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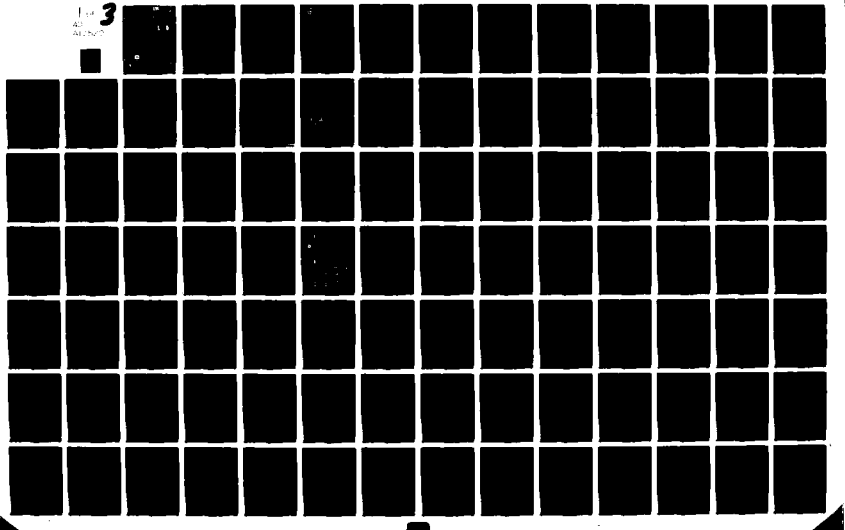
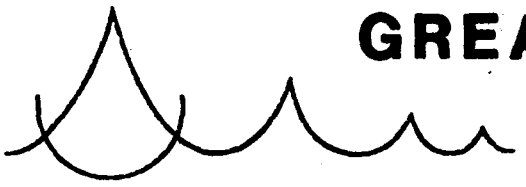


Great River Resource Management Study

GREAT III



RECONNAISSANCE REPORT

MISSISSIPPI RIVER

(SAVERTON, MISSOURI TO CAIRO, ILLINOIS)

JULY 1980

US Army Corps
of Engineers
St. Louis District

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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	6. PERFORMING ORG. REPORT NUMBER
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Multiple resource planning; resource management; interdisciplinary - multi-agency, Upper Mississippi River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The purpose of this study is to develop a total river resource management plan for the water and related land resources of the Mississippi River from Saverton, Missouri (Lock and Dam 22) to Cairo, Illinois (the mouth of the Ohio River).

The study area consists of approximately 300 miles of the Mississippi River and its adjacent floodplain.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Resource management problems related to commercial transportation, fish and wildlife, water quality, recreation, cultural resources, regulating works, dredging and dredged material uses, erosion and sediment control, and flood-plain management will be investigated. This Reconnaissance Report was prepared to satisfy the requirements for Stage 1 of the planning process consistent with the Water Resources Council's Principles and Standards. Herein is a determination of the range of water and related resource management problems the study will address, a synthesis of pertinent information leading to specific planning objectives and a preliminary identification of potential management measures to be used in the plan formulation process.

This study is a multi-agency, inter-disciplinary effort involving personnel from the various State and Federal agencies. Representatives from these different agencies will participate in formulating and evaluating alternative management plans.

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

LMSED-BR

30 July 1980

SUBJECT: Great River Resource Management Study, GREAT III, Reconnaissance Report

Division Engineer, Lower Mississippi Valley
ATTN: LMVPD-P

1. The Reconnaissance Report for the Great River Resource Management Study (GREAT III) is submitted for review and approval. This document represents the results of a multi-agency, inter-disciplinary approach to river resource management planning and will provide a guide for the development of the Stage 2 report.

2. In compliance with Section 117 of the Water Resources Development Act of 1976 (PL 94-587, passed on 8 October 1976), this report has been forwarded concurrently to the Upper Mississippi River Basin Commission and the Lower Mississippi Valley Division, Corps of Engineers.

3. It is recommended that the subject Reconnaissance Report be approved.

Robert J. Dacey

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as

ROBERT J. DACEY
Colonel, CE
District Engineer

GREAT RIVER RESOURCE MANAGEMENT STUDY
(GREAT III)

RECONNAISSANCE REPORT

THE GREAT III TEAM

Illinois Department of Conservation
Illinois Environmental Protection Agency
Illinois Department of Transportation
Missouri Department of Conservation
Missouri Department of Natural Resources
Missouri Department of Transportation
Bi-State Development Agency
US Fish and Wildlife Service
US Soil Conservation Service
US Army Corps of Engineers
US Heritage Conservation and Recreation Service
US Environmental Protection Agency
US Department of Transportation
US Department of Commerce
US Department of Housing and Urban Development

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SPECIAL NOTE

This Reconnaissance Report was prepared to satisfy the requirements for Stage 1 of the planning process consistent with the planning requirements of the Water Resources Council's Principles and Standards (P & S), the National Environmental Policy Act of 1969 (NEPA), and related policies. The report emphasizes the primary thrust of Stage 1 - Problem Identification and discusses procedures and requirements for further study. Herein is a determination of the range of water and land related resource management problems the study will address, a synthesis of pertinent information leading to specific planning objectives and a preliminary identification of potential management measures to be used in the plan formulation process.

SYLLABUS

The purpose of this study is to develop a total river resource management plan for the water and related land resources of the Mississippi River from Saverton, Missouri (Lock and Dam 22) to Cairo, Illinois (the mouth of the Ohio River).

The study area consists of approximately 300 miles of the Mississippi River and its adjacent floodplain. This study is an investigation of such resource management problems as commercial transportation, fish and wildlife, water quality, recreation, cultural resources, regulating works, dredging and dredged material uses, erosion and sediment control, and floodplain management.

This study is a multi-agency, inter-disciplinary effort involving personnel from the various State and Federal agencies. Representatives from these different agencies will participate in formulating and evaluating alternative management plans.

SECTION I

GREAT RIVER RESOURCE MANAGEMENT STUDY

GREAT III

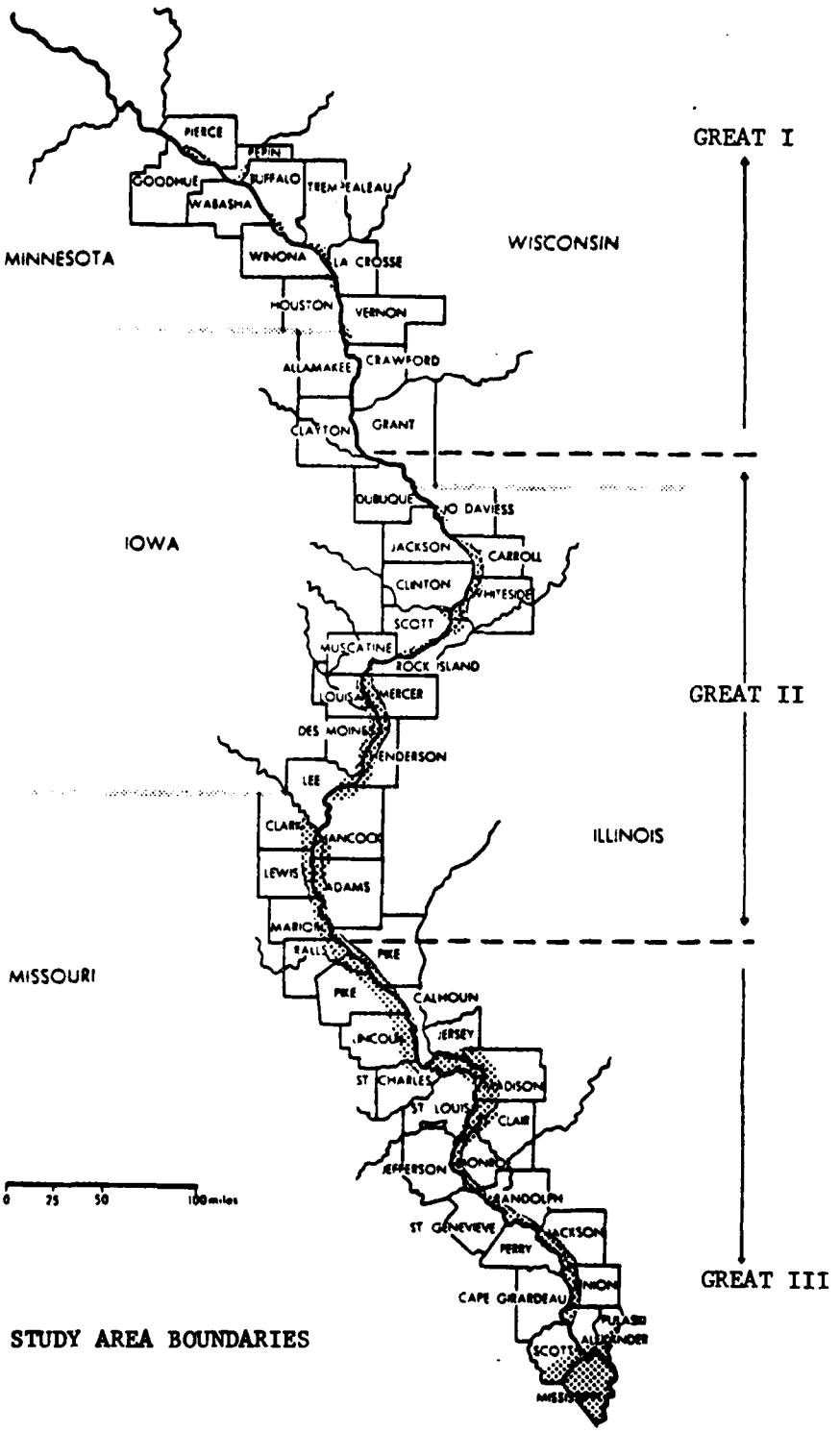
INTRODUCTION

In recent years, organizations and individuals have expressed concern about the operation and maintenance of the inland waterway system of the Upper Mississippi River. In 1973, the State of Wisconsin initiated a lawsuit against the Corps' dredging practices in the St. Paul District. This action resulted in an announcement in September 1974 by the North Central Division Engineer of the Corps of Engineers and the North Central Regional Director of the U. S. Fish and Wildlife Service that they planned to establish a partnership team within the North Central Division area. This team would work out a long-range management strategy for the multi-purpose use of the river. This move led to the establisment of a broad-based federal-state task force. Previously, the Upper Mississippi River Basin Commission (UMRBC) had established a special Dredged Spoil Disposal Practices Committee to begin laying the groundwork for such a cooperative effort. This committee was composed of delegates representing the five principal river basin states and five federal agencies. Thus, what finally became known as the Great River Environmental Action Team (GREAT) was set up in October 1974 as a working partnership of federal agencies and states under the auspices of the UMRBC.

GREAT I covers the reach of the Mississippi River between St. Paul and Minneapolis, Minnesota, and Guttenburg, Iowa (St. Paul District). GREAT II extends from Guttenburg to Saverton, Missouri (Rock Island District). GREAT III extends from Saverton, Missouri, to the confluence of the Mississippi with the Ohio River at Cairo, Illinois (St. Louis District), and will be referred to as the Great River Resource Management Study (see FIGURE 1).

GREAT III was begun in the summer of 1977 as a result of the 1976 Water Resources Development Act (Public Law 94-587). The study area covers the Mississippi River and its floodplain from Saverton, Missouri, to Cairo, Illinois. This study will be an investigation of the total river resource management requirements, including, but not limited to, navigation, effects of increased barge traffic, fish and wildlife, recreation, watershed management, and water quality at an estimated cost of approximately $4,000,000. The final report is presently scheduled to be completed by September 1984.

Although the Corps of Engineers has overall responsibility for the study, it is to be a cooperative effort with the following State and Federal agencies:



GREAT STUDY AREA BOUNDARIES

FIGURE 1

Illinois Department of Conservation
Illinois Environmental Protection Agency
Illinois Department of Transportation
Missouri Department of Conservation
Missouri Department of Natural Resources
Missouri Department of Transportation
Bi-State Development Agency
US Fish and Wildlife Service
US Soil Conservation Service
US Army Corps of Engineers
US Heritage Conservation and Recreation Service
US Environmental Protection Agency
US Department of Transportation
US Department of Commerce
US Department of Housing and Urban Development

Twelve work groups have been formed to investigate problems identified by each work group and by the public. These work groups are:

Data and Reports (Plan Formulation: composed of work group chairmen)
Commercial Transportation
Cultural Resources
Dredging and Dredged Material Uses
Erosion and Sediment
Fish and Wildlife
Floodplain Management
Industrial and Economic Development
Public Involvement
Recreation
Regulating Structures
Water Quality

STUDY AUTHORITY

GREAT I and II were initiated using Corps of Engineers Operation and Maintenance funds prior to their authorization. Formal authorization of GREAT I, II, and III was initiated by Section 117 of the Water Resources Development Act of 1976 (PL 94-587, passed on 8 October 1976). This act was sponsored by Senator Gaylord Nelson and Representatives Alvin Baldus and Albert Quie. Section 117 states that:

> "The Secretary of the Army, acting through the Chief of Engineers, is authorized to investigate and study, in cooperation with interested States and Federal Agencies, through the Upper Mississippi River Basin Commission the development of a river system management plan in the format of the "Great River Study" for the Mississippi River from the mouth of the Ohio River to the head of navigation at Minneapolis, incorporating total river resource requirements including, but not limited to, navigation, the effects of increased barge traffic, fish and wildlife, recreation, watershed management, and water quality at an estimated cost of $9,100,000."

In addition to the above provisions of Section 117, this study and its resultant resource management plan will follow the guidance and constraints of other applicable laws and regulations, such as the National Environmental Policy Act (PL91-190), the Fish and Wildlife Coordination Act (PL 732), the National Historic Preservation Act (PL89-665), Clean Water Act showing changes made by the 1977 Amendments, PL 95-217, Principles and Standards of the Water Resources Council, and other appropriate State and Federal laws and regulations.

SCOPE OF THE STUDY

PURPOSE

The purpose of this study is to develop a total river system management plan for the water and related land resources of the Mississippi River from Saverton, Missouri, (Lock and Dam 22) to Cairo, Illinois, (the mouth of the Ohio River). This study is to represent the cooperative efforts of the concerned state and federal agencies, the Upper Mississippi River Basin Commission, as well as the interests of other public and private organizations and individuals.

The study will have the following focus:

This River Resource Management Plan will identify conflicts and inadequacies in existing river resource management procedures. The objective is to provide decision-makers with improved management procedures and programs. The plan will contain policy recommendations for responsible and coordinated environmental, economic, and social uses of the GREAT III reach of the Mississippi River.

Section III contains a detailed interpretation of this River Resource Management Plan definition and sets forth a framework under which the study will be conducted.

GREAT III STUDY AREA

The GREAT III study area consists of about 300 miles of the Mississippi River, from river mile 0.0 at Cairo, Illinois, upstream to river mile 301.2 at Lock and Dam No. 22 at Saverton, Missouri. (see FIGURE 2) The river consists of two major reaches for operation and maintenance purposes: (1) from mile 0.0 at the mouth of the Ohio River upstream to the low water dam (Chain of Rocks) at mile 190.3, the Mississippi is an open river and a 9-foot navigation project is maintained by the use of channel contraction dikes, protective bankline revetments, and dredging; and (2) from mile 190.3 to mile 301.2, the Mississippi is operated as a series of slackwater navigation pools with locks and dams with maintenance dredging as required (see TABLE 1).

TABLE 1
LOCKS AND DAMS IN THE GREAT III AREA

Lock and Dam Number	Location	River Mile above the Mouth of the Ohio River
22	Saverton, Missouri	301.2
24	Clarksville, Missouri	273.4

TABLE 1 (CONTINUED)
LOCKS AND DAMS IN THE GREAT III AREA

Lock and Dam Number	Location	River Mile above the Mouth of the Ohio River
25	Winfield, Missouri	241.4
26	Alton, Illinois	202.9
Lock 27	Granite City, Illinois	185.1
Low Water Dam 27	Granite City, Illinois	190.3

The study area, as visualized by each work group, includes varying geographical limits, i.e., side channel studies adjacent to the river as compared to social impact analyses which may encompass several counties. Generally, however, the study area will be the Mississippi River and its floodplain and bluffs from Saverton, Missouri, to Cairo, Illinois.

The study area has been defined by the work groups in two ways: (1) the Impact Area, a broad geographical area that might be influenced by the various water and land related resource uses of the Mississippi River; and (2) the Specific Resource Management Area, which represents a more limited geographic area that would most likely be affected by resource management recommendations. The scope of these study area definitions is dependent upon the resource and/or resource use being studied.

TABLE 2 presents the study area as defined from the perspectives of the various work groups.

FIGURE 2

UPPER MISSISSIPPI RIVER

Great River Resource Management Study Area

GREAT III

1978

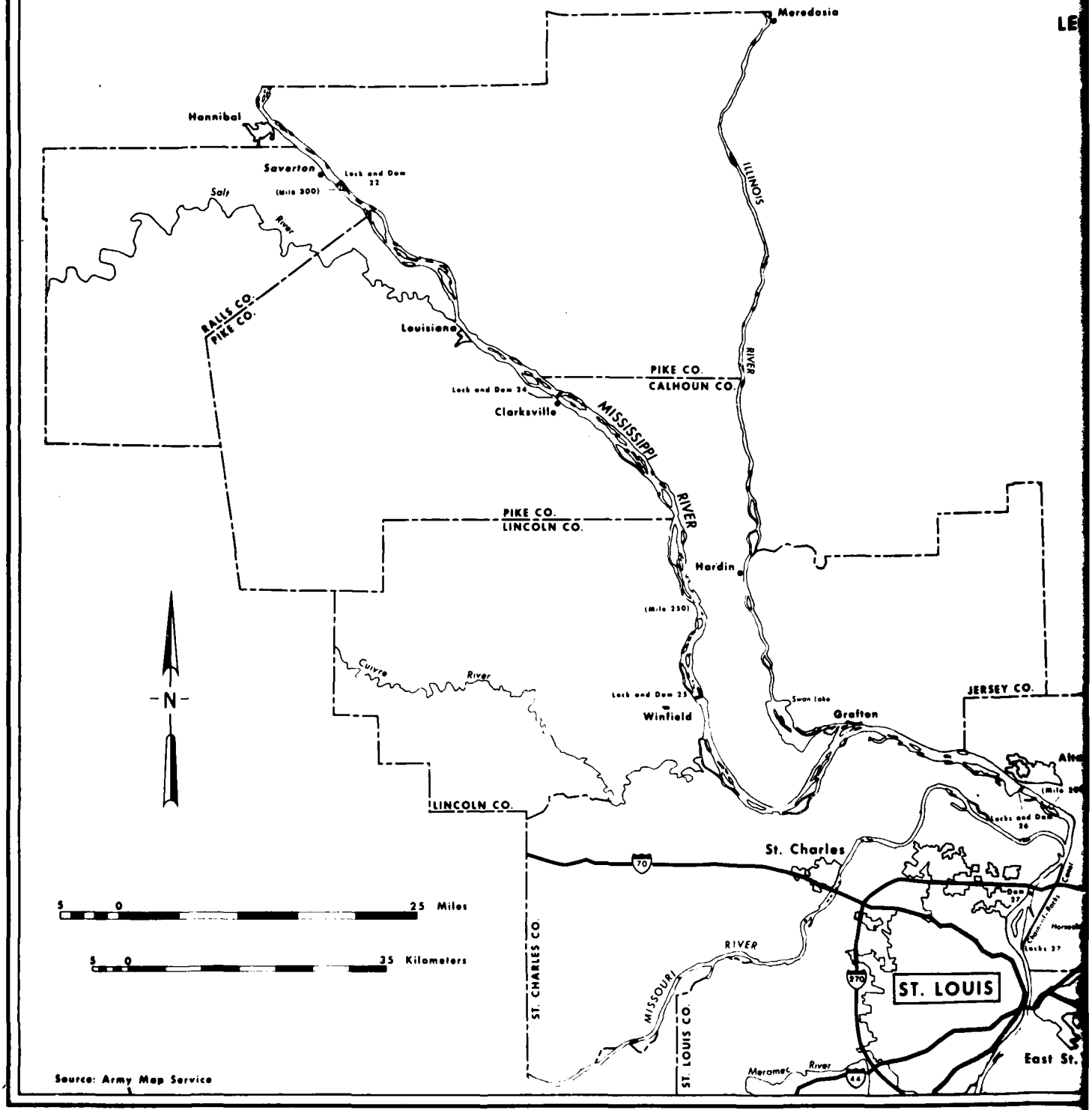


FIGURE 2

UPPER MISSISSIPPI RIVER

Great River Resource Management Study Area

GREAT III

1978

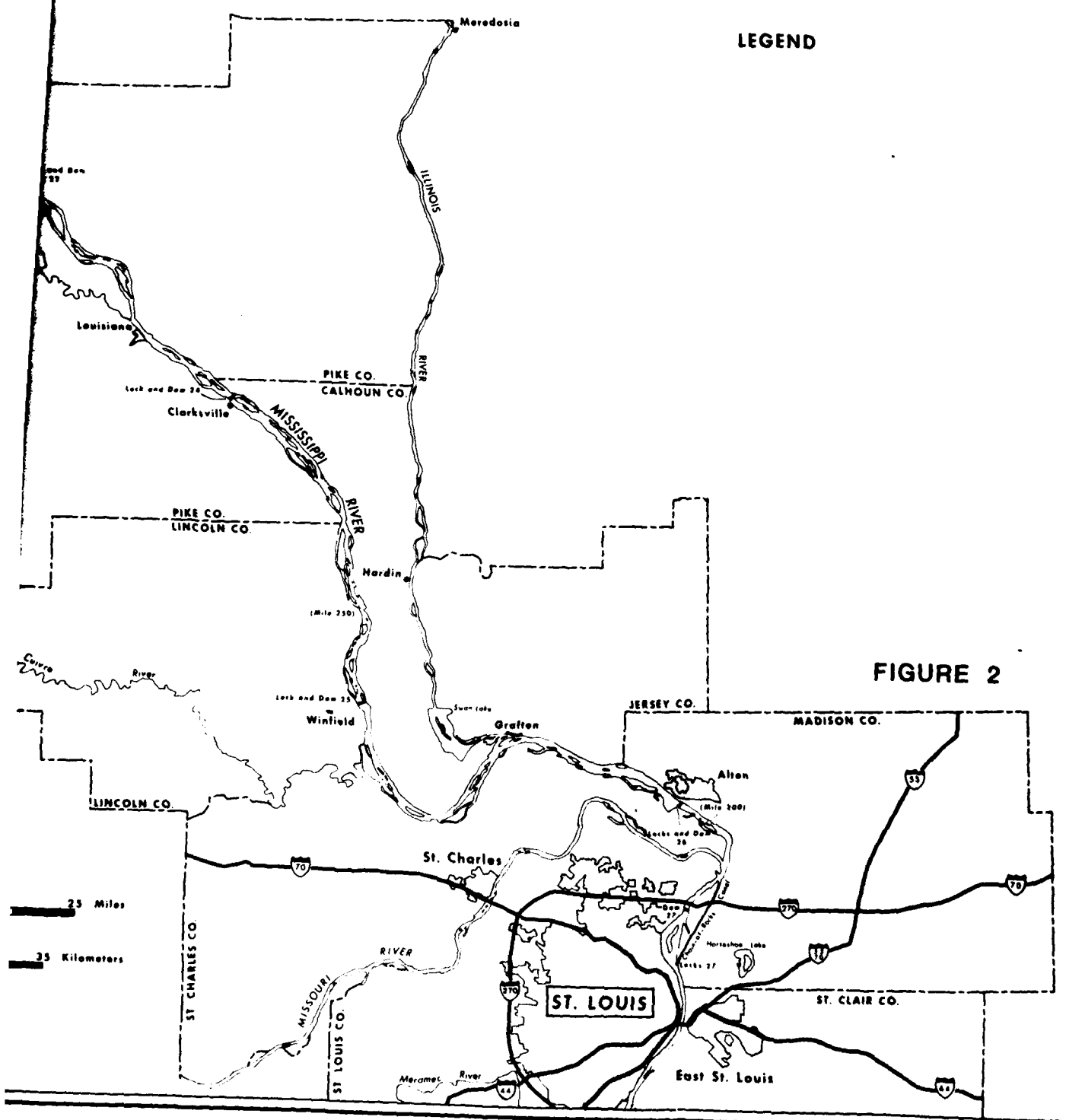
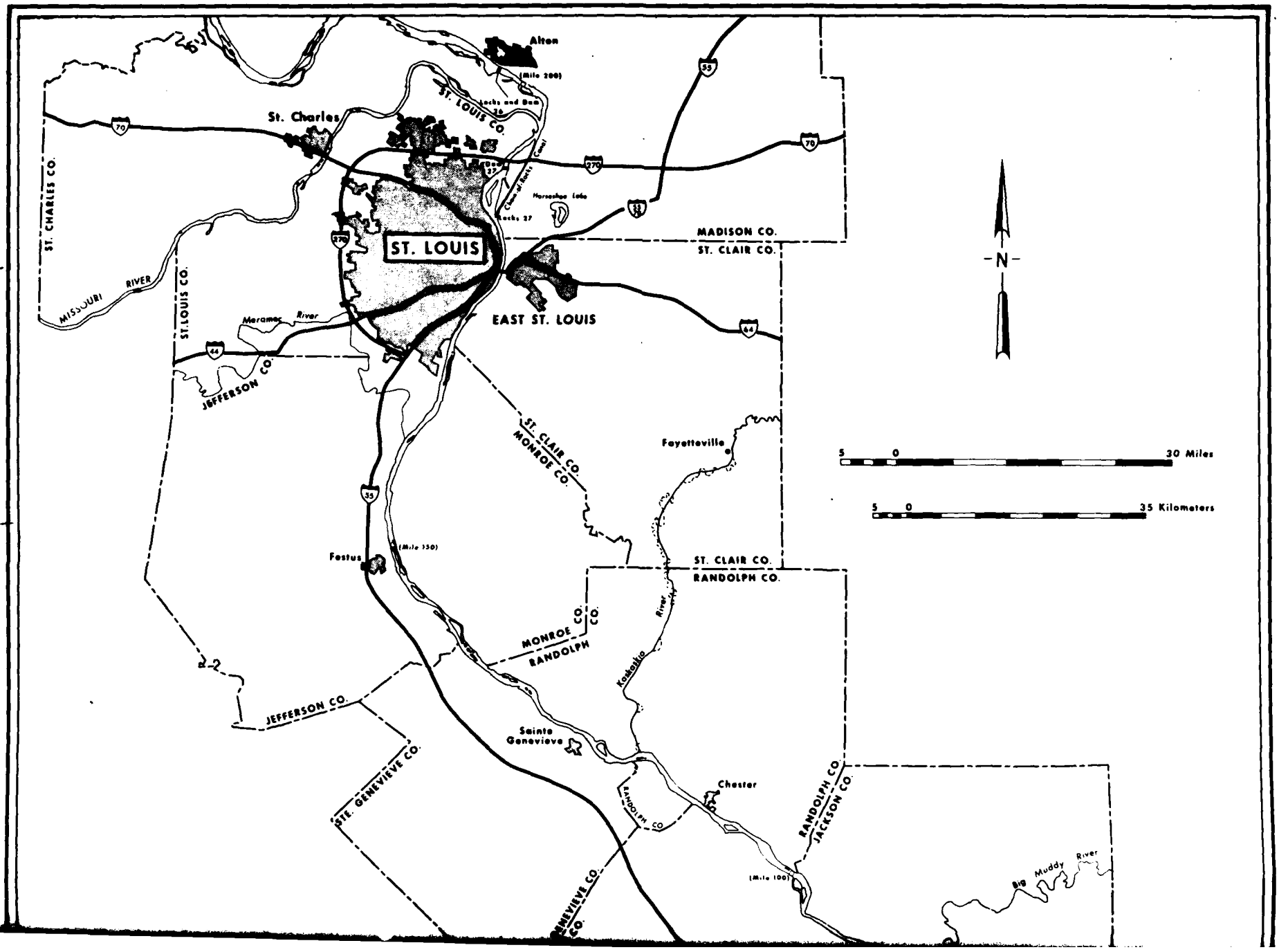


FIGURE 2


Alton
(Mile 200)
St. Louis Co.
Locks and Dam 26
St. Charles
ST. CHARLES CO.
Locks 27
Chain of Rocks Canal
Horseshoe Lake
MADISON CO.
ST. CLAIR CO.
ST. LOUIS
MISSOURI RIVER
ST. LOUIS CO.
Meramec River
EAST ST. LOUIS
JEFFERSON CO.
ST. CLAIR CO.
MONROE CO.
Fayetteville
5 0 30 Miles
5 0 35 Kilometers
Festus
(Mile 150)
ST. CLAIR CO.
RANDOLPH CO.
MONROE CO.
RANDOLPH CO.
Kaskaskia River
JEFFERSON CO.
Sainte Genevieve
Chester
STE. GENEVIEVE CO.
RANDOLPH CO.
RANDOLPH CO.
JACKSON CO.
(Mile 100)
Big Muddy River
GENEVIEVE CO.

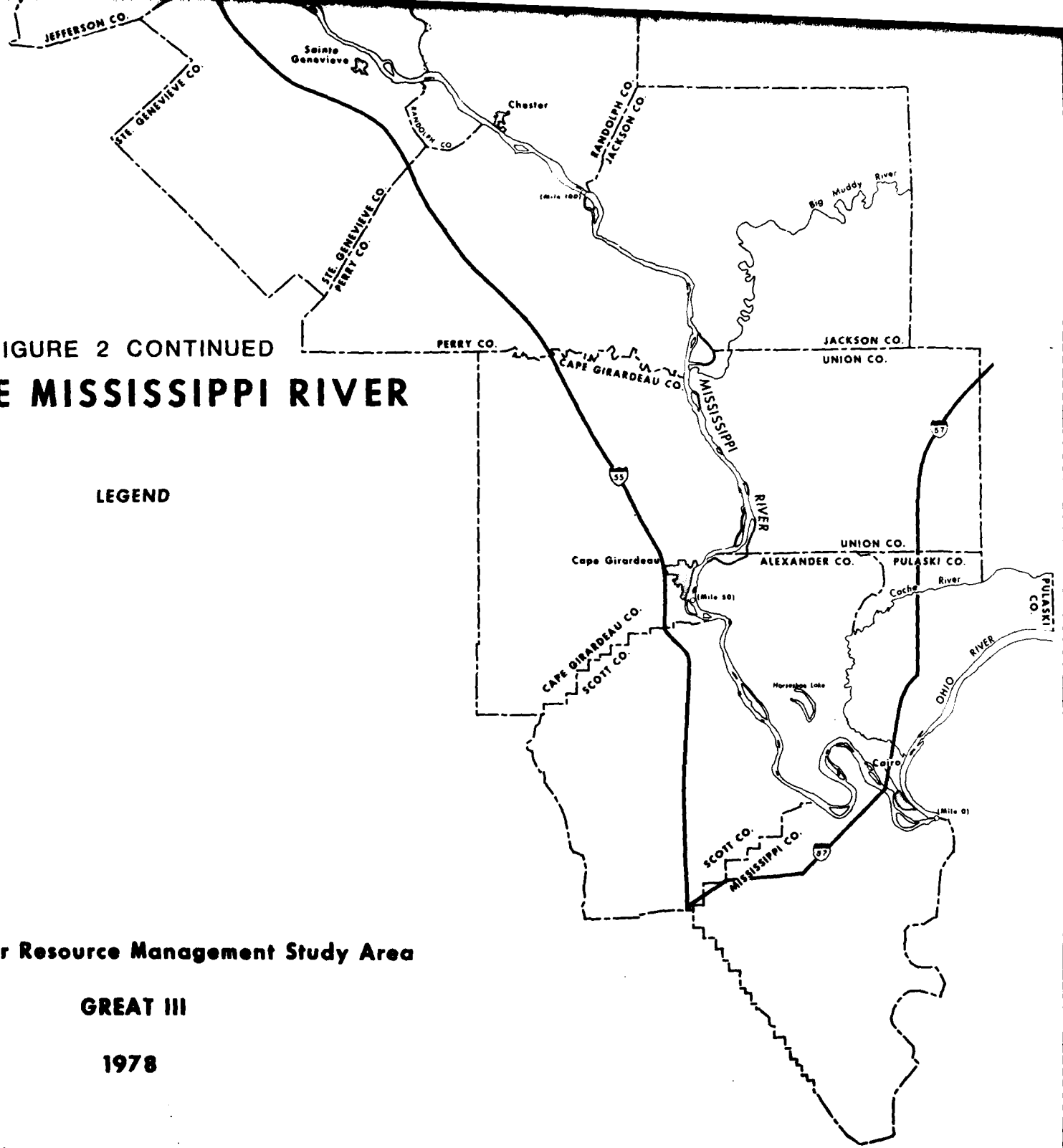


FIGURE 2 CONTINUED

MIDDLE MISSISSIPPI RIVER

LEGEND

Great River Resource Management Study Area

GREAT III

1978

FIGURE 2 CONTINUED

TABLE 2

GREAT III Study Area as Defined By
Individual Work Groups

Work Group	Impact Area	Specific Resource Management Area (SRMA)
Commercial Transportation	Mississippi River from Cairo, Illinois to Saverton, Missouri.	Adjacent land areas that are or may be used for support facilities.
Cultural Resources	The GREAT III Cultural Resources Work Group will examine the cultural resources in the Missouri and Illinois counties adjoining the Mississippi River from river mile 9.9 at Cairo, Illinois upstream to river mile 301.2 (Lock and Dam No. 22) at Saverton, Missouri.	The GREAT III Cultural Resources Work Group will make management recommendations for the floodplain and bluff areas of the Mississippi River from Cairo to Saverton. This will include bluff-top areas extending from the bluff crest to an upland peripheral limit 1 mile away. The SRMA will also include regions such as the confluences with the Salt, Illinois, Quiver, Missouri, Meramec, Kaskaskia, Big Muddy, Cache, Ohio rivers and other small tributaries of the Mississippi River. Also included in the SRMA will be areas which have been intensively occupied or exploited during prehistoric and historic times.
Dredging and Dredged Material Uses	The Dredging and Dredged Material Uses Work Group will study the impacts of maintaining the authorized channel in the 300-mile reach from Cairo, Illinois (mouth of the Ohio River to Saverton, Missouri (tailwater Lock and Dam No. 22) by dredging.	This work group will make management recommendations for maintaining the authorized channel which will include locations for the placement of dredged material and possible beneficial uses. These locations may include areas both within and outside the floodplain in addition to riverine disposal.
Erosion and Sediment	The GREAT III study area includes 301 miles of river and associated floodplain and blufflands.	Erosion and sediment affect floodplain lands; and from a sediment standpoint, the entire area of the contributing drainages need to be considered. The drainage area at Saverton, Missouri, is 137,500 square miles and at Cairo, Illinois, is 717,000 square miles.
Fish and Wildlife	The GREAT III Fish and Wildlife Work Group will consider resource needs in the natural floodplain of the Mississippi River from mile 0.0 at Cairo, Illinois, upstream to river mile 301.2 at Lock and Dam No. 22, at Saverton, Missouri; as well as those lands which are contiguous to the Mississippi and are managed specifically for fish and wildlife purposes extending beyond the natural floodplain. In determination of the factors influencing these resources, the effects of major drainages (such as, but not limited to, Illinois, Missouri, Meramec and Kaskaskia Rivers) will also be considered. In cases where fish and wildlife population are commonly collected in reference to political boundaries, the first tier of counties contiguous to the river border will be utilized for analysis purposes in order that consistency and comparability of data is maintained.	The GREAT III Fish and Wildlife Work Group will intensively study and make management recommendations for only that portion of the impact area located within and at the base of the Mississippi River bluffs.

TABLE 2 (Con't)

Work Group	Impact Area	Specific Resource Management Area (SRMA)
Floodplain Management	The Floodplain Management Work Group of GREAT II will consider floodplain managment problems, needs and policies within the floodplain (bluff to bluff) of the Mississippi River from river mile 0.0 at Cairo, Illinois, to river mile 301.2 at Saverton, Missouri.	The floodplain (bluff to bluff) of the Mississippi River within the impact area.
Industrial and Economic	Direct Impact Area. This work group will consider the industrial and economic demands and needs in the Illinois and Missouri counties adjoining the Mississippi River from river mile 0.0 at Cairo, Illinois, upstream to river mile 301.2 at Lock and Dam No. 22 at Saverton, Missouri, plus the city of St. Louis and other counties in the St. Louis Standard Metropolitan Statistical Area (SMSA) which includes Franklin, Jefferson, St. Charles, and St. Louis Counties in Missouri and Clinton; Madison, Monroe, and St. Clair Counties in Illinois. Indirect Impact Area. This work group will also consider hinterland areas not now definable.	This work group will make management recommendations for the impact area plus any other adjacent land areas that are or may be used for support facilities.
Recreation	The GREAT III Recreation Work Group will consider the recreation demands and needs in the Illinois and Missouri counties adjoining the Mississippi River from river mile 0.0 at Cairo, Illinois, upstream to river mile 301.2 at Lock and Dam No. 22 at Saverton, Missouri, plus other counties in the St. Louis SMSA (This recreation market are is subject to change but the best current estimate indicates that most demand comes from within 25 miles of the river. See George Fleener, Recreation Use of Pool 21, Mississippi River, Missouri Department of Conservation, 1975, p. 12).	The GREAT III Recreation Work Group will make management recommendations in area generally encompassing the Mississippi River from Cairo to Saverton, its floodplain and bluffs. This area will include bluff-tops overlooking the river and its floodplain. The SRMA will include special recreation modes or regions such as the confluence with the Illinois, Missouri, Meramec and Kaskaskia Rivers. The SRMA will exclude certain urbanized floodplain areas such as the area east of Highway 3 in the Illinois portion of the St. Louis SMSA.
Regulating Structures	The Mississippi River from Saverton, Missouri (Lock and Dam No. 22), at Cairo, Illinois (the mouth of the Ohio River).	Approximately 300 miles of the main stem Mississippi River and the side channels adjacent to the river.
Water Quality	The impact area is the Mississippi River from Saverton, Missouri to Cairo, Illinois including all sloughs and backwaters of that segment of the river.	The same as Impact Area.

STUDY PARTICIPANTS AND COORDINATION

The responsibility for administering the GREAT III Study is defined under the previously cited Section 117 of the Water Resource Development Act of 1976 (PL 94-587), which stipulates that the "Secretary of the Army, acting through the Chief of Engineers, is authorized to investigate and study, in cooperation with interested states and Federal agencies, through the Upper Mississippi River Basin Commission, the development of a river system management plan..." The hierarchy and coordination of the GREAT III study is illustrated in FIGURE 3.

FUNCTIONAL ELEMENTS

Responsibility for the GREAT III Study lies with the St. Louis District, which reports to the Lower Mississippi Valley Division. This necessitates dual coordination with the Lower Mississippi Valley Division and the North Central Division, which is accountable for the GREAT I and GREAT II Studies.

