatments, new barge and boat hull designs, reduced crew size, sequencing waiting tows, improving lock approaches, lock automation, and others.

A *Plan of Study for Upper Mississippi River and Illinois Waterway Navigation Studies* was distributed to the public on August 7, 1989. The POS provided the framework for Corps of Engineers' reconnaissance-phase planning studies for both waterways. It detailed the study authority, purpose, and how the engineering, economic, and environmental components would be addressed.

The St. Paul, Rock Island, and St. Louis Districts of the Corps of Engineers initiated an *Upper Mississippi River Navigation Study* in April 1990. This study will focus on the 613 miles of the Upper Mississippi River Navigation System which extends from Lock and Dam 25 near Clarksville, Missouri, to St. Anthony Falls, Minneapolis, Minnesota.

THE REPORT AND STUDY PROCESS

The report process began with the development of a *Plan of Study for Upper Mississippi River and Illinois Waterway Navigation Studies* which was published in draft form in July 1989. The report was distributed to State, Federal, and local agencies, special interest groups, and the public on August 7, 1989. A Notice of Study Initiation for the Illinois Waterway Navigation Study, which included an invitation to a public meeting, then was distributed on December 26, 1989. The 3-hour public scoping meeting was held in Peoria, Illinois, on January 31, 1990. The meeting established communication and offered a forum for the exchange of ideas and concerns early in the study.

Over the next several months, the study team developed this reconnaissance report. Efforts included performing field reconnaissance, attending many meetings, performing literature searches, and assessing and evaluating available economic, environmental, and engineering data associated with the Illinois Waterway System. Finally, each team member contributed to this three-volume reconnaissance report and developed a plan for further study which is incorporated in Appendix A - Initial Project Management Plan.

Volume 1 of this report includes the table of contents, the syllabus, the main report, Appendix A - Initial Project Management Plan, Appendix B - Planning Aid Report, and the distribution list. Volume 2 includes Appendix C - Economic Analysis and Appendix D - Hydrology and Hydraulics. Volume 3 includes Appendix E - Cultural Resources, Appendix F - Geotechnical, Appendix G - Public Involvement, and Appendix H - Pertinent Correspondence.

DESCRIPTION OF STUDY AREA

The study area is defined as the Illinois Waterway, its navigation system, and adjacent watershed. This important waterway system influences the Midwestern economy by providing a vital link for the shipment of commodities from Lake Michigan in Chicago southwesterly to where the waterway joins the Mississippi River at Grafton, Illinois. Located entirely within the State of Illinois, the navigable portion of the waterway meanders through 20 counties and is 327 miles long (see plate 1).

The northern one-quarter of the basin, which includes the Chicago metropolitan area, is primarily a highly developed, industrialized urban area. The remaining portion of the basin is essentially rural, with a few major industrial centers scattered throughout.

In addition to its economic importance, the Illinois Waterway area is rich in both natural and cultural resources. There are 669 known archeological sites and perhaps thousands of unrecorded sites located within the Illinois River Valley. Over 86,000 acres of open water and wetland habitats and 26,000 acres of terrestrial habitats support countless species of flora and fauna in and along the waterway (USFWS Planning Aid Report - Appendix B).

The Illinois Waterway also affords boating, fishing, trapping, and hunting opportunities to the residents of over 60 cities, towns, and villages located along the river. Riverboat gambling, recently legalized in Illinois, will offer yet another opportunity for recreation.

The navigation system consists of eight locks and dams constructed to provide a water transportation route with a minimum depth of 9 feet. The width of the navigation channel ranges from 225 feet at the Cal-Sag Channel in the northernmost portion to over 1,200 feet in the Upper Peoria Pool, River Miles (RM) 170 to 180.

As stated above, the waterway extends southwesterly for about 327 miles. From Lake Michigan to Lockport, the waterway is about 36 miles long. From Lockport south, extending downstream for some 60 miles, the waterway utilizes the Des Plaines and Illinois Rivers and consists of a series of four pools that have been created by permanent dams. Through this upper reach, the slope is steep and the waterway falls over 1.33 feet per mile.

Locks and dams controlling navigation in this section are Brandon Road, Dresden Island, Marseilles, and Starved Rock.

In the lower reach, the waterway is relatively flat and falls more gently, only 0.083 foot per mile. It extends 231 miles from Starved Rock to Grafton and is regulated by Starved Rock, Peoria, and LaGrange locks and dams. Two wicket dams, located at Peoria and LaGrange, assist in maintaining pool levels in the lower reach. During periods of low water stages, the wickets are raised to dam the river and to maintain navigation. The five locks in the upper section of the navigation system are electrically controlled, while the two locks in the lower reach and the northernmost lock, the T. J. O'Brien, are hydraulically operated. The waterway profile is illustrated on plate 4. A description of the navigation structures is included in table 1 below.

TABLE 1

Illinois Waterway Locks and Dams

Name of Lock and/or Dam	Miles Above the Mouth [1]	Age as of 1990	Size (WxL)	Lift [2]
T. J. O'Brien	327	30 yrs	110x1,000'	5'
Lockport	291	57 yrs	110x600'	40'
Brandon Road	286	57 yrs	110x600'	34'
Dresden Island	271	57 yrs	110x600'	22'
Marseilles	245	57 yrs	110x600'	24'
Starved Rock	231	57 yrs	110x600'	19'
Peoria	158	51 yrs	110x600'	11'
LaGrange	80	51 yrs	110x600'	10'

[1] Rounded to the nearest whole mile.

[2] *Lifts and depth on miter sills are those obtained with flat pools (rounded to the nearest 1 foot).*

The importance of the Illinois River is recorded in the early history of our Nation. The Illinois River was used by Indian canoes and early explorers for transportation. Pioneer families later migrated to the Midwest by way of the Great Lakes or the Ohio River. Then, as the land was developed, so did the importance of water transportation. First, rafts and flatboats were used to ship goods downstream. These vessels later were replaced by keelboats and steamboats. In 1822, Congress passed an act that served as the first step leading to the completion of the Illinois and Michigan Canal in 1848. Connecting Lake Michigan and the Illinois River at LaSalle, this canal, along with the mule-drawn barges that plied it, served for years as the first "connecting link" between the Great Lakes and the Mississippi waterway system.

In 1871, the State of Illinois built locks and dams on the Illinois River at Henry and at Copperas Creek to provide a navigation channel up river to LaSalle. By 1893, the

United States had constructed locks 75 feet wide and 350 feet long at Kampsville and LaGrange. Passage of a $20 million bond issue in 1908 provided funds for the State of Illinois to construct a navigation channel on the Des Plaines and Illinois Rivers from Lockport to Utica. However, construction did not begin until 1921. In 1927, Congress approved legislation authorizing a 9-foot-deep, 200-foot-wide, federally maintained channel on the Illinois River from Utica to Grafton. This legislation authorized the transferral of the State-owned submerged dams at Henry and Copperas to the Federal Government.

By 1930, the State of Illinois had constructed about 75 percent of its project, but was unable to raise the additional funds required to complete it. On July 3, 1930, Congress assigned the Federal Government responsibility for the project, which included construction of locks at Marseilles, Dresden Island, Brandon Road, Starved Rock, and Lockport.

The authorized Federal project for the Illinois Waterway provides for construction of the eight locks and six dams. The Federal project also provides for construction of supplementary locks at seven locations downstream of the Calumet-Sag Junction; a navigation channel with least dimensions of 9 feet in depth and 300 feet in width from the mouth of the Waterway at Grafton, Illinois, to Lockport, Illinois (291.1 miles); a navigable channel having a depth of not less than 9 feet and at present widths, from Lockport to a controlling works at mile 293.1 (2 miles); a channel with usable depth of 9 feet and width of 225 from the controlling works to Calumet-Sag Junction (10.4 miles) and along the Calumet-Sag Channel to Blue Island, Illinois (16 miles); a channel 9 feet deep and 300 feet wide in Calumet and Little Calumet Rivers, Blue Island to turning basin 5 in the Calumet River (7.8 miles); a channel with usable depth of 9 feet and a width of 225 feet along the general route of Grand Calumet River from its junction with Little Calumet River to and in the Indiana Harbor Canal to 141st Street, East Chicago, Indiana (9 miles); a channel having usable depth of 9 feet and a width of 160 feet from the junction of Indiana Harbor Canal and Grand Calumet River, to Clark Street in Gary, Indiana, with a turning basin at Clark Street (4.2 miles). The project also provides for a navigable channel having a depth of not less than 9 feet at present width from Calumet-Sag Junction to Lake Street, Chicago, via Chicago Sanitary and Ship Canal and South Branch of Chicago River, a distance of 22.1 miles. Provision is also made for a small-boat harbor in the vicinity of Peoria, Illinois, by construction of a basin 510 by 250 feet, at a depth of 7 feet, and protected by an earthen embankment riprapped on lakeside. Total length of the project from Grafton to Lake Street, Chicago, is 325.7 miles; to turning basin 5, 327.5 miles; to 141st Street, 334.7 miles; and to Clark Street in Gary, Indiana, 336.5 miles.

The completed portion of the Federal project includes the LaGrange, Peoria, Starved Rock, Marseilles, Dresden Island, and Brandon Road locks and dams; the Lockport lock, and the Thomas J. O'Brien lock and controlling works. A navigable channel 300 feet wide and 9 feet deep exists between Grafton and Lockport, Illinois, with the exception of the Marseilles Canal. Between Lockport and Calumet-Sag Junction, a channel having a width of 160 feet and a minimum depth of 9 feet exists. From Calumet-Sag Junction to turning basin 5, a channel having a minimum width and depth of 225 feet and 9 feet, respectively, has been constructed. From Calumet-Sag Junction to Lake Street, Chicago, a channel having a width of 160 feet and minimum depth of 9 feet exists.

The major remaining uncompleted items of work include widening at Pekin Bend, widening of the Marseilles Canal, and construction of the Calumet-Sag Navigation project, Part III, which generally consists of widening the Chicago and Sanitary Ship Canal from 160 to 225 feet between Lockport and Calumet-Sag Junction.

GEOMORPHOLOGY

The Illinois River basin is best described physiographically by dividing it into the Upper River and the Lower River sections. The Upper River is the section that flows westerly from the start of the Illinois River at the confluence of the Des Plaines and Kankakee Rivers to the town of Hennepin at the "Great Bend" of the river. Six locks are located within this section: Dresden Island, Marseilles, Starved Rock, Lockport, T. J. O'Brien, and Brandon Road. The Lower River flows southwesterly and contains La Grange and Peoria locks and dams.

Except for an area at its mouth, the river and its basin were affected by the Illinois glacier. More than half of the present river basin was covered by the Wisconsin Drift. Melting glaciers provided high discharges that determined the present river's physiography.

The average width of the Upper River is 400 feet, with banks 10 to 20 feet above normal pool elevations of around 550 feet National Geodetic Vertical Datum (NGVD). Rock bluffs prevail along the river, with land elevations on the bordering uplands averaging 750 feet NGVD. The Upper River Valley has numerous strip mines, quarries, and gravel pits along the adjacent floodplain and bluffs.

The Lower River occupies a preglacial channel whose bed is about 100 feet above a rock bottom, unlike the Upper Section which rests directly on the rock surface. The 55.8-mile segment between Hennepin and Pekin, Illinois, has an insignificant gradient of 0.82 inch per mile (Mills, *et al.*, 1966). The widest part of the Lower Section is near Grafton, Illinois, where its width spans nearly 1,400 feet. The accumulation of alluvial deposits has caused the river's capacity to be reduced within the banks. Over the years, many natural levees were formed from sediment deposited by tributary streams. The low-flow conditions set the stage for development of an extremely productive and diverse aquatic and wetland ecosystem. Low flows, combined with extensive cultivation and erosion of the land, create many backwater lakes, ponds, sloughs, and marshes for which the Illinois River is famous.

The Illinois Waterway's geologic characteristics vary greatly from its headwaters to its confluence with the Mississippi River. For this reason, the mineral resources, ground water, soils, and stratigraphy are described on a site-specific basis rather than system-wide. (Refer to appendix F for technical geomorphologic information.)

CLIMATE

Continental type climate dominates the area, characterized by frequent penetrations throughout the year of different types of air masses and their associated weather disturbances. The seasons are distinct, with great temperature variations occurring day-to-day, month-to-month, and year-to-year. Summers are commonly warm-to-hot and often humid. July is the warmest month. Winters are moderately cold, with January being the coldest month. The growing season varies from about 200 days in the southern portion of the basin to 160 days near Chicago.

HYDROLOGY

Principal tributaries of the Illinois River are the Des Plaines, Iroquois, Kankakee, Fox, Vermilion, Mackinaw, Spoon, Sangamon, and LaMoine Rivers and several smaller streams along the waterway. Waterway flows are measured by three U.S. Geological Survey (USGS) gages located at Meredosia, Kingston Mines, and Marseilles, RM 71.3, 145.0, and 246.6, respectively. Pool elevations vary with measurable rainfall and the amount of water diverted from Lake Michigan. Average annual rainfall for the area is 36 inches. Unique characteristics for each pool are described in Appendix D - Hydrology and Hydraulics.

WATER QUALITY

Beginning around 1900 with the diversion of Chicago sanitary waste into the river, water quality declined dramatically, especially in the upper pools. Although partial recovery of some aquatic resources has occurred in the past 20 years with the passage of the 1972 Clean Water Act, significant water quality problems remain. According to H. B. Mills', *et al.*, report entitled *Man's Effect on the Fish and Wildlife of the Illinois River* (1966), the number one problem impacting the aquatic resources is sedimentation and the resulting high turbidity levels. These problems are especially severe in the lower pools where sedimentation rates and turbidity levels tend to be higher. During low-flow periods in 1963 and 1964, the turbidity ranged from 71-320 Jackson Turbidity Units (JTU) in the Alton pool, 79-220 in LaGrange, and 15-140 in Peoria. Starved Rock pool ranged from only 15-52 for the same period (Mills, *et al.*, 1966). Most of this turbidity is still caused by the inflow and resuspension of sediments originating from upland erosion. These sediments are being deposited at alarming rates. F. C. Bellrose, *et al.*, produced a report in 1983 entitled *The Fate of Lakes in the Illinois River Valley*. The report estimates that Upper Peoria Lake was filling in at an average of 1.2 inches per year.

Sedimentation reduces the food supply for fish, waterfowl, and other wildlife. High turbidity levels reduce light penetration and have suppressed the reestablishment of aquatic vegetation needed by many species of fish, waterfowl, shorebirds, and mammals (Bellrose, *et al.*, 1979). Sediment resuspension is a problem of primary concern relative to increased navigation on the river. Since much of the river's remaining wildlife uses the main channel and main channel border, resuspension of sediments by navigation traffic needs to be evaluated for potential impacts to aquatic resources.

Sediment contamination is a potential problem anywhere along the waterway. Although existing point source contaminations are mostly under control, contaminants are still present in recently buried sediments. This is of particular concern in the upper reaches of the river near Chicago (i.e., Cal-Sag Canal). The most widespread contaminant affecting aquatic life is ammonia. Elutriate testing performed by the Corps of Engineers on dredged material samples has repeatedly shown ammonia levels that exceed State standards.

ENVIRONMENTAL RESOURCES

Before the opening of the Chicago Sanitary and Ship Canal, the backwaters of the river allowed luxuriant growths of aquatic vegetation that supported nationally significant populations of fish, waterfowl, and other wildlife. However, the increased flow provided by the canal's opening inundated thousands of acres of floodplain forests and resulted in the die-off of important species such as pin oak and pecan. Concurrent with the decrease in water quality came an increased development of manmade agricultural levees, resulting in the conversion of most backwater lakes to row crops. The most notable of these are Thompson and Flag Lakes near Havana, Illinois. The increasing silt burden of the river ultimately led to a drastic decline in submergent and aquatic vegetation from record high floods (and possibly pollutants) (Bellrose, *et al.*, 1979).

The lack of aquatic vegetation and ongoing high sedimentation rates are arguably two of the most significant problems impacting the river's wildlife today. For example, a study by Stall and Melsted (1951) of Lake Chautauqua showed that 18.3 percent of the lake's volume was lost in a 24-year period. The significance of the Illinois River's natural resources has been well documented by a multitude of investigators, the most notable being those working for the Illinois Natural History Survey (see publications of the Illinois Natural History Survey, 1876-1988).

SIGNIFICANT RESOURCES OF THE ILLINOIS RIVER

In addition to the technical significance given the river by the immense body of technical literature, the national significance of the Illinois River's natural resources is identified in the Water Resources Development Act of 1986 (Public Law 99-662). Section 1103, subsections (g) and (h)(2) of the act states:

> To ensure the coordinated development and enhancement of the Upper Mississippi River System, it is hereby declared to be the intent of Congress to recognize that system as a nationally significant ecosystem and a nationally significant commercial navigation system . . . the terms "Upper Mississippi River system" and "system" mean those reaches of river having commercial navigation channels on the . . . Illinois River and Waterway, Illinois;

The USFWS Planning Aid Report identified several natural resources of significance on the Illinois River. They include the following general resource categories: backwaters and side channels and associated wetlands; fish eggs, larvae, and adults; mussels; aquatic macrophytes; macro-invertebrates; and waterfowl. The known locations of these resources are identified in the USFWS Planning Aid Report - Appendix B.

AQUATIC BIOTA

Today the Illinois River is a narrow channel over most of its length with levees abutting much of the shoreline. Aquatic and terrestrial floodplain natural resources are now found mostly along the main river channel/border and designated refuges. In spite of the decline in the river's natural resources in recent decades, significant remnants of river ecosystem remain along with the potential to restore some of them to their former productivity. These resources include several federally endangered species and numerous State and Federal wildlife management areas and refuges. The USFWS Planning Aid Report (appendix B) identifies several significant biotic resources present along the Illinois Waterway. They include general resource categories such as fish eggs, larvae, and adults; mussels; aquatic macrophytes; macroinvertebrates; and waterfowl. Nearly 50 mammal species have been identified is this region, namely muskrat, beaver, raccoon, moles, shrew, vole, fox, coyote, and deer. (See appendix B for a detailed listing of the Illinois Waterways' significant biota and natural resources.)

Bellrose, *et al.* (1977) calculated the surface areas of various habitat types in the Illinois River. The habitat differences between the upper and lower river sections are very apparent. For example, in the Peoria and LaGrange pools there are 15,065 and 23,500 acres, respectively, of backwater lakes and ponds. Upstream of Peoria, however, there is only a total of 568 acres. Sloughs and side channel habitat types are probably the most scarce habitat on the entire waterway. The LaGrange pool has only 642 acres of side channel and slough habitat, and Peoria has only 546 acres of side channel and no sloughs. Upstream of Peoria there is only 21 acres of slough habitat and 599 acres of side channel.

Havera, *et al.* (1980) gives an excellent overview of the fishery resources of the Illinois River. In general, fish abundance and number of species increase proceeding downstream. Peoria, LaGrange, and Alton pools have approximately 100 species each, whereas the upper river segment from Dresden pool to Starved Rock has from 44 to 75 species. The upper waterway near Chicago such as the Calumet River has only 17 species. The most common species identified by Havera were carp, carpsuckers, catfish, gizzard shad, and emerald and spottail shiners. In the lower pools where more backwater habitat is available, sport fish such as crappie, largemouth bass, and sunfishes are abundant. The USFWS estimates that sport-fishing on the river generates about 2,135,000 activity days per year with an expenditure of $49.1 million.

Commercial fishermen harvested 777,301 pounds of fish in 1988 worth $233,530 (Fritz, Personal Communication) compared to almost 24 million pounds in 1908. The most recent high was 1,546,241 pounds in 1986 worth $425,315. Although water quality has improved, the loss of aquatic habitat, increased sediment inputs, and resulting loss of aquatic vegetation was too much of an impact for the fish resource to overcome. Bellrose, *et al.* (1977) attributed part of the fishery decline to the impoundments created by the 9-foot channel. Although the impoundments increased the acreage of backwater lakes and sloughs, they also increased sedimentation rates and elevated turbidity levels. Other studies such as Todd, *et al.* (1989) indicate that navigation traffic affects the way fishes utilize the main channel. The significance of these impacts has not yet been determined.

The Illinois River at one time supported a productive mussel or "clamming" industry. In 1922 (which was about 10 years after the peak), 2,759,000 million pounds of mussels was harvested for the pearl button industry. By 1966, commercial mussel fishing was confined to the lower 87 miles of river, and 25 mussel species had been extirpated from the river (Starrett 1971). Aside from any overharvesting that may have occurred earlier in the century, the decline in mussels can be attributed primarily to changed substrate conditions (increased silt) and undetermined pollutants.

A renewed interest in mussels began with the Japanese cultured pearl industry in the 1960's. The mussel resource has recovered enough in 20 years to generate a commercial harvest of 292.9 tons of mussels worth $321,874 in 1989 (Fritz, Personal Communication). The record high harvest for the 1980's was 731.1 tons in 1985, worth $402,451. The disproportionate value between 1985 and 1989 is due to the increased price per pound being paid by the shell buyers; up to $1.00 per pound for some species. These recent statistics indicate a significant improvement in the mussel resource relative to the 1970's and previous.

Another macroinvertebrate of major importance to the Illinois River is the fingernail clam (*Musculium transversum*). Although it has no commercial value, it is extremely important to the river's waterfowl. When aquatic vegetation was largely eliminated from the river in the 1940's (Bellrose, *et al.*, 1979), diving ducks switched to fingernail clams as a primary food source. Fingernail clams largely supported the migrating diving ducks of the Illinois River Valley until the clam's population collapse in the mid-1950's.

MIGRATORY BIRDS

The Illinois River is a nationally significant waterfowl flyway (Bellrose 1976, 1979). "The Illinois and Mississippi River Valleys are outstanding duck and goose areas whose fame for waterfowl flight dates back to pioneer days. There are more than 300 private hunting clubs located along the lower 200 miles of the Illinois River." In 1988, the annual fall USFWS aerial census recorded 17,673,930 waterfowl use days for dabbling ducks and 1,195,400 use days for diving ducks. (Note: Any discussion of waterfowl frequently distinguishes between diving ducks such as scaup, canvasback, and ruddy ducks and dabbling ducks such as mallards because of their differing food requirements.) The peak number of all ducks on the river for the fall migration in 1988 was 399,624. Waterfowl censuses were not initiated until 1938, so it is difficult to estimate historical use levels.

Dabbling duck migrants have varied from year to year, due primarily to water level fluctuations. When fall migrations coincide with high water events, moist soil plants used by the dabblers are lost and they move on to other habitat. Fall raises that partially flood moist soil plants on the extensive mudflats create very attractive conditions that keep dabblers in the area. The long-term decline in dabbling duck use days on the river is attributed mainly to loss of habitat in more northern habitats than any habitat degradation along the Illinois River.

Until the 1940's, diving ducks relied heavily upon submergent aquatic vegetation as a primary food source. A combination of record floods and high sediment loads severely reduced aquatic plants favored by divers in the 1940's. For the most part, divers switched to fingernail clams as an alternate food source. Divers remained relatively abundant until about 1953 when the fingernail clam population collapsed. The fall use days for divers then declined from 16,979,009 in 1953 to only 986,642 in 1957.

Habitat for fall migratory waterfowl is now maintained at several State and Federal management areas along the river. Numerous private duck clubs also provide some essential habitat. About 14,000 acres of wildlife refuges is maintained by the USFWS refuge system, including the Mark Twain National Wildlife Refuge and the Chautauqua National Wildlife Refuge. The State of Illinois manages over 50,000 acres at 23 sites along the river. It is estimated that waterfowl hunting generates 83,400 activity days per year with an expenditure of $2.2 million.

VEGETATION

Vegetation of the waterway is of such importance that it deserves separate discussion. Vegetation, or impacts to it, is the connecting thread that is found in practically all of the volumes of natural resource literature written on the Illinois River. The effects of sedimentation on the floodplain forests and aquatic vegetation relate directly to the health of the waterway's fish and wildlife resources. Few, if any, of the plant species critical to the waterway's fauna could be classified as endangered, but the remaining locations of aquatic vegetation constitute a resource of technical significance. Although not directly stated as such, it is well documented in scientific literature. This point was emphasized by biologists from several agencies at a coordination meeting for the present study. When discussing potential fish and wildlife enhancement features, the biologists stated that finding alternatives to help restore aquatic vegetation system-wide was a top priority.

THREATENED AND ENDANGERED SPECIES

Endangered or threatened animal species on the Illinois River and waterway identified by the USFWS are the gray bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*), American bittern (*Botarus lentiginosus*), great egret (*Casmeroides albus*), bald eagle (*Haliaeetus leucocephalus*), yellow mud turtle (*Kinosternon flavescens*) and Strecker's chorus frog (*Pseudacris streckeri*). The plant species decurrent false aster (*Boltonia decurrens*) is also on the threatened list at the Federal level.

CULTURAL RESOURCES

The Illinois River Valley and its associated environs have a rich record of human history spanning over 10,000 years. Beginning with its first use by Paleo Indian hunters and gatherers 10,000 years ago to the European discovery by Louis Jolliet and Father Marquette in 1673 and on to the present day, the river has been recognized for its wealth of natural resources and value as a transportation route. Significant information concerning the importance of this ecosystem and transportation route to our Nation's past is contained in the remaining archeological sites, standing structures, and historic documents which have survived to the present.

The majority of cultural resource data are included in appendix E (volume 3) which contains the body of a report entitled *The Illinois Waterway Archaeological Data Base* (IWADB) prepared by the Illinois State Museum Society under contract with the Rock Island District, Corps of Engineers. The IWADB is a compilation of the current knowledge of archeological sites in the Illinois River Valley. It contains a 206-page bibliography, cross-referenced by county, of archeological reports relevant to the study area. A component of the IWADB is a computerized data base for the 669 known archeological sites in the study area. The confidential data base has been installed on Rock Island District's Geographic Information System (GIS) and will be used to facilitate evaluation of future navigation study alternatives. Due to the paucity of previous systemic archeological surveys in the study area, the IWADB must be viewed as only a very small sample of the archeological resources actually existing along this waterway.

Appendix E also contains the body of a report entitled *Structural Inventory at the Illinois Waterway Locks and Dams: A Reconnaissance Level Survey of Historic Resources* which was prepared by Rock Island District staff. The document provides a preliminary inventory of historic properties which could be impacted by future improvements to the Illinois Waterway. A major component of the report is a photographic log of the approximately 140 extant structures located on federally owned land at the eight locks and dams controlling the Illinois Waterway. An historic overview of the Illinois River Valley is provided for context. Corps dredging guidance and an index of relevant Chief of Engineers' Reports from 1866 to 1917 are included as baseline information for addressing potential impacts to submerged historic properties.

The structural inventory report also contains a preliminary listing of historic maps and documents relevant to the waterway. Many of these original documents are currently housed at lock and dam field offices, and no detailed inventory is known to exist. In order to ensure the continued existence of these historic documents so important to the history of the Corps of Engineers, an inventory of the documents will be made for use during the feasibility phase of this study.

In terms of the National Historic Preservation Act, "significant historic properties" is defined as those properties listed in or eligible for listing in the National Register of Historic Places. The register includes prehistoric and historic districts, sites, buildings, structures, and objects as well as those artifacts, records, and remains associated with the property. To date, coordination wth the Illinois State Historic Preservation Office has not considered the Illinois Waterway System, including the locks and dams, to be eligible for listing on the National Register of Historic Places (see Appendix E - Cultural Resources). However, this does not preclude the potential for unevaluated individual structures as objects to be determined eligible during the feasibility phase of this study.

Appendix E also contains a compendium of those properties in the Illinois River Valley actually listed on the National Register of Historic Places. Major urban areas in the floodplain which contain listed properties such as Peoria and Chicago are not included in this compendium. In addition, the compendium does not contain those properties determined to be eligible (but not yet listed) pursuant to Section 106 of the National Historic Preservation Act. It must be noted, too, that there are hundreds of known archeological sites which have not been evaluated to determine National Register eligibility. There are also perhaps thousands of sites which have not been discovered that are potentially significant.

RECREATIONAL RESOURCES

In addition to providing for the commercial transportation needs of the nation, the Illinois Waterway provides a valuable and vital resource for water-based recreation. Recreation-related spending by Illinois residents totaled over $6.3 billion in 1985, or 5.7 percent of their total spending. As an indication of the economic significance of recreation in Illinois, this $6.3 billion clearly shows that recreation is a major industry in the state. Sixty-two percent of the State's 11 million people reside in the northeastern counties within an hour's drive of the Illinois Waterway. Many more live in the less urban counties through which the Illinois flows. Boaters can navigate from the Great Lakes to the Gulf of Mexico, as well as access a vast network of navigation systems and intercoastal waterways. Few watersheds provide such opportunities.

The Illinois Waterway is part of the Mississippi Basin, and, as such, is considered to be a nationally significant resource. Further, the Illinois Waterway and the Illinois and Michigan Canal National Heritage Corridor support and complement the recreational opportunities offered by the other. National attention to the region's resources is expected to increase in the future. As an example, the National Park Service has completed a trail study for the Illinois River and found it feasible and desirable to designate it as a National Historic Trail.

Numerous recreation sites, parks, and natural areas are found along the waterway, including Federal, State, county, municipal, and private areas. The Corps of Engineers' administration along the Illinois Waterway is limited to the locks and dams. Unlike the Mississippi River, no other Corps-managed lands or recreation areas exist. The two largest recreational providers are the U.S. Fish and Wildlife Service (USFWS) and the Illinois Department of Conservation (ILDOC). The USFWS manages two wildlife refuges along the system – Mark Twain National Wildlife Refuge and the Chautauqua National Wildlife Refuge – totaling approximately 14,000 acres. While these lands and water areas are managed primarily for fish and wildlife benefits, they play a significant role in meeting the recreational needs of the region's residents. The ILDOC manages approximately 50,000 acres of land, including State parks and conservation areas. Table 2 provides a complete listing of the recreational sites located along the waterway.

TABLE 2

Illinois Waterway Recreation Sites (by River Mile)

334.0	Hennepin
326.1	Marina City Marine
326.0	Sunset Harbor
325.5	Croissant Yacht Club
323.2	Pier II Marina
323.2	Sun Marine
322.8	Skipper's Marina
313.8	Public Boat Ramp
288.0	Will–Joliet Park
277.8	Dock 66
275.0	Three Rivers Marine Services Inc.
273.7	Harborside Marina
263.5	William G. Stratton State Park
253.0	Anchor Inn Marina
252.8	Spring Brook Marina
247.0	Illini State Park
242.0	Four Star Marina
240.0	Starved Rock Yacht Club
239.5	City of Ottawa Allen Park
239.5	Ottawa Boat Ramp
236.0	Buffalo Rock State Park
233.0	Starved Rock Marina
230.0	Starved Rock State Park
222.6	City Landing Area
222.0	South Shore Boat Club
218.5	Public Boat Ramp
218.5	Spring Valley Access Area
218.0	Spring Valley Boat Club
211.0	Lake DePue State Fish and Wildlife Area
207.6	Hennepin Landing
207.5	Hennepin City Park
199.0	Senachwine Lake
198.0	Putnam Co. Conservation District
196.0	Henry Harbor Marina
189.1	Lacon Municipal Harbor
189.0	City of Lacon Boat Ramp
182.0	Sparland Unit Fish & Wildlife Area
180.5	Chillicothe Boat Ramp
180.0	Chillicothe Marina
180.0	Marshall State Fish & Wildlife Area
178.8	Woodford Co. State Conservation Area
178.6	Hamm's Holiday Harbor
178.6	Seaway Marina
178.0	Woodford Co. State Fish & Wildlife
173.8	Spring Bay Marina
171.1	Gaylord Wildlife Area
170.7	Galena Marina – Launching Area
169.2	White Cap Drifters Boat Club
168.4	National Marine Sales
167.9	Rainbow Cove Marina
167.8	Illinois Valley Yacht/Canoe
167.7	Sodowski Boat Basin
166.2	Lorentz Street Overlook
165.4	Wharf Harbor Sales
165.1	Carl Spindler Marina and Camp
164.8	Cooper Park
164.3	Woodruff Field
163.7	Peoria Boat Club
163.7	Detweiller Marina
155.6	Bartonville Boat Ramp
152.9	Pekin Boat Access Area
145.6	Kingston Landing
143.2	Lancaster Landing
141.0	Banner Marsh State Fish and Wildlife Area
128.1	Liverpool Landing
128.0	Chautauqua Nat'l Wildlife Refuge Ramp
128.0	Liverpool Landing
122.1	Havana Boat Club
120.7	Havana City Ramp
119.4	Havana Ramp (DOC)
110.0	Bath Ramp
108.3	Anderson Lake State Conservation Area
108.1	Holmes Landing
98.9	Sangonois Conservation Area
97.2	Browning Landing
91.7	Fredrick Landing
88.1	Beardstown Landing
80.2	LaGrange Lock Ramp
74.2	Meridosia Lake #2
73.5	Meridosia Lake Narrows
71.1	Meridosia Ramp
65.6	Naples Boatel
61.2	Pike Co. State Fish and Wildlife Area
57.2	KE–LA–SU Access
48.5	Bedford Access
42.3	Pearl Access Area
32.1	Greene Co. Ramp & Access Area
32.1	Kampsville Access
27.5	Michael Landing
24.7	Godar Diamond Access
13.5	Hadley Landing Access Area
13.2	The Glades Landing
8.7	Long Lake Access
7.2	Pere Marquette St. Pk. Marina
3.5	Pere Marquette Bank Fishing Area
3.4	Poulman Lake Access
0.4	Grafton Ramp

Recreational pursuits afforded by the Illinois Waterway are varied and diverse. Some of the most noted include: sport fishing, various types of hunting, target shooting, trapping, motorboating, sailing, swimming, sunbathing, camping, picnicking, hiking, bicycling, horseback riding, sightseeing, photography, product gathering (mushrooming, berry picking, nut gathering), plant and wildlife observation, environmental education, cultural and interpretive activities, off-road vehicle riding, skiing, snowmobiling, and relaxing along the river.

Recreational use data for this array of activities is very limited at this time. However, the USFWS has collected some data specific to consumptive recreational uses along the Illinois River. According to USFWS data, annual hunting and fishing use totals 2.6 million activity days and involves $60.2 million in expenditures. Table 3 lists the use and expenditure information by activity. No data are available for the many other recreational activities pursued across the multi-agency jurisdictions which exist on the Illinois Waterway.

TABLE 3

Annual Fishing/Hunting Use and Expenditures on the Illinois River

Form of Recreation	Activity Days	Expenditures [1] Per Year
Sport Fishing	2,135,000 [2]	$49.1 million
Waterfowl Hunting	83,400 [3]	2.2 million
Deer Hunting	73,000 [3]	3.3 million
Small Game Hunting	400,000 [3]	5.6 million
TOTAL	2,691,400	$60.2 million

[1] From USFWS, 1989. ($23 fresh water sport fishing, $26 migratory birds, $45 big game, $14 small game).

[2] From Baur, 1988; Havera, *et al.*, 1980.

[3] Waterfowl and other hunting adapted from Conlin (1989) and represents activity for all counties adjacent to the Illinois River.

As a multiple-purpose waterway, the Illinois Waterway locks serve recreation vessels as well as commercial traffic. Within the Rock Island District, two Mississippi River locks have auxiliary locks. Unlike the Mississippi River navigation system, no auxiliary locks are present on the Illinois Waterway. Consequently, recreation craft often compete with commercial vessels for lockage, and, as a result, the competition limits the number of recreation craft using the locks. Boaters often choose to confine their activities to one pool rather than wait for lockage. In 1989, 36,636 recreation vessels were processed through the locks. This represents a new high and more than an 81 percent increase over lockages in 1976, which was the first year that recreation craft lockages were recorded (plate 2).

As indicated by the graph on plate 2, recreation traffic remained steady throughout the late 1970's and early 1980's, while traffic on the Mississippi experienced a marked decline due to the economic recession. Lockages at T. J. O'Brien account for half of all recreation vessels transiting the locks (plate 3) due to the large number of recreation vessels moving from docking facilities on the Calumet River to the recreational opportunities on Lake Michigan. The low lockage delays at T. J. O'Brien facilitate this arrangement. However, the canal portions of the Illinois Waterway are very confining and more hazardous to recreational boaters than other parts of the system.

This recreational lockage use represents just a portion of the total boating activity. As noted previously, many boaters prefer to limit their activities to one pool and therefore are not counted by the Corps of Engineers for the Performance Monitoring System (PMS) data base. Total boating use estimates are not available. Further, total boating use estimates would measure just a portion of the existing recreational use taking place on the Illinois Waterway.

SOCIOECONOMIC SETTING

The Illinois Waterway extends 327 miles from Lake Michigan to the Mississippi River, and is bordered by 20 counties and 15 major communities. River cities include: Chicago, Peoria, Joliet, Ottawa, LaSalle-Peru, Pekin, and Beardstown. The 1990 population for the Illinois Waterway counties is estimated at 7,207,100, with nearly 95 percent of this population residing in urban areas. Table 4 presents an overview of population trends for Illinois Waterway counties from 1985 through 2000.

TABLE 4

Population Trends for Illinois Waterway Counties, 1985 through 2000

Illinois Counties	1985	1990	2000	Estimated 1990 Urban Population (%)
Brown	5,300	5,200	5,100	1
Bureau	37,700	36,800	35,200	34
Calhoun	5,700	5,600	5,400	1
Cass	14,300	13,700	12,800	42
Cook	5,308,500	5,361,100	5,432,100	100
Dupage	718,200	781,900	863,500	98
Fulton	39,500	36,500	32,100	47
Greene	15,900	15,200	14,200	35
Grundy	31,300	31,800	32,400	39
Jersey	20,300	20,200	20,100	37
LaSalle	108,800	106,300	101,200	63
Marshall	13,600	13,200	12,600	19
Mason	17,900	17,000	15,700	36
Morgan	36,700	36,200	35,500	63
Peoria	188,200	180,600	170,400	84
Pike	18,200	17,600	16,800	1
Putnam	6,000	5,900	5,700	22
Schuyler	7,900	7,500	6,800	40
Scott	6,000	5,900	5,500	1
Tazewell	127,100	123,600	117,200	77
Will	333,600	352,900	379,000	78
Woodford	32,600	32,400	32,000	21
TOTAL	7,093,300	7,207,100	7,351,300	95

Source: State of Illinois, Bureau of the Budget, *Illinois Population Trends: 1980 to 2025.*

Economic activities along the waterway center on agricultural and industrial production. Regional industries produce chemicals, fertilizers, petroleum products, earthmoving equipment and off-highway trucks, communication towers, plastics, plate and sheet metal, and diesel engines. Agricultural activities focus on crop production, including corn, soybeans, feed grains, vegetables, and pumpkins. Other important activities along the waterway include meat processing and manufacturing of patio furniture, paper products, musical instruments, and appliances.

The navigation system is important for transporting goods that are either produced or consumed in the Upper Midwest region, to and from the South, and overseas markets.

Direct economic effects from commercial navigation include spending and employment generated by the commercial navigation industry, including wages, fuel, supplies, rents, and terminal expenses. Indirect economic effects include the inter-industry activities supported by the purchases of supplies, service, labor, and other inputs. Induced effects include economic activity that comes from household purchases of goods and services made possible because of the wages generated by the direct and indirect economic activities.

Section 2 - Plan Formulation

PROBLEMS, NEEDS, AND OPPORTUNITIES (EXISTING AND EXPECTED)

SYSTEM-WIDE PROBLEMS

The following paragraphs describe the findings of the reconnaissance study with regard to problems associated with the entire navigation system. Terms used in this section are those used in the Performance Monitoring System (PMS), specifically defined in the *PMS User Manual for Data Collection and Editing* (Manual 85-UM-1, August 1985). See the glossary located at the end of the main report.

Lockage Delays

Lockage delays occur on the Illinois Waterway due to increased tonnage being transported on a navigation system designed to handle tow sizes up to 600 feet. Tow sizes today are routinely 1,200 feet long, and double locking is a common, time-consuming, and costly process. Statistics concerning lock delays in the following paragraphs were published in the *1988 Inland Waterway Review.*

The total average processing time for Illinois Waterway locks, which includes arrival at the lock to the end of lockage, in 1987 ranged from 38 minutes to 371 minutes (6.18 hours), with a median value of 139 minutes. Total peak average processing time for the 1980-1987 time period ranged from 49 minutes (1980) for T. J. O'Brien to 977 minutes or 16.28 hours (1981) for Peoria.

Total delay ranged from 173 hours to 15,384 hours in 1987. Total delay time was high at all the locks except for T. J. O'Brien. The median value of total delay is 3,388.50 hours, and T. J. O'Brien was the only lock that fell considerably below this value. The peak total delay for the 1980-1987 time period varied from 1,152 hours (1980) for T. J. O'Brien to 35,925 hours (1981) for Peoria. Peoria Lock had the highest peak total delay (35,925 hours in 1981) in this segment from 1980 to 1987. Lock utilization for 1987 ranged from 34 percent to 54 percent.

Utilization rates for LaGrange, Peoria, Marseilles, and Lockport were all greater than the median value of 48.5 percent. The peak utilization data from 1980 through 1987 ranged from 38 percent (1986) at T. J. O'Brien to 100 percent (1981) at LaGrange. In this segment, the highest peak utilization for the 1980-1987 time period was 100 percent in 1981 for LaGrange.

Total downtime ranged from 6 hours to 336 hours. Four locks (Starved Rock, Marseilles, Dresden Island, and T. J. O'Brien) fell below the median of 105.5 hours. The total peak downtime varied from 15 hours in 1982 at T. J. O'Brien to 1,631 hours in 1985 at LaGrange. The highest total peak downtime during the 1980-1987 time period occurred in 1985 at LaGrange (1,631 hours).

Total stall events for 1987 ranged from 6 to 119, and the median value is 46 stall events. The peak for total stall events from 1980 to 1987 ranged from 13 at T. J. O'Brien in 1981 to 119 at LaGrange in 1987. From 1980 through 1987, LaGrange had the highest peak total stall events of 119 in 1987.

Projected Traffic Demands

Commodities on the Illinois Waterway reflect the influence of an agriculturally dominated lower waterway, with the Chicago metropolitan area exerting a strong influence on commodities moved on the upper portion of the waterway. The upper portion is tied more toward the industrial sector, with coal, petroleum products, and chemical products accounting for about half of all commodities shipped and received.

Commerce on the Illinois Waterway has experienced moderate growth over the past decade (see plate 5). Total traffic has been over 40 million tons for 7 of the past 10 years. Grain tonnage grew from 12.5 million in 1979 to a peak in 1982 of 18.6 million (45 percent of total traffic in that year), then declined to 13.8 million in 1986. The volume of coal traffic has generally been increasing, from a low of 4.2 million tons in 1978 to a high of 7.5 million tons in 1986. Petroleum products tonnage has remained fairly stable throughout the decade.

Waterborne Commerce Statistics for 1988 (the most recent available) show that total traffic on the Illinois Waterway was 40.5 million tons. Grain constituted 34 percent of the traffic (13.6 million tons) followed by petroleum products at 16 percent (6.5 million tons), coal at 15 percent (5.9 million tons), and chemical products at 11 percent (4.5 million tons).

The *1988 Inland Waterway Review* projects tonnage transported on the Illinois Waterway to increase at an average annual rate between 1.2 and 2.5 percent through the year 2000. Farm products are the largest factor affecting future projections. By the year 2000, movements of farm products on the Illinois River are forecast to range between 21.4 and 25.3 million tons. Traffic of coal and petroleum products is projected to experience slow, steady growth, while the movement of non-metallic minerals is projected to remain static. Plates 6, 7, and 8 show historic tonnage and trends for locks representing the upper, middle, and lower portions of the river, respectively.

Modern towboats moving commodities on the Illinois Waterway are limited to about 5,000 horsepower and move a typical tow size of about 5 to 10 barges. The general types of barges used are: (1) open hopper, (2) covered hopper, (3) deck, and (4) tank. Open hopper barges are used for all types of bulk solid cargo (primarily coal) and account for about 45 percent of the tonnage capacity of all barges operating on the inland waterways. Covered hopper barges, carrying mainly grain and fertilizer, account for about 25 percent of the total tonnage capacity. Tank barges (for petroleum and chemicals) and deck barges make up about 22 and 8 percent, respectively.

Table 5 compares historical tonnage growth and the *1988 Inland Waterway Review* traffic growth rates. As can be seen, the annual historical rate percent is equivalent to or exceeds the high *1988 Inland Waterway Review* rate at O'Brien, Peoria, and LaGrange locks.

TABLE 5

Comparison of Historic and 1988 Inland Waterway Review Traffic Growth Rates [1]

Lock	Low	Med	High [1]	Historical 1950-1988 [2]
O'Brien	0.6	1.1	2.0	2.2
Lockport	0.5	1.2	1.9	1.2
Brandon	0.5	1.2	1.9	1.1
Dresden	0.5	1.2	1.9	1.4
Marseilles	0.8	1.5	2.2	1.6
Starved Rock	1.0	1.6	2.4	2.0
Peoria	1.3	1.9	2.7	2.7
LaGrange	1.4	2.0	2.8	4.6

[1] Commodity-specific traffic growth rate applied to commodity distribution at the lock.

[2] Compound annual growth rate, percent.

SITE-SPECIFIC PROBLEMS

The following paragraphs describe major features of each structure as constructed, the major rehabilitation effort, the present condition of the structure, and problems with towboat approaches. Table 6 compares similar characteristics at each site.

TABLE 6

Illinois Waterway Lock and Dam Characteristics

LOCK			DAM			
Name	Type of Construction	Character of Foundation	Kind	Type of Construction	Character of Foundation	Year Complete
LaGrange	Concrete	Piles in sand	Moveable (wicket with A-frame crest)	Concrete and timber	Piles in sand	1939
Peoria	Concrete	Piles in sand	Moveable (wicket type)	Concrete and timber	Piles in sand	1939
Starved Rock	Concrete	Rock	Moveable (tainter gates)	Concrete and structural steel	Rock	1933
Marseilles	Concrete	Rock	Moveable (tainter gates)	Concrete and structural steel	Rock	1933
Dresden Island	Concrete	Rock	Moveable (tainter gates)	Concrete and structural steel	Rock	1933
Brandon Road	Concrete	Rock	Moveable (tainter gates)	Concrete and structural steel	Rock	1933
Lockport	Concrete	Rock	Moveable	Concrete and structural steel	Rock	1933
T.J. O'Brien	Concrete and sheet piling	Piles in clay	Fixed	Concrete and sheet piling	Piles in clay	1960

Thomas J. O'Brien

a. **Description.** The O'Brien lock, constructed in 1960, is located on the Little Calumet River about 326 miles above the mouth of the Illinois River and about 2,700 feet south of the deep-draft Calumet River. The project links the Upper Mississippi River inland navigation system and the Great Lakes deep draft system. The flow of the Little Calumet River has been reversed to carry polluted water away from Lake Michigan; the purpose of the O'Brien Lock and Controlling Works is to regulate and maintain this flow and to prevent backflow into the lake. The lock normally operates for downstream flows at partial gate openings because of limitations on Lake Michigan diversions.

(1) **Navigation Lock.** The O'Brien lock has a usable chamber of 110 feet by 1,000 feet. The lock is a low lift sector gate lock with sheet pile cellular walls capped with concrete. The average depth over the sills is 18.5 feet. The lift varies between 0 to 5 feet depending on the water level of Lake Michigan.

(2) **Fixed Dam & Controlling Works.** The fixed dam is connected directly to the lock and extends about 257 feet easterly to the left bank of the river. The fixed dam (approximately 205 feet long) consists of two sections, with the controlling structure located westward of the center of the dam. It is a steel sheet pile structure with an approximate pile length of 36 feet. The controlling structure is 53 feet long and consists of four slide gate sections founded on "H" piles.

b. **Major Rehabilitation.** There has been no major rehabilitation project at this facility.

c. **Condition of Existing Structures.** The latest periodic inspection, dated September 1987, found the facility to be structurally safe and stable. No operational deficiencies were noted. Itemized elements inspected and discussed were dam concrete surfaces, operating machinery, and structural steel components.

d. **Approach Problems.** There are no upper or lower approach problems with this facility.

Lockport Lock

a. **Description.** The Lockport lock, completed in 1933, is located on the Chicago Sanitary and Ship Canal at RM 291. The lock has a usable chamber of 110 feet by 600 feet and a lift of 39.5 feet. Lock walls and sills are mass concrete structures founded on limestone. The upper two gates are submersible vertical lift gates and the lower gate is a horizontally framed miter gate. The filling and emptying system is of the wall-port type. The average filling and emptying times of the lock chamber are 22.5 and 15 minutes, respectively. The right descending wall is the river wall with the backside exposed above the elevation of the low pool. The left wall retains stone rubble backfill material. The upper guidewall is a part of the channel walls upstream of Lockport lock. The left wall extends from the junction of the Chicago Sanitary and Ship Canal with the Calumet-Sag Channel to the lock, a distance of about 12 miles. The 1,000 feet of the left channel wall immediately upstream of the lock serves as a guidewall and is provided with mooring bits. The right wall is an earth and rock fill embankment with a core wall and is about 2 miles long. The channel walls were constructed in the early 1900's by the Metropolitan Sanitary District of Greater Chicago (MSDGC). The lower guidewall is an L-shaped 3-foot-thick concrete facing extending 9 feet down from the top of the wall. The wall protects the limestone rock ledge and provides a smooth surface for guiding tows into and out of the lock.

(1) **Powerhouse.** The powerhouse is a gravity structure at the west end of the dam. Bays 1 and 2 have vertical turbines which are used for power generation. Bays 3 and 4 have the turbines and generators removed and are used to regulate water flow. Between bays 4 and 5 are butterfly gates controlling the electrical exciter chamber. Bays 5 and 6 have horizontal turbines but are bulkheaded off with a concrete closure. Bay 7 has the turbine removed and is used to regulate water flow. Bay 8 never had the turbine installed and is closed with a concrete bulkhead. Adjacent to the powerhouse is a 20-foot, 9-inch-high sluice gate.

(2) **Sanitary District Canal Lock.** At the east end of the dam adjacent to Lockport lock is the abandoned Sanitary District canal lock. The lock is approximately 130 feet by 22 feet and is sealed with a concrete bulkhead on the upstream end.

(3) **Controlling Works.** The Lockport Controlling Works, completed in 1900, is located on the right descending bank of the canal. It consists of seven operable sluice gates; 8 bulkheaded sluice gate openings with a retaining wall; an abandoned bear trap dam; and 4 concrete-filled, 30-foot-diameter protection cells. The seven operable 30-foot by 20-foot-high vertical lift sluice gates control discharge from the canal during storm periods. The 160-foot-long abandoned bear trap dam was originally designed to operate as a dam with a movable sill elevation. The dam's major structural steel components have been removed and its spillway backfilled. The 8 bulkheaded sluice gate openings also are protected by a retaining wall and earthen embankment on its downstream side. The controlling works provide an additional outlet from the canal to the Des Plaines River to help minimize flooding in the city of Chicago. The canal water surface is lowered several feet in anticipation of major storm runoff in the city of Chicago.

b. **Major Rehabilitation.** Major rehabilitation of the lock and controlling works was performed from 1983 to 1988. The major work items included: removal of an old butterfly dam upstream, stabilization of the lock, concrete resurfacing, electrical systems replacement, miter gate and lift gate machinery replacement, and lower miter gate replacement.

c. **Condition of Existing Structures.** The latest periodic inspection, dated July 1985, found the lock facility to be structurally safe and stable. An analysis and inspection are under way to determine stability of the Lockport dike. No operational deficiencies were noted. Itemized elements inspected and discussed include the lock concrete surfaces, lock machinery, and structural steel components.

d. **Approach Problems.** Due to the relatively low volume of traffic, there are no problems at the upper or lower approaches.

Brandon Road Lock and Dam

a. **Description.** The Brandon Road Lock and Dam, completed in 1933, is located at RM 286 of the Illinois Waterway on the Des Plaines River. The lock and dam maintain the waterway pool at elevation 539.0 feet NGVD. The lock is of gravity wall design founded on rock with a usable chamber of 110 feet wide by 600 feet long with miter gates at both ends. Normal lift is 34 feet. The filling system is of the side port type. The average filling and emptying times for the lock are 19 and 15 minutes, respectively. There also is a pair of guard miter gates on the upstream end. The upper guidewall consists of concrete beams which span 40 feet between piers. The lower guidewalls are founded on bedrock with post tensioned anchors added for stability. The upper guidewall is 610 feet long, while the lower guidewalls are 190 feet on the left bank and 600 feet on the right bank.

On the dam there are 21 gates which span a distance of 1,100 feet. The tainter gates are 50 feet wide, 2 feet 3.5 inches high, and have a radius of 6 feet. Each gate is composed of two counter-weighted side arms and a horizontal truss spanning between the side arms. Electric winches with cables are used to operate the gates. The overflow section is a converted ice chute gate which is 30 feet wide. The conversion consisted of removing the existing steel gate and appurtenances, removing approximately 100 cubic yards of concrete, and placing concrete to form the overflow. The original dam contained six sluice gate openings that spanned a distance of 91 feet. These gates have been closed off with concrete bulkheads. There is also a head gate section that originally was intended for hydropower use. Formerly there were 16 gate openings which spanned a total length of 328 feet. Eight of these openings have been closed off with concrete bulkheads. The remaining eight gates are roller type headgates spanning an opening of 15.75 feet by 15 feet each. Three stationary and one movable electric gate hoists are used to operate the eight gates. An earthen embankment abuts each side of the lock and extends from the concrete dam structure to the Illinois and Michigan Canal. The embankment has a core wall that extends from bedrock to elevation 539.0 NGVD. The Joliet Channel walls extend upstream of the dam through the city of Joliet and help retain the Brandon pool. The walls are of gravity design, 15 to 40 feet in height, and are founded on rock with a sewer system included at the base of the walls.

b. **Major Rehabilitation.** Major rehabilitation of the lock and dam was accomplished from 1983 to 1988. This work included miter gate repairs, concrete resurfacing, electrical and mechanical systems replacement, and gate bulkhead closures.

c. **Condition of Existing Structures.** The *Brandon Road Periodic Inspection*, dated September 1987, found the facility to be structurally safe and stable. No operational deficiencies were noted. Itemized elements inspected and discussed include the lock and dam concrete surfaces, operating machinery, and structural steel components.

d. **Approach Problems.** The upper approach has a narrow channel in the Joliet area which constrains traffic during low flows. An area just upstream of the Ruby Street bridge is in extremely bad condition due to a shallow rock cut. The lower approach is obstructed by the Brandon Road lift bridge, located only 200 feet below the lower miter gates. The 600-foot guidewalls on the upper and lower approaches are inefficient for double lockages.

Dresden Island Lock and Dam

a. **Description.** The Dresden Island Lock and Dam, completed in 1933, is located immediately downstream of the junction of the Des Plaines and Kankakee Rivers at RM 271.5 of the Illinois River, and approximately 8 river miles northeast from Morris, Illinois. The dam is operated to maintain a normal pool elevation of 504.5 feet NGVD in order to provide a 9-foot channel between miles 271.5 and 286 on the waterway. The lock is of gravity wall design founded on rock with a usable chamber 110 feet wide by 600 feet long with horizontally framed miter gates at both ends. Normal lift is 21.75 feet. The filling system is of the side port type. The average filling and emptying times of the lock are 14 and 12 minutes, respectively. The lower guidewall is of gravity design founded on rock. The upper guidewall consists of sand-filled sheet pile cells with concrete beams between the cells. Between the operating lock and the dam are upper gate monoliths for a lock. A concrete arch dam spans between the gate monoliths. Adjoining the lock is the control section of the dam, consisting of nine counter-weighted tainter gates and an ogee spillway section. Next to the tainter gates is a 30-foot-wide ice chute section.

b. **Major Rehabilitation.** From 1977 to 1983, major rehabilitation of the structures was performed. This work included concrete resurfacing, gate repair, tainter gates 4 and 9 replacement, head gate closures, machinery replacement, stabilizations, and lock house repair.

c. **Condition of Existing Structures.** The latest periodic inspection report, dated July 1985, found the facility to be structurally safe and stable. No operational deficiencies were noted. Itemized elements inspected and discussed include the lock and dam concrete surfaces, operating machinery, and structural steel components.

d. **Approach Problems.** There are very few problems with the upper approach, but there are several problems with the lower approach. Dredging is required to make use of the existing mooring cells located just below the lock. The low railroad bridge below the lock inhibits tows from passing and increases approach time. The 600-foot upper and lower guidewalls are inefficient for double lockages.