The Steering Committee is composed of executive personnel from each participating Federal agency and the States of Illinois and Missouri (see APPENDIX A). The Steering Committee establishes policy, reviews program management, and resolves major conflicting issues.

The GREAT III Team is composed of representatives from each participating State and Federal agencies (see APPENDIX A). The Team is responsible for program management, and directing and reviewing work group efforts.

The Work Groups are composed of technical personnel. Each Work Group is chaired by a representative from an agency which plays a lead role (see APPENDIX A). Representation by outside interest groups, individuals, or other technical personnel is encouraged. The work groups are responsible for drafting the GREAT III planning studies, and assisting in the formation of recommendations.

TABLE 3 indicates a more detailed description of the composition, responsibilities, and outputs of the Steering Committee, Team, and Work Groups.

FIGURE 3
GREAT III
ORGANIZATIONAL CHART

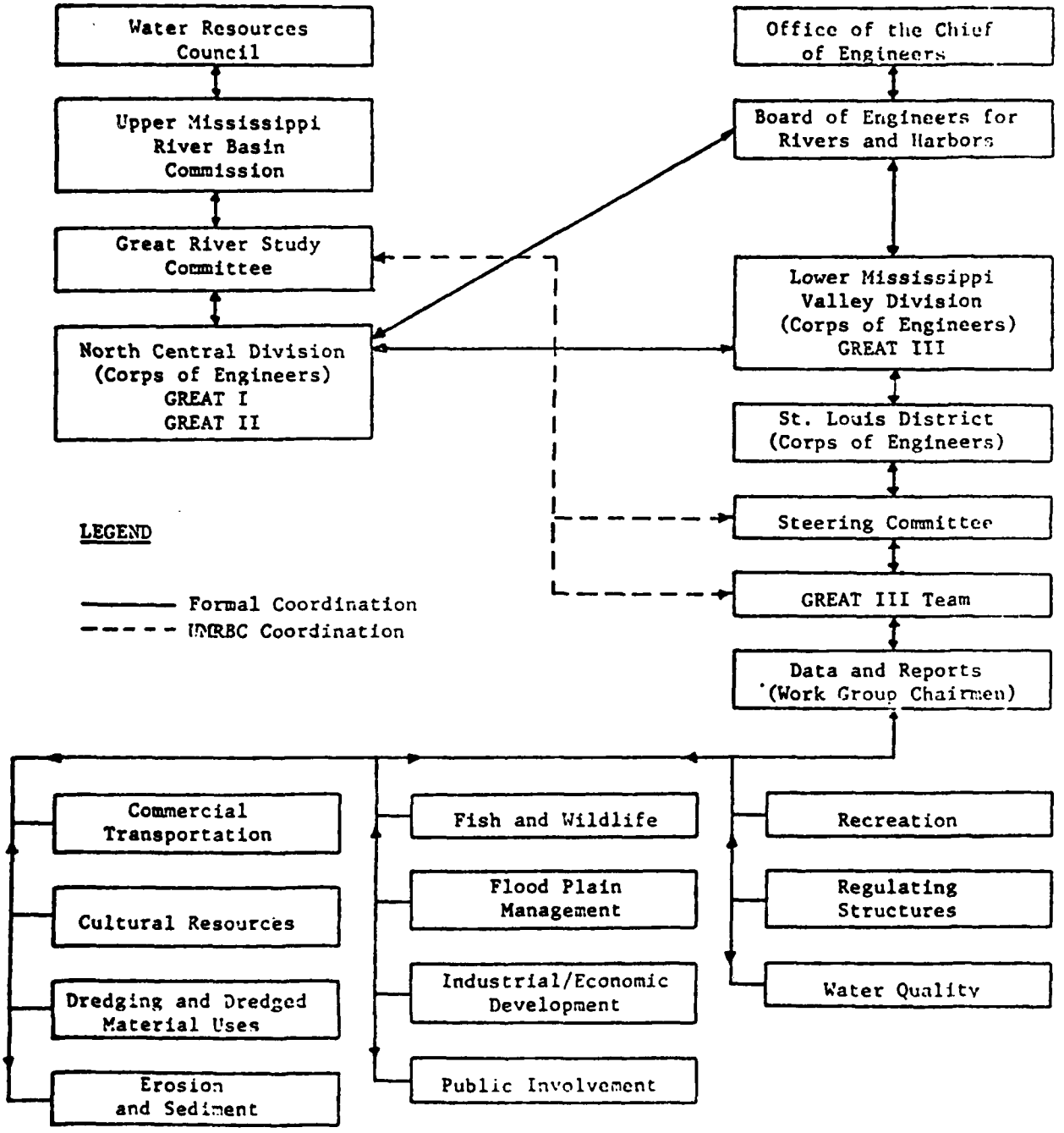


TABLE 3
GREAT III
FUNCTIONAL ELEMENTS

Element	Composition	Responsibility	Output
STEERING COMMITTEE	1. Co-Chairmen: St. Louis District Engineer and Director of Illinois Department of Conservation	1. Make major study management decisions	1. Make recommendations to District Engineer
	2. Representative from each participating Federal agency	2. Provide general guidance and direction to GREAT III Team	2. Recommend multi-objective river resource management plan(s) to District
	3. Representatives from Illinois and Missouri	3. Resolve major controversial issues of GREAT III Team	3. Submit plan(s) to UMRBC
	4. Upper Mississippi River Basin Commission (observer)	4. Coordinate with UMRBC and Great River Study Committee on policy matters	
TEAM	1. Chairman: St. Louis District	1. Overall program management and coordination	1. Provide interim recommendations to Steering Committee
	2. Vice Chairman: Missouri Department of Natural Resources	2. Review of planning reports	2. Recommend multi-objective river resource management plan(s) to Steering Committee
	3. Representative from each participating Federal agency	3. Monitoring of work groups	
	4. Representative from each participating state agency	4. Assist in review of contracts and funding	
WORK GROUPS	1. Chairmen: Lead Agency Representatives	1. Submit Plans of Action to Team	1. Provide input to Team in the form of recommendations and draft reports for Stage 1, 2, and 3 studies
	2. Technical personnel from participating state and Federal agencies	2. Provide Scopes of Work for contracts	
	3. Other interest groups or individuals interested or having expertise with the subject matter	3. Supervise contracts	
		4. Formulate and evaluate alternatives	
		5. Present alternatives to Team	

THE REPORT AND STUDY PROCESS

THE PLANNING APPROACH

The GREAT III study will be executed in three time-phased stages to develop a comprehensive river system management plan. These three stages are: (1) Development of Reconnaissance Report, (2) Development of Intermediate Plans, and (3) Development of Final Plans. Each of the stages involves participation, coordination, and cooperation of interested Federal and State agencies, the Upper Mississippi River Basin Commission and the public in the GREAT III area as prescribed in Section 117 of PL 94-587.

The planning procedures for the GREAT III study are designed to comply with the Water Resources Council's (WRC) "Principles and Standards for Water Resources Planning (P&S)." The planning will be accomplished by carring out four planning tasks during each of the three stages of plan development. These tasks are:

(1) the identification of issues, problems, needs, and opportunities

(2) the formulation of alternative plans addressing identified issues, problems, needs, and opportunities

(3) the assessment of the impacts or effects of each alternative

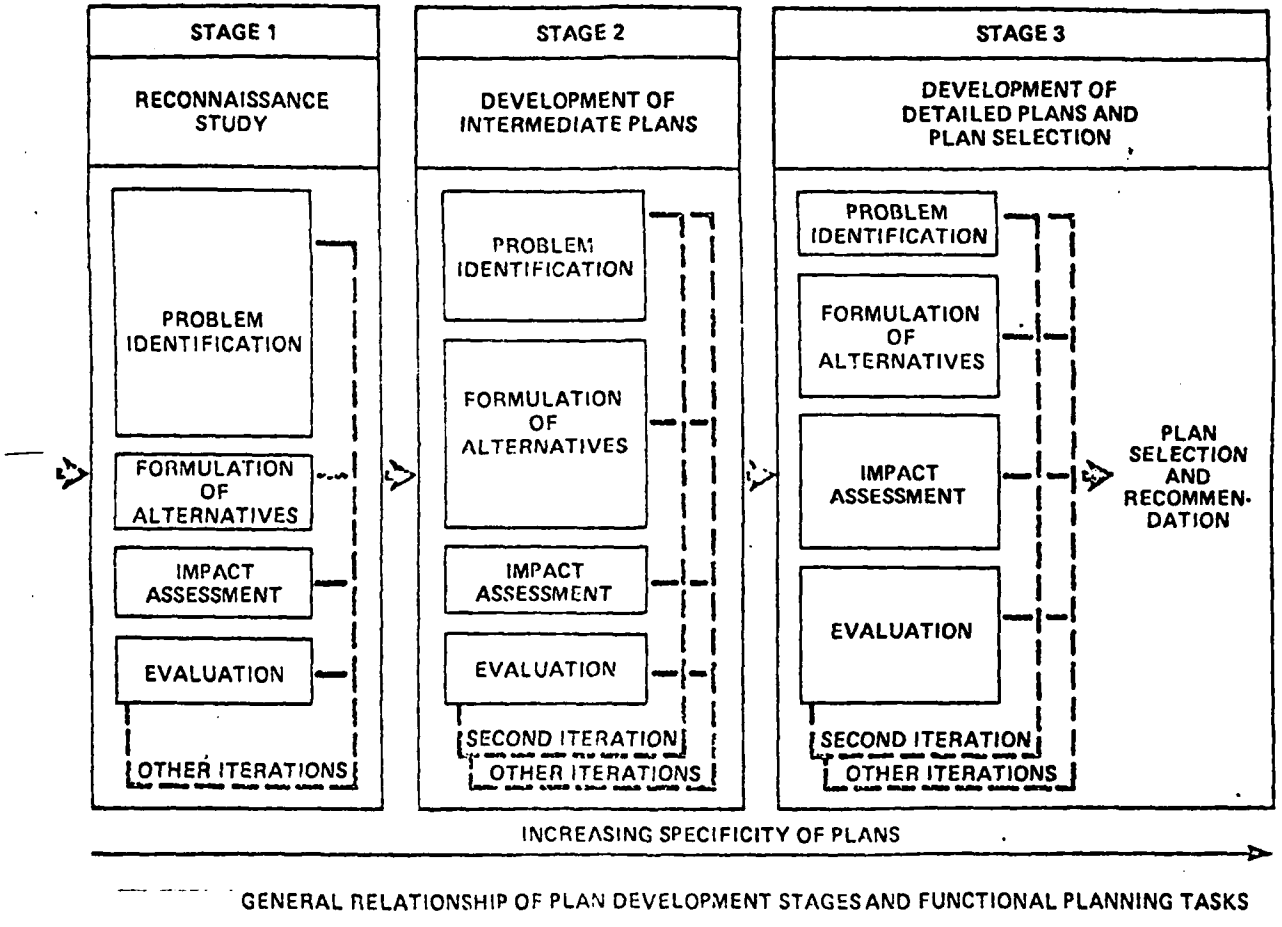
(4) the evaluation and comparison of the alternatives.

FIGURE 4 presents the relationship between the three stages of the study and the four planning tasks.

The GREAT III planning approach involves iteration or partial repetition of the four planning tasks during each of the three stages of the study. The reiteration technique facilitates progress in developing a final plan and implementable recommendations via sequential refinements and improvements. The three stages of plan development are:

Stage 1: The purposes of Stage 1 are: (1) to establish the scope of the study; (2) to determine the specific constraints that will have to be considered during the study; (3) to specify how subsequent planning activities will be accomplished; and (4) to execute the four planning tasks shown in FIGURE 4. In Task 1, the identification of, problems, and the determination of objectives are emphasized. The remaining three tasks will be addressed to a lesser degree during the Stage 1 planning iterations. All four planning tasks will be developed on the basis of available information, coordination and public involvement. The Reconnaissance Report is the result of the Stage 1 planning process.

FIGURE 4
THREE STAGE PLANNING PROCESS



Stage 2: This stage will produce a report that has explored a broad range of alternative management measures. Stage 2 will include a thorough analysis and specific identification of the water and related land resources problems and opportunities in the study area. A set of more complete planning objectives will be developed, and practical alternative solutions to these objectives will be formulated. The social, environmental, and economic effects of each of the alternative plans will then be assessed and evaluated to provide a basis for plan comparison.

Stage 3: The purpose of this stage is to perform the necessary subsequent iterations of the four planning tasks in greater detail. The level of detail will be sufficient to determine the technical, institutional, economic, social and enviromental elements of a plan. Output of Stage 3 will be a final report which emphasizes the detailed assessment and evaluation of a small number of alternatives in order that a final plan may be selected. The more promising of the Stage 2 alternatives will be refined and reevaluated during Stage 3, and more detailed investigations will be undertaken for these remaining alternatives.

Selection of a final river resource management plan will be based upon a multitude of factors including, but not limited to, fulfillment of the planning objectives; contributions to the National Economic Development (NED), Environmental Quality (EQ), Regional Development (RD), and Social Well-Being (SWB) accounts of Principles and Standards (P and S); specified evaluation criteria such as acceptability, completeness, effectiveness, and efficiency; trade-off analyses; and designation of the NED Plan and the EQ Plan.

The study process will continue to involve and seek participation from interested Federal and state agencies and people in the GREAT III study area. To the greatest extent possible, the river resource management plan will reflect the concensus of the public and the participating agencies. Depending upon the nature of the recommendations contained in the final plan, various institutions, both public and private, will pursue the implementation of the individual plan components.

Section IV provides procedures and requirements for further study in Stages 2 and 3 of the planning process. FIGURE 11 displays a general work flow diagram designed to accomplish the GREAT III study.

STUDY DOCUMENTATION

This Reconnaissance Report reflects the results and activities of Stage 1 of the planning process. Stage 2 is documented by a draft of the main report and a series of supporting appendices.

The product of Stage 3 will be a refinement of the draft report and appendices first presented in Stage 2 and will describe the selected plan which best satisfies the objectives of the study. In addition, Stage 3 documentation will also include an Environmental Impact Statement as part of the main report and the final system of accounts displaying the significant beneficial and adverse impacts of alternative plans.

PUBLIC PARTICIPATION

The process of identifying water and related land resources issues, exploring alternatives, and selecting feasible and desirable plans requires a continuous two-way communication process between planners and the interested public. This communication process can provide: (1) consideration of a wider range of alternatives; (2) accumulation of more accurate and detailed study information; (3) early development of public preferences for specific alternatives and detailed analyses of these alternatives; (4) general public acceptance of the planners' work; and (5) public support for the eventual implementation of recommended plans.

The public involvement program for GREAT III as designed by the Public Involvement Work Group is detailed in APPENDIX B. A discussion of how the results of the public involvement program have been incorporated in the Reconnaissance Report is explained in the section which documents the planning process relative to Problem Identification.

FORMULATING A PLAN

An array of alternative management plans will be formulated, each of which meets one or more of the planning objectives. Within this array, one plan, the NED Plan, will be developed which maximizes net tangible economic benefits, thereby providing a benchmark of economic efficiency against which other plans and the effect of trade-offs between plans may be evaluated. In addition, one of the plans to be developed will meet specific planning objectives in such a way as to enhance the environment to the maximum extent possible. This plan will be designated as the EQ Plan.

Formulation and evaluation of alternative plans will be accomplished utilizing the GREAT III multi-agency, inter-disciplinary Team, and the various work groups. In addition, the public involvement work group will provide considerable input during the entire study and the major participants will be identified in the final report. During the course of the study, professionals from various disciplines will contribute to the study effort as the need arises.

Formulation and Evaluation Criteria

To insure analytic objectivity, all plans will be formulated on the same basis and evaluated according to the same standards and criteria.

Engineering Criteria. The selection and design of alternative management plans will be based on the following engineering criteria:

a. Structural and non-structural alternatives will be considered equally in addressing the study objectives.

b. All management plans presented in the final report will be of a type that could be implementable, either by the Corps or by other Federal, State, and local agencies, if the appropriate authority were obtained.

c. Design standards used in the formulation of the alternative plans will be consistent with those established for the respective agencies within whose area the particular responsibility lies.

Economic Criteria. The following economic criteria are established for the formation and evaluation of the NED Plan:

a. Tangible economic benefits must exceed the economic costs.

b. Each incremental unit of a given measure or purpose must provide economic benefits at least equal to its cost.

c. The scope of development will be that which provides the net tangible benefits.

d. Benefits and costs will be expressed in comparable terms utilizing a common period of analysis up to the year 2000, current price levels, and the current interest rate as established by the Water Resources Council.

Environmental Criteria. No plan of improvement will be recommended which will cause the following adverse environmental impacts unless the nonmonetary as well as the monetary benefits clearly outweigh the damages.

a. Destruction or degradation of critical habitat for threatened or endangered species, as designated by the U. S. Department of Interior.

b. Destruction or degradation of archaeological or historical sites considered eligible for nomination to the National

Register of Historic Places without providing cultural resource agencies with an opportunity to comment upon a plan of mitigation.

c. Degradation of air or water quality below state or Federal standards, or below existing conditions, if they are already less than those standards.

d. Destruction or degradation of the environmental quality of any Federal, state, or locally-managed public land and/or water areas such as floodplains and wetlands without full agreement between all affected agencies.

Formulation of Alternatives

Alternative resource management plans will be developed that address the planning objectives. Several activities will be performed in the formulation of alternatives. These activities include identifying a broad range of management measures that can address one or more of the planning objectives; consideration of the plans of others, or parts thereof; and the development of plans that integrate appropriate resource management measures and/or other plans which address the planning objectives.

Impact Assessment

The purpose of this task in the planning process is to identify and measure the likely economic, social, and environmental changes that could be expected to result from the implementation of various alternative plans and the "without condition." Activities of impact assessment involve the determination of the sources of impacts; comparison of each alternative plan with the "without condition" to trace any changes which might occur; description of the magnitude of each change that has been identified; and specification of the incidence of these changes (i.e., location, timing, and duration).

Evaluation of the Resource Management Plans

Four different means of evaluating the alternative management plans will be employed. First, the degree of planning objectives fulfillment will be determined by an examination of the impacts, both intended and unintended, of each alternative management plan. During this process, actual contributions will be distinguished from potential contributions to determine if additional effort should be directed toward realizing potential contributions.

Second, a system of accounts will be set up to display how the significant impacts of each management plan and its individual components contribute to four separate accounts: National Economic Development (NED), Environmental Quality (EQ), Regional Development

(RD), and Social Well-being (SWB). The final system of accounts will display all management plans carried through the final stage of planning.

Third, the following specified planning criteria, either stated in or derived from the Water Resource Council's Principles and Standards, will be applied to each of the plans:

a. Its acceptability to the public.

b. Its completeness (whether all necessary investments and actions needed for attainment of stated benefits are incorporated in the plan).

c. Its effectiveness with respect to its technical performance.

d. Its efficiency in achieving the planning objectives in the least costly way.

e. Its certainty (likelihood that it will attain the planning objectives and the contributions to the NED and EQ accounts).

f. Its geographic scope (the relevancy of the geographic area encompassed by the plan).

g. Its reversibility (the capability of restoring the plan to approximately the same condition if unusual future circumstances so warrant).

h. Its stability (the plan's ability to accommodate a range of alternative futures, data, and assumptions).

Finally, a tradeoff analysis will be conducted to analyze the comparative contributions of the alternative plans. Among other things, this analysis should surface those alternatives which appear to be most acceptable to major segments of the public.

SECTION II

PROBLEM IDENTIFICATION

BASIS FOR PROBLEM IDENTIFICATION

Problem identification regarding the management of the water and related land resources in the GREAT III reach of the Mississippi River has involved eliciting information from the public and incorporating this input with work group data. The array of problems identified in this report represents a synthesis and prioritization of the public's perceptions of problems with those identified by each work group.

The work groups have accomplished specific tasks leading to their problem identification. These tasks included: (1) definition of the study area as it relates to each work group's area of study; (2) a description of base condition; and (3) projecting what may be reasonably expected to occur without any changes in existing resource management programs. From this frame of reference, each work group developed what essentially represented a professional viewpoint of resource management problems.

During 19 through 22 September 1978, a river trip was conducted with the purpose to coordinate and acquaint GREAT III participants with the reach of the Mississippi River from Saverton, Missouri to Cairo, Illinois. This trip afforded approximately 100 persons, representing various public and private interests, an opportunity to collectively visit recreation areas, dredged material placement sites, side channels, islands, dike fields and revetment location.

Between 2 November 1978 and 20 November 1978, five public workshops were held at locations along the GREAT III reach of the River. These locations were Louisiana, St. Louis, and Cape Girardeau in Missouri; and Alton and Chester in Illinois. The purpose of these meetings was two-fold: (1) to explain the study to the interested public and (2) to begin the planning process by identifying problems resulting from the many uses of the Mississippi River. As a result of these workshops and other public involvement activities, approximately 440 problem statements were identified by a broad range of interests.

Each work group reviewed the entire list of public input and utilized a six-step process to consolidate public and professional perceptions of resource management problems:

STEP 1: Selecting problem statements within their areas of study.

STEP 2: Eliminating duplicative problem statements and/or combining overlapping problem statements.

STEP 3: Eliminating problem statements based upon the following criteria:

a. Beyond the scope of GREAT.

b. Previously studied or being studied by another program.

c. Under study in GREAT I.

d. Under study in GREAT II.

STEP 4: Synthesizing where appropriate problem statements with professional prescriptions of problems.

STEP 5: Adding remaining problem statements to the array of professional perceptions of problems.

STEP 6: Prioritizing the combined array of public and professional problem perceptions.

The results of this screening and prioritization process by the individual work groups is presented at the end of Section II. It is significant to note that only approximately 10 percent of the concerns expressed by the public at the five workshops will not be considered in Stage 1 of the planning process. The omission of problems identified by either the public or professional participants is due to 2 factors: (1) beyond the scope of study and/or (2) the problem has been or is presently under examination by another program. During Stage 1, the public has been informed of this process and the results. A report was made available to the public providing a list of the problem statements as well as the specific responses, by work group, to every concern expressed by the public at the workshops.

NATIONAL OBJECTIVES

A resource management plan for the GREAT III study will be formulated within the multi-objective planning framework as prescribed in Principles and Standards. Principles and Standards requires that Federal and Federally-assisted water and related land planning be directed in such a way as to achieve the equal national objectives of National Economic Development (NED) and Environmental Quality (EQ). NED is achieved by increasing the value of the nation's output of goods and services and improving national economic efficiency. EQ is achieved by the management, conservation, preservation, creation, restoration, or improvement of certain natural and cultural resources and ecological systems.

BASE CONDITION

The base condition represents a composite of the existing economic, social and environmental characteristics of the study area. Description of the base condition is divided into two sections: (1) general information covering characteristics such as land use, establishment of the navigation pools, geology, soils, groundwater, climate and weather, population trends, socio-economic elements, and water use needs; and (2) more specific descriptions of the vase condition which have been developed using the perspectives of the study participants in each of the work groups.

Geology

The Mississippi River in the GREAT III reach follows a major boundary line for landform regions in the Central United States. The study area north of Crystal City, Missouri, is in the Central Lowland Province. South of Crystal City the River enters the Ozark Plateaus Province. Between Cape Girardeau, Missouri, and Thebes, Illinois, the River flows into the Coastal Plain Province.

The flood plain of the Mississippi River in the GREAT III reach averages about 5 miles in width. The alluvial valley widens considerably in three areas: (1) at the confluence of the Mississippi, Illinois, and Missouri Rivers in St. Charles County; (2) the American Bottoms in Madison and St. Clair Counties, Illinois, and (3) where the River enters the coastal plain.

During the Pleistocene Epoch, or Ice Age, the Mississippi Valley was filled with outwash from the melting glaciers. After the last glacier withdrew from the Mississippi River drainage area, the river began to scour and remove the glacial sands and gravel. During recent times, subsequent river changes and flooding have created the present-day flood plain landforms and have deposited upon the glacial valley-fill the modern alluvial soils.

Soils

The soils in the valley are located in four basic positions: (1) materials found at the foot of the bluff consisting of reworked silty loess, bedrock, or glacial drift. The soil which develops on these parent materials are coarse in texture, have good drainage, and are moist but not wet; (2) terraces, which are remnants of flood plain levels of ancient stream regimes, are more common in tributary valleys, found adjacent to the bluff. These terraces are sometimes referred to as "second bottoms" and may be remnants of Pleistocene sands and gravels which were deposited as glacial streams aggraded. Some terraces may be more of recent origin and consist of finer sediments than the Ice Age terraces; (3) low areas, such as depressions, old water courses, and sloughs are additional flood plain features. Gumbo is the common name for the soil found in

these areas. These soils are usually high in clay content and are very wet; and (4) higher areas in the flood plain were at one time sand bars, natural levees, or islands. These soils are composed of sands or silts and are usually moist but not wet.

Groundwater

Data on groundwater potential and supply in the GREAT III study area are available primarily for the St. Louis area including the American Bottoms between Alton and Dupo, Illinois. It has been assumed that the layers of pervious sands and gravels which cover the bedrock of the Mississippi River Valley are excellent aquifers. The thicknesses of these layers of coarse sediments vary from 70 to 100 feet. Industrial and municipal pumpage accounts for most of the water withdrawals in the American Bottoms. Yields of 1,000 gallons per minute and over are common for individual wells.

Climate and Weather

The movement of large masses of air into the GREAT III region is a major climatic control. Dry, cold air from Canada covers the area occasionally. A large percentage of total precipitation, however, occurs when warm, moist air from the Gulf of Mexico dominates. The alternate invasion of air masses from these sources and the conflict along their frontal zones produce a variety of weather conditions, none of which persist to the point of monotony. The climate of the region is transitional between humid continental with hot summers and mild winters and humid subtropical with its very mild winters.

Average annual precipitation is slightly over 35 inches, with about 14 inches per year of snow at St. Louis and 8 inches per year at Cairo. Severe droughts occur from time to time, such as in 1954 and 1964. Flooding, the other extreme, is occasionally a problem when snowmelt and certain hydrologic factors combine, such as in 1973.

The mean monthly temperatures range from 50 degrees Fahrenheit at the northern edge of the region to 58 degrees Fahrenheit at Cairo. The average July temperature is 79 degrees Fahrenheit at St. Louis and Cairo. The average January temperature ranges from 32 degrees Fahrenheit at St. Louis to 36 degrees Fahrenheit at Cairo.

Air quality in the GREAT III area, except for the St. Louis region, is relatively good due to the predominantly rural character of the area. The sparse population and the remoteness of the few point sources aid in the dissipation of air pollution.

Socio-Economic Elements

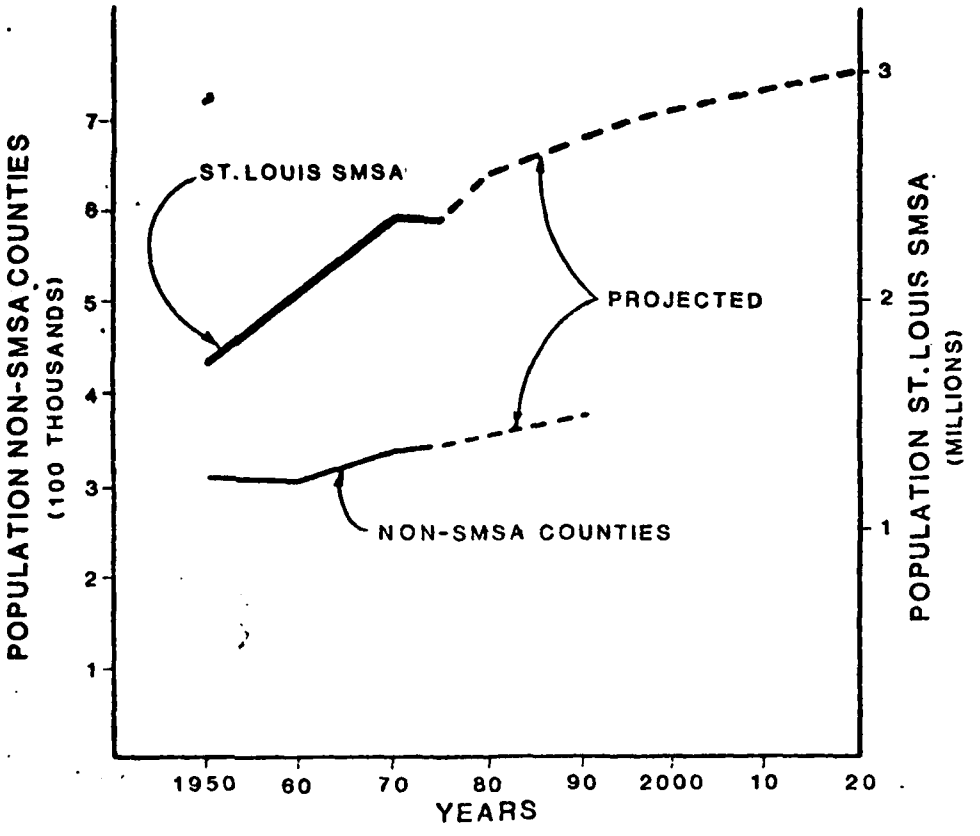
This section presents a general socio-economic profile of the GREAT III study area. The first tier of counties on either side of the river that generally comprise the GREAT III study area are not likely to have many socio-economic characteristics that would distinguish them from adjacent counties. Pertinent comparisons below are therefore drawn primarily in terms of differences between the St. Louis Standard Metropolitan Statistical Area (SMSA) and non-SMSA portions of the GREAT III study area. Two counties in the St. Louis SMSA, Franklin and Clinton, are not officially part of the GREAT III study area, but have been included in the profile since the socio-economic data is aggregated at the SMSA level. The population contribution of these two counties to the SMSA is not large.

Population Characteristics The 1975 population for the GREAT III study area, as estimated by the U.S. Census, was 2,619,300. This figure represents a two percent decrease from the 1970 total of 2,662,538. Approximately 87 percent of this population is concentrated in those counties contained in the St. Louis SMSA. From 1960-1970, most of the study area's population growth was concentrated in the St. Louis SMSA. Migration rates for 1960-1970 were 0.8 percent and -1.6 percent for the SMSA and non-SMSA study area counties. Since 1970, there is some evidence that migration may be shifting away from large metropolitan areas to non-metropolitan areas. Population change between 1970 and 1975 supports this hypothesis; during this time period, the SMSA portion of the study area experienced a decrease of 50,059 persons, while the non-SMSA counties as a group has a two percent net increase (6,358 persons). Of course, several SMSA counties, e.g., St. Charles and Jefferson Counties, continued to experience strong growth during 1970 through 1975, and some non-SMSA counties continued to lose population.

Population Trends. FIGURE 5 presents historical and projected population totals for the GREAT III study area. Projections for the St. Louis SMSA are from OBERS, Series E; while projections for non-SMSA counties were obtained from official State population forecasts.

Employment and Industry. A comparison of the GREAT III study area's employment and industrial mix with that of the United States reveals that the study area has relatively more employment in the transportation and wholesale trade industries and is relatively under-represented in agricultural, forestry, and fisheries, and mining activities. These statistics point to the fact that the GREAT III region is a transportation corridor containing rail lines, waterway transportation, and north-south highways. This intermodal transportation network has facilitated the development of a more intense commercial infrastructure within this corrdior.

HISTORICAL AND PROJECTED POPULATION, GREAT III STUDY AREA



LEGEND:

ST. LOUIS SMSA

NON-SMSA COUNTIES

PROJECTED

SOURCE:

U.S. CENSUS OF POPULATION
OBERS, SERIES E
STATE OF ILLINOIS
STATE OF MISSOURI

FIGURE 5

Social Well-Being. This section presents several indicators related to the social welfare of the study area's population. The indicators relate to standard of living, employment opportunities, and general satisfaction with the region. Specific indicators and measures chosen to address the social well-being categories are shown in TABLE 4.

These indicators present a profile of welfare at a general, aggregate level. They obscure substantial inequities in the distribution of social welfare components within the population. To present a somewhat clearer picture of the distribution of social welfare within the GREAT III study area, indicators are disaggregated on the basis of SMSA and non-SMSA counties. TABLE 5 presents these social well-being indicators.

Energy. The Mississippi River influences both the regional and national energy situation serving as a primary transportation corridor for bulk commodities and as a source of water supply for thermal electric generating plants. Description of the fuel efficiency of water transportation is discussed further in the Base Condition relating to Commercial Transportation and Industrial and Economic Development. The present focus of national policy on energy is toward a decrease in dependence on imported oil with an increased emphasis on the production of domestic oil. A shift to a substantial use of coal is also being stressed. Transportation of coal by barge is presently an efficient method and is the preferred fuel for electrical power generation. Appropriate consideration will be given to the efficient utilization of energy resources in the development of the river resource management plan.

TABLE 4
SOCIAL WELL-BEING COMPONENTS, INDICATORS, AND MEASURES

Social Well-Being Component	Indicator	Measure
Standard of Living	Income	Median Family Income
	Poverty Status of Population	Percent of Families With 1969 Income below Poverty Line
	Housing Quality	Percent of Homes Not Having All Plumbing Facilities
Employment Opportunities	Unemployment	Unemployment Rate
General Satisfaction with region	Migration	Net Migration Rate

TABLE 5
SOCIAL WELL-BEING MEASURES, GREAT III STUDY AREA

Indicator	SMSA	Non-SMSA Counties	United States
Income (median family income)	$10,503	$7,504	$9,589
Poverty (percent families below poverty line, 1969)	8.1	15.9	10.7
Housing Quality (percent homes without all plumbing)	3.6	12.5	5.5
Unemployment (unemployment rate, 1970)	4.9	4.4	4.4
Migration (Net migration rate 1960-1970)	.8	-1.6	-

Source: U.S. Census of Population

Water Use Needs

Consumptive Uses. The water needs and consumption presented are based on water withdrawal and consumption data as developed for the study area by the Upper Mississippi River Basin Commission in its Level "B" Study Phase II - Report.

The information in the above report was abstracted from the Water Resources Council Second National Assessment using National Future (NF) for withdrawals and consumption, and OBERS, Series E data for domestic, commercial, institutional, and manufacturing uses. The estimated water requirements for functional uses in 1980, 1990 and 2000 are shown in TABLE 6.

Instream Uses. Instream uses include hydroelectric power production, navigation, water oriented recreation and fish and wildlife habitats. Many of these functional uses are simultaneous so that flow needs are not necessarily additive. The flow needs provided for Alton, Illinois and Cape Girardeau, Missouri are based on information provided in the Upper Mississippi River Basin Commission, Level "B" Study, Phase II - Report (TABLE 7).

General Patterns of Land Use

Navigation Pools. Over one-half of the land in the upper or pooled portion of the study area is devoted to agriculture. This proportion roughly holds for the entire stretch of the Upper Mississippi River, from the head of navigation to St. Louis. Along Pools 24, 25, and 26, agriculture is found on the neighboring uplands, the alluvial plain, and some of the larger islands, particularly those with road or dike access. Yet, while agriculture seemingly is one of the more primal activities, as compared to urban, it has caused substantial alteration of the natural environment. Steep slopes are grazed or plowed, contributing to the erosion of the land. On the alluvial plain, agriculture has displaced large areas of native forest and has served as an impetus for the construction of extensive levee and drainage systems.

Land use on the alluvial plain of Pool 24 is dominated by agriculture, which takes up approximately 70 percent of the area. On the floodplain, agriculture is removed from the River and located generally, on higher ground. Agriculture probably could not exist at its present magnitude without the flood protection afforded by the levees. Agricultural use of the floodplain in Pool 25 amounts to about 60 percent. The broad west side of the floodplain is leveed it entire length and holds the bulk of Pool 25's agriculture. Pool 26 land use on the alluvial plain is predominately agricultural, comprising approximately 60 percent of the area. On the floodplain, agriculture is removed from the river, usually buffered by a corridor of forest. Agriculture on the floodplain exists without benefit of any major levees.

TABLE 6
VOLUMETRIC REQUIREMENTS BY FUNCTIONAL USE:
GREAT III STUDY AREA

(Millions of gallons per day)

Functional Use	1980		1990		2000	
	Withdrawal	Consumption	Withdrawal	Consumption	Withdrawal	Consumption
Domestic Commercial & Institutional	265	47	290	49	293	48
Manufacturing	373	82	223	107	201	146
Mining	8	1	10	1	12	2
Livestock	9	9	10	10	10	10
Irrigation	11	9	15	12	19	16
Steam Electric Power Generation	1481	43	1169	96	1055	189
TOTAL	2147	191	1717	275	1590	411

Note: Columns may not add due to independent rounding.

Source: Upper Mississippi River Basin Commission, Level B, Phase II Report.

TABLE 7
INSTREAM USES - GREAT III STUDY AREA
(Millions of Gallons Per Day)

Functional Use	1980		1990		2000	
	Alton	Cape Girardeau	Alton	Cape Girardeau	Alton	Cape Girardeau
Hydroelectric Power	398	0	795	0	795	0
Navigation	4590	27,184	4735	28,090	4780	28,115
Recreation	3571	5473	3939	5953	4524	6786
Fish and Wildlife	4602	6438	5432	7351	6539	8568
Water Quality	305	292	309	253	317	182

Median Annual Flow:
Alton: 62,839 Cape Girardeau: 120,645

Minimum Monthly Median Flow:
Alton: 36,452 Cape Girardeau: 67,492

Note: The needs for individual use categories are not additive because of multiple uses.

Source: This data was interpolated from "Second National Assessment".

Forest is defined as areas covered by trees, but not in agricultural use. Forest is the second ranking land use and is generally found where agriculture does not take place due to physical restrictions. Thus, forest will occur in linear fashion along streams, bands of the River, ditches, steep upland valley walls, in small scattered clumps around lakes or in large bodies in natural low areas on the alluvial plain.

Public open land refers both to ownership and land use. This category refers to all large plots of land owned and/or administered by either state or Federal government. This public land is primarily confined to low areas on the alluvial plain, adjacent to the River, and some of the islands in the River. Most of the public land is managed as refuges by either the U.S. Fish and Wildlife Service, the Illinois Department of Conservation, or the Missouri Department of Conservation.

Wetlands and lakes are frequent in the study area, especially on the alluvial plain, but still account for only a small portion of the area's land use. Wetlands are areas which have intermittent water, occuring in low areas, near lakes and the River. Lakes have water year-round and are usually remnants of a former river channel.

Urban development is the most conspicuous land use in the study area. Yet, the total area of development is far less than that of agriculture or forest. Except for Alton, Illinois, the urban developments are moderate in terms of the extent of physical development and offer central place functions normal of inland central places (i.e., farming communities). With only a few exceptions, the towns are regularly spaced along the river and are located on the transition zone of upland-alluvial fan-alluvial plain. Undoubtedly, the settlements began on the upland or alluvial fan, above flood stage, but later extended down onto the alluvial plain, exposing themselves to flood threats. Scattered free standing residential structures occur along the River, but not of significant magnitude. These are mostly farmsteads or small developments. The same is true of the magnitude of freestanding commercial/industrial developments.