Marseilles Lock and Dam

a. **Description.** The Marseilles Lock and Dam, completed in 1933, is located at the mouth of the Marseilles canal near RM 247 on the Illinois River, near the city of Marseilles, approximately 65 miles southwest of Chicago, Illinois. The dam is operated to maintain a normal pool elevation of 483.17 feet NGVD in order to provide a 9-foot channel between miles 244.5 and 271.5 on the waterway. The lock is located near mile 244.6 at the downstream end of the Marseilles canal. The lock is of gravity wall design founded on shale with a usable chamber of 110 feet wide by 600 feet long with horizontally framed miter gates on both ends. Normal lift is 24 feet. The filling system is of the side port type. The average filling and emptying times of the lock are 15 and 10 minutes, respectively. The main dam is a gated structure founded on shale and spans across the Illinois River at the mouth of the Marseilles canal. The main dam consists of a 552-foot-long tainter gate section and a 46.5-foot-long overflow section. The eight spillway tainter gates span 552 feet. The gates are submersible design and are 60 feet wide and 16 feet high. The headrace dam on the south channel consists of a 76-foot-long section with one tainter gate. The headrace dam across the north channel is a 144-foot-long section with two tainter gates. The fixed dam section between the two headrace dams is about 170 feet long. An earthen dike extends upstream along the Illinois River from the north headrace channel abutment.

b. **Major Rehabilitation.** Major rehabilitation at the site since its completion has included concrete resurfacing, machinery replacement, electrical systems replacement, new submersible tainter gates and machinery, new service bridge, and a new central control station. New controls allow the operation of the eight spillway tainter gates to be either automatic or remote manual control.

c. **Condition of Existing Structures.** The latest periodic inspection, dated September 1987, found the facility to be structurally safe and stable. No operational deficiencies were noted. Itemized elements inspected and discussed include the lock and dam concrete surfaces, operating machinery, and structural steel components.

d. **Approach Problems.** The upper approach is severely restricted due to the 2.4-mile-long and 200-foot-wide canal above the lock. While widening of the canal was recommended in House Document No. 184, 73rd Congress, 2nd Session, and authorized in the 1936 River and Harbor Act, only a 200-foot-wide channel was constructed. Consequently, the area of vessel thoroughfare continues to be inadequate for safe and efficient navigation through the channel. The only place in this narrow canal where tows can pass is just above the lock. When the chamber is being filled during lower water periods, traffic virtually comes to a standstill due to shallow water. An additional problem is an outdraft problem at the upstream end of the canal when the dam is passing high flows. The only problem with the lower approach is the need for dredging around the existing mooring cells.

Starved Rock Lock and Dam

a. **Description.** Starved Rock Lock and Dam, completed in 1933, is located near RM 231 on the Illinois River, near the city of Utica and approximately 85 miles southwest of Chicago, Illinois. The dam is operated to maintain a normal pool elevation of 458.7 feet NGVD in order to provide a 9-foot channel between miles 231.0 and 244.5 on the waterway. The lock chamber walls are concrete gravity type with both the landwall and riverwall retaining backfill. The usable lock chamber is 110 feet by 600 feet. The maximum lift is 19 feet. The average filling and emptying times are 12 and 9 minutes, respectively. The upstream guidewall consists of 30 concrete piers spaced at 20-foot centers. The piers are 3 feet thick by 13 feet wide and are encased in 18-foot 8-inch-diameter steel sheet pile cells. A concrete beam 6 feet wide by 7 feet deep spans the top of the piers. The lower guidewall is a concrete gravity type. The service gates are miter type and are horizontally framed.

The dam has an overall length of 1,280 feet and consists of four sections as follows: (1) fixed dam, 30 feet long; (2) head gates, 518 feet long; (3) ice chute, 52 feet; and (4) tainter gate section, 680 feet long. The head gates are double leaf vertical lift gates of riveted construction, with leaves 15 feet 5 inches wide and approximately 8 feet 6 inches high. The concrete piers are 4 feet thick by 30 feet wide and are located on 16-foot centers. The gate bays have been bulkheaded with reinforced concrete. The boiler house is 18 feet wide by 70 feet long; it houses a boiler and miscellaneous equipment used for tainter gate operation. Presently, the boiler house is used to provide steam which is used in a portable rig to heat the frozen gates. The ice chute pier is 8 feet wide by 59 feet long. The gate has been removed and the recess filled with concrete to form an overflow weir. There are 10 spillway tainter gates, each is 60 feet wide by 17 feet high. The tainter gate concrete piers are 8 feet wide by 59 feet long.

b. **Major Rehabilitation.** Major rehabilitation of the site took place from 1978 through 1984. The rehabilitation included concrete resurfacing, head gate closure, electrical crossover replacement, miter gate machinery replacement, and bridge decking replacement.

c. **Condition of Existing Structures.** The latest periodic inspection, dated September 1987, found the facility to be structurally safe and stable. No operational deficiencies were noted. Itemized elements inspected and discussed include the lock and dam concrete surfaces, operating machinery, and structural steel components.

d. **Approach Problems.** The upper approach has no serious problems. The entire lower approach is restrictive due to the narrow channel and tows cannot pass for approximately 1.5 miles below the lock. The existing 600-foot lower and upper guidewalls are inefficient for double lockages.

Peoria Lock and Dam

a. **Description.** The Peoria Lock and Dam is located at RM 157.7 just downstream from Peoria, Illinois. The lock and dam were completed in 1939. The dam is operated to maintain a normal pool elevation of 440.0 feet NGVD in order to provide a 9-foot channel between miles 157.7 and 231.0 on the waterway. The dam is comprised of wicket gates which are raised to create a navigation pool during low flows and lowered during high flows to allow for open pass conditions. This open pass condition is present 40 percent of the time in an average year. The wooden wickets are supported by a concrete sill which is founded on timber piles. These wicket gates contain parts that are over 50 years old and may be in need of complete replacement in the next 20 years. Steel sheet pile cutoffs are present at both the heel and toe of the dam. A regulating structure exists on the right bank of the dam. The dam maintains a 73-mile-long navigation pool that extends upstream to Starved Rock Lock and Dam. Normal upper pool is at elevation 440.0 NGVD. The minimum tailwater at Peoria is 429.0. The Peoria Lock is located on the left bank. The lock chamber is 110 feet wide by 600 feet long with hydraulically operated miter gates at each end of the lock. The maximum lock lift is 11 feet. The average lock filling and emptying time is 10 minutes. The lock walls and gate sills are of mass concrete construction and are founded on timber piles. A steel sheet pile cutoff exists under the lock walls and gate sills.

b. **Major Rehabilitation.** The Peoria Lock and Dam was rehabilitated between 1985 and 1990. This rehabilitation included upgrading the lock's mechanical/electrical systems, replacing deteriorated concrete, rehabilitating the miter gates, and rehabilitating the central control house. Rehabilitation of the dam included construction of a submersible tainter gate to replace a portion of the wicket gates. This will prevent ice and debris buildup in the upper approach to the lock and decrease the need for wicket gate operation.

c. **Condition of Existing Structures.** The latest periodic inspection, dated August 1982, found the facility to be structurally safe and stable. No operational deficiencies were noted. Itemized elements inspected and discussed include the lock and dam concrete surfaces, operating machinery, and structural steel components.

d. **Approach Problems.** The upper approach has few problems. The 600-foot upper guidewall is restrictive during double lockages, however, the I-474 bridge piers could restrict any possible extension. The lower approach does not allow for tows to wait within 1.5 miles of the lock. The 600-foot lower guidewall is inefficient for double lockages and is overtopped before the dam is completely lowered.

LaGrange Lock and Dam

a. **Description.** The LaGrange Lock and Dam is located at RM 80.2, 8 miles downstream from Beardstown, Illinois. The lock and dam were completed in 1939. The dam is operated to maintain a normal pool elevation of 429.0 feet NGVD in order to provide a 9-foot channel between RM 80.2 and 157.7 on the waterway. The dam is comprised of wicket gates which are raised to create a navigation pool during low water and lowered during high water to allow for open pass conditions. This open pass condition is present 47 percent of the time in an average year. The wooden wickets are supported by a concrete sill which is founded on timber piles. These wicket gates contain parts that are over 50 years old and may be in need of complete replacement in the next 20 years. Steel sheet pile cutoffs are present at both the heel and toe of the dam. A regulating structure exists on the left bank of the dam. The dam maintains a 78-mile-long navigation pool that extends upstream to Peoria Lock and Dam. Normal upper pool is at elevation 429.0 NGVD. The minimum tailwater at Peoria is 419.0. The LaGrange lock, located on the right bank, has a lock chamber that is 110 feet wide by 600 feet long with hydraulically operated miter gates at each end of the lock. The maximum lock lift is 10 feet. The average lock filling and emptying time is 10 minutes. The lock walls and gate sills are of mass concrete construction and are founded on timber piles. A steel sheet pile cutoff exists under the lock walls and gate sills.

b. **Major Rehabilitation.** The LaGrange Lock and Dam was rehabilitated between 1985 and 1990. This rehabilitation included upgrading the lock's mechanical/electrical systems, replacing deteriorated concrete, rehabilitating the miter gates and rehabilitating the central control house. Rehabilitation of the dam included construction of a submersible tainter gate to replace a portion of the wicket gates. This will prevent ice and debris build up in the upper approach to the lock and decrease the need for wicket gate operation during these conditions.

c. **Condition of Existing Structures.** The latest periodic inspection, dated August 1982, found the facility to be structurally safe and stable. No operational deficiencies were noted. Itemized elements inspected and discussed include the lock and dam concrete surfaces, operating machinery, and structural steel components.

d. **Approach Problems.** The upper approach has very few problems. The lower approach is narrow and tows do not have an exchange point close to the dam. The 600-foot upper and lower guidewalls are also inefficient for double lockages.

NEEDS

The preceding section described the existing conditions and associated problems for the Illinois Waterway. For this navigation study, the specified general needs are to:

a. Modernize the navigation system to meet the current and projected level of river traffic in the most cost-effective manner.

b. Protect the environmental and cultural resources in and around the waterway.

OPPORTUNITIES/STUDY OBJECTIVES

The *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*, dated March 10, 1983, stipulates that "The Federal objectives of water and related land-resources planning is to contribute to national economic development (NED) consistent with protecting the nation's environment ...." Contributions to NED are direct benefits and costs that accrue to the planning (study) area and the rest of the Nation. The Federal objective is further specified in terms of alleviating problems, satisfying needs, and realizing opportunities within the planning area or region. For the Illinois Waterway Navigation Study, the specified planning opportunities or objectives are:

a. Reduce the lockage delays (costs) to navigation throughout the system.

b. Restore and enhance fish and wildlife habitat and other natural resources on the Illinois River.

c. Evaluate the anticipated demand for recreational traffic.

d. Identify and preserve significant historic properties.

e. Provide a hazard-risk analysis for the system.

PLANNING CONSTRAINTS

The general planning constraint for this study is that it should be conducted within the boundary of all laws of the United States and by the State of Illinois, all Executive Orders of the President, and all engineering regulations of the Corps of Engineers.

FORMULATION AND EVALUATION OF ALTERNATIVE PLANS

The objective of this section is to identify and assess a preliminary number of alternative plans that will fully or partially satisfy the navigation concerns. Both nonstructural and structural measures have been developed to determine (1) the existence of alternatives that are economically feasible and warrant further Federal participation and (2) the scope of possible plans for future plan formulation efforts. The following paragraphs identify the alternatives considered in the reconnaissance study.

Based on preliminary system economic modeling, it was determined that LaGrange, Peoria, and Marseilles were the first physical constraints on the Illinois Waterway. The following alternatives considered were focused on those areas.

"WITHOUT PROJECT" CONDITION

A key element in the formulation process is to identify the most likely condition expected to exist in the future, given the absence of any improvements to service and as provided by the existing navigation system. This is referred to as the "Without Project" condition. The Without Project condition serves as a baseline against which alternative improvements are evaluated. The increment of change between an alternative plan and the Without Project condition provides the basis for evaluating the beneficial or adverse economic, environmental, and social effects of the considered plan.

National economic benefits of a project, a principal evaluation criteria for water resource studies, are determined by computing the difference of the average annual transportation costs for with- and without-project conditions.

The Without Project condition selected for use in this study assumes the following:

a. Ordinary operation and maintenance of the existing locks and dams on the system will be continued through the period of economic analysis, and rehabilitation or replacement in-kind of the project will be undertaken as needed to ensure continued navigability.

b. All existing waterway projects or those under construction are to be considered in place and will be operated and maintained through the period of analysis.

c. All reasonable nonstructural measures for improving lock efficiency that are within the purview of the Corps are assumed to be implemented at the appropriate time. All locks on the Illinois Waterway Navigation System were assumed to be using the most efficient locking policy.

d. Waterway user taxes would continue in the form of the towboat fuel tax prescribed by Public Law 99-662, the Water Resources Development Act of 1986.

e. Alternative surface transportation systems (rail, truck) are assumed to have sufficient capacity to move the waterway traffic at current rates over the period of analysis.

NONSTRUCTURAL MEASURES

Generally, nonstructural measures which can have a measurable effect on lock delays include such items as (1) use of helper or switch boats to assist in removing unpowered "cuts" from the lock chamber and (2) operation of various queuing disciplines to maximize tow processing efficiencies. Helper boats are available at both LaGrange and Peoria. The use of the most efficient queuing discipline was considered in evaluating the lock capacity for the without-project condition. It was determined that 1-up 1-down was the most efficient policy at Lockport, Brandon Road, and Dresden Island. A 10-up 10-down policy was most efficient at Marseilles, Starved Rock, Peoria, and LaGrange. Use of this policy adds substantial capacity to the without-project condition at Marseilles.

MINOR STRUCTURAL MEASURES

Minor structural measures include extending guidewalls, installing powered kevels, constructing mooring cells, and improving lock approaches. Based on the projected traffic conditions, these measures would be short-term improvements to extend the useful life of existing structures. These short-term alternatives will be fully evaluated during feasibility. However, if a long-term solution is performed at LaGrange and Peoria, widening of Marseilles canal could be a viable long-term solution and should be studied further.

MAJOR STRUCTURAL MEASURES

Major structural measures evaluated include: (1) constructing a 1,200-foot by 110-foot lock at LaGrange and constructing a 1,200-foot by 110-foot lock at Peoria; (2) enlarging existing locks at Peoria and/or LaGrange; and (3) constructing a new lock and dam near LaGrange which combines Peoria and LaGrange pools. Each of these major structural measures would fully satisfy the navigation concerns. Further detailed impact analysis will be required in a feasibility study.

ALTERNATIVE PLANS CONSIDERED

The primary focus of the formulation efforts for this stage of the analysis is reduction in existing and projected lock congestion. Due to the limited scope of this reconnaissance study, four of the potential plans screened were retained for a preliminary impact assessment. This section will focus on the four highest priority sites in terms of delays for the Illinois Waterway System, namely LaGrange, Peoria, and Marseilles. The plans include the construction of an additional 1,200-foot by 110-foot lock at LaGrange (Plan 1); the construction of an additional 1,200-foot by 110-foot lock at Peoria and LaGrange (Plan 2); an improvement to the Marseilles canal assuming that additional 1,200-foot by 110-foot locks were in place at Peoria and Marseilles (Plan 3); and the construction of a new lock and dam facility near LaGrange which combines Peoria and LaGrange pools (Plan 4).

PRELIMINARY ECONOMIC ANALYSIS

To evaluate alternatives, measurement and allocation of transportation saving benefits and costs for alternative system configurations on the Illinois Waterway require the consideration of several important issues. Foremost among these issues is the interrelationship between locks in the system and a determination by which alterations at one lock affect the efficiency of the system as a whole. This issue is referred to as "systems analysis." The General Equilibrium Model (GEM) is the system navigation model used in this study. The GEM model is designed to measure the transportation resource savings of potential actions affecting a navigation system by computing systemic equilibria of traffic. A systemic equilibrium is a system-wide level of traffic such that all movements transiting any portion of the system have economic incentive to do so, and all movements not transiting the system have no incentive to use the system. Systemic equilibria of various system alternatives may then be compared to determine the transportation resource cost savings of the potential actions.

The mathematical model itself is a non-linear programming formulation. The model is capable of handling individual movements with many alternate systemic routings. That is, the model will allocate movements to the least cost water routing (or divert a movement entirely from the waterway system) when more than one possible routing exists for that given movement.

Explicit recognition is made in the model of the interdependency of individual movement transit costs. The transit costs, faced by each potential movement, are an increasing function of the levels of other system traffic. Hence, the systemic equilibrium is a mutually consistent set of individual equilibria where each movement transits the system if, and only if, it has economic incentive to do so given every other movement's transit decision.

A detailed description of the GEM model and the input requirements can be found in appendix C. Plans considered in this analysis are discussed below. Due to the limited scope of this reconnaissance study, Plan 4 was not economically evaluated.

PLAN 1

Construct a 1,200-foot by 110-foot lock at LaGrange, retaining the existing 600-foot by 110-foot lock. Two lock chambers, located too close together, will create interference during lock approach and exit. To account for this phenomenon, the capacity of the 600-foot by 110-foot lock has been reduced to 60 percent of normal. To calculate the capacity of a 1,200-foot by 110-foot lock, it was assumed that all lockages would be singles with approach, chambering, and exit times based on Performance Monitoring System (PMS) records. At this level of capacity, significant delays are eliminated at LaGrange lock for the time span of our period of analysis.

PLAN 2

Construct a 1,200-foot by 110-foot lock at Peoria, retaining the existing 600-foot by 110-foot lock. This plan assumes that the lock addition at LaGrange, described in Plan 1, is in place. Plan 2 also assumes 60 percent capacity for the existing 600-foot by 110-foot lock at Peoria. At this level of capacity, significant delays are eliminated at both Peoria and LaGrange locks for the time span of our period of analysis.

PLAN 3

Widen Marseilles Canal. This plan assumes that the capacity and delay at Marseilles is improved to be equivalent to the Dresden Island lock. This plan also assumes that Plans 1 and 2 are in place.

Capacity and delay at one-half capacity used for each plan is shown in table 7.

TABLE 7

Capacity and Delay Parameters for Plans

	Without-Project		With-Project	
Plan	Capacity (millions of tons)	Delay at One-Half Capacity (hours)	Capacity (millions of tons)	Delay at One-Half Capacity (hours)
1 - LaGrange	58.9	.84	164.0	.210
2 - LaGrange	164.0	.210	164.0	.210
- Peoria	58.5	.88	170.8	.370
3 - LaGrange	164.0	.210	164.0	.210
- Peoria	170.8	.370	170.8	.370
- Marseilles	36.8	2.49	42.4	1.060

Note that capacities shown account for both the capacity of the existing lock and the proposed improvement where appropriate.

AVERAGE ANNUAL COSTS

The first costs developed in this report and interest during construction are displayed in table 8. Annual costs for all plans considered were computed using an 8-7/8 percent interest rate, a 50-year project life, and July 1990 price levels. Interest during construction was calculated based on a 4-year construction period for Plans 1 and 2 (addition of 1,200-foot locks at LaGrange and Peoria, respectively), and a 2-year construction period for Plan 3 (widening the Marseilles canal).

TABLE 8

Summary of First Cost
Interest During Construction and Annual Cost
($1,000,000)

Plan	First Cost	Interest During Construction	Investment Cost	Annual Investment Cost
1 - LaGrange	380.0	72.5 [1]	452.5	40.7
2 - Peoria	390.0	74.4 [1]	464.4	41.8
3 - Marseilles	8.1	0.7 [2]	8.8	.8

[1] Based on 4-year construction period.
[2] Based on 2-year construction period.

SYSTEM BENEFITS AND TIMING OF IMPLEMENTATION

The benefits calculated for each plan are entirely based on general navigation. Two measures of these benefits were estimated for each plan — total benefits and incremental benefits. Total benefits represent the transportation cost savings realized by all movements using the Illinois Waterway locks. The incremental benefits include only those system benefits attributable to the improvements called for under each plan. The incremental benefits are the appropriate values for use in the economic analysis of alternatives. System analysis techniques were used to measure the performance of the Illinois Waterway Navigation System with and without the alternative plans.

To establish the base case or without-project condition, the GEM model was run using the inputs for existing 1987 traffic and projected traffic in 1990 and in 10-year increments through 2040. The primary outputs of GEM over the 50-year period of analysis are delays at each system lock, tonnage at each lock, system tonnage moved, and total system transport costs (gross rate savings minus delay costs) for all movements transiting the Illinois Waterway.

The lock that shows up to be the major system constraint, i.e., the lock with the highest delays over the period of analysis, is analyzed for alternative solutions to reduce or eliminate the delays. On the Illinois Waterway, LaGrange lock was identified as being the first major constraint. Plates 9 and 10 show projected delays in hours/tow and tonnage at LaGrange lock, respectively, over the 50-year period of analysis. Annual tonnage moved on the system over the 50-year period is displayed on plate 11. (Note that this does not include tonnage that does not transit at least one Illinois Waterway lock). Unconstrained tonnage assumes that the locks have adequate capacity to pass projected traffic.

It is simply base traffic multiplied by the projected traffic growth rate. Constrained traffic accounts for the limited capacity of the Illinois Waterway locks. Plate 11 shows the added increment of traffic that moves on the system with each plan. When delay costs exceed the gross rate savings that water transport has over rail, then movements divert from water to rail transport. As can be seen in plate 12, significant diversions off the waterway occur just after the year 2010, under the without-project condition. Removing a constraint on the system reduces the cost of delay, allowing commodities to move on the waterway at a reduced cost.

Total dollar annual system benefits for the base case or without-project condition over the 50-year period of analysis are displayed in plate 13. As previously explained, system benefits are the gross rate savings water transport has over rail minus the delay costs on the waterway summed for all water movements in the analysis. Undiscounted (incremental) annual benefits for each plan are also shown in plate 13.

Incremental benefits include only those system benefits attributable to the improvements called for under each plan. They represent the difference between without-project and with-project system model runs. Incremental benefits for Plan 1 are the increase over the base condition. Incremental benefits for Plan 2 are the increase over Plan 1. Incremental benefits for Plan 3 are the increase over Plan 2.

For further illustration, incremental system benefits for a 1,200-foot lock addition at LaGrange over the 50-year period of analysis are shown on plate 14. These data are presented in tabular form (discounted) in table 9, along with benefit-to-cost ratios and net benefits. System benefits generally grow over time with increasing traffic, then decline when delays build at another system lock or constraint. Accounting for future (discounted) benefits shows the average annual benefits over the projected life of the project. As can be seen in the table below, projects at LaGrange, Peoria, and Marseilles can be implemented in the year 2000 with positive benefit-to-cost ratios.

TABLE 9

Average Annual Discounted Benefits and Costs [1]
July 1990 Price Levels, 8-7/8 Percent
($1,000,000)

Plan	Annual Benefits [2] Base Year	Benefits	Annual Cost	Benefit-to-Cost Ratio	Net Benefits
1	2000	55.0	40.7	1.4	14.3
2	2000	48.6	41.8	1.2	6.8
3	2000	16.9	0.8	21.1	16.1

1 Using high traffic growth scenario.
2 Discounted stream of benefits back to stated base year annualized over 50 years. (Base year + 50).

Under the high growth scenario, demand will exceed capacity at seven locks on the Illinois Waterway by the year 2040. This is illustrated in table 10. The needs, other than at LaGrange and Peoria (and the Marseilles canal) are sufficiently out into the future not to require immediate study. It should be noted, however, that in calculating benefits for alternatives considered in this reconnaissance phase, the cost of constraints caused by all locks in the system is fully accounted for. Therefore, future studies on capacity expansion measures at other locks would not constitute "double counting" of benefits.

TABLE 10

Illinois Waterway System Needs Assessment
High Growth Scenario

Lock	1987 WCSC Tonnage (million tons)	Capacity (million tons)	Year Capacity Reached	Average Growth Rate 1987 to Yr. Cap Reached	Lock Replacement in Year 2000 Justified
LaGrange	30.4	58.9	2010	2.9%	Yes
Peoria	26.4	58.5	2015	2.9%	Yes
Marseilles	17.2	36.8	2022	2.2%	No
Starved Rock	19.0	47.5	2023	2.6%	No
Lockport	13.8	29.5	2023	2.1%	No
Brandon	14.3	32.1	2025	2.2%	No
Dresden	16.0	42.4	2031	2.2%	No

As can be seed from the above table, LaGrange is projected to be the first lock where demand will exceed capacity. Associated with this are large delays and diversion of traffic off the system. This was observed in the results of the system model (GEM). When the replacement of LaGrange was analyzed with GEM, it was noted that the reduction of delay at LaGrange allowed tonnage to grow, creating substantial increases in delay at Peoria. Despite this, the overall level of system delay decreased (ton-hours of delay) and additionally much more system traffic was accommodated. The overall result was that replacement of LaGrange alone could yield positive net benefits.

SENSITIVITY ANALYSIS

Traffic growth rates have a significant impact on system benefits, and, in turn, on how early a project can be implemented. The Illinois Waterway System Analysis used commodity-specific high traffic growth rates from the *1988 Inland Waterway Review.*

Table 5, shown in the "Projected Traffic Demands" section of this report, compares historical tonnage growth and the *1988 Inland Waterway Review* traffic growth rates. As can be seen, the annual historical rate of 4.6 percent exceeds the high *1988 Inland Waterway Review* rate of 2.8 percent at LaGrange lock. Also, the historical period 1973-1980 shows an even higher annual growth of 5.4 percent for LaGrange lock.

Using medium *Inland Waterway Review* growth rates would result in a significant reduction in system benefits, but still show project justification (the addition of a 1,200-foot lock with a benefit-to-cost ratio greater than 1) in year 2003 at LaGrange lock.

Using the low growth rate, a 1,200-foot lock at LaGrange is justified in the year 2012.

SUMMARY

This analysis determines a near-term Federal interest in construction of additional locks on the Illinois Waterway. Justification for a 1,200-foot lock at LaGrange (benefit-to-cost ratio greater than 1) occurs earlier than the year 2000 using the *Inland Waterway Review* high traffic growth rates, which are clearly supported by historical PMS data, and discussions with shippers and carriers on the waterway. Justification for a 1,200-foot lock at Peoria and improvements to the upstream approach at Marseilles also occurs before the year 2000, given that a 1,200-foot lock is in place at LaGrange. With 1,200-foot lock additions in place at LaGrange and Peoria and improvements to the Marseilles canal, the next major constraint identified was Starved Rock Lock, with justification for an additional lock in the 2000-2010 timeframe.

PRELIMINARY ENVIRONMENTAL EVALUATION

Navigation impacts can be assigned to either: (1) site-specific impacts caused by construction or (2) system-wide and cumulative impacts caused by an increased number of tows transiting the navigation system. Site-specific impacts are relatively easy to evaluate compared to system-wide effects. Determining system-wide impacts related to navigation has been the focus of several State and Federal research efforts for many years. A discussion of the Mississippi River Lock and Dam 26 (Melvin Price Lock and Dam) project in the St. Louis District is included here because it has set the stage for this study. The study area for that project also included 331 miles of the Illinois River.

Regional interest in navigation impacts intensified since the St. Louis District's improvement of Lock and Dam 26 (Melvin Price Lock and Dam) on the Mississippi River. The addition of a second 600-foot lock for that project prompted the preparation of an Environmental Impact Statement (EIS). The difficulty in determining navigation impacts to aquatic resources is exemplified by that EIS. The St. Louis District stated in the EIS that "...the overall system-wide impacts of the second lock are minor." The USFWS, the five surrounding states, and several private environmental groups strongly objected to the conclusions of the draft environmental impact statement (DEIS) released in September 1986. As a whole, the State environmental resource agencies, USFWS, U.S. Environmental Protection Agency (EPA), and private environmental groups commented that the DEIS had insufficient information to make a determination of whether or not any significant system-wide impacts would occur. The EPA assigned the project a rating of "EO-2" (Environmental Objections-Insufficient information).

A supplemental DEIS then was prepared and released in November 1987 to address their concerns. It was still judged to be inadequate in terms of impact evaluation. In addition, the USFWS could not issue a Final Coordination Act Report on the project since the Final Environmental Impact Statement (FEIS) lacked a mitigation plan. They also advised that an acceptable mitigation plan could not be prepared until further studies to evaluate navigation impacts from the second lock were conducted. This recommendation was included in the Record of Decision for the EIS. The USFWS therefore issued an Interim Fish and Wildlife Coordination Act Report for the FEIS in March 1988. An FEIS for that project was issued in July 1988, but with several unresolved issues. The Record of Decision was signed in November 1988.

One of the significant unresolved issues was "the existence of data gaps in our knowledge of the UMRS and the impacts of navigation upon that system." The USFWS concurred with a proposal that a Plan of Study (POS) be conducted to determine the incremental effects of increased tow traffic. Since incremental impacts from increased tow traffic could not be predicted, the FEIS contained no mitigation plan. The St. Louis District concluded that any adverse impacts would be minor and require no mitigation. According to the FEIS, a mitigation plan will be prepared following completion of the POS *if* impacts were identified. An interagency team of biologists was convened to prepare the POS for the second lock. A draft POS document was released in September 1989 (U.S. Army Engineer District, St. Louis). A preliminary draft of the POS recommended that 15 separate work units be funded over a 10-year period to study navigation impacts at an estimated cost of $27 million. At this time, the POS has not been approved or funded. In order of importance, the following 15 work units and estimated study lengths were recommended (further details of these work units are contained in the USFWS's Planning Aid Report and the Draft POS report):

Subject Matter Critical to Illinois R. EIS[1]		Work Unit (In order of ranking by POS team)
Yes	1.	Physical Forces (5 years)
Yes	2.	Side Channel/Backwater Sediment (5 years)
Yes	5.	Backwaters (5 years)
Yes	6.	Adult fish (5 years)
Yes	3.	Fish: Early Stages (4 years)
Yes	8.	Plants: Sediments (7 years)
Yes	4.	Mussels (3 years)
Yes	7.	Larval Fish: Drawdown (2 years)
No	16.	Induced Development (3 years)
No	14.	Sight Feeding fish (1 year)
Yes	9.	Plants: Waves (5 years)
No	10.	Macroinvertebrates (4 years)
No	12.	Phytoplankton (1 year)
No	13.	Commercial Fishing (4 years)
No	11.	Waterfowl Hazing (3 years)
Yes	15.	Data Management & Math Models (8 years)

[1] Indicates that this POS work unit will provide information for the EIS in the feasibility phase. Progress on each of these work units will be reflected in the quality and quantity of data available on which to base the navigation study EIS.

The acquisition of adequate environmental data to complete NEPA requirements in the feasibility phase is dependent upon navigation impact information of the sort to be generated by the Melvin Price Lock and Dam Plan of Study (POS). This view is held by the Rock Island District, the Illinois Department of Conservation (and other State resources agencies, i.e., Illinois State Natural History Survey), the U.S. EPA, and the USFWS. The USFWS's Planning Aid Report (appendix B) assumes that the POS studies are indispensable in completing an EIS. The U.S. EPA's view reinforces that assumption and also advises that several of the POS studies need to be completed sooner than anticipated in order to fit the projected feasibility schedule.

The insistence of the agencies that the POS studies be completed before the EIS is prepared stems from the Melvin Price Lock and Dam second lock controversy. The State and Federal resource agencies held the view that construction of the second lock should not proceed because there was insufficient environmental data to predict whether or not increases in navigation traffic would cause significant impacts. The record indicates that an all out attempt by the environmental community (private and governmental agencies) to block construction of the second lock was avoided by the promise of the St. Louis District to conduct post-construction studies on navigation impacts.

The uncertain implementation of the POS explains why the USFWS, the U.S. EPA, and others are unwilling to concur with any additional navigation projects until data of the sort expected to be generated by the POS are available. Failure to have the information of the quality and quantity expected to be generated by the POS studies available during the feasibility phase will likely cause serious problems and very lengthy delays in completing NEPA requirements. This likely would include the U.S. EPA elevating the EIS to the Council on Environmental Quality for resolution, elevation by the USFWS to the Washington level on endangered species, and lawsuits by private environmental groups.

NEPA REQUIREMENTS

The recommendation of this reconnaissance study to pursue study of removing the first major constraint of the system, identified as LaGrange in this report, will require the preparation of an EIS. A reconnaissance study for the Mississippi River is being performed concurrently with the study on the Illinois River. The suggestion has been made that a combined EIS for both studies should be made. An inspection of the tow traffic indicates that there is very little interchange of traffic between the study areas. Hence, any navigation improvements on the Illinois are unlikely to affect Upper Mississippi River traffic. On this basis, the Rock Island District recommended the preparation of a separate EIS for each navigation study. The USFWS and State biologists raised no objection to this recommendation at an environmental coordination meeting held during this study. The U.S. EPA also indicated no opposition to this recommendation in their letter.

This does not mean that potential impacts to the Upper Mississippi River will not be evaluated, however. Any impacts to the Mississippi River identified during the feasibility phase will be addressed. The EIS prepared in a first feasibility study will be a system-wide EIS that evaluates potential impacts to the Illinois Waterway. Any additional navigation improvements studied afterward will contain a site-specific EIS that also addresses the incremental impact of that additional improvement.

POTENTIAL IMPACTS OF PLANS RECOMMENDED FOR FURTHER STUDY

Site Specific

Site-specific impacts resulting from additional 1,200-foot locks at Peoria and La-Grange are difficult to predict until alternative designs can be examined. Some of the potential site-specific impacts to be evaluated are:

- Loss of benthic and riparian habitat in and adjacent to the construction site.

- Changes in the lock and or dam structure that could alter tailwater velocities or water quality (i.e., dissolved oxygen).
- Changes in lock approach patterns that could cause towboats to increase bank erosion or benthic disturbance.
- Water quality impacts from dredging (i.e., release of contaminated sediments).
- Impacts to recreational boating.
- As historic properties, modification of the Peoria and LaGrange lock and dams may affect their potential National Register of Historic Places eligibility.

Construction of a new impoundment to replace Peoria and LaGrange locks could have the site-specific impacts identified above as well as impacts associated with raising water levels in a reservoir. First and foremost would be the inundation of several miles of shoreline under several feet of water, resulting in a significant loss of bottom land forest and conversion of wetlands to deep water. Shallow backwaters inevitably would suffer from increased sedimentation.

Increased water depths would likely cause adverse impacts to local levee and drainage districts and refuge and wildlife management areas adjacent to the river. Such an impoundment could cause changes in river morphology that would affect fish and mussel resources. Aside from the impacts to both man-made and natural resources, there could be an opportunity for wildlife enhancement on newly inundated lands. The determination of whether such an impoundment would create a net benefit for wildlife or net habitat loss ultimately would depend on where such a dam were located and how it would be operated.

System Impacts

Determining whether or not systemic impacts resulting from increased navigation will occur will be extremely time consuming and costly if performed in accordance with traditional scientific methods. In addition to the difficulty in predicting these impacts is the difficulty in predicting how traffic will increase as the result of a proposed improvement. Projected increases in tonnage is not a good parameter to use in habitat evaluation. Increases in the number of towboats per year transiting the system is more reflective of potential effects.

The USFWS Planning Aid Report uses the projected number of tows per day (converted from projected tonnage increases).

The types of physical impacts likely to occur on the Illinois River will be very similar to those discussed in the Lock and Dam 26 FEIS and illustrated in Figure 4 of the Planning Aid Report.

The narrow navigation channel on the Illinois River and its close proximity to the shoreline in places may exacerbate some effects. The most likely system-wide impacts will be sediment related. These would include: (1) sediment resuspension effects by tows and its effect on main channel fish and vegetation; (2) substrate disturbance impacts on fish spawning, mussels, vegetation; (3) increased bank erosion in particular and its effect on riparian vegetation and animals; (4) propeller-related effects on aquatic organisms (i.e., larval fish); and (5) erosion, accretion, and saturation of cultural resources due to pool fluctuation, channel increases, and navigation turbulence.

Before the overall impacts of increased tow traffic can be determined, four levels of evaluation are needed: (1) what physical impacts towboat passage imparts on the aquatic habitat and its biota; (2) assessing the potential for burying, eroding, or otherwise disturbing cultural resources; (3) what is the sum effect of multiple tow passage on the significant resources in the study area; and (4) determining appropriate mitigation for any significant adverse impacts.

The EIS completed for the Lock and Dam 26 second lock has not yet completed the first step to everyone's satisfaction. There are numerous studies that show physical effects ranging from negligible to significant. This is due in part to the fact that the studies were performed under different river or laboratory conditions with different organisms, etc. The results of the previous studies are inconclusive. Determination of physical impacts is the number one work unit priority in the Second Lock POS. Agency agreement on how to evaluate these physical impacts will be essential during the early stages of feasibility. Determining the sum of these impacts on the system also will be a major task. It is not practical to perform field studies for each significant resource location along the river. This mandates that some type of predictive impact model be used.

Development of a model is a part of the St. Louis District's POS. Such a model will be useful in identifying and quantifying impacts on river resources at certain sites. Whether or not the sites identified by a model would require mitigation can be determined only by more site-specific field studies. The USFWS's Planning Aid Report discusses several models that could be used in the feasibility study. The model being considered most seriously at this time is one developed by the Louisville District, Corps of Engineers, for use on the Ohio River System. Huntington District also is considering its use in their navigation studies. Because it is still being perfected, the Navigation Predictive Analysis Technique, or NAVPAT, is yet undocumented. With assistance from the Rock Island District, a documentation of the model's input and outputs should be available in the fall of 1990. The Rock Island District is working with Louisville District to determine if NAVPAT can provide the needed information for the Illinois River study. The potential of NAVPAT also is being investigated by the Long-Term Resource Monitoring (LTRM) element of the Upper Mississippi River System Environmental Management Program (UMRS-EMP).

The EMP is a 10-year effort authorized by the Water Resources Development Act of 1986. Its activities include demonstrating and investigating methods of habitat enhancement on the UMRS, collecting data on long-term habitat trends, and investigating causes and solutions of specific resource problems on the UMRS. Under this effort, the LTRM is conducting a field demonstration of the NAVPAT model to determine its value on the UMRS. The LTRM is also conducting certain navigation physical impact studies since navigation is a major element affecting the UMRS. On the basis of the LTRM's NAVPAT demonstration and further coordination with Louisville District, the Rock Island District will decide if NAVPAT should be used in impact evaluation during the feasibility study.

POTENTIAL MITIGATION FEATURES

The USFWS Coordination Act Report for the Lock and Dam 26 FEIS discussed multiple mitigation alternatives that would be applicable to the Illinois River. Schnick, *et al.* (1982) discusses mitigation for the UMRS in great detail.

Foremost among the mitigation alternatives, as mandated by Corps of Engineers regulations, should be investigation of "avoid and minimize" measures. As part of the Record of Decision for Lock and Dam 26, the Corps of Engineers recommended the initiation of a program to address such measures (including the Illinois River). Next to the USFWS's recommendation to complete the POS, the implementation of "avoid and minimize" measures is one of their highest priorities.

RECOMMENDED ENVIRONMENTAL STUDIES TO BE PERFORMED IN FEASIBILITY PHASE

The Rock Island District, the USFWS, and the States support the implementation of the second lock POS. The POS is a joint product of these agencies and outside experts. It offers the best possible avenue of achieving a mutual agreement on what navigation impacts are likely to occur. At this time, the POS has not been approved or funded. If the feasibility phase is to proceed as proposed, it is imperative that data such as that expected to be obtained from certain elements of the POS be available as soon as possible.

At present, the ideal feasibility study timeframe is 3 years. Several of the critical POS work units (physical impacts in particular) are projected to take 5 years to complete. This means that final results of the most critical study may not be available until a minimum of 2 years after the feasibility study's earliest completion. This discrepancy is even wider since the FEIS would have to be started at least 1.5 years before submission. The USFWS has indicated that they will not provide a Final Coordination Act Report until completion of the second lock POS. Quoting from recommendations in the Planning Aid Report:

> Most important among these recommendations is the completion of the St. Louis District POS, so that we can complete our Fish and Wildlife

Coordination Act Requirements. Any future delay in implementation of this study will only serve to delay future feasibility planning.

The U.S. EPA also has expressed concern about the lag between POS results and the proposed feasibility schedule, further emphasizing the POS importance to this study.

Although the POS will provide essential data on navigation impacts necessary to complete the EIS, additional site-specific and systemic studies also will be needed. The USFWS's Planning Aid Report has identified these as follows:

I. <u>Site-Specific Studies</u>

a. Mussel surveys

b. Sediment analyses

c. Hydraulic changes in flow patterns, etc.

d. Riparian effects (i.e., bank erosion from altered tow use)

e. Biological Assessment

II. <u>Systemic Effects</u>

a. Main channel mussel survey

b. Bank erosion

c. Resource inventory in Alton Pool

d. Adapt Louisville NAVPAT model for use

e. Sediment analyses

f. Identify increased barge fleeting needs

g. Assess potential for accidental spills

h. Determine recreation use on the river

i. Determine cumulative effects

The following studies and courses of action are recommended for feasibility phase planning in order to assure the preparation of a timely and defensible NEPA document:

a. Substantially complete essential POS work tasks or funding of similar studies for this project;

b. Prepare EIS and associated items (i.e., Biological Assessment, USFWS Coordination Act Report) exclusive of other studies listed separately;

c. Conduct a mussel survey of study area to determine location of significant mussel beds and predict impacts to benthic organisms;

d. Implement Louisville District NAVPAT model, or a model of similar purpose;

e. Obtain assistance from USFWS in developing and conducting NAVPAT, or similar, analysis;

f. Perform sediment analyses for contaminants at LaGrange Lock and Dam and determine water quality impacts of sediment resuspension;

g. Determine riparian impacts of bank erosion at one new lock. Based on the NAVPAT, or similar, model, evaluate system-wide impacts of bank erosion and work currently being done by the USFWS Environmental Management Technical Center (LaCrosse, Wisconsin);

h. Identify increased barge fleeting that would be needed from increased navigation;

i. Determine hydraulic changes that might occur from new locks or dams;

j. Identify recreational needs and use on the river; and

k. Inventory natural resources at the lower 80 miles of the Illinois Waterway in the Alton pool.

COORDINATION

Coordination of navigation studies with other State and Federal agencies, as well as other Corps of Engineers elements, will be extremely important in order to complete the feasibility study efficiently. Presently, there are many different entities studying Upper Mississippi River navigation impacts within and outside the Corps of Engineers. Within the Corps of Engineers, these include the Louisville, St. Louis, and St. Paul Districts, and the Waterways Experiment Station. Outside the Corps of Engineers, the USFWS's

Environmental Management Technical Center in LaCrosse, Wisconsin, is investigating certain navigation effects. Due to the number of agencies and investigators involved in navigation effects research and planning, it is recommended that regularly scheduled information transfer meetings and/or memorandums be implemented soon to avoid a duplication of efforts.

The recent initiation of the Mississippi River Navigation Reconnaissance study also emphasizes the need for coordination. That study will have very similar data needs to this study. Coordination between study teams will be extremely important since the Illinois Waterway Navigation study is likely to set some precedents for the Mississippi River. For this reason, the USFWS is coordinating their input for this study with the States of Missouri, Iowa, Minnesota, Wisconsin, and Illinois.

As in the Lock and Dam 26 study, separate but simultaneous coordination will be occurring with the USFWS on the potential impacts to federally endangered species. It is likely that a biological assessment will be needed for the bald eagle, Indiana bat, and decurrent false aster.

RESTORATION/ENHANCEMENT

The Illinois River has resources of national significance as identified by Congress in Public Law 99-662. The USFWS and the States have expressed a strong interest in investigating restoration strategies as part of the feasibility study. The Planning Aid Report identified several items pertaining to restoration (appendix B, pages B-63 through B-66). Potential restoration and enhancement opportunities also will be identified based on long-term fish and wildlife goals and objectives established for the river. If possible, restoration and enhancement opportunities will attempt to complement site-specific fish and wildlife goals. The Rock Island District will be coordinating with field biologists from the State of Illinois and the USFWS to identify specific opportunities for enhancement on the Illinois Waterway. The District also will identify/classify those enhancement opportunities according to those that are (1) of national significance and can be implemented as part of the navigation project, (2) those that are of state or local significance and would require a cost-sharing sponsor, and (3) enhancement projects that have no connection with the navigation project.

PRELIMINARY CULTURAL RESOURCE ASSESSMENT

POTENTIAL IMPACTS OF ALTERNATIVE PLANS

Navigation impacts to historic properties can be assigned to either: (1) site-specific impacts caused by new construction or (2) system-wide and cumulative impacts caused by an increased number of tows transiting the navigation system. Site-specific impacts to historic properties are relatively easy to evaluate. An archeological and structural inventory and evaluation of the proposed construction site, combined with an assessment of the submerged resource potential of the construction site and any associated borrow, disposal, or construction easement area, will determine the impact of the proposed construction to significant historic properties.

Construction of a new impoundment to replace Peoria and LaGrange locks would have the site-specific impacts identified above as well as impacts associated with raising water levels in a reservoir. Foremost would be the inundation of several miles of shoreline. The effort required to accomplish the archeological inventory and evaluation needed to establish mitigation requirements for this plan would be tremendous. This portion of the lower Illinois River is known throughout the Midwest for its wealth of significant archeological remains.

The determination of system-wide impacts related to navigation is much more difficult. Several State and Federal research efforts have been conducted to address navigation impacts to environmental resources along major waterways. Issues related to these studies remain controversial and undecided at present. (Please refer to the Environmental Resources section of this report, pages 13 through 17, for a brief discussion of these issues.)

System-wide impacts resulting from navigation are most likely to affect archeological sites much more than other forms of historic properties. These impacts include site inundation, site alluviation and burial, and site erosion. The single-most impact to archeological sites along the Illinois Waterway is thought to be caused by streambank erosion.

A study conducted for the Illinois Department of Energy and Natural Resources (Warren 1987) indicated that four out of five sites located on the banks of the Illinois River were experiencing loss due to streambank erosion, equating to an average of 35 cm per year with documentation for 90 cm per year for some sites. At this rate, the studied sites will be completely destroyed in as little as 15 years, with remote portions of the larger sites surviving only 80 years.

Some idea of the magnitude of this loss is apparent if one considers that over 150 previously unrecorded sites were identified in erosional contexts along the LaGrange pool alone during the low water surveys of 1988 and 1989 (Esarey 1990). Plate 15 taken from Esarey 1990 shows the distribution of recorded streambank sites in the Peoria and LaGrange pools. It is clear that numerous potentially significant sites are being impacted by streambank erosion along the Illinois Waterway.

The physical effects of primary importance to the present study are those associated with increased vessel traffic, predominantly wave action and draw down. The physical causes of streambank erosion have been the topic of ongoing debate.

The results of the physical effects studies planned as part of the Second Lock POS may help clarify and predict those conditions under which vessel traffic has a significant effect on shoreline erosion. This information, combined with geomorphological and archeological studies, will form a basis for determination of effect during the feasibility phase of the navigation study.

RECOMMENDED CULTURAL RESOURCE STUDIES TO BE PERFORMED IN FEASIBILITY PHASE

Accomplishment of required historic properties studies will depend on the availability of information early in the study process which can be used to clearly identify areas of potential impact. Assessment of system impacts will require information on physical effects to shoreline similar to that proposed in the POS (discussed in the Environmental Section of this report). Once available, this information will be used to develop archeological and geomorphological survey methodologies to identify those archeological sites in the Illinois River system which will be potentially impacted. Geomorphological investigations are required to identify landforms which have a potential for containing significant buried archeological deposits which may be impacted by the proposed actions. Archeological sites occur in a three dimensional universe and can be located and evaluated only by understanding the sites' relationship to landforms which contain them.

An inventory and evaluation of all archeological, structural, and submerged resources in site-specific construction zones is recommended. To facilitate the identification and evaluation of potentially significant resources, all historic documents, maps, and records relevant to the Illinois Waterway which are presently located throughout the District should be inventoried early in the feasibility phase. Recommendations should be developed for the documents' appropriate curation to assure continued availability of these fragile nonrenewable resources.

CULTURAL RESOURCE COORDINATION

Coordination with the Illinois State Historic Preservation Office, the Advisory Council on Historic Preservation, and other interested parties shall continue through out the planning phases of this study. In a letter dated June 27, 1990, the Illinois State Historic Preservation Office provided recommendation concerning the types of studies which may be required during the feasibility phase (Appendix H - Pertinent Correspondence).

PRELIMINARY SOCIOECONOMIC ASSESSMENT

The Illinois Waterway Navigation System is essential to several of the most important economic sectors in the State of Illinois and the Nation, particularly agriculture, construction, and energy. The navigation system is vital for transportation of goods that are either produced or consumed in the Upper Midwest region, to and from the South and overseas markets. For example, in 1989 commodities valued at more than $4.5 billion transitted LaGrange lock on the Illinois Waterway.

The cost-effective transportation system provided by the locks and dams on the Illinois Waterway has provided stimulus for growth of river communities and the entire Midwest region. Regional industries and businesses rely on the waterway for distribution and receipt of agricultural and industrial products and supplies, petroleum, and chemicals. Increasing the capacity of the waterway would help maintain the current efficiency of the system (public facility), while providing continued growth opportunities.

Upgrading the navigation facilities would have limited impacts on the surrounding population. The number of potential residential, business, and farm relocations would be minimal and no significant impacts to community cohesion would result. The proposed improvements could impact property values or related tax revenues. For example, increasing the capacity of the waterway could indirectly affect property values and tax revenues by providing stimulus for business and industrial growth along the river and in nearby communities.

Modifications to the navigation system would reduce life, health, and safety threats of current operation on the waterway. The upgrading measures (e.g., providing additional floating timberheads) would reduce the likelihood of injury to lock and towing industry personnel or recreationists using these public facilities.

The Upper Mississippi River Navigation System, including the Illinois Waterway, helps to maintain the economic viability of the Midwest and the State of Illinois for agricultural and industrial production. The navigation system positively impacts business and industrial activity by fulfilling a need for low-cost, accessible transportation for shipping large quantities of low-value bulk commodities.

However, without increasing its current capacity, the Illinois Waterway Navigation System will be unable to accommodate the demand for grain, petroleum, gravel, coal, and related commodity shipments. While other modes of transportation could provide the needed service at higher costs, the result could adversely impact the local, regional, state, or national economy. In addition, a reduction in the cost effectiveness and supply of water transportation would potentially impact the Nation's capability to compete in the international market as a leading supplier of grains and other commodities. For example, grain prices at the producer level are directly affected by transportation costs to each market. Therefore, increases in shipping costs that would result from the absence of commercial navigation activity could result in a loss of the sales of a portion of the grain grown in the region.

Other significant, direct economic effects from commercial navigation include spending and employment generated by the commercial navigation industry, including wages, fuel, supplies, rents, and terminal expenses. Indirect economic effects include the inter-industry activities supported by the purchases of supplies, services, labor, and other inputs. Induced effects include economic activity that comes from household purchases of goods and services made possible because of the wages generated by the direct and indirect economic activities.

During the construction process, an increase in business and industrial activity would be noticed in the vicinity of each project area. A portion of this impact would be attributable to the purchases made for the upgrades. The remaining increase would result from purchases made by construction workers (i.e., meals and lodging). It is anticipated that between 50 and 300 workers would be employed during upgrading activities. Workers would be hired through labor unions in nearby communities. Long-term impacts to business and industrial activity, employment, and labor force would be related to community and regional growth. These impacts would be directly related to the scope and scale of improvement activities at each facility.

Heavy machinery would generate a temporary increase in noise levels during the construction process at each site. This could impact individuals pursuing recreational activities within the vicinity, including boating, fishing, hiking, and camping. However, project areas are primarily rural in nature, featuring large spans of open fields and low density residential, recreation, and commercial development. It is, therefore, unlikely that this noise level increase would significantly affect the surrounding population. No significant impact to area aesthetics would result from maintenance or capacity upgrading activities.

PRELIMINARY RECREATIONAL ASSESSMENT

IMPACT ASSESSMENT

Participation rates for the many recreational activities being pursued on the Illinois Waterway are not available at this time. Many providers and a variety of activities are involved. To further complicate the situation, use occurs in both developed and dispersed areas along the 327-mile waterway. The task of measuring this recreational use is difficult and costly. Historical use data are available for very specific sites or on a State Comprehensive Outdoor Recreation Plan regional basis.

Additionally, the impact that recreational use has to the local or regional economy of the Illinois Waterway has not been addressed in a comprehensive manner. This recreational use and economic impact is now the subject of an Economic Impact of Recreation Study (EIRS) which is being done under the auspices of the EMP. This study will yield use data and spending profiles for the Illinois Waterway region. Ten specific activities will be studied. Broad-scale use estimates and more specific spending profiles for these 10 activities will be generated.

The EMP Long-Term Resource Monitoring Program also has a public use component. The public use component will combine creel surveys with public use measurements. A stratified random sampling technique will be used in the given study area. These studies will collect direct counts of use which can be extrapolated to produce an estimate of the amount of recreational use within the given study area. The study also will reveal information such as the number of visits, hours of use, and distance traveled to access the river. Future plans call for a combined survey of Pool 26 on the Mississippi River and the Illinois Waterway up to LaGrange Lock and Dam. It is anticipated that this survey will be done in Fiscal Year 1992. This survey will yield much needed data for the lower portion of the Illinois Waterway. However, comprehensive use measurements for the entire Illinois Waterway System are necessary to perform the feasibility study impact analysis.

An Illinois Department of Conservation (ILDOC) state-wide recreation survey in 1985 found that the average motorboater spent $91.80 per trip and participated for 3.06 days per trip. The averages for sailors and canoeists were less. The ILDOC repeated the study in 1987 and found that the percentage of survey respondents participating in motorboating grew from 22.9 percent in 1985 to 28.4 percent in 1987. Other activities such as fishing and camping experienced participant increases, but of these only motorboating was statistically significant. According to the National Marine Manufacturers Association, Illinois is ranked 10th in the nation in boat ownership, with nearly 300,000 registered motorboat and sailboats over 12 feet long. Based on these statistics and the known recreational use of the locks, the total boating use and economic impact to the Illinois Waterway region would appear to be significant.

While marinas are growing and expanding, recreational boating is facing problems. There is the potential for some reaches of the waterway to become very congested with recreational boat traffic. Sheer numbers of boats are increasing, and there is growing potential for conflicts between these recreational boats and commercial vessels. Certain areas of the system are very narrow, channelized chutes which impose serious hazards to safety. Some reaches of the river are experiencing sedimentation, preventing or severely limiting navigation. Riverboat gambling has been approved in Illinois. Riverboat gambling may bring an increase in the number and frequency of commercialized riverboat excursions and draw more recreationists/tourists to the waterway. As recreation traffic grows, there is the potential for congestion and delays at some of the locks, resulting in increased costs to commercial operators, increased safety concerns, and a reduced recreational experience.

This report recommends plans for further study such as a 1,200-foot lock at LaGrange or Peoria. This replacement will reduce any congestion problem at this lock through increased locking efficiency and provide secondary benefits for recreational boating. However, LaGrange ranked 7th (out of eight locks) in recreational usage in 1989. System-wide, these alternatives alone will have limited benefits for recreational boating. The impact of project alternatives on recreation will be examined in the feasibility study. Conflicts between commercial and recreational boating also will be addressed.

RECOMMENDED RECREATIONAL STUDIES TO BE PERFORMED IN FEASIBILITY PHASE

The Illinois Waterway provides a wealth of recreational opportunities for the citizens of the State and the Nation. The use created by these opportunities has value to the user above and beyond the regional economic impact.

As part of the feasibility phase of this navigation study, more comprehensive and specific recreational use data for the Illinois Waterway are warranted to determine project impacts on the variety of existing recreational activities. This comprehensive and activity-specific use data will not result from the EIRS or the LTRM public use component. The EIRS should produce spending profiles for 10 specific recreational activities that can be modeled to determine the economic impact to a particular pool or site. The LTRM data will be limited in scope and may not be completed in time to be usable for the feasibility study.

Further recreation demand and supply studies are needed so that the feasibility report can address the impact of the chosen plan(s) on the market area. Competing facilities within the market area and their existing and expected future use with and without the proposed plan(s) will be examined.

Additionally, a study to determine recreation value or "willingness to pay" on the Illinois Waterway will be needed as this information will not result from the EIRS.

In summary, the way Americans recreate is changing. We now tend to take more frequent vacations, of shorter duration, and closer to home. Bisecting a state with a population of 11 million people, the Illinois Waterway has the potential to satisfy the recreational desires and contribute to the region's economy in much greater proportions than today.

PRELIMINARY ENGINEERING ASSESSMENT

PURPOSE

This portion of the report identifies possible solutions to future traffic congestion at each lock and dam site and presents costs and solutions for various traffic needs.

SCOPE

The information contained in this section was compiled from existing data and conceptual studies. This information is preliminary in nature; additional studies will need to be undertaken to refine cost estimates and engineering feasibility.

Lockport Lock

a. **Lockport/Brandon Road Replacement Project.** This plan, now deauthorized, included removing the existing Brandon Road Lock and Dam, lowering the existing navigation channel 35 feet from Brandon Road upstream through the city of Joliet to Lockport, constructing a new high lift (73 feet) lock, 1,200 feet long by 110 feet wide, and constructing a new dam and controlling works near the existing Lockport Lock and Dam. New fixed bridges, having a 46.9-foot vertical clearance, would be provided at Caton Farm Road and Brandon Road. New fixed bridges, at or near their present elevations, would be constructed at Ruby Street, Jackson Street, Cass Street, Jefferson Street, the CSXT (formerly Chicago, Rock Island, and Pacific) Railroad crossing, and McDonough Street. The piers of the Interstate 80 and the Elgin, Joliet, and Eastern Railroad bridges would be modified to accommodate the lowered waterway.

This plan was presented in the *Duplicate Locks GDM Phase I, A Plan for Modernization of the Illinois Waterway* (5 Volumes), Chicago District, December 1974. The total estimated cost of this plan is estimated to be in excess of $1 billion.

The State of Illinois (ILDOT-DWR) has commented on this plan as recently as September 1989. The State:

- considers the project costs too high,
- has concerns about economic impact on railroads,
- is concerned about loss of tax revenues (from displaced industry),
- believes that a lock size of 80' by 800' should be considered,
- has concerns about some of the original assumptions in formulating this plan, and
- has concerns about siting of a new lock.

During a feasibility study, the assumptions about future needs will be reassessed, along with the traffic projections.

b. **New Lock and Channel Improvements.** The locations considered in the past for a new lock were the undeveloped areas to the right of the power dam or to the left of the lock. However, both of these locations have problems due to the proximity of the Des Plaines River to the right and Deep Run Creek and the railroad to the left. Also, local interests were not in support of using available land for the lock and adjacent channel developments. The only other viable location for a new lock is between the existing lock and the dam powerhouse. This could require removal of the canal lock, dam spillway, or portions of the dam powerhouse. Upstream cofferdams could be minimized by utilizing existing structures. Channel work would be required upstream and downstream of the new lock location, however, the scope of this work cannot be quantified at this time. The lock would be founded on rock and have the same lift as the existing lock. The estimated cost for this lock is $550 million.

Brandon Road Lock and Dam

a. **New 1,200-Foot Lock.** A new lock could be located either landward or riverward of the existing lock. For construction purposes, the riverward location would not require the relocation of U.S. Highway 6. Brandon Road highway would require constructing a new bascule bridge over the new lock and raising of the approaches. The new 110-foot by 1,200-foot lock would be founded on rock and have a lift of 34 feet. The structures would be concrete gravity type and use a bottom lateral filling system. The operational gates would be miter type both upstream and downstream. No modifications to the dam are required. The estimated cost for this project is $370 million. This project may be affected by the outcome of the study at Lockport due to its close proximity. An increase in the capacity of the Brandon Road lock is not needed unless the Lockport lock capacity also is increased.

b. **Lockport/Brandon Road Replacement Project.** See Lockport Lock.

Dresden Island Lock and Dam

New 1,200-Foot Lock. The proposed location of the new lock would be at mile 271.5 to the south (landward side) of the existing lock, as shown on plate 16. The landward side was chosen to eliminate the navigation difficulties that would be present in a riverward lock due to the cross currents across the upper approach to the existing lock. The landward location also would require less cofferdamming and be less costly to construct than a riverward lock. The new lock would have a lift of approximately 22 feet with a bottom lateral filling system. The usable chamber of the new lock would be 110 feet wide by 1,200 feet long. The walls would be of the concrete gravity type founded on rock. Both upper and lower service gates would be miter gates. An emergency gate also would be provided for emergency closures and for passing ice when the need arises. No modification to the dam would be required. The estimated cost is $330 million.

Marseilles Lock and Dam

a. **New 1,200-Foot Lock.** The proposed location for a new lock would be in the Marseilles canal north of the existing lock. Widening the canal would have to be done in conjunction with the new lock to obtain maximum economic benefits. The new lock construction should be in conjunction with the widening of the canal. The new 110-foot by 1,200-foot lock will be founded on rock. The lock will be concrete gravity type and will have a lift of 24 feet. There will be upstream and downstream miter gates for operational use and an emergency gate for passing ice. No modifications would be required on the dam. The cost for the new lock is estimated to be $410 million. (See plate 17 for a site plan of the proposed structures.)

b. **Marseilles Canal Widening.** The 2.4-mile-long Marseilles canal was excavated at the time Marseilles Lock and Dam were built. The canal allowed the lock to be sited past the Illinois River Rapids downstream of the dam. The canal is 200 feet wide for most of its length, but not wide enough for two 15-barge tows to pass in the canal. The lock capacity is limited by the existing canal because downbound tows cannot enter the canal to approach the lock until upbound tows clear the canal. Two solutions will be considered for increasing the capacity of the Marseilles canal: (1) widen the entire length to 300 feet, or (2) widen "passing zones" within the canal. Much of the excavation would be rock excavation.

The canal is surrounded by a State park. The additional canal width would impact on some of the park lands. If a 1,200-foot-long lock were constructed, the canal also must be widened to realize the greater lock capacity. Estimates of the cost for partial widening and full canal widening are $3.9 million and $8.1 million, respectively.

Starved Rock Lock and Dam

New 1,200-Foot Lock. The proposed location of a new 110-foot by 1,200-foot lock would be riverward of the existing lock. This location provides a good alignment for both upstream and downstream approaches. The new lock will be adjacent to a new ice gate that will be located between the old and new lock. This new gate currently is being studied by the Rock Island District and the U.S. Army Cold Regions Research and Engineering Laboratory. The current hydropower development proposed would not be affected by the new lock. The lift will be approximately 18 feet, and a bottom lateral filling system will be used. The lock structures will be concrete gravity type founded on rock. Both upstream and downstream lock gates will be horizontally framed miter gates. Modifications to the dam will be required to tie the new lock into the existing dam structure. The estimated cost is $360 million, and the layout is shown on plate 18.

Peoria Lock and Dam

a. **New 1,200-Foot Lock.** The proposed location of the new lock would be at the west abutment of the existing dam across the channel from the existing lock. This site provides improved alignment for both upstream and downstream approaches. It also would avoid costly relocation of oil and chemical companies facilities and railroads along the east bank of the river. This location will, however, require relocation of the keystone canal. The underlying geologic formation at the selected site consists of glacial till. Steel "H" piles likely would be used to support the new lock masonry which will consist of concrete gravity type walls. The usable lock chamber will be 110 feet wide by 1,200 feet long, with miter gates at both the upper and lower ends. The lift will be approximately 11 feet. The filling and emptying system will be of the side port type. Plate 19 shows a preliminary layout of the new 1,200-foot lock which is estimated to cost $390 million.

b. **Peoria/LaGrange Replacement Project.** The predicted congestion in the lower end of the Illinois River could be reduced by replacing the existing lock and dam sites at Peoria and LaGrange with one new lock and dam site. This site, located in the vicinity of the existing LaGrange Lock and Dam, would incorporate a 1,200-foot lock and wicket dam to allow for open pass potential during high water. This replacement would raise the LaGrange pool elevation level of 429.0 to equal that of the Peoria pool at elevation 440.0. The drainage districts along the Illinois River upstream of the new dam would be affected by the creation of additional head on the levees.

The river profiles for the Illinois River at this location indicate that the new pool level will not overtop the existing drainage district levees. These levees are approximately equivalent to the 100-year flood frequency. The normal pool elevations would be higher than the surrounding lands in many locations. This will require the existing levees to be reevaluated for seepage and stability in order to take the permanent duration of the new pool into account. Additional pumping due to increased seepage also must be taken into account. Input from local interests affected has not been requested to date.

The design and construction of this replacement lock and dam would be similar to that being proposed for the Olmsted replacement project on the lower Ohio River. The new dam will have to incorporate a movable dam which will allow for continued use of open pass conditions during periods of high water. This new dam will incorporate hydraulically operated wicket gates similar to what is being proposed for the new Olmsted Lock and Dam on the Ohio River. This design would improve the safety of operation by reducing the labor intensive operation presently used to lower and lift the existing wicket gates. The Peoria/LaGrange replacement project will reduce the congestion on the lower Illinois River as well as solve the problem of total wicket replacement expected in the next 20 years at both Peoria and LaGrange by effectively replacing two locks and dams with one lock and dam.

The impacts that will have to be fully evaluated during the feasibility phase are as follows:

- Impact of higher pools on existing levees and drainage districts.
- Impact of higher pools on local communities in the study reach.
- Impacts of higher pool levels on future dredging requirements.
- Environmental impacts of the pool raise, including benefits to the Peoria pool and increased wetlands.

The estimated cost of the Peoria/LaGrange replacement project is $950 million.

LaGrange Lock and Dam

a. **New 1,200-Foot Lock.** The proposed location of a new lock would be located at the east abutment of the existing dam on the northern end of LaGrange Island across the channel from the existing lock. This location will require extensive excavation of La-Grange Island, a new diversion channel for the South Beardstown pumping station, and reconstruction of approximately 3,000 feet of levee. This site provides better alignment for both upstream and downstream approaches. The underlying geologic formation at the selected site consists of glacial till. Steel "H" piles will likely be used to support the new lock which will consist of concrete gravity type walls. The usable lock chamber will be 110 feet wide by 1,200 feet long, with miter gates at both the upper and lower ends. The lift will be approximately 11 feet. The filling and emptying system will be of the side port type. Plate 20 shows a preliminary layout of the new lock. The estimated cost of the new 1,200-foot lock is $380 million.

b. **Peoria/LaGrange Replacement Project.** See Peoria Lock and Dam.

COST ESTIMATES

The cost estimates in this report are based on available data from similar projects including McAlpine, Olmsted, Gallipolis, Montgomery Point, Karawha, and Melvin Price. A summary of the basic design parameters including estimated costs are included in table 11.

OTHER ALTERNATIVES

Alternatives to total lock replacement and short-term navigation improvements to extend the useful life of the existing structures will be fully evaluated during the feasibility study. These alternative studies will include, but not be limited to:

a. Guidewall Extensions

b. Mooring Cells

c. Guide Cells

d. Powered Traveling Kevels

A summary of these features and estimated costs is contained in table 12.

ENGINEERING REQUIREMENTS DURING FEASIBILITY PHASE

The requirements for additional engineering information during feasibility study will be divided into two separate phases. The first phase will provide the preliminary engineering required to evaluate the viable alternatives and to select a preferred plan. The second phase will provide detailed engineering data for the selected plan. Shown below is the outline to accomplish the engineering studies required for both phases 1 and 2.

a. **Phase 1.**

(1) Develop alternatives at each lock and dam site.

(2) Perform initial site surveys at each lock and dam site.

TABLE 11

Summary of Conceptual Studies Lock Replacements

Concept	Lock Size	Required Relocations	Modifications to Dam	Type of Foundation	Estimated Cost (Millions)*
Lockport/Brandon *Repl. Project*	110' x 1200' x 73'	Extensive	New Dam	Rock	>$1,000
Lockport	110' x 1200' x 39.5'	Powerhouse Relocation	None	Rock	$ 550.0
Brandon Road	110' x 1200' x 34'	*No Reloca-*tions; 1 New Bridge	None	Rock	$ 370.0
Dresden Island	110' x 1200' x 22'	Minor	None	Rock	$ 330.0
Marseilles	110' x 1200' x 24'	Dependent on Marseilles Canal Widening	None	Rock	$ 410.0
Starved Rock	110' x 1200' x 18'	None	Yes, lock *located in head* gate section	Rock	$ 360.0
Peoria	110' x 1200' x 11'	Canal Relocation	None	Pile	$ 390.0
Peoria/LaGrange Repl. Project	110' x 1200' x 22'	Extensive	New Dam	Pile	$ 950.0
LaGrange	110' x 1200' x 11'	Relocation of Pumping Station and Massive Exc.	None	Pile	$ 380.0 - Lock $263.0 - Relocations $20.0 - Excavation $50.0 - E&D $22.0 - S&I $25.0

* Estimated costs include construction, E&D, and S&I.

TABLE 12

Summary of Conceptual Studies - Alternate Studies

Concept	Practicability	Est. Cost ($1,000's)
Lockport		
Guidewall Extension w/powered kevel	None	--
Mooring Cells	None Identified	--
Brandon Road		
Guidewall Extension w/powered kevel	Upper - 600' Lower - 700'	15,000.00
Mooring Cells	Upper - 2 Cells	800.00
Dresden Island		
Guidewall Extension w/powered kevel	Upper - 600' Lower - 600'	14,000.00
Mooring Cells	None Identified	--
Marseilles		
Guidewall Extension w/powered kevel	Upper - 600' (Dependent on Canal Wid.) Lower - 600'	14,000.00
Mooring Cells	None Identified	--
Starved Rock		
Guidewall Extension w/powered kevel	Upper - 600' Lower - 600'	14,000.00
Mooring Cells	Lower - 2 Cells	800.00
Peoria		
Guidewall Extension w/powered kevel	Upper - Inter. w/I-74 Lower - 600'	8,000.00
Mooring Cells	None Identified	--
LaGrange		
Guidewall Extension w/powered kevel	Upper - 600' Lower - 600'	16,000.00
Mooring Cells	None Identified	--

(3) Determine real estate requirements, including relocations.

(4) Perform preliminary Geotechnical analysis based on available information or with minor field investigations.

(5) Perform preliminary hydraulic analysis.

(6) Provide preliminary project design.

(7) Refine cost estimates.

b. **Phase 2.**

(1) Perform detailed site surveys of selected site.

(2) Prepare preliminary right-of-way drawings, if required.

(3) Perform detailed geotechnical analysis, including extensive foundation investigations and pile load tests, as needed. This analysis will probably result in a Feature Design Memorandum.

(4) Perform detailed Hydraulic analysis and determine needs for a model test. This analysis and model test will probably result in a Design Memorandum (DM).

(5) Provide project design for feasibility study. Finalize project design after completion of all supporting DM's. The final project design will probably result in a DM. This DM would include final project costs.

PRELIMINARY REAL ESTATE ASSESSMENT

Real estate requirements for all viable alternatives and selected plans will be addressed during the feasibility study. Real estate requirements will include relocation, interests to be acquired, etc.

Section 3 - Coordination, Public Views, and Comments

Public participation is of critical importance during project planning. Public input provides valuable information about public support or opposition to potential solutions during all phases of the study process. Public comments provide information regarding the publics' concerns, values, interests, goals, opinions, and understanding of alternatives and issues. In addition, public coordination assures that the study addresses all significant concerns, considers all possible solutions, and maximizes information available to decision makers.

The Administrative Procedures Act, National Environmental Policy Act, National Historic Preservation Act, and additional Federal planning policies and regulations require and encourage extensive public coordination. In terms of the Illinois Waterway Navigation System, the consequences and public acceptability of each potential alternative must be evaluated and considered as part of the reconnaissance study and any potential feasibility study.

Reconnaissance study public involvement efforts and public input are summarized in appendix G. Public coordination efforts have included distribution of a Plan of Study and a Notice of Initiation to the public, press releases, a public meeting, and speaking engagements. Public coordination for the Illinois Waterway Navigation Reconnaissance Study will conclude with the distribution of a North Central Division Commander's Notice of Completion early in 1991.

Public comments and input have been considered during the formulation of alternative plans to address the future of the Illinois Waterway Navigation System. Public views and comments received as of July 1, 1990, generally indicated support for the Illinois Waterway Navigation Study. Additional concerns regarded environmental, cultural, sedimentation, and recreational issues. Specific concerns or questions from the public have been addressed in this reconnaissance report or will be addressed in any future feasibility studies for the Illinois Waterway Navigation System.

Section 4 - Conclusions and Recommendations

The reconnaissance-level investigation of the Illinois Waterway Navigation System, focusing on the potential for enhanced navigation, is complete. The findings of this investigation are summarized in this section. The conclusions shown in this portion of the report are intended to indicate typical structural solutions and to provide a foundation and direction for more comprehensive feasibility level studies. A comprehensive evaluation of alternatives at each site will be accomplished during feasibility studies. This will include combinations of structural and nonstructural measures to alleviate navigation constraints and initiatives for restoration of fish and wildlife and other natural resources.

CONCLUSIONS

The system economic model prioritized the navigational constraints of the Illinois Waterway. Based on the projected traffic demand and the need for capacity expansion, the highest priorities are the elimination of constraints at the following three sites:

1. LaGrange

2. Peoria

3. Marseilles

The system economic analysis identified the need to remove constraints at LaGrange by the year 2000. Based on need and system benefits available, a Federal interest exists in the construction of a 1,200-foot by 110-foot lock at LaGrange.

Once the constraint at LaGrange is removed, the system analysis identified the need to remove constraints at Peoria. Based on the need and benefits, a Federal interest exists in the construction of an additional 1,200-foot by 110-foot lock at Peoria.

Once constraints at both LaGrange and Peoria are removed, system benefits identify a Federal interest in widening the Marseilles canal.

Since there are enough economic benefits to justify a 1,200-foot by 110-foot lock at LaGrange and Peoria, a possible alternative may be to replace LaGrange and Peoria by constructing a lock and dam facility near LaGrange. This option appears to be viable from an engineering and operational standpoint and will be addressed during the feasibility phase.

Based on projected traffic demand, nonstructural and minor structural measures could be used to extend the economic life of existing structures.

Based on coordination with the environmental community, studies will be required to adequately determine navigation-related impacts and identify environmental enhancement opportunities.

RECOMMENDATIONS

The Illinois Waterway Navigation Reconnaissance Study indicates that improved navigation conditions are needed. Economic analyses further indicate that there are feasible alternative plans for reducing delays and maintaining the efficiency of the existing system. Since there is a Federal interest in improving the navigation system, it is recommended that this reconnaissance report be approved and that a feasibility study be undertaken. The objectives of that recommended feasibility study will be to prioritize capital investments on the Illinois Waterway Navigation System for the 50-year planning horizon, to perform system-wide environmental analyses, to prepare appropriate NEPA documentation, and to perform detailed engineering, economic, and environmental studies at the first priority site, identified in this report as LaGrange Lock at Illinois River Mile 80.2.

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GLOSSARY

Delay Time (same as Wait Time) - The time elapsed from the arrival of a tow or single vessel at a lock to the start of its approach to a lock chamber. Delay time for a queue of vessels or tows is the cumulative total for all vessels and tows waiting.

Lockage - The series of events required to transfer a vessel or tow (with all barges) through a lock in a single direction. More than one vessel can be processed during the lockage, and a tow may require several cycles to be completely processed.

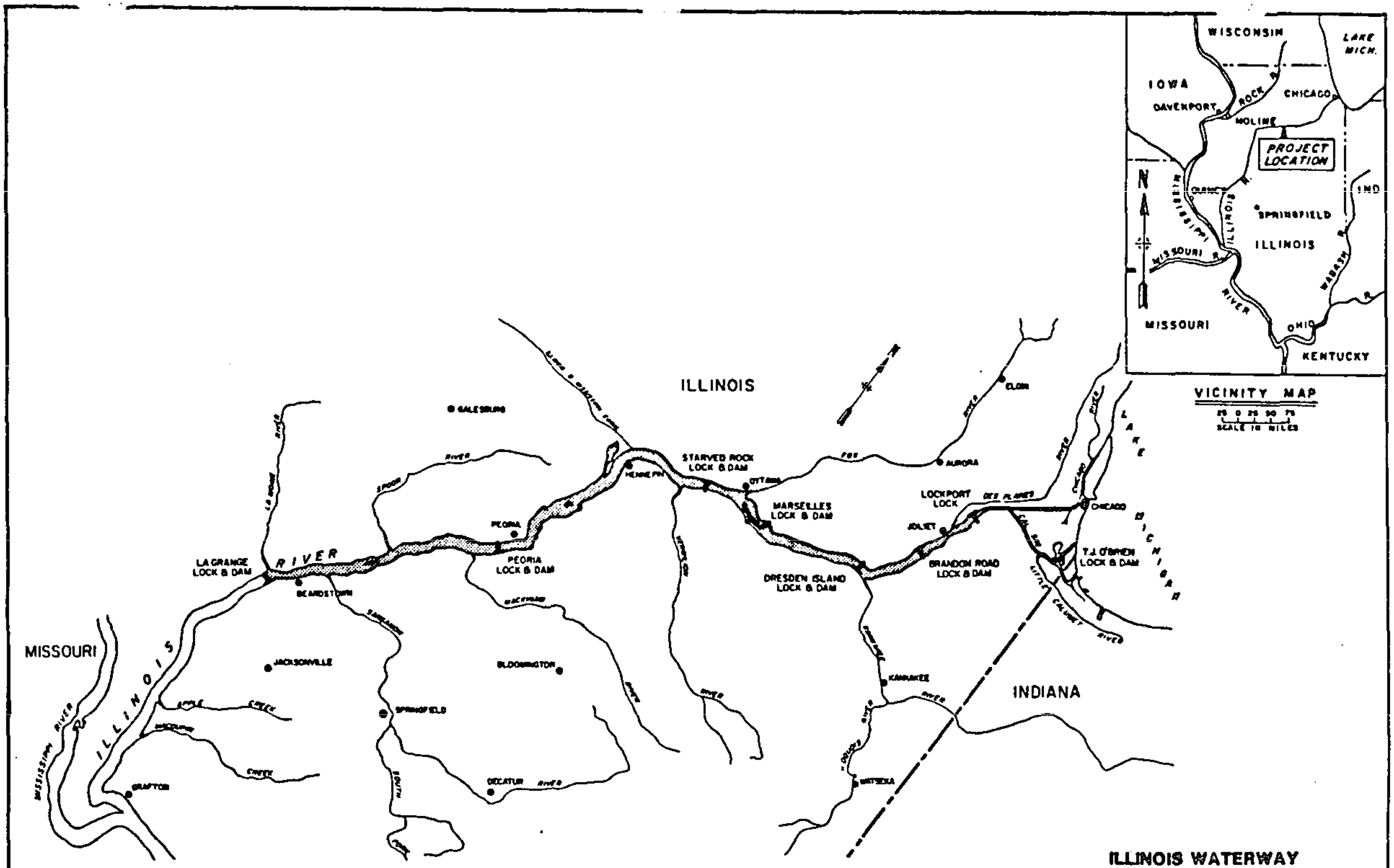
Stall - An occurrence which stops lock operation (due to either a lock malfunction, weather conditions, a vessel problem, or seasonal or part-time lock operations). Stalls during idle time are still accounted for as stalls.

Transit Time - Time required for a vessel to transit a lock, including waiting or delay time and processing time excluding stalls.

Lock Utilization Time/Rate - Utilization time is a derived number based on the total operating time (vessel and lock processing time and open pass operation) entered into the data base via individual lockage records. The utilization rate is the percentage produced by dividing total operating time by the total time in the reporting period (usually monthly).

Idle Time - This is the interval between lockages when the lock or chamber is available for service. It is a derived number produced by subtracting all stall time (including stall time that occurs when no vessels are awaiting lockage) and total operating or utilization time for the reporting period, from total chronological time in the period.

Available Time - This is the amount of time in a reporting period that a lock chamber is in service, operating and idle. This number is derived by subtracting all stall time from total chronological time.



ROCK ISLAND DISTRICT LIMITS OF RESPONSIBILITY

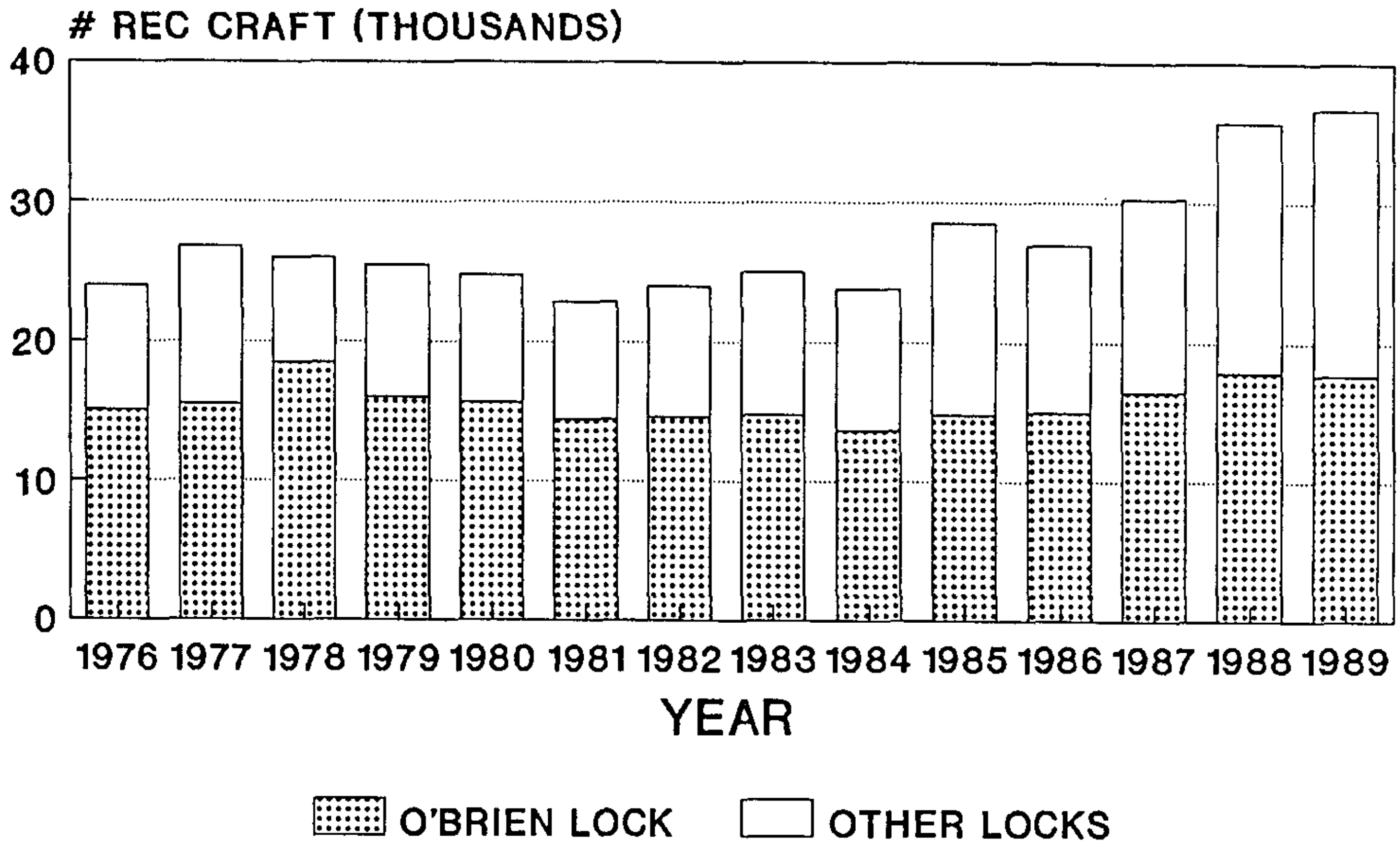
ILLINOIS WATERWAY

NAVIGATION STUDY, IL

US ARMY CORPS OF ENGINEERS
ROCK ISLAND DISTRICT

PLATE 1

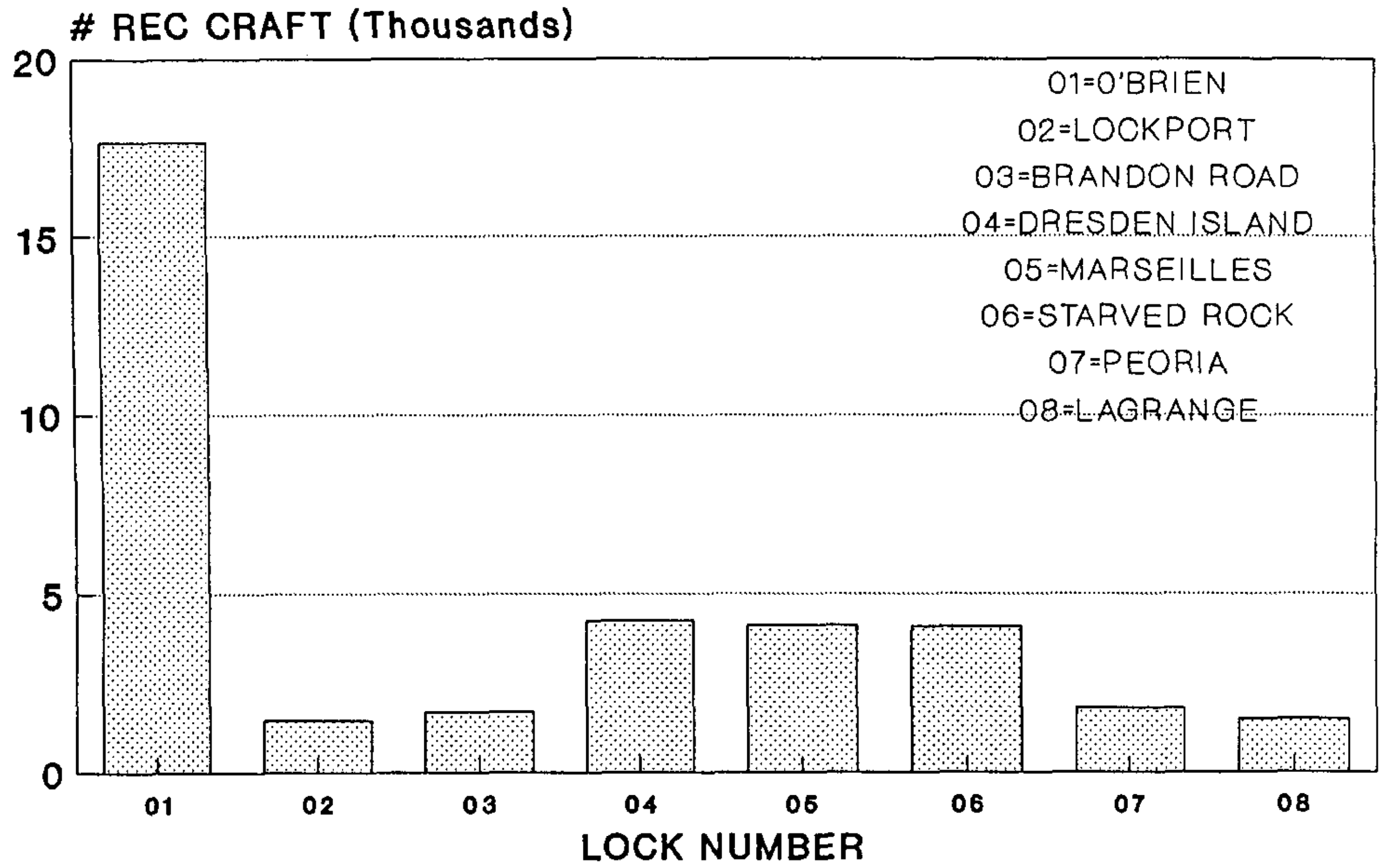
LOCK TRANSITS BY RECREATIONAL VESSELS ILLINOIS WATERWAY



PMS DATA

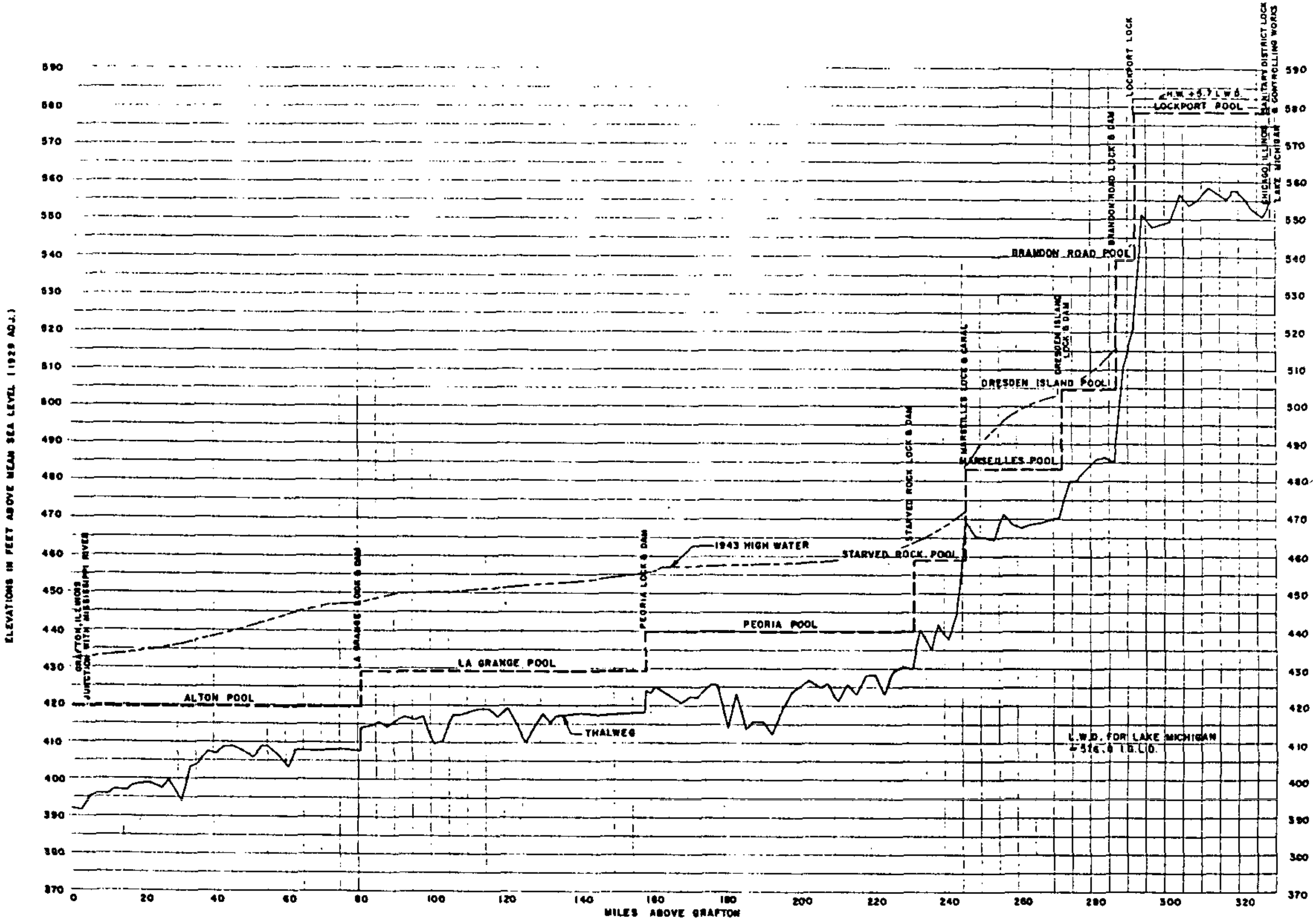
PLATE 2

NUMBER OF RECREATIONAL VESSELS BY LOCK ILLINOIS WATERWAY -- 1989



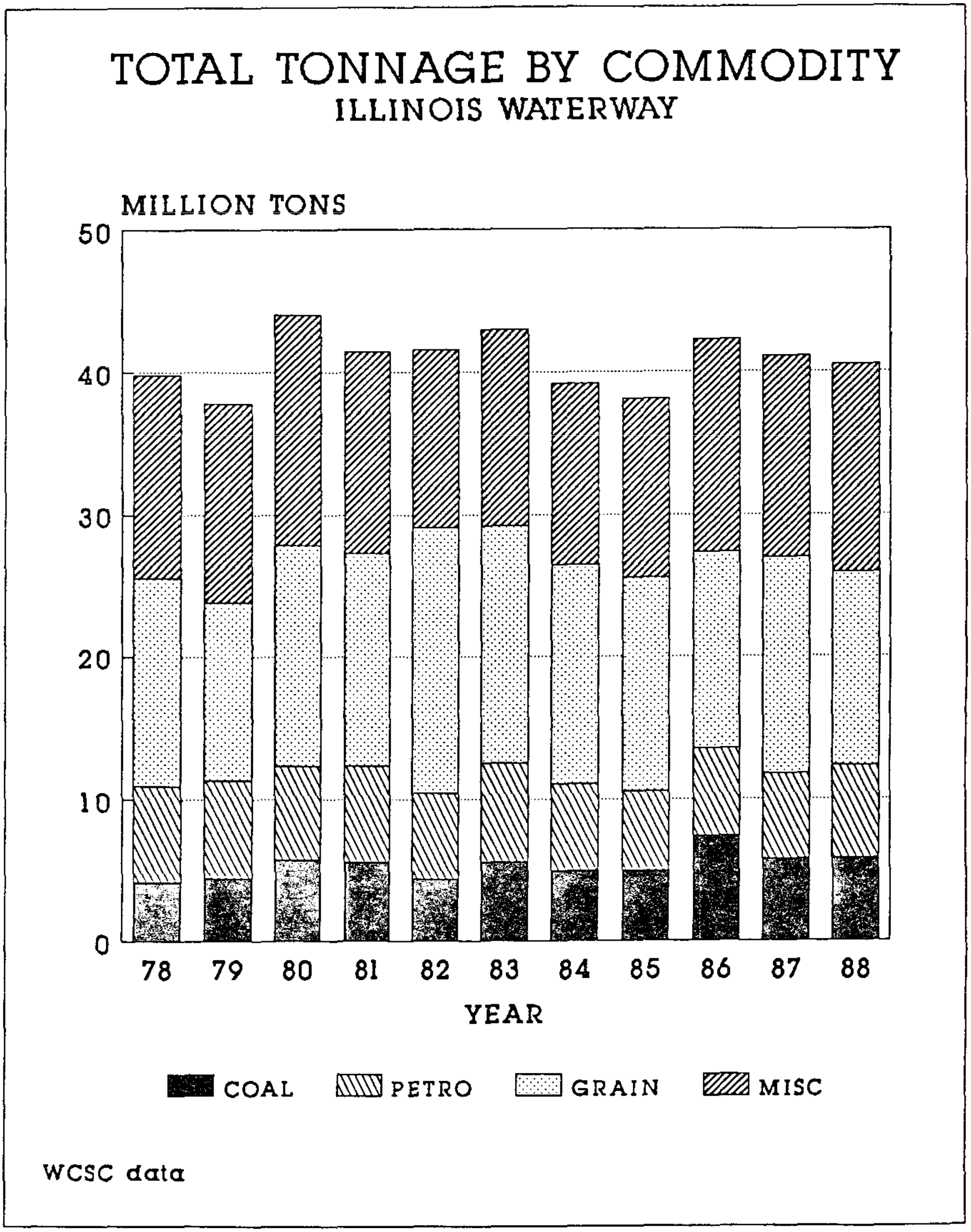
PMS DATA

PLATE 3



ILLINOIS WATERWAY, ILLINOIS
PROFILE
MILE 0.0 TO MILE 327.2

PLATE 4



TOTAL TONNAGE BY COMMODITY
ILLINOIS WATERWAY
MILLION TONS
50
40
30
20
10
0
78
79
80
81
82
83
84
85
86
87
88
YEAR
COAL
PETRO
GRAIN
MISC
WCSC data

PLATE 5

LOCKPORT

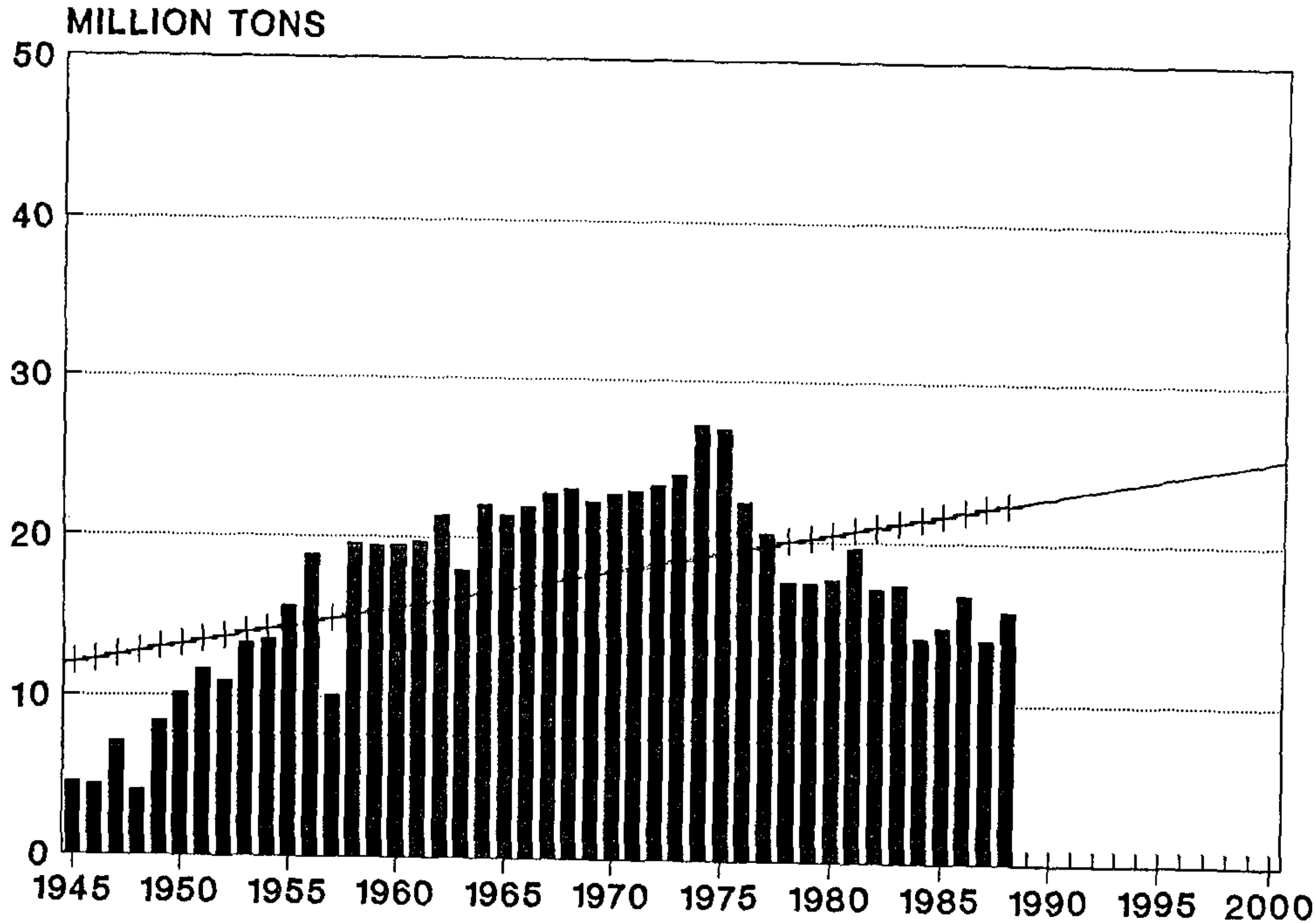


PLATE 6

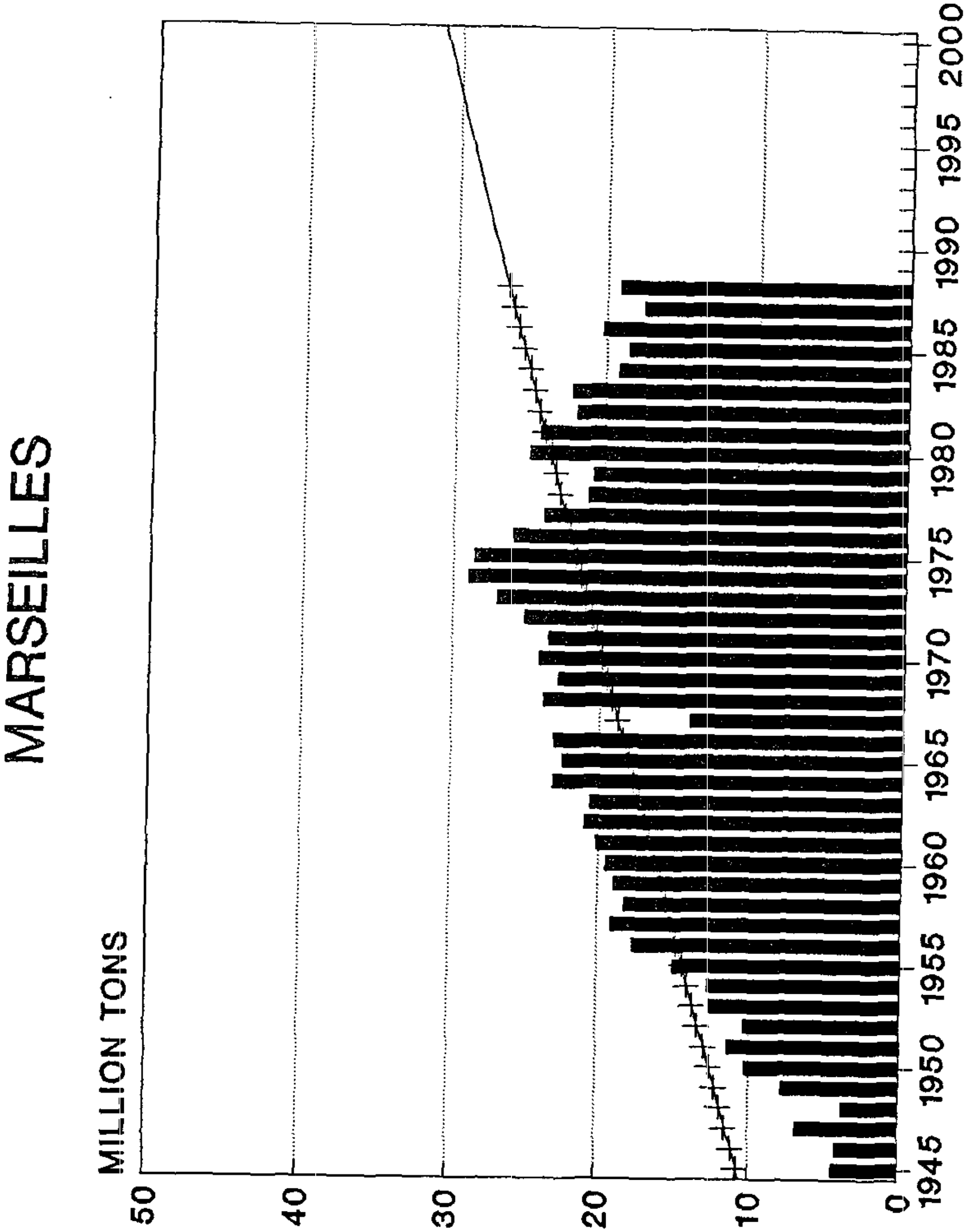

MARSEILLES
MILLION TONS
50
40
30
20
10
0
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000

PLATE 7

LAGRANGE

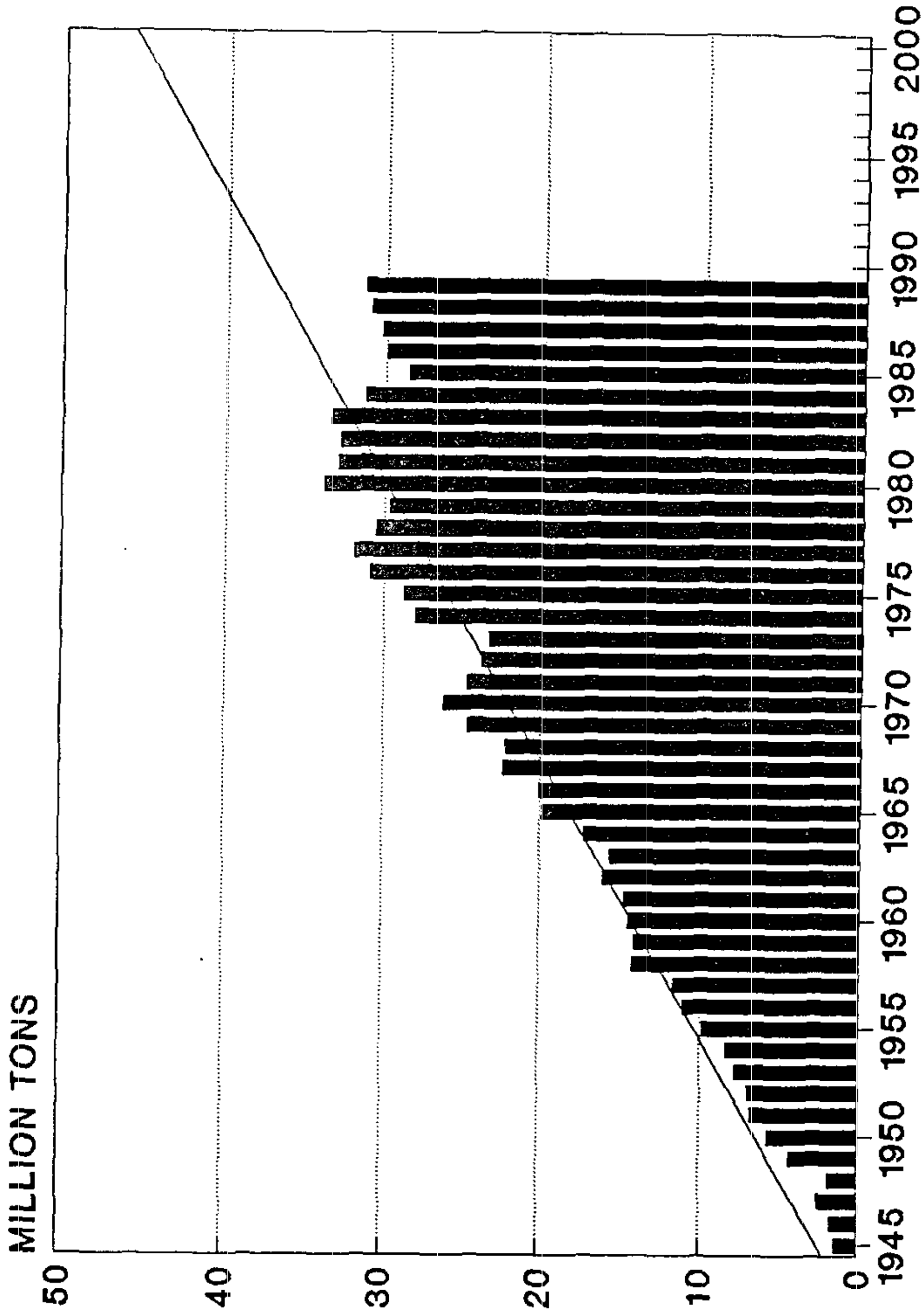
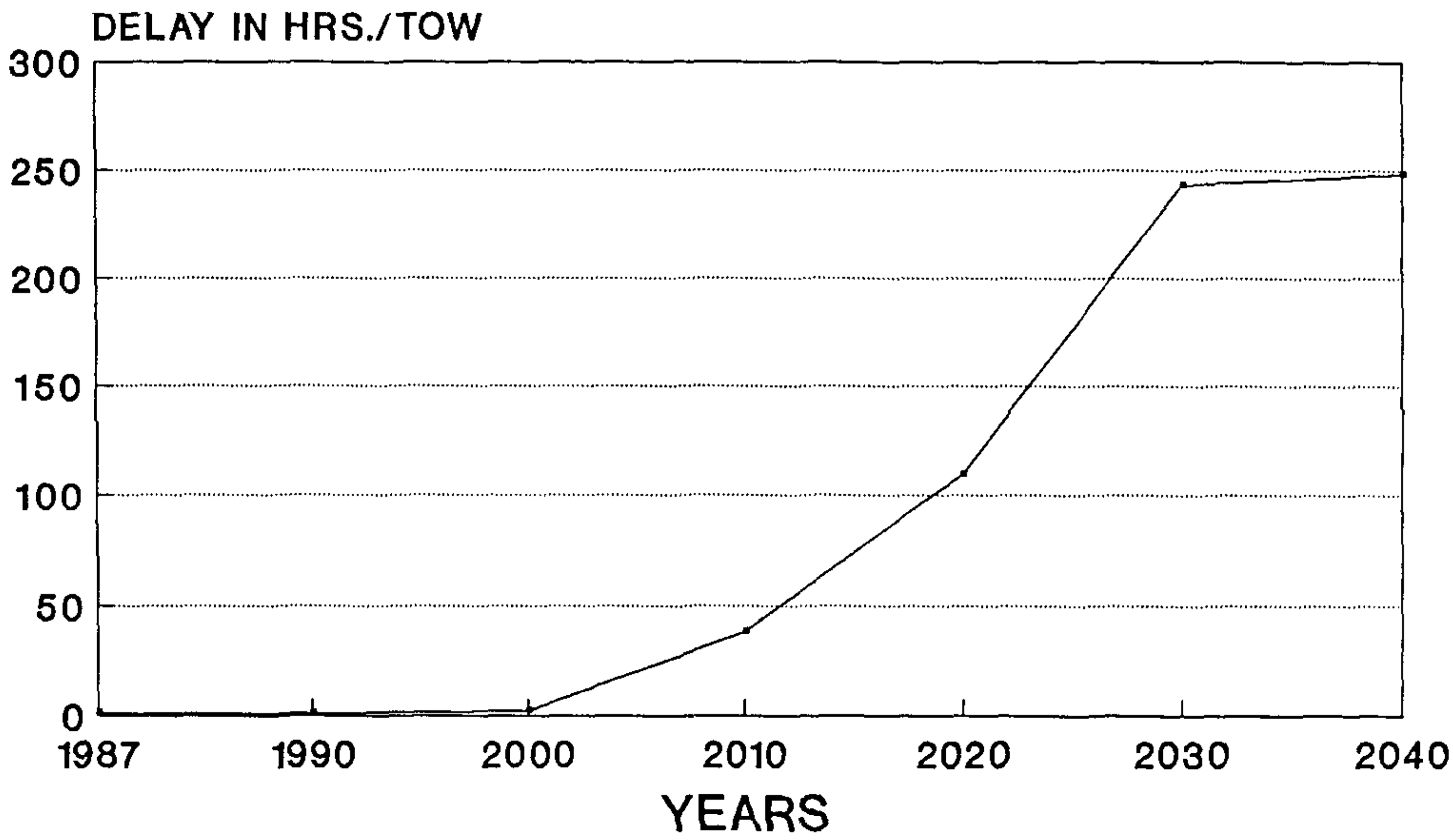


PLATE 8

WITHOUT PROJECT DELAYS AT LAGRANGE LOCK
(HIGH TRAFFIC GROWTH)



WITHOUT PROJECT TONNAGE AT LAGRANGE LOCK (HIGH TRAFFIC GROWTH)

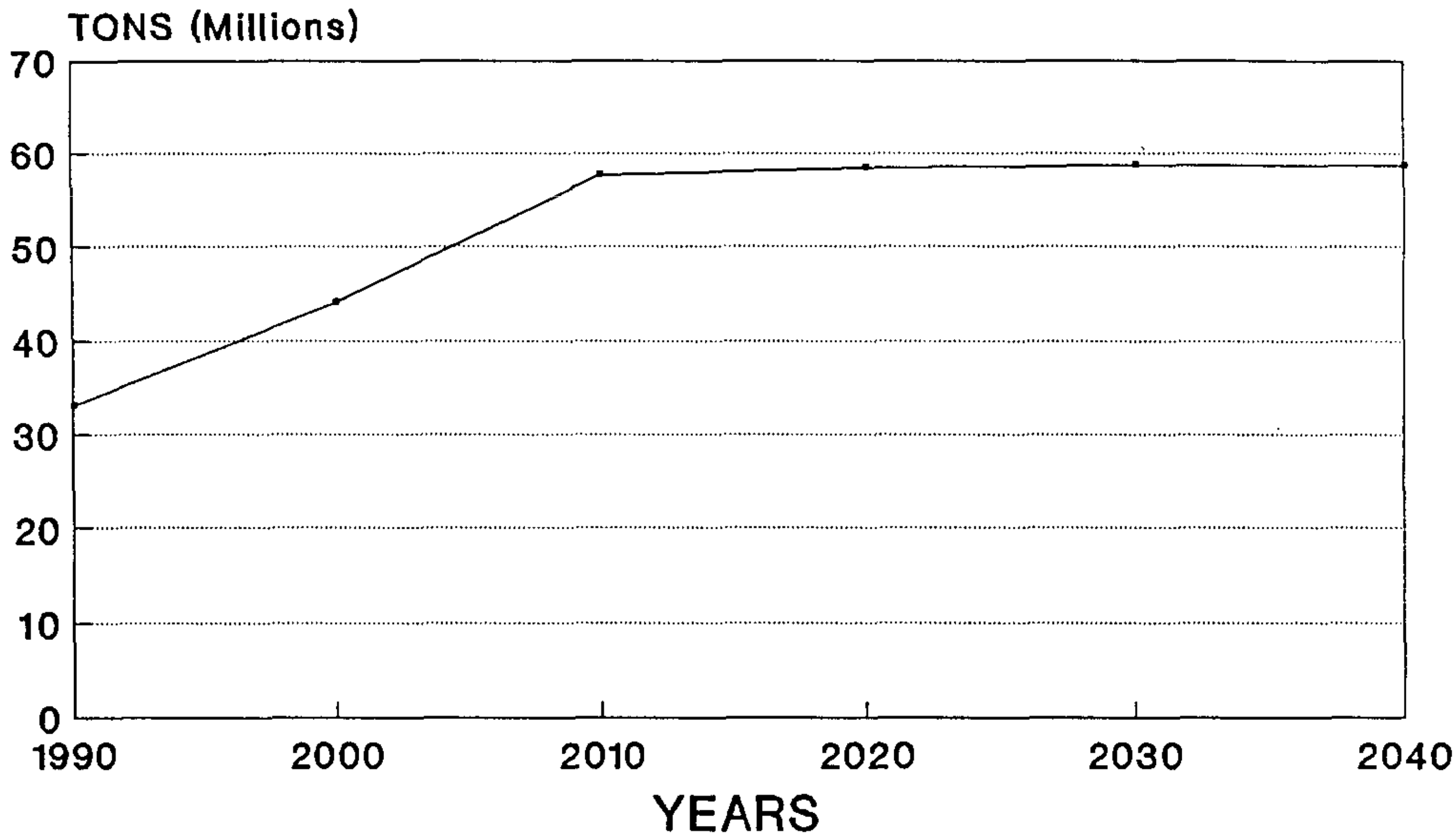


PLATE 10

SYSTEM TONNAGE ON THE ILLINOIS WATERWAY WITHOUT IMPROVEMENTS (HIGH TRAFFIC GROWTH)