Transportation facilities not only comprise a major use of land, but also more importantly add to the character and development of the land by way of relative accessibility. The Upper Mississippi river area possesses good inter- and intra-regional accessibility of highway, rail, and water. All three modes of transportation run north-south through the area and rail and highway provide east-west accessibility.

Open River. Present land use on the flood plain is carried on despite its wet origin and history of flooding. Of the nearly 78,000 acres of flood plain, agriculture is the dominant land use with 34,800 acres. Other major land use categories include lake and backswamp, woodland, urban, and industrial.

Agriculture is located on both the flood plain proper as well as the larger islands, supplanting woodland at the higher, more favorable sites. Farmers cleared forests for farming and built small levees to protect their crops. During the 1930's, the first federal programs for levee construction began leading to the present flood protection and surface drainage. Flood protection and drainage in this reach of the river provide for a complex pattern of agricultural, transportation, industrial and residential needs. Woodland, in turn, has been relegated to the lower areas which are susceptible to periodic flooding, and thus too wet to farm. Woodland occurs along streams, lakes, backswamps, side channels, and the river, on both the flood plain and the islands. Backswamps and lakes on the flood plain are widely scattered, and most occur in the long, linear bodies, indicating an origin as a meander scar. Lakes also occur at side channels or chutes which have been purposely closed by dikes, thus forming a lake. Backswamps occur at low areas which have only been partially drained or at eutrophic lakes.

Urban land, as a small use type makes up only a small percentage of the floodplain. Primary urban centers along the open portion of the river included the St. Louis metropolitan area, Ste. Genevieve and Cape Girardeau, Missouri and Chester, Illinois. In addition, there are smaller river communities such as Herculanium and Commerce, Missouri and Prairie de Rocher, Grand Tower and Thebes, Illinois. Industrial land, which is found near communities or adjacent to the Mississippi River, also represents a small percentage of land use. Industrial types on the floodplain include electric power plants, quarries, manufacturing, and terminal transport facilities.

Recreation is a floodplain use that takes place on a limited scale. Present opportunities for public access are relatively few. Public access to the river is limited by private ownership of the shoreline and intervening lands between the highways, railroad tracks and the river. The river's islands and side channels are utilized for duck and goose hunting, small game hunting, fishing and trapping.

Establishment of Navigation Pools by Locks and Dams

By 1925, it was determined that it would not be possible to attain adequate navigation depths by channel contraction methods alone. A 9-foot navigation project was authorized in 1930 and work on the navigation dams within the St. Louis District was begun in 1934 (TABLE 6).

TABLE 8
NAVIGATION POOL DATA

Pool	Date Put into Operation	Pool Length (miles)	Width (feet)	Water Surface Area (acres)	Pool Elevation (feet, msl)
24	1940	27.8	1,900-2,300	13,000	449.0
25	1939	32.0	1,300-2,500	18,000	434.0
26	1938	38.5	1,900-2,700	30,000	419.0

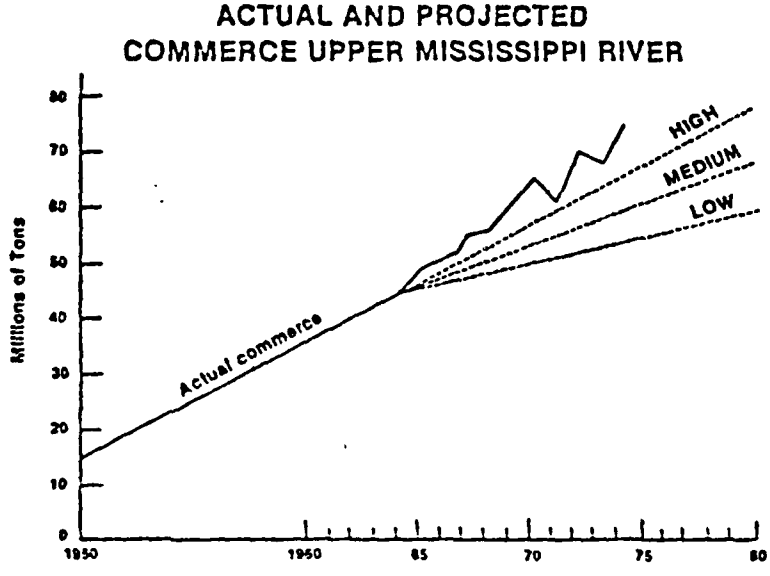
The purpose of the series of dams is to create semi-slackwater pools for navigation during periods of low and medium flows. The purpose of the locks is to pass river traffic vertically from one pool level to another. When the inflow is sufficient to sustain navigation without the dams, the gates of the dams are lifted out of the water allowing stream flows to pass. The dam structures were constructed as single purpose navigation structures and, thus, were designed to have no control or effect on flood stages.

Commercial Transportation

Commercial river navigation was developed in response to a vital need for the transportation of people and merchandise. While the character of river traffic, and the goods carried, have drastically changed from the early years, river transportation has grown to help meet the increased demands for transportation. Commercial navigation, air, rail, pipeline and highway form a complex transportation system each with its unique characteristics, advantages and disadvantages. As demonstrated in FIGURE 6, each year the volume of commodities carried on the Upper Mississippi River has exceeded predictions made for the Upper Mississippi River Basin in 1964.

The importance of transportation cannot be over emphasized. It affects jobs, the quantity and quality of products available, local and national economies, as well as international trade and the balance of payments. Some people living in river towns such as St. Louis, as well as other parts of the country, do not realize the importance of transportation, and water transportation in particular, upon their daily lives. (Kearney, 1974) The advantages of water transportation include a great capacity for carrying bulk cargo as illustrated in FIGURE 7 and unusually large and heavy equipment. FIGURE 8 shows that water transportation is a low cost mode of transportation. The fuel efficiency of water transportation is demonstrated in TABLE 9. It is also considered the safest mode

FIGURE 6



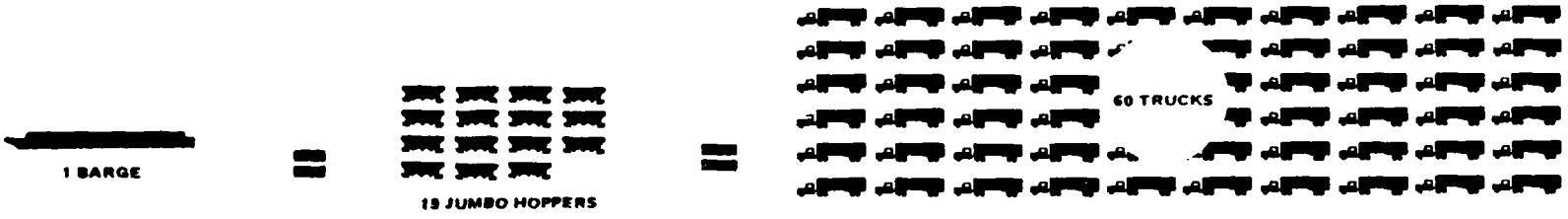
Source: Upper Mississippi River Basin Commission. 1975. *Decision Oriented Information Base.*

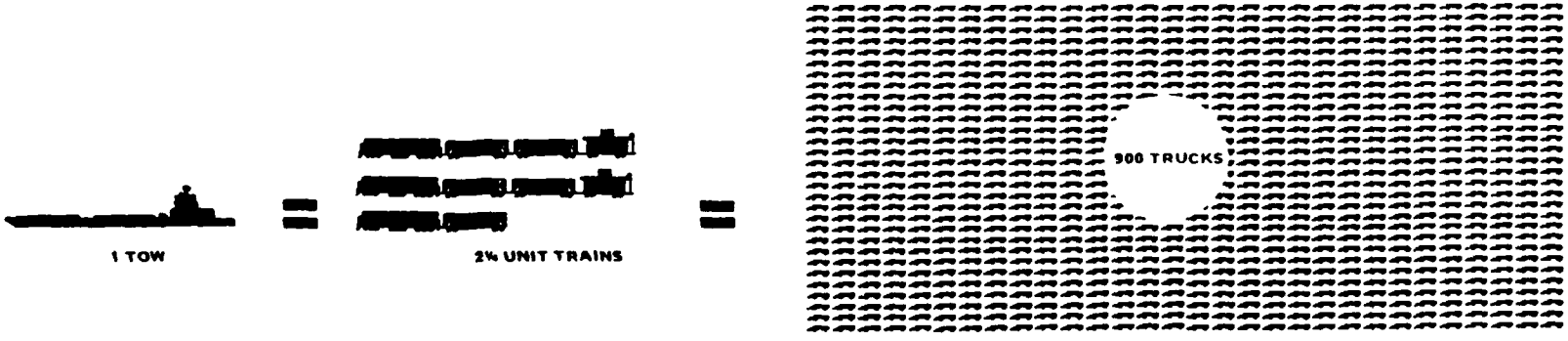
COMPARE

CARGO CAPACITY

BARGE	15 BARGE TOW	JUMBO HOPPER CAR	100 CAR UNIT TRAIN (GRAIN)	LARGE SEMI
1500 TON	22,500 TON	100 TON	10,000 TON	25 TON
52,500 BUSHELS	787,500 BUSHELS	3,500 BUSHELS	350,000 BUSHELS	875 BUSHELS
453,000 GALLONS	6,804,000 GALLONS	30,240 GALLONS	3,024,000 GALLONS	7,560 GALLONS

EQUIVALENT UNITS





EQUIVALENT LENGTHS

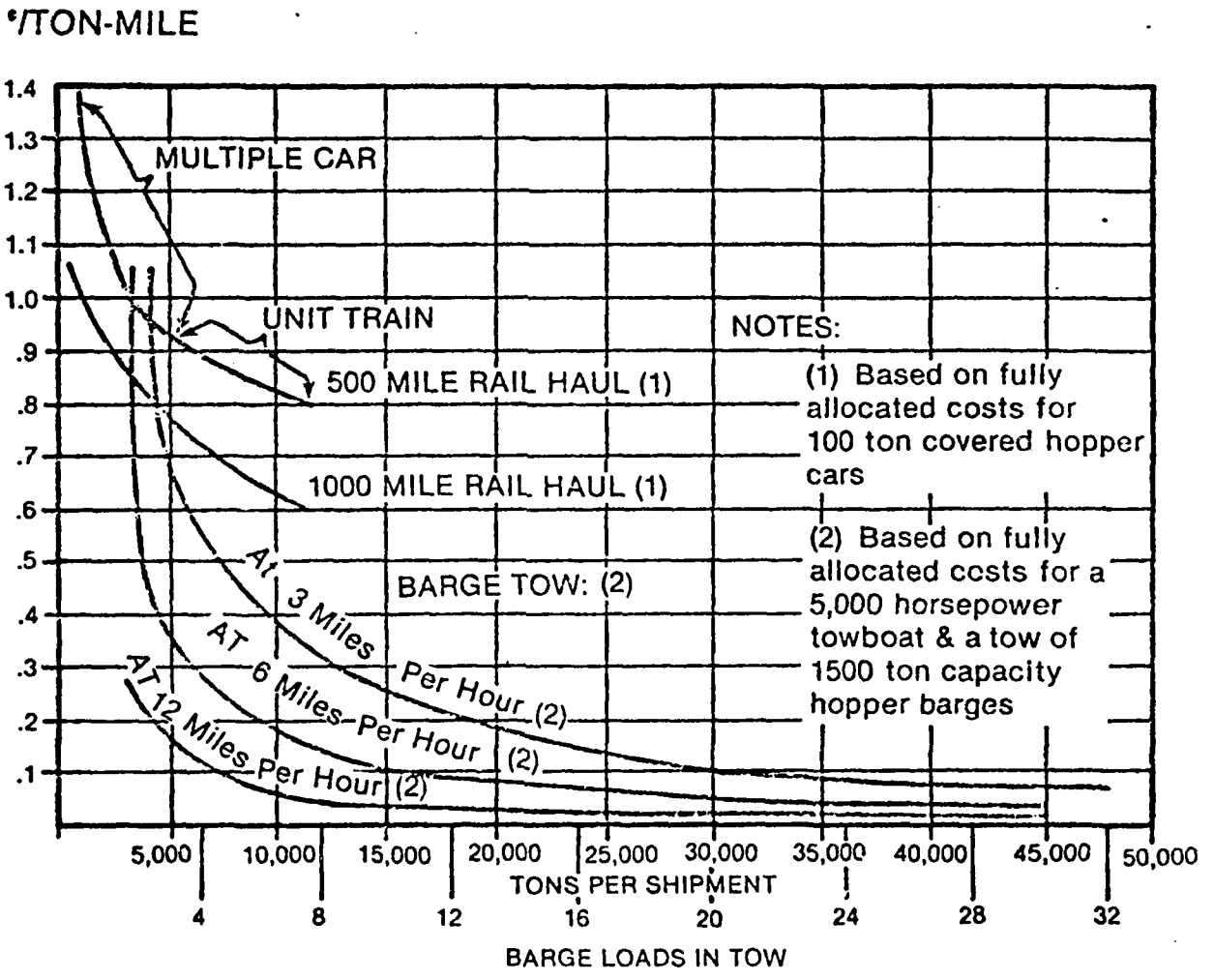
¼ MILE	2¼ MILES	36 MILES
15 BARGE TOW	2¼ UNIT TRAINS	ASSUMING 150 FT. BETWEEN TRUCKS

Prepared by:
Planning and Research Division
Iowa Department of Transportation

FIGURE 7

FIGURE 8

LINE-HAUL COST RELATIONSHIPS
RAIL VERSUS BARGE



Source: DOMESTIC WATERBORNE SHIPPING MARKET ANALYSIS, February 1974, A.T. Kearney, Inc.

TABLE 9

ENERGY INTENSIVENESS - RAIL VERSUS WATER

(in BTU/ton-mile)

Author	Source	Data Years	Rail	Unit Train	Water
Hirst, Eric	Energy Consumption for Transportation in the United States. March 1972. Oak Ridge National Laboratory, ORNL-NSF-EP-15.	Mid-1960's	680		540
Hirst, Eric	Intensiveness of Passenger and Freight Transportation Modes: 1950-1970. April 1973. Oak Ridge National Laboratory, ORNL-NSF-EP-44.	1970	670		680
Rice, Richard A.	Energy Efficiencies of the Transport System. Transportation Research Institute, Carnegie-Mellon University. Doc. no. 730066.	1967-70	680		567
Rice, Richard A.	System Energy and Future Transportation. MIT Technology Review, January 1972.	1967-70	324-567		567-618
Moor, William E.	The Effect of Fuel Price Increases on Energy Intensiveness of Freight Transportation. December 1971, Rand, R-804-NSF.	1968-67	706		570
Peat, Marwick and Jack Faucett Associates	Industrial Energy Studies of Ground Freight Transportation, SIC Codes 4011, 4013, 4041, 4212, 4213, 4214, 4231. July 1974.	1973	700	330	500
Sebald, Anthony V.	Energy Intensity of Barge and Rail Freight Hauling. May 1974, Center for Advanced Computation, University of Illinois at Urbana-Champaign. CAC Technical Memo. NO. 20.	1971	639-711	226-359	785
Tihansky, Dennis P.	Methods for Estimating the Volume and Energy Demand of Freight Transport. December 1972, Rand, R-988-NSF.	1965-67	750		500
Batelle Memorial Institute	Energy Required for Movement of Intercity Freight.		475-580		-
Reebie Associates	(Referenced in Peat, Marwick, Mitchell/Jack Faucett study)		544		-
Mascy, A.C. & Paullin, R.L.	Transportation Vehicle Energy Intensities. June 1974, NASA/DOT.	1974	330-550		-
National Petroleum Council	Transportation Task Group Interim Report Phase 1.	1973	-		510
Brinegar, Claude S.	Statement before the House Appropriations Subcommittee on Transportation, March 5, 1974.	1973	771		462
Cook, Harry N.	Letter to DOT Secretary C.S. Brinegar from National Waterways Conference, Inc., February 4, 1974.	1961-68	-		217-415
A "Major" Railroad	Reported to U.S. Transportation Systems Center		314-504		-
Upper Mississippi Waterway Association	The Economic Impact of Waterborne Transportation on the Upper Mississippi River Basin. June 1975.	1972	679		331
Barloon, Marvin	Reported in Upper Mississippi Waterway Association Study.	1970	650		416
Southern Pacific Railroad	Reported in Upper Mississippi Waterway Association Study.	1973	238		-
U.S. Army Engineer District St. Louis, Missouri	Locks and Dam No. 26 (Replacement) Design Memorandum No. 11 Formulation Evaluation Report, Volume 2, Appendix F. April 1975.	1971	711		649

SOURCE: River Transportation in Iowa, Iowa DOT. May 1978

of transportation (Little, 1974). To ensure safety there are strict regulations for vessels, cargos, and licensing of towboat operators. Terminals and fleeting areas located adjacent to the navigation channel provides for the efficient transfer of cargo and handling of barges.

Because water transportation cannot serve all inland facilities directly, terminals are developed to interface with other transportation modes in accomplishing a total transportation network. Technological development has led to vast improvements in marine productivity over the past 40 years. Improvements in propulsion, navigation and control have cut crew size in half. The net result is an approximate forty-fold increase in productivity per man in the last 40 years. Diesel engine improvements, the kort nozzle, radar, bow-thrusters and telecommunications have allowed marine operators to increase maximum tow size from 5,000 to 50,000 tons. Further example of this is a 70-80 percent increase in tons per tow passing through Locks No. 26 between 1946 and 1974. Equipment advances have made this increase possible.

The National objectives for water transportation are stated in Title 49 U.S. Code of Federal Regulations establishing the U.S. Dept of Transportation. They are summarized as follows:

a. Increase economic efficiency and service

b. Improve safety and security

c. Lessen unfavorable environmental effects

d. Minimize adverse effects of energy constraints

e. Support other national interests

In the GREAT III area, the U.S. Army Corps of Engineers is authorized by various Congressional Acts since 1927 to maintain a 9 foot navigation project for commercial navigation. The project has been maintained in accordance with Congressional and Corps interpretations that include allowances required for advance maintenance dredging, dredging tolerances, squat and trim for the class of vessels for which the project was designed, wave action, shoaling rates, and other overdepth allowances necessary to afford safe navigation for vessels with a draft of 9 feet. Above St. Louis, a series of locks and dams insure adequate water levels for navigation. The locks allow for passage of vessels from one water level to the next. They also limit the river system capacity in two ways. First, tow size is limited by the physical dimensions of the lock. As a result barge tows in the pooled reaches of the river rarely exceed 15 barges. Second is the limitation caused by delays and constrictions to passing vessels. A lock can only pass vessels

in one direction at a time and takes approximately 1 hour and 45 minutes to accomplish a one way passage. On open reaches of the river tows of 45 barges are not uncommon and pass each other easily and safely in a short period of time.

Locks and Dam 26 has caused delays to commercial traffic of several days during peak periods. Recent legislation has authorized the construction of a new dam and single lock 1200 x 110 feet to accommodate existing traffic demands. The law also contains provisions for future expansion.

Maintenance of the navigation channel is accomplished by periodic dredging in conjunction with regulating structures, however, channel maintenance problems are quite different in the pooled and open portions of the river. Dredging plant capability, environmental and economic concerns are factors which are considered in the disposal of dredge material. There are some pressures to change existing channel maintenance practices. This may have a serious effect upon the efficiency and safety of water transportation. The demand for transportation is increasing each year while at the same time it is becoming more and more difficult to provide the increased service. This is primarily the result of legal and institutional constraints, and the growing competition for specific pieces of available land by environmental, recreational and industrial interests. Much of the study area, however, is under utilized and remains available for multipurpose use. Commercial navigation support facilities tend to be developed where there are existing industries or areas that use or produce the commodities shipped by water, ample manpower supplies, support industries, and other transportation terminals. Environmental interests perceive an adverse effect to the environment from water transportation. There is also a general increased awareness by the public, water transportation industry, and government agencies for the preservation of our environment. Environmental concerns include water quality, bank erosion, and fish and wildlife habitat. Industrial, navigation interests and government agencies are aware of the increased emphasis on environmental concerns and are working to achieve a balanced approach. Both the environmental and economic issues are being identified and considered in current planning.

The Federal Government, through the U.S. Army Corps of Engineers and the U.S. Coast Guard, administer management programs for commericial navigation and channel maintenance. Other federal agencies manage river resources that have a limited, but never the less important, effect upon commercial navigation.

Bi-State Development Agency was created by legislative acts in Missouri and Illinois, and approved by the U.S. Congress. Their charter is to coordinate and assist many of the individual port districts or authorities existing in the Port of Metropolitan St. Louis area. A product of their activities is a Development Plan

for the Port of Metropolitan St. Louis to the year 2000 based upon a study by A.T. Kearney Co. (Kearney, 1974) Industrial and navigation interests also have plans that affect the river resource, but due to the competitive nature of their business, those plans are not generally known.

Cultural Resources

The Mississippi River Valley in the GREAT III area possesses a long and complex cultural history. The fertility of the alluvial bottomlands and the availability of a variety of resources in both bottomlands and adjacent upland areas have attracted people to this region for about the past 14,000 years. Changing adaptive strategies and increasingly specialized technological capabilities has resulted in an intensive and varied exploitation of the area's resources.

Prehistoric cultural activity in the midwestern United States has generally been divided into six chronological periods: Early Man, 20,000 B.C. or earlier; Paleo-Indian, 12,000 - 8,000 B.C.; Dalton, 8,000 - 7,000 B.C.; Archaic, 7,000 - 1,000 B.C.; Woodland, 1,000 B.C. - A.D. 900; and Mississippian, A.D. 900-1700. Historic cultural activity is considered to be from A.D. 1700 - present. However, it cannot be assumed that boundaries between time periods are well-defined. It is often the case that some cultural resources represent a transitional period between major cultural traditions or a period of temporary contact between cultures.

The Early Man Period (20,000 - 12,000 B.C. or earlier) refer to the time when people first entered the area. It has been very difficult to describe this period accurately due to lack of evidence. It is possible that people were hunting and gathering in the Mississippi River Valley at this time although no conclusive data has been found in the area. Other Early Man sites have been examined in Missouri (e.g., Schriver Site at Kansas City dates geologically at 18,000 years.) In 1860 it was believed that stone tools had been found in association with mammoth and mastodon remains at Kimmswick, about 25 miles south of St. Louis in Jefferson County, Missouri. However, the association between the bones and the tools remains questionable but still possible. It is up to future investigations to be aware of this possibility and to search carefully for evidence of these early inhabitants in the GREAT III area.

The Paleo-Indian Period (12,000 - 8,000 B.C.) generally refers to a time when small nomadic bands or family groups were organized, having a hunting-gathering subsistence pattern based on seasonal mobility. Their lithic technology has been characterized by the fluted projectile point. Fluted points have been found in the GREAT III area but often the lack of precise locational information and

other site-specific data prevents any conclusive statements from being made. The greatest concentration of known Paleo-Indian evidence in the GREAT III reach is along the main stream of the Mississippi, Missouri, and Ohio rivers.

The Dalton Period (8,000 to 7,000 B.C.) is a transitional period between Paleo-Indian and Archaic and is thought to represent a subsistence shift from an emphasis on hunting to one including foraging. The diagnostic technological attribute of this period is the serrated Dalton style projectile point or knife form. Few Dalton sites have been reported north of the confluence with the Missouri River while a relatively greater number of sites have been found further downstream. As with the Early Man and the Paleo-Indian Period the Dalton Period also lacks the specific site information necessary for more detailed descriptions of cultural activity during this period.

During the Archaic Period (7,000 - 1,000 B.C.) subsistence activities became more diversified as the Archaic people began concentrating more on foraging as a major economic activity. The importance of foraging is well-portrayed by the stone tools found in Archaic sites which show an increase in the manufacture of special purpose tools used in collecting and preparing a variety of wild plant foods. By the end of this period critical changes seem likely to have occurred stimulating a shift from foraging to an emphasis on horticultural practices. Archaic sites have been found in the GREAT III study area and a few well-preserved sites have been excavated. The greatest hindrance to studying the Archaic, Dalton, and Paleo-Indian periods is that many of the sites representative of these periods have been deeply buried by alluvial stream valley deposits.

The Woodland Period (1,000 B.C. - A.D. 900) is generally characterized by technological and subsistence changes correlated with population increases and, by the end of this period, an increase in sedentary settlement patterns. Increased efficiency in hunting and food storage and preparation is reflected in the use of the bow and arrow and the construction of pottery vessels. Small-scale horticultural practices were further developed at this time with the cultivation of local plants. Increased social and religious complexity also developed, as evidenced by complex burial mounds and large earthworks with associated ceremonial artifacts. The presence of materials imported from outside the area also suggest the use of well-developed trade networks. Woodland sites have been found in the GREAT III area, many of them dating to the latter half of this period. Early Woodland sites in the study area are not so well known at the present time.

The Mississippian Period (A.D. 900 - 1700) represents a shift to a basic dependence on agriculture in the central Mississippi River Valley. Large campsites and villages in the fertile river

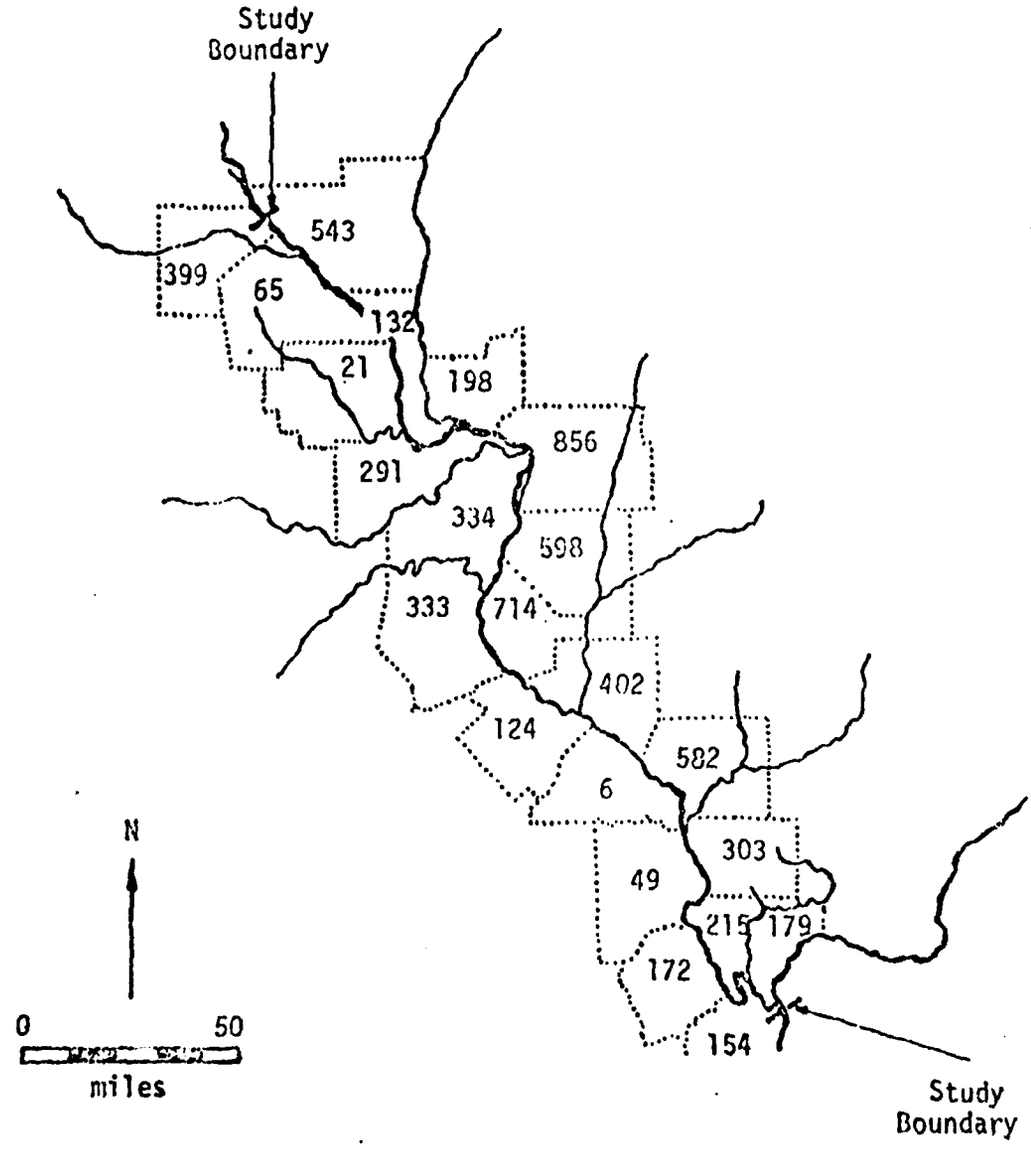
bottomland show a marked increase in population, specialization of labor, and a complex social structure. The largest prehistoric center, Cahokia, is the largest prehistoric site in the GREAT III area and North America. Also associated with Cahokia are numerous satellite towns and farmsteads which functioned in the "life support" system of this large urban center. The climax of the Mississippian culture occurred between A.D. 1200 and 1500. Although many of the main centers were eventually abandoned the basic cultural pattern of this period continued in many locations until European exploration and settlement began.

During the Historic Period (A.D. 1700 - present) the GREAT III area was occupied and traversed by numerous Indian groups such as the Illini, Miami, Sauk, Fox, Potawatomi, Ottawa, Chippewa, Kickapoo, Mascouten, Shawnee, and the Deleware. During the 1700's European explorers, trappers, missionaries, and later, settlers, encountered many of these Indian groups. As the Indians were forced out of the area many Europeans moved in to settle this fertile region. By the end of the eighteenth century, towns had been established at present-day St. Louis, Ste. Genevieve, Cape Girardeau, Cahokia, and Kaskaskia. Numerous farmsteads and small towns were also built on the surrounding floodplain. Since that time the land has been continuously occupied and developed by Europeans and other immigrants and at the present time supports almost 3 million people. Many of these historic Euro-American cultural activities have resulted in the creation of original and sometimes very complex architectural elements unique to the area.

Presently there are about 1900 reported historic and prehistoric sites in Missouri and about 4800 in Illinois in the GREAT III impact area (FIGURE 9). Seventeen archaeological and historic National Register districts in the GREAT III area have been established in Missouri and 48 in Illinois, There is also an unknown number of unreported sites in both states which have been discovered by amateur archaeologists.

Prior Studies and Reports. Literally thousands of studies and reports exist in academic and agency files which document the existing state of knowledge of cultural resources in the GREAT III study area. These documents range from purely descriptive reports of material discovered in the field or analyzed in laboratories to more synthetic works attempting to accurately reconstruct the

FIGURE 9



The Distribution and Number of Reported Archaeological Sites in the Great III Illinois and Missouri counties.

(NOTE: The distribution and number of reported historic sites has not been tabulated.)

cultural activities of one or more time periods. Complete detailed summaries of most known cultural data is an ominous task and has yet to be accomplished for the GREAT III area. There is sufficient literature to document the development of present ideas and explanations for cultural resources in the study area.

Significant Environmental Elements. During the past 14 thousand years the central Mississippi River Valley became one of the most concentrated areas of human activity in North America. The river valley and adjacent upland areas provide a unique ecotonal zone offering a variety of readily accessible environmental resources. During these times people have occupied or exploited many parts of the study area and have left evidence of their activities in most of these locations.

Areas which have been reported to have been intensively utilized are:

1) confluences with major tributaries such as the Illinois, Salt, Missouri, Meramec, and Kaskaskia rivers;

2) floodplain sand ridges and terraces;

3) bluff areas and associated slopes.

Existing Public and Private Programs. Public and private programs for planning and managing resources in the study area are varied and most programs do not manage all cultural resources in the area or at least, do not treat the GREAT III area as a unique management unit. Some of these programs are described below:

The Heritage Conservation and Recreation Service (HCRS) within the Department of the Interior coordinates a broad range of conservation and recreation activities by citizens in the public and private sectors. HCRS forms the nucleus of the National Heritage Program developed for the identification, evaluation, and protection of cultural and natural resources. To fulfill its responsibilities in each of these areas HCRS incorporates the functions of the Office of Archaeology and Historic Preservation (OAHP) and the National Landmark Program. HCRS also has responsibility for the recreational, historical, archaeological, and natural scenic aspects of regional and river basin planning to ensure that plans of the Federal Government requireing a Federal action, license, or permit give adequate consideration to these aspects.

The State Historic Preservation Offices in Illinois and Missouri coordinate and review all cultural resource management work conducted in these states. The Missouri Department of Natural Resources and the Illinois Department of Conservation administer Grants-In-Aid programs for the Department of the Interior which provide matching funds to qualified individuals, agencies, and institutions proposing to study cultural resources in the two states.

The Archaeological Survey of Missouri and the Illinois Archaeological Survey serve as state-wide repositories for site information. The primary function of these offices is to maintain up-to-date site information files to be used by professionals conducting research in the state.

The Illinois Department of Conservation has initiated a program to develop predictive models for the state of Illinois. The predictive model program is designed to synthesize the presently available data and to produce preliminary models predicting site locations. However, it has been found that existing data is insufficient and in many cases not detailed enough to allow for a high degree of accuracy in a predictive statement (Brown, 1978). The initial model is now being tested and refined as funds become available to conduct field investigations.

The Northwestern University Archaeology Program, in association with the Foundation for Illinois Archaeology, has recently expanded their study of the Illinois River trench to include portions of the adjacent Mississippi Valley. The fundamental goal of this program is to compile a master inventory of all prehistoric and historic aboriginal sites in the area.

The major agency providing funding for the management of cultural resources in the GREAT III area is the Corps of Engineers. Numerous archaeological surveys have been conducted for the Corps construction and development activities in the area so that they may comply with federal regulations.

The following public agencies, institutions, and private organizations are dealing either directly or indirectly with management of cultural resources in the study area:

Federal

U.S. Army Corps of Engineers
National Park Service
U.S. Dept. of Agriculture--Soil Conservation Service
U.S. Fish and Wildlife Service
Federal Highway Administration
Federal Aviation Administration

Federal (cont'd)

Environmental Protection Agency
Economic Development Administration
U.S. Heritage Conservation and Recreation Service

State

Missouri Department of Natural Resources
Missouri State Highway Commission
University of Missouri - Columbia
University of Missouri - St. Louis
Washington University
Southwest Missouri State University
Northeast Missouri State University
Southeast Missouri State University
Illinois Department of Conservation
Northwestern Illinois State Universtiy
University of Illinois - Urbana
Southern Illinois University - Carbondale
Southern Illinois University - Edwardsville
Illinois State Museum
University of Nebraska -Lincoln

Private

Foundation for Illinois Archaeology
Fischer-Stein Associates
Environmental Research Center
Missouri Heritage Trust
Landmark Association
Missouri Archaeological Society

Dredging and Dredged Material Uses

There are approximately 150 existing locations which have been dredged in the study area. Each year between 30 and 50 of these sites require dredging. Some locations have required dredging more than once during the season while other sites are dredged annually and the remainder less frequently. When the channel requires maintenance dredging, the material excavated is placed either along the shore or between the channel and the bank. In either case, the material is almost always disposed into the river. The exact location of the disposal site is dependent on several variables such as river stage; hydrologic; geomorpholic and geometric properties of the particular reach of the river; volume of material to be excavated; capability of the equipment used; river structures in the area (i.e., dikes, revetments, and locks and dams); the volume of river traffic; and recommendations received from Federal and State conservation and fish and wildlife agencies.

The St. Louis District, Corps of Engineers uses two boats equipped with depth indicative devices to patrol the river and identify areas where shoaling is occurring and dredging may be required. Commercial towboats and U.S. Coast Guard also report areas where the channel is becoming or has actually filled in to a degree that restricts safe passage. When a site is identified and dredging is necessary, hydrographic surveys are obtained and copies with the dredge cut and disposal site shown are sent to interested parties for comment. In emergencies these interested parties are notified of a dredging requirement by telephone with the hydrographic surveys sent later.

The volume of material dredged in any given year in the GREAT III reach of the Mississippi River is dependent on a number of uncontrolled factors such as: sediment supply, intensity and areal extent of precipitation, runoff, temperature, rates of fluctuations in the water levels and velocities of the tributary streams and the Mississippi River, ice cover, ice jams and dams, durations of high and/or flood flows, and the frequency of occurrence and duration of the lack of precipitation.

Over the last 15 years an average of 6,894,000 cubic yards of material annually has been dredged from this reach of the river. This nearly 7,000,000 cubic yards annually which becomes temporarily resuspended during disposal, while sizable, is very small in comparison with the approximate average of 274,000 cubic yards of suspended material which daily passes (or 100,000,000 cubic yards annually) St. Louis, Missouri.*

Each spring before dredging commences, the St. Louis District holds a coordination meeting with the U.S. Fish and Wildlife Service, U.S. Coast Guard, U.S. Environmental Protection Agency, the State of Missouri: Departments of Conservation and Natural Resources, and the State of Illinois: Department of Conservation and Transportation, Division of Water Resources and the state Environmental Protection Agency, to inform them of these locations which will or may require dredging and the proposed disposal sites. Alternate disposal sites are recommended by the agencies' representatives and made where possible. Some recommendations are rejected because equipment capability is lacking; that is, not enough pipeline to reach alternate site or not enough pump capacity

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*See Erosion and Sediments Work Group Description of the Base Condition: 370,000 tons per day, and estimated density of dredged material of 100 pounds per cubic foot.

to dispose onshore. While this coordination is beneficial, between 24 and 50 percent of the sites dredged each season are not identified at the predredging meetings. Coordination of these dredge sites is accomplished by telephone with the hydrographic surveys prepared and sent to the agencies when they become available. In most cases the surveys are not received until after the dredging has been performed.

The Corps of Engineers' responsibility for dredging is to maintain the authorized navigation channel. This dredging is performed by using either the Corps of Engineers dredges or by contracting with dredging companies. All other dredging performed is done by private contractors for Federal and State agencies or groups in the private sector.

All dredging activities in this 300-mile reach of the river must comply with the applicable Federal and State regulations.

With the exception of sand and gravel dredging by private contractors, the beneficial uses of material dredged to maintain the authorized navigation channel has been limited to beach nourishment and creation of sandbars and islands primarily for use by the recreational boater. During 1977, approximately 2,227,000 tons of sand and gravel valued at $4,133,000 were extracted from the Mississippi River between miles 0 and 300 by commercial dredging.