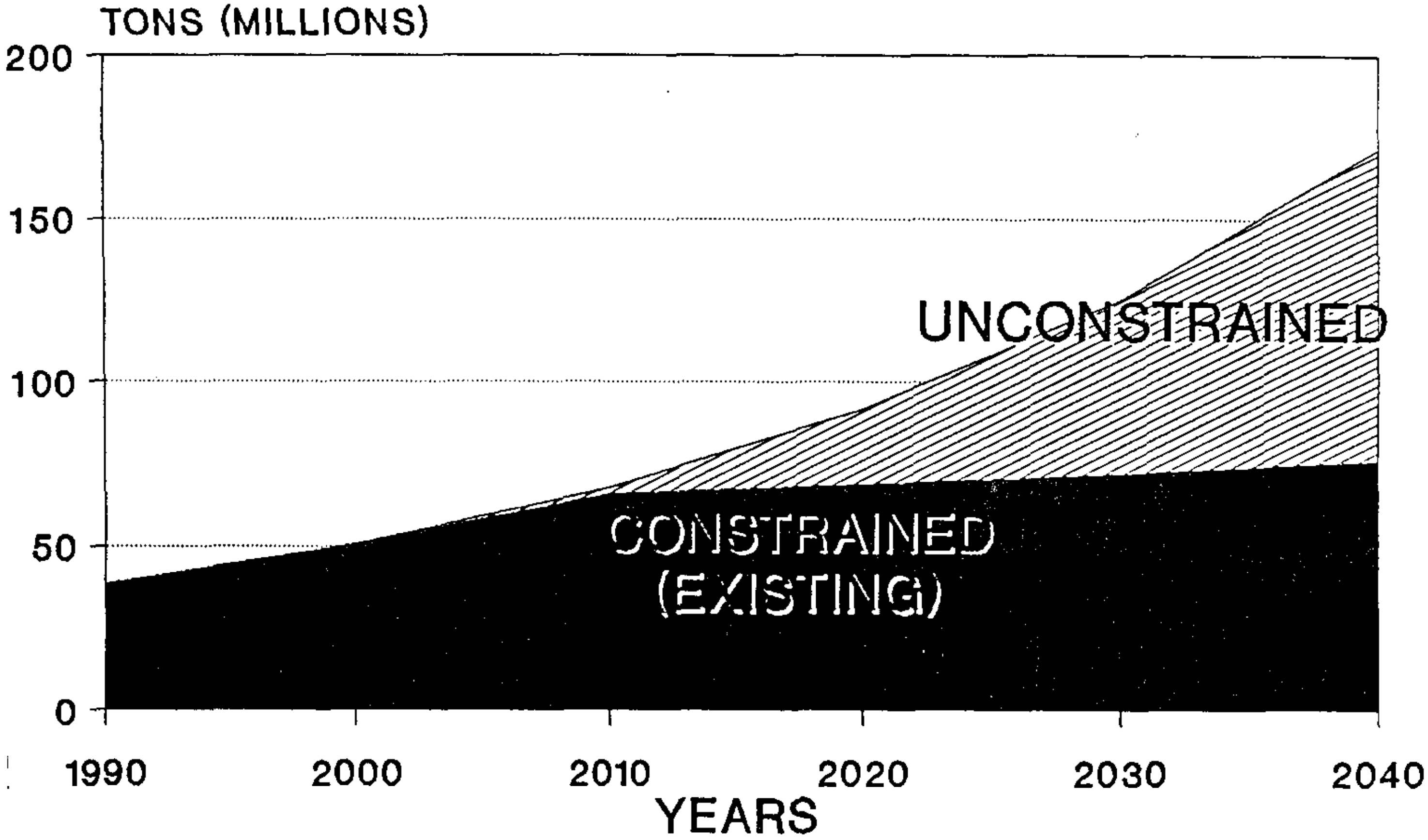
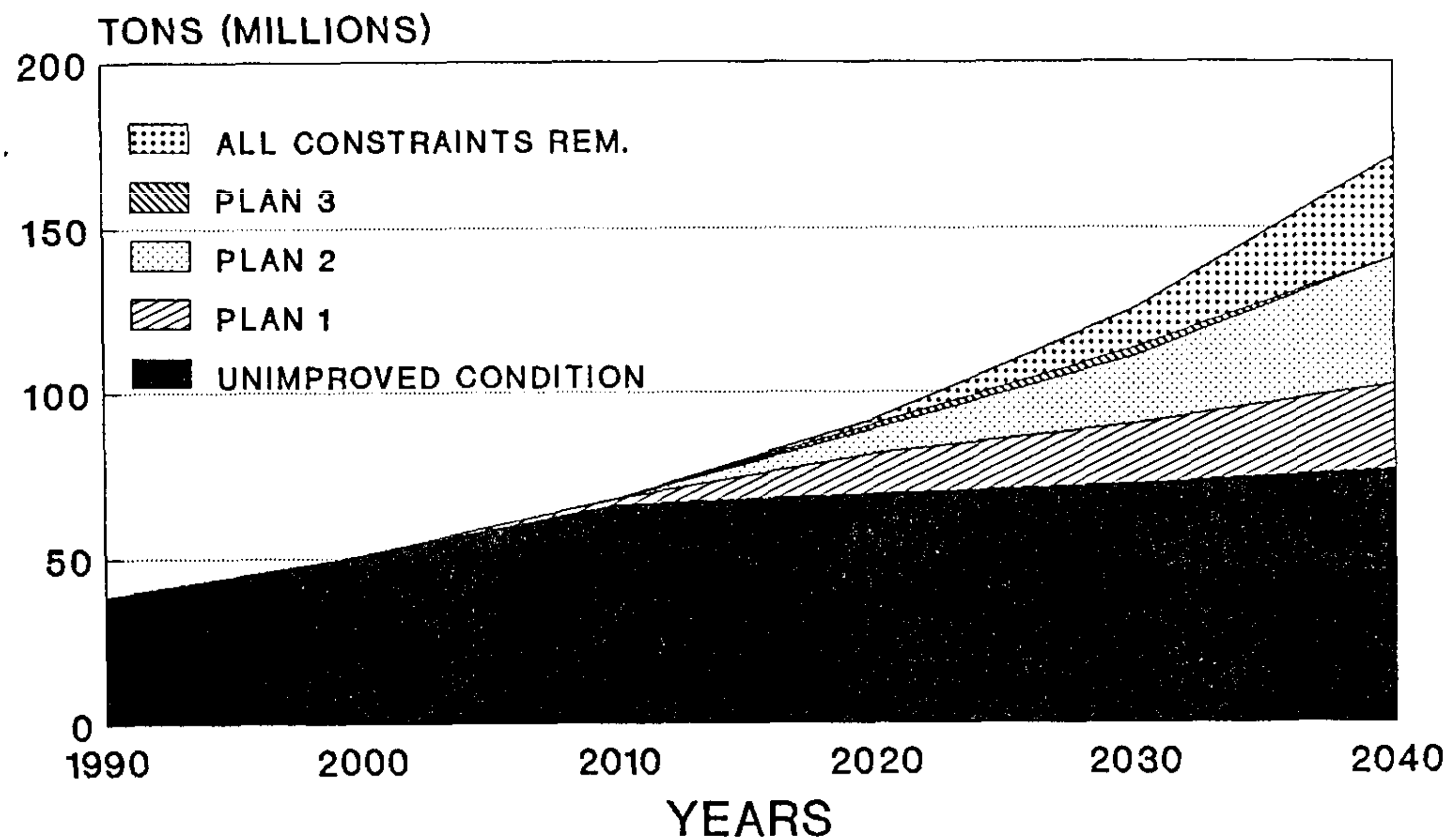


PLATE 11

SYSTEM TONNAGE ON THE ILLINOIS WATERWAY WITH IMPROVEMENTS (HIGH TRAFFIC GROWTH)



PLAN 1 - 1200' LOCK AT LAGRANGE
PLAN 2 - 1200' LOCK AT LAGRANGE AND PEORIA
PLAN 3 - 1200' LOCK AT LAGRANGE AND PEORIA, AND IMPROVEMENT TO MARSEILLES CANAL

PLATE 12

ILLINOIS WATERWAY SYSTEM BENEFITS (HIGH TRAFFIC GROWTH)

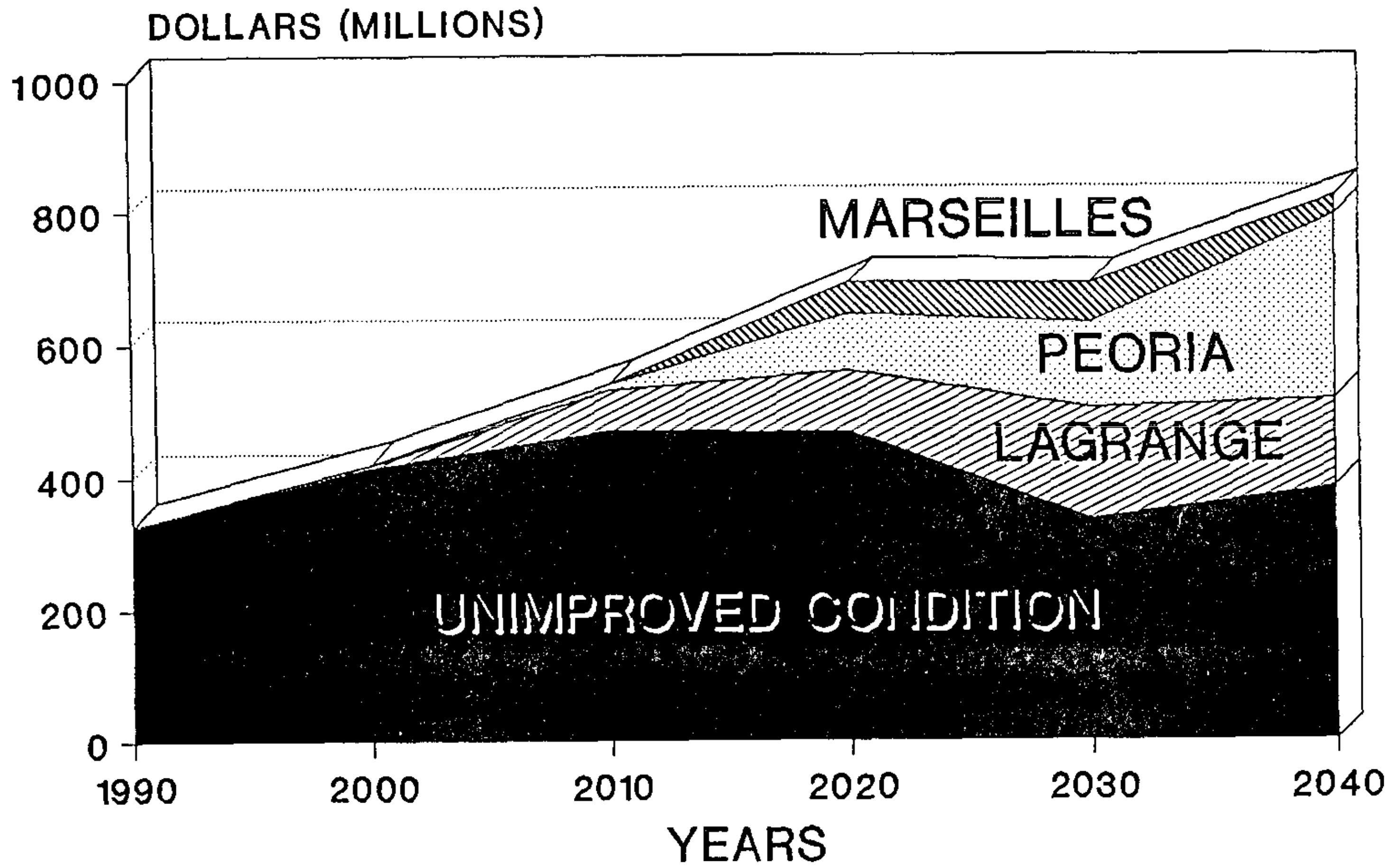
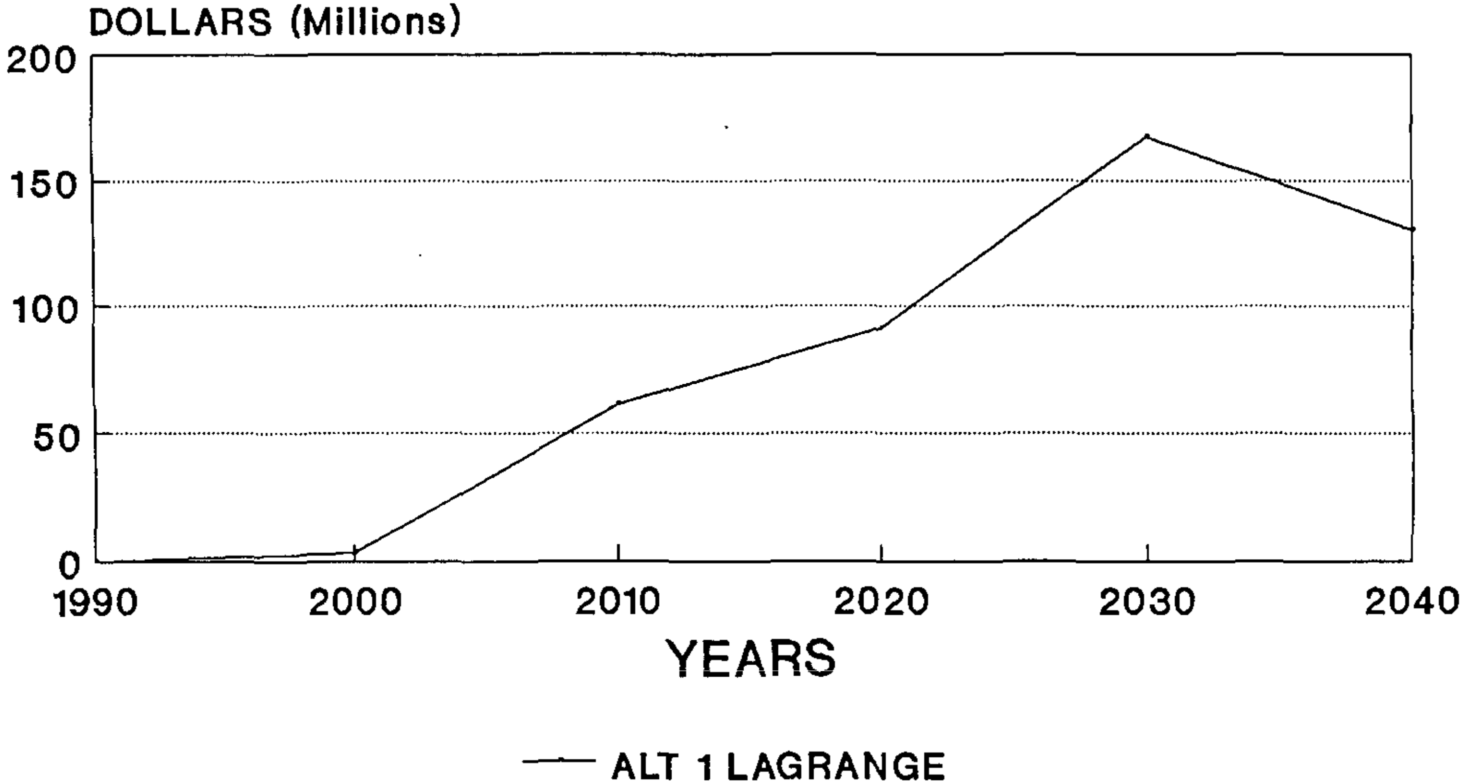


PLATE 13

INCREMENTAL SYSTEM BENEFITS
1200 FT. LOCK ADDITION AT LAGRANGE
HIGH GROWTH SCENARIO

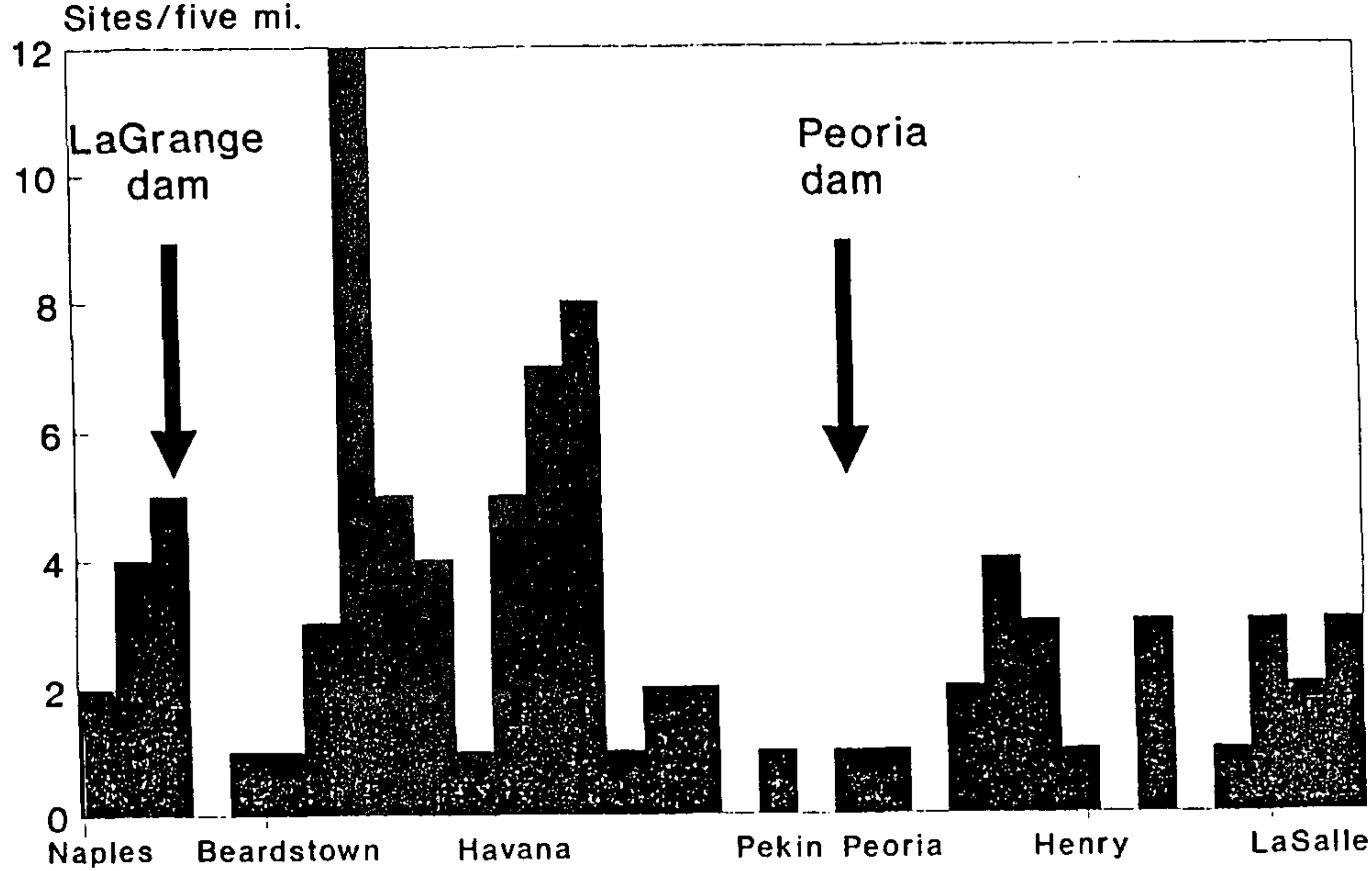


BENEFITS TO ADD A 1200 FT. LOCK TO THE EXISTING SYSTEM AT LAGRANGE.

PLATE 14

Site density along Illinois River banks

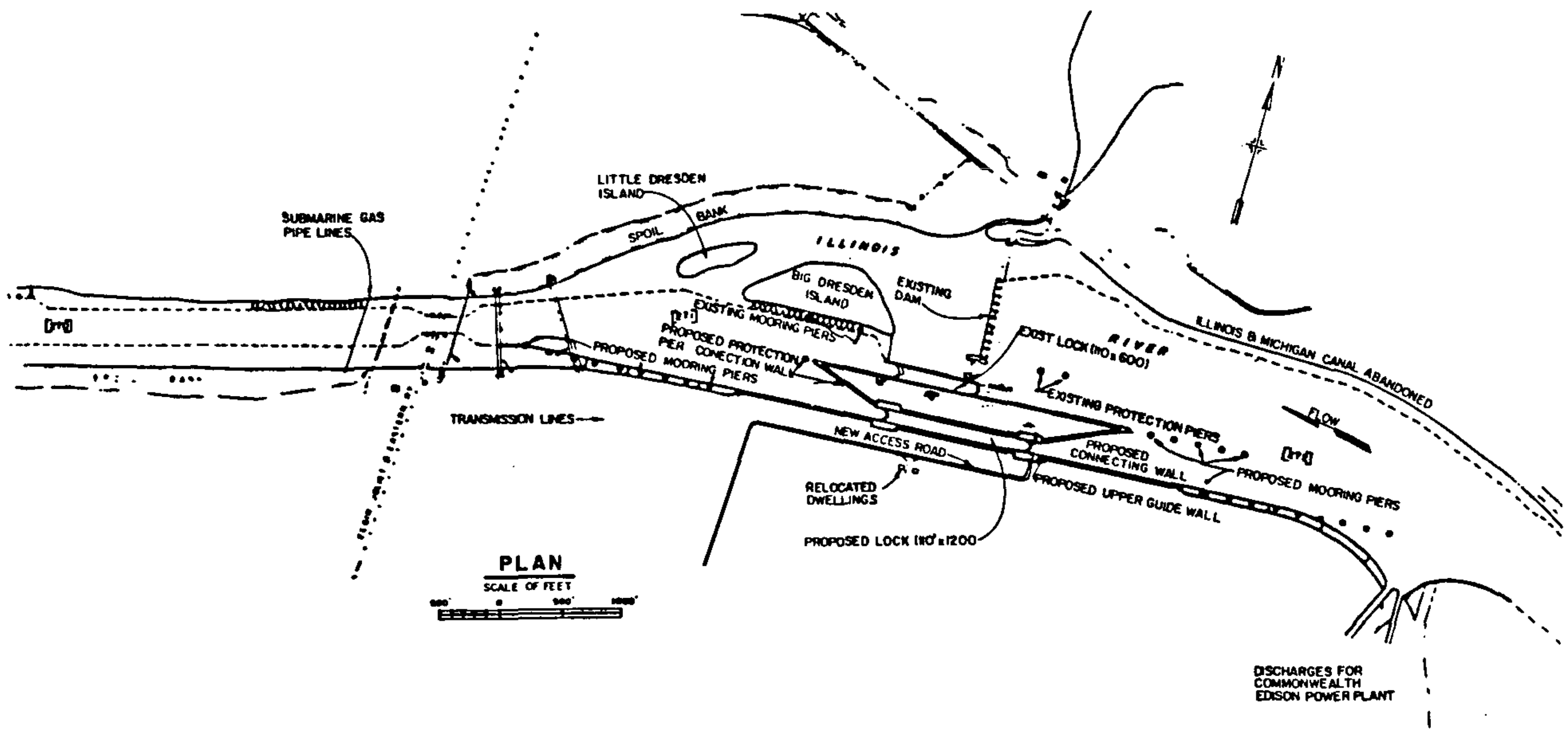
Number of sites* per five miles



* sites with 5+ cultural items 1st visit

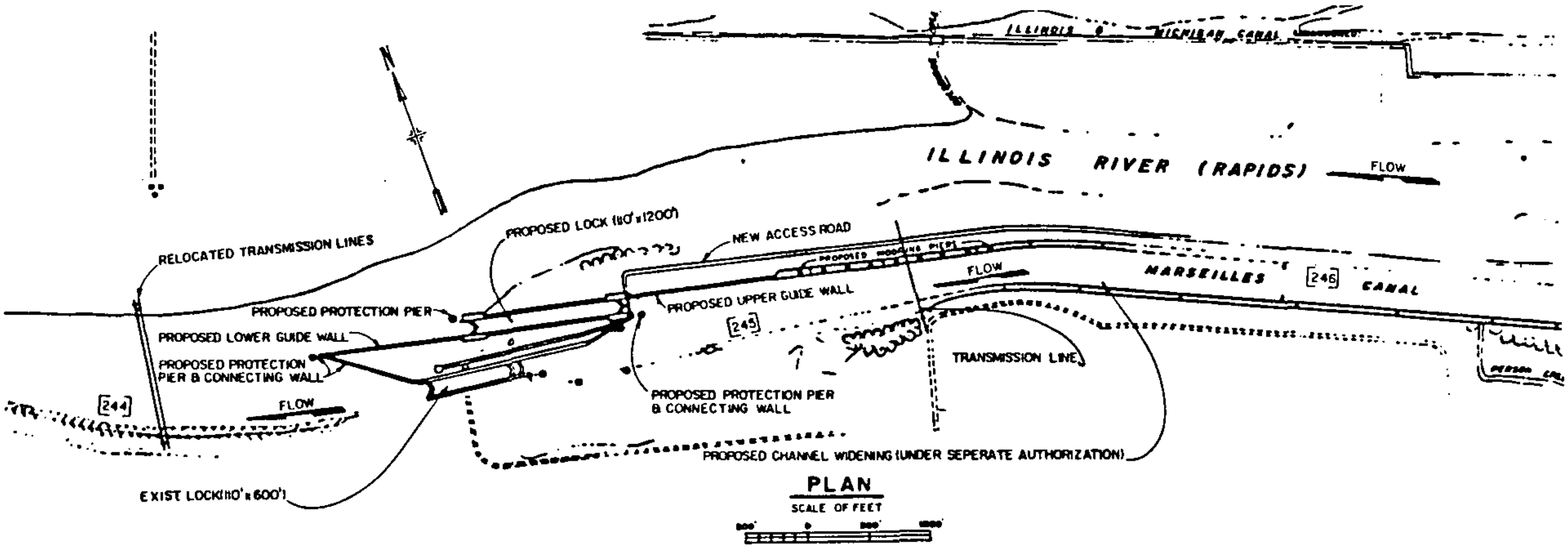
** From Esarey 1990

PLATE 15

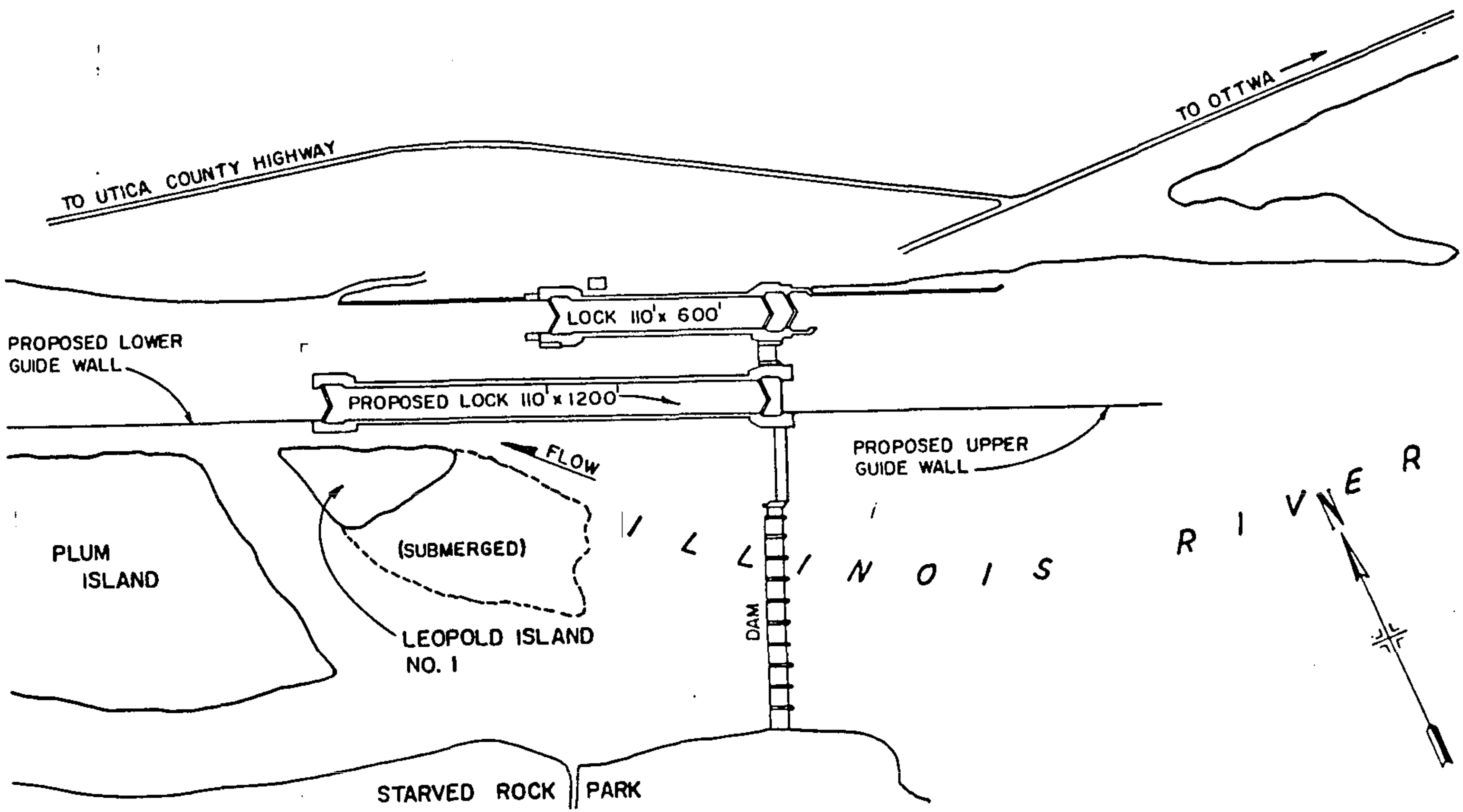


DRESDEN ISLAND LOCK AND DAM
PROPOSED LOCATION
OF 1200 ft. LOCK

PLATE 16

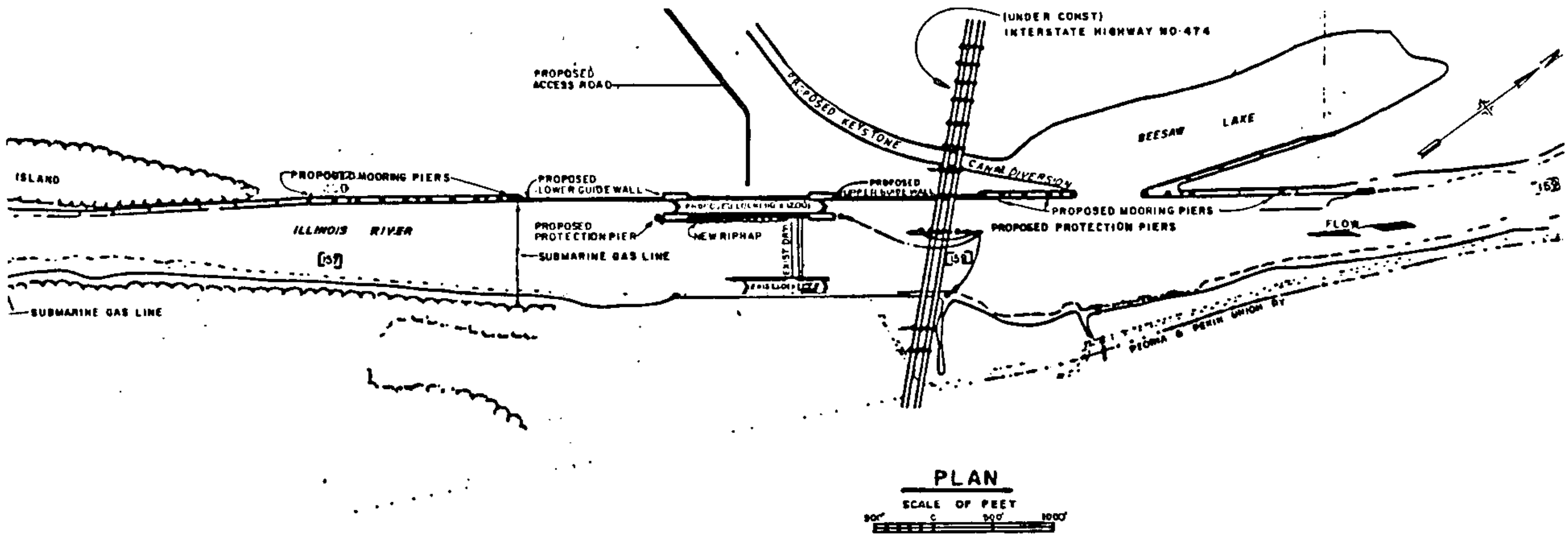


MARSEILLES LOCK AND DAM
PROPOSED LOCATION
OF NEW 1200 ft. LOCK

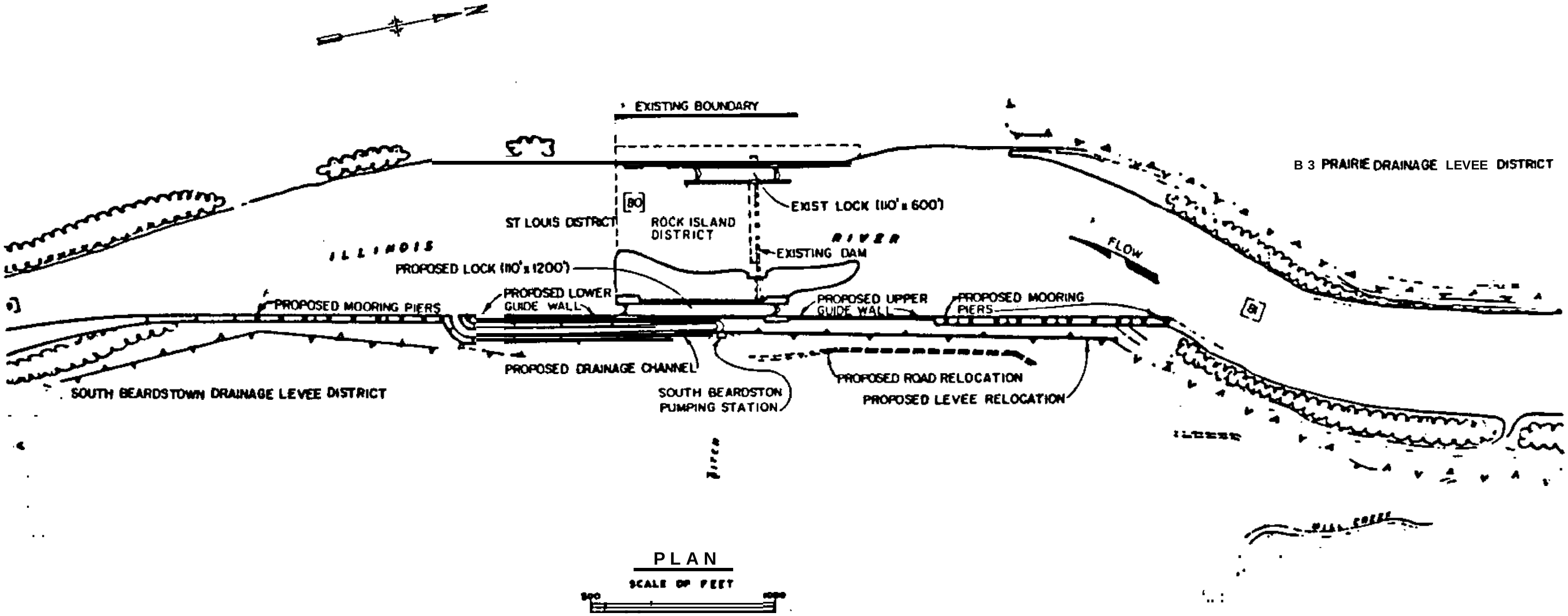


STARVED ROCK LOCK AND DAM
PROPOSED LOCATION
OF 1200 ft. LOCK

PLATE 18



PEORIA LOCK AND DAM
PROPOSED LOCATION
OF NEW 1200 ft. LOCK



LA GRANGE LOCK AND DAM
PROPOSED LOCATION
OF 1200 ft. LOCK

PLATE 20

INITIAL PROJECT MANAGEMENT PLAN

A
P
P
E
N
D
I
X

A

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SECTION 1 - INTRODUCTION

PURPOSE

The Initial Project Management Plan (IPMP) details the scope, schedule, and budget required to execute the feasibility phase.

OBJECTIVE

The IPMP must establish two primary objectives for the feasibility phase study. First, the IPMP must clearly relate cost and schedule to scope of work within the feasibility phase. This allows the IPMP to be utilized as a tool for managing and monitoring the feasibility study, and it promotes a better understanding among the administrative management, project manager, and interdisciplinary study team members of the commitments required to deliver a quality study on schedule and within budget. Secondly, during feasibility, the IPMP will be modified for the recommended project to establish scope, schedule, budgets, technical performance requirements for management, and control of the project from planning through construction.

DEVELOPMENT

The development of this IPMP is dependent on the identified scope, costs, and schedule necessary to complete the feasibility phase.

STUDY SCOPE

The LaGrange Feasibility Study will have two main objectives: (1) establishment of the system-wide National Economic Development (NED) plan and (2) a detailed evaluation of the first recommended project or portion of the plan.

The system-wide NED plan establishes priority by which navigation improvements will be accomplished over the 50-year planning horizon. The study will include a system-wide environmental and economic analysis, a preliminary engineering analysis and cost estimate, a schedule for implementation of portions of the plan, and a preliminary scope of work and budget.

Results of the system reconnaissance study identify LaGrange Lock as the first major constraint on the Illinois Waterway. The second objective of this feasibility study will be to formulate and evaluate site-specific alternatives, structural and nonstructural, and address how to best reduce delays at the LaGrange Lock. The study will include a site-specific environmental, economic, and engineering analysis. Follow-up site-specific feasibility studies will be required as the additional portions of the plan are implemented. The cost and schedule of these studies will be shown in detail in the LaGrange feasibility study.

DESCRIPTION OF STUDY AREA

The feasibility study area is the Illinois Waterway, located entirely within the State of Illinois. Any improvements proposed will be environmentally and economically evaluated on a system-wide basis. Based on the results of the reconnaissance study, LaGrange Lock is the first site-specific study area.

The LaGrange Lock and Dam is located at River Mile (RM) 80.2, 8 miles downstream from Beardstown, Illinois. The lock and dam were completed in 1939. The dam is operated to maintain a normal pool elevation of 429.0 feet National Geodetic Vertical Datum (NGVD) in order to provide a 9-foot channel between miles 80.2 and 157.7 on the waterway. The dam is comprised of wicket gates which are raised to create a navigation pool during low water and lowered during high water to allow for open pass conditions. This open pass condition is present 47 percent of the time in an average year. The wooden wickets are supported by a concrete sill which is founded on timber piles. These wicket gates contain parts that are over 50 years old and may be in need of complete replacement in the next 20 years. Steel sheet pile cutoffs are present at both the heel and toe of the dam. A regulating structure exists on the left bank of the dam. The dam maintains a 78-mile-long navigation pool that extends upstream to Peoria Lock and Dam. Normal upper pool is at elevation 429.0 NGVD.

The minimum tailwater at Peoria is 419.0. The LaGrange Lock is located on the right descending bank. The lock chamber is 110 feet wide by 600 feet long. Access to the lock is controlled by hydraulically operated miter gates at both ends of the lock. The maximum lock lift is 10 feet. The average lock filling and emptying time is 10 minutes. The lock walls and gate sills are of mass concrete construction and are founded on timber piles. A steel sheet pile cutoff exists under the lock walls and gate sills.

STUDY BUDGET

The feasibility study cost estimate of $9,750,000 was approved by the North Central Division Commander (Memorandum for Commander, Rock Island District, dated August 14, 1989). The study cost estimate was increased to $10 million (account for salary increases) in the Fiscal Year (FY) 1991 budget.

The development of the cost estimate considered the following: (1) establishment of the system-wide NED plan; (2) a detailed evaluation of the first recommended project or portion of the plan (i.e., a new 1,200-foot by 110-foot lock); (3) further data acquisition, evaluation of economic models, continued refinement, and optimizing of the system economics; and (4) the requirement to comply with National Environmental Protection Agency (NEPA), yet recognizing the need to evaluate not only the site-specific environmental effects due to project construction, but also the potential effects of the project to the entire system.

The timely execution of the feasibility study requires that approximately 50 percent of funds budgeted for this study be used for contracted services; therefore, it is essential to identify sources of potential contractors (i.e., Architect-Engineer firms, universities, laboratories, other agencies, and other Corps Districts, etc.) for their expertise and manpower availability. If at a future date additional Full Time Equivalent (FTE) positions are available, the amount of contracted work would be reduced.

The second section of this IPMP, Interdisciplinary Management Plans, identifies, by discipline, the tasks and respective costs required to evaluate alternatives during the feasibility study. In addition, this section indicates potential work items requiring the services of a contractor.

All cost estimates were based on unconstrained funding and completion of the study in 3 years as directed by Corps of Engineers' planning guidance. The reprogramming of funds, as shown on the current FY 92 Federal budget program, has impacted the study schedule. Since the funding is spread over a 6-year time frame, we will begin planning for a 6-year feasibility study. Future reprogramming or reduction of funds during the execution of the feasibility study may affect the quality and thoroughness of some analyses, and certainly would impact the 6-year study schedule.

STUDY SCHEDULE

The Corps of Engineers' planning guidance outlines the length and principal milestones required to execute and complete a feasibility phase study. The feasibility study is one of the two components that comprise the feasibility phase. The second component covers the North Central Division review plus the Washington level review and certification of the feasibility study report. Feasibility studies are scheduled for 36 months, followed by a 1-month Division review and a 6-month Washington level review and certification of the feasibility study report. Based on the current FY 92 Federal budget ceiling level, the 36-month study schedule will have to be extended to 72 months in order to complete the work tasks needed for a comprehensive report.

The results of the study will be the identification of the NED plan and the recommended project or portion of that plan. The recommended project will include the detailed analyses necessary to support and establish the baseline cost estimate of the project. The design analyses should produce quality and detailed drawings, such that a General Design Memorandum (GDM) will not be necessary prior to beginning the Plans and Specifications (P&S) of the recommended project. Feature Design Memorandums will be initiated during the feasibility and completed during Planning, Engineering, and Design (PED). Additionally, during this timeframe a Project Management Plan (PMP) will be developed and submitted to the Project Review Board for approval. This PMP will facilitate the task scheduling and manpower allocations necessary during PED, P&S and the Construction Administration of the project. The Final Feasibility Study Report and accompanying Final Environmental Impact Statement (FEIS) then are submitted to the North Central Division Commander for review.

Once submitted, the report undergoes the 7-month review and certification by the Division and the Washington Level Review Center (WLRC).

SECTION 2 - INTERDISCIPLINARY MANAGEMENT PLANS

PLANNING

STUDY MANAGEMENT

Scope

The study manager ultimately will be responsible for coordinating the budget and schedule of the entire project. Due to the interdisciplinary nature of the study, certain team elements will rely on information from other study areas. The study manager will function as a link between study elements, as well as to upper management.

Budget

The feasibility study management cost of $900,000 includes a 6-year study and a year of certification and review. All cost estimates developed account for direct labor, technical indirect, and district overhead. The development of the cost estimate considered the following: (1) one full-time study manager, (2) one half-time technician, (3) one half-time individual project manager from the project management office, (4) one quarter-time first line supervisor, (5) one quarter-time secretary, and (6) associated travel.

Schedule

The project management will be spread uniformly throughout the feasibility study phase.

PLAN FORMULATION

Scope

Plan formulation will concentrate on establishing a system-wide NED plan. This will be accomplished by determining benefits and costs for several alternative plans. Engineering, environmental, and economic benefits and costs for the system will be evaluated to select the optimum plan.

Once the NED plan is selected, detailed engineering and analyses of site-specific impacts for the recommended first portion of the plan will be accomplished. This portion of the study will enable the project to proceed to the Pre-Engineering and Design (PED) phase and provide a system-wide and site-specific Environmental Impact Statement (EIS).

Budget

The feasibility plan formulation cost estimate of $500,000 will account for portions of study management and study team participation over the 6-year study period.

Schedule

The plan formulation of the project will be more intense during the first half of the study; however, revisions and alterations will occur throughout the study.

ECONOMIC EVALUATION

Scope

All lock sites in the Illinois Waterway System will be analyzed to determine the relative magnitude of the constraint that each poses to the efficient flow of traffic and determine the potential transportation resource cost savings that could be realized through modernization. An overview of the procedures is presented in appendix C. All Illinois Waterway locks and critical channel constraints will be analyzed and modeled in the first feasibility study with emphasis on the major constraints identified. The interdependence between locks with regard to delay will be studied for any proposed improvements to the system. The following work tasks expand on work completed during the reconnaissance study and comprise the economic work items necessary for evaluating alternatives in this feasibility study.

Work Tasks

a. Develop and refine delay and capacity estimates and delay costs. Reevaluate the TK Solver Program as a practical means of calculating capacity. Sensitivity testing will be conducted to determine confidence intervals for both delay and capacity estimates. Additional sensitivity tests will examine the impact of recreational traffic on system delays to commercial traffic. Alternate capacity calculations will be made using the Lock Simulation Model (LOCKSIM) and the Waterway Analysis Model (WAM). Capacity and delays will be evaluated on a seasonal basis and for historical and projected future conditions (i.e., changing tow size, horsepower, and barge loading).

b. Obtain the most current 3 years of available Origin-Destination (O-D) data, and analyze changes in origins and destinations. The O-D data to be used in the system analysis will be reviewed with industry groups and discussed with shippers to assure accuracy of the data. With year-round navigation available on the Illinois Waterway, the origin of grains needs to be analyzed with respect to seasonal changes.

c. Develop a statistically adequate sample of water movements. From this sample of origin destination pairs, costs for both water and alternative modes of transport (i.e., rail, truck) will be developed using cost models for linehaul portions and extensive surveys of carriers and shippers for access, loading and unloading changes. Linehaul costs also will be obtained through surveys to verify the cost models. A 1 percent railway bill sample will be obtained and evaluated to verify rail cost modeling. The resulting rate/cost matrix will be reviewed with industry groups and adjusted as necessary to reflect actual transportation routes, costs, and modes of transport. Particular attention will be given to grain and coal in determining the basic origin destination data base. Because these two commodities are general intermodal shipments, the distribution of grain origins and source of coal could be important factors in alternative rates and costs.

d. Develop traffic demand projections by commodity group for the entire Illinois Waterway System by relating the existing traffic base to indexes of growth in the specific regions served by the waterway. The traffic projections developed for the Inland Waterway Review will be reviewed with industry groups. Updating and revising traffic projections will be based on both historical and current growth trends. The current growth of grains and tons shipped on the Illinois Waterway and changes from eastern to western coal sources makes this analysis important to accurately predicting future traffic and its demands.

e. Determine which system model is most appropriate for use in conducting the system analyses for the Illinois Waterway. Set up and run both the General Equilibrium and the Tow Cost models, to estimate system impacts of various alternatives considered in the feasibility study, to include sensitivity analyses. The Waterway Efficiency Evaluation Model (WEEM) was developed for use in the evaluation efficiency measures on the Upper Mississippi River. If converted for use on the Illinois Waterway, it will prove to be a useful tool for evaluating similar measures. If funding is available, this conversion will be accomplished during the feasibility study.

f. This feasibility study will define the order and timing of system improvements needed at the remaining seven locks and their pools. A full range of alternatives will be evaluated separately and in combination and sequenced at each lock site or constraint on the Illinois Waterway. These alternatives can be categorized as major and minor structural improvements, floating plant, and nonstructural improvements.

g. Make multiple runs of the system model to examine the sensitivity of system benefits to changes in capacity, delay, delay cost, and rates/costs. A risk analysis will be conducted examining the probability of open pass at Peoria and LaGrange locks. This analysis will identify the probability of open pass in relation to traffic on a periodic rather than annual basis.

h. The objective of this task is to prepare a draft and final economic report which explains the system analysis and prioritization of improvements on the Illinois Waterway System. Work conducted in completing each task will be summarized, and results from model runs will be presented. The analysis will be fully coordinated within the District and with division and higher headquarters. Industry groups and environmental agencies will be coordinated with throughout the study process.

Budget/Schedule

All cost estimates were developed taking into account direct labor, technical indirect, district overhead, and field travel expenses. It is estimated that 43 percent of the funds budgeted for the economic work tasks will be contracted, unless additional FTE's are allotted. Table A-1 shows a breakdown of the expected costs and schedule of executing the necessary economic work tasks. Figure A-1 graphically shows the expected schedule for each work task.

TABLE A-1

Economic Cost Estimate

Task	Cost ($1,000)	Schedule (FY) Start	End	Work Performed By
a. Capacity and delay estimates	70.0	94	96	CENCR [1]
b. O-D data base	140.0	92	94	CENCR
c. Rate/cost studies	280.0	92	96	CENCR, Advertised Bid [2]
d. Traffic projections	140.0	92	96	CENCR, Advertised Bid [2]
e. Set up and testing of navigation system models with base data	280.0	91	96	CENCR
f. evaluate alternatives	140.0	91	96	CENCR
g. Risk and uncertainty analysis	210.0	91	96	CENCR
h. Coordination and report prep.	140.0	91	96	CENCR
TOTAL	$1,400.0			

[1] U.S. Army Engineer District, Rock Island
[2] Could include other Federal or State agency.

ILLINOIS WATERWAY NAVIGATION STUDY
ECONOMIC
SCOPE OF WORK SCHEDULE

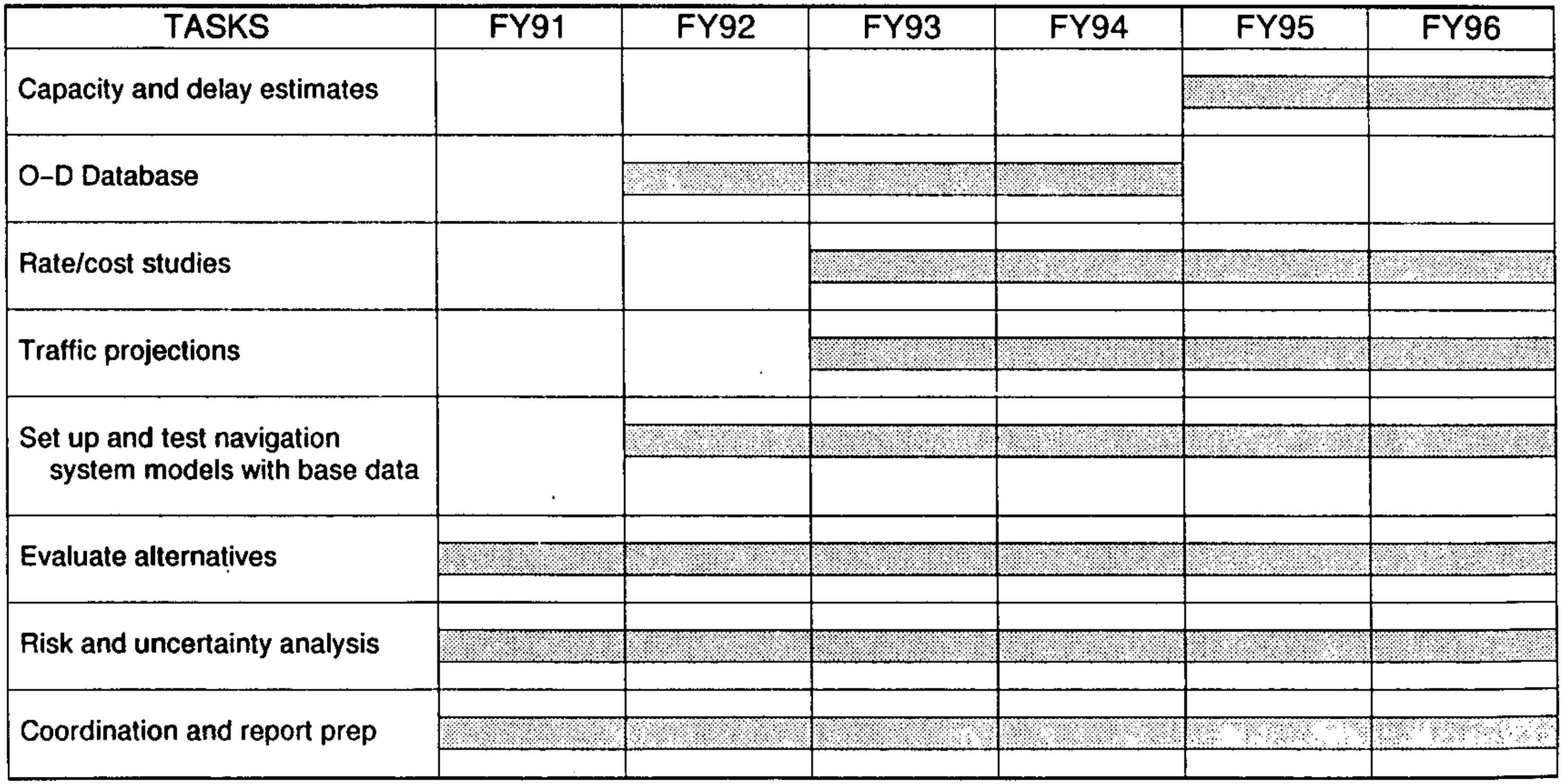

Figure A-1.

SOCIAL EVALUATION

Scope

Determine socioeconomic impacts resulting from proposed measures to increase capacity on the Illinois Waterway navigation system.

Work Tasks

a. Determine and describe the study area. Gather maps and geographic information about the immediate study area, affected region, and affected state(s). Prepare maps indicating the boundaries of the affected study area, region, and state(s).

b. Inventory existing conditions. Gather and review existing statistical, social, and institutional data. Gather additional data through surveying efforts. Perform content analysis and statistical review of respondent/public contact data.

c. Examine past and present relationships between study area communities, regions, and populations and the affected navigation facilities. Identify the concerns and the alternative(s) preferred by Senators and Congressional Representatives, Federal agencies, State and smaller units of government, organized groups, business representatives, and the general public. Identify the underlying political relationships between various institutions, including interest groups, business groups, elected officials, and businesses.

d. Identify the relationship between employment, income, business activity, and the navigation facilities for the study area, region, and state(s). Identify businesses dependent upon or supporting navigation activities, facility improvements and upgrades, or facility construction or maintenance. Determine the local, regional, and state-wide jobs and income resulting from navigation support and navigation dependent businesses.

e. Identify and explore future conditions or scenarios. Perform or gather population, business activity, employment, and labor force forecasts. Compare the study area and region with areas directly impacted by past navigation capacity improvements on the Illinois Waterway or Mississippi River. Develop future scenarios for "with" and "without capacity improvement" conditions (in coordination with study team).

f. Identify socioeconomic impacts resulting from the "with" and "without action" alternatives. Assess impacts as required by NEPA for Environmental Impact Statements/Environmental Assessments: community and regional growth; community cohesion; displacement of people, businesses, or farms; public facilities and services; property values and tax revenues; business and industrial activity; employment and labor force; noise levels; and aesthetics. Identify additional socioeconomic impacts as appropriate, including, for example, impacts to life, health, and safety.

g. Identify measures and alternatives which minimize adverse impacts. Identify alternatives which have unacceptable impacts.

h. Compare action alternatives. Develop a matrix to assess the range of impacts resulting from each action or no action alternative. Discuss the NED plan's departure from the alternatives preferred by institutions or the general public. Discuss the rationale for selecting the recommended plan.

i. Prepare report text addressing all topics discussed in Items 1 through 8. Address additional topics or questions identified during study or review.

Budget/Schedule

All cost estimates were developed accounting for direct labor, technical indirect, district overhead, and field travel expenses. Table A-2 shows the breakdown of expected costs and schedule of executing the necessary socioeconomic work tasks. Figure A-2 graphically shows the expected schedule for each work task.

TABLE A-2

Socioeconomic Cost Estimate

Task	Cost ($1,000)	Schedule (FY) Start	End	Work Performed By
a. Delineate and describe study area	5.0	91	91	CENCR
b. Inventory existing conditions	22.0	91	92	CENCR
c. Examine community and facility relationships	6.0	92	93	CENCR
d. Examine employment, business activity and facility relationships	6.0	91	96	CENCR
e. Identify future socioeconomic conditions	12.0	91	96	CENCR
f. Identify socioeconomic impacts	6.0	95	96	CENCR
g. Identify measures to minimize impacts	7.0	95	96	CENCR
h. Compare action alternatives	7.0	95	96	CENCR
i. Prepare socioeconomic text	8.0	95	96	CENCR
j. Travel	3.0	91	96	CENCR
k. Other significant costs (computer, photo-reproduction, etc.)	3.0	91	96	CENCR
TOTAL	85.0			

ILLINOIS WATERWAY NAVIGATION STUDY
SOCIOECONOMIC
SCOPE OF WORK SCHEDULE

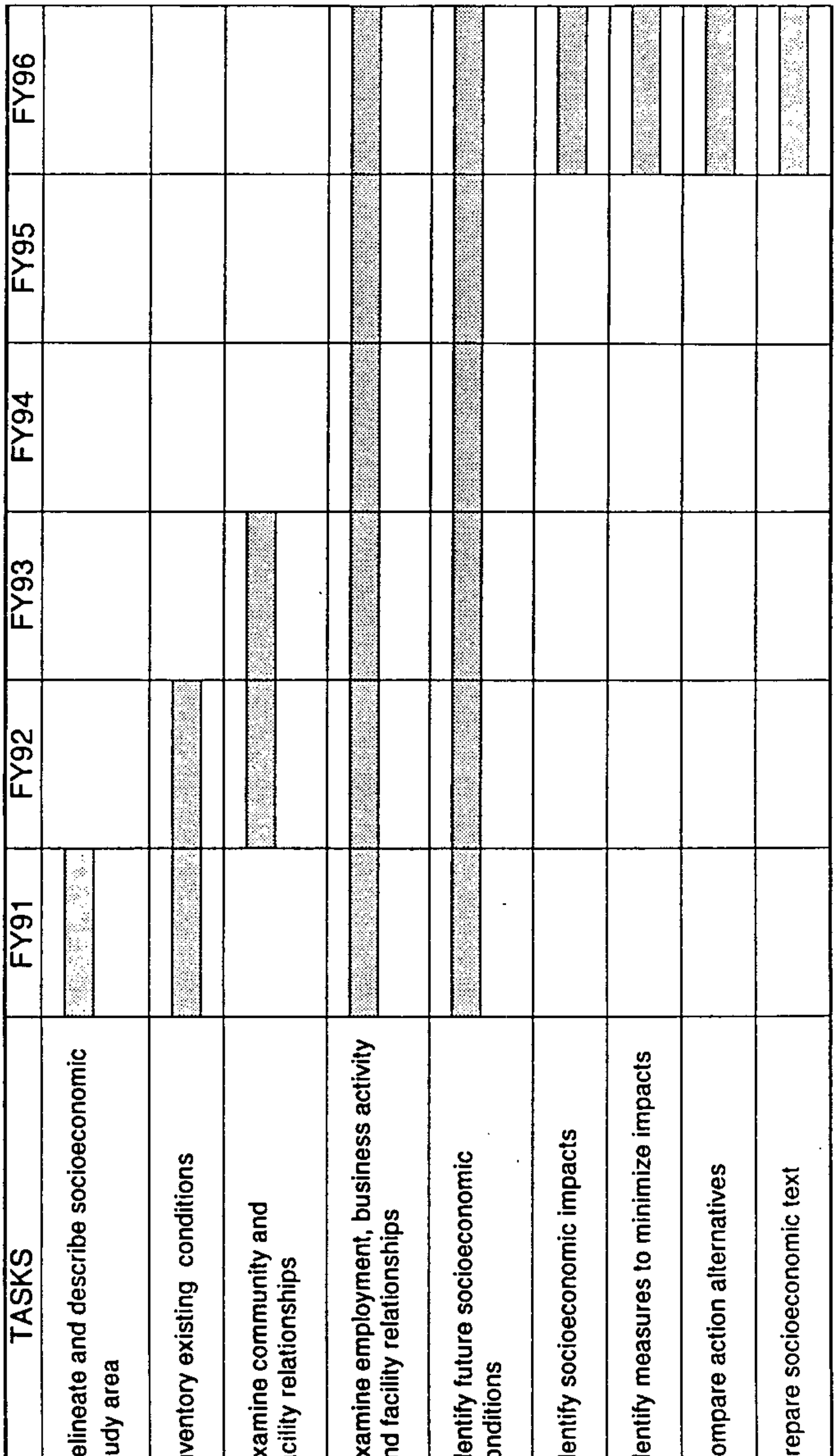

Figure A-2.

ENVIRONMENTAL RESOURCES EVALUATION

Scope

The following studies, costs, schedule, and courses of action are recommended for feasibility in order to assure the preparation of a timely and defensible NEPA document. The cost of this portion of the feasibility reflects a system-wide and site-specific analysis. Any future studies for other portions of the NED plan will utilize these system studies and will only require site-specific analyses. This will reduce future costs for environmental analyses. All cost estimates developed account for direct labor, technical indirect, district overhead, and field travel expenses.

a. **NEPA Compliance**. Prepare a draft and final EIS with necessary supporting documents such as Section 404(b)(1) Water Quality Evaluation and Biological Assessment for endangered species. Conduct scoping and coordination meetings with other agencies and the public. The EIS will include a site-specific evaluation of the construction related impacts for one or more new 1,200-foot locks at Peoria and/or LaGrange. In addition to an evaluation of site-specific impacts, a system-wide impact evaluation also will be made. Preparation of the EIS will include assistance from St. Louis District personnel since the lower 80 miles of the study area lies within St. Louis District boundaries.

b. **Mussel Survey of Illinois Waterway**. Historically the Illinois Waterway supported expansive mussel beds that supported a large "clamming" industry. The mussel population declined dramatically through the 1960's because of pollution and sedimentation. Mussel resources on the river have been expanding in the last 20 years due to improving water quality. Commercial harvest of mussels also has increased. The continued resurgence of the mussel resource is potentially jeopardized by increased navigation traffic and associated developments such as fleeting areas. The last comprehensive mussel survey of the river was performed in 1966. The recovery of the mussel fauna in the intervening years now mandates that the location of mussel beds and their significance be determined. This information is necessary for addressing aquatic impacts in the EIS.

c. **Conduct an Impact Evaluation of Future Traffic Scenarios Using the Louisville District's Navigation Predictive Analysis Technique (NAVPAT)**. Attempting to predict impacts to the entire river would be an impossible task without using a predictive model of some type. NAVPAT is the only known technique that can analyze site-specific data (hydrological, biological, and economic) on the Illinois Waterway and predict site-specific impacts as well as to the entire system. The model also is needed to evaluate "avoid and minimize" measures. The following specific tasks are required to run the model:

(1) Field mapping of river bathymetry/morphology.

(2) Develop stage-discharge data for critical biological periods for river cross sections generated in task 1.

(3) Develop future traffic scenarios and files ("with" and "without project" condition).

(4) Develop hydraulic forces models specific to Illinois River.

(5) Develop habitat models for six species of critical concern on the Illinois River.

(6) Execute NAVPAT for three alternatives.

d. **Technical Assistance from Louisville District to Run NAVPAT.** To date, NAVPAT has been used and developed only by the Louisville District. The technique has not been used outside the Ohio River Division and there is insufficient documentation and experience to allow others to perform an adequate analysis. Technical assistance from Louisville District will be required to conduct a model simulation of the Illinois Waterway and potential alternatives.

e. **Fish and Wildlife Service Support of NAVPAT.** Data acquisition, species model development, and data analysis will require considerable involvement of the U.S. Fish and Wildlife Service (USFWS) over and beyond the requirements for preparation of a Coordination Act Report (CAR). Results of NAVPAT would be used for mitigation planning and identifying "avoid and minimize" measures. USFWS involvement in model development and analysis of results will be essential if the results are to have any validity with the State and Federal resource agencies.

f. **Site-Specific Sediment Analysis.** Construction of any new locks or dams will involve excavation/dredging of large volumes of sediment. Although recent sediment testing for O&M dredging activities has not indicated any significant problems with hazardous and toxic sediments, there is a potential for encountering such problems due to the history of pollution on the river. This is especially true for the more deeply buried sediments likely to be encountered in lock and dam construction. These data are needed to complete Section 401 State Water Quality certification requirements.

g. **Water Quality Impacts of Sediment Resuspension.** Sedimentation is one of the most serious threats to aquatic organisms on the Illinois River. The existing aquatic ecosystem already has been severely impacted by high turbidity levels and high sedimentation rates. The short- and long-term effects of sediment resuspension caused by construction and increased navigation need to be addressed. Representative samples from the river will be tested for their potential effects on aquatic biota. This testing may involve some bio-assay testing if sediment analyses warrant it.

h. **Riparian Impacts of Bank Erosion.** A significant portion of the river's natural resources lies along the shoreline and riparian zone. Numerous cultural and historical sites also are located in the riparian zone. Because of the river's narrow width, tow traffic frequently passes very near the shoreline. Increased tow traffic, changes in channel alignment, and other navigation improvements could cause a significant increase in bank erosion at many locations. In addition to direct physical impacts, increased erosion also would cause an undesirable increase in the river's sediment load.

i. **Identify Increased Barge Fleeting.** Future increases in tow traffic would mean a concurrent increase in fleeting areas. There are known direct and indirect impacts associated with fleeting areas. The number of additional fleeting areas needs to be identified to determine the significance of the impacts. This study also needs to identify river reaches where these facilities would most likely be needed.

j. **Evaluate Hydraulic Changes Due to a New Lock or Dam.** Construction of new structures may cause changes in river hydraulics that affect aquatic resources. Dam tailwaters are especially important to fish. Dams also increase the amount of dissolved oxygen in the water. Any proposed alternatives that would alter a dam's recreation ability need to be evaluated for impacts to aquatic organisms.

k. **Recreation Assessment.** Specific recreation studies are needed to complete an evaluation of potential impacts and benefits to recreation in the EIS. Please see the following separate Recreation Evaluation portion of this IPMP.

Budget/Schedule

All cost estimates were developed taking into account direct labor, technical indirect, district overhead, and field travel expenses. It is estimated that 97 percent of the funds budgeted for the environmental work tasks will be contracted, unless additional FTE's are allotted. Table A-3 and figure A-3 show a breakdown of the expected costs and schedule in executing the necessary environmental work tasks.

TABLE A-3

Environmental Cost Estimate

Task	Cost ($1,000)	Schedule Start	(FY) End	Work Performed By
a. NEPA compliance	2,600.0	91	96	CENCR, CELMS [1]
b. Mussel survey of IWW	300.0	91	92	Advertised Bid [2]
c. Impact evaluation of future traffic scenarios using NAVPAT	500.0	92	94	CENCR, CEORL [3]
d. Technical assistance from Louisville District to run NAVPAT	85.0	91	94	CEORL
e. USFWS support of NAVPAT	80.0	92	94	USFWS [4]
f. Site-specific sediment analysis	80.0	93	94	CENCR, Advertised Bid [2]
g. Water quality impacts of sediment resuspension	165.0	91	93	Advertised Bid [2]
h. Riprarian impacts of back erosion	120.0	91	94	Advertised Bid [2]
i. Identify increased barge fleeting	150.0	92	93	CENCR
j. Evaluate hydraulic changes due to new locks or dams	120.0	93	94	CENCR, Advertised Bid [2]
TOTAL	$4,200.0			

[1] U.S. Army Engineer District, St. Louis
[2] Could include other Federal or State agency
[3] U.S. Army Engineer District, Louisville
[4] U.S. Fish and Wildlife Service

ILLINOIS WATERWAY NAVIGATION STUDY
ENVIRONMENTAL RESOURCES
SCOPE OF WORK SCHEDULE

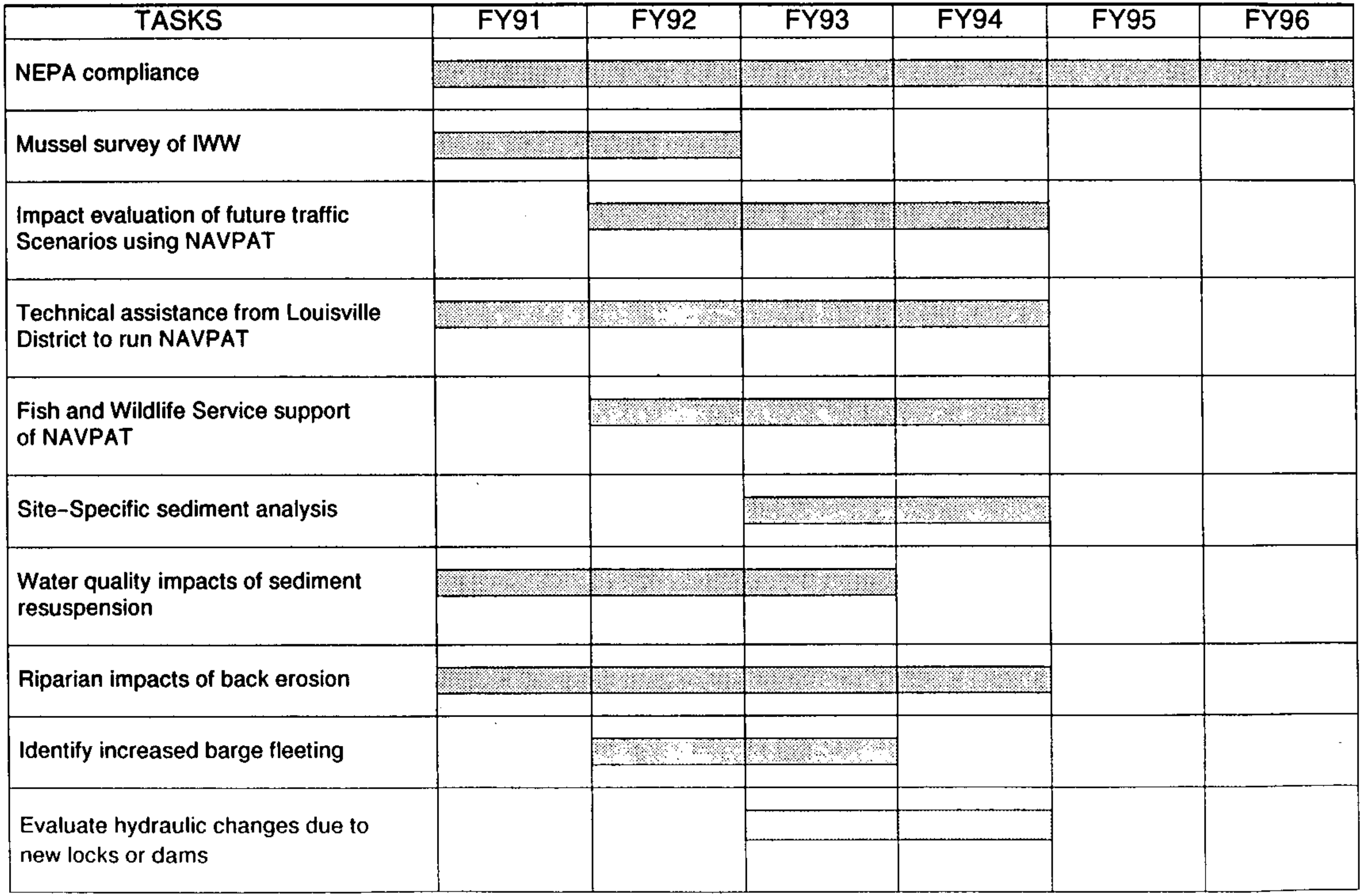

Figure A-3.

RECREATIONAL EVALUATION

Scope

The Illinois Waterway is a significant recreational resource in the State of Illinois. Increased tow traffic and degradation of natural resources may affect recreational use. On the other hand, system improvements also may enhance recreational use. Preliminary investigations and coordination during the reconnaissance phase have indicated that recreation use and facility data specific to the Illinois Waterway are not available. The purpose of this evaluation is to determine the impacts of the proposed Illinois Waterway navigation system improvements on the recreational significance of the system.

Work Tasks

a. Compile an accurate comprehensive inventory of all recreation sites within the Illinois Waterway corridor to include the number, location, and types of facilities currently available.

b. Identify these sites/facilities on a map.

c. Prepare, coordinate, and finalize Scope of Work (SOW) for surveys.

d. Perform recreational surveys to determine:

(1) Use - The types of activities being pursued, the number of participants, and the day-use hours or length of stay for overnight occupancy.

(2) Needs/Demands - The types of facilities or opportunities that are in demand or needed but unavailable.

(3) Recreation Value - The participants' "willingness to pay" for opportunities/services above and beyond those for which they currently pay.

e. Using the data gathered in paragraph c. above and data which are already available in the PMS, perform an assessment of the impacts of various system improvement options on recreation ("with" and "without action") for NEPA compliance.

Budget/Schedule

All cost estimates developed account for direct labor, technical indirect, district overhead, contract estimates, and field travel expenses. The estimate takes into account the data which may be available from the Environmental Management Project Economic

Impact of Recreation Study and the LTRM Public Use component studies. If these data are not available or do not provide the information needed for the assessment, the cost estimate may be higher. The Second Lock POS does not include a recreation use analysis, but rather addresses the physical effects of recreational boat effects on backwater areas. Table A-4 shows a breakdown of the expected costs and the schedule for executing the necessary recreation work tasks. It is estimated that 90 percent of the funds budgeted for the recreation work tasks will be contracted, unless additional FTE's are allotted. Figure A-4 graphically shows the expected schedule for each work task.

TABLE A-4

Recreation Cost Estimate

Task	Cost ($1,000)	Schedule (FY) Start	End	Work Performed By
a. Compile inventory	3.0	91	91	CENCR
b. Produce site/facility map	2.0	91	91	CENCR
c. Prepare SOW	9.0	91	91	CENCR
d. Perform recreational surveys	180.0	92	96	Advertised Bid [1]
e. Perform recreation assessment	6.0	94	96	CENCR
TOTAL	200.0			

[1] Could include other Federal or State agency.

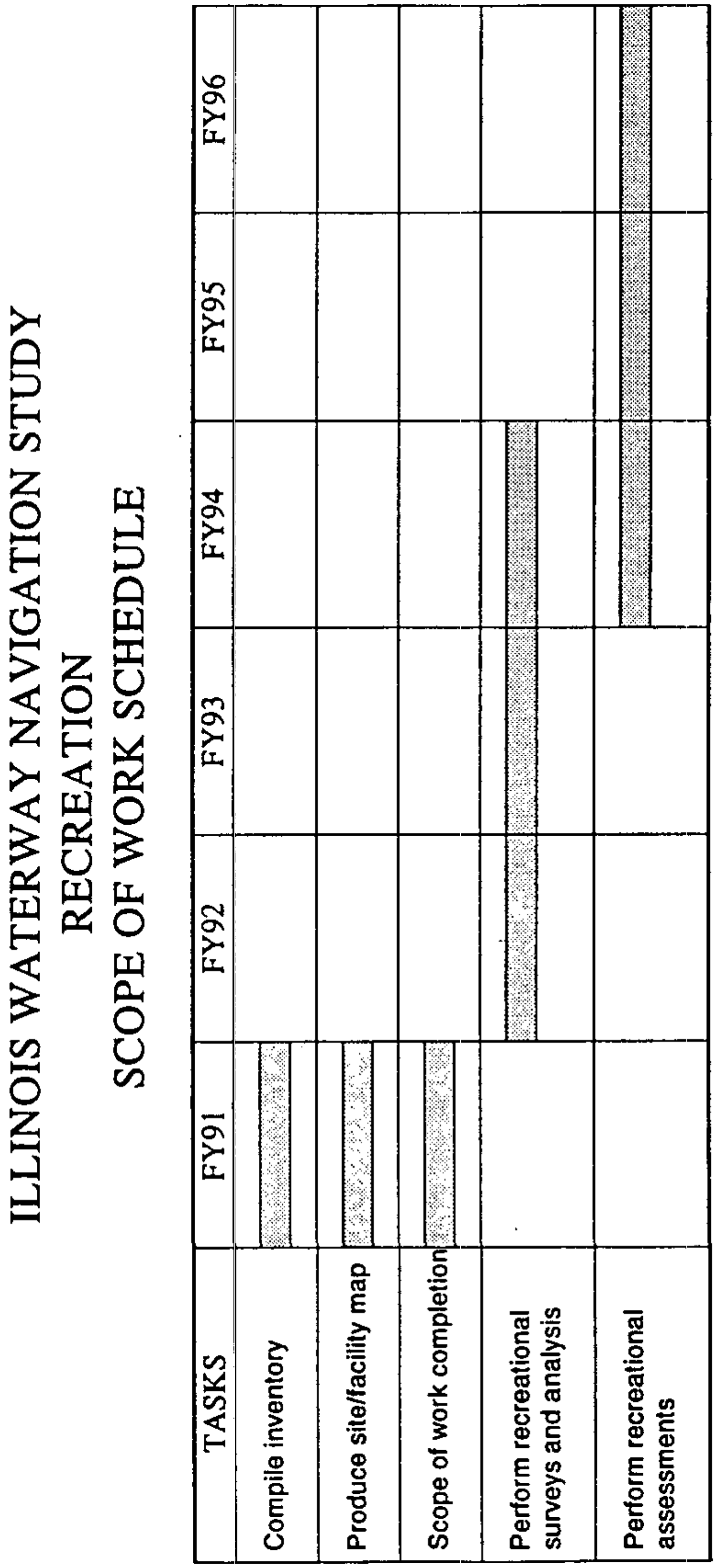
ILLINOIS WATERWAY NAVIGATION STUDY
RECREATION
SCOPE OF WORK SCHEDULE
TASKS
FY91
FY92
FY93
FY94
FY95
FY96
Compile inventory
Produce site/facility map
Scope of work completion
Perform recreational surveys and analysis
Perform recreational assessments

Figure A-4.

CULTURAL RESOURCES EVALUATION

The IPMP for Cultural Resources Evaluation outlines the tasks required to fulfill National Historic Preservation Act requirements at the feasibility study phase and address impacts for the Illinois Waterway System EIS. Tasks to be contracted are indicated in the following text and associated costs are shown in table A-5. The Rock Island District has a very successful track record in contracting for cultural resource studies and has averaged approximately $400,000 annually for these types of studies.

<u>Scope and Work Tasks</u>

Geomorphological landform modeling will be conducted using extant historical documentation, soil information, and known archeological site locations as well as available physical impacts data. The model will be used to develop a systematic stratified sampling design to locate sites which may be impacted by proposed site-specific construction and projected increased traffic on the system. Preliminary documentation will be compiled to determine potential site-specific impacts to historic structures and submerged resources. Using the above information, a detailed SOW will be developed to procure a systematic stratified sample survey of impact zones. The above tasks will be completed in FY 91.

A historic properties inventory contract will be awarded to assess site-specific construction zones identified at this point in the study as well as system impact zones on one-half of the study area. This first half of the historic properties inventory will be completed in FY 92.

A second historic properties inventory contract will be awarded to assess additional site-specific construction zones not included in the FY 92 contract as well as system impact zones on the balance of the study area. This balance of the systematic sample inventory of historic properties will be completed in FY 93.

Using the results of the systematic sample inventories, a stratified sampling design will be developed to evaluate the National Register of Historic Places (NRHP) eligibility of the properties identified within the impact zones. The proposed evaluation design will be developed into a SOW and coordinated with the State Historic Preservation Office (SHPO), Advisory Council on Historic Preservation, and interested parties. A contractor will be procured to execute the first one-half of the required NRHP evaluations. The above tasks will be completed in FY 94.

A second historic properties evaluation contract will be awarded to complete the NRHP evaluations designated in the stratified sampling design. The results of the evaluation studies will be available in FY 95.

Using the above studies, avoidance, protection, restoration, and mitigation strategies, will be developed for significant historic properties which will be adversely impacted. A Memorandum of Agreement (MOA) will be negotiated with the SHPO and the Advisory Council outlining the need for any future studies or conditions. Preliminary SOW preparation will be initiated for any follow-on mitigation or evaluation studies pursuant to the MOA. This will be completed in FY 96 for inclusion in the EIS.

Budget/Schedule

Table A-5 shows a breakdown of expected costs and the schedule for accomplishing the necessary cultural resources work tasks outlined above. The cost estimates reflect direct labor and associated overhead, as well as all travel and contract costs. It is estimated that 75 percent of the funds budgeted for the cultural resources work tasks will be contracted, unless additional FTE's are allotted. Figure A-5 graphically shows the expected schedule for each work task.

TABLE A-5

Cultural Resources Cost Estimate

Task	Cost ($1,000)	Schedule (FY) Start	End	Work Performed By
a. Geomorphological landform modeling	60.0	91	91	CENCR, Advertised Bid [1]
b. Historic properties inventories	120.0	92	92	"
c. Second historic properties inventories	125.0	93	93	"
d. Historic properties evaluation	125.0	94	94	"
e. Second historic properties evaluation	125.0	95	95	"
f. Negotiate MOA with SHPO for future studies	45.0	96	96	"
TOTAL	600.0			

[1] Could include other Federal or State agency.

ILLINOIS WATERWAY NAVIGATION STUDY
CULTURAL RESOURCES
SCOPE OF WORK SCHEDULE

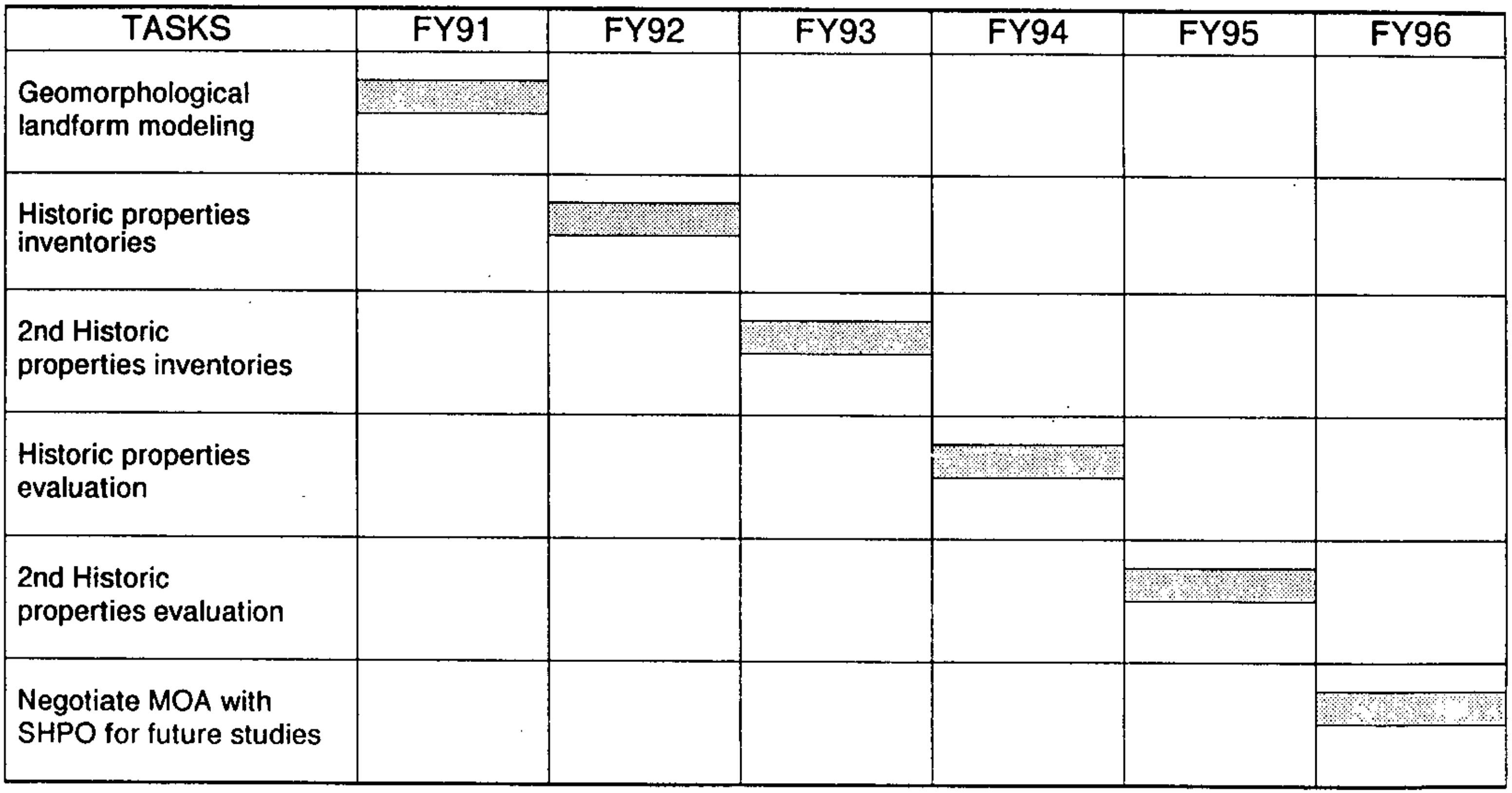

Figure A-5.

PUBLIC INVOLVEMENT

Scope

I. Inform the public and solicit public response regarding the public's needs, values, and evaluations of proposed solutions to increase capacity of navigation facilities on the Illinois Waterway.

a. Identify those agencies, organizations, and individuals affected by or interested in the elements of the feasibility study. Use the list of organizations and individuals developed during the reconnaissance study as the basis for public involvement and education in the feasibility study.

b. Establish, update, and maintain a computerized mailing list for the feasibility study. Arrange mailings for the entire study mailing list or portions thereof.

c. Obtain a complete understanding of how navigation-related problems are viewed by all significant interests through discussion with study team personnel and literature and records review. Determine how extensive a public involvement program will be required, which publics are likely to participate, and which techniques are most suitable to reach these publics.

d. Determine, through initial public involvement activities, what the issues are and how strongly the different publics feel about the issues, which publics see themselves as affected by the problem(s) or possible solution(s), and what kinds of public involvement are desirable or acceptable.

e. Design a comprehensive public involvement program for the feasibility study which will be visible and understood by those who may participate. Provide visible links between public comment and decision making to encourage the public to participate.

f. Ensure that the public involvement program is responsive to the level of interest and concern expressed by the public. Monitor public input, attendance at meetings, and comments regarding meeting formats, schedules, dates, and frequency. Survey public opinion regarding meetings, workshops, open houses, and other public involvement techniques.

g. Develop the format for a periodic newsletter about the feasibility study progress and prepare newsletters utilizing desktop publishing software.

h. Review existing materials and develop informational literature, including publicity brochures, materials, and handouts.

i. Prepare slide shows describing the feasibility study and identifying key issues for use at informal presentations to interest groups and other publics.

j. Prepare and organize formal and semiformal presentations to the general public, community organizations, agencies, and others. Tailor presentations to the individual interests and educational needs of the audience. Prepare slides, graphics, flipcharts, and other visual aids as needed.

k. Organize and arrange public workshops and meetings to serve as the main opportunity for a variety of public input on study interests and issues. Determine, arrange, and prepare meeting formats, agendas, locations, times, dates, notices, and other information materials. Arrange meeting facilities and materials, including meeting room reservations, court stenographer, contract review, facility set up, registration materials and table, and other related arrangements.

l. Prepare a camera-ready copy of an invitational notice to workshops and public meetings. Arrange for printing and mailing of the invitational notice to all persons and organizations on the study mailing list, or portion thereof.

m. Coordinate with the CENCR Public Affairs Office to report and react to the media.

n. Conduct field trips as needed and appropriate.

II. Utilize content analysis techniques and automated measures to code, store, retrieve, summarize, and display public comments in a systematic, objective, visible, and traceable manner maximizing information available to decision makers.

a. Summarize and store public comments and inputs using microcomputer software. Assure that comments are addressed by appropriate personnel or offices and that no comments or input records are misplaced.

b. Perform content analysis on all public comments and input received. Prepare statistical assessments of comments received, viewpoints expressed, and support or opposition to proposed alternatives.

c. Monitor the understanding of and support for the feasibility study by affected elected officials, including representatives from the U.S. Senate, House of Representatives, the Governor of Illinois, State legislators, local governments, drainage districts, and others.

d. Monitor the understanding of and support for identified alternatives and any required mitigation by elected officials, Federal, State, and local governments and agencies, drainage districts, businesses, interest groups, and others.

e. Identify potential controversy, public opinion, and study input to allow the study team to be prepared for potential comments at public meetings, and assure that the study will answer the public's concerns.

f. Prepare a summary of public comments on the alternative plans to increase capacity on the waterway including any required mitigation. Prepare an analysis of the publics that see themselves as affected and the issues as viewed by them.

g. Distribute summary of public comments received and analysis of content analysis data to all study team members for informational purposes and responses as appropriate.

h. Utilize content analysis data to evaluate alternatives, focus on the impacts most important to the public, modify alternatives (when possible) to be more publicly acceptable, and develop feasible and responsive mitigation measures.

III. Identify the advantages and disadvantages of existing and alternative institutional structures as they affect and are affected by alternative plan implementation.

a. Identify and catalog existing organizations, their authorities, geographic boundaries, coordination, management and personnel structure, financing methods and capabilities, and interagency and interjurisdictional coordination mechanisms.

b. Identify the various organizations' views of the study objectives and alternatives through review of public input and content analysis data.

c. Define actions required from affected institutions (organizations and processes) to implement the proposed alternative(s).

d. Identify specific considerations relative to the existing institutions and potential changes to them as a consequence of plan implementation including: functional responsibility and authority, local and state water development plans; jurisdiction and land acquisition; interagency coordination; cost sharing; state water development budget priorities and appropriation levels; financial capabilities; reallocation of income and profit between private, public, local, and state institutions; and effects on tax base, property, and industry.

e. Provide information regarding the financial, political, and social trade-offs required of each institution with the implementation of the proposed alternative(s).

f. Prepare an assessment of the overall institutional support or opposition to the study and the proposed alternatives for use in the decision-making process.

IV. Prepare report text.

a. Prepare a public involvement appendix for the study environmental impact statement.

b. Provide a summary of the public comments received, including a statistical assessment and tally of said comments. Document the content analysis procedures used to summarize public comments.

c. Document all public comments received or expressed as part of the Public Involvement Appendix for the feasibility study, with the study team providing responses or answers as appropriate.

Budget/Schedule

All cost estimates developed take into account direct labor, technical indirect, district overhead and field travel expenses. Table A-6 breaks down the expected costs of executing the necessary economic work tasks. Figure A-6 graphically shows the expected schedule for each work task.

TABLE A-6

Public Involvement Plan Cost Estimate

Task	Cost ($1,000)	Schedule (FY) Start	Schedule (FY) End	Work Performed By
a. Inform the public and solicit public response regarding the public's needs, values, and evaluations of proposed solutions to increase capacity of navigation on the Illinois Waterway	58.0	91	96	CENCR
b. Utilize content analysis techniques in to maximize information available to decision makers	32.0	91	96	CENCR
c. Prepare text for report	13.0	91	96	CENCR
d. Travel	10.5	91	96	CENCR
e. Public meetings	2.5	91	96	CENCR
f. Other significant costs (i.e., computer, photo-reproduction, printing, etc.)	10.0	91	96	CENCR
TOTAL	126.0			

ILLINOIS WATERWAY NAVIGATION STUDY
PUBLIC INVOLVEMENT
SCOPE OF WORK SCHEDULE

TASKS	FY91	FY92	FY93	FY94	FY95	FY96
Inform public and solicit public needs						
Prepare information for decision makers						
Prepare for public meetings						
Prepare report text						

Figure A-6.

ENGINEERING

The engineering requirements for this study cover a wide range of disciplines: surveying, hydrology/hydraulics, geotechnical, design, and cost engineering. The development of the engineering plan has been divided into two stages: (1) provide the preliminary engineering required to narrow down the viable alternatives, thereby identifying the NED plan and (2) accomplish the necessary detailed engineering analyses and establish the baseline cost estimate for the selected project. It is estimated that 50 percent of the funds budgeted for the engineering work tasks will be contracted, unless additional FTE's are allotted.

SURVEY ASSESSMENT AND REQUIREMENTS

Scope

The initial survey work will encompass a review of all available survey data for the site. Once survey data gaps are identified, preliminary site surveys can be accomplished. During the second stage of the study, detailed surveys of the selected site will be undertaken. In addition to the survey work, preliminary right-of-way drawings will be developed.

Budget/Schedule

All cost estimates developed take into account direct labor, technical indirect, district overhead, and field travel expenses. Table A-7 breaks down the expected costs of executing the necessary surveying work tasks. Figure A-7 graphically shows the expected schedule for each work task.

TABLE A-7

Surveying Cost Estimate

Task	Cost ($1,000)	Schedule (FY) Start	End	Work Performed By
a. Initial site surveys	10.0	91	91	CENCR
b. Detailed surveys of selected site and preliminary ROW drawings	100.0	92	96	CENCR, Advertised Bid [1]
TOTAL	110.0			

[1] Could include other Federal or State agency.

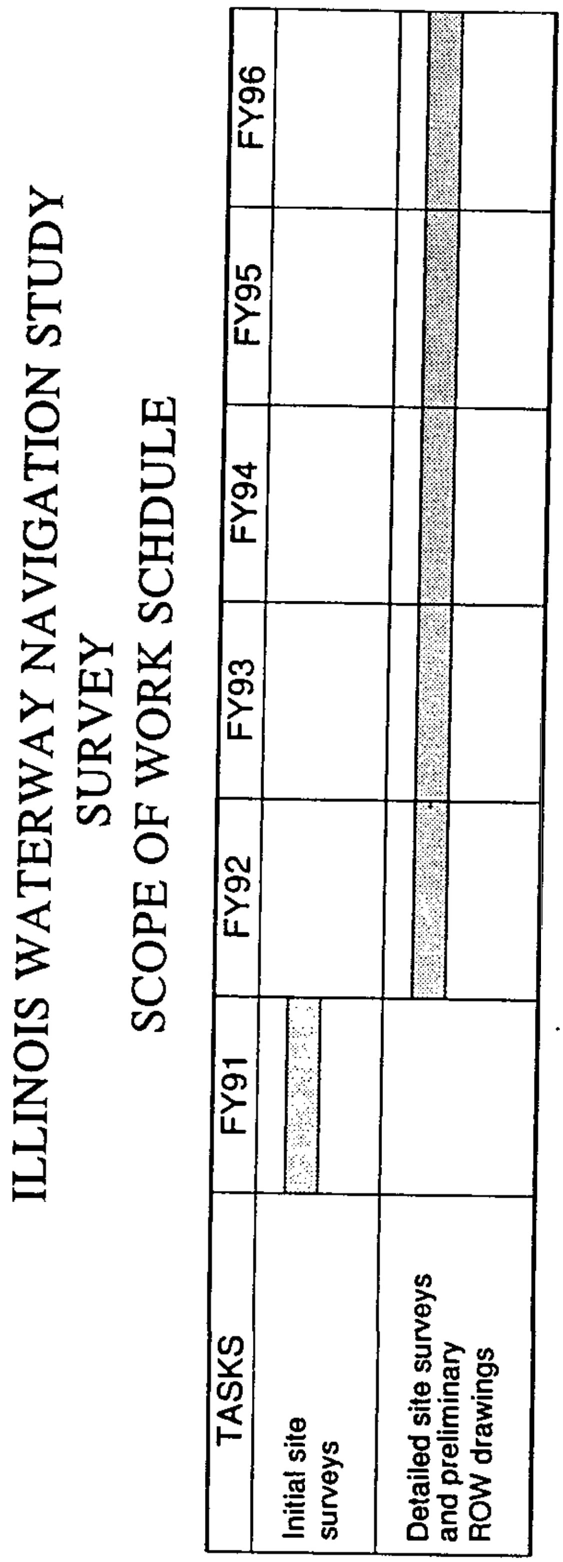
ILLINOIS WATERWAY NAVIGATION STUDY
SURVEY
SCOPE OF WORK SCHDULE
TASKS
FY91
FY92
FY93
FY94
FY95
FY96
Initial site surveys
Detailed site surveys and preliminary ROW drawings

Figure A-7.

HYDROLOGIC AND HYDRAULIC EVALUATIONS

Scope

During the preliminary stage of the study, a thorough literature and data search of hydraulic information pertaining to hydraulic impacts of new lock structures on the Illinois Waterway and/or similar waterways is to be accomplished. It also is anticipated that preliminary hydraulic analyses will include TABS2-Sediment Distribution Analysis and bendway analysis.

The hydraulic evaluation and assessment throughout the second stage of the study will include: (1) numerical and physical modeling, (2) riprap design, (3) cofferdam design, (4) regulation plan revisions, (5) hydraulic design of lock structure, and (6) impacts to water surface profiles.

Budget/Schedule

All cost estimates developed take into account direct labor, technical indirect, district overhead, and field travel expenses. Table A-8 is a breakdown of the expected costs in executing the necessary economic work tasks, and figure A-8 graphically shows the expected schedule for each work task.

TABLE A-8

Hydrologic and Hydraulic Cost Estimate

Task	Cost ($1,000)	Schedule (FY) Start	End	Work Performed By
a. TABS2-Sediment Distribution Analysis	60.0	91	94	CENCR
b. Approach and bendway analysis	30.0	91	94	CENCR
c. Numerical and physical modeling	150.0	94	96	WES [1]
d. Riprap design analysis	10.0	95	96	CENCR
e. Cofferdam design	30.0	95	96	CENCR
f. Regulation plan revision	20.0	95	96	CENCR
g. Hydraulic design of lock structures	130.0	93	96	CENCR, WES
h. Assess impacts to water surface profiles	60.0	93	96	CENCR
i. Preparation of appendix for report	10.0	96	96	CENCR
TOTAL	500.0			

[1] U.S. Army Engineer Waterways Experiment Station

ILLINOIS WATERWAY NAVIGATION STUDY
HYDROLOGY and HYDRAULIC
SCOPE OF WORK SCHEDULE

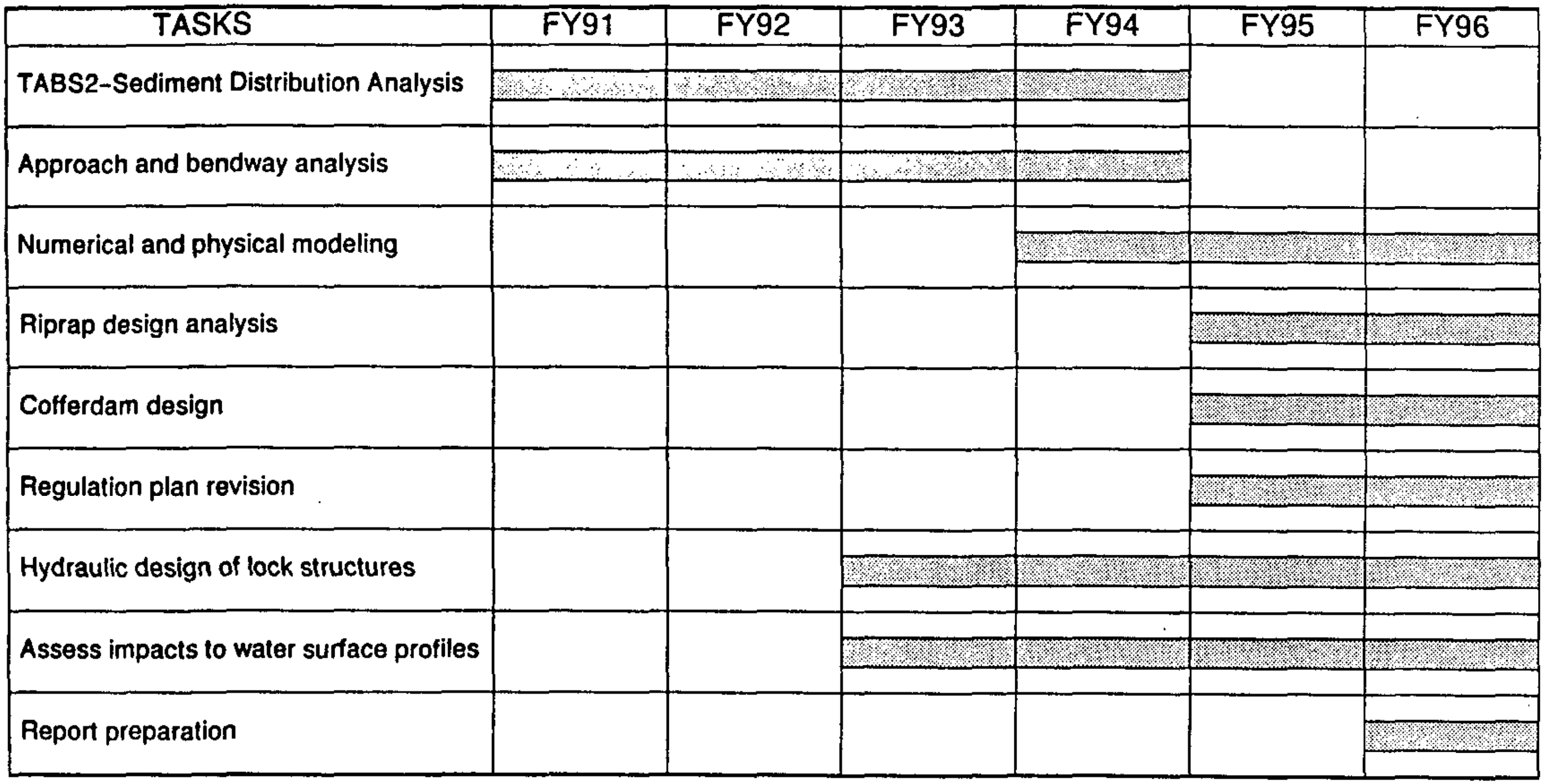

Figure A-8.

GEOTECHNICAL EVALUATIONS

Scope

As is the case with all the engineering elements, a preliminary literature and existing geotechnical data search will be conducted. This will be followed in the second stage of the study with detailed geotechnical analyses. These analyses will include: (1) extensive foundation investigations, (2) pile load tests, (3) instrumentation, (4) seepage computations, and (5) establishment of analysis and design values.

Budget/Schedule

All cost estimates developed take into account direct labor, technical indirect, district overhead, and field travel expenses. Table A-9 breaks down the expected costs of executing the necessary economic work tasks. Figure A-9 graphically shows the expected schedule for each work task.

TABLE A-9

Geotechnical Cost Estimate

Task	Cost ($1,000)	Schedule (FY) Start	End	Work Performed By
a. Extensive foundation investigations	100.0	94	96	Advertised Bid [1]
b. Pile load testing	50.0	94	96	Advertised Bid [1]
c. Instrumentation analysis	50.0	93	96	CENCR, Advertised Bid [1]
d. Seepage computations	50.0	92	96	CENCR
e. Establishment of analysis and design values	145 .0	92	96	WES
TOTAL	345.0			

[1] Could include other Federal or State Agency.

ILLINOIS WATERWAY NAVIGATION STUDY
GEOTECHNICAL
SCOPE OF WORK SCHEDULE

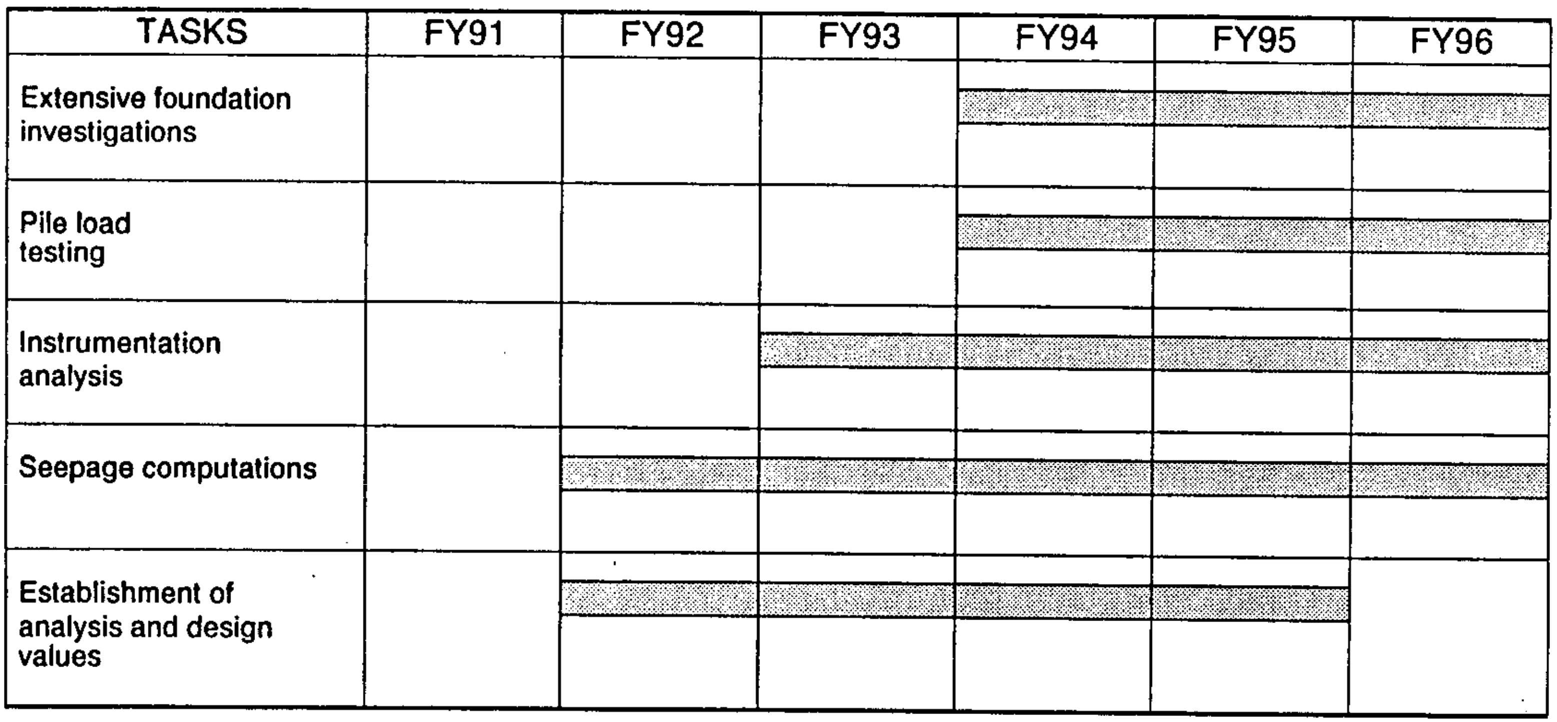

Figure A-9.

DESIGN EVALUATIONS

Scope

The first stage of the study will entail developing alternatives for the selected study area and provide preliminary project design. This will allow the elimination of alternatives, resulting in the selected plan.

During the second stage of the study, detailed design efforts of the selected project will be accomplished. Design evaluations, assessments, and evaluations will include: (1) structural analysis, (2) electrical/mechanical input, (3) research state-of-the-art design procedures, (4) quantity computations, and (5) preparation of drawings for the report and in detail to allow for use in the Plans and Specifications phase.

Budget/Schedule

All cost estimates developed take into account direct labor, technical indirect, district overhead, and field travel expenses. Table A-10 breaks down the expected total costs of executing the necessary design work tasks, and figure A-10 graphically shows the expected shcedule for each work task.

TABLE A-10

Design Analysis Cost Estimate

Task	Cost ($1,000)	Schedule Start	(FY) End	Work Performed By
a. Provide preliminary project designs	250.0	91	91	CENCR
b. Structural analyses	250.0	91	96	CENCR
c. Electrical/mechanical input into design	350.0	94	96	CENCR, Advertised Bid [1]
d. Research state of the art design procedures	85.0	91	94	CENCR
e. Quantity computations	50.0	93	96	CENCR
f. Prepare drawings for the report	100.0	91	96	CENCR
TOTAL	1,085.0			

[1] Could include other Federal or State agency.

ILLINOIS WATERWAY NAVIGATION STUDY
DESIGN
SCOPE OF WORK SCHEDULE

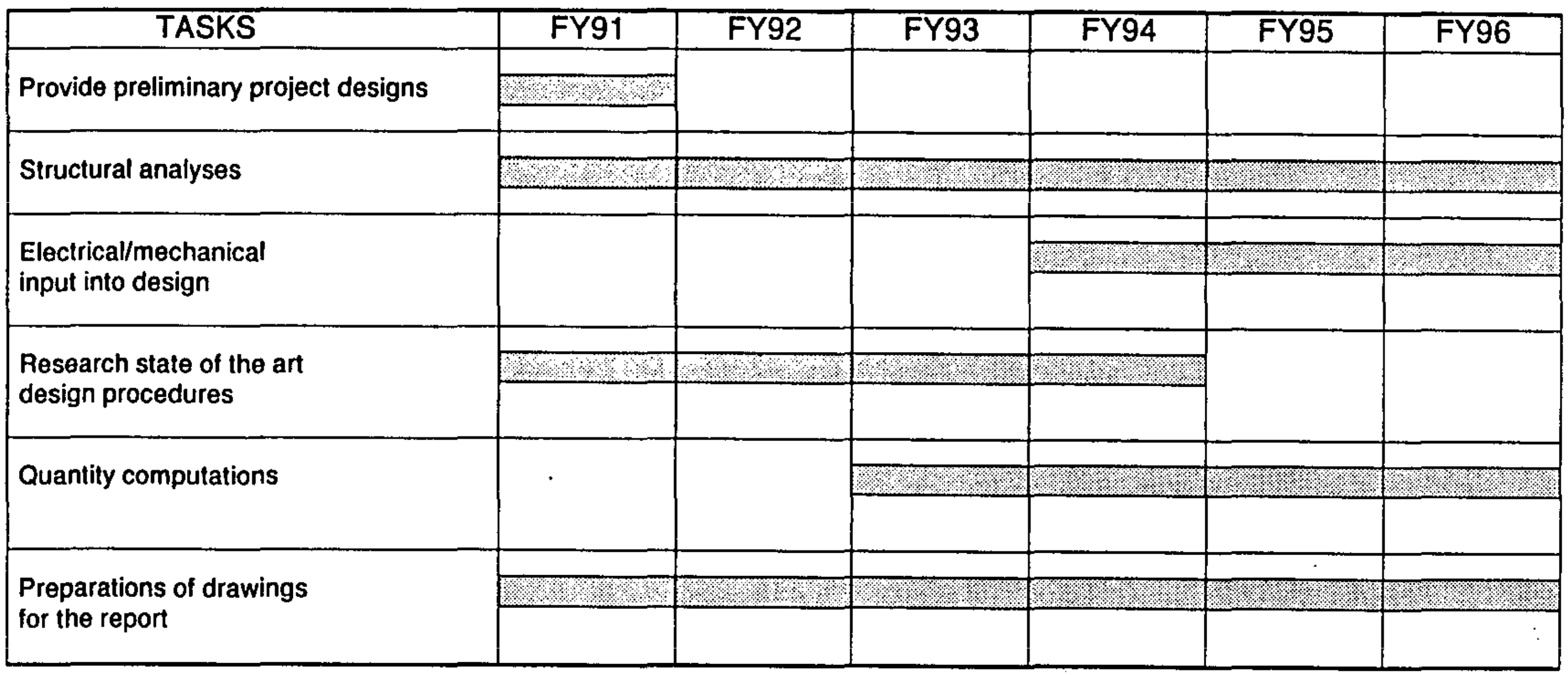

Figure A-10.

COST ENGINEERING EVALUATION

Scope

During the first stage of the study, cost estimates for several alternative plans will be refined. These preliminary cost estimates will be used to determine feasibility of the plans and the final recommended project or portion of the plan.

Once the selected project has been identified, the cost estimates will be developed in detail and in consideration of the code of accounts. The ultimate product will be a baseline M-Caces cost estimate for the recommended project.

Budget/Schedule

All cost estimates developed take into account direct labor, technical indirect, district overhead, and field travel expenses. Table A-11 is a breakdown of the expected costs of executing the necessary cost engineering work tasks. Figure A-11 graphically shows the expected schedules for each work task.