Erosion and Sediment

The drainage area of the Mississippi river increases over five-fold between Saverton, Missouri and Cairo, Illinois. This increase is due to the additon of seven major rivers and a narrow corridor of minor tributaries. The rivers and their drainage areas are presented in TABLE 10:

TABLE 10
RIVERS AND DRAINAGE AREAS IN
THE GREAT III STUDY AREA

River - Location	Drainage Area (Sq. Mi.)	% Upstream Watershed
Mississippi - Saverton, MO	137,500	1.8
Salt River - New London, MO	2,480	
Mississippi - Salt Confluence	140,900	
Cuivre River - Troy, MO	903	0.6
Mississippi - Cuivre Confluence	142,000	
Illinois River - Hardin, IL	28,070	16.4
Mississippi - Illinois Confluence	171,300	

TABLE 10 (Cont'd)
RIVERS AND DRAINAGE AREAS IN
THE GREAT III STUDY AREA

River - Location	Drainage Area (Sq. Mi.)	% Upstream Watershed
Missouri River - Hermann, MO	528,200	75.3
Mississippi - Missouri Confluence	700,906	
Kaskaskia River - Roots, IL	5,781	0.8
Mississippi - Kaskaskia Confluence	712,600	
Big Muddy River - Gorham, IL	2,240	0.3
Mississippi - Big Muddy Confluence	715,696	
Mississippi River - Cairo, IL	717,000	

In addition to the mainstem reservoirs on the Missouri River, major reservoirs are present on the Kaskaskia River (Carlyle Lake, Lake Shelbyville) and the Big Muddy River (Rend Lake, Crab Orchard Lake). Clarence Cannon Dam and Reservoir is under construction on the Salt River. The Mississippi River above the study area is controlled by 22 locks and dams. Sediment problems in the river are a continuing problem. Historical accounts describe the adverse effects of sediment. Below the confluence with the Missouri River Man's activities have accelerated erosion of sloping uplands with a resulting increase of sediment delivered to river waters. Reservoirs have trapped sediment and erosion of river bed, banks, and floodplain has been a natural occurrence. Historically, the course of the river constantly shifted within the alluvial valley. New channels were formed, abandoned channels were closed and islands grew where sediment was deposited at the mouth of major tributaries.

River control activities retard the natural migration of the river. The pools behind dams in the upper river inundated much of the old river course. In the open river, shifting of the channel has been minimized by river regulating structures. A nearly tamed river has significantly reduced bank caving. The riverbed continues to erode and fill, a natural occurrence in alluvial rivers. Sediment deposition in dike fields is a function of numerous variables, the most significant of which is the volume of sediment in transit. There appears to have been a significant reduction is annual sediment loads during the past 25 years. Some tributaries which enter the river in reaches controlled by pools are aggrading in lower reaches. Estimated daily suspended sediment transport at St. Louis ranges from 2,800 tons to 7 million tons and averages 370,000 tons. Average annual sediment yield at various gaging stations is presented in TABLE 11.

TABLE 11
AVERAGE ANNUAL SEDIMENT YIELD AT GAGING STATIONS

Station	Drainage area (square miles)	Sediment yield (ton per square mile per year)	Total Tons
Mississippi River at Keokuk, Iowa	119,000	79	9,401.000
North Fabius River at Monticello, MO	452	973	439,790
Mississippi river at Hannibal, MO	137,300	181	24,851,300
Salt River near Monroe City, MO	2,230	454	1,012,420
Missouri River at Hermann, MO	528,200	295	155,819,000
Mississippi River at St. Louis, MO	701,000	258	180,858,000

The sediment ranges from silts and clay size to gravel. Principal sediment constituents are silt, clay and sand. Coarser materials are carried along the thalweg in contact with the bed of the river. Suspended sediment measured at St. Louis contains 47% clay, 38% silt and 15% sand. Sediment is trapped in pool areas and builds up on islands, in river regulating structures and in river crossings where the main channel shifts from one side of river to the other. Islands generally form at the mouths of tributaries. Sediment in the upper river, is typically fine sand, silt and clay size. The lower river contains appreciable amounts of coarse sand, gravel, and frequent deposits of cohesive silt and clay size sediment.

The principal source of sediment is upland erosion. Other sources are gully erosion, floodplain scour, bed and bank erosion, and resuspension due to watercraft and dredging. Fine sediment has a tendency to deposit in side channels and backwaters; coarser materials are typically found in the main channel. Dredging in the GREAT III study area annually affects 6% of the river length and produces 6.9 million cubic yards of dredged material. Most material is deposited in open water adjacent to the main channel or on islands and in backwaters. Dike fields ultimately fill with sediment and some have been used for agriculture when the land elevation is favorable. This land accretion limits the surface area of water, thereby reducing aquatic fish and wildlife habitat. In an effort to stop or reverse deposition within dike fields, experimental notches have been created in some dikes. Some observers indicate that this change tends to draw more sediment into the dike fields; an effect opposite to that desired. Others maintain that this effect has not been substantiated.

Turbidity of the river has been inventoried at high and low stages. During high stage, greatest turbidity is persent in the main channel. Increasingly lower turbidity is found in the channel border area adjacent to the main channel, the dike areas and is lowest in the side channels. There is a direct proportional relationship between velocity and turbidity. Settleable solids are highest in the main channel and river border. Lowest amounts of settleable solids occur in dike fields and side channels.

During low flows, the mean surface turbidity is highest in the side channels. Next highest are the channel borders. The dike fields are lower, with lowest turbidities found in the main channels. The amount of settleable solids are found to be similar in all river areas. This range in turbidity is believed to be due to the variation in standing crop of plankton. (Corps of Engineers, 1975)

Studies (Jordan, 1968) indicated that 90% of the sediment in the open river originated in the Missouri River drainage area. In the upper river, sediment transport varies with the stage of the river. During low flows, erosion occurs below dams in the upper ends of pools where velocities are greatest. Deposition occurs in the deeper waters of the pools. During the high flows the process is reversed. The net change is a slight aggradation in shallow area.

Programs for Soil Conservation. The Soil Conservation Service cooperates with Soil and Water Conservation Districts to assist landowners in the solution of land and water resource problems. Funding for projects is available through the Agricultural Stabilization and Conservation Service (ASCS) and PL-566, the Small Watershed Projects Program. The Soil Conservation Service together with the Cooperative Extension Service and the State of Illinois and Missouri are cooperating to survey soils and provide interpretations.

Fish and Wildlife

The study area is divided into two biotic communities as a result of differences in the means used to obtain and maintain the nine-foot navigation channel. The pooled portion (approximately 98 miles of river between Saverton, Missouri, and Alton, Illinois) is somewhat characteristic of lentic ecosystems, with expansive slackwater areas. Riparian borders and islands are mostly in public ownership and many are managed for fish and wildlife purposes. In contrast, the open water reaches (approximately 203 miles of river between Alton, Illinois and Cairo, Illinois) have stronger currents, higher turbidity levels, less stable water elevations and reduced water quality. Shorelines in this section are predominately in private ownership and are subject to unregulated agricultural, commericial, industrial and residential development.

The entire length of the river in the study area is maintained for commercial barge traffic. This is accomplished by the placement of structures. (i.e., dams in the upper portion and dikes and revetments in both sections) and by maintenance dredging, to insure that a navigation channel nine feet in depth and three hundred feet in width is provided. Both activities influence fish and wildlife habitats: their maintenance as well as development.

Navigation dams have converted former riverine habitat into slackwater areas. In so doing, they have greatly increased water surface area. The change of the river to a lake habitat has favored some species while working to the disadvantage of others (Carlander, 1954). However, because the primary function of the dams is to provide a satisfactory navigation pool, their operation does not take into consideration fish and wildlife needs.

Dikes and revetments affect fish and wildlife resources in many ways. Primarily, they influence water velocities and assist in maintaining the flow into a designated channel. This prevents the river from meandering and, thus, prevents the development of new side channels which would replace those naturally lost by accretion and eutrophication and, in some cases, accelerates the loss of existing side channels. They also reduce habitat diversity necessary for ecological stability.

Under certain circumstances dredging operations and the riverine placement of dredged materials could disturb the habitat for bottom dwelling organisms, increase ambient turbidity, resuspend potentially toxic substances and are a contributing factor to the accretion of material into valuable shallow water habitats.

The operation of power driven crafts on the river influences turbidity by resuspending sediments and accelerating erosion of unprotected shorelines. The full impact of these effects on fish and wildlife resources is presently unknown.

Industry related to waterway transportation creates a need for docks and mooring facilities. At present, the location of such facilities is influenced by many factors other than the value of a particular site to fish and wildlife resources. As a result, highly productive and unique ecosystems are endangered.

Throughout the floodplain of the study area, development has been generally unregulated. Urbanization, commerce, industry and agriculture have encroached onto flood-prone lands, thereby increasing demands for flood protection. Levees have been and continue to be constructed without regard to their effects on the natural flood storage capacity of the river or the fish and wildlife resources.

Pooled Portion of the Study Area (Aquatic). Fishery habitat in the pooled portion of the Mississippi River has been defined and classified for the purpose of scientific study and fishery management (Sternberg, 1971). Six separate habitat types have been identified; these are main channel, main channel border, tailwaters, side channels, river lakes and ponds, and slough (FIGURE 10).

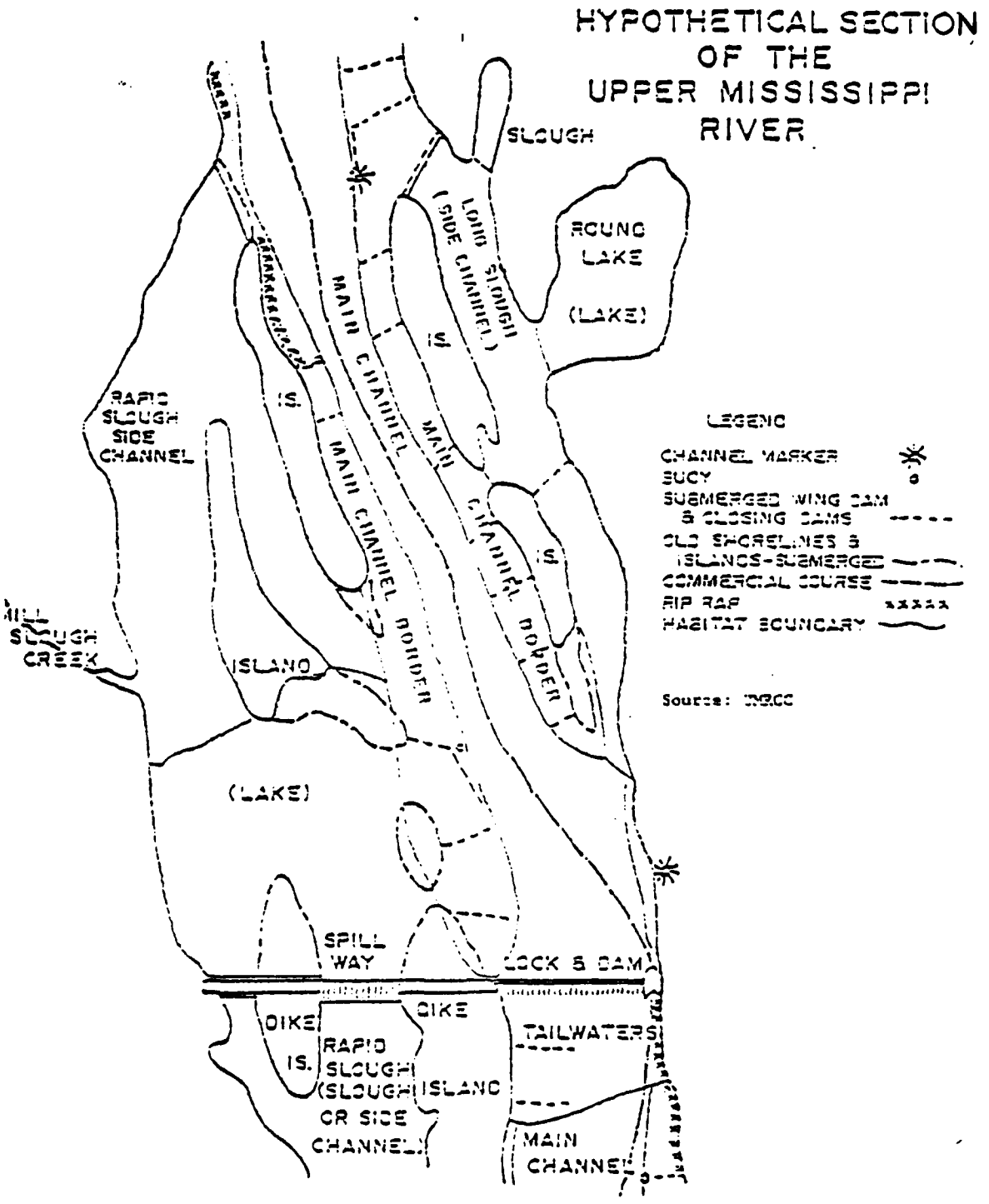
Main channel habitat includes the 300 foot wide, nine foot deep navigation channel and areas riverward of the ends of wing dikes. A current always exists, varying in velocity with water stages. Bottom type is usually a function of current, but sand predominates in the upper pools and sand over silt in the lower reaches. Rooted vegetation is absent. Of the six habitat types, the main channel supports the fewest number of fish and other aquatic organisms. Channel catfish, flathead catfish, sturgeon and drum are normally found in this habitat. Near the upper end of the pool, walleye and sauger are found.

The main channel border lies between the ends of wing dikes and the main river bank, islands or submerged parts of the old main river channel. The area may be thought of as being part of the main channel, but for fishery purposes is considered as separate habitat. Banks are frequently riprapped. Dredged material has been placed in some sections of this zone, sometimes covering wing dikes. The bottom is mostly sand in the upper sections of pools and silt in lower reaches. Little or no aquatic vegetation is present. Channel catfish, white bass, carp, and freshwater drum are part of this habitat. Forage fish are generally abundant. The habitat provides some of the better fishing.

Tailwater habitat includes the area immediately below dams. Turbulance from the passage of water through the gates of the dam characterize the habitat. Bottom conditions are rocky and devoid of rooted or attached aquatic vegetation. This highly aeriated water attracts an abundance of forage fish and such predatory species as walleye, sauger, white bass, and catfish. The downstream boundaries for defining the tailwater fishery habitat have been set a distance of one-half mile below the dam.

Side channels are off the main channel and main channel border and have a sustained current during normal river stages. These habitats vary in length from a few hundred yards to several miles, and in width as well as volume of flow. They are also sometimes called sloughs, running sloughs, chutes, cuts, guts, cutoffs, and canals. Unless they are former main channel, the banks are usually unprotected. Undercut or eroded banks are common near their departure from the main channel. Closing structures or diversion dams are frequently present. The bottom type usually varies from sand at the upper reaches to silt in the lower. Rooted aquatic vegetation is absent in the swifter current, but may be common in shallower areas with silty bottoms. The habitat supports species

FIGURE 10


HYPOTHETICAL SECTION
OF THE
UPPER MISSISSIPPI
RIVER
SLOUGH
LONG SLOUGH
(SIDE CHANNEL)
ROUND
LAKE
(LAKE)
MAIN CHANNEL
IS.
RAPID
SLOUGH
SIDE
CHANNEL
MAIN CHANNEL BORDER
ISLAND
(LAKE)
SPILL
WAY
LOCK & DAM
DIKE
DIKE
IS.
RAPID
SLOUGH
(SLOUGH
OR SIDE
CHANNEL)
ISLAND
TAILWATERS
MAIN
CHANNEL
LEGEND
CHANNEL MARKER
BUOY
SUBMERGED WING DAM
& CLOSING DAMS
OLD SHORELINES &
ISLANDS-SUBMERGED
COMMERCIAL COURSE
RIP RAP
HABITAT BOUNDARY
Source: USACE

such as channel catfish, sauger, drum black bass, crappie, sunfish, and carp. This diminishing habitat has been identified as one of the highest value fisheries in the study area.

River lakes and ponds are expanses of shallow water, normally having little or no flow. These habitats may or may not be connected with other water bodies. Bottoms are composed of muck or silt. Heavy growths of aquatic vegetation are normally present. Bullheads, carp, crappie, and bowfin are generally associated with this habitat. The type is heavily used by furbearers and aquatic avifauna.

Sloughs are similar to lake or pond habitat, except that they are relatively narrow branches or offshoots of other water bodies. They are characterized by their lack of current at normal water stages, muck bottoms and abundance of submerged and emergant vegetation. These sloughs, and some of the ponds and smaller lakes in the floodplain, are representative of ecological succession taking place in the river bottoms. Catfish, buffalo, carp, and members of the sunfish family inhabit these areas. They are also heavily used by waterfowl and aquatic furbearers.

Biological studies in the pooled portion of the GREAT III study area provide some insight into their ecology. Fish sampling surveys have identified 80 species of fish inhabiting these waters. In terms of total numbers and the total weight of fish collected, commercial species such as carp, buffalo, drum and channel catfish normally predominate. However, samples also contain significant numbers of sport, forage, and predatory species. Among the habitat types identified, the main channel is determined to be least productive.

Pool Portion of the Study Area (Terrestrial). Riparian borders and islands in the pooled portion are characterized by numerous wooded ridges and bottomland forests. The floodplain is also interspersed with scatterd permanent, seasonal and ephemeral wetlands, normally detached from the main river system. Many of these habitat are highly productive in food and cover vegetation and utilized by a variety of wildlife species. Areas within protective levees are primarily devoted to some form of agriculture. Residential, commercial, industrial, and recreational developments also exist in scattered locations throughout the protected and unprotected floodplain.

An important feature of riparian habitats in the pooled portion of the river, as compared with the open river, is that most shorelines are publicly owned. A considerable proportion of riparian habitat is leased and intensively managed by the Illinois and Missouri Departments of Conservation and the U.S. Fish and Wildlife Service, under General Plan coopertive agreement with the Corps of Engineers.

Bottomland forests of the river valley are primarily confined to the unprotected floodplain and low, poorly drained areas within levees. These habitats are occupied by fauna native to the region, such as white-tailed deer, bobwhite quail, mourning doves and wild turkeys. They are also utilized by wood ducks, wading birds, and song birds as nesting habitat.

Great blue heron and great egret rookeries are scattered througout the river bottoms. Turkey vultures and gulls are abundant along the river. Bald eagles winter in open water reaches created by dams and thermal effluents. Spring and fall warbler migrations are annual highlights for birdwatchers.

The Mississippi Valley is a major flyway for migrating waterfowl. During migrations, puddle ducks utilizing the area include mallard, wood duck, green- and blue-winged teal, pintail gadwall, widgeon, and shoverler. Diving ducks; primarily the lesser scaup, ringneck, bufflehead, goldeneye, canvasback and redhead, frequent the river both as migrants and winter residents. The fingernail clam is an important food source for these species. Mergansers include common, red-breasted and hooded, Canada, snow and blue geese winter in habitats provided on Mark Twain National Wildlife Refuge.

The river bottoms are recognized for their importance in furbearer production. Muskrat, the most abundant species, prefers slow-moving waters with lush vegetation, but will also occupy river banks, streams, and ditches. Riprap and other forms of shoreline protection reduce overall habitat for this species. Other commercially important furbearers include raccoon, mink, beaver, oppossum, coyote, and red and gray fox.

A total of 416 species and subspecies of vertebrate animals other than fish have been recorded in the pooled section of the GREAT III study area. These include 49 mammals, 296 birds, and 81 reptiles and amphibians. In terms of total faunal diversity, floodplain forests, backwaters and old fields (in that order) are highest in value (Tarpening, et al., 1975).

Open River (Aquatic). The Middle Mississippi River portion of the Upper Mississippi River between St. Louis, Missouri, and Cairo, Illinois, is commonly referred to as the "open river." This reach differs substantially from the pooled segment because of (1) high turbidity as a result of the flow of the Missouri River at mile 195, (2) high velocity, (3) fluctuating water levels, (4) pollution from treated and untreated discharges in the St. Louis Metro area, and (5) differences in methods used to provide authorized navigation channels. The waters are highly turbid as a result of high suspended sediment concentrations. These sediments reduce biotic production, accelerate accretion and adversely impact aesthetics.

High velocities, due to channel modifications by dikes and dredging tend to keep material in suspension. Most common sport and commercial species are carp, channel catfish, flathead catfish, drum, buffalo, carpsucker, and sturgeon.

Fluctuating water levels limit the development of marsh areas to old river chutes that evolve to river cutoffs and sloughs. In a natural dynamic river, creation and distruction of such habitats is a continuing process, thereby insuring habitat diversity. Dikes, revetments, dredging and closing structures have affected the development of new side channels and accelerated the lost of many existing side channels.

The water quality of the Middle Mississippi River has been somewhat improved by recently upgraded wastewater treatment facilities in the St. Louis area. In the recent past, water quality problems have limited the use of fish for food consumption due to objectional taste in nearly a hundred miles of the river downstream from St. Louis. Although much remains to be done, the treatment of municipal and industrial wastes has improved fishery quality in nearly all of this region.

The nine-foot navigation project authorized in 1927 initially led to the construction of 800 wooden pile dikes. Pile dikes changed current and sedimentation patterns and, hence, sediment was deposited in the main channel borders. Vegetation, such as willows and cottonwoods, invaded the accreted area, thereby further reducing velocities and permitting additional accretion. Most of these areas were eventually cleared and converted to agriculture.

In the early 1960's, wooden pile dikes were gradually converted to stone because of cost and maintenance problems. Today there are more than a hundred miles of effective rock dikes in the 195 miles of river comprising the Middle Mississippi River. Each year, dikes are repaired, lengthened, and additional dikes are planned and constructed. This results in additional accretions and loss of water surface areas.

Most of the existing fisheries habitat in the Middle Mississippi River can be classified as main channel and main channel border. There are no tailwaters and many side channels become desiccated during low river stages. Average annual river stage fluctuations exceed twenty feet. The scarcity of vital nursery areas makes those which do exist extremely important to the fishery.

Open River (Terrestrial). Major habitat types along the Middle Mississippi River include agricultural fields, bottomlands forests, old fields, sand bars and mud flats. The wetland habitats which formally occupied expansive areas within this region have been considerably reduced, making those which remain considerably important to biotic resources.

Drainage and levee construction in this portion of the GREAT III study area has been extensive. The majority of flood protected lands are utilized for agricultural production or urban development. The unprotected floodplain has been reduced to 78,000 acres; of which 44 percent is cultivated, 30 percent is in bottomland forest and 14 percent is in sandbar and mudflats. Water areas outside the river's main channel and main channel border comprise only 6 percent of the unprotected floodplain. These include side channels, sloughs, borrow pits and various other depressions.

The open river floodplain is reported to be inhabited with more than 300 naturally occurring plant species and utilized by more than 310 animal species. Fauna of interest to man include white-tailed deer, wild turkey, bobwhite quail, cottontail, swamp rabbit, and song birds. At least three heron and egret rookeries are known to exist in the area.

Endangered Species. The study area provides habitat for a variety of plant and animal species designated threatened and endangered. These include Higgin's eye pearly mussel, bald eagle, peregrine falcon, gray bat and Indiana bat, among others. The status of such species and their habitats in the study area has not been determined, and no formal consultation actions have been initiated.

Environmental Elements of Ecological Importance. Environmental elements ecologically important to fish and wildlife resources because of their scarcity, fragility or resiliency are as follows:

Fisheries

main channel border
tailwaters
side channels
river lakes and ponds
sloughs
wooden pile dikes

Wildlife

side channels
river lakes and ponds
sloughs
floodplain forests
open water areas during winter months
eagle roosts
wildlife management areas
unprotected riverbanks in slackwaters
wetlands

Planning Agencies Responsible for Fish and Wildlife Resources in the GREAT III Study Area. Agencies dealing specifically with fish and wildlife resources in the GREAT III area are U.S. Fish and Wildlife Service, Illinois Department of Conservation and Missouri Department of Conservation. The U.S. Fish and Wildlife Service through the Mark Twain Refuge System is presently developing master plans for those lands directly under their control. In addition, the Service administers General Plan agreements in cooperation with the U.S. Army Corps of Engineers on General Plan lands managed by the state agencies. Missouri and Illinois Departments of Conservation both have master planning sections which oversee development in general where state or federal actions are involved. In addition, plans for state managed fish and wildlife lands, such as Ted Shanks and Upper Mississippi River Wildlife Areas in Missouri; and Batchtown, Calhoun Point, Fuller Lake, Glades, Godar, Diamond, Hurricane, Pool 24, Pool 25, Red's Landing, Stump Lake, and Riprap Landing Wildlife Management Units in Illinois; are developed by the respective state agencies.

In addition to these major fish and wildlife planning agencies, a number of other Federal, state, and local agencies and private individuals develop programs affecting fish and wildlife habitat. These include:

U.S. Army Corps of Engineers
U.S. Heritage Conservation and Recreation Service
U.S. Forest Service
U.S. Soil Conservation Service
National Park Service
Upper Mississippi River Basin Commission
Illinois Department of Conservation - Division of Lands and Historic Sites
Illinois Department of Transportation
Missouri Department of Natural Resources
Missouri State Highway Commission
Regional Planning Commissions
Port Authorities
Bi-State Development Agency
Counties
Cities
Nature Conservancy
Audubon Society
Izzak Walton League
Sierra Club
Duck Clubs
Industrial Firms
Commercial Firms
Agricultural Organizations
Wastewater Treatment or Sanitary Districts

Organizations Managing Fish and Wildlife Resources. Population management of resident fish and wildlife in the GREAT III area is under the jurisdiction of the Illinois and Missouri Department of Conservation. To effect coordination between the states, cooperative agreements on the management of fisheries in the Mississippi River have been completed. Migratory bird management is under the authority of the Mississippi Flyway Council, a consortium of represented state and Federal agencies, as well as private organization. The U.S. Fish and Wildlife Service manages National Wildlife Refuge lands and administers funds through the Dingell-Johnson and Pittman-Robertson Acts. Coordination between these agencies is facilitated by the Upper Mississippi River Conservation Committee, an advisory group of member organizations.

Floodplain Management

Floodplain management has evolved as a response to the ever increasing costs of flood damages. Presently, floodplain management in the GREAT III study area is in an emerging status and not been fully developed or utilized.

The information about floodplain resources within the study area is incomplete. The location of many parameters such as: drainage outlets; land use areas; mineral resources; prime farmland; water users and land ownership is unknown or scattered through documents and difficult to interpret. Hydraulic information regarding floodplain delineation and groundwater system definition are not fully developed.

There is presently a diversity of interest in floodplain management between Federal, state and local governments and a resulting diversity of study and regulation. These floodplain management activities are coordinated to the least extent mandatory. There has not existed prior to GREAT III, a coordinating body. Overall concern for multiple uses of the river resources and multiple impacts of river-related activities is not largely apparent.

Federal status affecting floodplain management issues include: 1) the National Flood Insurance Act of 1968 which adopts a non-structural program developed to spread the cost of flood disaster among probable victims rather than the entire public; 2) the Flood Disaster Protection Act of 1973 which raised insurance coverage, provided for identification and notification of flood prone communities and increased the incentive for communities to participate in the insurance/floodplain management program. 3) The Water Resource Development Act of 1974 (PL 93-251) requires analysis of non-structural alternatives for floodplain management. 4) Flood Plain Management Executive Order 11988, May 24, 1977 addresses management of federal lands and projects with the requirement that action taken in floodplains be avoided if practical alternatives exist, and closely monitored to avoid compounding flooding problems

if there is no practical alternative; and 5) the Clean Water Act showing changes made by the 1977 Amendments, Section 404 designates the Corps of Engineers as the regulating Federal agency regarding the discharge of dredged or fill material (especially wetlands). Section 404(t) of this act requires compliance by Federal agencies with state regulatory authorities regarding discharge of dredged or fill material.

State regulation differs between the GREAT III area in Missouri and the corresponding areas in Illinois. There is no floodplain management comprehensive legislation in Missouri. General planning and zoning authorities lie in local governments. A referendum is required to effect planning and zoning in third and fourth class counties. Illinois' floodplain authorities rest in the Rivers, Lakes and Streams Act of June 10, 1911, as amended, which assigns the Department of Transportation permit authority regarding encroachments and obstructions on public waters. Specifically, Section 65f requires floodplain mapping and subsequent regulation to avoid increasing flood damages. Missouri and Illinois have signed a joint agreement regarding coordination of floodplain management activities.

Industrial and Economic Development

The United States produces and consumes more goods and services than any of the world's 154 nations. All persons are affected in one way of another by the commodities and goods that move within and in and out of the United States. An enormous amount of raw materials is required to fuel the American and world economy. Many basic commodities are either found in limited quantities insufficient to meet required national demands or are unavailable in the United States. In order to pay for these imports and balance trade, it is essential that U.S. producers export agricultural, mining and manufacturing products. Domestic and foreign trade exerts a significant impact on jobs and opportunities for employment not only upon the American population but upon the people of the world.

The struggle for foreign markets is becoming more intense, especially with growing industrialization of many of the less developed countries (LDC's). The term "national interest" is embracing. It has security, economic and political connotations. It is difficult to quantify precisely or even approximately the value of American maritime industries to the American economy but all contributing factors (local, national, and international) should be considered in any evaluation of the maritime industry as a whole (Heine, 1976). The inland waterway system is and has always been an important factor in industrial or economic growth. Many of the most prosperous cities are located on the nation's river system. The GREAT III area is strategically located within the national waterway system and serves as a transshipment hub for all modes of domestic

and international transportation. The Port of Metropolitan St. Louis is the largest inland river port in the United States.

As the population center of the United States the region offers a large, diverse labor supply. The river provides an energy efficient means of transport to reach a vast concentration of American consumers. The waterway system plus numerous other readily available natural resource have made the St. Louis metropolitan area the fifth largest corporate headquarters city in the United States, both for domestic and multi-national firms plus a major manufacturing center, generating and receiving substantial domestic and foreign commerce by utilization of the most energy-efficient form of transportation--water (TABLE 9). In 1977 the barge industry averaged 408 ton-miles per gallon of fuel consumed or it took one gallon of fuel to move a ton of freight over 400 miles by water. In comparison, rail transportation averaged 207 ton-miles per gallon of consumed fuel during the same period. By transporting by water, the same amount of tonnage can be moved the same distance on half the amount of fuel. This represents an important energy savings at a time when conservation of our energy resources is a critical national goal. - (American Waterways Operators, 1979)

Historically, water transportation has proven a key factor in the development of a flourishing economy in the GREAT III area. The location of the region provides the ability to serve all domestic and international markets. The full potential of the metropolitan port of St. Louis has not been realized as yet. If it were to develop as proposed in a recent year 2000 port plan, the following economic benefits could be realized (A. T. Kearney Inc., 1974):

- Cargo growth from 23 to 84 million tons per year
- $3.5 billion of new construction (in 1975 dollar)
- 60,000 man-years of construction effort
- 16,000 new direct manufacturing jobs in addition to current 43,000 river-related industry jobs
- Increased number and quality of river-related recreation facilities

Each mode of freight transportation (barge, pipeline, rail, truck, and airline) serves a particular range of shippers' needs. Water transportation provides distinct advantages for the movement of bulk cargos and unusually large and heavy equipment (FIGURE 7) at low cost (FIGURE 8), it is fuel efficient (TABLE 9), and is the safest mode of transportation.

River port facilities which serve industries are also dependent on efficiently scheduled and quality rail and truck service. Rail/truck-to-barge cargo transfer operations occur in a variety of circumstances and under numerous owners. Multi-modal facilities provide great flexibility in meeting transportation needs. Conservation of energy supply must be of paramount consideration and fuel economy essential. Long hauls of bulk commodities must utilize water transport, where available, and otherwise by rail. Trucks must continue their indispensable role for short-haul movements as feeders for rail and water transport, and to deliver fast service for high value freight. (Creelman, 1979).

Since the inland marine mode of transportation was revitalized by public works projects in the 1930's, the productivity of barge line haul service has increased forty-fold per man causing per ton mile line haul costs to remain steady for decades. (U.S. Department of Commerce, Maritime Administration, 1976). Because of the continuity of costs, this has provided a solid base which industry has been able to depend on and to use for planning future growth.

Manufacturing and industrial markets in Illinois and Missouri are well diversified among all major standard industrial classification groups. The study area is located in the middle of a 20 state industrial area which is growing more rapidly than the national average. During the past decade, manufacturing employment grew 15 percent (15%) in the area, compared to nine percent (9%) nationwide. This is attributed to the favorable position in relation to population, raw materials, finished products, and the superior transportation network which allows companies to ship manufactured goods and raw materials throughout North America and the world. (The Missouri Corporate Planner, and Illinois Facts - A Corporate Location Guide).

In 1976, 388 new plants or expansions occurred along the nation's 25,000 miles of navigable waterways representing a capital investment of six billion dollars ($6,000,000,000) and minimum of 46,120 new jobs. The Mississippi River led with 51 facilities. (The American Waterways Operators, Inc. 1977).

Although the information presented above indicates considerable industrial expansion in the overall 20-state industrial area and along the inland waterway system, this is not the case for the GREAT III Study Area. TABLE 12 compares various socio-economic indicators in the GREAT III Study Area with the states of Missouri and Illinois and the United States as a whole. The information indicates that in almost all cases, the GREAT III Study Area is socio-economically not keeping pace with two states or the nation as a whole. Consequently, industrial and economic development in the GREAT III Study Area should be of prime concern so that our economic base is strengthened rather than eroded.

TABLE 12

COMPARATIVE SOCIO-ECONOMIC CONDITIONS AND TRENDS:
GREAT III REGION AND SELECTED AREAS

INDICATOR	GREAT III REGION	ILLINOIS	MISSOURI	UNITED STATES
1. Population Change (%)				
a. 1960-1970	10.4 (256,607)	10.2 (1,031,639)	8.3 (356,849)	12.5 (22,526,158)
b. 1970-1976	-.1 (- 2,447)	.7 (80,203)	2.1 (100,377)	5.9 (11,907,842)
c. 1960-1976	10.3 (256,160)	11.0 (1,111,842)	11.0 (457,226)	19.0 (34,434,000)
2. Growth in Total Private Sector Employment				
a. 1962-1970	27.7 (181,761)	25.7 (742.650)	30.9 (328,406)	31.6 (13,754,940)
b. 1970-1976	3.8 (32,031)	4.0 (139,966)	4.9 (68,216)	12.9 (7,380,554)
c. 1962-1976	32.6 (213,792)	30.5 (862,616)	37.3 (396,622)	48.6 (21,135,494)
3. Change in Manufacturing Employment (%)				
a. 1962-1970	15.5 (39,209)	17.2 (202,060)	22.4 (84,046)	20.4 (3,347,761)
b. 1970-1976	-13.2 (-40,489)	-9.2 (-127,068)	-7.9 (-36,222)	-4.0 (- 796,204)
c. 1962-1976	.3 (720)	6.4 (74,992)	12.8 (47,824)	15.5 (2,551,557)
4. Unemployment Rate (% of Labor Force)				
a. 1960	4.3	4.5	4.1	5.5
b. 1970	5.0	3.7	3.3	4.9
c. 1978	6.4	6.1	4.9	6.0
5. Per Capita Income (Dollars)				
a. 1959	$1,897	$2,646	$1,983	$2,168
b. 1969	3,184	3,496	2,952	3,119
c. 1975	4,821	5,334	4,571	4,838

SOURCES:

1. U.S. Department of Commerce, Bureau of the Census, U.S. Census of Population 1960: Missouri, Illinois, U.S. Department of Commerce, Bureau of the Census, Current Population Reports, Series P-26. U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, 1977.

2. U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, 1976.

3. U.S. Department of Commerce, Bureau of the Census, Current Population Reports, Series P-25. U.S. Department of Commerce, Bureau of the Census, U.S. Census of Population, Illinois, 1960, U.S. Census of Population, Missouri, 1960. Southwestern Illinois Metropolitan and Regional Planning Commission.

Note: 1959 Per Capita Income Methodology:

$$\frac{\text{1960 mean income x 1960 \# of recipients}}{\text{1960 population}}$$

4. U.S. Department of Commerce, Bureau of the Census, County Business Patterns, Iowa, Minnesota, Missouri 1962--Illinois, Indiana, Ohio 1962; U.S. Deparment of Commerce, Bureau of the Census, County Business Patterns, Illinois 1970--Missouri 1970--Missouri 1970; U.S. Department of Commerce, Bureau of the Census, County Business Patterns, Illinois 1976--Missouri 1976; U.S. Department of Commerce, Bureau of the Census, County Business Patterns, U.S. Summary 1962, 1970 and 1976.

5. The GREAT III region includes those Missouri and Illinois Counties adjacent to the Mississippi River from Saverton, Missouri to Cairo, Illinois, and all counties within the St. Louis SMSA.

Industrial development today is complicated by environmental and other government regulations. Industry generally agrees that there is a need for clean air, water, and unscathed natural surroundings. But these sometime conflicting economic and environmental factors need to be balanced so that steady economic growth and development can proceed while still requiring sound reasonable environmental policies.

The study area upstream from Lock 27 (mile 185.1) is controlled by locks and dams. Downstream the river is open with little or no development except in the SMSA area. The environmental and other governmental regulations are applied uniformly in both locations with compliance charged to the developer. This can impede economic goals which have been established by the general public and local, state, and federal governments.

There are many federal, state, county, municipal, regional, and private programs charged with the responsibilities for planning and implementing the industrial and economic development in the GREAT III study area. Often little or no coordination exists between these agencies. All levels of government and private industry have committed staff and budgets to maximize the usage of available natural resources into economic and employment gains. In addition to federal and state agencies, the Illinois and Missouri legislatures have established public port districts which in general have powers and responsibilities to promote industrial, commercial, transportation, and recreational activities to create employment and increase economic growth. Also the Bi-State Development Agency was created by legislative acts in Missouri and Illinois, and approved by the U.S. Congress, granting broad regional powers to plan, coordinate, operate and develop economic programs in the St. Louis region.

Recreation

Outdoor recreation has become an increasingly important part of the lifestyle of people in the United States. Studies made in recent years have documented the growth in recreation demand, and have indicated the most popular forms of outdoor recreation activities. Major recreation activities in this 300-mile reach of the river include power boating, water skiing, swimming, sailing, bicycling, camping, bird watching, hiking, sight-seeing, hunting and fishing.

The Mississippi River in the GREAT III study area is a great recreation resource. It contains diverse landscapes: broad open expanses of water, side channel, sloughs, oxbow lakes, islands, beaches, backwater areas, marshes, swamps, bottomland forests and agricultural areas, towering bluffs and river break hills. Many people feel that this large and diverse area has the capability of satisfying many of the recreation needs of the population in the impact area without degrading the resource base.

Public access to the navigation pools is generally limited to Federal owned shoreline lands, which are scattered of varying width and located predominately in the lower reaches of the pools. The acquisition policy for the navigation pools limits the amount of land that is suitable for the development of public access areas and facilities. Lands that have been developed are subject to annual flooding and some shoreline damage due to ice flows. Principal allocations of Federal lands, including numerous islands, are designated for fish and wildlife management purposes and are administered under a "General Plan and Cooperative Agreement" between the Corps of Engineers, the U.S. Fish and Wildlife Service, and the Illinois and Missouri Departments of Conservation. Public access areas and facilities adjacent to the navigation pools have been developed jointly with the Corps of Engineers or on lands leased from the Corps. There are a number of commercial concessions offering public access and services. In addition, there are many commercial marinas developed on privately owned lands.