TABLE A-11

Cost Engineering Cost Estimate

Task	Cost ($1,000)	Schedule (FY) Start	End	Work Performed By
a. Preliminary alternative cost estimates	10.0	91	91	CENCR
b. Baseline M-CACES cost estimate for recommended project	220.0	92	96	CENCR
TOTAL	230.0			

ILLINOIS WATERWAY NAVIGATION STUDY
COST ENGINEERING
SCOPE OF WORK SCHEDULE

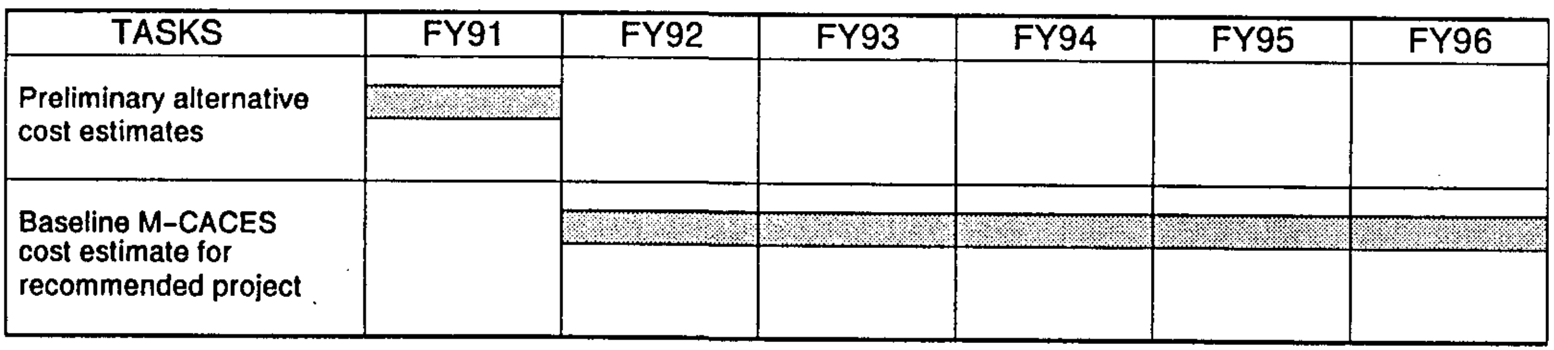

Figure A-11.

PLANNING AID REPORT

A

P

P

E

N

D

I

X

B

Illinois River and Waterway
Navigation Studies

PLANNING AID REPORT

U.S. Fish and Wildlife Service
1830 Second Avenue
Rock Island, Illinois 61201

August 1990

United States Department of the Interior

Fish and Wildlife Service
Rock Island Field Office (ES)
1830 Second Avenue, Second Floor
Rock Island, Illinois 61201

TAKE PRIDE IN AMERICA

In Reply Refer to:

COM: 309/793-5800
FTS: 782-5800

August 29, 1990

Colonel John R. Brown
District Engineer
U.S. Army Engineer District
Rock Island
Clock Tower Building, P.O. Box 2004
Rock Island, Illinois 61204-2004

Dear Colonel Brown:

In accordance with our transfer fund agreement, we have completed the enclosed Planning Aid Report for the Illinois River and Waterway Navigation Reconnaissance planning.

Congress has designated the Illinois River and Waterway as a component of the Upper Mississippi River System, a nationally significant ecosystem. Our primary concern in these navigation studies is the potential effects to fish and wildlife from any increases in commercial navigation traffic. Although the U.S. Fish and Wildlife Service has raised this concern to the Corps of Engineers on numerous occasions in the last 20 years, the environmental effects of any increases in navigation traffic remain largely unknown.

The potential for significant impacts are great on the Illinois River due to the narrow channel, fine sediments, and importance of main channel and channel border habitats to aquatic resources. Understanding the effects of tow movement on the Illinois River is especially important due to the improving nature of its water quality. The effects or potential limits that may be placed on this ecosystem as a result of increases in commercial tow traffic need to be defined.

The following recommendations should be completed as a part of the feasibility study. All should be initiated as soon as possible in order to complete feasibility planning in a timely manner. Most important among these recommendations is the completion of the St. Louis District Plan of Study which is necessary for us to complete our Fish and Wildlife Coordination Act requirements. Any further delay in implementation of this study will only serve to delay future feasibility planning. In addition, we are concerned that programs to address measures to avoid and minimize impacts of tow traffic is largely being ignored by the three districts on the UMRS. This program was agreed to in the Records of Decision for the Lock and Dam Major Rehabilitation Program and the Second Lock at Lock and Dam 26. Strides should be undertaken to implement this program immediately.

The recommendations are divided into several categories.

1. DATA COLLECTION AND IMPACT ANALYSIS FOR SITE SPECIFIC EFFECTS

a. Conduct a survey of freshwater mussels and other benthic invertebrates within one mile of each lock and dam or proposed construction area.

b. Conduct a bioassay of the sediments within one mile of each lock and dam or proposed construction area.

c. Determine dredging requirements and sediment quality at each site proposed to be dredged. Identify disposal alternatives.

d. Determine changes in river hydraulics for each proposed alternative.

e. Evaluate riparian effects including bank erosion from tow operation for each proposed alternative.

2. DATA COLLECTION AND IMPACT ANALYSIS FOR SYSTEMIC EFFECTS

a. Complete the St. Louis District Plan of Study.

b. Assess potential effects on bank erosion from increases in tow traffic and resulting riparian effects, including bald eagle perches, colonial nesting areas, mudflat shorebird use, furbearer dens, and catfish spawning habitat.

c. Complete a freshwater mussel survey of main channel and channel border to identify beds and assess condition.

d. Complete the resource inventory of the Illinois River and Waterway including identification of significant resources in Alton Pool.

e. Adapt Louisville District Navigation Predictive Analysis Technique (NAVPAT) or similar model to Illinois River to assess relative differences of planning alternatives and potential mitigation alternatives, if required. Assumptions need to be evaluated and validated for Illinois River. Note: an economy can be achieved by addressing main channel and channel border habitats in the habitat appraisal guide work being done by the District.

f. Complete bioassays of the sediment quality of the Illinois River, and potential effects of increasing suspended sediment concentrations, particularly in areas where the main channel width may expand due to increased traffic and passing requirements.

g. Identify potential barge fleeting needs in each pool.

h. Assess the potential for accidental spills from increasing traffic or induced development.

i. Determine recreation use of the Illinois River by the contingent valuation method and assess potential effects from increasing navigation including constraints on recreational lockages.

j. Complete a systemic Environmental Impact Statement to address the potential effects of increases in traffic. This EIS should include the potential cumulative effects of not only navigation traffic but also hydropower, pool raises, and channel maintenance activities. It should also address the effects of induced development and increases in barge fleeting.

3. ENDANGERED SPECIES COORDINATION

a. Conduct a biological assessment on the potential affects to the bald eagle, Indiana bat, lakeside daisy, and decurrent false aster.

b. Evaluate the need for formal consultation in accordance with Section 7 of the Endangered Species Act of 1973, as amended.

4. LONG TERM ENHANCEMENT STRATEGY

a. Compile all public natural resource management goals for the Illinois River and Waterway.

b. Identify common goals and objectives and any additional goals necessary to achieve a functional floodplain river system and a healthy ecosystem.

c. Develop a comprehensive vision and long term management and enhancement strategy for the fish and wildlife resources of the Illinois River and Waterway with identification of action items that may be implemented by the Corps of Engineers or other Federal and State agencies.

3. COORDINATION

a. Continue coordination with the Rock Island Field Office to address the above considerations.

b. Ensure active coordination by the Illinois Department of Conservation. A feasibility study of this magnitude will require close coordination with IDOC, particularly with regard to the long term enhancement strategy. However, its personnel and funding resources to provide such assistance is limited. The Corps should be prepared to fund IDOC work.

c. Contract with the Illinois Natural History Survey (directly or through cooperative agreement) to initiate the long term enhancement strategy.

d. Request and fund assistance from the Long Term Resource Monitoring Program to collect data as required, and to address the long term enhancement strategy through use of resource trends data being collected by the Havana Field Station.

e. Coordinate sediment quality analysis with the U.S. Geological Survey National Water Quality Assessment Program underway for the upper Illinois River basin.

f. Devote staff time to a program to avoid and minimize the effects of tow traffic.

g. Keep the Inland Waterways Users Board up to date on environmental analysis and planning requirements.

We would like to express our concerns for the proposed schedule for future feasibility planning. We understand that the Office of the Chief of Engineers has mandated that feasibility planning be accomplished within three years. We believe this is an unrealistic schedule considering the importance of the Illinois River and the magnitude of additional information that needs to be collected in order to make a sound choice among alternatives. For instance, consistant with our position on the Second Lock at Mel Price Locks and Dam, we will be unable to complete a final Fish and Wildlife Coordination Act Report on any feasibility study resulting from the Illinois River reconnaissance studies until the St. Louis District Plan of Study is completed. We recommend that you facilitate discussions among interested parties, including industry representatives and environmental organizations, to work out a planning schedule that all can subscribe to.

If you have any questions, please contact me or Gail Carmody.

Sincerely,

for Richard C. Nelson
Field Supervisor

cc: Illinois Department of Conservation (Lutz, Bertrand)
Plan of Study Team
American Waterways Operators (Smith)
Izaak Walton League (Hansen)
Sierra Club (Ettinger, Hulsey)

GC:hw

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APPENDICES

I. INTRODUCTION

The Corps of Engineers has initiated two reconnaissance studies to address future strategic planning for the Upper Mississippi River System (UMRS). One study will be done for the Illinois River and one for the Upper Mississippi River. This report addresses the Illinois River study only.

The Illinois River and Waterway is the major tributary river in the UMRS (figure 1). The Congress has designated the UMRS as a nationally significant ecosystem in Public Laws 99-88 and 99-662 and mandated that the rivers be managed to <u>balance</u> navigation and environmental interests.

The Illinois River has had a long history of navigation development. Between the 1840's and the 1920's, numerous alterations were made to the river to assist navigation. By 1940 the Corps of Engineers completed the existing nine-foot navigation project on the river that includes eight lock and dam complexes. Now there is a need to identify commercial traffic delays and other navigation inefficiency. This analysis will help to define site-specific capital investment alternatives to meet future navigation traffic projections. These alternatives will be identified by site in a priority order. Nonstructural efficiency measures also will be an important component of these studies.

The purpose of the reconnaissance study is to determine if there is a Federal interest in making capital improvements to the existing system. In addition, environmental objectives will be pursued to ensure that commercial navigation and environmental concerns receive equal consideration during the planning process. The reconnaissance report will identify potential new locks, dams, guidewalls, or operating procedures, to name a few, that could be addressed in detailed feasibility planning. It is during the feasibility stage that an environmental impact statement would be prepared and specific enhancement opportunities identified.

The purpose of this Planning Aid Report is to identify fish and wildlife related problems, needs, and opportunities as they relate to the Illinois River Navigation study. It includes a general appraisal of the study area, identification of significant resources, potential site specific impacts, potential systemic effects, data gaps, methods to complete impact analysis and mitigation planning, potential enhancement measures, and recommendations for feasibility planning.

This report is submitted in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and the National Environmental Policy Act of 1969, as amended. It has been reviewed by the Illinois

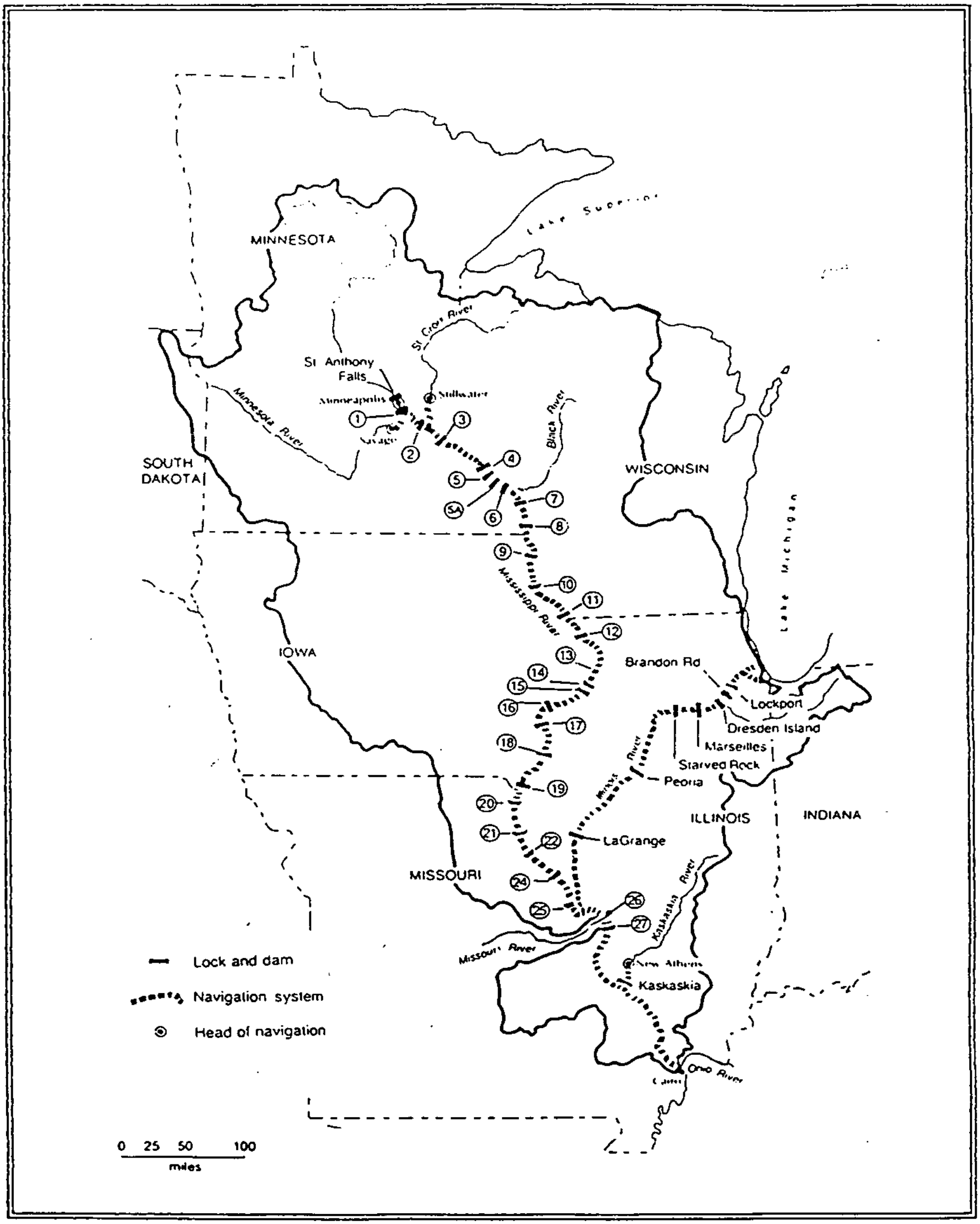

Figure 1. Upper Mississippi River System.

Department of Conservation, and a letter of comment is included as Appendix A. Because of the potential precedent-setting nature of this report's recommendations on the upcoming Upper Mississippi River Navigation studies, we requested comments from the Iowa, Minnesota, and Wisconsin Departments of Natural Resources and the Missouri Department of Conservation. Letters received are also included in Appendix A.

II. FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT

The Illinois River and Waterway is characterized by urban sections, narrow glacial valley sections, and broad floodplain sections. It consists of 331 navigable miles. The river portion includes the Illinois River from it's confluence with the UMR upstream to its confluence of the Kankakee and Des Plaines Rivers. The waterway portion includes the Des Plaines River, the Chicago Sanitary and Ship Canal, the Calumet-Sag Channel, the Chicago River and the Calumet River.

II.A. HABITATS

The river consists of over 86,000 acres of open water and wetland habitats and 26,000 acres of terrestrial habitats (Table 1) in the unleveed floodplain. However, these numbers are incomplete, because no habitat inventory has been completed for the Alton Pool. Due to extensive backwater lakes, about 52% of the aquatic area consists of backwaters and side channels.

II.A.1. Aquatic Habitats

Aquatic habitats are those open water and wetland areas that have a defined water boundary at a reference stage. Aquatic habitats are the foundation of the aquatic ecosystem. Important aquatic resources include fish, freshwater mussels, invertebrates, and aquatic plants.

An aquatic habitat classification system for the UMRS, including the Illinois River, has been developed by the Long Term Resource Monitoring Program (Wilcox, in preparation). It is based in part on the scheme developed by the Upper Mississippi River Conservation Committee (UMRCC) (Rasmussen, 1979). Wilcox expanded the UMRCC classification to include the unpooled river (ESE, 1982) and to be consistent with the classification used on the Lower Mississippi (Cobb 1989).

Table 1. Total acres of aquatic and terrestrial habitat of the Illinois River (Bellrose et al. 1977).

	Alton Pool[1]	La Grange Pool	Peoria Pool	Starved Rock Pool	Marseilles Pool	Dresden Pool	Brandon Pool	Totals
AQUATIC								
Main Channel	1571	3911	5282	721	1162	803	241	13691
Channel Border	--	1883	15515	1890	625	1175	184	21272
Secondary Channel	--	381	546	368	139	92	--	1526
Backwater	246	261	--	--	21	--	--	528
River Lakes	3184	23500	15065	171	338	943	2	43203
Tail-waters	--	39	71	38	65	79	19	311
Wetland	562	2673	2482	--	10	147	9	5883
Total Aquatic	5563	32648	38961	3188	2360	3239	455	86414
TERRESTRIAL								
Forest	4529	4591	4774	--	9	46	--	13949
Grasslands/ Forblands	361	--	--	--	--	--	--	361
Shrublands	147	--	--	--	--	--	87	234
Sand and Mud Flats[2]	429	4621	2049	--	--	--	--	7099
Agricultural	2347	2	1039	--	490	--	--	3878
Developed	271	59	257	--	--	--	--	587
Total Terres-trial	8084	4652	6070	--	499	46	87	26108
Total Acres in Study Area	13647	37300	45031	3188	2859	3285	542	112522

[1]Only first 13 miles of Alton Pool inventoried by Hagen et. al (1977). Main channel, channel border, and tailwaters combined.

[2]Due to their temporary nature, mud flats are not included in totals.

Aquatic habitats (table 2) on the Illinois River include:

Main Channel
The main channel conveys the majority of the river discharge, and in most reaches, includes the navigation channel. Boundaries of the main channel are the apparent shorelines (apparent shorelines are the land/water boundaries visible from aerial photos taken at a reference level of river discharge), straight lines across the mouths of secondary and tertiary channels, and along the top of inundated portions of the natural bankline. The main channel aquatic areas includes the gated sections of the navigation dams and the tailwater areas. Tailwater areas are included in the main channel category, while recognizing that there are unique microhabitat conditions in the tailwater areas downstream of the navigation dams.

Navigation Channel
The navigation channel is the designated navigation corridor marked by channel buoys. In reaches where buoys are not used, the centerline of the navigation channel is defined by lights and daymarks on shore that pilots use to navigate. The navigation channel on most of the UMRS is 91.4 m (300 ft) wide in straight reaches and 152.4m (500 ft) feet wide in bends. The navigation channels in the upper pools of the UMRS and tributary waterways are narrower. The navigation channel extends through the locks at each lock and dam. The navigation channel is usually in the main channel, but in some reaches, the navigation channel is located in secondary channels.

Channel Border
The channel border is the area between the navigation channel and the river bank. Boundaries of the channel border are the apparent shorelines, the navigation channel buoy line, straight lines across the mouths of secondary and tertiary channels, and along the inundated portions of the natural bank line.

Wing Dam
Wing dams are stone and brush channel training structures that extend laterally into the main and secondary channels to concentrate flow into the navigation channel. The boundaries of wing dam areas are defined by proximity to wing dam structures. The landward boundaries are the apparent shorelines, and along inundated portions of the natural bank line. The upstream and downstream boundaries of wing dam areas are parallel to, and 50m from the wing dam structures. The riverward boundaries are perpendicular across the riverward end of the wing dams. There are few wing dams on the Illinois River.

Closing dam
Closing dams are stone and brush channel training structures that were built across channels to concentrate flow into the navigation channel. Boundaries of closing dam areas are parallel with and 50 m upstream and downstream of the structures. Where closing dams are close to the main channel border, the upstream boundary is across the mouth of the channel. The lateral boundaries are the apparent shorelines of the channel. One closing dam is known on the Illinois River at Six Mile Slough.

Revetted bank
Revetted banks are the armored shorelines of the main and secondary channels. Revetment is rock riprap or articulated concrete mats. Limited lengths of shoreline with concrete or steel bulkheads or paved levees are included in this category. In some locations, bank revetment is no longer connected to shore. Boundaries of revetted bank areas are the apparent shoreline, the upstream and downstream limits of the revetment, and a long riverward, parallel to, and 15 m from the apparent shoreline. For revetments that are no longer connected to shore, the shoreward boundary of revetted bank areas is a line parallel to and 15 m from the top of the remaining revetment material.

Secondary channel
Secondary channels are large channels that carry less flow that the main channel. Boundaries are the apparent shorelines, straight lines at the upstream and downstream limits of the apparent shorelines where secondary channels connect with the main channel.

Sandbar
Sandbars are flat-sloped areas within the main and major secondary channels that are characterized by sand substrate. Sandbars have side slopes of less than 1V:6.67H, are completely submerged at the 5-year exceedence frequency discharge, and are not connected to shore at the reference river discharge level. Portions of sandbar areas emergent at the reference river discharge are unvegetated.

Tertiary channels
Tertiary channels are small channels less than 30m wide. The lateral boundaries of tertiary channels are the apparent shorelines. The upstream and downstream limits of tertiary channels are straight lines between the upstream and downstream limits of the apparent shorelines.

Table 2. An aquatic habitat classification system for the Upper Mississippi River System (Wilcox, in preparation).

Aquatic Areas

- Channel
  - Main channel
    - Navigation channel
    - Sandbar
    - Channel border
      - Natural bank steep
      - Natural bank gradual
      - Revetted bank
      - Wing dam
      - Closing dam
  - Secondary channel
    - Navigation channel
    - Sandbar
    - Channel border
      - Natural bank steep
      - Natural bank gradual
      - Revetted bank
      - Wing dam
      - Closing dam
  - Tertiary channel
  - *Excavated channel*
- Backwater
  - Contiguous
    - Floodplain lakes
      - Abandoned channel lakes
      - Tributary delta lakes
      - Lateral levee lakes
      - Scour channel lakes
      - Floodplain depression lakes
      - Borrow pits lakes
      - Other man-made lakes
    - Floodplain shallow aquatic
    - Impounded
  - Isolated
    - Floodplain lakes
      - Abandoned channel lakes
      - Tributary delta lakes
      - Lateral levee lakes
      - Scour channel lakes
      - Floodplain depression lakes
      - Borrow pits lakes
      - Other man-made lakes
    - Floodplain shallow aquatic

Microhabitat Conditions

- Depth
- Current
  - Velocity
  - Turbulence
- Temperature
- Dissolved oxygen concentration
- Suspended solids concentration
- Light
- Substrate
  - Rock
  - Gravel
  - Sand
  - Silt/clay
  - Organic
- Cover
  - Submersed aquatic vegetation
  - Emergent aquatic vegetation
  - Flooded terrestrial vegetation
    - Grasses/sedges
    - Brush
    - Forest
  - Overhanging trees
  - Woody debris
  - Overhanging bank
  - Rock
  - Man-made structures

Tributary channels
Tributary channels are channels of tributary streams and rivers. The landward boundary is the line where the tributary crosses the study area boundary. The lateral boundaries are the apparent shorelines. The riverward limits of tributary (including distributary) channels is a line drawn across the downstream limits of the apparent shorelines.

Excavated channels
Excavated channels are man-made channels with flowing water.

Impounded
Impounded areas are large, mostly open water areas located in the downstream sections of the navigation pools. The downstream boundary of impounded areas are the navigation dam and connecting dikes. Landward boundaries are the apparent shorelines or are the boundaries of other aquatic areas. Upstream boundaries are generally with islands and floodplain shallow aquatic areas. Riverward boundaries are channel border areas.

Backwater
Backwater areas are all aquatic areas other than channels.

Contiguous, Isolated
Contiguous means hydraulically connected by surface gravity flow at reference river discharge. For mapping purposes, contiguous means having apparent surface water connection with the rest of the river. Isolated means having no hydraulic connection by surface gravity flow at reference river discharge. For mapping purposes, isolated means having no apparent surface water connection with the rest of the river.

Floodplain shallow aquatic
Floodplain shallow aquatic areas are portions of floodplain inundated by the navigation dams that are not part of any channels or floodplain lakes. Floodplain shallow aquatic areas are shallow areas usually containing a mosaic of open water and emergent vegetation interspersed among islands. The boundaries of these areas are defined by the apparent shorelines and by other aquatic areas. Boundaries of floodplain shallow aquatic areas are often irregular. Where floodplain shallow aquatic areas grade into impounded areas, the boundaries will be lines connecting the downstream parts of islands or peninsulas across the floodplain.

Floodplain Lakes
Floodplain lakes are distinct lakes formed by fluvial processes or are manmade.

Abandoned Channel Lakes
Abandoned channel lakes are oxbow lakes formed by meander cutoffs, lakes formed by point bar cutoffs, and lakes formed by avulsion (lakes formed by a major shift in channel course). Boundaries are the apparent shorelines. For contiguous abandoned channel lakes, to downstream boundary is a line that is a continuation of the apparent shoreline of the lake. Abandoned channel lakes vary greatly in size. Shape of most abandoned channel lakes reveals their origins as former channels.

Tributary delta lakes
Tributary delta lakes are formed by the tributary deltas impounding all or part of the floodplain upstream of the mouth of the tributary. Boundaries are the apparent shorelines. For contiguous tributary delta lakes, the riverward boundary is where the (usually downstream) end of the lake joins a channel. The boundary is a line that is a continuation of the apparent shoreline of the channel.

Lateral levee lakes
Lateral levee lakes are lakes formed by the impounding effect of natural riverbank levees. This type of lake is formed between the natural levee and the high ground that defines the edge of the floodplain of the river. Lateral levee lakes are also formed where natural levees impound tributary streams. Boundaries of this type of aquatic area are the apparent shorelines and the boundaries of other more clearly delineated aquatic areas. On lakes formed at the mouth of tributary streams, the upstream boundary is the boundary of the study area.

Scour channel lakes
Scour channel lakes are formed by the scouring of point bar swales during high flows. Scour channel lakes are generally small and crescent-shaped. Most of these aquatic areas are isolated. Boundaries are the apparent shorelines. Where contiguous, the connecting boundary is a line across the downstream limit of the apparent shorelines.

Floodplain depression lakes
Floodplain depression lakes are generally large, shallow water bodies formed by uneven aggradation of sediment on floodplains during floods. This type of lake has even shorelines (limited shoreline development), and a shallow basin of even depth. Most of these lakes are larger than 100 hectares (247 acres). Boundaries are the apparent shorelines. Where contiguous, the connecting boundary is a line across the limits of the apparent shorelines.

Borrow pits
Borrow pits are man-made water bodies where material was excavated for levee or dike construction. The boundaries are the apparent shorelines, or the limits of excavation. Most borrow pits are parallel and immediately adjacent to dikes or levees.

Man-made lake
These aquatic areas are created by dikes or levees (not the main navigation dams and dike systems) or by excavation. The boundaries of man-made lakes are the apparent shorelines, and where contiguous, the connecting boundary is a line across the limits of the apparent shorelines.

The relative importance of each of these habitats to aquatic species is one of the objectives of the EMP Long Term Resources Monitoring Program. The Havana field station is collecting data specific to the La Grange pool.

II.A.2 Wetlands

Wetlands can be considered those zones of transition from open water to terrestrial habitat. There may be some overlap with the aquatic habitats described above. Frequently flooded areas of this type support prolific populations of wildlife because of their cover diversity, available food, loafing and escape cover and breeding habitat. Species relying on this cover type include, fish, ducks, coot, rails, bitterns, herons, egrets, numerous songbird species, hawks, wintering eagles and osprey. Many species of invertebrates, amphibians, reptiles, and furbearers including muskrat, mink, fox, raccoon, opossum, beaver and otter are found in marshlands. In fact, Illinois River marshlands produce and sustain higher numbers of wildlife than any other habitat category.

The U.S. Fish and Wildlife Service (USFWS) has devised a more specific classification system for wetlands and deepwater habitats (Cowardin et al., 1979). The structure of this classification system is hierarchical, progressing from systems and subsystems at the most general level to classes, subclasses and dominance type. It can be used to further classify the aquatic habitats delineated above, but is especially useful for classifying marshland or wetland habitat.

For purposes of the USFWS classification scheme, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports a predominance of hydrophytes (water loving plants); (2) the substrate is predominantly undrained hydric soil, or (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.

Wetland systems encountered on the Illinois River are either palustrine, lacustrine or riverine. For example, bottomland forests found throughout the Illinois River would be classified as palustrine, broad leaf deciduous forested wetlands. These are generally seasonally flooded (water regime), by circumneutral water (water chemistry) and have developed on organic soils. A submergent aquatic plant bed in the river may be classified as a riverine, rooted vascular aquatic bed wetland. A lotus bed in a backwater slough might be classified a lacustrine, littoral, rooted vascular aquatic bed wetland. A cattail marsh might be classified as a palustrine, persistent emergent wetland.

II.A.3. Terrestrial Habitats

Terrestrial habitats are not normally inundated by water, but some may be inundated for part of the year. They include bottomland and upland forests, agricultural lands, grasslands or forblands, shrublands, developed lands, and sand and mud flats. Again there is some overlap with the habitats described above.

Bottomland Forests or Forested Wetlands of the Illinois River are greatly reduced in size from their historic prominence. Most have been largely converted to agricultural fields.

In reviewing 16 representatives forests, Havera et al. (1980) found that silver maple accounted for 61.4% of the basal area. Cottonwood, ash spp., and elm spp. accounted for an overall average of 11.8%, 5.3%, and 4.8% respectively. They stated that "the Majestic, fruitful, and diverse pecan and pin oak stands once prevalent in the bottomlands along the river from approximately Peoria southward were and are being transformed to forests less diverse and dominated by silver maple." Pecan and pin oak mast provided the greatest amount of food and shelter for floodplain dwelling wildlife species. However only a few remnants exist. Most all trees offer themselves to cavity nesting wildlife species at some point in their growth span. Standing dead trees contribute sources of food and home for wildlife as well.

Upland Forests of the Illinois River are an oak-hickory community. Most common species are shagbark hickory; black walnut; sugar maple; white ash; red maple; and white, black, and northern red oaks. These also provide mast for many species of wildlife including deer, squirrels, rabbit, chipmunk, turkey, pheasant, quail, woodpeckers and many others. Upland forests are found primarily on ridges and in the blufflands of the river corridor.

Agricultural Lands include open areas devoted to annual crops, pastures, fallow ground and fields that show some sign of recent cultivation. These cultivated areas are located on the driest parts of the floodplain and in many cases are protected by levees. This habitat type provides a food source for many mammals including opossum, raccoon, white-tailed deer, striped skunk, woodchuck, coyote, short-tailed shrew, deer mouse, white-footed mouse, prairie vole and house mouse.

This cover type is also foraging habitat for some birds. There is some nesting at the edges of fields. Flooding of cultivated fields attracts migratory shore and wading birds as well as ducks and geese. These areas provide foraging habitat for reptiles. Amphibian use is largely restricted to periods of flooding or to drainage channels and edges adjacent to waterways.

Grasslands/Forblands support mixed stands of grasses, including reed canary-grass, rice cutgrass, other mixed forbs and broadleaf weeds. Except for overlap or edge habitat occurring near marsh edges and occasional openings in the timber which provide good habitat interspersion, these grassy areas are generally not as productive for wildlife as forest lands or marshes. They do offer important loafing cover for deer and feeding and nesting cover for passerine bird species, however.

Shrublands are typically dominated by small willows, buttonbush, wild grape and other low growing shrubs and vines. They may be considered wetlands, depending on plant species and hydrology, and provide habitat diversity in conjunction with other habitat types. Buttonbush and grapes offer food for waterfowl, rails, deer and a variety of songbirds.

Developed Lands include areas dominated by industrial or commercial developments, structures, parks and residential areas. Common industries are grain elevator operations, power companies, fertilizer plants, and barge docking and loading facilities. Very few species depend on developed land for completion of any life stage. Use is normally transitory, providing resting perches for birds or travel routes for mammals. Several species may be attracted by insects found at night in lighted areas or by warm water effluent.

Sand and Mud flats are deposited by floodwaters or are composed of dredged material deposited by man. Mud flats are often short lived, soon to become vegetated with herbaceous or woody growth. They act as production zones for aquatic invertebrates, feeding and loafing areas for waterbirds, loafing areas for waterfowl, foraging areas for mammals and nesting and wintering habitat for turtles and other herpetiles. The quality of habitat provided/destroyed by dredged spoil deposition is determined by how and where the material is placed. For example, material placed in the water generally provides very little habitat, destroys existing aquatic habitat and reduces water area. Material deposited in a configuration similar to sand flats will undergo similar successional patterns and provide similar habitat. Material deposited on existing islands immediately destroys all existing habitat, although succession eventually follows.

II.B. WATER AND SEDIMENT QUALITY

The hydrology of the Illinois River basin has been altered significantly over the last century. Perhaps of greatest importance is the diversion of much of the Calumet River system away from Lake Michigan and into the Des Plaines River basin. Opening of the Chicago Sanitary and Ship Canal in 1900 allowed large volumes of Lake Michigan water to be directed to the Illinois River. This diversion flushed much of Chicago's raw sewage and industrial pollutants to the River in attempt to protect Lake Michigan and to dilute and transport untreated waste away from the growing metropolitan area. The result was severe degradation of aquatic habitats and fish and wildlife resources. Steffeck and Striegl (1989) summarized, "Pollution problems peaked in about 1920, resulting in the loss of vascular aquatic plants, benthic organisms, and fish throughout the project area [Upper basin] of the Illinois River and 160 miles downstream to Peoria (Richardson, 1928; Starrett, 1972). In addition, extensive filling of wetlands for waste disposal in the Chicago metropolitan area adversely affected biological resources by eliminating habitat and causing pollution of streams by surface runoff, leachate, and contaminated groundwater (Colton, 1986)."

The majority of current water quality information on the Illinois River is from samples collected from the channel, not backwater areas. The Illinois Environmental Protection Agency has rated the river (255 miles) as "partially supporting aquatic life uses with minor impairment." This rating is primarily due to elevated turbidity values, and to a lesser degree, high nutrient concentrations. Most point-source discharges and municipal wastewaters currently are treated; however numerous non-point sources exist including abandoned hazardous waste sites (Jackson et al. 1981).

Water quality in the Illinois River has been improving in recent years, but contaminants from urban, industrial, and agricultural developments eliminated some important invertebrate species, such as fingernail clams, in the early 1900's. These species may be returning to the river where habitats are suitable, but reestablishment of some species, such as fingernail clams may be severely limited. For instance, Blodgett et al. (1983) found that sediments along a 180-mile reach of the river downstream of Chicago were toxic.

In a broad survey of sediment quality, sediments from 6 sites on the Illinois River and its tributaries were analyzed for organic and inorganic contaminants (U.S. Fish and Wildlife Service, in preparation). Relative toxicity of sediments were determined using bioassays. Concentrations of contaminants were extremely high in the Chicago River and declined with increasing distance from Chicago. Ammonia appears to be the factor most significantly affecting aquatic life. Levels of polynuclear aromatic hydrocarbons and heavy metals are also of concern (Cahill and Steele 1986). Demissie and Bhowmik (1985) found that the sediment layer deposited since the 1970's has decreased levels of inorganic compounds indicating a decreased input level when compared to sediment layers of the 1950's and 1960's. Effects of tow traffic on resuspension of contaminants and redistribution are unknown.

The U.S. Geological Survey has selected the Upper Illinois basin as a pilot study area for the National Water Quality Assessment Program (NAWQA). This program is to 1) describe current water quality conditions, 2) define long term trends in water quality, and 3) identify major factors that affect water quality trends and conditions. Work on the Upper Illinois basin is ongoing.

II.C. BIOTA

II.C.1. Migratory Birds

Because of its importance as a major migration route, the Illinois River valley is used by a wide variety and number of migratory birds. As many as 285 species of birds belonging to 17 taxonomic orders are likely to occur in the valley (Havera et al. 1980).

Many of these species are of particular importance from a public interest point of view because of scarcity (endangered and threatened), sporting value (waterfowl and upland game birds) or aesthetic value.

A number of wading shorebirds use the Illinois River during their long distance migrations. Two species of wading shorebirds are thought to nest in the Illinois River valley (Havera et al. 1980). These are the common snipe and the American woodcock. The greatest numbers of shorebirds are found between July and September when mudflats are exposed, and feeding and resting areas are ample (Havera et al. 1980). Spring migration use is limited because of lack of feeding areas. Gulls and terns migrating between the Great Lakes and the Gulf of Mexico use the Illinois River corridor. Two species, ring-billed and herring gulls winter in the area in large numbers (Havera et al. 1980). No gulls or terns are known to currently nest in the Illinois Valley. Historically, the black tern, State endangered species, nested in the area, but became extirpated due to lack of marsh vegetation. Herons are common in the Illinois River valley and many nest in the area, including cattle egrets, great blue herons, great egrets, black-crowned night herons, and green herons.

The bald eagle deserves special recognition because it forages and roosts near the Illinois River during winter. See Section II.D.1. for more discussion.

The Illinois River corridor also provides crucial migration habitat for as many as 32 waterfowl species migrating from as far away as Alaska, Hudson Bay, the McKenzie River Delta and Baffin Island, and including the productive prairie pothole region of the U.S. and Canada. In the late 1970's, there was an average of over 39 million use days by ducks and geese (Havera et al. 1980). Dabbling ducks were 92.3% of the total, diving ducks 2.9% and geese 4.8%. Lesser numbers overall were found in the spring migrations, but comparatively diving ducks were five times more abundant in the spring. This may be due to the increased habitat resulting from flood water. Some geese and ducks overwinter along the river in open water areas usually associated with generating plants, locks and dams, and, in a few instances, grain elevators. Mallards, goldeneyes, Canada geese, black ducks and common mergansers are representative of the species which usually overwinter and may average about 17 million waterfowl use days each winter (Havera et al. 1980).

Wood ducks breed more abundantly along the backwater lakes of the Illinois River than elsewhere in the State. The Illinois Valley is one of the most important breeding grounds for this species in the nation (Havera, et al. 1980).

Historically, aquatic plants provided the primary food source for dabbling ducks. However, these plants have virtually disappeared from the backwater lakes of the Illinois Valley due to sedimentation (Bellrose et al. 1979). During the last three decades, moist-soil plants have become the most important food resource (Havera et al. 1980). Diving duck numbers declined drastically following the disappearance of the fingernail clam from the Illinois River (Mills et al. 1966).

II.C.2. <u>Mammals</u>

The remaining wildlife habitats support an abundant and diverse mammal population. Forty-nine mammal species have been identified. Most of these species are observed infrequently due to their nocturnal, crepuscular, or secretive habits.

Aquatic-oriented mammals, such as muskrat, beaver and raccoon, are commonly found in river backwaters. Mink, skunk, and weasels can also be observed, although, they are relatively rare. Small mammal species typically associated with moist soil communities include the masked shrew, meadow vole and southern bog lemming.

Small terrestrial mammals common to the study area include the eastern mole, least shrew, western harvest mouse, white-footed mouse, deer mouse, meadow vole and fox and gray squirrels. The gray and fox squirrels are quite common in woodlands of the study area. The southern flying squirrel is also found in the densely forested areas. Backwater breeding areas for insects are attractive to several species of bats. Hollow trees and crevices in tree bark are used by bats to roost.

Large mammals include the coyote, red and gray foxes and white-tailed deer. The red fox and coyote are extremely versatile and have been able to increase in numbers as man has altered the environment. The gray fox is at home in the forest, river bottoms and bluffs.

II.C.3. Fish

Distribution and relative abundance of Illinois River fish are more completely known than most other faunal groups. Havera et al. (1980) provides an excellent discussion of the fishery. A total of 150 species representing 27 families have been recorded from Illinois Waterway waters, of which 66 are considered common to abundant. Carp, buffalo species, and freshwater drum are the most common commercial species caught. Bluegill, white bass, channel catfish, freshwater drum, and sauger are the abundant sport fish. Considerable variation in number of species is found from north to south as Table 3 indicates.

Extensive leveeing along the Illinois River, the loss of backwater lakes due to sediment deposition, and industrial and municipal pollution have reduced species diversity. Species numbers decline as one progresses upstream nearer the Chicago metropolitan area. The River's fishery has shown a strong recovery, however, since water pollution control efforts were implemented. Commercial fishing, continues to be prohibited above Illinois Route 89 in Bureau County because of sport fishing conflicts. The Illinois Environmental Protection Agency 1990 sport fish health advisories for organochlorine contamination in Illinois waters includes the Illinois River, headwaters to Starved Rock Dam, for carp which are designated group 3 (high levels of contaminants, no one should eat).

The most abundant fishes collected in the Illinois River in recent years have been carp, carpsuckers, catfish, gizzard shad, emerald shiners, and spottail shiners (Havera et al. 1980). Species composition and abundance in certain reaches vary depending on available habitat. Many important sport fishes, such as largemouth bass, crappies, and other sunfishes were more numerous in Peoria and LaGrange pools which has greater backwater habitat. In spite of severe sedimentation, the backwater lakes support relatively greater numbers of fishes than other habitats (Havera et al. 1980). However, major shifts in species composition has resulted with carpsuckers replacing crappies and bluegills in the last 50 years.

Table 3. Number of fish species in various reaches of the Illinois River and Waterway.

Reach	Number of Species
Upper Waterway	
North Shore Channel	12
North Branch, Chicago River	8
Chicago River	14
South Branch, Chicago River	4
Chicago Sanitary and Ship Canal	8
Calumet River	17
Little Calumet River	11
Calumet-Sag Channel	11
Brandon Road Pool	37
Upper Illinois River	
Dresden Pool	44
Marseilles Pool	68
Starved Rock Pool	75
Lower Illinois River	
Peoria Pool	95
La Grange Pool	107
Alton Pool	96

II.C.4. Herpetofauna

The Illinois River provides suitable habitat for a wide variety of amphibians and reptiles. However, because of their relatively insignificant economic importance and secretive nature, they have not been as well studied as other groups. Two amphibian species have been listed as endangered by the IDOC.

II.C.5. Macroinvertebrates

Benthic macroinvertebrates play a key role in the transfer of matter and energy to higher trophic levels. Their distribution and abundance are usually influenced by current velocity, substrate particle size, predation and access to food. Turbidity, water level fluctuations, depth and dissolved oxygen also affect benthos in large rivers. However, historic organic pollution contributed significantly to the decline in the macroinvertebrate population of the Illinois River and Waterway.

In general, Illinois River benthos is dominated by aquatic earthworms and bloodworms (bloodworms are actually insect larvae, midges of the family Chironomidae). The diversity of bottom-dwelling macroinvertebrates generally decreases upstream, with the loss of small mollusks (snails and clams) and mayflies. The declining diversity of macroinvertebrates in the upstream direction, toward Chicago, indicates that municipal and industrial wastes from the Chicago area and sediment toxicity probably continue to affect the benthos.

Starrett (1971) showed that Illinois River mussel abundance and diversity declined in the upstream direction. No living mussels were taken in the uppermost Illinois River reach in the 1960's, and the original mussel population there had been eliminated as early as 1912. In 1966, the Illinois commercial mussel fishery was confined to the River's lower 87 miles, but in 1969 it resumed in the vicinity of Peoria, where a substantial population occurred at mile 162.0.

II.C.6. Planktonic Organisms

Phytoplankton are primary fixers of sunlight through photosynthetic activity. They are found in almost all surface waters. Illinois River side channels are very important plankton habitat, particularly during high flow periods. They provide refuge in the form of slower moving waters, which leads to increased plankton abundance, which in turn provides a food source for such planktivores as zooplankton, benthic insects, shad, larval fishes and paddlefish. During reduced river stage, the impounded river channel becomes increasingly important as the abundance of phytoplankton increases due to larger areas of slack water and associated reduced turbidity.

Numerous algal taxa were identified in the Illinois Waterway from phytoplankton and periphyton collections (Havera et al., 1980). Many of these species were common to several River locations, although there were noticeable differences in spatial distributions of certain taxa. The predominant algal group was the Bacillariophyta (diatoms), which is common to many freshwater habitats, as are the Chlorophyta (green algae), Cyanophyta (bluegreen algae), Euglenophyta (euglenoids), Chrysophyta (yellow-green algae), and the Cryptophyta (cryptomonads).

In general, the lowest numbers of Illinois River phytoplankton taxa were observed in collections from upstream locations. The increase in numbers observed at most downstream stations resulted from additions of phytoplankton from various sources along the River. Greatest numbers of taxa were often present in the reach from the Lockport lock and dam near Joliet to Peoria Lake (Havera et al., 1980).

The turbidity induced limitation of algal photosynthesis in the Illinois River has been pointed out by Wang (1974) and the probable relationship between barge traffic and resuspension of silt in the River has been mentioned by other researchers including Mills, Starrett, and Bellrose (1966).

Zooplankton can be thought of as the animal community or grazers that consume phytoplankton. Typical zooplankton populations of large turbid rivers are comprised of rotifers and protozoans. Organisms of these two groups feed on phytoplankton and detritus.

Forty-one taxa of rotifers and 44 microcrustaceans were the predominant zooplankters collected in the Illinois Waterway (Havera et al., 1980). Primary cause of a more than 50% reduction of rotifer species since the turn of the century are thought to be physical changes of the river environment and deterioration of water quality.

Species of the family Brachionidae were the most common and widely distributed rotifers throughout the waterway. Only one, cladoceran, was collected at all sampling locations. One calanoid and one cyclopoid copepod taxa were the dominant forms. Densities of total zooplankton generally increased in a downstream direction. Intolerance to various water quality conditions may limit rotifer abundance in the uppermost region of the waterway.

II.D. PROTECTED SPECIES

II.D.1. Federally Protected Species

In accordance with Section 7(c) of the Endangered Species Act of 1973, federally listed species found in the study area are identified in Table 4.

The bald eagle frequents the Illinois River valley in winter, feeding on fish in open, ice free areas and roosting in protected ravines leading away from the River. As many as 600 bald eagles may use the River in a year. The status of the bald eagle is currently under review. The Service has proposed that the species be down listed to "threatened" due to its improving continental population.

Havera and Kruse (1988) found that eagles seldom had substantial use on the Upper Illinois. Generally, fewer than 25 eagles were observed. In Peoria Pool, they found that eagle numbers peaked between December and March. The largest number observed in one inventory was 120. Density averaged 0.67 per river mile. The Lower Illinois had a census high of 345 individuals. An average of 0.56 eagles per river mile was noted. Individuals on the Illinois River are observed in the winter feeding on fish in open, ice free areas below locks and dams and power plant and sewage treatment plant effluent discharges. During the night, they roost in protected ravines among the bluffs adjacent to the river. Data on relative abundance of immature eagles on the Illinois River valley indicate increasing reproductive success (Havera et al. 1980).

The Indiana bat has statewide distribution. It prefers small stream corridors with well developed riparian forests and an enclosed tree canopy. It roosts under the loose bark of dead or

Table 4. Endangered and threatened species on the Illinois River and Waterway.

COMMON NAME/ SCIENTIFIC NAME	HABITAT	STATUS FED	 IL	Upper Illinois	Lower Illinois
MAMMALS					
Gray bat Myotis grisescens	Caves for roosting, forage over streams, rivers and lakes		E	X	
Indiana bat Myotis sodalis	Riparian forest	E	E	X	
River Otter Lutra canadensis	Wooded rivers, large creeks lakes		E	X	
BIRDS					
Common moorhen Gallinula chloropus	Marshes, ponds with emergent aquatic vegetation		T	X	
Cooper's Hawk Accipiter cooperii	Deciduous forest with meadows or clearings		E	X	
Yellow-headed blackbird Xanthocephalus xanthocephalus	Cattails & bulrushes adjacent to open water, large marshes		E	X	
American Bittern Botaurus lentiginosus	Freshwater marshes and marshy lake shores		E	X	X
Loggerhead shrike Lanius ludovicianus	Open areas with thorn trees, hedgerows		T	X	
Black-crowned night heron Nycticorax nycticorax	Bottomland forests with willows or cottonwoods		E	X	
Great Egret Casmeroides albus	Floodplain forests along large marshes and river backwaters		E	X	X
Bald Eagle Haliaectus leucocephalus	Nests in riverbottom forest winters along river	E*	E	X	X
Great blue heron Ardea herodias herodias			SC	X	
AMPHIBIANS AND REPTILES					
Blandings Turtle Emydoidea blandingii			SC	X	
Illinois Chorus Frog Pseudacris streckeri	Open sandy areas of river lowland	C2	T		X
FISH					
Greater Redhorse Moxostoma valenciennesi		E		X	
PLANTS					
Decurrent false aster Boltonia decurrens	Wet prairie	PT	T	X	X
Leafy prairie clover Dalea foliosa		PT	E	X	
Lakeside daisy Hymernoxys acualis	Dry, rocky prairies	T		X	

COMMON NAME/ SCIENTIFIC NAME	HABITAT	STATUS FED IL	Upper Illinois	Lower Illinois
COMMUNITIES				
Glacial drift hill prairie			X	
Dry upland forest			X	
Sandstone cliff community			X	
Mesic upland forest			X	
Limestone glade				X
Dry-mesic upland forest			X	
Wet-mesic dolomite prairie			X	
Mesic floodplain forest			X	
Northern flatwoods			X	
Geological feature			X	

*Federal Status is being reviewed.

LEGEND FOR STATUS:

E - Endangered
R - Rare
T - Threatened
SC- Special Concern
PT- Proposed Threatened
C2- Federal Candidate for Listing

decaying trees that are 16 inches or greater diameter breast heighth. While the Illinois River does not itself represent typical bat habitat, the species may use the small stream corridors or ravines that are tributary to it, such as in Pike County. Indiana bats were collected in 1987 at the Waterfall Glen Forest Preserve (CSSC RM 301.3). No critical habitat is listed on the Illinois River and Waterway.

The lakeside daisy is a threatened plant found adjacent to the Illinois River and Waterway. Although extripated from Illinois in 1981, three transplant efforts were initiated in 1988: Lockport Prairie Nature Preserve (RM 291.4-293 R) and Romeoville Prairie Nature Preserve (CSSC RM 296.1-297.0 R) in Will County and Manito Prairie Nature Preserve in Tazewell County. The Will County sites are adjacent to the river, and the Tazewell County site is within 2 miles of the river. Future restoration work may be done at the Waterfall Glenn Forest Preserve (CSSC RM 301) in DuPage County.

The lakeside daisy is now restricted to dry, thin-soiled, degraded prairies in which limestone or dolmite bedrock is at or near the surface. Habitats are alkaline, seasonally wet in spring and fall, and are moderately to extremely droughthy in summer.

The decurrent false aster is listed as endangered. It is found *in Morgan, Schuyler, Fulton, and Marshall* counties along the Illinois River. This plant is a wet prairie perennial found on disturbed alluvial ground and open muddy shores of the floodplain forest. It seems to be most common in lowland areas disturbed by periodic cropping which controls plant succession and keeps the habitat relatively open. A proposed recovery plan for this species is currently under review.

The leafy prairie-clover is proposed to be listed as endangered. it is found on prairie remnants on thin soil over limestone, such as the Romeoville Prairie Nature Preserve (CSSC RM 296.1-297.0 R).

Section 7(d) of the Act underscores the requirement that the Federal agency and permit or license applicant shall not make any irreversible or irretrievable commitment of resources during the consultation period which in effect would deny the formulation or implementation of reasonable alternatives regarding their actions on any endangered or threatened species.

In accordance with Section 7(c), the Federal agency responsible for actions authorized, funded or carried out in furtherance of a construction project that significantly affects the quality of the human environment is required to conduct a biological assessment. The purpose of the assessment is to identify listed or proposed species likely to be adversely affected by its action and to assist the Federal agency in making a decision as to whether it should initiate consultation. The biological assessment is to be completed within 180 days of initiation and before contracts are entered into or construction begun.

When conducting a biological assessment, the following steps should be taken:

1. Conduct an on-site inspection of the area affected by the proposed activity or program. This may include a detailed survey to determine if species are present and whether suitable habitat exists for either expanding the existing population or potential reintroduction of populations.

2. Interview recognized experts on the species at issue, including those within the Fish and Wildlife Service, State conservation department, universities and others who may have data not yet found in scientific literature.

3. Review literature and other scientific data to determine the species' distribution, habitat needs and other biological requirements.

4. Review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration for the cumulative effects of the proposal on the species and its habitat.

5. Analyze alternative actions that may provide conservation measures.

II.D.2. State Protected

The State of Illinois has legislation to protect species that have been identified as threatened, endangered or otherwise deserving of special consideration. Table 4 lists all species protected by State law and shows where they may be found. In addition several unique communities that are of special concern in the Upper Illinois area are listed.

II.E. HUMAN USE AND ECONOMIC EVALUATION

Tables 5 and 6, summarize available data for various recreational and commercial uses of fish and wildlife resources on the Illinois River. It should be pointed out that this is an incomplete database. No data are available for some reaches and data shown are considered to be minimal due to limitations in sampling efforts and the reporting of consumptive harvests.

II.E.1. Sport Fishing

The Illinois River is about 18% of the total stream acreage in Illinois and accounts for about 17% of the stream fishing demand (IDOC 1989). Over two million sport fishing days are fished on the *Illinois* River averaging about 5% of the total fishing in Illinois.

Sport species commonly occurring in the Illinois River include largemouth bass, white bass, smallmouth bass, sauger, channel catfish, drum, crappie, bullhead, bluegill and miscellaneous sunfish. With the large metropolitan areas of Chicago at its head and St. Louis near its mouth, and by cutting more or less centrally through the northern half of the State, the River is in an excellent position to provide quality fishing to a great number of Illinois citizens. Unfortunately, this location has also made it susceptible to extensive development and pollution which has damaged the River's image and depressed fishing activity.

Man has so influenced the Illinois River system that most species were rarely found as recently as 20 years ago (Herndon, 1983). In the 1970's, measures to reduce toxic waste and organic pollutant loads were enacted by public agencies. The result has been a improving sport fishery. Recently the Illinois River has provided exceptional fishing for some game fish species. Now, among the fish frequently caught by anglers are sauger, walleye, and smallmouth bass. Estimated expenditures per day are $49.1 million for over two million sport fishing activity days.

Use of the sport fishery on the Illinois river directly corresponds to the desirability of the fish population. A definite increase in sport fishing pressure has been noted in recent years. New recreation areas make boating access for fishing easier in the Tri-County area (Peoria) than in many areas along the river. The resurgence of the game fish population is being well utilized. Fishing should remain good as long as water conditions remain favorable (Herndon 1983).

II.E.2 Commercial Fishing

Historically, the Illinois River was a nationally significant commercial freshwater fishery. At the turn of the century a 200-mile reach between Hennepin and Grafton produced 10% of the total U.S. catch of freshwater fish, more than any other river without a commercial anadromous fishery. During this time, about 180 pounds per acre were harvested. The decline in the commercial fishery is shown graphically below (figure 2) for the years data were collected.

Table 5. Annual recreational use and expenditures on the Illinois River.

	Activity Days	Expenditures/Day[1]
Sport Fishing	2,135,000[2]	$ 49.1 million
Waterfowl Hunting	83,400[3]	$ 2.2 million
Deer hunting	73,000[3]	$ 3.3 million
Small game	400,000[3]	$ 5.6 million
Other Recreation	NO DATA	NO DATA
Total Recreation	2,691,400	$ 60.2 million

[1]From U.S. FWS 1989. ($23 freshwater sportfishing, $26 migratory birds, $45 big game, $14 small game).

[2]From Baur 1988, Havera et al. 1980.

[3]Waterfowl and other hunting adapted from Conlin (1986) and represents activity for all counties adjacent to Illinois River.

Table 6. Annual commercial tonnage and first market value of fish and wildlife resourcestaken from Illinois River.

	Total Tons	1st Market Value
Commercial Fishing[1]	389	$224,000
Commercial Trapping[2]	NO DATA	$400,000
Commercial Musseling[3]	181	$267,000
Total Commercial		$891,000

[1]Fritz 1989a
[2]Conlin 1986
[3]Fritz 1989b

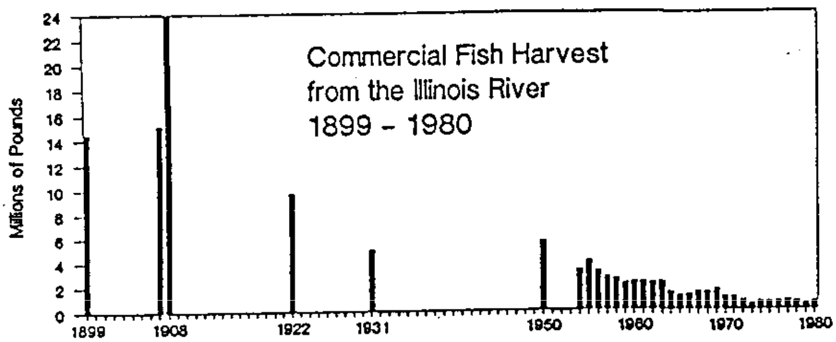

Figure 2.