The lower 184-mile reach of this part of the river has no Federal lands for public access. Opportunities for public access are limited due to private ownership of the shoreline and intervening lands between the highways, railroad tracks, and the river. The most visual identification with the river below St. Louis occurs at bridge crossings and at river communities. Most of the public land that is available in this reach is located in state parks, state conservation areas, and U.S. Forest Service lands. Roadside parks, points of interest, and city parks comprise a minor amount of the total acreage. Fuel stops for transient recreation craft along this reach are extremely limited, forcing most craft to carry extra fuel and provisions.

Although Missouri and Illinois have upgraded their boating safety programs, only a fraction of available personnel and time may be devoted to the Mississippi River. Funding and personnel assigned to boating safety law enforcement and education are inadequate to control the problem of boating safety.

Regardless of the constraints on the use of the river and related land resources, the existing recreation resources and the cooperative efforts among governmental agencies and private enterprise combine to provide millions of people annually with an opportunity to experience the diversity of the river's recreational, natural, cultural, and historic values.

These deficiencies in satisfying recreational needs are documented in the Statewide Comprehensive Outdoor Recreation Plan (SCORP) of Missouri and Illinois. For example, the 1976 Missouri SCORP shows significant need in both 1980 and 1990 in most categories of outdoor recreation for the East-West Gateway coordinating Council Planning Region. (Missouri Department of

Natural Resources, 1976). The 1995 Park and Recreation Areas Plan for the St. Louis Region (1974) shows a deficiency of park lands of 59,168 acres by 1995. (East-West Gateway Coordinating Council. 1974)

High quality recreation is made possible by the large, scenic and diverse landscape described above. Particularly important from a recreation viewpoint are river banks, bluffs and blufftops, side channels, backwaters, beaches and islands. Anything which affects the scenic quality, wildlife habitat or water quality will impact the recreation potential of the area.

These are specific examples of areas which are critical because of their high recreation potential:

-The confluences with major tributaries: The Illinois, the Missouri, the Meramec and the Kaskaskia.

-Major islands with high recreation potential or significant wildlife habitat, e.g. Clarksville Island, Mosenthein Island.

-Scenic bluff or river hills areas, e.g. Alton Bluffs, Fountain Bluff and Grand Tower in Illinois; and the river hills at Clarksville and Louisiana in Missouri.

-Unique natural areas are identified in the natural area surveys of Illinois and Missouri. (Illinois Department of Conservation, 1978)

There is a complex mixture of federal, state, county, municipal, and private programs providing recreation opportunities in the GREAT III study area. The Recreation Section of the Upper Mississippi River Conservation Committee recently completed a Recreation Facility Inventory for the GREAT III area. (Upper Mississippi River Conservation Committee, 1977). This report states that there are 11,147 acres of developed recreation land along the Mississippi River from Saverton to Cairo. There are 92 small boat ramps and 2,630 marina slips in this reach.

Most of this development is on the three navigation pools between Saverton and Grafton (pools 24, 25, & 26). A large proportion of this development is provided by private clubs, marinas and concessions. Of the public facilities most are provided in Illinois while most of the private recreational development is on the Missouri side of the river, particularly on pool 26, in St. Charles County.

While two-thirds of the total river mileage (301 miles) of the GREAT III study area is in the "open" or "middle" river (202 miles from Locks and Dam 26 to Cairo), only a small proportion of the public lands and recreation facilities are in this reach of the

river (2486 acres of developed recreation land, i.e., 22.3% of GREAT III total; 22 small boat ramps, i.e., 23.9% of GREAT III total; and 230 marina slips, i.e., 8% of GREAT III total).

The major public agencies providing recreation facilities in the study area include the U.S. Army Corps of Engineers (primarily in connection with the 9 ft. channel navigation project), the U.S. Fish and Wildlife Service (through the Mark Twain National Wildlife Refuge, the U.S. Forest Service (at Fountain Bluff and Larue-Pine Hills in the Shawnee National Forest), the Missouri Department of Natural Resources (at Trail of Tears State Park), the Missouri Department of Conservation (at Dupont Reservation and several river access areas) and the Illinois Department of Conservation (at Pere Marquette State Park, Fort Chartres State Park, Fort Kaskaskia State Park, Horseshoe Lake Conservation Area and the Calhoun County Conservation Area, and several river access areas).

The Corps of Engineers has recently (1977) developed master plans for navigation pools 24, 25, and 26 containing proposals for further recreation development in these pools. The U.S. Fish and Wildlife Service is completing (1978) a master plan for the Mark Twain National Wildlife Refuge which will recommend further development of recreation facilities in the GREAT III area. The Missouri Department of Conservation is developing the Ted Shanks Wildlife Area near Louisiana, Missouri and plans to acquire other lands under their Design for Conservation programs. The Missouri Department of Natural Resources has identified several potential natural areas adjacent to the river between St. Louis and Cape Girardeau. The Corps of Engineers is completing a preliminary Master Plan for the Middle Mississippi, the City of St. Louis is planning to develop its north riverfront park and expand Bellerive Park in south St. Louis. The National Park Service is completing the development of the Jefferson National Expansion Memorial Park on the St. Louis riverfront (with a possible expansion to the East St. Louis riverfront.)

The Corps of Engineer and the Department of Interior prepared a proposal in 1971 for an Upper Mississippi River National Recreation Area but no action has been taken to implement the proposal. (Department of Interior and Department of the Army, 1977).

In 1973 Pride, Inc. of Alton, Illinois proposed the development of a Great Rivers Recreational Area at the confluence of the Mississippi and Missouri Rivers. (Goetz and Rohrbach, 1973).

The Corps of Engineers plans to construct a recreation area and marina in conjunction with the recently authorized replacement of Locks and Dam 26. In a report from their consultants there is also a proposal for a Mississippi-Missouri "Confluence Park." (U.S. Army Corps of Engineers, St. Louis District, 1973).

The public agencies and private organizations that have jurisdiction over or have the authority or ability to provide recreation programs, facilities, or activities in the GREAT III study area are presented in TABLE 13.

Not all of these agencies have exercised their authority to provide recreation planning, facilities, or programs. In other cases, actions are limited by restrictions on authority or by a lack of funding.

None of these agencies has more than a partial and fragmentary authority for planning and management of recreation resources on the Mississippi corridor. Coordination of planning has been haphazard at best and non-existent in many cases. There is no standardized system of collecting recreation use data for the river corridor.

Regulating Structures

The Mississippi River within the GREAT III study area consists of two different segments. The upper portion, from Dam No. 27 (river mile 190.3, above the mouth of the Ohio River) upstream to Locks and Dam No. 22 (river mile 301.2), is in a pooled condition. Downstream from Dam No. 27 to Cairo, Illinois (river mile 0.0, the river is in an open condition. In addition to the pooled and open river differences, the water and sediment contribution of the Missouri river (river mile 195.0) gives the open river different characteristics.

The Pooled River - Saverton, Missouri, to Low Water Dam No. 27. During the latter part of the nineteeth century, the currently pooled portion of the Mississippi River above the confluence with the Missouri River was wide and generally shallow, with numerous islands and emerging sandbars during periods of low flow. The earliest Federal involvement with the river was in 1824 when funds were appropriated for the removal of fallen trees-snags. Four-and-one-half and six foot navigation channel projects were begun in 1874 and 1907, respectively. These provided a deeper navigation channel within the river primarily by using channel contraction dikes and bankline revetments.

The dikes were made of wood and stone and their purpose was to confine the low flows to the main channel and temporarily increase stream velocities within the contracted reach, thereby increasing the stream's sediment transport capacity, thus deepening the navigation channel by the riverbed scour. The sandbars between adjacent dikes soon become vegetated, with subsequent inundations depositing layers of finer-grained sediments such as silts and clays upon them.

To alleviate the increased scouring action on the opposite bank due to the confinement of low flows, the lower portion of the

TABLE 13
RECREATION AGENCIES AND PRIVATE ORGANIZATIONS
IN THE GREAT III STUDY AREA

	Planning Information	Funding	Development	Management	Program/ Services
Federal					
U.S. Army Corps of Engineer	x	x	x	x	x
U.S. Fish and Wildlife Service	x	x	x	x	x
National Park Service	x	x	x	x	x
U.S. Heritage Conservation and Recreation Service	x	x			
U.S. Forest Service	x	x	x	x	x
U.S. Coast Guard	x	x	x	x	x
Federal-State					
Upper Mississippi River Basin Commission	x				
Upper Mississippi River Conservation Committee	x				
State					
Illinois Department of Conservation	x	x	x	x	x
Illinois Department of Transportation	x	x	x	x	x
Missouri Department of Natural Resources	x	x	x	x	x
Missouri State Highway Commission	x	x	x	x	
Missouri Department of Conservation	x	x	x	x	x
Missouri Department of Public Safety (Boat Patrol)	x	x	x		x
Regional					
Regional Planning Commissions/Councils of Government	x				
Port Districts	x	x	x	x	
Bi-State Development Agency	x				
St. Louis County Municipal League	x				
Local					
Counties	x	x	x	x	x
Cities	x	x	x	x	x
Private					
Foundations: (L-A-D Foundation: Missouri Natural Area Survey)	x				
Clubs:					
Power Squadron	x				x
U.S. Coast Guard Auxiliary	x				x
Sierra Club	x				x
Audubon Society	x				x
Scouts	x				x
Pride, Inc.	x				x
Ducks Clubs		x	x	x	x
Boats Clubs			x	x	x
Sailing Clubs			x	x	x
Water Ski Clubs			x	x	x

riverbank was first usually protected with woven wooden mats placed against the bank and sunk with stone before the upper portion of the bank was revetted. Stabilization of the riverbanks reduced the amount of lateral channel migration, thus reducing the number of new side channels that were being formed.

Prior to the establishment of Pools 24, 25, and 26, approximately 300 dikes and 65 miles of revetment were bulit. Due to their general deterioration and heavy ice-pack damage, a substantial portion of these structures was severely damaged or completely destroyed, thus significantly reducing their effectiveness. Until recently, only very minor repairs were made to these regulating structures. Minor maintenance efforts are now used more extensively in repairing existing revetment works and dikes.

The Open River - Low Water Dam No. 27 to Cairo, Illinois. The reach of river from the mouth of the Missouri River to the mouth of the Ohio River is called the Middle Mississippi River. The Middle Mississippi has characteristics which are a composite of those of the Upper Mississippi and Missouri. From St. Louis to Grays Point, a distance of 134 river miles, it flows in an alluvial valley generally 4 to 5 miles wide between bluffs. Its character changes in passing through the 7-mile rockbound gorge from Grays Point to Commerce, and again when it emerges into the wide delta-like valley of the lower Mississippi. Historical accounts indicate that about 1820 the Middle Mississippi River passed from its natural state into a state where man's activities had a significant effect on the morphological processes. (U.S. Army Corps of Engineers, St. Louis District, 1976).

As the timber from the banklines of the river was being removed, the banks became less stable and began to deteriorate. (U.S. Army Corps of Engineers, St. Louis District, 1976 and U.S. Army Chief of Engineers, 1880). The river width increased from an average of 3,600 feet in 1821 to an average 5,300 feet in 1888. In the 1880's, the United States Government began the task of obtaining and maintaining a navigation channel. After many years of progress on the navigation project and associated studies, planning, and analysis, the river of today provides an improved navigation channel. The average width of the Middle Mississippi River was changed from about 5,300 feet in the 1880's to an average width of 3,200 feet today, as compared to the 3,600 feet in 1820's. The navigation project has caused geomorphic changes as shown in TABLE 14. River length has varied from a minimum of about 186 miles to a maximum of about 195 miles.

TABLE 14
GEOMORPHIC CHANGES OF THE OPEN RIVER

Year	Surface Area sq. mi.	Island Area sq. mi.	Riverbed Area sq. mi.
1821	109	14	95
1888	163	35	128
1968	100	17	83

Source: Simons, et al. Geomorphology of the Middle Mississippi River. 1974

If flow in a river increases, stages will increase; and if flow decreases, the stages will decrease. However, there is no simple physical relationship between the amount of increase or decrease in stage due to increasing or decreasing flow in alluvial rivers. Neither is there a consistent pattern of association between either dike construction or average top-bank width and stage-discharge changes with respect to time. (U.S. Army Engineers Division, Lower Missouri Valley, 1976). Irregular behavior of the stage discharge relationship during floods (loop effect), water temperature, sediment load, ice conditions, flood control structures, and floodplain development all play an important part in the complicated physical relationship between stage and discharge.

The St. Louis District has been cooperating with concerned agencies since 1969, in an effort to make the Nine-Foot Navigation Channel Project more compatible with aquatic and terrestrial habitat. Since 1971, all contract work calling for the construction and maintenance of river regulating structures has been reviewed by concerned conservation agencies. This review process has resulted in the elimination of some dikes, lowering the crown elevation on numerous other dikes, and construction of approximately 50 stone-fill dikes which contain a notch. Studies conducted to date indicate that the elimination of some stone-fill dikes may eventually have an adverse impact upon the authorized channel dimensions and may result in some increased dredging at some future date. A complete evaluation of approximately 50 notched dikes has not been made as to their effectiveness for the enhancement of aquatic and terrestrial habitat. Model studies indicate that notched dikes in certain situations may have a tendency to draw material into a field at a faster rate than unnotched dikes. Yet, with the proper selection of guidelines and criteria, it appears as though much can be done to enhance aquatic and terrestrial habitat through the modification of channel improvement structures.

Two of the most obvious beneficial effects of the Nine-Foot Navigation Project in the Mississippi River between Saverton, Missouri (Lock and Dam No. 22), and Cairo, Illinois (the mouth of the Ohio River), are the provision of a navigation channel and stabilization of the banks. The navigation channel provides an economical means of transporting bulk commodities such as grain, fertilizer, and coal. It is a low cost, fuel efficient, and safe mode of transportation. During 1977, 74,512,050 tons of cargo were shipped on the Middle Mississippi River.

Bank stabilization for erosion control is a significant component of the project concept. This erosion protection supports the integrity of the flood control levees along the waterways, as well as stabilizing the economic value of the many miles of highly productive farmland which is adjacent to the river. Land values are considerably higher because of the erosion protection provided and the increased per acre crop yield.

The stabilized banks have permitted the development of highly productive farmlands adjacent to the river and the construction of many levees to protect these valuable farmlands from flooding. Without the stabilized banks, the river would erode the levees away. The stabilization project has also permitted the reclamation of many acres of land which are now growing crops to feed the nation. It has permitted the permanent location of water intakes for consumptive uses and for cooling water used by power companies. Were the banks not stabilized, these companies would be constantly changing the location of their intakes as the river decided to move away from, behind, or through their intake.

One of the less obvious benefits has been the improvement in suspended sediments on the Mississippi River. Of all the physiochemical features affecting the lower Missouri River and Middle Mississippi River biota, turbidity is one of the most important. This condition has improved over the past 20 years due to reduction of the suspended sediment load by over one-half and an even more noticeable decrease in turbidity, which can be credited to reservoir regulation, bank stabilization, and land management. Due to these facts coupled with the knowledge that the Missouri River contributes approximately 90 percent of the suspended sediment load to the Mississippi River as it flows by St. Louis; and reports from the St. Louis Water Department that turbidity is approximately one-tenth of its value of ten years ago, it follows that the Middle Mississippi River today is much cleaner than it was 10-20 years ago, because of less sediment being transported. (Munger et al. 1974, U.S. Army Engineer Division, Lower Mississippi Valley, 1977).

There are no existing public or private programs for planning, constructing, or managing regulating structures in the Mississippi River between Saverton, Missouri (Lock and Dam No. 22), and Cairo,

Illinois (mouth of the Ohio River). Only the Federal Government plans, constructs, and manages regulating structures in the Mississippi River reach in our study area.

The institution dealing with resource management of river regulating works in the study area is the Federal Government. All existing jurisdictional, functional, and financial arrangements concerning resource management of river regulating works are the responsibility of the Federal Government.

Water Quality

The Mississippi River in the GREAT III study area is a large and complex river system composed of slow flowing or still waters in sloughs or backwaters and faster flowing, more turbulent waters in the main channel. Within the study segment major tributaries, the Missouri and Illinois Rivers, and direct discharges from the St. Louis area may cause substantial changes in water quality in the Mississippi. If sound recommendations for river management with respect to water quality are to be made, an understanding of the processes which affect the water quality in the Mississippi must be gained. Evidence of serious water quality problems exists. Although the Mississippi River provides a very valuable aquatic resource for Illinois and Missouri, the interstate nature of the river and its large size has hampered state management efforts. Federal agencies have approached river problems from their own particular area of interest. Therefore most local, state, or federal data gathering or management efforts have been aimed at specific issues. What is needed is a comprehensive examination of a large segment of the Mississippi in order to put many pollutant sources and water quality processes in their proper perspective.

Many instances of water quality degradation in the GREAT III segment of the Mississippi River can be cited. These range from violations of secondary drinking water supply standards for iron and manganese to more serious problems such as low dissolved oxygen (DO) concentrations (Missouri Water Quality Report, 1978), high frequency of occurrence of Dieldrin and other pesticides, PCB's and Mercury in Mississippi River fish. (A Brief Summary of the Occurrence of Toxic Materials in the Aquatic Environment in the Missouri and Upper Mississippi Rivers). Water quality, among other factors, is probably responsible for great reductions in the numbers of at least four species of fish and the extinction of another. (Pflieger, 1971). A once viable commercial and sport fishery between St. Louis and the confluence of the Ohio has been greatly reduced; apparently as result of the palatability of the fish.

The existence of such potentially toxic materials in river water and river sediments as PCBs, pesticides and several heavy metals whether they act singly, or synergistically with each other or with low DO concentrations threatens the integrity of the aquatic

food web and the potability of the water. Disposal of spoils materials or any other practices which would modify the aquatic environment could adversely affect the habitat of the river benthos (bottom dwelling plants and animals), thus undermining the food supply as well as the spawning areas of river fishes.

The bioaccumulation (accumulation by an individual through its lifetime) and biomagnification (the increasing concentration of a substance with increasing trophic level) present potential problems for all animals that consume benthos or fish from the Mississippi. This would include all the fish species in the river, as well as birds, mammals, and man. The biomagnification of chlorinated hydrocarbons in raptors may be a critical issue since it is known to cause reproductive system dysfunction in species which are rare in the study area. The above phenomenon is a problem or potential problem throughout the study area.

The potability of the water from the Mississippi River can be made to conform to primary (health) drinking water standards. However, the effects of long term chronic ingestion of toxics are generally unknown, and since many toxic substances frequently are found in Mississippi River water and many other toxics are not regularly monitored, a potential problem of low level chronic poisoning exists, particularly for longer lived species such as man.

Existing Planning and Resource Management Programs. Many of the water quality related activities taking place in or adjoining the GREAT III segment of the Mississippi (planning, standards development, National Pollution Discharge Elimination System (NPDES) permits, water quality monitoring construction of wastewater treatment facilities and enforcement) are requirements of Public Law 92-500, Federal Water Pollution Control Act Amendments. Enforcement of this law is the responsibility of the U.S. Environmental Protection Agency. The U.S. Environmental Protection Agency has delegated parts of this authority to states, where state program development and standards are adequate to meet the objectives of the Federal Clean Water Law. In some cases, the states will further delegate part of their authority to the local and regional level.

(1) Water Quality Planning. The major impetus for planning comes from two sections of PL 92-500. Section 303(e) requires each state to develop a continuing planning process to insure that states will continue toward or maintain the established goals of the Clean Water Law. In Illinois this responsibility falls on the Illinois Environmental Protection Agency and in Missouri on the Department of Natural Resources. Section 208, requires development of plans for areawide waste treatment of all pollution sources including nonpoint pollution. This planning requirement originally applied only to certain designated areas but was later expanded to include another plan for all non-designated areas within each state. The East-West Gateway Coordinating Council is responsible for the plan for the

Missouri part of the St. Louis metropolitan area, and Southwestern Illinois Metropolitan and Regional Planning Commission is responsible for plan development in the Illinois part of the St. Louis area. The statewide 208 plans are the responsibility of Missouri DNR and Illinois EPA.

(2) Water Quality Standards. Federal water quality standards recommendations are published in the U.S. Environmental Protection Agency, Quality Criteria for Water, 1976. Actual standards are set by the state (the Illinois Pollution Control Board and Missouri DNR) but a close review of these state standards are made by U.S. Environmental Protection Agency and standards in most states closely conform to those recommended by U.S. Environmental Protection Agency.

(3) National Pollution Discharge Elimination System (NPDES) Permit Issuance. A section of the federal clean water law set up a national system for identifying point source dischargers of pollutants and establishing limits on the amount and/or concentration of pollutants that could be discharged. Under this system all point source dischargers must have an NPDES permit showing what quantity and quality of discharge is allowed and must monitor their discharge to determine if the permit limitations are met. This permitting function is the responsibility of the Illinois EPA and the Missouri DNR.

(4) Construction and Management of Wastewater Collection and Treatment Facilities. In the private sector of the economy, waste water treatment system owners are responsible for meeting NPDES permits limits and constructing and operating such systems if permit limits require treatment. In the public sector, funding is available for the design and construction of wastewater treatment facilities. Design and construction decisions originate with the organization that will own and operate the facility (typically a city) but the entire process is subject to review by many regional, state and federal agencies. Those typically involved in the review of the design and construction of such facilities would include: regional planning agencies, state authorities in geology and historic preservation, the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers. The administration of state and federal funds into these projects and hence the most intensive review, is made by the Missouri DNR, Illinois EPA and U.S. Environmental Protection Agency.

The following permit holders discharge directly into the Mississippi or into a tributary less than 2 miles from the Mississippi in the GREAT III study segment of the river (TABLE 15).

TABLE 15
PERMIT HOLDERS WHICH DISCHARGE INTO MISSISSIPPI OR INTO A TRIBUTARY LESS THAN TWO (2) MILES FROM THE MISSISSIPPI IN THE GREAT III STUDY AREA
(1978)

RIVER MILE	OWNER	TYPE OF FACILITY	TYPE OF TREATMENT
283	City of Louisiana, Mo.	Water Treatment	*
282	City of Louisiana, Mo.	Sewage Treatment	Activated Sludge
282	Louisiana Mfg. Co.	Manufacturing	*
274	Dundee Cement Co.	Cement Plant	*
273	City of Clarksville, Mo.	Sewage Treatment	1-Cell Lagoon
	Hercules Inc.	Sewage Treatment	Imhoff Tank
	Hercules Inc.	Nitrogen Mfg.	Activated Sludge
	Hercules Inc.	Water Treatment	Settling Basin
258	Calhoun County Housing Authority	Sewage Treatment	* Septic Tanks
241.5	U.S. Lock & Dam 25	Sewage Treatment	Extend Aeration
241	City of Winfield, Mo.	Sewage Treatment	*
225	City of St. Charles, Mo.	Sewage Treatment	Tertiary
218	City of Grafton, Ill.	Sewage Treatment	Imhoff Tank
213	Principia College	Sewage Treatment	Extended Aeration
212	City of Portage Des Sioux	Sewage Treatment	Septic Tanks
209.5	Principia College	Sewage Treatment	Extended Aeration
209.5	Elsah Hill Apartments	Sewage Treatment	Septic Tanks
209.5	Lockhaven Development Inc.	Sewage Treatment	Activated Sludge
209.5	Oak Grove MHP	Sewage Treatment	3-Cell Lagoon
209.5	Godfrey Warren Levis	Sewage Treatment	3-Cell Lagoon
209.5	Belmont Village Subdiv.	Sewage Treatment	Imhoff, Trickling Filter
209	Union Electric Corp	Power Generation	*
207.5	Godfrey TWP	Sewage Treatment	*
207	Godfrey Youngblood	Sewage Treatment	1-Cell Lagoon
203	U.S. Lock & Dam 26	Sewage Treatment	Extend Aeration
201.5	Owens-Illinois Corp.	Manufacturing	3-Cell Lagoon
202	Laclede Steel Corp.	Manufacturing	*
202	Alton Box Board Corp.	Manufacturing	Primary
200	Illinois Power Co.	Power Generation	*
199.3	City of Alton, Ill.	Sewage Treatment	Primary
199.3	Illinois Power Co.	Power Generation	1-Cell Lagoon
199.3	Alton Box Board Corp.	Manufacturing	*
199.3	City of East Alton, Ill.	Sewage Treatment	Primary
198.5	City of Wood River, Ill.	Sewage Treatment	Primary
198	Amoco Corp.	Petroleum Storage	*
197.5	City of Roxana, Ill.	Sewage Treatment	Activated Sludge
197.5	Shell Oil Co.	Petroleum Storage	Tricking Filter, 1-Cell Lagoon

*Information not presently available

TABLE 15 (CONTINUED)
PERMIT HOLDERS WHICH DISCHARGE INTO MISSISSIPPI OR INTO A TRIBUTARY LESS THAN TWO (2) MILES FROM THE MISSISSIPPI IN THE GREAT III STUDY AREA
(1978)

RIVER MILE	OWNER	TYPE OF FACILITY	TYPE OF TREATMENT
197	National Marine Services	Barge Cleaning	
197	Clark Oil Co.	Petroleum Storage	Activated Sludge
196.5	City of Hartford, Ill.	Sewage Treatment	Imhoff Tank
195	Chemetco		Settling Pond
190	City of St. Louis, Mo.	Water Treatment	*
187	Missouri Portland Cement	Cement Plant	*
187	Certain-Teed Products	Manufacturing	*
187	GAF Corp.	Manufacturing	*
185	City of Granite City, Ill.	Sewage Treatment	Activated Sludge
183.4	Metropolitan Sewer Dist.	Sewage Treatment	Primary
182	Union Electric Co	Power Generation	*
181	PVO International Corp.	Processing	*
181	Union Electric Co.	Power Generation	*
178.5	City of E.St. Louis, Ill.	Sewage Treatment	Primary
178.5	Union Electric Co.		*
178	City of E.St. Louis, Ill.	Sewage Treatment	1-Cell Lagoon
178	Monsanto Corp.	Manufacturing	*
177	Anheuser-Busch Corp.	Brewery	*
173	Pott Industries		*
172	Monsanto Corp.	Manufacturing	*
172	Great Lake Carbon Corp.		*
171	Metropolitan Sewer Dist.	Sewage Treatment	Primary
171	National Lead Industries	Manufacturing	*
168.5	Triangle Refineries		*
168.5	Martigney Sewer Co.	Sewage Treatment	*
168	Asphaltic Concrete Corp.		*
166.5	City of Dupo, Ill.	Sewage Treatment	Primary
166.5	Missouri-Pacific R.R.	Train Yard	1-Cell Lagoon
165.5	City of Columbia, Ill.	Sewage Treatment	1-Cell Lagoon
159	Four Oaks Rest Home	Nursing Home	*
157.5	City of Herculaneum, Mo.	Sewage Treatment	Contract Stabilization
156.5	National Vendors	Manufacturing	
153	Teamsters Health Camp		Extended Aeration
153	Glenoma MHP		1-Cell Lagoon
153	St. Pious X Monastery		Septic Tank
152	St. Joe Minerals Corp.		*
152	City of Valmeyer, Ill.	Sewage Treatment	1-Cell Lagoon
152	KOA Campground		1-Cell Lagoon

*Information not presently available

TABLE 15 (CONTINUED)
PERMIT HOLDERS WHICH DISCHARGE INTO MISSISSIPPI OR INTO A TRIBUTARY LESS THAN TWO (2) MILES FROM THE MISSISSIPPI IN THE GREAT III STUDY AREA
(1978)

RIVER MILE	OWNER	TYPE OF FACILITY	TYPE OF TREATMENT
152	Herculaneum School Dist.	Junior High School	*
150	City of Crystal City, Mo.	Water Treatment	*
148.4	Festus Airport & Industrial Park		1-Cell Lagoon
148.4	PPG Industries	Manufacturing	
148.4	Cities of Festus, Crystal City, Mo.	Sewage Treatment	Contact Stabilization
145.7	River Cement Co.	Cement Plant	*
144.5	U.S. Steel, Ag.Chem. Div.	Manufacturing	*
140	Union Electric Co.	Power Generation	*
130	City of PrairieduRocher, Ill.	Sewage Treatment	1-Cell Lagoon
122.5	Mississippi Lime Co.	Mining	*
122	City of Ste. Genevieve, Mo	Sewage Treatment	1-Cell Lagoon
110	Menard Penitentiary		*
109	City of Chester, Ill.	Sewage Treatment	*
81	CIPS	Sewage Treatment	Extended Aeration
81	CIPS	Power Generation	*
69	Charmin Paper Products Co.	Manufacturing	*
68.5	Trail of Tears State Park		*
50.4	City of Cape Girardeau, Mo	Sewage Treament	Primary
50.2	S.E. Missouri Stone Co.	Mining	*
49	Marquette Cement Co.	Cement Plant	*
43.5	City of Illmo, Mo	Sewage Treatment	*
42	Alexander County Housing Authority	Sewage Treatment	Extended Aeration

*Information not presently available

(5) Monitoring of Discharge Effluent and Ambient Water Quality. Most NPDES permits require the holders to sample their effluent and report its quality. In addition, Missouri DNR, Illinois EPA and U.S. Environmental Protection Agency have regular effluent sampling programs to determine if permit holders are in compliance with permit restrictions. Ambient water quality stations on the Mississippi have been established by Illinois EPA, Missouri DNR, U.S. EPA and U.S. Geological Survey. Indirect monitoring of water quality through sampling of stream fish and/or benthos has been done by Illinois Natural History Survey, the Missouri Department of Conservation, and the Illinois Department of Conservation.

(6) Water Quality Research. Basic research in both wastewater treatment and in the actual stream environment and its processes is done by many colleges and universities in Illinois and Missouri. The largest supporters of water related research are the Office of Water Research and Technology, Department of Interior, through its grant and matching funds programs, and U.S. EPA through its funding of short term research projects.

(7) Recycling of Industrial Wastes. The East-West Gateway Coordinating Council has received a grant from the U.S. Environmental Protection Agency to promote recycling through a material exchange system in the St. Louis metropolitan area. This continuing 208 grant is intended to facilitate recovery of materials before they become pollutants in water.

Institutions Involved in Water Quality Management. The agencies which are directly involved in water quality management are described in the subsequent paragraphs:

(1) U.S. Environmental Protection Agency. This agency has responsibility for enforcement of PL 92-500. Although much of the authority has been delegated to state or regional institutions. U.S. EPA maintains the ability to interject itself into almost any level of the management process through the distribution of federal funds and its ultimate responsibility for enforcing PL 92-500. Its major functions are: to review state Continuing Planning and 208 Planning documents, to review State Water Quality Standards development, to review the Construction Grant Program for wastewater collection and treatment facilities, to assist states in inspection of wastewater treatment facilities and in sampling effluents, ambient water quality monitoring of the Mississippi in the St. Louis area and facilitate technology transfer through seminars and publications of EPA funded research. EPA has taken the lead in certain areas of water quality management where individual states have not had the resources, nor could have gained the national perspective of the problem. One such area has been the development of the toxics program to better define the national scope of water pollution caused by small concentrations of over 100 toxic compounds.

(2) Missouri Department of Natural Resources and the Illinois Environmental Protection Agency. These agencies have been designated by their respective governors to bear responsibility for enforcement of state and federal clean water legislation. Their major functions are: to develop water quality planning strategies as required in Section 303(e) and 208 of the Federal Clean Water law, to administer both state and federal municipal grant programs for construction of wastewater collection and treatment facilities, to monitor effluents from dischargers and monitor ambient water quality, to assist in the training and provide certification of wastewater treatment operators and to enforce state and federal clean water legislation. In addition, the Missouri DNR has rule

making authority in administering the clean water law and sets and revises state water quality standards. The Illinois Environmental Protection Agency is the certifying agency for Section 404 dredge and fill permits for Illinois.

(3) Illinois Pollution Control Board. This board established all rules in the administration of clean water law including the development and revision of water quality standards. It acts as the court of original jurisdiction in enforcement and grants variances from the law or its rules.

(4) State Agencies. Other state agencies involved in geology and historic preservation retain review and comment authority during the municipal grant project.

(5) Regional Planning Commissions. East-West Gateway Coordinating Council (City of St. Louis and St. Charles, St. Louis, Franklin and Jefferson Counties in Missouri), Southwest Illinois Metropolitan and Regional Planning Commission (Madison, St. Clair, Monroe , Randolph, Bond, Clinton, Washington Counties in Illinois). These two regional planning commissions have been responsible for areawide wastewater treatment planning through Section 208 of the Clean Water Act showing changes made by the 1977 Amendments and review all wastewater construction projects in their area. Other regional planning agencies within the study area assisted in developing state wide 208 plans. The East-West Gateway Coordinating Council is also responsible for developing point source treatment for the St. Louis 201 area.

(6) Municipalities. Cities are responsible for adequate treatment of the wastewaters of their citizens and any industry or business connected to the city sewer system. Since the Clean Water Act, showing changes made by the 1977 Amendments, requires a fairly high degree of treatment of municipal wastes, many cities through 201 planning are upgrading or replacing less effective treatment plants. Cities receive funding through U.S. EPA under programs administered by the state. It is the responsibility of the city to initiate this grant process and to see that the contractor(s) for design and construction of the facilities does the job properly. In most instances, cities must pay for 10% of the project cost, the state 15% and the federal government 75%.

(7) U.S. Army Corps of Engineers. The major functions of the Corps of Engineers in water quality management are gained through Sections 402 and 404 of the Clean Water Act showing changes made by 1977 Amendments. Section 401 requires that any activity which may cause a discharge into navigable waters requires a permit. Review of permit application and issuance of permit is usually done jointly with the state NPDES authority. Section 404 requires that dredge and fill activities on the river acquire permits. As with 401 permits, these permits are issued by joint action of the Corps and

the state and should reflect an accurate environmental impact assessment of the activities permitted. Disagreement between environmental impact assessment in the issuance of 404 permits led to the initiation of the Great Study. The Corps has review and comment authority in the design and construction of wastewater treatment facilities.

(8) U.S. Geological Survey. This agency, through its water resources program, monitors both flow of the Mississippi and its chemical quality at several locations in the GREAT III study segment.

(9) Illinois Department of Conservation, Missouri Department of Conservation, Illinois Natural History Survey, Illinois Institute of Natural Resources. These state agencies function in the water quality management field as data collectors and as researchers. The first three agencies work stresses the relationship of water quality and the associated biota.

(10) U.S. Fish and Wildlife Service. This agency retains review and comment authority on design and construction of wastewater treatment facilities.

(11) Office of Water Research and Technology. It is mandated by the Water Resources Act (PL 88-379) to fund water quality management related research. Title I grants are matched by state water resource research institutes' funds for research conducted in that state. Title II funds are grants or contracts to commercial organizations, educational institutions, private foundations, other organizations and to individuals for research.

(12) State Water Resources Research Institutes. These research institutes are responsible for providing necessary matching funds, administering grants and research projects and the collection and distribution of water research papers.

(13) U.S. Coast Guard. This agency is responsible for the prevention of spills through vessel regulation and for insuring the containment and cleanup of spilled materials.

FUTURE CONDITIONS

Determination of future development trends in the GREAT III study area was predicted on a number of assumptions. These assumptions are: (1) there will be continued growth of waterborne commerce as projected in the Locks and Dam 26 (Replacement) studies, (2) the recent Executive Orders (May 1977) concerning floodplain management and protection of wetlands will be enforced, and (3) the floodplain insurance program will be continued.

Each work group has described what will most likely happen without changing existing programs for resource management. The

"most probable future" provides a framework within which to define the "without condition" (i.e., the conditions that will prevail in the absence of this plan for resource management).

Commercial Transportation

River navigation operating in the free market place will continue to help meet the nation's transportation needs in a safe and economical manner. While the volume of barge traffic is expected to increase (TABLE 16), barge tows are not expected to either increase or decrease in size. Double hull barges will increase in number and therefore reduce the possibility for vessel damage or cargo spills. The number of barge terminals and fleeting areas are not anticipated to increase at a corresponding rate with increased traffic.

Water transportation industry forsees the emphasis on better utilization of existing facilities in lieu of new development. Continued environmental objections to adequate channel maintenance may inhibit the growth and safety of commercial navigation. Locks with insufficient capacity and restrictive bridges will remain impediments to navigation. Although Locks and Dam 26 has received Congressional approval, it will probably take 10 years to complete as a result of construction time and court challenges. Future political decisions will have a profound effect upon the demand for barge traffic such as the recognition of Red China that may stimulate grain and soybean sales.

Cultural Resources

In the absence of a plan for the GREAT III area, it will be impossible to coordinate systematically present and future planning and management practices during compliance procedures with the following Federal regulations:

a. The Antiquities Act (1906).

b. Historic Sites Act (1935).

c. Reservoir Salvage Act (1960).

d. The National Historic Preservation Act (1966).

e. National Environmental Policy Act (1969).

f. Executive Order 11593 (1971).

g. 36 CFR 800 (1974).

h. The Archeological and Historic Conservation Act (1974).

i. 33 CFR 305 (1978).

TABLE 16

Summary of Projected Waterborne Commerce Through Locks No. 26
Most Likely Traffic Level
1972-2040
(Tons in Thousands)

	1972	1980	1985	1990	2000	2010	2020	2030	2035	2040
Corn	14,977	12,302	13,607	19,594	28,398	31,209	34,704	38,299	40,345	42,082
Soybeans	4,737	7,774	9,867	12,336	15,299	16,981	18,687	20,519	21,677	22,774
Other Grains	2,519	2,030	2,135	2,434	2,805	3,082	3,368	3,738	3,940	4,119
Coal	7,953	11,135	12,676	13,819	16,777	20,144	24,208	29,079	31,870	34,920
Petroleum	8,130	18,838	27,891	30,142	35,503	36,600	38,118	39,875	40,946	42,162
Cement, Stone, Sand & Gravel	1,204	1,109	1,195	1,287	1,494	1,734	2,011	2,332	2,510	2,708
Iron and Steel	1,919	3,193	3,364	3,639	4,286	4,972	5,811	7,002	7,670	8,480
Industrial Chemicals	3,967	5,277	6,200	7,321	10,145	13,973	18,024	23,041	26,005	29,433
Agricultural Chemicals	2,669	3,642	4,003	4,369	5,193	5,759	6,383	7,044	7,399	7,771
Miscellaneous & Other	4,202	4,487	4,856	5,380	6,611	7,244	7,961	8,797	9,378	9,924
TOTAL	52,301	69,677	85,799	100,319	126,511	141,698	159,075	179,896	191,730	204,373

Index of Change from 1985

Corn	110	90	100	144	209	229	254	281	296	309
Soybeans	48	79	100	125	155	172	189	209	220	231
Other Grains	118	95	100	114	131	144	158	175	185	193
Coal	63	88	100	109	132	159	191	229	251	275
Petroleum	29	68	100	113	127	131	136	143	147	151
Cement, Stone, Sand & Gravel	101	93	100	108	125	145	168	195	210	227
Iron and Steel	57	95	100	108	127	148	173	208	228	252
Industrial Chemicals	64	85	100	118	164	225	291	372	419	475
Agricultural Chemicals	67	91	100	109	130	144	159	176	185	194
Miscellaneous & Other	87	93	100	111	136	149	164	181	193	204
TOTAL	61	81	100	119	147	165	185	209	223	238

Source: U.S. Army Corps of Engineers, St. Louis District. Lock and Dam 26 (Replacement) Design Memorandum No. 11, Volume 1, June 1975.

The GREAT III study may allow for orderly compliance to the above Federal regulations and the prevention of conflicts which often arise between developers and preservationists when cultural resources are threatened during development activities. Presently developers often wait until the last minute to request an examination of cultural resources within an impact area. This usually results in last-minute compromises to protect or at least minimally disturb these resources. In many cases developers are not required by law to consider the protection of cultural resources. The ideal, which GREAT III seems to offer, calls for long-term planning and the coordination of activities between all developers and preservationists so that cultural resources will be protected and development activities may proceed with little or no interruption.

To the professional archaeologist and historian conducting investigations of cultural resources in the study area, the GREAT III study will significantly improve the methods for interpretation and the interpretation itself of the prehistoric and historic cultural record in the area. The present absence of a comprehensive summary of the existing literature and an inventory of known resources in the area prevents the formulation and use of predictive models for the proper evaluation and management of those resources. Presently, investigators must often extrapolate from evidence found outside the area in order to reasonably hypothesize the nature of subsistence and settlement patterns within.

Dredging and Dredged Material Uses

Dredging will continue to be required in order to maintain the authorized navigation project. While some adverse impacts of dredging may be reduced by implementation of the recommendations presented in the reports of the recently completed Dredged Material Research Program directed by the U. S. Army Waterways Experiment Station, Vicksburg, Mississippi, all real and perceived adverse impacts to the other river resources will not be eliminated.

Section 404(t) of the Clean Water Act, showing changes made by the 1977 Amendments, gave states the authority to impose their own permit programs and other requirements established under state law on Corps of Engineers navigation maintenance dredging projects. Depending on the programs and requirements passed by the States of Missouri and Illinois, additional constraints on the Corps of Engineers maintenance dredging program may or may not generate new problems. In the future, some dredged material may be classified as "hazardous solid waste" which will require Corps' compliance with the provisions of the Resource Conservation and Recovery Act of 1976.

Recommendations made at the completion of the Industry Capability Program and the Corps of Engineers' Minimum Dredge Fleet

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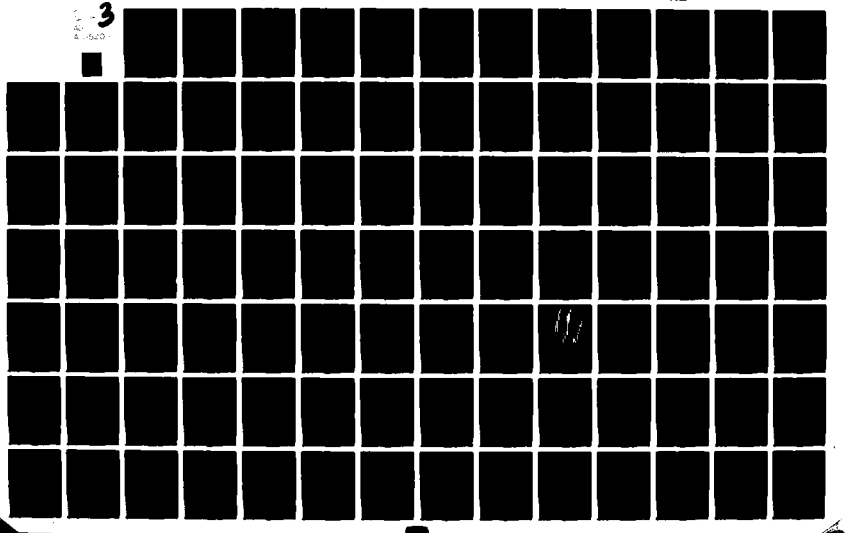


Studies may result in increased delays to commercial transportation when channel closures occur and alter the operations and maintenance programs.

Erosion and Sediment

If the pools are operated in the present-day manner for the next 50 years and if the sediment load to the study reach remains essentially unchanged, the following geomorphic changes can be expected to occur: The riverbed in Pool 24 will degrade approximately 1.5 feet overall. Pool 25 will degrade 3.0 feet immediately upstream of the control point and remain unchanged in the lower portion. Pool 26 will degrade between 6 and 7 feet immediately downstream of Lock and Dam 25 and will aggrade approximately 2.5 feet in the middle and near Locks and Dam 26 (Simons, Schrum, Stevens, 1974).

Fish and Wildlife

Population and economic growth in the GREAT III area will increase demands on the river system for all uses, including the recreational and aesthetic qualities provided by its fish and wildlife resources. Without proper identification of the river system's capabilities and limitations, development of techniques which assist in achieving its full potential, and completion of a management plan which incorporates all resource needs and can be endorsed by all river users, the conflict for its use will continue. As a result, all resources will suffer.

If present conditions persist, wildlife and fisheries habitat will continue to decline. Valuable fish spawning and nursery areas will be lost. Riparian borders will be modified and productive wetlands will continue to decline. Unregulated development in the floodplain will continue, resulting in increased demands for flood protection and subsequent losses of habitat. Navigation and navigation channel development may proceed in a manner which is detrimental to fish and wildlife resources.

Provisions exist with present authorizations (i.e., Fish and Wildlife Coordination Act, National Environmental Policy Act, Clean Waters Act, Rivers and Harbors Act, Endangered Species Act, etc.) by which significant losses in fish and wildlife resources may be prevented. However, most losses of significant proportions result from the cumulative effects of many actions. Without full knowledge of all the actions, it is difficult to predict the effect of a single action. As a result, assumptions must be made which may not be valid in light of full knowledge.

Without proper planning, individuals and organizations will continue to expend great deals of funds and effort on proposals which are ecologically unsound. Opposition to such proposals by agencies charged with the protection of biotic resources will continue to cause hardships on these organizations and individuals, and conflicts between river users will persist.

Floodplain Management

Diversity of activities between agencies may diminish as emphasis continues to be directed to coordination of programs and as floodplain mapping and resource inventory information is completed. The Missouri and Illinois interstate agreement and resultant coordination will diminish interagency and interstate conflicts regarding floodplain activities. Costs attributable to flood damages will subsequently cease to increase.

Industrial and Economic Development

Population within the impact area will continue to demand increased industrial and economic growth. Recurrent economic slowdown trends may result in increased unemployment in the study area.

Industry's future is highly dependent upon governmental policy decisions in the area of energy production, consumption and processing, national transportation planning, environmental elements and regulations, and foreign trade relations.

If economically possible, private enterprise will continue to meet the needs of the market place, but industrial and financial institutions need assurance that government will continue to finance and construct infrastructure projects which are required to support industry's growth. Present environmental and regulatory constraints require industry to prove that all constraints are met. This "burden of proof" on the industry is an expensive and time consuming deterrent to growth.

Congress, for the first time in history, has enacted a waterway user charge which will increase future operating costs of the barge industry. What effect this will have on the availability and efficiency of the waterways as an attraction to new industrial development is now uncertain. However, a May 1978 Study - "Impacts of a Waterways User Charge on the Economy of Tennessee by the Bureau of Business and Economic Research of Memphis State University" indicates that thousands of jobs can be lost depending on the magnitude of cost recovery level (TABLE 17).

A clear claim to a reasonable share of waterfront land must be secure for industrial and economic development. This means lands for factories so that raw materials or products might logically move by water transportation; and also lands for terminals and warehouses for product shipments to and from other regions in order to maximize usage of all modes of transportation.

Recreation

The population of the impact area will continue to grow, causing increased recreation demands. Present trends toward outdoor recreation will continue.

TABLE 17

ESTIMATED POTENTIAL LOSS IN EMPLOYMENT OPPORTUNITIES RESULTING FROM DIFFERENT LEVELS OF WATERWAY USER CHARGES ON FUTURE PLANT EXPANSIONS AND LOCATIONAL DECISIONS

	User Charge Alternative			
Year	4¢ Tax	8¢ Tax	24¢ Tax	40¢ Tax
1977	546	1,092	3,425	4,700
1978	592	1,184	3,733	5,121
1979	646	1,292	4,071	5,583
1980	704	1,408	4,438	6,076
1981	771	1,542	4,838	6,633
1982	838	1,676	5,271	7,229
1983	913	1,826	5,746	7,879
1984	996	1,992	6,263	8,592
1985	1,083	2,166	6,825	9,363

[1]The loss in employment is computed from information provided by the industry sample survey. The survey respondents had estimated assets of $238.5 million with employment of 10,000 workers for assets per employee of $23,850. By dividing the change in expenditure by $23,850, the number of employees can be estimated. In the estimates above, $24,000 is used rather than the $23,850 for simplicity.

Source: Bureau of Business and Economic Research, Memphis State Univiersity. "Impacts of a Waterways User Charge on the Economy of Tennessee," May, 1978.

Without planning, conversion of areas of river, riverbank, floodplains, backwaters, bluffs, and river hills will continue to preempt potential recreation lands for other uses, particularly residential, industrial, and transportation uses. These conversions will also degrade the scenic quality of the river corridor and possibly the air and water quality which will degrade the recreation experience. Destruction of potential natural areas will continue.

Continued loss of wildlife habitat will also cause loss of recreation opportunities. The present lack of access to many parts of the river and the lack of public lands along the river will mean continuing unsatisfied recreation needs.

Conflicts between different recreational uses and conflicts between commercial navigation and recreation will continue. Based on projections of increases in boating activity, the probability of boating accidents might be assumed to increase. However, due to recent, encouraging downward trends in accident rates, expanded state enforcement and education programs can be expected to reduce overall accident rates, total loss of life, and property damage significantly within the next 20 years if increases in enforcement and education capability correspond to the high forecasted activity. (Upper Mississippi River Basin Commission, Level B Draft Paper on Recreation Boating Safety, 1978)

Regulating Structures

Presently, the navigation project is of a singular purpose and will probably remain so unless the GREAT III study can supply Congress with justification to modify the project authorization to allow additional project purposes. Continued progress on the development of a dependable navigation channel by present design criteria will probably result unless studies conducted under the authority of GREAT III recommended revised criteria and guidelines.

Water Quality

Assessment of the present water quality conditions of the river are complicated by the presence of a large number of potentially toxic substances whose concentrations and; therefore, impacts on aquatic and linked terrestrial systems are generally unknown. Also, the lack of a comprehensive water quality overview of the Upper Mississippi which would put major pollutants and water quality processes in perspective makes sound water quality management decisions more difficult. Projection of the future condition without the needed studies would be similar to present conditions with the following mitigations and exacerbations:

The production and domestic use of certain toxic compounds found frequently in the Mississippi River, its sediments, and biota

have been greatly curtailed. Polychlorinated biphenols (PCB's) are a class of compounds of great stability under both heat and pressure that have been manufactured and used since 1929. Beginning in 1970, the uses of PCB's have been progressively restricted (Kleinert, 1976). At present the primary use is for dieletric fluids for the electrical industry. The recent emphasis of U. S. Environmental Protection Agency on control of toxic substances will probably result in stricter control of PCB's in wastewater discharges. The stability of PCB's means that they will persist in the ecosystem for some time. Estimates range from several years to several decades (Sheffy, 1977). Evidence of a reduction in the PCB problem in the GREAT I and II study areas has been documented, (A Brief Summary of the Occurrence of Toxic Materials in the Aquatic Environment in the Missouri and Upper Mississipi Rivers).

The restriction in use of chlorinated hydrocarbon insecticides should reduce future levels of these persistent compounds in the aquatic environment. Future reductions in the occurrence of these compounds makes knowledge of their impact on water quality less critical than at present.

The present need for information to make sound water quality management decisions may be aggravated in the future by:

1. A profusion of new chemicals appearing in wastewater discharges.

2. Decline in Mississippi River water quality which would make information deficiencies more critical.

3. Increasing importance of the Mississippi River as a natural resource, thereby making proper management more critical.

Less than comprehensive knowledge of water quality processes in the Mississippi will lead to periodic ecological guideline or standard changes based on a particular facet of the ecosystem which does not account for relevant synergistic categorizations.

PROBLEM STATEMENTS

The following resource management problems have been identified by each technical work group through an examination of the existing and projected future conditions of the GREAT III reach of the Mississippi River and related land resources. Work group study participants analyzed the problems as perceived by work group members and the public and combined these problem statements into a prioritized array of public and professionally perceived problems. Subsequently, all study participants reviewed this synthesis of concerns expressed by the work groups and the public. This section presents these problem statements by work group.

Two work groups (i.e., Data and Reports and Public Involvement) function somewhat differently than the other work groups in that these work groups provide the necessary coordination between study participants and between study participants and the public throughout the planning process. As a result, resource management problems identified by Data and Reports and communication concerns identified by Public Involvement were formulated based primarily on the concerns expressed by the public during the Stage 1 public meetings, and are not presented in a priorty order. The perceived problems, represented by Data and Reports and Public Involvement, are also distinct from those presentd by the other technical work groups in that these problems interface with all work groups and are pertinent to the overall development of a resource management plan.

Data and Reports Work Group

- Lack of coordination and cooperation between different and sometimes conflicting users of the river.

- Insufficient coordination in river management and funding.

- Corps of Engineers' resource management is limited by a single purpose authorization.

- Duplicate studies waste time and money.

- Lack of public awareness of the river.

Public Involvement Work Group

- There is a need to make information available to the public in order to increase public awareness and understanding of the GREAT III Study.

- There is a need to assist the public in conveying its views, preferences, and concerns relative to GREAT III before decisions are made on studies and projects.

- There is a need to maintain cooperation between study participants and the public in the understanding and formulation of common goals.

- There is a need to give full consideration to public views and preferences in the GREAT III planning process.

Commercial Transportation

1. Current and future barge traffic is constrained from meeting transportation needs.

2. The role, characteristics and requirements of the waterway transportation system are not understood by the general public.

3. Increased collisions due to increased traffic.

4. Waste disposal control from towboats.

5. Better shore facilities for radio communications in the marine band.

6. Adverse effect of GREAT III on commercial navigation.

Cultural Resources

1. Management of known cultural resources in all areas of the GREAT III reach is extremely limited. The absence of a comprehensive summary of published and unpublished literature, an inventory of recorded cultural resources, and an inventory of areas surveyed, prevents the development of any useful cultural resource management plan.

2. Cultural resource management procedures and programs, as required by Federal laws and regulations, of the some agencies are often unknown or unclear to both agency individuals and other institutions conducting cultural resource management projects in the area. This results in a lack of communication and coordination between the two groups and their activities.

3. The lack of communication between the public and those individuals and institutions managing cultural resources, results in the unnecessary public misunderstanding and apprehension of the role cultural resource management plays in development activities.

4. The lack of long range planning for floodplain development often results in the direct, indirect, or potential, adverse impact on known and unknown cultural resources.

5. Systematic survey data for cultural resources are often lacking for present and most future development and land disturbance activity areas.

6. Many cultural resources are generally known to exist in the GREAT III area but extensive and reliable up-to-date information for many of these resources is not available.

7. Methods for the preservation of cultural resources (e.g., physical site maintenance, protection, or public education) have not been adequately developed or utilized.

8. Need for access to historical/cultural sites.

Dredging and Dredged Material Uses

1. Decisions on the placement locations of dredged material may be affected by the impacts to the other river resources such as fish and wildlife habitats, recreational, industrial development and cultural sites and are limited by dredge plant capacity, volume of material displaced, and placement technology for beneficial uses of dredged material for commercial, industrial and recreational purposes; and the legality of any proposed beneficial use of dredged material.

2. Shoaling may occur in the open reach of the river at many crossings simultaneously reducing the progress of commercial traffic which may be intensified by the recommendations of the Industry Capability Program and the Corps of Engineers' Minimum Dredge Fleet Study.

3. Projected flow depletions may increase future dredging requirements through consumptive and non-consumptive water uses.

4. Lack of authority to dredge outside of the authorized channel by the Corps of Engineers.

Erosion and Sediment

1. Sediment produced at upland sites affects the river corridor.

2. River training works affect aquatic habitat by limiting water surface area and modifying sediment deposition and erosion patterns.

3. River regulating works trap sediment, induce bed scour and change fish and wildlife habitat.

4. Erosion of the river banks affects the river resources.

5. Overflows cause sediment deposition and scour on floodprone lands.

Fish and Wildlife Work Group

1. Channel regulating structures (i.e. revetments, dikes, and dams) may result in alterations of valuable fish and wildlife habitats by modifying water surface, changing water velocities, changing bed scouring and sedimentation patterns, and altering reparian habitat.

2. Dredging and the disposal of dredged material has been conducted in a manner affecting fish and wildlife.

3. Inventory data on biological resources are insufficient for planning purposes.

4. Improved flood protection has altered fish and wildlife habitat.

5. Increased tow traffic may affect the biological productivity on the river.

6. Increased tow traffic may result in increased demands for support facilities (fleeting areas, harbors, docks, etc.), thereby resulting in additional fish and wildlife losses.

7. Regulation of water levels in the pooled river does not include consideration for the needs of fish and wildlife resources.

8. Federal lands in the pooled portion of the GREAT III study area are not being developed to their full fish and wildlife resource potential.

9. Increased tow traffic may create additional demands for year-round operations. This will compound other tow traffic problems and place fish and wildlife under additional stress.

Floodplain Management

1. There needs to be a greater reduction in flood damages.

2. The social, economic and environmental impacts of floodplain management or the lack thereof are not known.

3. There is a lack of floodplain mapping and resources inventory.

Industrial and Economic Development

1. Institutional and regulatory impacts on economic development need to be assessed.

2. Physical barriers, intermodal conflicts and inadequacies of existing transportation system hinder industrial operations and future economic development.

3. There is a lack of fully serviced or reasonably serviceable industrial and commercial lands.

Recreation Work Group

1. There is a lack of recreation opportunities in the GREAT III study area.

2. Funding and coordination of law enforcement and education programs regarding the use of the river are inadequate.

3. Undisturbed areas in the GREAT III study area with the potential to be designated as natural areas have not been protected.

4. Developments in the river corridor adversely impact the recreation experience by diminishing the aesthetic and safety qualities of the river resources.

5. The development, operation, and maintenance of the navigation project affects recreation activities and opportunities.

6. Land use plans, developments and regulations often adversely impact the quantity and quality of recreation resources and opportunities.

Regulating Structures

1. It is presently unknown what effect river regulating structures have on main channel corridor aquatic and terrestrial habitat.

2. Effects of regulating structures on channel geometry and their relationship to problems 1 and 3.

3. It is presently unknown what effect river regulating structures have on side channel aquatic and terrestrial habitat.

Water Quality Work Group

1. The adverse impact on water quality of increased and more powerful barge traffic and maintenance of navigation channel on the Mississippi River adversely impact on water quality.

2. The adverse impact on water quality of municipal, commercial, agricultural and industrial discharges to the Mississippi and its tributaries.

These two general problems (Numbers 1 and 2) raise these specific concerns: a) Water supplies endangered by toxic materials; b) Aquatic habitat endangered by toxic materials and suspended sediment; c) Periodic low dissolved oxygen concentration in certain segments of the river and d) Reduction of the value of sport and commercial fisheries due to bioaccumulation and biomagnification of toxic materials and taste and odor producing materials.

3. Lack of coordination between local, state and federal agencies on water quality, etc.

PLANNING CONSTRAINTS

The primary planning constraint is indicative of the nature of the GREAT III planning process which employs representatives from various state and Federal agencies that constitute the planning team. This organizational arrangement has been developed to achieve a resource management plan that has resulted from an interdisciplinary, cooperative and combined effort. Technical work groups, chaired by representatives from these agencies, provide imput and review for the study. Coordination of work group activities and products is a time consuming and cumbersome process that requires a high degree of flexibility on the part of study management. Although this is presented as a planning a constraint, it also represents an opportunity as envisioned by Section 117 (P.L. 94-587) to bring together the diversity of interests in the management of the Mississippi River and its' related land resources.

A second planning constraint is the amount of time entailed in initiating technical studies. Detailed and well defined contracting procedures are necessary to ensure the professional quality and accuracy of the numerous technical studies required to address the objectives identified for the GREAT III Study. This study utilizes the Department of Army (DAR) Regulations to contract for technical studies. The process is lengthy and time-consuming. At any of several points in the process, a scope of work may undergo revision or refinement; thus, further extending the amount of contract process time prior to initiating the study.

Recent legislation (i.e., P.L. 95-502) authorizes the Upper Mississipi River Basin Commission to prepare a Comprehensive Master Plan for the Management of the Upper Mississippi River System. The GREAT studies were also mandated to develop "a river system management plan." The legislation that authorizes the UMRBC Master Plan indicates that the Basin Commission shall utilize, to the fullest extent possible, the resources and results of the Upper Mississippi River resources management (GREAT) study. To date, the interrelationship between the two studies has been unclear. With two public laws mandating the development of a management plan for the Mississippi River, it seems imperative that an understanding be reached on the intergration of these plans to avoid not only duplication, but potential conflict. The GREAT III Team has agreed that it is the responsibility of the Upper Mississippi River Basin Commission to take the lead in determining how the resources and results of the GREAT studies will be utilized. To avoid duplication, the GREAT III Team will not investigate any areas specifically designated for the Upper Mississippi River Basin Commission Master Plan.

Based upon the quantity and complexity of the resource management problems identified in the Reconnaissance Report, it seems unlikely, at this time, that it will be possible to make adequate study of all perceived problems within the time and funding

constraints of the study. The time constraint of September 1981 for completing technical studies may preclude the type of long-term studies necessary for a thorough examination of some problems. The degree to which the study will be restricted by the study schedule and funding limitations can better be determined after scopes of work and cost estimates have been finalized for the priority studies.

PLANNING OBJECTIVES

The planning objectives have resulted from an analysis of the public and professional concerns; and state, in general terms, the resource management needs to be addressed in this study. This section presents the planning objectives by technical work group. As the study progresses, the planning objectives will be reanalyzed in order that a manageable and well defined set is specified prior to developing alternative plans.

Commercial Transportation Work Group

1. Insure sufficient width and depth to provide for the safe and efficient passage of nine foot draft vessels.

2. Seek means of improving economic efficiency and service.

3. Insure the availability of suitable areas for the development of terminals and fleeting areas to meet the present and future needs of water transporation.

4. Encourage the development of multi-modal transportation facilities.

5. Identify and evaluate the effects of commercial transportation activities for their social, economic and environmental beneficial or adverse impacts.

6. Seek a system for determining the proportionate allocation of public costs for river projects.

7. Minimize government controls to those economically justified or absolutely necessary to insure safe vessel operation and cargo transfer.

8. To objectively inform the public of the role, characteristics and requirements of the water transportation system and how it is integrated into a total transportation network.

9. Identify restraints to commercial navigation that appear unjustified as to net public benefits.

10. Identify safety hazards to commercial navigation.

11. Determine future market demands and their effect upon barge traffic.

12. To minimize the physical constraints to navigation caused by locks, bridges, and other impediments.

Cultural Resources Work Group

1. Inventory the known cultural resources and conduct a literature search and review of published and unpublished materials concerning cultural resources in the area.

2. Formulate long and short term management procedures and recommendations for cultural resources.

3. Recommend improvements to existing procedures of the Corps of Engineers and other agencies managing cultural resources in areas under their jurisdiction.

4. Evaluate and recommend methods for the preservation of cultural resources.

5. Provide assistance to other work groups on the relationship of cultural resource management to their programs and projects.

6. Contact and maintain communication with citizens and citizen groups interested in or dealing with cultural resources.

Dredging and Dredged Material Uses

1. The objective is to recommend a dredging plan for maintaining the authorized navigation channel and facilities which will minimize the actual adverse impacts to the other river resources and maximize the beneficial uses for dredged material economically.

2. Determine how other river resources may benefit by alternative dredging practices.

3. Develop criteria for and acquire a data base to make meaningful projections of future dredging requirements.

4. Identify present uses for dredged material and develop new beneficial uses economically.

5. To determine the feasibility of requesting authorization to dredge for purposes other than the authorized channel maintenance projects.

Erosion and Sediment Work Group

1. Evaluate erosion in representative locations by inventory and mathematical predictions. Measure sediment transport at selected locations and related to hydrological records. Erosion types to be evaluated include sheet-rill, gully, streambank and floodplain. Make recommendations for control.

2. Inventory and evaluate sedimentation and erosion related to river training works (dikes, revetments, etc.). Make recommendations for the modification of river training works to achieve the best combination of navigational and aquatic environment effects.

3. Evaluate sedimentation and erosion effects due to river regulating structures. Make recommendations to lessen adverse environmental effects.

4. Inventory the riverbanks of the main stem and selected tributaries and classify according to severity of erosion. Evaluate the past erosion rate and predict the future rate. Calculate volume of sediment produced by streambank erosion. Make recommendations for control.

5. Inventory and evaluate the adverse effects of floodplain erosion. Make recommendations for control or lessening impacts.

6. Evaluate the effect of pollutants transported with sediment on the quality of water and the aquatic environment. Assess the effects of this pollution. Make recommendations to lessen the impacts.

Fish and Wildlife Work Group

1. Describe (i.e. inventory) the fish and wildlife resources.

2. Identify problems crucial to fish and wildlife management.

3. Recommend programs needed to solve the identified crucial problems.

4. Identify legislative and funding needs to allow implementation of recommended fish and wildlife programs.

5. Determine the effects of existing channel regulating structures on fish and wildlife.

6. Identify habitat enhancement features of various structural modifications.

7. Determine ways to enhance fish and wildlife conditions and/or replace lost habitat with dredged material disposal.

8. Determine the effects of water levels on aquatic and moist soil plant development.

9. Develop recommendations for improved management of federal lands for fish and wildlife.

Floodplain Management Work Group

1. Develop a program for flood damage reduction

2. Assess the social, economic and environmental impacts of the lack of floodplain management (flooding).

3. Compile an inventory of floodplain resources.

Industrial and Economic Development

1. Develop a system for establishing regulations which balance the economic, environmental and cultural impacts of river-related commerce and economic development.

2. Improve and expand public awareness and understanding of waterbourne commerce and related economic activities, especially in regard to the area's standard of living.

3. Reduce and/or simplify the institutional and regulatory constraints and costs which presently discourage development, and be able to predict adverse effects (such as loss of jobs) on a particular area if and when an area is vacated by industry due to strict regulatory guidelines.

4. Encourage the development of multi-modal transportation facilities.

5. Provide a rational way for industry to develop and fluourish in coordination with the low-cost transportation afforded by the river system.

6. Facilitate continued expansion of river-oriented commerce and economic development in order to promote growth in employment and personal income in the Study Area.

7. Ensure availability of an adequate supply of industrial land and supporting infrastructure for future development needs.

Recreation Work Group

1. Inventory recreation facilities in the GREAT III study area (resource management area).

2. Determine recreation demand (use) in study area.

3. Determine recreation needs in the study area.

4. Identify and recommend acquisition and development of potential recreation land and resources.

5. Identify and reduce actual and perceived conflicts between various users of river and promote boating/swimming safety.

6. Reduce litter problems in study area.

7. Identify and recommend protection of potential natural areas.

8. Enhance recreational benefits in the study area from channel maintenance and regulatory activities and reduce adverse impacts from channel maintenance and regulatory activities.

9. Protect the aesthetic qualities of the study area.

10. Coordinate recreation developments with other land use plans, developments and regulations.

11. Reduce adverse impact of recreation developments on local landowners.

Regulating Structures Work Group

1. To construct, operate and maintain regulating works in a manner compatible with beneficial uses of the river and recommend legislation necessary to accomplish this goal.

2. Investigate the effects of regulating works on channel geometry and their relationship to problems 1 and 3.

3. Investigate ways and means to enhance aquatic and terrestrial habitat by regulating works.

Water Quality Work Group

1. Compile and summarize existing data on ambient water quality and assess as far as the data allows, the impact of pollutant discharges to the river.

2. Compile and summarize existing data on the impacts of dredging, dredge disposal and tow traffic on water quality.

3. Develop a management tool for predicting the water quality impacts of dredging and dredge disposal.

4. Insure that the information compiled and generated during the study is utilized.

SECTION III

FORMULATION OF PRELIMINARY PLANS

STAGE 1 - PLAN FORMULATION RATIONALE

Formulation of alternative plans during Stage 1 of the planning process has been limited to the identification of potential management measures and a screening of these measures through a preliminary impact assessment and evaluation. A more detailed account of this screening process is available in Stage 1 - Working Paper: Preliminary Formulation of Alternatives, Impact Assessment, and Evaluation. (St. Louis District, Corps of Engineers Files). Each of the technical work groups (excluding Data and Reports and Public Involvement) conducted this analysis to determine which of the measures identified should be given further consideration during Stage 2 of the study. The sources for these measures were the work groups primarily; yet some of the measures considered were identified through the existing plans of others. Based on the problem identification activities and information developed during Stage 1, potential measures were considered that could possibly satisfy the planning objectives. These various preliminary measures will be examined during Stage 2 to formulate alternative plans. The Management Plan Framework, which was developed as part of the planning process in Stage 1, provides a significant mechanism for planning in Stage 2 to delimit the range of problems identified and associated planning objectives and measures.

During Stage 1, there existed considerable confusion and misunderstanding on the part of study participants as what actually constituted a River Resource Management Plan for the GREAT III study area. At the request of the GREAT III Team, a task force was created to make recommendations in this regard. As previously discussed in Section III - Problem Identification, the individual work groups consolidated both the public and professional perceptions of resource management problems in the study area. This array of 54 resource management problems were prioritized by work group or functional area. Based on this unilaterial prioritization by work groups, the GREAT III Team reviewed study proposals and allocated funds for technical studies to address the higher priority resource managment problems. Although this approach provided the Team a reasonably balanced procedure for allocating study funds, it did not provide an overall ranking of importance of all resource management problems identified during Stage 1. Therefore, and overall ranking was accomplished using combined input from the Data and Reports Work Group and the Team.

On the basis of the River Resource Management Plan definition, the overall ranking and consolidations of resource management problems, the study proposals recommended by the Team and the time and funding constraints, a framework was developed to set the parameters by which a management plan would be formulated.

MANAGEMENT PLAN FRAMEWORK

Great III River Resource Management Plan Definition

This River Resource Management Plan will identify conflicts and inadequacies in existing river resource management procedures. The objective is to provide decisionmakers with improved management procedures and programs. The plan will contain policy recommendations for responsible and coordinated environmental, economic, and social uses of the GREAT III reach of the Mississippi River.

I. Interpretation of Management Plan Definition Language

A. THIS RIVER RESOURCE MANAGEMENT PLAN WILL IDENTIFY CONFLICTS AND INADEQUACIES IN EXISTING RIVER RESOURCE MANAGEMENT PROCEDURES AND PROGRAMS.

1. River Resources Management Plan: The contents of the plan will reflect the perceptions of agencies and individuals participating in the study, regarding the coordinated use of the river within prescribed time and financial constraints. It is conceivable that during the course of study, certain problems not originally perceived may surface. Due to these constraints, problems identified at later stages in the study will not be addressed. Nevertheless, generalized recommendations dealing with these circumstances will be made.

2. Conflicts: Conflicting authorities result in simultaneous demands for the use of river related land and water resources which often create interagency difficulties (e.g. recreational land use versus industrial/commercial land use).

3. Inadequacies: Conditions in which agencies or persons cannot fully execute existing authorities due to a lack of resources (e.g., financial and personnel), or the nonexistence of particular authorities/policies to deal with resource management problems, or an absence of technical/scientific information.

4. Management Procedures and Programs: The mechanisms utilized in executing legislative authorities given to federal and state agencies to fulfill their functions in a coordinated manner.

B. THE OBJECTIVE IS TO PROVIDE DECISIONMAKERS WITH IMPROVED MANAGEMENT PROCEDURES AND PROGRAMS.

To achieve this objective the plan will propose changes in management procedures and programs to address the conflicts and inadequacies identified.

C. THE PLAN WILL CONTAIN POLICY RECOMMENDATIONS FOR RESPONSIBLE AND COORDINATED ENVIRONMENTAL, ECONOMIC, AND SOCIAL USES OF THE GREAT III REACH OF THE MISSISSIPPI RIVER.

1. Policy Recommendations. These would entail the following:

(a) Changes in authorities (combine, enhance and/or diminish).

(b) New and/or modified organizational procedures to river resource management. Under this category of policy recommendations, two river resource management procedures shall be specifically addressed during the study:

(1) A mechanism for coordinating management of the river resources after the completion of the GREAT III study will be investigated. The mechanism to be studied is the creation of a "River Resource Management Group" made up of agency personnel comparable to the level of the GREAT III Team with support of pertinent resource personnel.

(2) A mechanism for combining resources (i.e. financial and personnel) of agencies, where possible, to manage the river and related land areas will be investigated. The primary purpose of this management procedure will be to combine agency resources in a manner that provides for the total public benefit.

(c) Additional studies and research.

2. Responsible and Coordinated Environmental, Economic, and Social Uses of the GREAT III Reach of the Mississippi River.

This is the overall goal of the study and everything that is accomplished strives toward achieving this end.

II. Specific Topics of Investigation.

Based on the foregoing interpretation of the GREAT III River Resource Management Plan definition, the conflicts and inadequacies to be studied shall include the following:

Institutional Arrangements.

1. Conduct an institutional analysis of the various agencies that are responsible for the management of the Mississippi River and related land resources.

2. Develop a management system that will provide an organized, coordinated and objective approach to the integration of the diverse river resource management interests. The study of this topic shall include items I.C.1.(b.1. and b.2.)

Resource Management Procedures and Programs.

1. River regulating structures (i.e. revetments and dikes) can result in alterations of aquatic and terrestrial habitats by modifying water surface, changing water velocities, changing bed scouring and sedimentation patterns, and altering riparian habitat.

2. Impacts of dredged material placement on other river resources and resource uses may influence the decisions on placement locations.

3. Current and future barge traffic may be constrained from meeting transportation needs.

4. Sediment produced at upland sites affects the river corridor.

5. There may be a lack of recreation opportunities in the GREAT III study area.

6. River regulating structures can have an effect on side channel aquatic and terrestrial habitats.

7. Increased and more powerful barge traffic and the maintenance of the navigation channel may have an effect on water quality.

8. Flood damage reduction and the lack of flood plain management can have an impact on the social, economic and environmental resources of the Mississippi River.

9. Inventory data on biological resources are insufficient to provide a basis for improved management procedures.

10. Management of known cultural resources is difficult due to the fragmentation of information.

11. Industrial and economic development activity may be constrained from meeting GREAT III area needs.

POTENTIAL MANAGEMENT MEASURES CONSIDERED IN PRELIMINARY PLANNING

TABLE 18 displays the problems identified and the associated base and without conditions, planning objectives, and potential management measures. An array of management measures is presented in the aforementioned table. The measures considered most likely satisfy the planning objectives have been highlighted with an asterick, however, this does not preclude the possibility that other measures, either listed or not yet recognized, could be proven to be more appropriate solutions during the planning process. The base and without conditions in this table have been abstracted from the overall base and without (future) conditions as described in Section II and are specifically related to the identified problems only.

PLANS OF OTHERS

There are no existing plans of others that comprehensively address the problems identified in this study. However, where appropriate, existing plans will be used in the formulation of alternative plans. A review of the activities and plans of others relative to the management of the Mississippi River clearly demonstrates an interest in resource

development and management. The existing management of the Mississippi River and related land resources involves a multiplicity of governmental and private institutions that contribute directly and/or indirectly to resource management.

FEDERAL INTEREST IN RESOURCE MANAGMENT

Federal interest in resource management of the river and related land resources is exhibited by the past, present, and proposed management programs of several principal agencies. The Federal agencies having the most direct responsibility for river resource management include the Corps of Engineers, the Fish and Wildlife Service, and the Coast Guard. The Corps is authorized by Congress to obtain and maintain a channel for navigation. The U. S. Fish and Wildlife Service manages two divisions of the Mark Twain National Wildlife Refuge and one division of the Calhoun National Wildlife Refuge. Portions of these wildlife management lands (approximately 7,500 acres) were acquired for the 9-foot navigation channel project. Management programs for maritime law enforcement, marine accidents, and navigation aid maintenance are the responsibility of the Coast Guard.