Today, however, commercial harvest is considerably less. This decline has largely been attributed by numerous authors to pollution and general environmental degradation in the Illinois River valley. Also, the decreased economic incentives to commercial fishermen has decreased their numbers from approximately 2000 in 1908 to just 87 in 1988.

The overall harvest decline "bottomed-out" in 1979 at 305,018 pounds and has shown an increasing trend in recent years, reaching nearly one million pounds by 1988. The increased harvest has largely been attributed to improved water quality. Fritz (1989a) reported a harvest of 780,455 pounds in 1988. The majority (55%) was taken from La Grange Pool with 26% from Alton Pool, 18% from Peoria Pool and under 1% from Starved Rock Pool. Primary species were carp, buffalo, drum, and catfish. Over 58% of the total pounds harvested were species of buffalo. The current first market value of the Illinois River fishery can be estimated at $224,000 (Fritz, 1989a).

II.E.3. <u>Commercial Shellfishing</u>

The commercial mussel harvest on the Illinois dates back to the late 1800's when mussel shells were used in the pearl button industry. This industry flourished until about 1930 when plastic buttons were introduced. More recently, beginning in the 1960's, mussels have been harvested for the Japanese cultured pearl industry.

Fritz (1989b) reported that 181 tons were harvested from the Illinois River in 1988. This compares to the range of 12 to 288 tons he reported for the period 1971-1981. The 1988 reported valued was $267,000. Species harvested in 1988 include washboards (42%), three-ridge (56%), mapleleaf (1%), and pimpleback (1%). Most of the harvest occurred in Alton Pool (96%). In 1988, almost five tons were taken from La Grange Pool and almost nine tons from Peoria Pool.

II.E.4. Hunting

The Illinois River is an important segment of the Mississippi River Flyway, which draws birds from summer nesting grounds in the prairie pothole region of the U.S. and Canada, and the Arctic. Waterfowl hunters along the Illinois River utilize sandbars and islands, private clubs in backwaters, or conservation areas managed for controlled hunting. Harvest of waterfowl is significant, but has declined over the years due to loss of nesting habitat in the northern prairie region of the continent, and shifts in migratory patterns of diving ducks. Also loss of habitat in the migratory corridor on the Illinois has resulted in decreased waterfowl numbers.

Significant losses on the Illinois River, include collapse of the entire food supply for diving ducks (i.e. fingernail clams) in the mid 1950's. This collapse, thought to be caused by deteriorated water quality, produced a shift of the migration route of the entire midcontinent diving duck population to the UMR, where it is now seasonally concentrated on Pools 7, 8, 9 and 19. The primary food source in those pools is wild celery. Both food sources are thought to be in jeopardy from chemical pollution (fingernail clams) and excessive turbidity (wild celery).

Waterfowl hunting has been estimated at about 83,400 activity days annually with a value of $2.2 million. Mallard and wood duck are the most common species bagged.

Cottontails, gray and fox squirrels, woodchucks, raccoons, and red and gray foxes are the principal small game species. Rabbits and squirrels are taken in the greatest numbers. Conlin (1986) estimated that about 400,000 activity days were spent hunting small game in the counties adjacent to the Illinois River. This could have resulted in expenditures of about $5.6 million. The white-tailed deer is the only remaining big game species in Illinois. Over 73,000 activity days were spent in pursuit of deer in the counties adjacent to the River (Conlin 1986) with estimated expenditures of $3.3 million. Over 20% of the statewide total deer harvest is in the Illinois River corridor (Havera et al. 1980).

II.E.5. Trapping

Bottomland species of greatest economic importance include raccoon and muskrat. Other furbearers of lesser economic importance are fox, opossum, mink, beaver, skunk, weasel, and coyote. Conlin (1986) estimated that about $400,000 of pelts were taken along the Illinois River.

II.E.6. Pleasure Boating and Related Recreation

Pleasure boating and related activities (i.e. water skiing, sailing, swimming, and camping) are nonconsumptive recreational activities of the Illinois River. No data are available on the activity days or value involved.

II.E.7. Passive Recreation

Passive recreation along the Illinois comes in many forms. Activities may include picnicking, sightseeing, loafing, hiking, product gathering, nature study, snowmobiling, sunbathing, parking, skiing, photography, cottage use, environmental education, target shooting, off-road vehicles, bicycling and others.

The attraction of the River to passive recreation is often overlooked by resource managers and decision makers and it is difficult to define, being slightly different for each participant. It's importance, however, cannot be overlooked in terms of its economic contribution, if not social well being, to the region and its residents.

II.E.8. Summary

Human use of the natural resources of the Illinois River takes many forms, in addition to the more traditional uses of water supply and navigation. We are just beginning to appreciate and understand the full extent and importance of these other uses to the regional economy, and indeed, to our own mental and economic well being.

By combining available estimates, human use in the form of recreation and commercial uses can be valued at the first market at over $61 million annually. Applying the 1.5 multiplier factor used by the UMRCC (1982), this totals to well over $91 million in annual benefits to the regional economy. If <u>all</u> activities on <u>all</u> river reaches were included, this total would be even higher. The Environmental Management Program is in the process of completing an Impacts of Recreation study which will provide additional information on the probable value of recreation in the region. However, no data will be collected on actual recreation use in the corridor.

II.F. RESOURCE MANAGEMENT

Congress mandated a dual role for the Illinois River by establishing and funding <u>both</u> national wildlife refuges and a commercial navigation system. Furthermore, a variety of other interests, including agriculture, industry, recreation and water supply, make legitimate claims on the system's resources. The needs, demands and expectations of these interests frequently conflict and, in some instances, appear to be incompatible.

Land management authorities vary in the Illinois River Corridor. Public lands along the lower Illinois River are owned and managed primarily by the Illinois Department of Conservation or the U.S. Fish and Wildlife Service. Unlike on the Upper Mississippi River, the Corps of Engineers owns little land along the Illinois River, except in Alton Pool. Along the upper Illinois River public lands are managed by the Illinois Department of Conservation or a county forest preserve.

II.F.1. Federal Management

The mainstem floodplain of the Illinois River contains about 200,000 acres of bottomland and aquatic habitat. Congress has placed about 13,700 acres of this land and water into a complex of wildlife refuges (Figure 3).

The Federal lands on the Illinois River are managed primarily for the benefit of fish and wildlife, but contribute greatly to recreation, flood storage and water supply functions of the system. The commercial navigation channel passes along or through most of these tracts. The refuge lands provide significant habitat for many animal and plant species and are of particular importance to species which depend on floodplain habitat. Such habitat has been largely eliminated, or is being developed or modified in many non-refuge areas.

The gradual elimination of waterfowl nesting sites in the north and wintering habitat in the south and east is placing severe strains on many important migratory species. The decline in quantity and quality of floodplain habitats has increased this strain. The situation is worsened by increasing sedimentation and pressure to use Federal lands for recreational boating. Protection of the refuge system is essential if habitat for these species is to be maintained.

The Mark Twain National Wildlife Refuge (MTNWR) includes several divisions on the lower Illinois River. The Brussels District of MTNWR includes the Calhoun Division (4833 acres) and Gilbert Lake (800 acres). These areas were included in the National Wildlife Refuge system in 1958, and occupy land purchased for the nine-foot navigation project. Both divisions are managed to provide and protect wintering habitat for the bald eagle, to provide food and shelter to migratory birds, and to provide other compatible uses. Several areas are used for moist soil management.

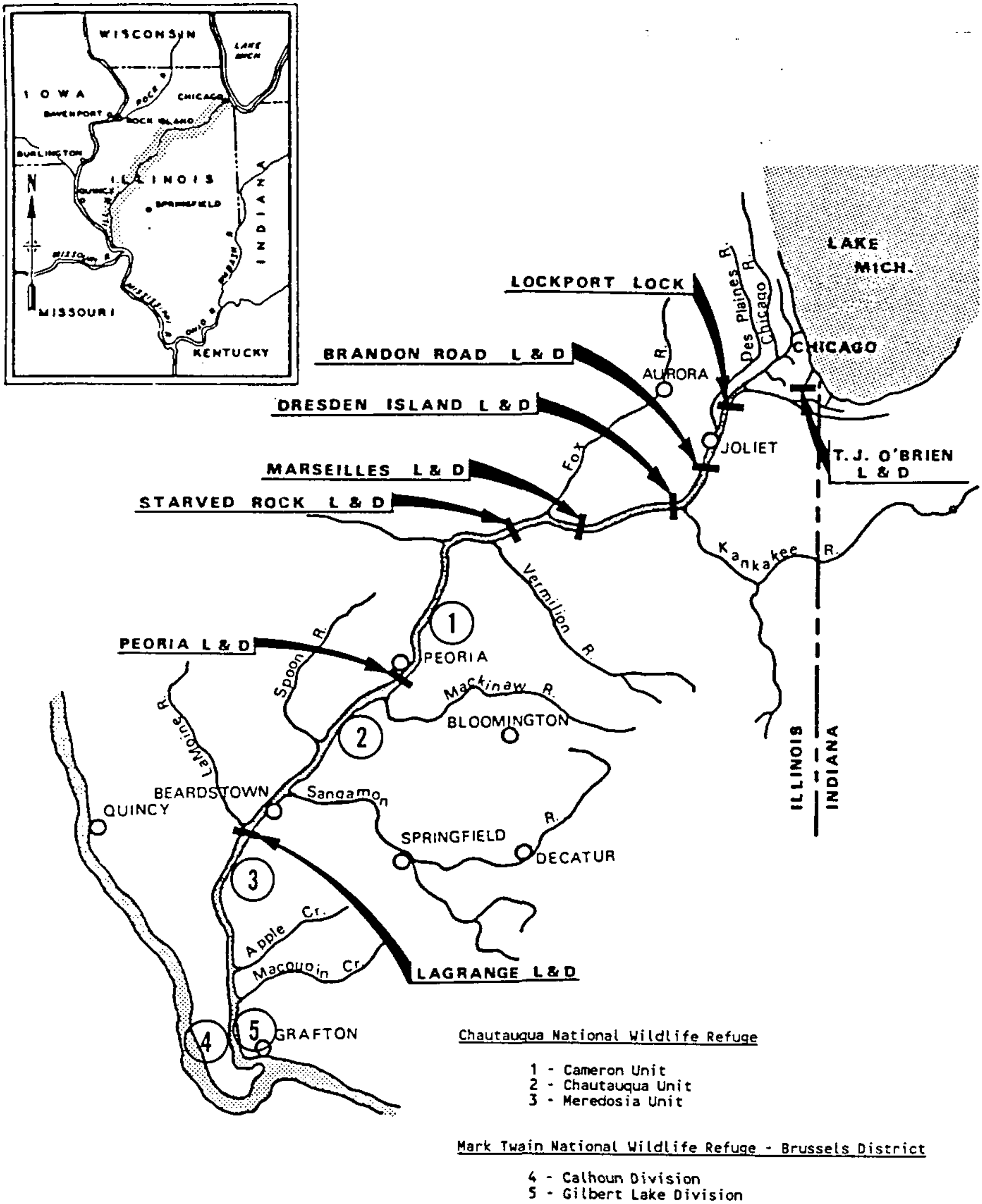

Figure 3. Approximate locations of National Wildlife Refuges on the Illinois River

The Chautauqua National Wildlife Refuge (CNWR) consists of three units on the Illinois River. The Chautaugua Unit was established in 1936 and consists of 4488 acres. The Cameron Unit was established in 1958 with an addition in 1981, now totaling 1707 acres. The Meredosia Unit was established in 1973 and consists of 1850 acres. In all, these three units include 2988 acres of wetland, 4585 acres of open fresh water, 175 acres of non-commercial timber, nine acres of grassland, 15 acres of brush and 170 acres of agricultural land for a refuge total of 8035 acres. Waterfowl production consists primarily of wood ducks with some mallards and giant Canada geese. The refuge provides resting areas and food for a variety of other migratory birds, and wintering habitat for the bald eagle. Highest priority management of the CNWR is to protect and enhance refuge habitat to maintain or increase use by bald eagles and ospreys. Also, management is to provide optimum conditions for migrating mallards and Canada geese, and to increase wood duck production.

II.F.2. State Management

A number of areas are protected by the State of Illinois on the Illinois River. The Illinois Department of Conservation (IDOC) manages over 50,000 acres for migratory waterfowl and hunting (table 7) at 23 sites along the river. Approximately 8800 acres of Corps-owned land are managed by IDOC in the Alton Pool. Additionally the IDOC maintains six State parks and several access sites. In general, management objectives of these lands are to provide refuge for fish and wildlife and to provide access and enhance opportunities for outdoor recreation including camping, hiking, boating, hunting, fishing, trapping and wildlife observation. The number and placement of duck hunting blinds are also regulated.

II.G. SIGNIFICANT RESOURCES OF ILLINOIS RIVER

The national and regional significance of the fish and wildlife resources of the Illinois River and Waterway are described above. Where data exists, site specific information on these resources has been summarized in tables 8 and 9. This list should not be a substitute for site specific review. The absence of information for a particular area does not necessarily mean that the area is less significant. There simply may be no information available.

In accordance with U.S. Army Corps of Engineers planning guidelines, table 10 has been prepared to demonstrate significance of resources based on their institutional, public concern, national economic development benefits, and ecological significance.

Table 7. Illinois River waterfowl management areas of Illinois Department of Conservation.

Site Name	Total Acreage	Wetland Acreage	Hunted Acreage	Refuge Acreage	Primary[1] Objective
Anderson Lake CA	2,133	1,537	1,132	0	1,2
Banner Marsh SFWA	3,900	781	0	781	1,2
Donnelly SFWA	517	224	224	0	1,2
Lake DePue SFWA	2,136	650	575	75	1,2
Marshall Co. CA	4,380	2,907	2,557	350	1,2
Pekin Lake CA	1,488	548	181	367	1,2
Powerton Lake	1,429	1,426	800	626	1,2
Rice Lake CA	5,660	1,804	1,607	197	1,2
Sparland CA	1,281	1,100	1,100	0	1,2
Starved Rock SP	2,617	800	672	128	1,2
Woodford Co. SFWA	2,901	2,462	1,562	900	1,2
Batchtown WMA	1,701	1,399	1,399	0	1,2
Calhoun Point	1,792	353	353	0	1,2
Fuller Lake	949	406	406	0	1,2
Glades - 12 Mile Island	1,355	469	469	0	1,2
Godar - Diamond & Hurrican Islands & Michael Landing	2,199	853	495	358	1,2
Helmbold Slough	271	71	71	0	1,2
Illinois River Jersey & Calhoun Co. near Grafton	300	300	300	0	1,2
Pike Co. CA	862	100	100	0	2
Red's Landing	669	128	128	0	1,2
Riprap Landing	1,231	200	200	0	1,2
Sanganois CA	9,778	4,525	2,680	2,915	1,2,3
Stump Lake	2,950	1,175	1,129	86	1,2
TOTAL	50,251	24,659	18,581	6,783	

[1]Primary Objectives: 1) midmigration duck habitat, 2) public duck hunting, 3) wood duck production, 4) wintering goose habitat, 5) giant Canada goose production, 6) public goose hunting

Table 8. Significant fisheries resources of the Illinois River and Waterway (USFWS, in preparation).

River Mile	
0-80	Inventory not available
80.1	LaGrange Dam tailwater fishery
82.7 - 87.1 L	Backwater slough and levee borrow ditch sport fishery
83.8R	LaMoine River sport fishery
85.8 - 86.0 L	Bar Island side channel sport fishery
86.5 - 87.0 L	Grape Island side channel sport fishery
90.5 - 93.0 L	Muscooten Bay/Wood Slough sport fishery
94.0 - 95.5 L	Tredway Lake sport fishery
94.3 - 95.2 L	Sugar Creek Island side channel sport fishery
94.6 - 95.2 R	Sugar Creek Lake sport fishery
95.0 - 98.0	Commercial fishery
99.0 - 101.4 L	Chain Lake/Panther Slough sport fishery
99.0 - 105.4 L	Chain Lake, Crane Lake, Stewart Lake, Ingram Lake sport fishery
107.0 - 117 0	Commercial fishery
106.8 - 113.4 L	Bath Chute - Commercial and sport fishery
107.6 - 112.0 L	Jack Lake sport fishery (private)
114.5 - 117.0 L	Matanzas Bay private lake sport fishery
120.5 R	Spoon River catfish nursery, sport fishery
122.5 - 124.0 L	Quiver Lake sport and commercial fishery
124.0 - 126.3 R	Commercial fishery
124.1 - 130.5 L	Meyers Ditch sport fishery
124.2 - 129.5 L	Lake Chautauqua sport fishery
125.0 L	West spillway of Lake Chautauqua sport fishery
129.5 - 131.8 R	Fish spawning area in rock substrate
129.5 - 135.0 L	Clear Lake sport fishery
132.5 - 134.3 R	Goose Lake sport fishery spawning of white bass and bluegill
134.1 L	Jake Wolf Hatchery outfall
133.0 - 137.6 R	Rice Lake/Big Lake sport fishery
136.9 - 137.5 R	Copperas Creek Lock sport fishery
137.6 R	Copperas Creek white bass nursery
135.0 - 141.0	Spring Lake sport fishery
136.8 - 136.9 R	Copperas Creek Lock sport fishery
141.1 - 142.9 R	Side channel or levee borrow ditch sport fishery
147.6 L	Mackinaw River sport fishery
148.2 - 150.8 L	Powerton Fish and Wildlife Area sport fishery
149.7 R	LaMarsh Creek spawning and nursery area
150.0 - 157.7	Commercial fishery
151.2 L	Gravel quarry spawning and wintering area
153.0 - 156.0 L	Pekin Lake/Lake of the Woods spawning and nursery area
159.7 R	Kickapoo Creek spawning and nursery area
159.8	Peoria Dam tailwater fishery
160.0 L	Wesley Slough spawning and nursery area
162.5 - 163.5 R	Spawning area
163.0 - 166.0	Lower Peoria Lake sport fishery
166.0 L	Spawning area
166.5 - 167.5 R	Spawning area
166.5 - 168.0	Main channel catfish overwintering area
166.5 - 179.0	Upper Peoria Lake sport fishery
179.7 - 181.0 L	Chilicothe Island side channel (East River) sport fishery and spawning area
179.0 - 182.0 R	Goose Lake/Rice Pond spawning and nursery area and sport fishery
181.0 - 181.3 R	Gravel pit pond overwintering area
182.6 - 195.5 L	Babbs Slough sport fishery
183.5 - 185.3 R	Big Meadow Slough sport fishery
185.5 - 186.5 L	Hitchcock Slough sport fishery
186.5 - 188.5 L	Sawyer Slough sport fishery
187.1 - 189.0 R	Wightman Lake sport fishery
189.5 L	Gravel pit pond fish overwintering area
190.0 - 191.5 R	Sparland Lake sport fishery
191.5 - 193.0 R	Weis Lake sport fishery
193.0 - 195.3 L	Billsbach Lake sport fishery
195.0 R	Gravel pit sport fishery
196.2 - 197.2 R	Mud Lake sport fishery
197.0 - 199.0 L	Sawmill Lake sport fishery
198.5 - 204	Senachwine Lake sport fishery, spawning and nursery area
200.2 - 201.5 L	Swan Lake sport fishery
204.3 - 206.5 R	Goose Lake sport fishery
209.5 - 210.5 L	Coleman Lake sport fishery, spawning and nursery area
207.9 - 208.9 R	Hickory Ridge Lake sport fishery, spawning and nursery area
209.5 - 211.0 R	Spring Lake sport fishery, spawning and nursery area
211.0 - 213.5 R	DePue Lake sport fishery, spawning and nursery area
214.5 - 216.0 L	Turner Lake sport fishery
223.2 R	I&M Canal sport fishery
218.5 upstream	Commercial fishery prohibited

Table 8 cont.

226.0 - 227.0 R	Lake Pecumsaugen sport fishery
226.4 L	Vermillion River sport fishery
230.7 - 231.0	Starved Rock Dam tailwater fishery
230.0 - 230.7 L	Plum Island side channel sport fishery
231.0 - 235.0	Submerged island/aquatic plants/sport fishery
235.2 - 236.5 R	Sheehan Island side channel sport fishery
237.0 - 239.0 L	Hitt island side channel sport fishery
240.3 - 241.5 R	Scherer/Bulls Island side channel sport fishery
244.0 - 247.0	Marseilles Dam tailwater and rapids sport fishery
247.6 - 248.3 L	Ballard island side channel sport fishery/ bullhead spawning and nursery area
249.0 L	Collection of greater redhorse (Moxostoma valenciennesi), 1985, an Illinois endangered species
258.3 - 259.2 R	Waupecan Island side channel sport fishery
259.0 - 262.5 L	Gravel pit (Material Services Corp) spawning, nursery, overwintering area, no public access
265.0 - 269.5 L	Lake Heidecke Fish and Wildlife Area cooling pond sport fishery
268.3 R	Aux Sable Creek sport fishery
271.5 R	Dresden Island Dam tailwater sport fishery
274.0 L	Kankakee River-Dresden Island Nuclear Power Plant cooling pond sport fishery
274.8 L	Grant Creek Cut-Off sport fishery
275.2 - 276.4 R	Side channel sport fishery
276.7 - 277.7 R	Off channel sport fishery
278.4 L	Jackson Creek sport fishery
279.3 - 280.0 L	Treats Island side channel sport fishery
285.3 - 286.2	Brandon Road Dam tailwater fishery
305.7-307.5 R	Chicago Ship Canal-Saganashkee Slough sport fishery
....	Lake Calumet sport fishery

Table 9. Significant wildlife resources of the Illinois River and Waterway (USFWS, in preparation)

River Mile	
0 - 80.0	Inventory not available
82.7-87.1 L	Backwater slough and levee borrow ditch waterfowl use
83.8 R	LaMoine River bottoms
85.5 - 89.0 R	York Lake heron feeding area
89.0 - 99.0 L	Muscooten Bay/Sangamon River bottoms waterfowl, heron and eagle use
	Muscooten Bay - 1985 Census Data 1180 ducks and coots 19 bald eagles
90.0 - 99.0	Sanganois Conservation Area waterfowl, heron and eagle use
90.0 - 99.0	Sangamon River - 1985 Census Data 17,245 ducks and coost 4,300 geese 20 pelicans 10 herons 8 bald eagles
94.0 - 95.5	Treadway Lake - 1985 Census Data 55,700 ducks and coots 1,125 geese 12 pelicans 1 bald eagle
93.7 - 97.2 L	Shoreline eagle perching
98.0 - 103.0 L	Shoreline eagle perching
99.0 - 105.4	Chain Lake - 1985 Census Data: 9,180 ducks and coots 30 geese 10 pelicans 4 bald eagles
	Crane Lake - 1985 Census Data 176,270 ducks and coots 2,400 geese 10 pelican
	Stewart Lake - 1985 Census Data 2,525 ducks and geese 6 bald eagles
	Ingram Lake - 1985 Census Data 10,140 ducks and coots 3 bald eagles
105.5 - 109.5 L	Snicarte Lake - 1985 Census Data 5,025 ducks and coots 185 geese 1 bald eagle
	Jack Lake - 1985 Census data 113,185 ducks and coots 680 geese 20 heropns 5 pelicans 8 bald eagles
	Moscow Lake - 1985 Census Data: 2785 ducks and coots 3 bald eagles
107.9-113.3 L	Shoreline eagle perching
108.2-111.9 R	Shoreline eagle perching

Table 9 cont.

108.2-111.9 L	Grand Island, Jack Lake, Moscow Lake waterfowl, heron and eagle use
	Anderson Lake Conservation Area
109.0-112.0 R	Anderson Lake - 1985 Census Data: 11,330 ducks and coots 15 herons 4 bald eagles
107.9-113.3 L	Shoreline eagle perching
108.2-111.9 R	Shoreline eagle perching
113.7-114.2 L	Dierker Lake - waterfowl use
120.5-121.0 R	Spoon River bottoms
122.5-124.0 R	Quiver Lake - waterfowl, heron, eagle use 1985 Census Data: 2230 ducks and coots 10 herons 15 eagles
124.0-129.5 L	Chautauqua National Wildlife Refuge waterfowl, heron, and eagle use
	Lake Chautauqua - waterfowl, heron, eagle use 1985 Census Data: 158,510 ducks and coots 13,650 geese 40 herons 9 pelicans 21 bald eagles
129.5-134.0 L	Clear Lake - waterfowl, heron, eagle use 1985 Census Data: 163,510 ducks and coots 3,260 geese 25 herons 13 bald eagles
132.5-134.3 R	Goose Lake - waterfowl, heron and eagle use 1985 Census Data: 20,730 ducks and coots 580 geese 15 herons 3 bald eagles
132.8 L	Heron rookery - 1987 Census Data: 315 great blue herons 61 great egrets 28 black crowned night herons
134.5-135.0 R	Lost Lake (on Senate Island) - waterfowl use
134.4-134.7 L	Shoreline eagle perching
133.0-137.6 R	Rice Lake Conservation Area, including Rice Lake, Big Lake, Goose Lake and associated backwaters and wetlands provide exceptional mid-migration habitat for waterfowl, nesting for wood ducks and habitat for shore and wading birds.
	Rice Lake - 1985 Census Data: 26,315 ducks and coots 120 geese 5 herons 3 bald eagles
	Big Lake - 1985 Census Data: 97,230 ducks and coots 4,850 geese 35 herons 6 pelicans 5 bald eagles

Table 9 cont.

134.5-135.0 R	Lost Lake (on Senate Island) - waterfowl use
138.0 R	Bald eagle night roost
135.0 L	Spring Lake Conservation Area Spring Lake - 1985 Census Data: 31,260 ducks and coots 864 geese 20 herons 2 bald eagles
138.0-144.0	Banner Special Levee and Drainage District Fish and Wildlife Area - Entire mine is proposed for future acquisition by the IDOC for development into waterfowl habitat. Banner Cooling Lakes - 1985 Census Data: 1405 ducks and coots 534 geese 5 herons 11 bald eagles Banner Mine - 1985 Census Data: 14,515 ducks and coots 2,700 geese 65 herons 12 pelicans
148.2-150.8 L	Powerton Fish and Wildlfie Area 1985 Census Data: 31,555 ducks and coots 550 geese 35 herons 9 bald eagles
148.3-149.3 R	Shoreline eagle use December-February
153.0-156.0 L	Pekin Lake/Lake of the Woods 1985 Census Data: 15,520 ducks and coots 325 geese 25 herons 2 bald eagles
155.0 L	Heron Rookery - 1987 Census Data: 67 great blue herons 29 common egrets 172 black-crowned night herons
157.8 R	Waterfowl use
158.2 R	Beesaw Lake - heron use
159.4-160.7 L	Wesley Slough - waterfowl use
163.0-166.0	Lower Peoria Lake - 1985 Census Data: 6185 ducks and coots 580 geese 1 bald eagle
166.0-179.0	Upper Peoria Lake - 1985 Census Data: 51,130 ducks and coots 1,240 geese 60 herons 3 bald eagles
172.0-173.0 R	Shoreline eagle perching
179.7-181.0 L	Chilicothe Island shoreline eagle perching area
178.5-180.0 L	Woodford County Conservation Area
179.0-180.5 R	Goose Lake - 1985 Census Data: 14,585 ducks and coots 460 geese

Table 9 cont.

	Rice Pond - 1985 Census Data: 69,915 ducks and coots 1,600 geese 1 bald eagle
180.5 R	Upper end of Goose Lake - heron feeding area
182.9 R	Heron rookery - 1987 Census Data: 150 great blue herons 25 great egrets
182.0-185.0 R	Spring Branch Unit of Marshall County Conservation Area
182.6-185.5 L	Babbs Slough - 1985 Census Data: 43,445 ducks and coots 3 bald eagles
	Babbs Island shoreline - heron feeding area
183.5-185.3 R	Big Meadow Slough - 1985 Census Data: 555 ducks and coots
184.5-186.0 L	Marshall County Conservation Area
187.1-189.0 R	Wightman Lake - 1985 Census Data: 350 ducks and coots
184.5-185.5 L	Waterfowl closed area
186.0 L-188.0 R	Waterfowl closed area
189.0-191.0 R	Sparland Unit of Marshall County Conservation Area
190.0-191.5 R	Sparland Lake - 1985 Census Data: 430 ducks and coots 1 bald eagle
191.5-194.4 R	Cameron Unit - Chautauqua National Wildlife Refuge
	Weis Lake - 1985 Census Data: 1290 ducks and coots 175 geese
	Weis Lake shoreline heron feeding area
193.0-194.4 L	Billsbach Unit - Chautauqua National Wildlife Refuge
	Billsbach Lake - 1985 Census Data: 6390 ducks and coots 675 geese 1 bald eagle
197.0-199.0 L	Sawmill Lake - 1985 Census Data: 5220 ducks and coots 675 geese
198.5-204.0	Senachwine Lake - 1985 Census Data: 42,745 ducks and coots 2,200 geese 10 herons 6 pelicans 4 bald eagles
199.2-201.2 R	Shoreline heron use
200.2-201.5 L	Swan Lake - 1985 Census Data 4825 ducks and coots 290 geese 1 bald eagle
204.3-206.5 R	Goose Lake and wetlands - 1985 Census Data: 99,975 ducks and coots 13,800 geese 25 heron 15 pelicans 8 bald eagles

Table 9 cont.

206.3-210.0 R	Big Bureau Creek bottoms waterfowl use area
	Bureau Ponds - 1985 Census Data: 30 ducks and coots
209.5-210.5 L	Coleman Lake - 1985 Census Data: 2500 ducks and coots 35 geese
209.5-213.5 R	Spring/De Pere Lake - 1985 Census Data: 2275 ducks and coots shoreline heron use
211.0 R	Heron Rookery - 1987 Census Data: 250 great blue herons 25 great egrets
	Donnelly-DePue State Fish and Wildlife Area
214.5-216.0 L	Turner Lake - 1985 Census Data: 655 ducks and coots
215.2-215.6 L	Clark Island shoreline heron use
226.5-233.8 L	Starved Rock State Park and Nature Preserve
231.0-235.0 L	Submerged Island/aquatic plants/waterfowl use
257.1-257.8 R	McNellis Bayou - waterfowl use
259.0-262.5 L	Gravel pit (Material Service Corp.) waterfowl use - NO PUBLIC ACCESS
265.0-269.5 L	Lake Heidecke Fish and Wildlife Area cooling pond waterfowl use
268.4-271.0	Goose Lake Prairie Natural Area
268.3-268.9 R	Aux Sable Creek bottoms - wood duck nesting
268.4-271.0 L	Goose Lake Prairie Natural Area
273.7-274.7	Public waterfowl hunting area
274.0 L	Kankakee River - Dresden Island Nuclear Power Plant cooling pond - waterfowl use
273.7-274.7 R	McKinley Woods (Will County Forest Preserve)
275.0 L	Des Plaines Conservation Area
275.2-276.4 R	Side channel - waterfowl and heron use
275.2-277.2	Public hunting area
276.6-277.7 R	Off channel - waterfowl and heron use
279.8 R	Public hunting area
285.3-286.2 L	Waterfowl and heron use area
CSSC 291.4-293 R and 291.7-292.0 L	Natural Area - Lockport Prairie wet-mesic dolomitic prairie, dry-mesic dolomitic prairie, mesic dolomitic prairie sedge meadow marsh, Petalostemum foliosum, Deschampsia cespitosa, Muhlenbergia cuspidata, and Hymenoxys acaulis var. glabra (introduced) federally listed threatened species
CSSC 294.6-295.1 R	Natural Area - Material Services Prairie wet-mesic dolomitc prairie marsh, sedge meadow, Deschampsia cespitosa

Table 9 cont.

CSSC 296.1-297.0 R	Natural Area - Romeoville Prairie wet dolomitic prairie wet-mesic dolomitic prairie sedge meadow, spring community, Petalostemum foliosum, Deschampsia cespitosa, and Hymenoxys acaulis var. glabra (introduced) federally listed threatened species Dalea folisa, proposed federally listed endangered species
CSSC 299.1-299.4 R	Nature Preserve - Black Partridge Forest Preserve mesic upland forest, dry-mesic upland forest, springs and seeps
CSSC 300.7 L	Natural Area - The Bowl intermittent stream
CSSC 301.0-304.0 R	Nature Preserve - Waterfall Glen Forest Preserve, dolomitc cliff community and wetland
CSSC 301.3 R	Collection of Endangered Species Indiana bat (Myotis sodalis) - 1987 Waterfall Glen Forest Preserve
CSSC 304.0-308.0 L	Cook County Forest Preserve - including the
CSC 204.0 L/R	Cap Sauers Nature Preserve
CSSC 304.0-308.0 L	Cook County Forest Preserve - including the
CSC 304.0 L/R	Paw Paw Woods Nature Preserve and Little Red Schoolhouse Nature Center
CSC 305.0 L	Nature Preserve - Sagawau Canyon dolomitic cliff community ponds, springs, cave
CSC 305.7-307.5 R	Saganashkee Slough - waterfowl use
CSC	Nature Area - Dolton Avenue Prairie wet-mesic prairie
CSC	Natural Area - Burnham Prairie dry-mesic prairie, wet-mesic prairie, wet prairie, and oak savanna
	Natural Area - Lake Calumet and surrounding wetlands - habitat for shorebirds, waterfowl herons and egrets, black-crowned night heron rookery, great blue heron and great egret feeding, yellow-headed blackbird nesting, common tern,
	Wilson's phalarope nesting, upland sandpiper nesting, common moorhen nesting, yellow rail, and herring and ring-billed gull colony
	Wolf Lake and W. Powers Conservation Area

CSSC - Chicago Sanitary and Ship Canal
CSC - Calumet-Sag Channel

Table 10. Significant resources of the Illinois River and Waterway that may be affected by increases in navigation traffic.

Resource	*Institutional*	*Public*	*Technical*	NED Resources
Backwaters and side channels and associated wetlands	E.O. 11990, Protection of Wetlands; E.O. 11988, Flood Plain Management; Executive Branch "no net loss" wetland policy; UMR NWR's established to protect habitat.	A concern identified by public during public participation hearings on Master Plan	Nesting, spawning, rearing feeding and cover for a variety of fish species	Recratational boating
Fish eggs, larvae, and adults	Species on State Threatened or Endangered Species Lists; National Recreational Policy.	"		Total sport fishing use on IR is 2.1 million days annually representing $49 million in expenditures. 1988 commercial harvest was 389 million tons having a value of $0.2 million.
Mussels		"	Food source for many vertebrates; intermediate step in aquatic food chain	1988 IR harvest 181 tons having a value of $0.3 million.
Aquatic Macrophytes	E.O. 11990, Protection of Wetlands	"	Important link in life cycles of plankton, benthos, fish, watefowl and furbears	
Macroinvertebrates			Intermediate step in UMR aquatic food chain	
Waterfowl	Migratory Bird Treaty Act, two National Wildlife Refuges, North American Waterfowl Management Plan	"		35,000 activity days annually at representing $910,000 annually in expenditures.

III. SITE SPECIFIC OVERVIEW

III.A. ALTERNATIVES BEING CONSIDERED

The following alternatives have been identified by the Rock Island District as having the potential to reduce future inefficiencies in the Illinois River and Waterway navigation system. Each alternative is being evaluated by the District for purposes of reconnaissance planning.

1. New 1200-foot long lock chamber at **each site.**

2. Replacement of locks and dams at LaGrange and Peoria with a single new facility.

3. Extending the existing 600′ chamber to 1200′ at **each site.**

4. Guidewall extensions upstream and downstream at **each site.**

5. Mooring cells upstream and downstream at **each site.**

6. Replacement of locks and dams at Lockport and Brandon Road with a single new facility.

7. Widen Marseilles canal.

8. Non-structural, operational procedures.

III.B. POTENTIAL SITE SPECIFIC EFFECTS OF CONCERN

At this time the District's assessments of the various alternatives are broad and very general in nature with greatest emphasis on the Peoria and LaGrange facilities. Therefore, little site specific impact analysis can be done. For discussion purposes, we have grouped the alternatives being considered into a) construction at the lock and dams, b) newly impounded areas, c) mooring cells, d) widening of Marseilles canal, and e) operational procedures.

III.B.1. Construction at Locks and Dams

Construction at the locks and dams could range from a new 1200-foot lock, extension of 600-foot locks to 1200 feet, or guidewall extensions. Each of these measures would result in the permanent loss of aquatic habitat and any benthic macroinvertebrates at the site. The extent and significance of these losses are unknown. In addition, any changes in the dam structure could result in changes in tailwater velocities and alteration of general tailwater habitat suitability for a number of fish species including most importantly walleye feeding and spawning.

Any changes in operation of the tows due to the improved facility may cause adverse aquatic impacts. These include riparian losses from increased erosion, and changes in aquatic habitat from new approach characteristics.

Additional concerns regarding construction at the lock and dam site include dredging requirements, contaminated sediments, and dredged material disposal options. Effects on recreational boating and use need to be evaluated.

Adverse effects of these construction alternatives can be largely avoided or minimized by proper site selection. Opportunities for enhancement of aquatic habitat may be possible to incorporate in project design.

III.B.2. New Impoundments

Construction of a new lock and dam facility to replace two existing facilities would have construction site effects and operational effects. Construction effects would be similar to those described above, including permanent loss of aquatic habitat and resources and dredging and disposal impacts.

Operation of the new lock and dam facility could have a number of environmental effects depending on location and extent of impoundment required. A new dam would change the river hydraulics and may result in a variety of changes in aquatic habitat. New dikes or revetments may be required, and land acquisition requirements are unknown.

Water depths will change with impoundment. It is assumed that a new dam would result in expanded aquatic habitat and/or increased depths, depending on extent of adjacent levees. Wetland habitat may be replaced by deepwater habitat. Depending on the amount of additional impoundment, backwater habitats could be enhanced by increased water depths. Water level management in important waterfowl areas could be adversely affected. If normal water levels decrease in an area, backwaters or channel border wetlands may be adversely affected. Additional concerns are for habitat changes that may result from bed aggradation in the upper end of the new pool, loss of existing tailwater fisheries, changes in sedimentation patterns of backwaters, and changes in substrate composition in important aquatic habitats.

Adverse impacts from construction of a new dam can be avoided or minimized by timing, careful site selection, and by not significantly affecting normal pool water levels or current river hydraulics. Opportunities for habitat enhancement may be possible depending on sites selected.

III.B.3. Mooring Cells

Construction of mooring cells would result in permanent loss of aquatic habitat. The significance of this loss will vary by location, and is dependent on substrate conditions or presence of invertebrates. Construction may also involve dredging, which raises concerns regarding contaminated sediments and disposal alternatives.

Operation of the mooring cell may result in adverse impacts associated with movement of the tow in and out of areas not previously used by tows. These effects are described in the following section. A mooring cell should reduce tie-offs to trees and reduce any adverse effects to bald eagle feeding perches. Overall impacts to the riparian zone and channel border will be concentrated in a single area, thereby reducing effects in other areas.

Mooring cells should be located to avoid entrances to side channels or sloughs. Depths should be adequate to preclude maintenance dredging. Sites should avoid existing eagle perch trees or recreational access areas. Banks at the site should be stabilized to minimize future erosion damage.

III.B.4. Widening Marseilles Canal

The widening of Marseilles Canal was previously addressed for District reconnaissance planning in a Fish and Wildlife Planning Aid Letter dated October 19, 1988. Concerns expressed in that letter included 1) dredging to the authorized 300-foot width, 2) disposal of dredged material, and 3) construction of a regulatory structure downstream. Dredging would remove about 27 acres of shallow water habitat and would reduce habitat diversity in the canal. Dredging would result in significant quantities of dredged material. Few suitable disposal sites exist within close proximity. A regulatory structure would serve to direct sediments away from the main channel, but presumably not other aquatic habitats where adverse effects could occur.

III.B.5. Operational Procedures

Locking procedure changes could be done to increase locking efficiency. These include a) queuing policies, b) switchboats or helper boats, c) increased lock staffing, d) lock scheduling, and/or e) "ready to serve" policy. Implementation of one or more of the procedures could cause changes in tow traffic patterns approaching or exiting the locks. Impacts could include changes in bank erosion, suspended sediment concentrations, or substrate scouring. Changes could be adverse or beneficial, depending on locations.

III.C. SITE SPECIFIC SIGNIFICANT RESOURCES

Significant fish and wildlife resources that may be affected directly by any of the planning alternatives include backwater and wetland habitats, tailwater fisheries, benthic macroinvertebrates, and bald eagle perch trees. Significant resources are identified in more detail in tables 8 and 9 above.

IV. **SYSTEMIC EFFECTS OF TOW TRAFFIC**

The environmental effects of a tow transversing a riverine system has been the subject of much debate, including litigation, over the past 20 years. During this period, a number of effects have been hypothesized. However, no complete quantitative analysis has been undertaken. Several fragmented studies indicate potential effects.

In completion of future environmental impact statements, it will be necessary to: 1) identify significant effects along the entire course of the Illinois River, 2) quantify impacts of incremental increases in tow traffic, and 3) determine mitigation requirements for any significant impacts that are identified. The remainder of this section addresses the current state-of-the-art.

IV.A. INCREMENTAL INCREASES IN TOW TRAFFIC

The Rock Island District has projected commercial tow traffic growth for the Illinois River and Waterway (table 11). This information is based on the 1988 Inland Waterway Review and assumes unconstrained demand. Also assumed are increasing numbers of barges per tow and changes in potential back haul opportunities.

High and low estimates of growth have been projected, both showing relatively small increases in the early years. A much larger increase is expected in the out years, especially for the high growth projections. This is due to the fact that tonnage growth in the early years can be accommodated, in large part, by increased tow size (more barges per tow). In later years, however, tow sizes will reach practical maximums and hence tonnage growth will be accommodated solely by increasing the number of tows.

In making an analysis of the biological impacts from an incremental increase in tow traffic, it is helpful to put the number of tows in a common frame of reference, such as tows per day by season. This data has not been completed for the reconnaissance study; however, table 12 will provide some comparison over time. This estimate assumes equally distributed tows throughout the year. This may or may not be true, depending on economic demands and ice conditions.

Table 11. Projected number of tows transitting Illinois River and Waterway locks in an unconstrained system, includes both high growth and low growth scenarios.

HIGH GROWTH SCENARIO

YEAR	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	AVE. ANNUAL GROWTH
O'BRIEN	2337	2442	2549	2657	2765	2873	2979	3203	3616	4096	4683	1.40%
LOCKPORT	3396	3477	3557	3636	3712	3786	3865	4314	4833	5435	6135	1.19%
BRANDON ROAD	3323	3404	3483	3562	3637	3711	3813	4262	4783	5387	6088	1.22%
DRESDEN ISLAND	2910	2984	3057	3128	3197	3345	3764	4248	4808	5458	6213	1.53%
MARSEILLES	2782	2855	2926	2993	3057	3209	3657	4177	4784	5491	6318	1.65%
STARVED ROCK	2895	2963	3028	3088	3275	3772	4357	5046	5860	6820	7955	2.04%
PEORIA	3418	3527	3631	3731	3858	4475	5205	6072	7100	8321	9773	2.12%
LAGRANGE	3210	3328	3440	3546	4124	4858	5732	6772	8010	9458	11243	2.54%

LOW GROWTH SCENARIO

YEAR	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	AVE. ANNUAL GROWTH
O'BRIEN	2322	2351	2383	2420	2460	2504	2552	2602	2656	2712	2774	0.36%
LOCKPORT	3384	3406	3431	3459	3488	3520	3553	3587	3622	3658	3694	0.18%
BRANDON ROAD	3311	3334	3359	3386	3415	3447	3479	3513	3548	3584	3620	0.18%
DRESDEN ISLAND	2899	2921	2944	2970	2997	3026	3056	3087	3119	3151	3184	0.19%
MARSEILLES	2771	2796	2822	2849	2876	2903	2930	2957	2983	3009	3060	0.20%
STARVED ROCK	2886	2908	2931	2963	3024	3087	3151	3217	3373	3674	4012	0.66%
PEORIA	3411	3486	3562	3638	3714	3790	3865	3938	4219	4633	5097	0.81%
LAGRANGE	3204	3292	3380	3468	3554	3639	3810	4219	4679	5195	5775	1.19%

BASED ON 1988 INLAND WATERWAY REVIEW HIGH AND LOW TRAFFIC GROWTH PROJECTIONS BY COMMODITY & INTERNALLY PREPARED ESTIMATES OF FUTURE TOW SIZE.

Table 12. Projected number of tows per day on Peoria Pool, Illinois River, using various unconstrained projection data.

Year	High Growth[1]	Low Growth[1]	Master Plan[2]
1990	9.4	9.3	14
2000	10.0	9.8	17
2010	10.6	10.2	
2020	14.3	10.6	
2030	19.5	11.6	
2035	22.3	12.7	
2040	26.8	14.0	21

[1]Date provided by U.S. Army Corps of Engineers, Rock Island District.

[2]Upper Mississippi River Basin Commission 1982.

Incremental increases in tow traffic on the Illinois by 2040 have the potential to range from 9% to 81% at Lockport lock under unconstrained conditions to 80% to 250% at LaGrange lock. It should be recognized that these figures are based on national trends and numerous economic assumptions. Further refinement will be necessary to more accurately predict future growth of traffic if capital improvements are made. Since achieving an unconstrained system is an ideal, traffic projections for each of the potential planning alternatives are likely to be less than shown on table 11.

IV.B. SUMMARY OF PHYSICOCHEMICAL IMPACTS AND GENERAL IMPACTS TO FISH AND WILDLIFE RESOURCES

Evaluation of the impacts of increasing navigation traffic on a river ecosystem involves many complex issues, as demonstrated by figure 4. A number of these impacts have been documented, but significant data gaps still exist (Rasmussen 1983 and St. Louis District Plan of Study, in preparation).

It should be stressed that the following summary of impacts is based on the best available information, and is drawn from an incomplete database. Much of the missing data are relevant to understanding the incremental impacts of increased navigation on the river environment. In summary, the impacts of concern are:

1. Physical Impacts

The relationship of tow movement to actual physical changes is dependent on a number of factors. These include 1) number of tows per day in an area, 2) size and direction of each tow, 3) distance between actual sailing line and shoreline, 4) erodibility of banks, 5) sinuosity of channel, 6) channel cross-sectional area, 7) depth of channel, 8) size of bottom sediments, 9) flow conditions, 10) habitats impacted, and 11) time of year.

Drawdowns - The extent of tow induced water level fluctuations depends on vessel speed and length, the ratio of river cross-sectional area to submerged cross-sectional area to submerged cross-sectional area of the tow and barges (blocking factor), and distance from shore to the sailing line. Drawdowns observed on the UMRS range from 0.7 to 1.5 feet. Greater effects were observed in backwater areas away from the navigation channel. Depending on slope, a portion of river bottom may be exposed for a short period of time.

Waves - Tow movement causes bow, stern, side diverging and transverse waves. Prop wash turbulence also generates some minor waves. Near shore wave heights generated by tows on the UMRS range from 0.1 feet to 1.5 feet. Maximum wave height is a function of vessel speed, length, and blocking factor. Observed wave heights and energies are sufficient to cause bank erosion.

Velocity Changes and Turbulence - Tow movement can significantly alter water velocities. Acceleration of flow is primarily dependent on the proximity of the tow to the riverbed. Increases in velocity from an upbound tow of up to three times ambient have been observed on the UMRS. Downbound tows can actually reverse the flow. Tow propellers can have inflow velocities ranging from 1000 to 1500 c.f.s. per propeller depending on horsepower and rpm.

Turbulence is a shear force created mainly by the propellers. It is dependent on propeller diameter and pitch, rpm, and speed of the vessel. Turbulence caused by tows can cause significant vertical mixing of the river.

Ice Movement - Vessel passage during winter causes ice to break and move laterally. Significant shoreline and terrestrial habitat damage may occur due to ice pile-up and gouging of the shore. Broken ice may form large ice jams that cause dewatering of backwaters and tailwaters. Ice build-up on towboat and barge hulls (up to

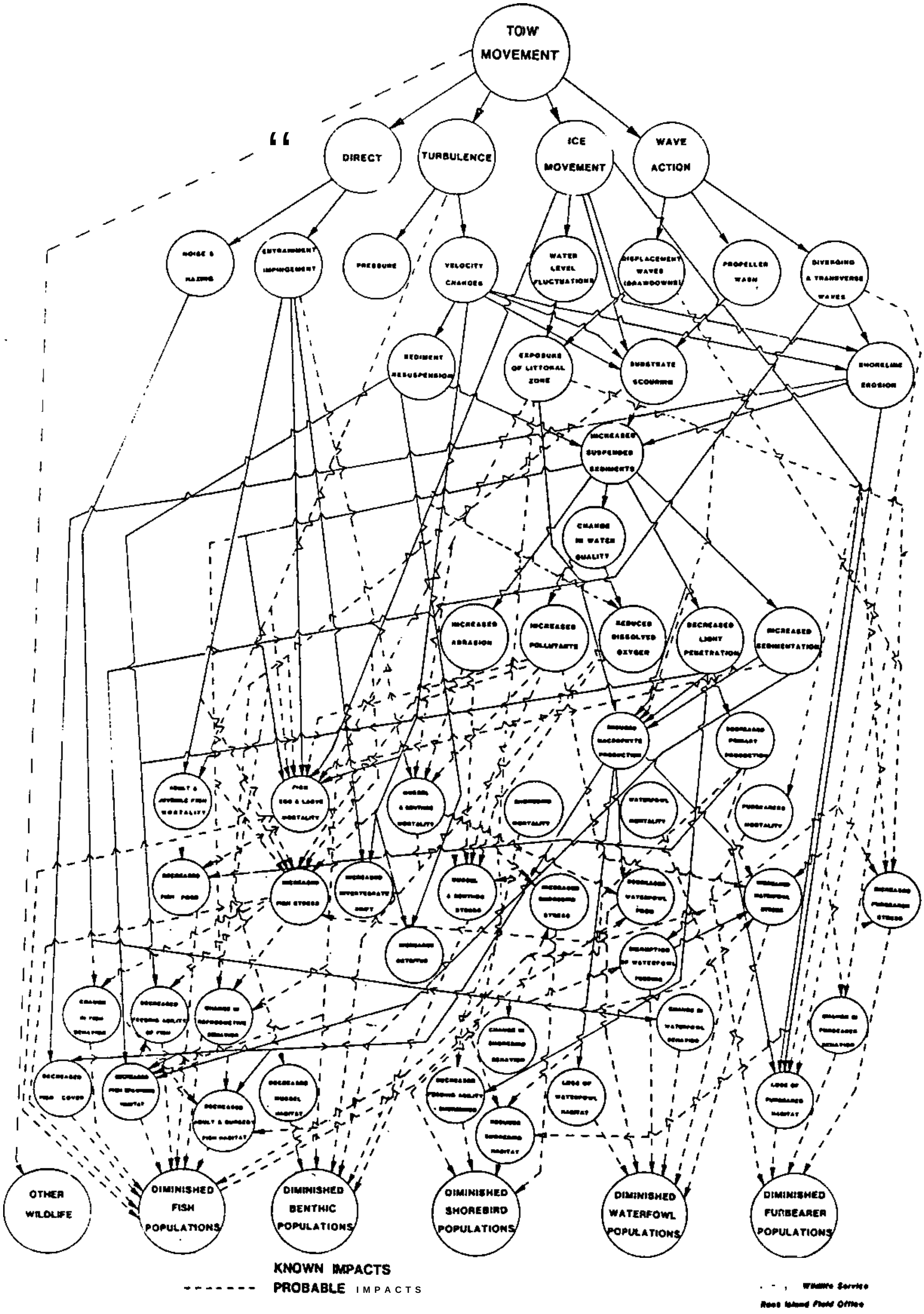

Figure 4. inter-relationship of physical effects of tow movement and possible biological effects (Carmody et al. 1986).

several feet in thickness) may scour bottom sediments and exacerbate other physical impacts due to the increased blocking factor.

Erosion - Streambank erosion results when forces exerted on the bank exceed soil strength. Tow induced waves contribute to this erosive energy on shorelines. Increased erosion increases sediment transport. Impacts are dependent on size of the tow, bank stability and the distance between the tow and the shoreline. Erosion impacts are significantly greater when a tow passes within 150 feet of the shore.

Estimates of erosion impacts have been made for selected UMRS reaches. These impacts will vary by location and level of tow traffic. The lesser distance between the sailing line and shore of the Illinois River and Pools 2-10 result in greater impacts. It is estimated that 15.4 - 20.1% of the erosion on the Illinois River is due to current levels of tow traffic (Simons et al., 1981b). Future increases in tow traffic may increase this proportion to an annual average of 17.4 to 29.3% (Simons et al., 1981b) and will result in an overall increase in erosion.

Resuspension of Sediments - Increased water velocities due to tow movement resuspend bottom sediments and increase ambient suspended sediment concentrations. Suspended sediment concentrations following tow passage are greater in the main channel border than in the main channel itself. Fine sediments of the main channel are transported laterally to the main channel border. Increased suspended sediment concentrations are directly proportional to turbidity.

Elevated levels of 40-125% greater than pre-passage levels are observed for an average of 20 minutes following tow passage and do not return to pre-passage concentrations for about 90 minutes following passage. Successive tow passage prolongs the period of increased suspended sediment concentrations and has an additive effect.

Resuspension by tows is a function of the physical factors which alter water velocities and varies by location, tow size, and tow frequency. The effect of tow passage is significantly greater on the Illinois River due to the greater percent of finer bed material and a narrower cross-sectional area.

Existing levels of tow traffic account for 27 - 84% of the suspended sediment (or turbidity) on the Illinois River. Future levels of tow traffic will increase the theoretical ambient (no tow traffic) level by an average of 40 - 93% on the Illinois River (Simons et al., 1981b).

Potential suspension of contaminated sediments are also a concern.

Sediment Deposition - Increased suspended sediments due to tow movement and the resulting increased mass transport of sediments may cause increased sediment deposition in the main channel border and backwater areas. It is thought that most sediments are redeposited between 30 minutes and 2.5 hours following tow passage, provided no additional tows pass. In effect, tows may add to the annual volume of sediment entering backwater areas. The percent contribution depends on physical characteristics of the site and the number of tows and barges moving past the site. Also, the percent increases dependent on the relative change in water velocities due to tow traffic and the volume of sediment entering side channels and backwaters. Tow-induced increases in sediment volume could increase the sediment deposition rate and reduce the life of valuable backwater areas.

It is estimated that tows currently add 2 to 28% to the annual sediment volume entering UMRS backwaters (Simons et al., 1981b). Projected increases in tow traffic will add 6 - 44% (Simons et al., 1981b). Resulting increases in sedimentation are dependent on trapping efficiency of a given backwater. Potential redistribution of contaminated sediments are also a concern.

2. Chemical Impacts

Water Quality - Changes in D.O., potential releases of toxicants, and alterations of temperature regimes all may be caused by increased tow traffic. Also, tow passage may significantly alter mixing zones calculated for wastewater outfalls. The relative significance of these impacts is unknown.

3. Biological Impacts

The following significant biological impacts may result from the above physical impacts and may occur at varying levels depending on channel configuration, the number of tows and barges, direction of travel, draft, width, speed and sailing position of the tows:

Terrestrial Habitat - Losses of habitat will occur primarily from increased bank erosion or wave run-up. It is estimated that about 650 bank miles of the UMRS are eroding of which 390 bank miles may be considered sever (Corps of Engineers, 1969). Tow-induced waves and ice movement will accelerate the rate of erosion and may increase total erodible banks.

Accretion of sediments along the channel border and in backwaters eventually will lead to expansion of terrestrial habitat at *the* expense of valuable aquatic habitat. *Although* wetlands will be established for a short period, net diversity will be reduced as bottomland forests succeed.

The net loss in terrestrial habitat acreage and value is unknown.

Aquatic Habitat - Aquatic habitat could be impacted in a number of ways by navigation traffic. The extent of impacts is dependent on the characteristics of an area, its proximity to the sailing line and frequency of tow passage.

One of the most significant impacts results from increased turbidity, and reduction of the photic zone. Sediment deposition due to tow traffic degrades and destroys backwaters and main channel border habitats by decreasing depth and altering substrates. Erosion and bank slumping result in the loss of overhanging and squat ic cover and loss of important catfish spawning sites. Waves and turbidity may reduce aquatic vegetation. All impacts are accentuated during winter navigation.