TABLE 18
POTENTIAL MANAGEMENT MEASURES
CONSIDERED IN PRELIMINARY PLANNING

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
COMMERCIAL TRANSPORTATION				
1. (a) Current and future barge traffic is constrained from meeting transportation needs as a result of insufficient channel capacities and access to docks, terminals and harbors.	Commercial river transportation is in demand for the movement of goods and commodities. The Corps of Engineers is authorized by law to maintain a navigation channel of minimum specified dimensions. This is becoming increasingly difficult due to environmental concerns that are resulting in possible undue restrictions and increased costs. Some ports and terminals are restricted in their operations due to inadequate access. Railroad and environmental interests are concerned about the potential for increase in commercial river transportation.	Use conflicts will continue to exist and will become more critical as the demand for river transportation increases and environmental concern increases.	(a) Insure sufficient width and and depth to provide for the safe and efficient passage of nine foot draft vessels. (b) Seek means of improving economic efficiency and service. (c) Determine future market demands and its effect upon barge traffic. (d) To objectively inform the public of the role, characteristics and requirements of the water transportation system and how it is integrated into a total transportation network. (e) Identify safety hazards to commercial navigation.	*(a) Seek legislation to broaden Corps dredge authority. (b) Seek state or Federal assistance to private industry for accomplishment. (c) Responsibility of private industry.
(b) Current and future barge traffic is constrained from meeting transportation needs as a result of insufficient lock capacities.	The locks and dams are necessary constraints because they maintain pool levels and facilitate passage from one pool to the next. Traffic of L&D 26 experiences delays which are very costly and the	The lock waitng time may increase to the point where it is no longer profitable to ship by water.	(Planning objectives a through e pertain to Problem 1a-1g.)	*(a) Replace Lock & Dam 26 (b) Direct commodities to other transportation modes. (c) Reduce locking times. (d) Do nothing.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
COMMERCIAL TRANSPORTATION				
	resulting congestion creates safety hazards.			
(c) Current and future barge traffic is constrained from meeting transportation needs as a result of inadequate bridge clearances.	Supporting bridge piers often do not provide sufficient horizontal clearances for vessels to safely pass through the bridge. The safety margin deminishes with various conditions of water level and current. There are 19 bridges in the GREAT III area. One bridge is a swing bridge that must open for marine traffic. Often delays occur because the bridge cannot open due to train traffic or mechanical breakdowns.	Collisions between vessels and bridge peirs will continue. Delays at swing bridges will increase as the result of more vessel and train traffic.		*(a) Increase channel dimensions near obstructions and seek legislation to remove obstructions. (b) Relocate bridge piers to a minimum opening. (c) Remove opening type bridges. (d) Provide additional pier protection guidewalls. (e) Install training structures to control currents.
(d) Current and future barge traffic is constrained from meeting transportation needs as a result of the lack of available fleeting areas.	Therefore, requests have been made for new fleeting areas in GREAT III area. State environmental agencies have objected; however, no data is currently available indicating the environmental ef-	If no action is taken, the situation will not be addressed and may become more acute. This will result in increased shipping cost and a possible		*(a) Corps dredging of fleeting areas. (b) Forecast fleeting needs. (c) Designate areas for long-term fleeting.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
COMMERCIAL TRANSPORTATION				
	fects of fleeting. Existing areas are "silting in" or the fleeting areas are being converted to another use.	limitation on the quantity of materials shipped by water.		(d) Determine environmental effects of fleeting.
(e) Current and future barge traffic is constrained from meeting transportation needs as a result of the lack of terminals.	Existing government regulations and environmental pressures are making it increasingly difficult to establish industrial facilities. The number and location of terminals are an important factor in meeting transportation needs. Government has recognized this problem and has instituted regulations that require cost benefit analysis of new regulations.	Increased regulation by government as the solution to all problems results in increased costs and inflation. The end product could become economic stagnation.		*(a) Conduct cost benefit analysis of regulations. (b) Forecast terminal needs. (c) Deregulation.
(f) Current and future barge traffic is constrained from meeting transportation needs as a result of insufficient equipment capacities due to shortages of barges and tow boats.	Uncertainties concerning government regulations, environmental constraints, L&D 26, fuel availability and the economy has resulted in a hesitation by industry to insert new equipment or modernization of existing equipment.	The present situation will not improve and could become more critical as present equipment becomes older and more obsolete.		*(a) Cost benefit evaluation of government regulations. (b) Replace Lock & Dam 26. (c) Fuel allocations for water transportation. (d) Forecast traffic needs.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
COMMERCIAL TRANSPORTATION				
(g) Current and future barge traffic is constrained from meeting transportation needs as a result of conflicts with recreational boating.	Recreational use of the river is increasing at a rapid rate. There is competition vessel, fleeting and terminal location and operation.	Public demands for increased recreational opportunities could inhibit commercial navigation conflicts will continue.		*(a) Analyze impacts on both uses. (b) Project commercial use. (c) Project recreation requirements. (d) Develop long range plans.
2. The role, characteristics and requirements of the waterway transportation system are not understood by the general public.	Public opinion on crucial matters is often lacking, or is based on incomplete information. The public is being asked to become more involved in making decisions for management of the Upper Mississippi River system.	The base condition will continue to exist.	To objectively inform the public of the role, characteristic and requirements of the water transportation system and how it is integrated into a total transportation network.	*(a) Provide information on all aspects of water Transportation through GREAT. (b) Individual agencies provide information. (c) Private individuals and organizations provide information. (d) Do nothing.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
COMMERCIAL TRANSPORTATION				
3. Increased collisions due to increased traffic.	Collisions occur occasionally.	A slight increase in vessel accidents is inevitable with increased traffic. Vessel accidents are monitored by the Coast Guard. From their analysis, appropriate actions will be taken to minimize vessel accidents.	Identify safety hazards to commercial navigation. Insure sufficient width and depth to provide for the safe and efficient passage of nine foot draft vessels.	The problem must be analyzed to determine its scope and the effectiveness of existing programs. This is being done on a routine basis by the U.S. Coast Guard.
4. Waste disposal from towboats and users of the river.	Waste material from commercial vessels such as fuel, chemicals, sewage and trash occasionally discharged either intentionally or or unintentionally. Current regulations require holding tanks, for solid wastes or treatment. The Clean Water Act and Refuge Act of 1899 controls the release of oil and trash. Industry is making an effort to comply with these regulations. The scope of this problem extends beyond that of just commercial vessels.	Accidental discharges will reduce in number due to a greater awareness by commercial navigation of the regulations. Other river users may not be similarly motivated.	Identify and evaluate the effects of commercial transportation activities for their social, economic and environmental beneficial or adverse impacts.	*(a) Corps provide public disposal facilities at locks. (b) Industry provide disposal facilities at lock. (c) Improve enforcement of current regulations. (d) Do nothing.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
CULTURAL RESOURCES				
1. Management of known cultural resources in all areas of the GREAT III reach is difficult due to the fragmentation of information on cultural resources.	Studies and reports exist in academic and agency files which document the existing state of knowledge of cultural resources in the GREAT III study area. These documents range from purely descriptive reports of materials discovered in the field or analyzed in laboratories to more synthetic works attempting to accurately reconstruct the cultural activities of one or more time periods.	The present absence of a comprehensive summary of the existing literature and an inventory of known resources in the area will make the proper evaluation and management of cultural resources difficult.	Inventory the known cultural resources and conduct a literature search and review of published and unpublished materials concerning cultural resources in the area.	*(a) Develop a management procedure designed to determine the need for investigation of project sites that would impact cultural resources. *(b) Develop a management procedure designed to indicate appropriate action in the development of mitigation action for those impacted properties listed on or determined eligible for inclusion on the National Register. *(c) Develop a management procedure designed to provide for evaluation of sites in terms of National Register eligibility. *(d) Develop a management procedure designed to provide for the utilization of the data base to aid in the determination of areas that potentially contain archaeological resources.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
CULTURAL RESOURCES				
2. Cultural resource management procedures and programs are often unknown or unclear to agencies, individuals and institutions conducting or affecting cultural resource management.	Numerous uncoordinated Federal laws, executive orders, regulations and state programs exist.	It will be difficult to effectively coordinate present and future cultur al resource management and planning without a clear understanding of the existing programs.	(a) Formulate long and short term management procedures and recommendations for cultural-resources. (b) Recommend improvements to existing procedures of agencies managing cultural resources. (c) Provide assistance to other work groups on the relationship of cultural resource management to their programs.	*(a) Identify and recommend improvements in cultural resource management programs. *(b) Develop a report describing, summarizing and critiquing existing cultural resource management procedures and programs. *(c) Develop and implement a program to disseminate cultural resource management information to the public. (d) Develop a list of existing state and federal programs; rules and regulations.
3. Lack of communication between the public and those agencies managing cultural resources.	Presently cultural resource concerns are considered late in the design phases of projects. consequently, there are often conflicts and misunderstandings concerning cultural resource preservation and management.	Laws and regulations will most likely dictate better communication in the future.	Contact and maintain communication with citizens and citizen's groups interested in or dealing with cultural resources.	*(a) Develop a comprehensive plan to increase communication between the public and state/federal agencies, through increased public awareness. *(b) Implement a program

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
CULTURAL RESOURCES				
3.				to aid in better communication and understanding by holding public meetings which bring together the public and government agencies.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
DREDGING AND DREDGED MATERIAL USES				
1. Anticipated impacts of dredged material placement on other river uses may influence the decisions on placement locations.	*Dredging usually begins in May or* June about the time some species of fish spawn. Discharge of the dredged material in the spawning areas has an adverse impact on the newborn fish and eggs. Dredge material placement is limited by dredge plant capacity, volume of material displaced and placement technology for beneficial uses of dredged material and the legality of any proposed use of the dredged material.	*The conflict between those* who dredge and conservationists will continue and may intensify to a point where permits to dredge the authorized channel may be delayed, regardless of whether the perceived problems are real or not.	(a) The objective is to recommend a dredging plan for maintaining the authorized navigation channel and facilities which will minimize the actual adverse impacts to the other river resources and maximize the beneficial uses of dredged material economically. (b) Identify present uses for dredged material and develop new beneficial uses economically.	*(a) Delay dredging until after the spawning season. *(b) Avoid discharging in known habitats during spawning. (c) Dispose of material on shore. (d) Do not dredge.
2. Shoaling may occur in the open channel reach of the river at many crossings.	Disposal of dredged material is confined to the shallower water areas outside the channel, near the shore or in some cases on the shore to create beaches or in the river on sandbars or islands.	Dredging will continue as it has in the past with the probability that additional problems may be encountered. These include delays in obtaining permits	Determine how other river resources may benefit by alternative dredging practices.	*(a) Disposing of dredged material in the Thalweg whenever possible. (b) Discharge dredged material on shore. (c) Do not dredge.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
DREDGING AND DREDGED MATERIAL USES				
2.	Often the material is disposed between the channel and the shoreline and moves downstream and eventually an unknown amount settles in the channel to be dredged again. As shoaling in the open channel occurs it reduces the progress of commercial traffic, which may be intensified by the recommendations of the Industry Capability Program and the Corps of Engineers minimum dredge fleet.	to dredge, the Industry Capability Program requirements, and the results of the minimum dredge fleet study.		
3. Project flow depletions may increase future dredging requirements through consumptive and non-consumptive uses.	Maintenance dredging is performed to provide the authorized channel dimensions based on the low water reference plane. With more water being diverted from the river now and in future droughts, when maximum withdrawals are required, unexpected dredging may be increased significantly. This program may be serious enough to halt or drastically affect the movement of traffic.	Without a program which examines the cumulative effects of water withdrawals, individual projects will continue to be permitted and even larger withdrawals in the future, this low water reference plane may be lowered thus increasing the amount of dredging required.	Develop criteria for and acquire a data base to make meaningful projections of future requirements.	*(a) Compiles total water withdrawal and project future additional withdrawals to determine dredging requirements. (b) Reduce level of channel maintenance. (c) Reduce draft of barges. (d) Reduce all further water withdrawal requests.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
DREDGING AND DREDGED MATERIAL USES				
4. Lack of authority to dredge outside of the authorized channel by the Corps of Engineers.	Under existing conditions, the Corps of Engineers does not dredge recreational facilities and access thereto except where the facility is owned and operated by the Corps of Engineers. Some marina owners/ operators feel the Corps should dredge their harbors and the access routes to those facilities. The dredging that is performed is accomplished by private contractors.	If no action is taken, recreational boaters will continue to face the problem of marinas and their access to the main channel of the river silting in, with individual marina owners unwilling to contract for dredging services and provide disposal areas.	To determine the feasibility of requesting authorization to *dredge for purposes other than* the authorized channel maintenance projects.	*(a) Provide new launch access and marina locations which have less siltation problems. *(b) Obtain authority to dredge for recreational purposes.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
EROSION AND SEDIMENT				
1. Sediment produced at upland sites affects the river corridor. Sediment must be dredged to aid navigation; sediment degrades water quality and degrades or destroys aquatic wildlife habitat.	The river and its watershed have a dynamic erosion and sediment system. The greatest volume of sediment is produced by upland sheet-rill erosion; lesser amounts are produced by gully, streambank and floodplain erosion. The drainage area of the Mississippi River increases over five fold between Saverton, Missouri and Cairo, Illinois. This increase is due to the addition of seven major rivers and a narrow corridor of minor tributaries. Much of the sediment produced by sheet-rill and floodplain erosion is deposited within or nearby the eroding areas. Typically, less than 30% of the eroded material is delivered to downstream areas. A high percentage of sediment produced by the other types of erosion is transported to downstream locations. The	Sediment rates in the watersheds are expected to be simular in the future.	Evaluate erosion in representative locations by inventory and mathematical predictions. Measure sediment transport at selected locations and relate to hydrological records. Erosion types to be evaluated include sheet-rill, gully, streambank and floodplain. Make recommendations for control.	*(a) Establish sediment withdrawal locations. (b) Fund RCWP for accelerated erosin control. (c) Initiate federal authorization for accelerated erosion control. (d) Purchase sediment producing areas; convert to non-erosive uses.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
EROSION AND SEDIMENT				
1.	relationship and importance of the sources of sediment detrimental to uses of the river, is poorly understood. Programs for controlling erosion to protect the soil and water resources have been authorized but not implemented at a level great enough to significantly change sediment transported to downstream locations.			
2. Inventory and evaluate sedimentation and erosion related to river training works (fixed, revetments, etc.). Make recommendations for the modification of river training works to achieve the best combination of navigational and aquatic environment effects.	SEE REGULATING STRUCTURES: PROBLEM NUMBER 1 AND 2 AND FISH AND WILDLIFE: PROBLEM NUMBER 1			

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
EROSION AND SEDIMENT				
3. Evaluate sedimentation and erosion effects due to river regulating structures. Make recommendations to lesser adverse environmental effects.	SEE REGULATING STRUCTURES: PROBLEM NUMBERS 1 AND 2 AND FISH AND WILDLIFE: PROBLEM NUMBER 1			
4. Erosion of the river banks affects the river resources.	Reaches of riverbanks along the mainstem and tributary streams are eroding; resulting in the loss of valuable land and producing sediment. The area of erosion and the volume of sediment produced have not been inventoried. This sediment source may be significant to river resource problems as most sediment is contributed directly to the river.	Bank erosion will continue in the future altered only by the projects constructed by federal and state agencies. Most project controls will be installed on the mainstem. Only limited project assistance will be available for tributary problems.	Inventory the river banks of the mainstem and selected tributaries and classify according to severity of erosion. Evaluate the past erosion rate and predict the future rate. Calculate volume of sediment produced by streambank erosion. Make recommendations to control.	*(a) Use mechanical measures to protect the banks (concrete rip-rap). (b) Use vegetation to protect banks.
5. Overflows cause sediment deposition and scour on floodprone lands.	Some floodplain lands within the river corridor are eroded by overflows during flood events. Some of the erosion is due to water from the Mississippi River and	The rate of erosion damage in the future is not expected to be significantly different than at present.	Inventory and evaluate the adverse effects of floodplain erosion. Make recommendations for control or lessening impacts.	(a) Use levees or dams to prevent overflows. (b) Plant erosion prone areas to permanent vegetation.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
EROSION AND SEDIMENT				
5.	some is due to tributary overflows. The area affected and severity of damage have not been inventoried.			

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
FISH AND WILDLIFE				
1. Channel regulating structures (i.e., dikes and revetments) in the Middle Mississippi River have resulted in alteration of valuable fish and wildlife habitat by modifying water surface, changing water velocities, changing bed scouring and sedimentation patterns and altering riparian habitat.	The total affects of regulating structures on aquatic resources is unknown, however, existing designs are attributing to the loss of valuable backwater and main channel border habitats, possibly causing summer stagnation problems and generally reducing water surface area. Dikes are presently in place and new structures are being designed and constructed.	If no action is taken to prevent or reduce the loss of water surface area, losses will continue to occur at their present rate. Because of ongoing works to constrict the main channel, it appears reasonable to conclude that additional loss of the main channel border and side channels will occur.	(a) Determine the effects of existing channel regulatings structures on fish and wildlife. (b) Identify habitat enhancement features of various structural modifications.	*(a) Alter design of regulating structures to restore and preserve aquatic habitats. (b) Dredge side channels and dike fields. (c) Raise water levels (i.e., build dams). (d) Reduce erosion at its source. (e) Discontinue dike and revetment construction.
2. Dredging and the disposal of dredge material is conducted in a manner affecting fish and wildlife.	Dredging the GREAT III area maintains depths deeper than 9 feet. This practice increases dredging requirements and, thereby, fish	Existing losses will continue to occur and potential for loss prevention or replacement would not	(a) Identify problems critical to fish and wildlife management. (b) Determine ways to enhance fish and wildlife conditions	*(a) Develop methods for adequately identifying impacts and reducing fish and wildlife losses.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
FISH AND WILDLIFE				
2.	and wildlife impacts. Dredging itself may destroy invertebrate, bottom dwelling fauna as well as the substrate providing their habitat. Disposal may cover up valuable habitats and the organisms occupying them. To reduce fish and wildlife impacts, better coordination of dredging and disposal activities is required. Notices are sometimes received by reviewing agencies after the fact. Past coordination meetings have lacked sufficient detail for impact analysis due to the fact that, in may cases, hydrographic surveys have not been completed.	be realized.	and/or replace lost habitat with dredged material disposal.	(b) Develop methods of enhancing or replacing habitats with dredge material. (c) Alter channel alignment to make use of the natural characteristics of the river. (d) Develop alternatives to water disposal. (e) Discontinue overdepth dredging. (f) Talweg disposal.
3. Inventory data on biological resources are insufficient for planning purposes.	Preliminary biological data is provided by various UMRCC reports (Fishery Compendium, Heron Rookery Directory, state and federal wildlife management agency studies,	Without more comprehensive base-line data, the effectiveness of planning efforts will be incomplete. Consequently, the develop	Describe (i.e., inventory) the fish and wildlife resources in the GREAT III study area, where necessary, to provide adequate information for decision making-	*(a) Develop planning area maps from existing and acquired data. (b) Use available data in its present form.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
FISH AND WILDLIFE				
3.	Mississippi River Habitat Inventory, PR-DJ Reports, ongoing management surveys, etc.), environmental assessments (9-foot channel EIS, L&D 26 EIS, etc.) and other institutional studies. However, much of this information is incomplete and out of date. In addition, the data is so widely scattered throughout the literature and agency files that retreival is not practical by conventional means.	ment of a fish and wildlife appendix and river system management plan which truly give equal consideration to these resources will not be possible. This will result in continued losses of fish and wildlife in the study area.	and impact analysis.	(c) Conduct a complete base-line data study totally disregarding past work. (d) Make planning decisions without wildlife conditions. (e) Make planning decisions based on the recreational use of fish and wildlife, disregarding life needs.
4. Improved flood protection has altered fish and wildlife habitat.	With existing flood protection programs (i.e., increased levee heights, pumps, drainage ditches, etc.) fish and wildlife conditions within the protected and unprotected portions of the floodplain are undergoing change. As a result, overall diversity and productivity are declining.	No action may result in the following: (a) Loss of habitat as a result of clearing for agriculture and encroahment by industry and other developments. (b) Increased erosion and sedimentation. (c) Degraded water quality due to industrial,	(a) Describe (i.e. inventory) the fish and wildlife resources. (b) Indentify problems crucial to fish and wildlife management.	*(a) Develop mitigating measures to replace or compensate for fish and wildlife losses. (b) Develop river maps showing areas where industrial development has occurred. (c) Develop maps showing existing fish and wildlife distribution in the flood

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
FISH AND WILDLIFE				
4.		thermal amd municipal effluents. (d) Continued loss of fish and wildlife values.		plain. (d) Develop standards on levee heights.
5. Increased tow traffic may affect the biological productivity of the river.	The navigation system is presently in operation and expansions are underway which could significantly increase total operations. Past developments have impacted fish and wildlife resources.	Without the GREAT III study, river transportation developments will continue to proceed and the potential for additional fish and wildlife losses may increase.	(a) Describe (i.e. inventory) the fish and wildlife resources. (b) Identify problems crucial to fish and wildlife management. (c) Recommend programs needed to solve the identified crucial problems.	*(a) Develop planning area maps to direct futher development away from important fish and wildlife habitats. (b) Determine direct, indirect and cummulative affects and allow only compatible forms of expansion. (c) Allow no further expansion of the transportation network. (d) Compensate for past and future losses outside the study area. (e) Replace losses within the study area. (f) Designate biologically sensitive traffic zones and regulate traffic accordingly.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
FISH AND WILDLIFE				
5.				(g) Establish a water quality monitoring program so that the traffic flow pattern can be periodically modified. (h) Improve the system for reporting, monitoring, containing and cleaning up spillage. (i) Enforce and improve, where needed, regulations governing tow waste product disposal.
6. Increased barge tow traffic will result in increased demands for barge support facilities, the development of which will result in additional fish and wildlife losses.	The total number of barge support facilities in the GREAT III area is unknown. There are approximately 81 barge support facilities that have been identified in the St. Louis Harbor area alone, with 13 new areas pending in the permit process.	Expansion of barge tow traffic and barge support facilities without consideration or planning for fish and wildlife habitat maintenance and enhancement will result in the continued uncontrolled degradation of riverine habitat.	(a) Identify problems crucial to fish and wildlife management. (b) Recommend programs needed to solve the identified crucial problems.	*(a) Identify existing and proposed barge support facilities in the GREAT III area. Identify existing and potential impacts of barge support facilities on fish and wildlife resources and Inventory fish wildlife resources in potential barge support areas.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
FISH AND WILDLIFE				
6.				(b) Initiate legislative action to elevate fish and wildlife concerns to equal consideration with navigation in the development of additional barge support facilities. (c) Conduct a study to develop new methods of establishing barge support facilities that are environmentally sound and acceptable.
7. Regulation of water levels in the pooled river does not include consideration for the needs of fish and wildlife resources.	Vegetation, necessary as a source of food and cover for fish and wildlife, is subject to annual change as a result of existing operations. Annual conditions for many species of fish and wildlife, particularly waterfowl, are widely variable. Intensive management of waterfowl habitat conditions in some areas tends to concentrate waterfowl and increase the potential for	Without proper planning, the base condition will persist and overall populations of fish and wildlife will decline.	Determine the effects of water levels on aquatic and moist soil plant development.	*(a) Manipulate pool elevations to stimulate plant growth. (b) Develop moist soil plant units levees and pumps. (c) Intensify management of existing moist soil units.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
FISH AND WILDLIFE				
7.	the spread of disease. Recent studies indicate that historic mitigation patterns are undergoing change.			
8. Federal lands in the pooled portion of the GREAT III study area are not being developed to their full fish and wildlife resource potential.	Some federal lands have had extensive habitat development while others have had none at all.	Federal lands will continue through natural ecological succession until they reach climax stage. Valuable fish and wildlife habitats will be lost. Diversity and population will decline.	(a) Identify legislative and funding needs to allow implementation of recommended fish and wildlife programs. (b) Develop recommendations for improved management of federal lands for fish and wildlife.	*(a) Seek authorization for Corps expenditures to provide for fish and wildlife. (b) Seek authorization for long-term lease agreements with fish and wildlife agencies. (c) Initiate planning for fish and wildlife development.
9. Increased tow traffic may create additional demands for year-round operations. This will compound other tow traffic and place fish and wildlife under additional stress.	The ecological relationship of the main river channel during winter periods is not completely known. However, many backwaters become covered with ice for extended periods and are subject to oxygen depletion. It is assumed, therefore, that the main channel plays	Without proper precautions, winter navigation opertions and activities to support winter navigation may severly impace fish and wildlife resources during the period of the year when they are	(a) Describe (i.e. inventory) the fish and wildlife resources. (b) Identify problems crucial to fish and wildlife management. (c) Recommend programs needed to solve crucial problems.	*(a) Conduct studies to determine fishery use of the main channel. (b) Conduct studies to determine effects on fish, wildlife and water quality. (c) Study other means of commercial transportation

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
FISH AND WILDLIFE				
9.	a vital role in the winter survival of many fish. *This portion* of the river is also used by waterfowl and eagles in foraging for food. Winter navigation currently occurs on may reaches of the Mississippi River in the GREAT III area and additional winter use is presently being planned.	under the greatest stress *If winter operations* are not developed, environmental gains may be offset by economic losses.		during winter freeze-up. (d) Determine effects of winter navigation on commercial fisherman.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
FLOODPLAIN MANAGEMENT				
1. There is a need for a greater reduction in flood damages.	Floodplain residents do not seem to be aware of the dangers and risks associated with floodplain occupancy. Generally, floodplain residents that experience losses do nothing to prevent a reoccurrence.	Floodplain residents will continue to experience repeated losses with the likelihood of increasing disaster relief.	Develop a program for flood damage reduction.	Develop a floodplain resident (owner) awareness program for the reduction in flood damages.
2. The social, economic, and environmental impacts of floodplain management or the lack thereof are not known.	There is a presently a diversity of interest in floodplain management between federal, state and local governments. These activities are coordinated to the least extent mandatory. The interpretation and enforcement of the floodplain management regulations vary among the various governments.	The impacts of governmental floodplain management will continue to be unknown. The perceived differences in the interpretation and enforcement of floodplain management regulations will continue to cause conflicts in the prudent use of the floodplain.	Assess the adverse social, economic and environmental impacts of the lack of floodplain management (flooding).	*(a) Study impacts of governmental floodplain management (approximates an EIS). *(b) Inventory and assess the interpretation and enforcement of floodplain management regulations. *(c) Develop recommendations for proper interpreatation and enforcement of floodplain management regulations. *(d) Develop recommendations for methods of coordination of all Federal, state and local floodplain management regulations.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
FLOODPLAIN MANAGEMENT				
2.				(e) Devise a mechanism for resolving conflicts between interested and affected parties in a coordinated procedure. (f) Develop recommendations for new floodplain management regulation.
3. There is a lack of floodplain mapping and floodplain *resources inventory.*	The information about floodplain resources is incomplete. The location of much data is unknown or scattered through various documents and is difficult to interpret; such parameters as drainage outlets, land use, mineral resources, prime farmland, water users and land ownership are good examples.	Without a comprehensive summary of floodplain resource, a decision-making process involving the floodplain would require a separate investigation of resources which may be beyond the scope a particular investigation.	Compile an inventory of floodresources (map 1% - 100-year floodplain).	*(a) Compile existing groundwater resource data including water withdrawals and recommendations for extension studies. *(b) Prepare land use/land cover/prime farmland map. *(c) Map and list drainage structures, outlets and outfalls. *(d) Compile map of federal, state, local and private ownership. *(e) Prepare an overlay of 1% (100-year) floodplain. (f) Perform extensive

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
FLOODPLAIN MANAGEMENT				
3.				groundwater study including effects of withdrawals (quantity and location).

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
INDUSTRIAL AND ECONOMIC DEVELOPMENT				
1. Institutional and regulatory impacts on economic development need to be assessed.	Recent years have seen an influx of government regulations and guidelines which has and is having an impact on the location, cost, and expansion of industry and economic development.	We could possibly see a continuation of present regulations plus additional rules and guidelines, without the benefit of knowing their actual impacts in terms of economic development, environmental issues, and industrial expansion.	(a) Develops system for establishing regulations which balance the economic, environmental and cultural impacts of river-related commerce and economic development. (b) Reduce and/or simplify the institutional and regulatory constraints and cost which presently discouraged development, and be able to predict adverse effects (such as loss of jobs) on a particular area if and when and area is vacated or voided by industry due to strict regulatory guidelines. (c) Improve and expand public awareness and understanding of waterborne commerce and related economic activities, especially in regard to the area's standard of living.	*(a) Elimination of obsolete, inoperable regulations; *(b) Revision of regulations which are imbalanced between economic, environmental and cultural factors; and *(c) Elimination of regulations which show a low B/C ratio and others remained. (d) Complete elimination of governmental regulations.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
INDUSTRIAL AND ECONOMIC DEVELOPMENT				
2. Physical barriers, intermodal conflicts and inadequacies of existing, transportation system hinder industrial operations and future economic development.	Water transportation provides distinct advantages for the movement of bulk cargos and usually large and heavy equipment at low cost, it is efficient, and is the safest mode of transportation. There are, however, physical barriers, conflicts with other modes, and existing transportation inadequacies which hinder economic development and industrial operations. These impediments can take many forms within the GREAT III study area, such as inadequate depths between channel and docking facilities, conflicts with other transport modes, and the lack of highway and railroad access to the docking areas.	Without addressing existing inadequacies and intermodal conflicts, the efficiency of water transportation and other modes cannot be improved signifcantly. Existing conflicts and inadequate facilities will continue to deter industrial and economic development within the GREAT III study area.	(a) Encourage the development of multi-modal transportation facilities. (b) Provide a rationale way for industry to develop and flourish in coordination with the low-cost transportation afforded by the river system.	*(a) Design future transportation facilities (all modes), taking into account the magnitude and nature of major barriers, intermodal conflicts and inadequacies in the existing transportation system; and *(b) Promote programs focused on industry identifying the benefit of multi-modal transport.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
INDUSTRIAL AND ECONOMIC DEVELOPMENT				
3. There is lack of fully serviced or reasonably serviceable industrial and commercial lands.	Based on previous technical studies, there is a limited amount of land available or potentially suitable for river-oriented industrial or economic development. In many cases, land is inacessible by rail and/or highway. In addition, there are insufficient utilities to adequately service and support industrial development in much of the GREAT III study area.	Industrial sites will continue to be developed in a piecemeal fashion. The study area will not be able to attract major industry because of insufficient land and infrastructure. The region may continue to see a decline in its economic base.	(a) Facilitate continued expansion of river-oriented commerce and economic development in order to promote growth in employment and personal income in the study area. (b) Ensure availability of an adequate supply of industrial land and supporting infrastructure for future development needs.	*(a) Identify vacant "developable" land and associated infrastructure improvements and costs. (b) Project future land requirements for industry and commerce and allocate proper amount throughout study area. (c) Identify vacant "developable" land and associated infrastructure improvements and costs.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
RECREATION				
1. There is a lack of recreation opportunities in the GREAT III study area.	Deficiencies in satisfying recreational needs are documented in the Statewide Comprehensive Outdoor Recreation Plan (SCORP) of Missouri and Illinois. For example, the 1976 Missouri SCORP shows significant needs in both 1980 and 1990 in most categories of outdoor recreation for the East-West Gateway Coordinating Council Planning Region. The 1995 Park and Recreation Areas Plan for the St. Louis Region (1974) shows a deficiency of park lands of 59,168 acres by 1995.	The population of the impact area will continue to grow, causing increased recreation demands. Present trends toward outdoor recreation will continue. The present lack of access to many parts of the river and the lack of public lands will mean continuing unsatisfied recreation needs.	(a) Identify recreation facilities in the GREAT III study area. (b) Determine recreation demand in study area. (c) Determine recreation needs in the study area. (d) Identify and recommend acquisition and development of potential recreation land and resources.	*(a) Conduct studies to inventory recreation facilities, determined recreation demand and need for identifying potential recreation areas. *(b) Establish a standard system of collecting recreation use data for the river corridor. *(c) Identify critical areas of recreational potential. *(d) Conduct studies to identify constitutional, legislative and administrative needs concerning recreation. *(e) Develop institutional arrangements between agencies to aid in coordination for the benefit of recreation. (f) Utilize existing studies to determine recrea-

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
RECREATION				
1.				tion facilities demand and needed for identifying potential recreation areas.
2. Funding and coordination of law enforcement and education programs regarding the use of the rivers are inadequate.	Although Missouri and Illinois have upgraded their boating safety programs only a fraction of available personnel and time may be devoted to the Mississippi River. Funding and personnel assigned to boating safety law enforcement and education are inadequate to control the problem of boating safety.	Conflicts between different recreational uses and conflicts between commercial navigation and recreation will continue. Based on projection of increase in boating activity, the probability of boating accidents might be assumed to increase. However, due to recent, encouraging downward trends in accident rates, expanded state enforcement and education programs can be expected to reduce overall accident rates, total loss of life and property damage significantly within the next 20 years, if increases in	(a) Identify and reduce actual and perceived conflicts between various uses of the river and promote boating/swimming safety. (b) Reduce litter problems in the study area.	*(a) Conduct studies to determine the extent and amount of conflicts, boating mishaps and litter. *(b) Develop institutional arrangements between agencies to aid in coordination of law enforcement and education programs. *(c) Support additional funding for boating safety, law enforcement and education programs. (d) Organize public meetings to educate the public regarding boating safety and litter.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
RECREATION				
2.		enforcement and education and education capability correspond to the high forecasted activity.		
3. Undisturbed areas in the GREAT III study area with the potential to be designated as natural areas have not been identified and protected.	Natural area surveys have been done in Missouri and Illinois. However, these surveys are not specific to the Mississippi River area and as such it is possible some potential natural areas have not been identified.	Destruction of potential natural areas will continue.	Identify and recommend protection of potential natural areas.	*(a) Identify natural areas along the Mississippi River by reviewing existing surveys. *(b) Compile all existing natural area data for the GREAT III study area. *(c) Determine effective methods for designating and protecting natural areas. *(d) Develop an institutional arrangement to effectively coordinate natural area protection. *(e) Identify natural areas along the Mississippi River by collecting additional data to add to the existing natural area surveys.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
RECREATION				
3.				(f) Identify natural area by conducting new surveys of the Mississippi River area.
4. Developments in the river corridor adversely impact the recreation experience by diminishing the aesthetic and safety qualities of river resources.	Development of the river corridor for residential, industrial, transportation, and other uses in proceeding with little or no evaluation of the effect of such development on the recreation potential of the river. Existing measures to improve and/or protect the scenic quality of the river are inadequate. Continued degradation of the air and water quality of the river corridor is decreasing the quality of the recreation experiences.	Without planning, conversion of areas of river bank, floodplains, backwaters, bluffs, and river hills will continue to preempt potential recreation lands for other uses; particularly residential, industrial, and transportation uses. These conversions will degrade the scenic quality of the river corridor and possibly the air and water quality as well. Continued loss of wildlife habitat will also cause loss of recreation opportunities.	(a) Identify and reduce actual and perceived conflicts between various users of the river and promote boating/swimming safety. (b) Enhance recreational benefits in the study area from channel maintenance and regulatory activities. (c) Protect the aesthetic qualities of the study area.	*(a) Conduct a study to evaluate the impact of residential and industrial development on the aesthetic qualities of the river. *(b) Develop institutional arrangements between agencies to monitor the impacts of proposed river developments. *(c) Conduct a study to evaluate the effect of channel maintenance and regulatory. *(d) Support additional funding for boating safety and educational programs. (e) Conduct study to identify potential recreation and/or scenic areas along the river corridor.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
RECREATION				
5. The development, operation, and maintenance of the navigation project impacts recreation activities and opportunities.	Within the GREAT III study area, the nine foot navigation channel project divides the river into two segments. The upper portion from Dam No. 27 upstream to Lock and Dam No. 22 is in a pooled condition. Public access to the navigation pools is generally limited to federally owned shorelines which are located predominatly in the lower reaches of pools. Downstream from Dam No. 27 to Cairo, Illinois, the river is in an open condition. Opportunities for public access are limited due to private ownership of the shoreline . Within this section, dikes, revetments, and dredging operations significantly affect the recreation opportunities provided by the river.	Development and maintenance of the navigation channel will continue under present design criteria. The present lack of access to many parts of the river and the lack of public lands along the river will mean continuing unsatisfied recrea tion needs. Continued loss of wildlife habitat will also cause loss of recreation opportunities. Conflicts between commercial navigation and recreation will continue.	(a) Identify and reduce actual and perceived conflicts between users of the river. (b) Enhance recreational benefits in the study area from channel maintenance and regulatory activities and reduce adverse impacts from channel maintenance and regulatory activities.	*(a) Develop institutional arrangement to effectively review the impact of navigation channel developments on recreation use. *(b) Compile existing data on the impact of the navigation channel on the recreation use of the river. *(c) Conduct a study to evaluate the impact of dikes, revetments, and dredging operations on recreation opportunities. (d) Conduct a study to identify resources, assess demand, and project need for pooled portion of the river. (e) Develop a study to determine the extent of conflict between commercial transportation and recreation use of river.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
RECREATION				
6. Land use plans, developments, and regulations often adversely impact the quantity and quality of of recreation resources and opportunities.	Present planning and development efforts often do not adequately recognize the need for public access to and recreation use of the river. Any land development which affects the scenic quality, wildlife habitat, or water quality of the river will impact the recreation potential of the area. Existing land use plans and regulations may significantly impact the quantity and quality of recreation opportunities provided. Limited access tends to discourage use, yet it also provides a quality experience for the user.	Without coordinated planning, conversions of property along the river corridor to residential, industrial, and transportation uses will continue to preempt the use of this land for recreation purposes. These conversions will degrade the scenic quality of the river which will further decrease the quality of the recreation experience. The present lack of access to many parts of the river will mean continuing unsatisfied recreation needs.	(a) Coordinate recreation developments with other land use plans, developments, and regulations. (b) Protect the aesthetic qualities of the study area.	*(a) Develop institutional arrangements to insure that recreation is considered in land use planning. *(b) Compile data on existing recreation resources along the river corridor. *(c) Conduct a study to determine the impact of port development upon the recreation use of the river. *(d) Determine effective methods for requiring interagency coordination in land use planning. (e) Conduct a study to identify land use regulations presently being implemented on other major river corridors.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
REGULATING STRUCTURES				
1. It is presently unknown what effect river regulating structures have on main channel corridor aquatic and terrestrial habitat.	The primary objective of river regulating works is to obtain and maintain a dependable navigation channel (a single purpose project).	Presently, the navigation project is of a singular purpose and will probably remain so unless the GREAT III study can supply Congress with justification to modify the project authorization to allow additional project purposes. Continued progress on the development of a dependable navigation channel by present design criteria will probably result unless studies conducted under the authority of GREAT III recommends revised criteria and guidelines.	(a) To construct, operate and maintain regulating structures in a manner compatible with beneficial uses of the river. (b) To investigate ways and means to enhance aquatic and terrestrial habitat by regulating works.	*(a) Identify significant effects of navigation works on aquatic and terrestrial habitat. *(b) Develop a preliminary modified design criteria to achieve multiple results. *(c) Study results of revised design criteria by model testing. *(d) Construct prototype study reaches to observe results of modified criteria. *(e) Adopt proven modified design criteria for multi-purposes.
2. Effects of regulating structures on channel geometry.	Regulating structures are the primary method used to obtain and maintain a dependable navigation channel on the Middle Mississippi River. The more that is learned	The Corps of Engineers is continually evaluating and improving its knowledge of river mechanics; however, additional design modifi-	Investigate the effects of regulating works on channel geometry and their relationship to other uses of the river.	*(a) Determine significant effects of navigation works on channel geometry. *(b) Collect data on sedimentation and gradation of

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
REGULATING STRUCTURES				
2.	about the river's response to these structures, the better will be the results desired.	cations are primarily oriented towards navigation. Without GREAT III, no design modifications will be oriented towards other project purposes.		material near structures. *(c) Modify structures to produce different results. *(d) Re-examine area and reproduce data collection procedures. *(e) Evaluate results of testing program.
3. It is presently unknown what effect river regulating structures have on <u>side channel</u> aquatic and terrestrial habitat.	*SEE REGULATING STRUCTURES:* PROBLEM NUMBER 1			

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
WATER QUALITY				
1. Increased and more powerful barge traffic and maintenance of navigation channel on the Mississippi River adversely affects water quality.	Many instances of water quality degradation from the GREAT III segment of the Mississippi River can be cited. These range from violations of secondary drinking water supply standards for iron and manganese to more serious problems such as low dissolved oxygen (DO) concentrations, high frequency of occurrence of Dieldrin and other pesticides in river water, and the accumulation of pesticides, PCBs and Mercury in Mississippi River fish. The existence of such potentially toxic materials in river water and river sediments as PCBs, pesticides and several heavy metals, whether they act singly or synergistically with each other, or with low DO concentrations threatens the integrity of the aquatic food web and the potability of the water. The disposal of spoils materials or any other	Projection of the future condition would be similar to present condition except for the following: (a) The recent emphasis of U.S. EPA on control of toxic substances will probably result in stricter control of PCB's in wastewater discharges. (b) The restrictions in use of Chlorinated Hydrocarbon insecticides should reduce future levels of these persistent compounds in the aquatic environment. (c) The lack of comprehensive knowledge of water quality processes in the Mississippi will lead to periodic ecological guidelines or standards changes based on a particular facet of the ecosystem which does not account for revelant	(a) Compile and summarize existing data on the impacts of dredging, dredge disposal and tow traffic on water quality. (b) Develop a managament tool for predicting the water quality impacts of dredging & dredge disposal.	*(a) Review & compile data from previous WES and GREAT studies. *(b) Design & conduct a study of water quality dredge disposal impacts of the GREAT III reach. *(c) Develop predictive models for managing water quality from disposal operations using data from the GREAT III reach. (d) Use study results from GREAT I, II, WES and others to estimate the water quality impacts in the GREAT III area. (e) Use predictive models developed in GREAT II.

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
WATER QUALITY				
1.	practices which would modify the aquatic environment could adversely affect the habitat of river benthos (bottom dwelling) plants and animals), thus allowing the food supply or spawning areas of river fishes.	synergistic categorizations.		
2. Municipal, commercial, agricultural and industrial discharges to the Mississippi adversely affect water quality in water quality.	SEE WATER QUALITY: PROBLEM NUMBER 1		Compile and summarize existing data on ambient water quality and assess as far as the data allows, the impact of pollution discharges on the river.	*(a) Collect & produce a report on existing water quality data for the *(b) Assess the impact of pollution discharges on the existing data. *(c) Design and conduct new water quality studies on the impact of specific discharges on the river.
3. Lack of coordination of water quality information between local, state and federal agencies.	Evidence of serious water quality problems exist, but despite the magnitude of the resource the Mississippi River provides to the State of Illinois and Missouri, the interstate nature and great	The continuation of fragmentary water quality efforts on the Mississippi River.	Insure that information compiled and generated during the study is utilized.	*(a) Print and distribute all study documents to agencies involved in the regulation of water quality. *(b) Attempt to have all agencies with water quality

TABLE 18
(Continued)

PROBLEMS	BASE CONDITION	FUTURE WITHOUT CONDITION	PLANNING OBJECTIVES	POTENTIAL MEASURES (Astericks indicate measures most likely to satisfy planning objectives)
WATER QUALITY				
3.	size of the river has hampered state management efforts. Federal agencies have approached river problems from their own particular area of interest. Therefore, most local, state or federal data gathering or management efforts have been aimed at specific issues. As such there has been on comprehensive look or coordination concerning a large segment of the Mississippi which would put many pollutant sources and water quality processes in the proper prospective.			regulatory duties represented on the Water Quality Work Group. *(c) Make study documents available through the Water Quality Work Group Chairman on request.

SECTION IV

PROCEDURES AND REQUIREMENTS FOR FURTHER STUDY

The study will be conducted in three stages as previously discussed in Section I. The Reconnaissance Report emphasizes the primary task of Stage 1, that is, problem identification. It incorporates the planning tasks of formulation of alternatives, impact assessment and evaluation to a level of detail necessary to satisfy the requirements for Stage 1 of the planning process and provides requirements for further study.

This section provides the information on the budgetary process and funding procedures to be used in the study and the requirements for further study as identified by the study participants through the work groups.

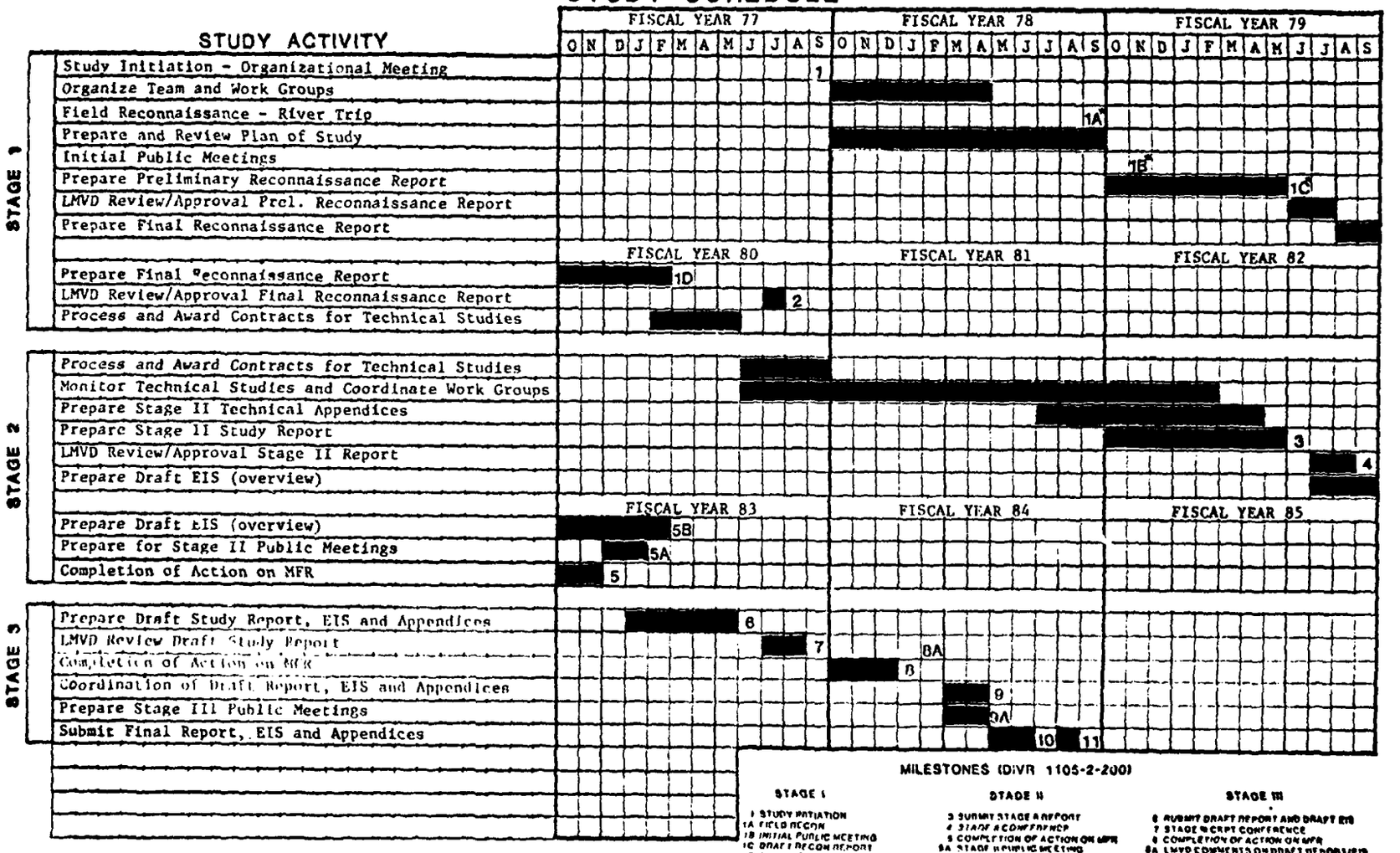
BUDGETARY PROCESS AND FUNDING PROCEDURES

At this stage of the study, it is not practical to determine the precise funding that will be required by each work group to address the perceived problems identified during Stage 1 of the planning process. Specific funding requirements will become more definitive after final scopes of work and detailed cost estimates have been developed for the studies proposed by the work groups. Development of these prerequisites to contracting is often a time consuming process and is not considered a necessary part of the Preliminary Reconnaissance Report. Therefore, in the spirit of developing a total river resource management plan, an initial budget allocation will be established for each work group on an equal basis. Although a maximum budget will be created for each work group, obligation and expenditure of this budget will be based upon scopes of work and detailed cost estimates. Work group study needs beyond this maximum budget level will require additional justification. Where possible, work groups will combine funds for studies of mutual interest and benefit. This method for funding work group studies will exclude funds for study management, funds required by agencies responsible for providing coordination of work group input to the plan and funds required by agencies providing representation on the TEAM for review of study output.

STUDY SCHEDULE

Figure 11 presents a general work flow diagram designed to accomplish the GREAT III study.

FIGURE 11
STUDY SCHEDULE



* Milestone Completed

STUDY COSTS

Table 19 presents a summation of actual and estimated study costs.

WORK GROUP TECHNICAL STUDIES

Technical studies to be accomplished during the planning process are based on studies proposed by the work groups in the Preliminary Reconnaissance Report (June, 1979) and recommendations by the GREAT III Team. These technical studies are presented in this section according to the conflicts and inadequacies in existing river resource management procedures and programs as identified in the Management Plan Framework: Specific Topics of Investigation (Reference Section III). Any additional study proposals to be considered subsequent to those outlined in the Reconnaissance Report shall be limited to the parameters provided by the Management Plan Framework and the time and funding constraints prescribed for the study.

Institutional Arrangements.

1. Conduct an institutional analysis of the various agencies that are responsible for the management of the Mississippi River and related land resources.

2. Develop a management system that will provide an organized, coordinated and objective approach to the integration of the diverse river resource management interests. The study of this topic shall include, but not to be limited to the following: (a) a mechanism for coordinating management of river resources after the completion of the GREAT III Study will be investigated; and (2) a mechanism for combining resources (i.e. financial and personnel) of agencies, where possible, to manage the river and related land resources in a manner that provides for the total public benefit.

These institutional studies will be conducted under the auspices of the Data and Reports Work Group. The purpose of this work group is to insure that proper coordination is maintained between work groups throughout the study. Composed of work group chairmen, this group functions as a clearinghouse for information related to all work groups. It is the responsibility of the Data and Reports Work Group to integrate the activities and results of these studies into a final product. The planning objective of this work group embraces the objective of the study, which is to develop a river resource management plan.

TABLE 19

SUMMATION OF ACTUAL AND
ESTIMATED STUDY COSTS[1]
($000)

Activity	Thru FY 79	FY 80 Anticipated	FY 81 Anticipated	FY 82-84 Anticipated	Total Actual & Anticipated Study Costs
Funds required for Technical Studies	- 0 -	629.0	650.4	- 4 -	
Funds required by agencies providing coordination and review	180.8	235.5	181.0	958.0	
Funds required for study management and report preparation[2]	619.2	197.7	185.0	705.0	
TOTAL	800.0	1,062.2	1,016.4	1,663.0	4,541.6 (4,290.0)[3]

(1) Actual and anticipated study costs as of 13 February 1980.

(2) Includes public meetings; reconnaissance river trip; meetings; room rental for meetings; travel; reproduction; mapping; automatic data processing; finance and accounting; supervision and administration; LMVD participation; Upper Mississippi River Coordinator; and overhead.

(3) Total study cost as reported on the PB-6, 31 March 1979, approved LMVPD, 17 April 1979.

(4) Study funds may be expended depending on contract work completed during FY 81.

Resource Management Procedures and Programs.

1. River regulating structures (i.e. revetments and dikes) can result in alterations of aquatic and terrestrial habitats by modifying water surface, changing water velocities, changing bed scouring and sedimentation patterns, and altering reparian habitat.

Study proposal and funds allocated by the GREAT III Team:

Study Title	Budget Estimate	Work Groups	Study Duration
Influence of Regulating Structures on Fish and Wildlife Habitat	$159,000	Fish and Wildlife; Regulating Structures and Erosion and Sediment	14 months

2. Impacts of dredged material placement on other river resources and resource uses may influence the decisions on placement locations.

A study proposal is currently being prepared by the Fish and Wildlife Work Group in coordination with the Dredging and Dredged Material Work Group to address this problem statement.

3. Current and future barge traffic may be constrained from meeting transportation needs.

Study proposal and funds allocated by GREAT III Team:

Study Title	Budget Estimate	Work Groups	Study Duration
Navigation and Industrial Forecasts, Needs Analysis and Recommendations	$190,000	Commercial Transportation and Industrial and Economic Development	12 months

4. Sediment produced at upland sites affects the river corridor.

Study proposals and funds allocated by GREAT III Team:

Study Title	Budget Estimate	Work Groups	Study Duration
Sediment Inventory and Gaging	$163,350	Erosion and Sediment	15 months
Quantifying Minor Sediment Sources Bank Erosion and Flood Plain Scour	$ 45,000	Erosion and Sediment	6 months

5. There may be a lack of recreation opportunities in the GREAT III study area.

Study proposal and funds allocated by GREAT III Team:

Study Title	Budget Estimate	Work Groups	Study Duration
Recreation and Natural Area Needs Assessment	$150,000	Recreation	14 months

6. River regulating structures can have an effect on side channel aquatic and terrestrial habitats.

Study proposal and funds allocated by GREAT III Team:

Study Title	Budget Estimate	Work Groups	Study Duration
Side Channel Investigation	$ 50,000	Regulating Structures and Fish and Wildlife	12 months

7. Increased and more powerful barge traffic and the maintenance of the navigation channel may have an effect on water quality.

Study proposal and funds allocated by GREAT III Team:

Study Title	Budget Estimate	Work Groups	Study Duration
Refinement and Verification of Predictive Models of Suspended Sediment Dispersion and Desorption of Toxics from Dredged Material	$100,000	Water Quality	12 months

8. Flood damage reduction and the lack of flood plain management can have an impact on the social, economic and environmental resources of the Mississippi River.

A study proposal is currently being prepared by the Flood Plain Management Work Group to address this problem statement.

9. Inventory data on biological resources are insufficient to provide a basis for improved management procedures.

Study proposal and funds allocated by GREAT III Team:

Study Title	Budget Estimate	Work Groups	Study Duration
Characterization of Aquatic Habitats	$130,000	Fish and Wildlife	12 months

10. Management of known cultural resources is difficult due to the fragmentation of information.

Study proposal and funds allocated by GREAT III Team:

Study Title	Budget Estimate	Work Groups	Study Duration
Cultural Resources Inventory	$ 96,400	Cultural Resources	12 months

RECOMMENDATIONS

I recommend that this Reconnaissance Report be approved as a basis for further planning and the development of the Stage 2 Report for the Great River Resource Management Study (GREAT III).

ROBERT J. DACEY
Colonel, CE
District Engineer

SECTION V

APPENDICES

APPENDIX A

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APPENDIX B

PUBLIC INVOLVEMENT PROGRAM

Introduction

The process of identifying water and related land resources issues, exploring alternatives, and selecting feasible and desirable plans, requires a continuous two-way communication process between planners and interested publics. This communication process can provide:

1. Consideration of a wider range of alternatives,

2. Accumulation of more accurate and detailed study information,

3. Early development of public preference for specific alternatives and detailed analyses of these alternatives,

4. General public acceptance of the planners work, and

5. Public support for the eventual implementation of recommended plans.

Goal

In keeping with the spirit of Section 117, the intent of the Public Involvement Program is to facilitate an atmosphere of public understanding and cooperation in the conducting of the GREAT III Study. The goals of the Public Involvement Program are:

1. To provide interested citizens with the opportunity to participate in the Study, and

2. To provide interested citizens with the information they may require to make contributions to the planning and decision making process.

In addition, evaluation of the Program must occur at key milestones of the study because the thrust of the planning process may be re-directed.

Objectives:

The objective of public involvement is to actively involve the public in the GREAT III Study in order to insure that the Study responds to public views and preferences to the maximum extent possible, within the bounds of local, state and federal programs, responsibilities and authorities. To accomplish this objective, the GREAT III Public Involvement Program will:

1. Open and maintain channels of communication with the public;

2. Encourage public understanding of federal, state, regional, and local responsibilities, authorities and procedures in conducting the GREAT III Study;

3. Present information which will assist the public in conveying its water resources problems, needs, objectives relative to the study;

4. Present information which will assist the public in conveying its views and preferences of alternative solutions and related impacts;

5. Solicit the public's comments, views and perceptions of problems, needs, alternative solutions and related impacts, and any recommendation for Federal action relating to GREAT III, and

6. Give full consideration to public needs and preferences in the GREAT III planning process.

Accomplishment of the objective of public involvement is the recognition by the public that study conclusions and selected implementation plans considered public views and preferences. The means which will be used to accomplish the objective are the Public Involvement Work Group and the Public Involvement Plan.

Public Involvement Work Group

The GREAT III Public Involvement Work Group is an advisory committee established to facilitate a broader-based review of the study's activities and plans than would otherwise be possible. In general, the Public Involvement Work Group acts as a sounding board for the professional planners. It also acts as a guidance group by assisting in monitoring the planning effort in order to aid study participants in determining the best, fairest and most practical means of dealing with water and related land resource problems.

The Work Group also functions as a channel of communication for those wanting information and desiring to make input to the plan. The Work Group can become an effective vehicle to assist in implementing the completed plan.

The specific functions of the GREAT III Public Involvement Work are to:

a. Help ensure that community goals are addressed in the plan.

b. Provide for representation of many different interests throughout the planning process.

c. Broaden study participants' view of issues.

d. Assist in setting planning priorities.

e. Assist in reviewing and commenting on study outputs, especiallly material destined for the public.

f. Assist in designing a public involvement plan.

g. Interpret the planning to others, for example agencies, organizations, officials, citizens and advise the governing bodies and staff of reactions and comments.

h. Assist in resolving conflicts among various interests.

i. Assist in reviewing and commenting on budgets.

j. Assist in selecting public involvement contractors reviewing contracts.

k. Assist staff in reaching local opinion leaders.

l. Assist in planning, hosting and participating in public meetings and meetings with organizations or agencies, especially those which work group members represent.

m. Help inform the public about GREAT III planning and activities.

n. Review plans for, and results of, public involvement techniques.

o. Advise on the politics of plan acceptance and/or implementation.

p. Act as a watchdog for the public on agency planning and/or implementation.

q. Assist with media contacts.

r. Encourage the public to become actively involved in other work groups.

All segments of the public are encouraged to participate in the Public Involvement Work Group and present representation in this work group appears in Table No. 1.

TABLE NO. 1
Public Involvement
Work Group Representation

American Waterway Operators, Inc.	Bi-State Development Agency
Coalition for the Environment	Conservation Federation of Missouri
Eugene Luhr & Company	Illinois Audubon Society
Illinois Department of Transportation	Illinois State Representative, Wyvetter Young
Massman Construction Company	Migratory Waterfowl Hunters, Inc.
Missouri Department of Conservation	Missouri Department of Natural Resources
Residents of the Study Area	St. Louis County Parks Department
Sierra Club, Ozark Chapter	Smith & Brennan Pile Company
Southern Illinois University-Edwardsville (student)	U.S. Army Corps of Engineers
U.S. Fish and Wildlife Service	Washington University (student)
Western Railroad Traffic Association	

Public Involvement Plan

Drawing on the previously mentioned objectives of public involvement, the GREAT III Public Involvement Work Group has devised a highly flexible plan to be used in involving citizens in the multi-purpose GREAT III Study. The plan follows the three basic planning stages indicated in Principles and Standards: 1) Development of Reconnaissance Report; 2) Development of Intermediate Plans; and 3) Development of Detailed Plans. In addition, the plan is primarily intended to satisfy the general approach of public involvement rather than represent a final work schedule.

The following three sections present the GREAT III Public Involvement Plan. SECTION I indicates the techniques to be employed in each planning stage to accomplish the public involvement objectives. For display purposes the objectives have been synthesized into three: 1) Dispersal of information; 2) Gathering of information; and 3) Promotion of interaction between the public and study participants. In SECTION II, each technique is outlined in order to review its specific objectives, inputs, and material requirements. Because the plan is intended to be flexible, future refinements of the individual tasks, timing, and material requirements will be appropriate. SECTION III represents the work diagram of the Public Involvement Program for the GREAT III Study.

SECTION I

PUBLIC INVOLVEMENT TECHNIQUES

DEVELOPMENT OF RECONNAISSANCE REPORT

Stage 1

Primary Purposes

(1) Determine Water-related Problems and Needs.
(2) Set Specific Objectives of Study.

Secondary Purposes

(1) Organize for Study and Implementation.
(2) Gather Basic Data.
(3) Accomplish Preliminary Iteration of Four Planning Tasks.

Techniques	Public Involvement Objectives		
	Dispersal of Information	Gathering of Information	Promotion of Interaction
PI Work Group	x	x	x
Mailing List	x		
Media Contacts	x		x
Public Meeting	x	x	x
Reports	x		x
Boat Trip	x		x
Fact Sheets	x		x
Reassessment	x	x	x

SECTION I

PUBLIC INVOLVEMENT TECHNIQUES
(CONT'D)

DEVELOPMENT OF INTERMEDIATE PLANS

Stage 2

Primary Purposes

(1) Develop Alternative Plans.
(2) Determine Effects of Each Alternative.
(3) Evaluate Each Alternative.

Secondary Purposes

(1) Consider Any Newly Indentified Problems.

Techniques	Public Involvement Objectives		
	Dispersal of Information	Gathering of Information	Promotion of Interaction
PI Work Group	x	x	x
Mailing List	x		
Media Contacts	x		x
Public Meeting	x	x	x
Reports	x		x
Surveys	x	x	x
Workshops	x	x	x
Fact Sheets	x		x
Reassessment	x	x	x

SECTION I

PUBLIC INVOLVEMENT TECHNIQUES
(CONT'D)

DEVELOPMENT OF DETAILED PLANS

Stage 3

Primary Purposes

(1) Detailed Analysis of More Promising Alternatives.
(2) Detailed Effect Assessment.
(3) Evaluate Each Alternative.
(4) Finalize Institutional Arrangements for Implementation of any Recommended Plan

Techniques	Public Involvement Objectives		
	Dispersal of Information	Gathering of Information	Promotion of Interaction
PI Work Group	x	x	x
Mailing List	x		
Media Contacts	x		x
Public Meeting	x	x	x
Reports	x		x
Surveys	x	x	x
Workshops	x	x	x
Fact Sheets	x		x
Reassessment	x	x	x

SECTION II

PUBLIC INVOLVEMENT
TECHNIQUES, OBJECTIVES, AND WORK TASKS

TECHNIQUES	OBJECTIVES			TASKS
	Stage I	Stage II	Stage III	
MAILING LIST	1. Inform interested publics of study initiation and planning process.	1. Inform interested publics of study progress and activitives.	1. Inform interested publics of study progress and activities.	1. Identify Influentials and interested publics.
	2. Open Lines of communication.	2. Continue plurality and involvement of of all sectors.	2. Continue plurality and involvement of all sectors.	2. Obtain District mailing list.
	3. Seek plurality and involvement of all sectors.	3. Provide for most effective distribution of reports, brochures, news releases and other information materials.	3. Provide most effective distribution of reports, brochures, news releases and other information materials.	3. Add mailing lists of others.
	4. Provide for most effective distribution of reports, brochures, news releases and other information materials.	4. Announce public meetings, workshops, etc.	4. Announce public meetings, workshops, etc.	4. Add attendees of public meetings, workshops, etc.
	5. Announce public meetings workshops, etc.			5. Add work groups' members.
				6. Update
MEDIA CONTACTS	1. Develop public awareness of planning initiation.	1. Develop public awareness of work group activities.	1. Continue public awareness of work group activities.	1. Compile media list.
	2. Develop public awareness of problems and needs in study area.	2. Develop public awareness of alternative plans.	2. Develop public awareness of detailed analysis of more promising alternatives, detailed effect assessment, and evaluation.	2. Obtain data from work groups and study participants.
	3. Broaden base of participation in Stage I public meeting.	3. Develop public awareness of evaluation of alternatives.	3. Develop public awareness of EIS and institutional arrangements.	3. Draft reveiw and finalize media presentations.
	4. Present information to assist public in defining and express preferences.	4. Present information to assist public in defining and expressing alternative preferences.	4. Present information to assist public in in expressing detailed alternative preferences.	4. Circulate to media
	5. Present results of Stage I public meeting.	5. Broaden base of participation in Stage II public meetings.	5. Broaden base of participation in Stage III public meetings.	5. Coordinate media contacts with other study participants.
	6. Develop working relationship with press and other media.	6. Present results of Stage II public meeting.	6. Present results of Stage III public meetings.	
		7. Continue working relationship with press and other media.		

PUBLIC INVOLVEMENT
TECHNIQUES, OBJECTIVES, AND WORK TASKS
(CONT'D)

TECHNIQUES	OBJECTIVES			TASKS
	Stage I	Stage II	Stage III	
PUBLIC MEETINGS	1. Inform publics of initiation.	1. Inform publics of Stage I results.	1. Inform publics of Stage II results.	1. Obtain specific meeting objectives from Data and Reports Work Group.
	2. Inform publics of planning effort.	2. Determine publics' perceptions of alternatives.	2. Determine publics' perceptions of detailed analysis of more promising alternatives.	2. Obtain appropriate data.
	3. Determine publics' perceptions of issues, problems and needs.	3. Determine publics' perceptions of effects and evaluation of alternatives.	3. Determine publics' perceptions of detailed effect assessment and evaluation.	3. Set date.
	4. Fulfill regulations regarding public meetings.	4. Determine any newly identified problems.	4. Determine publics' perceptions of institutional arrangements for implementation.	4. Secure facility.
		5. Fulfill regulations regarding public meetings.		5. Arrange for table, chairs, equipment, etc.
				6. Invite local representatives, influentials, interest groups, etc.
				7. Plan meeting agenda and format.
				8. Arrange for printed materials.
				9. Prepare and coordinate media contacts.
				10. Invite media.
				11. Continue publicity blitz before meeting.
				12. Assemble meeting results.
				13. Submit meeting results to Data and Reports Work Group.

SECTION II

PUBLIC INVOLVEMENT
TECHNIQUES, OBJECTIVES, AND WORK TASKS
(CONT'D)

TECHNIQUES	OBJECTIVES			TASKS
	Stage I	Stage II	Stage III	
REPORTS	1. Inform publics of significant Study findings, results, etc.	1. Inform publics of significant Study findings, results, etc.	1. Inform publics of significant Study findings, results, etc.	1. Obtain and review appropriate data from Data Report work group.
	2. Inform publics of detailed thoughts, comments suggestions, etc. of PI Work Group.	2. Provide "executive summaries" of key Stage I and Stage II planning reports.	2. Provide "executive summaries" of key Stage III and EIS's.	2. Coordinate preparation of "executive summaries" with Data Reports Work Group.
		3. Inform publics of detailed thoughts, comments, suggestions, etc. of P.I. Work Shop.	3. Inform publics of detailed thoughts, comments, suggestions, etc.	3. Draft, review, finalize and publish appropriate P.I. Reports.
				4. Solicit perceptions.
				5. Assemble perceptions.
				6. Report findings.
SURVEYS		1. Obtain publics' preferences of alternative plans and effects.	1. Obtain publics' preferences of detailed alternative plans and effects	1. Obtain survey objectives from Data and Reports Work Group.
		2. Obtain publics' perceptions of evaluation.	2. Obtain publics' perceptions of detailed evaluation	2. Obtain data from Data and Reports Work Group.
		3. Obtain public input into any additional specifics of Stage II.	3. Obtain public input into any additional specifics of Stage III.	3. Draft, review and finalize survey.
		4. Broaden representativeness in participation.	4. Continue representativeness in participation.	4. Select sample, if appropriate.
		5. Identify any preliminary resistance.	5. Identify public perceptions and/or resistance concerning implementation.	5. Arrange for printing.
		6. Put comments of study participants into perspective.	6. Put comments of study participants into perspective.	6. Mail.
		7. Inform publics of planning activities.	7. Inform publics of planning activies.	7. Assemble and interpret results.
		8. Use results for evaluation of process.	8. Use results for evaluation of process	8. Submit results to Data and Reports Work Group.
				9. Report, if necessary.
				10. Comment on evaluation.

SECTION II

PUBLIC INVOLVEMENT
TECHNIQUES, OBJECTIVES, AND WORK TASKS
(CONT'D)

TECHNIQUES	OBJECTIVES			TASKS
	Stage I	Stage II	Stage III	
FACT SHEETS	1. Reemphasize public role in planning effort.	1. Reemphasize public role in planning effort.	1. Reemphasize publics' role in planning efforts.	1. Secure data from all study participants.
	2. Open channels of communication.	2. Expand participation.	2. Expand participation.	2. Draft, review and finalize fact sheet.
	3. Emphasize importance of varied uses of River.	3. Reach additional interested publics.	3. Reach additonal interested publics.	3. Mail.
	4. Highlight and update Work Group activities.	4. Maintain channels of communication.	4. Maintain channels of communication.	4. Provide comments and/or input to appropriate group.
	5. Develop public awareness of Water-related problems and needs.	5. Highlight and update Work Group Stage II activities.	5. Highlight and update Work Group Stage III activities.	
	6. Increase workshop and meeting attendance.	6. Develop public awareness of preliminary alternatives, effects, and evaluation	6. Develop public awareness of detailed alternatives, effects, and evaluation.	
		7. Increase workshop and meeting attendance.	7. Develop public awareness of institutional considerations.	
			8. Increase workshop and meeting attendance.	

SECTION II

PUBLIC INVOLVEMENT
TECHNIQUES, OBJECTIVES, AND WORK TASKS
(CONT'D)

TECHNIQUES	OBJECTIVES			TASKS
	Stage I	Stage II	Stage III	
WORKSHOPS[a]		1. Inform specific publics of Stage I results.	1. Inform specific publics of Stage II results.	1. Obtain specific meeting objectives from Data and Reports Work Group, or Team.
		2. Determine specific publics' perceptions of alternatives.	2. Determine specific publics' perceptions of detailed analysis of more promising alternatives.	2. Determine specific publics if appropriate.
		3. Determine specific public's perceptions of effects and evaluation of alternatives.	3. Determine specific public's perceptions of detailed effect assessment and evaluation.	3. Obtain appropriate data.
		4. Determine any newly newly identified problems.	4. Determine specific public's perceptions of institutional arrangements for implementation.	4. Set date.
		5. Attempt to resolve conflicts, if necessary.	5. Attempt to resolve conflicts, if necessary.	5. Secure facility.
				6. Arrange for table, chairs, equipment, etc.
				7. Invite appropriate local representatives, influentials, interest groups, etc.
				8. Plan meeting agenda and format.
				9. Arrange for printed materials.
				10. Obtain input, perceptions, etc.
				11. Assemble meeting results.
				12. Submit results to Data and Reports.

[a]To be oriented toward specific or general publics as the need indicates.

STAGE I

MILESTONES:	1	1A	1B	1C	1D	2
WORK GROUP	Organize	Meet		Meet	Meet	
MAILING LIST	Prepare	Update	Utilize	Update		
MEDIA CONTACTS		Prepare/Utilize As Appropriate				
PUBLIC MEETINGS		Prepare	Conduct			
REPORTS				Prepare/Mail		
BOAT TRIP	Prepare	Conduct				
SURVEYS						
WORKSHOPS						
FACT SHEETS			Research/Prepare/Mail			
REASSESSMENT						Conduct

STAGE II

MILESTONES :	3	4	5	5A	5B
WORK GROUP	Meet	Meet	Meet	Meet	Meet
MAILING LIST	Utilize	Update/Utilize	Update	Utilize	Update/Utilize
MEDIA CONTACTS			Conduct As Appropriate		
PUBLIC MEETINGS			Prepare / Conduct		
REPORTS	Prepare / Mail			Prepare / Mail	
BOAT TRIP					
SURVEYS	Prepare / Mail				
WORKSHOPS	Prepare / Conduct				
FACT SHEETS		Prepare / Mail As Appropriate			
REASSESSMENT					Conduct

AD-A105 208 ARMY ENGINEER DISTRICT ST LOUIS MO F/G 5/1
GREAT RIVER RESOURCE MANAGEMENT STUDY (GREAT III): RECONNAISSAN--ETC(U)
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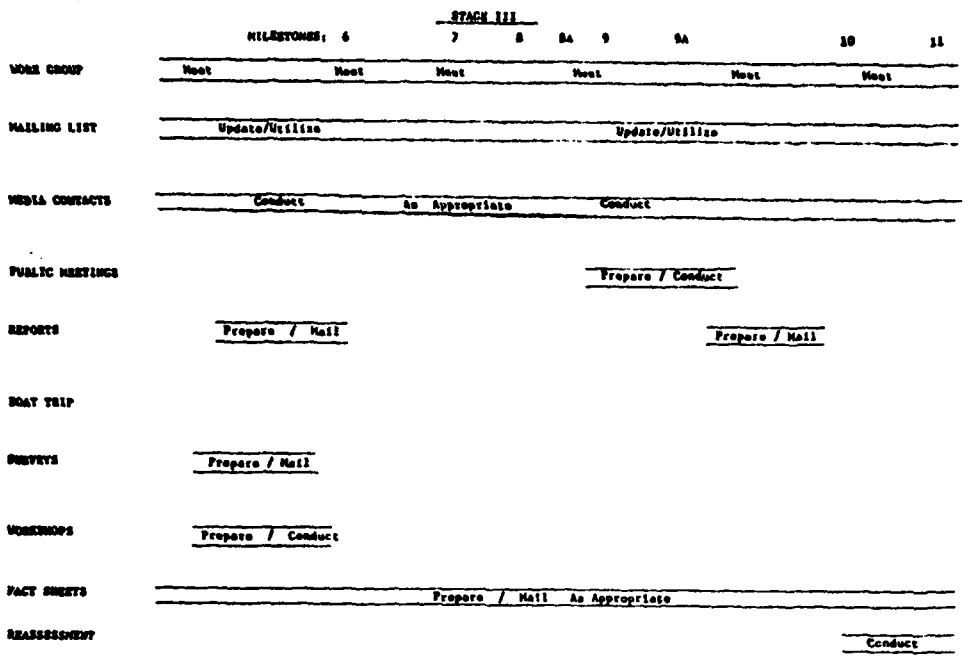

MILESTONES

STAGE I

- 1: Study Initiation
- 1A: Field Reconnaissance
- 1B: Initial Public Meeting
- 1C: Draft Reconnaissance Report
- 1D: Submission of Stage I Report
- 2: Approval of Reconnaissance Report

STAGE II

- 3: Submission of Stage II Report
- 4: Stage II Checkpoint Conference
- 5: Completion of Action on Memorandum for the Record (MFR)
- 5A: Stage II Public Meeting
- 5B: Approval of Stage II Study

STAGE III

- 6: Submission of Draft Stage III Report and Draft EIS
- 7: Stage III Checkpoint Conference
- 8: Completion of Action on MFR
- 8A: Division Comments on Draft Report/EIS
- 9: Coordination of Draft Report and EIS
- 9A: Stage III Public Meeting
- 10: Submission of Final Report and Draft EIS
- 11: Division Engineer's Notice

APPENDIX C

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LITERATURE CITED

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APPENDIX D

GLOSSARY

GLOSSARY

Acceptability. The acceptability of an alternative is determined by analyzing public expression concerning the various impacts and the degree to which the alternatives achieve the planning objectives. This is determined through workshops, public meetings, information bulletins, brochures or public notices, soliciting comments and other pertinent public involvement techniques.

Action Plan. The work program of a work group.

Alternative Plans. Alternative plans are different ways for managing water and related land resources employing structural and/or non-structural measures.

Base Condition. The base condition is a description of existing economic, social and environmental characteristics of the study area.

Certainty. The certainty of a given alternative is based on the likelihood of achieving the planning objectives should the plan be implemented.

Completeness. The completeness of a plan reflects on the inclusion and incorporation of all necessary actions and investments required to assure full attainment of the plan and its objectives.

Detailed Plans. Detailed plans are highly developed approaches for addressing different mixes of planning objectives, recognizing that additional efforts will be necessary to provide more detailed information once a plan is selected for implementation.

Effectiveness. A plan's effectiveness is determined by analyzing its technical performance and contribution to the planning objectives.

Efficiency. The efficiency of a plan is its ability to achieve planning objectives in the least cost manner.

Evaluation. Evaluation is analyzing plans against the "without condition" and against each other to determine and compare their beneficial and adverse contributions.

Impacts (effects). Impacts are the economic, social and environmental consequences expected to result from alternative plans.

Implementable Plans. Implementable plans are plans which can be transformed from concept to reality based, in part, on institutional compatibility, public acceptance, and economic, social and environmental feasibility.

Measure. A measure, which may be part of a plan or the entire plan, is any structural or non-structural means of resource management.

National Economic Development (NED) B/C Ratio. The NED benefit to cost ratio of a plan is determined by analyzing the net economic benefits in relationship to the net economic costs.

Nine-Foot Navigation Project

1. Authorization for the Project:

   a. Mississippi River Between the Ohio and Missouri Rivers

      1) Rivers and Harbors Committee Doc. 9 69th Cong., 2d Sess., 21 Jan. 1927.

      2) Rivers and Harbors Committee Doc. 12, 70th Cong., 1st Sess., 3 July 1930.

      3) H. Doc. 231, 76th Cong., 1st Sess., 2 Mar. 1945.

      4) S. Doc. 7, 85th Cong., 1st Sess. 3 July 1958.

   b. Mississippi River Between Missouri River and Minneapolis, Minnesota

      1) H. Doc. 290, 71st Cong., 2d Sess., River and Harbor Act of 3 July 1930 as amended by Public Resolution No. 10, 24 Feb. 1932.

      2) H. Doc. 137, 72d Cong., 1st Sess., River and Harbor Action of 30 Aug. 1935.

2. Implementation of Project Authorization

A current concern is that Congress only authorized that the channel is to be maintained to a 9-foot depth. However, the authorized project from the Ohio River to the northern boundary of the City of St. Louis as modified in 1930, provides for obtaining and maintaining a minimum channel depth not less than 9 feet, a

minimum width of not less than 300 feet at low water, with additional widths in bends. Between the northern limits of the City of St. Louis and the Illinois River a navigation channel of 9 feet depth and a minimum width of 200 feet with widening in bends was authorized in 1930. This was modified by the River and Harbor Act of 1935 which extended the Upper Mississippi River Project downstream from the mouth of the Illinois to the mouth of the Missouri River. Further modification was authorized in the River and Harbor Act of 1945, which added the Chain of Rocks Canal; thereby eliminating the 200 foot width originally authorized. Furthermore, it is Corps of Engineers policy, with respect to authorized navigation projects, per Engineering Regulation 1130-2-307, Project Operation Dredging Policies and Practices, to have full project dimensions maintained where feasible and justified. To avoid frequent redredging in order to maintain full project depths, overdepth dredging should be performed in critical, fast shoaling areas to the extent that it results in the least overall costs. Such additional dredging is exclusive on and beyond the allowable overdepth to compensate for dredging inaccuracies. The Engineering Regulation goes on to point out that overdepth dredging pertains to not only projects on which dredging operations are relatively continuous throughout the year, but also to those projects on which dredging is performed periodically and by application of this additional dredging principle, dredging intervals could be extended with attendant savings or justified where needs of commerce can be satisfied.

Opportunity. Potential for developing or enhancing resources.

Planning Objectives. Planning objectives are the national, state and local water and related land resource management needs (opportunities and problems) specific to a given study area that can be addressed to enhance NED or Environmental Quality (EQ).

Plan of Study. The plan of study is a document prepared during the initial stage of planning, containing a preliminary description of what the study will address and how it will be conducted.

Planning Process. The planning process is a systematic approach for analyzing needs and problems, establishing planning objectives and developing and evaluating alternative resource management plans.

Resource Management. Resource management involves the development, conservation, enhancement, preservation or maintenance of water and related land resources to achieve the goals of society expressed nationally and locally.

Reversibility. The degree to which a given alternative, once partially or fully implemented, could be reversed and the impacted areas restored to approximate base condition is evaluated. The reversibility of the plan depends on the degree of reversibility of its specific impacts, as determined earlier.

Stability. The stability of an alternative is determined by analyzing the range of "alternative futures" that can be meaningfully addressed within the scope of the alternative, or with minor modifications.