Plankton - Populations could be reduced or limited by elevated levels of suspended solids and turbidity. Vertical mixing by tows could induce movement of phytoplankton into areas unsuitable for photosynthesis. Additional impacts could result from adverse changes in water quality.

Aquatic Macrophytes - As tow traffic alters the physical and chemical ● cosystem components, aquatic plants can be significantly mpacted. Reduction in the photic zone due to increased turbidity will reduce availalee suitable habitat. Additional impacts result from increased wave acti On, sedimentation, and/or change in substrate.

Benthos - Tow traffic may directly affect survival of, benthic organisms by causing physical damage to individuals and by causing alterations of habitat. Also, any impact that reduces abundance of host fish species may affect mussel recruitment. Mussel shell damage and increased mortality have been observed in areas of frequent tow movement. In the laboratory, elevated suspended sediment concentrations at a frequency of once every 3 hours caused a significant drop in food clearance rates of mussels. A frequency of once every 0.5 hours caused mussels to cease feeding. The level of traffic or threshold level that first results in either response is unknown as is the potential impact to larval or juvenile mussels. Other changes in water quality, apticularly due to accidental spills, could have highly significant impacts on bent h0 s.

Fish - Impacts from tow traffic are caused both direct ly by the tow passage and indirectly through habitat degradation. Areas of primary concern are 10ss of vegetation, loss of habitat or physical burial of eggs due to sediment. tion, turbidity, drawdown, impingement and entrainment, degradat ion of water qual ity, and a complexity of issues associated with winter navigation.

Increased turbidity, in part due to tow traffic, appears to play a role in the abundance of turbidity tolerant fish species on the UMRS. Turbidity interferes with vital life processes such as respiration, feeding, and reproduction. TOM traffic levels on the UMRS and corresponding increases in turbidity variously affect habitat suitability; however, overall reduction in habitat and its translation to reduced abundance is unknown.

Drab.a'otms due to tows cause frequent, short- term exposure of substrate and biota in main channel border and backwater habitats that are used by fish for spawning and as nursery areas. Laboratory studies indicate that dewatering due to drawdown may have little direct impact on fish egg hatchability. However, dewatering of larvae for 2 minutes every 3 hours caused a significant drop in survival. Again the threshold level causing this response is unknown.

low passage directly impacts fish in the main channel. This habitat has been shown to be critical to the maintenance of certain valuable fisheries. Depending on densities and mortality from entrainment and impingement, tows may kill a number of larval fish per each mile of passage. Replacement value of these fish may be cost ly. In addition, the relative significance of prop damage and killing of adult fish is unknown.

Birds - The primary impact of tow traffic on waterfowl, shore birds and other migratory birds is the accelerated degradation of aquatic habitats essential for feeding and nesting. Noises due to tow traffic may decrease nesting productivity and increase stress. Tow search tights have been observed to flush feeding tundra swans. Tow passage infrequently disturbs diving ducks. The impact of underwater tow noise on feeding diving ducks is unknown. Due to the importance of migratory feeding habitat in providing sufficient energy reserves, any hazing due to tows is viewed as significant.

Furbearers - A major effect of navigation on furbearers is related to changes in plant community distribution and productivity. Muskrat reproduction and survival is related to the quality of emergent marshes for food and house construction and the availability of bank denning areas. Furbearers living in dens are quite vulnerable to water level fluctuations, especially in winter months.

Other Wildlife - Impacts from navigation on terrestrial mammals amphibians, and reptiles are largely unknown. However any degradation of habitat or water quality will affect these species.

4. Induced Activities

Terminal Development - This induced activity may result in filling of wetlands and conversion of aquatic habitat to developed terrestrial habitat, thus affecting biological productivity and diversity. Such habitat conversions result in reduction and/or relocation of fish and wildlife. Operation of a terminal may increase barge traffic in side channels and backwater areas causing subsequent traffic related impacts (see above). The potential for spillage and/or leaking of toxic materials into the aquatic environment is increased locally. Declining air quality may result. Construction of the facility may increase erosion.

Any dredging required may reduce benthic populations. Other impacts include disturbance to birds, especially waterfowl and colonial birds, increase in ambient noise levels, aesthetic impacts, and impacts on local recreational use.

Fleeting - Fleeting may degrade or alter terrestrial and aquatic habitat. Operation of the site may have the same effects as navigation traffic described above. Dredging may be required to create and maintain the fleeting area.

Accidents - Increasing navigation traffic and induced activities will increase the potential for accidental spills and groundings. Spills may degrade water quality and aquatic habitat. There is always a potential for mortality of aquatic organisms. Collisions with bridges and groundings comprise nearly 80% of the total reported accidents. Most of the pollution incidents reported involve petroleum based materials. Impact to fish and wildlife are dependent on the material spilled, the time of year, and river flow.

5. Human Use Impacts

Sport fishing - Sport fishing may be impacted both directly and indirectly by increased navigation. The indirect impacts are the most important and are primarily expressed in reduced fishing quality. This is due to potential changes in species composition and reduced abundance of fish. Direct impacts include disruption of fishing activity by tow wakes, inaccessibility of fishing areas due to terminals and fleeting, and inability to reach quality fishing areas due to lockage delays.

Commercial Fishing - Indirect impacts from degradation of fish habitat due to tow traffic are the most significant to commercial fishing. Additional impacts are noted due to loss of gear, and direct interference with tow traffic.

Hunting - The primary impact of tow traffic on hunting is the degradation of habitats, which result in reduced hunting quality and decreases in abundance of species hunted. Interference with tow traffic, hazing, and interference at access sites are also noted.

Trapping - The primary impact of tow traffic on trapping is degradation of furbearer habitats and reduced trapping quality.

Commercial Shellfishing - The primary impact of tow traffic is degradation of mussel habitats. Additionally, direct interference from tow passage, tow wakes, or fleeting could be significant. In fact, some fleet sites could make any mussel harvest physically impossible at adjacent beds.

Pleasure Boating - Tow traffic may reduce the aesthetic experience, interfere with locking, interfere with main channel use, interfere at access sites, and reduce the quality of recreational beaches.

Passive Recreation - Increases in tow traffic and subsequent habitat loss or degradation may reduce the recreational experience.

IV.C. IDENTIFICATION AND QUANTIFICATION OF IMPACTS

An interagency team assisting the U.S. Army Corps of Engineers, St. Louis District, has identified a number of study hypotheses that must be tested to fully understand the effects of increasing tow traffic on the UMRS, and to determine potential mitigation requirements. These hypotheses are listed in table 13. Proposed studies to test the hypotheses are contained in the St. Louis District Plan of Study (POS) (in preparation).

An integral part of the St. Louis District POS is development of a model to quantify impacts of incremental increases in tow traffic. Such a model is necessary to compare the relative differences among planning alternatives. It is also necessary due to the large geographic scope of the potential effects of increasing tow traffic. A model would be useful in identifying significant impact sites and assisting in mitigation planning. Selection of a model framework early in POS implementation could assist in developing study priorities.

A number of mathematical models have been developed to assess potential environmental impacts. These range from Habitat Evaluation Procedures (HEP) to energy flow models. Several models are described in Appendix B with documentation on advantages and disadvantages. The St. Louis District POS Team also evaluated the models described in Appendix B. The Team concluded originally that a site specific physical-biological approach to identifying impacts was a necessary first step. However, the team ultimately acknowledged the need for some sort of systemic model, as the cost of a site specific approach is likely prohibitive.

During the same time that the POS was being developed, the Louisville District refined its Navigation Predictive Analysis Technique (NAVPAT). This model offers several advantages worth noting:

1. Predictive capabilities to understand the relative difference between planning alternatives.

2. Ability to identify site specific problem areas and possible ways to avoid or minimize impacts.

3. Acceptance of output (habitat units) by Chief of Engineers for mitigation planning.

4. Many of bugs in the application have already been worked out.

5. Demonstration by Long Term Resource Monitoring Program (LTRMP) is occurring on Pool 13 of Upper Mississippi River.

Table 13. Work unit (WU) hypotheses to be tested as described in Second Lock Plan of Study, Lock and Dam 26, Upper Mississippi River (U.S. Army Corps of Engineers, St. Louis District, in preparation).

WU1:	Movement of barge tows in inland waterways results in measurable changes in the water velocity, surge and drawdown, surface waves and propeller jet flows. As these disturbances move along the waterway, they adversely affect plants and animals by 1) transporting them, 2) direct impact and disturbance, and 3) through direct and indirect effects of increased levels of suspended sediment and turbidity.
WU2:	Movement of barge tows in inland waterways results in pulse inputs of water and associated dissolved and suspended materials to side channels and backwaters. Both the pulsed flows themselves and the resulting increase in retention of materials in these habitats adversely affect their biological productivity.
WU3:	The early life stages of fish, eggs, and larvae, termed ichthyoplankton, are particularly vulnerable to injury or death caused by vessel passage effects because they are unable to swim away. Vessel passages, therefore, place the ichthyoplankton at significant excess risk.
WU4:	Turbulence, currents, sedimentation, and other effects of tow passage significantly reduce the ability of freshwater mussels to feed, and thereby cause significant physiological changes due to starvation.
WU5:	Effects due to passage of commercial and recreation craft adversely affect backwater habitats critical to spawning and maintenance of larval fish.
WU6:	Certain tow passage events increase net mortality, injury, or incapacitation of the fish populations which they affect.
WU7:	Drawdown from tow passage will cause significant stranding, and consequently damage or death, of fish eggs and larvae.
WU8:	Tow passage causes reductions in light levels which reduce the depth of the photic zone, thereby appreciably reducing the habitat available for rooted aquatic plants (macrophytes).
WU9:	Wave action caused by tow passage causes environmentally significant reductions in the diversity, density, and productivity of rooted aquatic plants.
WU10:	Turbulence created by vessel passage produces disturbances which both directly and indirectly significantly reduce the diversity, density, and productivity of macroinvertebrates inhabiting rock substrates.
WU11:	Disturbance caused by tows results in ecologically significant losses of energy reserves in migrating waterfowl.
WU12:	Direct effects of tows such as shear forces, and indirect effects such as increased suspended sediment levels, reduce the base of the food chain through reductions in phytoplankton density, diversity, and productivity.
WU13:	Increases in tow traffic appreciably affect commercial fishing through reduced catch sizes and site availability, and increased costs to replace damaged or lost gear.
WU14:	Commercial navigation causes resuspension of sediments to increase ambient levels to levels known to cause reduction in the growth of sight feeding fish.
WU15:	Data from the Work Units, in conjunction with other published and unpublished data, can be used to develop models which provide accurate quantitative predictions of tow-related physical forces, and which relate these forces to biological changes in the UMRS.
WU16:	The increase in traffic due to the Second Lock will be accomplished by the development of terminals and other facilities which will change the economy and character of the UMRS.

6. Data proposed in the POS will validate model assumptions for use on UMRS.

7. Data collected by LTRMP Havana field station may be able to be used in development of biological suitability indices for model application on the Illinois River.

IV.D. MITIGATION REQUIREMENTS AND OPPORTUNITIES

Site specific recommendations to avoid or minimize effects of potential construction alternatives have been identified in the previous chapter. Once significant effects of any incremental increase in tow traffic are identified and quantified, the various planning alternatives can be assessed, and a mitigation strategy can be developed for systemic effects. This strategy should address measures to, in priority, avoid, minimize, rectify over time or compensate for impacts identified.

A list of mitigation measures has been identified by Carmody et al. (1986) and Schnick et al. (1982). The U.S. Army Corps of Engineers, St. Louis District is preparing a synthesis of these ideas for mitigation to identify potentially implementable measures to avoid or minimize the effects of tow traffic. In addition, any method used to model incremental effects can be used to identify potential mitigation measures, such as specific areas to avoid or minimize a certain physical effect, or significant areas where compensation for impacts must be accomplished.

Some mitigation measures, such as adjustments to sailing line, can be done at no or minimal costs. Other measures; such as habitat compensation, may be expensive. The goal of any mitigation strategy for the Illinois River navigation improvements should be to reduce or offset any identified adverse effects in the most cost effective manner possible.

IV.E. RELATED STUDIES

There are several studies underway or recommended that may assist in identification and quantification of any increases in navigation traffic on the Illinois River. However, none of these are likely to address all of the impacts noted above.

IV.E.1. Upper Mississippi River Navigation Reconnaissance Study

A similar study to the one discussed herein is underway for the Upper Mississippi River. This study is about six months behind in the planning process. A reconnaissance report is scheduled for completion in June 1991.

IV.E.2. Long Term Resource Monitoring Program

The Long Term Resource Monitoring Program (LTRMP) is a component of the Environmental Management Program (EMP) authorized in the Water Resources Development Act of 1986. The LTRMP Operating Plan (Rasmussen and Wlosinski 1988) describes the goals and objectives of the program. However, inadequate appropriations will limit the number of tasks accomplished and the data available for use in future navigation improvement planning.

The following is to be accomplished during the 10-year study authorization and will be useful in addressing the effects of increases in navigation traffic on the Illinois River:

1. Trends analysis data in La Grange Pool
2. Problem analysis data
    - Navigation
    - Vegetation
    - Fisheries

The LTRMP will not provide a complete analysis of the effects of future increases in navigation and any needed mitigation planning. Funding constraints have limited problem analysis to addressing only single traffic events.

IV.E.3. St. Louis District Plan of Study

As described above, the POS is a comprehensive study plan to identify and quantify high priority navigation effects (see table 13). Completion of the plan is imperative in fully understanding the physical and biological dynamics surrounding tow movement and multiple tow events.

Once the POS has been approved by higher authority and funded, the majority of the plan can be completed in five years. Approximately, three additional years are necessary to fully understand effects to aquatic macrophyte beds.

The POS does not address some effects that may be significant on the Illinois River. These include potential riparian impacts to eagles, herons, egrets, furbearer dens and catfish, and any increases in bank erosion. In addition, the POS does not address the potential for resuspending contaminated sediments.

IV.E.4. Waterways Experiment Station

The Waterways Experiment Station - Environmental Laboratory conducted a number of navigation effects related studies. However, funding under this program has ceased. No additional work or funding is anticipated.

The Hydraulics Laboratory completed several flow visualization studies for the Louisville District. Recently, funding was made available through the Chief of Engineers to pursue additional physical effects modelling.

IV.E.5. Other Corps of Engineers Districts

As discussed above, the Louisville District is developing a navigation predictive analysis (NAVPAT) designed for the Ohio River. Its advantages and disadvantages are described in Appendix B. Additional data collection model verification and validation will be required before it is suitable for use on the Illinois River.

The Huntington and Pittsburgh Districts are also reviewing potential applications of NAVPAT. The Huntington District is completing some site specific analysis.

V. ENHANCEMENT STRATEGY FOR THE ILLINOIS RIVER AND WATERWAY

An important, but frequently overlooked component of the Illinois River Navigation Study is to identify enhancement measures of a broad scope. As the reconnaissance study addresses the future needs of the navigation system, it must also address the future fish and wildlife conservation and management needs of the River. To complete such a strategy, it is important to look at the historical values of the river, the future without any strategy, and potential action items to achieve enhancement.

V. A. HISTORICAL VALUE

Steffeck and Striegl (1989) wrote the following description of the pristine conditions once found on the Illinois River:

> Early explorers in the study area were impressed by the productivity of the Illinois River area. In 1673, following his ascension of the Illinois River, Marquette wrote that: "We have seen nothing like this river that we enter, as regards to its fertility of soil, its prairies and woods, its cattle, elk, deer, wildcats, bustards, swans, ducks, parroquets, and even beaver," (Mills and others, 1966; University of Illinois Water Resources Center, 1977). The Illinois River was described as clear in 1798 and infested with wild beasts in 1838 (Mills and others, 1966). The "Grand Marsh" of the Kankakee River was described by French explorers; marsh prairies and swamp forest held "countless" waterfowl, "were full of game," and the "meandering river teemed with fish" (Meyer, 1936). In the late 1890's, the waters of the bottomland lakes associated with the Illinois River were described by Kofoid (1903) as being transparent at that time and having bottom materials composed of decaying vegetation rather than mineral silts. An abundance of submergent and emergent vegetation was documented at the beginning of the 20th century (Bellrose and others, 1983). The general habitat types and backwater areas of the Des Plaines River and Illinois River from Chicago downstream were documented on maps prepared for the U.S. Army Corps of Engineers (Woermann, 1902-1904). Associated aquatic organisms were abundant. Aquatic insects and snails associated with aquatic plants were prevalent; invertebrates associated with aquatic plants were found to have, on average, eight times the biomass of benthic invertebrates in Illinois River bottomland lakes downstream from the study area (Bellrose and others, 1977). In 1900, the dollar value of the commercial fishery of the Illinois River was ranked third nationally behind the salmon fishery of the Pacific coast and the Great Lakes fishery. The commercial turtle fishing and mussel industries also were substantial along the Illinois River in the early 1900's (Bellrose and others, 1977).

Human disturbance in the Illinois River valley over the last century have greatly reduced the abundant fish and wildlife of the past. Adverse changes include diversion of Lake Michigan Water, excessive sewage and industrial waste, a greatly modified hydrology and landscape due to drainage and levee districts, impoundment by navigation dams, and sedimentation. While it is recognized that the River can never be as pristine as it once was, many actions are reversible and could result in restoration of a functional system in a number of areas along the River.

V. B. FUTURE WITHOUT ENHANCEMENT

The future without a comprehensive enhancement strategy for the Illinois River will depend upon many fragmented efforts including those identified in Appendices C and D, enforcement of water quality and erosion control regulations, the Environmental Management Program, and the numerous efforts by local governments and individuals.

Ultimately, the biological productivity of the river is linked to the sedimentation rates in the backwater lakes. Bellrose et. al (1983) estimated that the lakes closely associated with the Illinois River would lose half their depths in 24 to 127 years. Most estimates ranged between 60 and 100 years. Havera and Bellrose (1985) speculated that these estimates were conservative because of increasing sedimentation rates in recent years. They concluded that "...most of the current biological and recreational values of the Illinois River valley could disappear in 100 years."

V. C. OPPORTUNITIES FOR ENHANCEMENT

A comprehensive quantitative long term enhancement strategy for the Illinois River needs to be integrated from the various government and public objectives (Appendices C and D). In addition, an ecosystem perspective needs to be addressed in an overall conservation and management strategy. The strategy should address the feasibility of and specific actions for:

1. Restoration of segments of the river to a functional floodplain river ecosystem.
2. Point source and nonpoint source pollution control.
3. Watershed soil conservation.
4. Closing structures to protect important side channels.
5. Periodic and selective dredging of aquatic habitats.
6. Artificial island creation.

7. Diversion of high flows away from backwater habitats.

8. Wetland development.

9. Beneficial uses for dredged sediments including channel maintenance sediments.

10. Removal or detoxification of toxic sediments.

11. Restoration or creation of backwater lakes.

12. Restoration of historic side channels.

13. Protection and creation of contiguous habitats.

14. Identifying factors constraining re-establishment of aquatic macrophytes and restoration to 1950 wetland conditions or similar.

15. Identifying factors limiting other important fish and wildlife species. Exotic species control.

16. Public education and information.

Some site specific enhancement measures that have been identified in past planning efforts are listed in tables 14, 15, and 16. Additional opportunities may be found in Appendices C and D.

Table 14. Habitat rehabilitation and enhancement projects on the Illinois River proposed under the Environmental Management Program (U.S. Army Corps of Engineers 1990).

Project	River Mile	Primary Purpose
Alton Pool Side channels	0-80	Fish habitat improvement
Stump Lake	8-12	Moist soil and fisheries management
Swan Lake	5-10	Moist soil and fisheries management
Banner Marsh	138-144	Moist soil and fisheries management
Chautauqua Refuge	124-12S.5	Moist soil and fisheries management
Peoria Lake	162-182	Moist soil and fisheries management
Rice Lake	137	Waterfowl management

Table 15. Potential areas for habitat enhancement on Illinois River as identified by 1985 panels (Carmody et al. 1986).

River Reach	Proposal
0.0 - 80.0	Rehabilitate backwaters
83.0 - 80.5	Rehabilitate Muscooten Bay
120.7 - 123.6	Restore Thompson Lake
130.0 - 138.0	Enhance Senate Island
162.0 - 177.5	Reestablish aquatic plants
182.0 - 210.0	Open backwater lakes

Table 16. Severe erosion areas on Illinois River where shoreline protection may be considered to reduce degradation and enhance habitats (adapted from Carmody et al. 1986).

Pool	River Mile	Notation
Alton	12-15	5000 ft.
	18-19	3000 ft.
	21-28	26,000 ft.
	30-31	2500 ft.
	38-39	4000 ft.
	43-44	2000 ft.
	46-80	130,500 ft.
La Grange	80-157.5	351,200 ft.
Peoria	162-167	7500 ft.
	179-231	236,000 ft.
Starved Rock	231-245	20,000 ft.
Marseilles	250-271	82,000 ft.
Dresden	271-280	5000 ft.
Above Brandon Rd.	no data	

VI. CONCLUSIONS AND RECOMMENDATIONS

VI.A. CONCLUSIONS

Congress has designated the Illinois River and Waterway as a component of the Upper Mississippi River System, a nationally significant ecosystem. Our primary concern in these navigation studies is the potential effects to fish and wildlife from any increases in commercial navigation traffic. Although the U.S. Fish and Wildlife Service has raised this concern to the Corps of Engineers on numerous occasions in the last 20 years, the environmental effects of any increases in navigation traffic remain largely unknown.

The potential for significant impacts are great on the Illinois River due to the narrow channel, fine sediments, and importance of main channel and channel border habitats to aquatic resources. Understanding the effects of tow movement on the Illinois River is especially important due to the improving nature of its water quality. The effects or potential limits that may be placed on this ecosystem as a result of increases in commercial tow traffic need to be defined.

VI.B. RECOMMENDATIONS

The following recommendations should be completed as a part of the feasibility study, if recommended. All should be initiated as soon as possible in order to complete feasibility planning in a timely manner. Most important among these recommendations is the completion of the St. Louis District POS, so that we can complete our Fish and Wildlife Coordination Act requirements. Any further delay in implementation of this study will only serve to delay future feasibility planning. In addition, we are concerned that programs to address measures to avoid and minimize impacts of tow traffic is largely being ignored by the three districts on the UMRS. This program was agreed to in the Records of Decision for the Lock and Dam Major Rehabilitation Program and the Second Lock at Lock and Dam 26. Strides should be undertaken to implement this program immediately.

The recommendations are divided into several categories.

1. DATA COLLECTION AND IMPACT ANALYSIS FOR SITE SPECIFIC EFFECTS

    a. Conduct a survey of freshwater mussels and other benthic invertebrates within one mile of each lock and dam or proposed construction area.

    b. Conduct a bioassay of the sediments within one mile of each lock and dam or proposed construction area.

c. Determine dredging requirements, disposal alternatives and sediment quality at each site proposed to be dredged.

d. Determine changes in river hydraulics for each proposed alternative.

e. Evaluate riparian effects, including bank erosion from tow operation, for each proposed alternative.

2. DATA COLLECTION AND IMPACT ANALYSIS FOR SYSTEMIC EFFECTS

a. Complete the St. Louis District POS.

b. Assess potential effects on bank erosion from increases in tow traffic and resulting riparian effects, including bald eagle perches, colonial nesting areas, mud flat shorebird use, furbearer dens, and catfish spawning habitat.

c. Complete a freshwater mussel and fingernail clam survey of the main channel and channel border to identify beds and assess condition.

d. Complete the resource inventory of the Illinois River and Waterway including identification of significant resources in Alton Pool.

e. Adapt Louisville District Navigation Predictive Analysis Technique (NAVPAT), or similar model, to Illinois River to assess relative differences of planning alternatives and potential mitigation alternatives. Assumptions need to be evaluated and validated for Illinois River. Note: cost savings can be achieved by addressing main channel and channel border habitats in the habitat appraisal guide work being done by the District.

f. Complete bioassays of the sediment quality of the Illinois River, and potential effects of increasing suspended sediment concentrations, particularly in areas where the main channel width may expand due to increased tow passing requirements.

g. Identify potential barge fleeting needs in each pool.

h. Assess the potential for accidental spills from increasing traffic of induced development.

i. Determine recreation use of the Illinois River by the contingent valuation method and assess potential effects from increasing navigation, including constraints on recreational lockages.

j. Complete a systemic Environmental Statement (EIS) to address the potential effects of increases in traffic. This EIS should include the potential cumulative effects of not only navigation traffic but also hydropower, pool raises, and channel maintenance activities. It should also address the effects of induced development and increases in barge fleeting.

3. ENDANGERED SPECIES COORDINATION

a. Conduct a biological assessment on the potential effects to the bald eagle, Indiana bat, lakeside daisy, and decurrent false aster.

b. Evaluate the need for formal consultation in accordance with Section 7 of the Endangered Species Act of 1973, as amended.

4. LONG TERM ENHANCEMENT STRATEGY

a. Compile all public natural resource management goals for the Illinois River and Waterway.

b. Identify common goals and objectives, and any additional goals necessary to achieve a functional floodplain and a healthy ecosystem.

c. Develop a comprehensive vision and long term management and enhancement strategy for the fish and wildlife resources of the Illinois River and Waterway, with identification of action items that may be implemented by the Corps of Engineers or other Federal and State agencies.

3. COORDINATION

a. Continue coordination with the Rock Island Field Office to address the above considerations.

b. Ensure active coordination by the Illinois Department of Conservation. A feasibility study of this magnitude will require close coordination with IDOC, particularly with regard to the long term enhancement strategy. However, its personnel and funding resources to provide such assistance is limited. The Corps should be prepared to fund IDOC work.

c. Contract with the Illinois Natural History Survey (directly or through cooperative agreement) to initiate the long term enhancement strategy.

d. Request and fund assistance from the Long Term Resource Monitoring Program to collect data as required, and to address the long term enhancement strategy through use of resource trends data being collected by the Havana Field Station.

e. Coordinate sediment quality analysis with the U.S. Geological Survey National Water Quality Assessment Program underway for the upper Illinois River basin.

f. Devote staff time to a program to avoid and minimize the effects of tow traffic.

g. Keep the Inland Waterways Users Board up to date on environmental analysis and planning requirements. Facilitate discussions between the industry and environmental organizations to develop a planning schedule both can subscribe to.

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Appendix A. Letters of comment from state conservation agencies.

Illinois Department of Conservation
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August 2, 1990

Mr. Richard C. Nelson
Field Supervisor
USDI-FWS
Rock Island Field Office (ES)
1830 Second Avenue, Second Floor
Rock Island, IL 61201

Dear Mr. Nelson:

Department staff have been afforded the opportunity to review your July 1990 draft planning aid report for the Corps' Illinois River and Waterway Navigation Reconnaissance Study.

We are pleased that you have already incorporated recommendations provided by Department staff on earlier drafts into this report. Based on our review, to date, we support the report recommendations and look forward to a productive working relationship with all interested agencies as this study progresses.

Thank you for the opportunity to comment.

Sincerely,

Mark Frech

Mark Frech
Director

RWL:ts

AUG 3 19..

STATE OF IOWA

TERRY E. BRANSTAD, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LARRY J. WILSON, DIRECTOR

August 14, 1990

Richard C. Nelson
US Fish and Wildlife Service
Rock Island Field Office
1830 Second Avenue
Rock Island, IL 61201

Dear Mr. Nelson:

The Iowa Department of Natural Resources has received the planning aid letter for the US Army Corps of Engineers Illinois River and Navigation Reconnaisance. We are aware that recommendations contained within the planning aid letter may set a precedent for the Upper Mississippi River Navigation studies. Therefore, we appreciate the opportuniy to comment and would like to stress the following concerns.

The Department agrees with the Fish and Wildlife Service that concerns over effects of increased traffic have gone largely unanswered by the Corps of Engineers (COE). Since the (COE) is the major proponent of increased navigation capacity it is essential that they assume the lead role in answering environmental questions that have been raised over the past 20 years. One of the least costly and more effective measures that can be taken are those to avoid and minimize impacts, however, very little progress has been made since this program was agreed to in the Dam Rehabilitation Program. All three COE districts should assume a more active role in this program.

The Department concurs with the Fish and Wildlife Service that the completion of the St. Louis District Plan of Study (POS) is of paramount importance. The multi-agency task force which drafted the POS reflects the concern of all agencies charged with managing this nationally significant ecosystem. In addition the multi-agency aspect of this effort have given all of the partners on ownership interest in the project, and at the same time itr has set a precedent for continued inter-agency cooperation in dealing with navigational issues.

The Department supports the use of the Louisville District Navigation Predictive Analysis Technique or similar model in that it provides a means to assess relative differences in planning alternatives. This complimented by the habitat appraisal guide the Rock Island District is developing and information that should be forthcoming from implementation of the POS should lead to an economy of effort in addressing navigation related impacts.

A systematic Environmental Impact Statement (EIS) should be completed to address potential effects of increased traffic. This EIS should consider the cumulative effects of not only increased

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AUG 16

navigation traffic resulting from such projects as the Second Lock at the Melvin Price Locks and Dams and Dams Rehabilitation Programs but also address effects from hydropower development, channel maintenance activities, induced development, and increased barge fleeting. The development of a comprehensive long-term management and enhancement strategy for the UMRS that allows the navigation and environmental concerns to co-exist on this nationally significant navigation system and ecosystem appears to be a logical which is long overdo.

The Iowa Department of Natural Resources greatly appreciates the opportunity to comment on your report and looks forward to future coordination on the Mississippi River Study.

Sincerely,

Larry J. Wilson
Director

MISSOURI DEPARTMENT OF CONSERVATION

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JERRY J. PRESLEY, Director

July 11, 1990

Mr. Richard C. Nelson
Field Supervisor
U. S. Fish and Wildlife Service
1830 Second Avenue, Second Floor
Rock Island, Illinois 61201

Dear Mr. Nelson:

Thank you for the opportunity to review the planning aid report for the Illinois River Waterway Navigation Reconnaissance Study. The following comments are provided with the idea that a similar report will be prepared for the Upper Mississippi River. Overall, the planning aid report is a good pattern for the Upper Mississippi River report.

Comments:

1. Page 14. A discussion of exotic species introduced to the river system should be included here and possibly on macroinvertebrate section (p.16).

   Page 15. Has Illinois conducted analyses to determine the presence of chlordane and other chemicals in fish flesh? If analyses haven't been conducted, the statement "no fish consumption advisories" may be misleading.

2. Page 17. Add following larval fishes, "and paddlefish."

3. Page 23, paragraph 2. The percentages add up to 117%.

4. Page 39. The section on Site Specific Overview raised several questions about Upper Mississippi River that may not be answered at this time.
   a. Do we know, or will we have, some idea of what site specific item the Corps is proposing for Mississippi River? 12 foot channel? Year around navigation? New locks and dams?

   b. (p. 40) Would new dikes and revetments be required if new impoundments are created? Would additional land be acquired?

5. Page 52. Site specific recommendations to avoid or minimize are not found "above." Are they found in III B. starting on page 39?

6. Page 59. Would it be appropriate to add "Impacts of construction on fish and wildlife resources, endangered species, such as bald eagles, on a site specific basis", or won't sufficient detail be available?

   Add - Identify fingernail clam bed locations after Item 2C, page 59.

The report constitutes a great deal of effort on the part of your staff. We look forward to working with you and others in developing a similar report for the Mississippi River.

If you have questions, contact William H. Dieffenbach of my staff.

Sincerely,

Dan F. Dickneite

DAN F. DICKNEITE
ENVIRONMENTAL ADMINISTRATOR

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

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Carroll D. Besadny
Secretary

July 17, 1990

Mr. Richard C. Nelson
U. S. Fish and Wildlife Service
1830 Second Avenue
Rock Island, IL 61201

Dear Mr. Nelson:

We recently received a copy of the U.S.F.W.S. Planning Aid Report concerning Illinois River and Waterway Navigation Studies. Unfortunately, due to staffing limitations, we are not able to provide critical review of the report. Further, we will not, at the present time, be able to actively participate in development of the study. However, we would appreciate being kept informed of study developments as they occur.

The Wisconsin Department of Natural Resources remains committed to protecting and managing the resources of the UMRS. To that end, we continue to support the Service's efforts to ensure development of an effective, comprehensive Upper Mississippi River Navigation Study.

In the near future, the Western Boundary Rivers Unit will be filling a position which will include responsibilities for navigation studies coordination. Until that time, please contact Terry Moe at (608) 785-9004 for informational needs.

Sincerely,

Craig D. Thompson

Craig D. Thompson
Assistant Environmental Impact Coordinator

CDT:ak

cc: Terry Moe

Appendix B. Methods to identify and quantify fish and wildlife impacts from increasing tow traffic. Adapted from St. Louis District Final Environmental Impact Statement for Second Lock and Locks and Dam 26 (Replacement).

Included:

Appendix B

METHODS TO EVALUATE NAVIGATION IMPACTS

Method:

System-wide Physical Impact Approach

Description:

Use projections in Simons et al. (1981, 1987) and other literature to project physical impacts for Second Lock traffic increment. Assumes physical changes are significant biological effects that should be mitigated. Measures to avoid and minimize physical impacts are first priority.

Output:

Physical units (i.e. miles of eroding banks, cubic yards of sediment, # of adult fish etc.), and money for cost of rip-rap, dredging, fish replacement etc. to prevent/correct physical changes.

Advantages:

(1) No new data needed.

(2) Fast way to come up with a quantitative monetary measure.

(3) Implementation of avoid and minimize measures lowers mitigation cost.

Disadvantages:

(1) Simons' studies are disputed.

(2) Assumption that all physical changes cause significant, negative biological impacts has not been documented.

(3) Relationship of impacts to biological populations poorly understood.

(4) Benefits of avoid and minimize measures are difficult to quantify.

(5) Some mitigation measures are untested on the UMRS.

Method:

Site Specific Physical Impact Approach

Description:

Identify the most sensitive habitat areas with significant biological resources. Predict the nature and magnitude of adverse, physical changes to these resources due to increases in tow traffic. Develop and modify physical impact models based on physical data collections in these specific areas. Use laboratory testing after field test have determined the level of physical elements present (i.e. turbidity, sedimentation etc.). Focus on more valuable off-channel areas.

Output:

Physical units (i.e. miles of eroding banks, cubic yards of sediment etc.).

Advantages:

(1) Avoids trying to relate physical impacts with very complex biological impacts.

(2) Concentrates on most valuable habitats.

Disadvantages:

(1) Does not establish link between physical and biological impacts.

(2) Establishes precedent of doing mitigation without establishing biological impacts.

(3) Much time and data collecting needed to develop models.

(4) Study at all significant areas is costly.

Method:

Site Specific Physical and Biological Impact Approach

Description:

This approach is similar to the "Site Specific Physical Impact Approach", but also includes field studies, laboratory studies and modeling to attempt to determine biological impacts as well as physical impacts. Navigation effects on the main channel and main channel border would also be studied.

Output:

A variety of physical and biological units depending on parameters measured and study designs. Biological output may include percent mortality, energy units (biomass), habitat units, etc.

Advantages:

(1) Comprehensive approach that may establish link between physical and biological impacts and quantify biological impacts.

(2) Use a variety of study techniques (field, laboratory, modeling) to check on validity of results.

(3) Builds on work to date.

Disadvantages:

(1) Lots of time and money, numerous sites need to be investigated.

(2) May be over-detailed and not concentrate on specific data needs to verify models.

Method:

Habitat Evaluation System (HES) or
Habitat Evaluation Procedures (HEP)

Description:

HES (Lower Mississippi Valley Division 1980) assumes that the presence or absence, and abundance of animal populations in a habitat or community are determined by basic biotic and abiotic factors that can readily be quantified. A HES analysis attempts to measure quality of habitat types by using functional curves relating habitat quality to quantitative biotic and abiotic characteristics of the habitat. The HES does not treat individual species. Instead, general habitat characteristics are used that indicate quality for fish and wildlife populations as a whole.

The same assumptions underlie the HEP as the HES; however, in the HEP specific species are selected that represent a group of species that share a common habitat resource (a guild) such as feeding or spawning habitat. Habitat suitability index (HSI) models are developed for these species that relate selected biotic and abiotic parameters as a percentage of "optimal" habitat (U.S. Fish and Wildlife Service 1981). Specific HSI models are being adapted to Ohio River Division rivers by the USFWS using literature and expert opinions.

Output:

Habitat Units (HU)

Advantages:

(1) Comprehensive approach that attempts to establish links between physical and biological impacts and quantifies biological impacts.

(2) Gives system-wide impacts but can also be used to evaluate specific sites.

(3) Accuracy of models can be improved as new data is gathered.

Disadvantages:

(1) No models have been developed for large rivers.

(2) Links between physical and biological impacts are assumed since biological data is often lacking.

(3) Major biological changes have occurred and those caused by a small increase in tows will be difficult to measure.

(4) No physical forces for tow impacts models have been developed.

(5) Tow traffic in a waterway does not affect basic habitat attributes like water depth, velocity, cover, or substrate type. Instead, increases in subtle and complex factors, such as pulses or turbulence, suspended solids, wave-wash and drawdown occur. These changes are hard to measure or predict and biological consequences are not well known.

(6) The magnitude and duration of navigation effects can vary drastically because of variables such as bottom topography, sediment type and discharge. Many sample sites are needed for statistical accuracy.

(7) Direct mortality to fish as well as indirect effects such as habitat changes may occur and not be measured.

Method:

Navigation Predictive Analysis Technique (NAVPAT)

Description:

A series of economic, physical force and biological models are used to predict and quantify navigation impacts on large rivers in the Ohio River Division. Traditional Corps economic models predict the number, size, and types of tows for various economic scenarios. Physical force models are developed from field experiments measuring actual physical effects of tows as well as WES tow model studies. The habitat suitability indices are used to quantify biological impacts. Site specific river data on actual habitat parameters are collected for areas being impacted.

Output:

Changes in habitat suitability or habitat units (HU)

Advantages:

(1) Compares relative impacts of each planning alternative

(2) Comprehensive approach that attempts to establish link between physical and biological impacts and quantifies biological impacts.

(3) Good integration of traffic projections using size, horse power, etc.

(4) Gives system-wide impacts but can also be used to evaluate specific sites.

(5) Identifies potential avoid and minimize measures.

(6) Accuracy of models can be improved as new data is gathered.

(7) The system, to some extent, will include both habitat-based and population-based models.

(8) Large amount of physical effects modelling complete.

(9) Points to specific avoid and minimize measures.

(10) Output acceptable (habitat units) for mitigation planning.

(11) Demonstration to be done on Pool 13 by Long Term Resource Monitoring Program (LTRMP).

(12) LTRMP trends analysis data for LaGrange pool will be useful in developing habitat suitability indicies.

Disadvantages:

(1) Models are still in the development stage.

(2) Links between physical and biological impacts are assumed since biological data is often lacking.

(3) Major biological changes have occurred and those caused by a small increase in tows will be difficult to measure.

(4) There is some concern that additional traffic in a waterway does not affect basic habitat attributes like water depth, velocity, cover, or substrate type. It causes increases in subtle and complex factors, such as pulses of turbulence, suspended solids, wave-wash and drawdown. These changes are hard to measure or predict and biological consequences are not well known.

(5) The magnitude and duration of navigation effects can vary drastically because of variables such as bottom topography, sediment type and discharge. Many sample sites are needed for statistical accuracy.

(6) Direct mortality to fish rather than indirect effects such as habitat changes are not measured.

(7) Adaptation of physical and biological models developed for the Ohio River may require extensive additional study before use on the UMRS. For instance physical models do not include wing dams, side channels, or backwaters.

(9) The regression equations on which both physical and biological models are based may not be sufficiently accurate to quantify the effects of small increases in traffic.

Method:

Energy Flow Model (VPI 1985)

Description:

Energy flows were tracked from allocthonous (outside-the system) and autochthonous (within the system) inputs to the Winfield Navigation Pool through 19 major biological components (i.e. plankton, macrovertebrates, fish, etc.) within the pool and then accounted for as exports from the pool. The model was developed based on extensive field collections and was then used to determine the cumulative impacts on the components of each trophic level, according to different scenarios for future traffic.

Output:

Average annual standing stock (Kcal/m^2/yr) for each ecosystem component under conditions of scenario.

Advantages:

(1) Comprehensive ecosystem approach.

(2) Especially good to evaluate impacts of turbidity that effects energy flow.

(3) Quantifies this type of impact.

(4) Large data input required.

Disadvantages:

(1) Large river modeling is very complex and has only been done once before. The Illinois River is a more complex river system than the Kanawha River where this model was developed.

(2) Assumes that increased turbidity is the only significant impact. Does not address other impacts.

(3) It is questionable that the number of samples collected would account for the large variability in a large river.

(4) The finding that large rivers are driven by energy sources outside the system (allocthonous) rather than from within the system such as phytoplankton photosynthesis (autochthonous) is widely accepted by aquatic ecologists. However, this theory has recently been disputed by Sparks (1988) based on UMRS data.

Method:

Fish Population Studies

Description:

Fish populations experiencing chronic exploitation or impacts can compensate, within limits, for increased mortality levels through changes in individual survival rates, reproduction or growth. This is demonstrated by fish populations that are capable of being harvested on a sustained basis by removing the surplus production. The assumption of surplus production implies that the number of spawning adults and eggs produced is not limiting, and that recruitment is the result of density-independent factors. The evidence to date suggests that the first few months of life is the period during which both of these factors appear to operate in establishing the relative success of a year class. Studies in this area may shed light on tow impacts on eggs and larval fish (especially impingement impacts).

Output:

Various fisheries parameters such as growth rates, survival rates, year class strength, etc.

Advantages:

(1) Would address possible navigation impacts on population dynamics of fish.

Disadvantages:

(1) Density-independent (environmental) factors often mask the effects of density-dependent (compensatory) factors, making it difficult to measure the compensatory effects or to separate among varying factors.

(2) Applicability to navigation impacts is limited to those causing fish mortality, probably to early life history stages.

(3) Studies have been conducted for 10-years without fully quantifying power plant impacts.

(4) Does not address other biological effects.

(5) Difficult to apply in large rivers.

Appendix C. State and public fish and wildlife management goals applicable to the Illinois River.

FISH AND WILDLIFE MANAGEMENT GOALS
APPLICABLE TO THE ILLINOIS RIVER

RIVERS AND STREAMS[1]

<u>Overall</u>

* Protect habitat from degradation and destruction.
* Protect land and water from substance contamination.
* Protect the fisheries resource by regulation to prevent overharvesting.
* Protect endangered species for ecological and social values.
* Enhance by managing for optimum recreational, social, and economic benefits.
* Enhance by managing public lands and waters to provide productive ecosystems.
* Enhance by encouraging and developing better management of private lands and waters.
* Enhance by encouraging the acquisition and development of quality fishing areas.
* Enhance by developing public awareness of ecological facts and principles.
* Utilize by providing different opportunities for recreational use.
* Utilize by continuance of the commercial fish and mussel industry compatible with the resource base.
* Increase the quantity and quality of sport fishing opportunities.
* Maintain the current level of commercial harvest.

<u>Catfish</u>

* Maintain the quality and quantity of catfish sport fishing opportunities.
* Maintain the current level of commercial harvest.

<u>Black Bass</u>

* Maintain the quality and increase the quantity of black bass fishing opportunities.

<u>Panfish</u>

* Maintain the quantity and quality of panfish angling opportunities.

<u>Coolwater Fish</u>

* Maintain the supply of quality angling days for coolwater sport fish.

WILDLIFE RESOURCES[2]

Overall

- Protect habitat from degradation and destruction.
- Protect land and water resources from environmental contamination.
- Protect wildlife resources from overharvesting.
- Enhance recreational, social and economic benefits.
- Enhance recreational, social, and economic benefits.
- Enhance public lands management to provide productive ecosystems.
- Enhance better management of privately-owned land and water.
- Enhance the acquisition and development of hunting areas.
- Enhance public awareness of ecological principles about wildlife resources.
- Utilize by providing opportunities for recreational uses of wildlife resources.
- Utilize by encouraging continuance of commercial uses of wildlife in ways compatible with the resource.

Waterfowl

- Maintain populations of waterfowl at current levels.

Ducks

- Increase and enhance existing wetland habitats.

Geese

- Increase goose hunting opportunity.

Coots

- Maintain current supply of coots.

Rails

- Maintain current populations of rails.

Forest Game

- Increase the quality and quantity of forest game hunting.

Fox and Gray Squirrels

* Provide hunting opportunities without detracting from the quality of the hunting.

White-Tailed Deer

* Increase deer harvest and provide more hunter days afield.

Furbearers

* Viable furbearer populations capable of sustained annual harvests.
* Balance demand with supplies.
* Maintain current level and improve quality of fur harvesting opportunities.

HERITAGE ENDANGERED AND THREATENED SPECIES[3]

Heritage Mammals - (bats, squirrels, badger, and several species of mice, shrews and moles.

* Increase public awareness and appreciation of heritage mammals.
* Maintain or increase population levels of these species.

Heritage squirrels - (ground squirrels, eastern chipmunk, red squirrel, and flying squirrel)

* Maintain heritage squirrel populations in their natural habitat in the state.
* Ensure that current occupied range of each species is not reduced.

Bats

* Maintain viable bat populations in their natural habitat in the state.
* Ensure that the current occupied range of each species is not reduced.
* Improve the public image of bats.

Badger

* Maintain a viable badger population in its natural habitat that will adequately satisfy all types of demand related to recreation and aesthetic values, education and scientific investigations.

Other Heritage Mammals - (includes prey for native predators)

* Maintain viable population of these mammals in their natural habitat in Illinois.
* Ensure that currently occupied range of each species is not reduced.

Heritage Birds

* Maintain and enhance population levels of native bird species
* Provide and improve habitat.
* Minimize vegetative impacts of development projects.

Reptiles, Amphibians, Mussels and Crayfish

* Maintain the species diversity and abundance of reptile, mussel, crayfish and amphibian resources.
* Maintain current level of frog and turtle sport harvest and commercial harvest of mussels.

Endangered and Threatened Species

* Improve the status of species to the point they are no longer endangered or threatened in Illinois.
* Reintroduce extirpated wildlife species where possible and practical.

ILLINOIS RIVER ACTION PLAN

Aquatic Habitat

* Continue fisheries monitoring to document impacts of changes in aquatic habitat.
* Encourage re-establishment of aquatic vegetation.
* Support studies of ways to reduce stream bank erosion.

* Initiate studies to determine the sources of toxins in bottom sediments, and seek methods to detoxify the sediments.

* Assess the importance of deep water areas to survival of fish populations.

* Develop effective ways to create backwater areas and to acquire and restore to original conditions leveed floodplains in selected drainage and levee districts.

<u>Forestry</u>

* Advise landowners to ways to protect and better manage their forest lands and to encourage tree plantings and establishment of greenways along streams.

* Provide for a strengthened urban forestry program to encourage municipalities to retain forest lands and to establish greenways.

* Recognize the significance of forests in producing higher water quality and provide incentive to owners of forest lands by minimizing taxes on forest lands and maintaining provisions of the Farmland Assessment Act of lower taxes on forest lands.

* Increase DOC nursery seedlings production by a 4 to 5 fold increase.

<u>Wildlife</u>

* Provide technical and economic assistance for wildlife habitat development projects such as Banner Marsh levee renovation, Stump Lake levee improvements, and Rice Lake levee and site improvements.

* Provide cost-shared, grant, or loan funds to private organizations such as duck clubs for developing seasonal off-river lakes to benefit aquatic birds and waterfowl.

* Restore funding to DOC for the Wildlife Habitat Acquisition and Natural Areas Acquisition programs at originally planned levels.

* Continue aerial censuses of waterfowl populations during migrations.

Natural Areas

* Continue aerial surveys and monitoring of populations of the plant purple loosestrife, which is a severe threat to wetland areas.

General

* Increase staff levels as needed to promote, plan, and coordinate the above recommended actions at State, and local levels, using federal and State cost-share programs as much as possible.

* Strengthen local zoning requirements to reduce agricultural and urban development in floodplains and to prevent the filling of wetlands.

* Continue the partnership approach of government and private interest groups, such as with the Partners in Conservation effort, to promote cooperation toward mutually beneficial fish and wildlife improvements.

* Aggressively work to arrest erosion and sediment, concentrating demonstration projects and research at existing sites thus protecting past investments (for specific recommendations see the Sedimentation and Erosion Control sections).

* Complete natural resource inventories of streams, wetlands, fish and wildlife, and initiate planning based on the resulting data to identify quality natural resources and to establish priorities for acquisition programs.

* Initiate a Statewide Greenways program to focus resource protection on Illinois' major rivers, such as the Illinois River and its larger tributaries.

Sedimentation

* Conduct a sedimentation survey of backwater lakes to determine present state.

* Initiate and support a program of instream sediment load measurements including the quality of sediment at selected gaging stations on the tributaries and main stem of the Illinois River.

* Develop a comprehensive management program for Peoria Lake.

* Continue to pursue Corps of Engineers Environmental Management Program funding.

* Identify high-value backwater and bottomland lakes and develop a comprehensive management plan for each.

* Develop and implement techniques for the removal of sediment by selective dredging.

* Develop and test feasibility of using dredged material for artificial islands, public parks, and playgrounds, etc.

* Identify and develop techniques for controlling sediment input to selected backwater lakes by using methods such as gated control structures.

* Develop and implement management techniques to manage some or portions of backwater lakes as shallow water wetlands and terrestrial habitats.

<u>Sediment</u>

* Develop and implement low-cost bank stabilization techniques for streams located within the immediate vicinity of the river and backwater lakes.

* Implement best management practices on highly erodible areas of the watershed.

* Make the public aware that a state permit is required for stream channel modification or floodway construction.

* Include provisions to reduce erosion and preserve stream channel stability in permit requirements.

* Encourage the incorporation of streamside vegetative buffers for all new and existing developments in both rural and urban areas.

* Determine the impacts on erosion and sedimentation of any state or federally funded projects.

<u>Erosion Control</u>

* Increase and extend cost-share funding for erosion control.

* Employ full-time staff to work on the erosion control program.

- Fund the Illinois Conservation Enhancement Act to supplement the federal Conservation Reserve Program, removing highly erodible land from crop production.

- Provide assistance to farmers in choosing alternative land uses that will keep soil erosion loss at or below "T".

- Provide for assessments at one-sixth of the value for farmers who voluntarily take marginal land out of production.

- Promulgate and enforce construction permit regulations to assure that proper permit authority management practices are in place to mitigate impacts from stream alteration.

- Fund research to (1) define the erosion and sedimentation relationship, (2) determine effectiveness of best management practices for controlling water quality degradation, (3) define critical areas for solving downstream sediment and water quality problems, and (4) define biological and water quality benefits/damage of any sediment control technique.

- Encourage riparian landowners to adopt stream corridor protection measures through the use of critical area seedings, vegetative filter strips, and field windbreak practices.

RECLAIMING AND PRESERVING ILLINOIS RIVER AND PEORIA LAKE[5]

- Maintain a minimum of 12,000 acres as wetlands and lake between miles markers 167 and 182 (Upper Peoria Lake).

- Maintain 2000 acres at a minimum depth of 6 feet between mile markers 162 and 167 (Lower Peoria Lake).

- Maintain a navigation channel with minimum width of 300 feet and a minimum depth of 9 feet between mile markers 162 and 182.

Key:

1. Illinois Department of Conservation. 1990. "Action for the Nineties... and Beyond, Vol. 1, A Strategic Plan for Illinois Fisheries Resources."

2. Illinois Department of Conservation. 1990. "Action for the Nineties... and Beyond, Vol. 2, A Strategic Plan for Illinois Wildlife Resources."

3. Illinois Department of Conservation. 1987. "Action for the Eighties... and Beyond, Vol. 2, A Strategic Plan for Illinois Heritage Endangered and Threatened Species."

4. Illinois State Water Plan Task Force. 1987. "Illinois River Action Plan, Special Report No. 11."

5. Heartland Water Resources Council. "Action 90's Agenda, Solutions for Reclaiming and Preserving the Illinois River and Peoria Lake."

Appendix D. Fish and wildlife management goals of the U.S. Fish and Wildlife Service applicable to the Illinois River.

Refuge Objectives Summary for Mark Twain National Wildlife Refuge

Brussels District

The primary objectives for the district include:

(1) Provide and protect wintering habitat for the American Bald Eagle.

(2) Provide undisturbed feeding and resting areas for migratory waterfowl.

(3) Improve and maintain existing habitat to provide optimum wood duck production.

A secondary objective is to provide day - use wildlife associated recreation for refuge visitors. Refer to the Master Plan (Vol I and II) for further discussions of objectives relative to the Mark Twain NWR. In addition, a fisheries management plan is in preparation.

Current management is designed to support and compliment migrating waterfowl and waterfowl production. Major management programs include the manipulation of water and natural vegetation and cropland management. The divisions are closed to the public from October 15 to December 15 annually. This provides an undisturbed area for waterfowl during the waterfowl hunting season. Present public use facilities include numerous roads which can be driven or hiked, one boat ramp, parking areas and a public use/office building which includes an auditorium, visitor contact area and a wildlife observation deck. Fishing comprises a major portion of the public use on the district. Gilbert Lake has just been opened to fishing.

Refuge Objectives Summary for Chautauqua National Wildlife Refuge

Lake Chautauqua Unit

GOAL STATEMENT	OUTPUT	OBJECTIVE LEVEL[1]
HIGHEST PRIORITY		
Protect and enhance refuge habitat to maintain or increase use by endangered or threatened species.	Bald eagle and osprey use days	1,665 UD[2]
Provide optimum conditions for mallards during the fall migration to achieve maximum production from birds returning to the breeding grounds.	Mallard maintenance	6,500,000 UD
Provide optimum conditions for migrating Canada geese consistent with distribution objectives established for MVP in the flyway management plan.	Goose maintenance	324,000 UD
Increase wood duck production	# birds produced	500
HIGH PRIORITY		
Provide habitat and maintenance requirements for maximum number of species of migratory birds at optimum population levels.	Duck maintenance other than mallards	2,176,000 UD
	Marsh & water birds	1,329,175 UD
	Shorebirds	336,500 UD
	Raptorial birds	16,825 UD
Preserve bottomland hardwood ecosystem	# acres preserved	1,054
	# natural areas	2
	# archaeological sites	2
Provide opportunities to view and appreciate refuge wildlife population	Wildlife observation	57,500 AH[3]
Expand visitor understanding and appreciation of wildlife and Man's role in environment	Interpretive trail and exhibits	3,300 AH
MODERATE PRIORITY		
Provide hunting and fishing opportunities	Waterfowl hunting	2,568 AH
	Fishing[4]	74,100 AH
Provide environmental opportunities	Students	450 AH
	Teachers	50 AH

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[1] Objective levels derived from resource base, current wildlife use and 5-year averages plus rational projected potential based on past 9 years of managing refuge.

[2] UD = use days

[3] AH = activity hours

[4] A fisheries management plan is in preparation.

Cameron-Billsbach Unit

GOAL STATEMENT	OUTPUT	OBJECTIVE LEVEL
HIGHEST PRIORITY		
Protect and enhance refuge habitat to maintain or increase use by endangered or threatened species.	Bald eagle and osprey use days	500 UD
Provide optimum conditions for mallards during the fall migration to achieve maximum production from birds returning to the breeding grounds.	Mallard maintenance	75,000 UD
Provide optimum conditions for migrating Canada geese consistent with distribution objectives established for MVP in the flyway management plan.	Goose maintenance	30,000 UD
Increase wood duck production	# birds produced	250
HIGH PRIORITY		
Provide habitat and maintenance requirements for maximum number of number of species of migratory birds at optimum populations levels.	Duck maintenance other than mallards	100,000 UD
	Marsh & water birds	50,000 UD
	Shorebirds	100,000 UD
	Raptorial birds	75,000 UD
Preserve bottomland hardwood ecosystem	# acres preserved	1,706.5
MODERATE PRIORITY		
Provide opportunities to view & appreciate refuge wildlife population	Wildlife observation	3,500 AH
Provide fishing opportunities	Fishing	7,500 AH

Meredosia National Wildlife Refuge

GOAL STATEMENT	OUTPUT	OBJECTIVE LEVEL
HIGHEST PRIORITY		
Protect and enhance refuge habitat to maintain or increase use by endangered or threatened species.	Bald eagle and osprey use days	1,250 UD
Provide optimum conditions for mallards during the fall migration to achieve maximum production from birds returning to the breeding grounds.	Mallard maintenance	1,750,000 UD
Provide optimum conditions for migrating Canada geese consistent with distribution objectives established for MVP in the flyway management plan.	Goose maintenance	130,000 UD
Increase wood duck production	# birds produced	650
HIGH PRIORITY		
Provide habitat and maintenance requirements for maximum number of species of migratory birds at optimum population levels.	Duck maintenance other than mallards	875,000 UD
	Marsh & water birds	500,000 UD
	Shorebirds	100,000 UD
	Raptorial birds	15,000 UD
Preserve bottomland hardwood ecosystem	# acres preserved	1,380

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