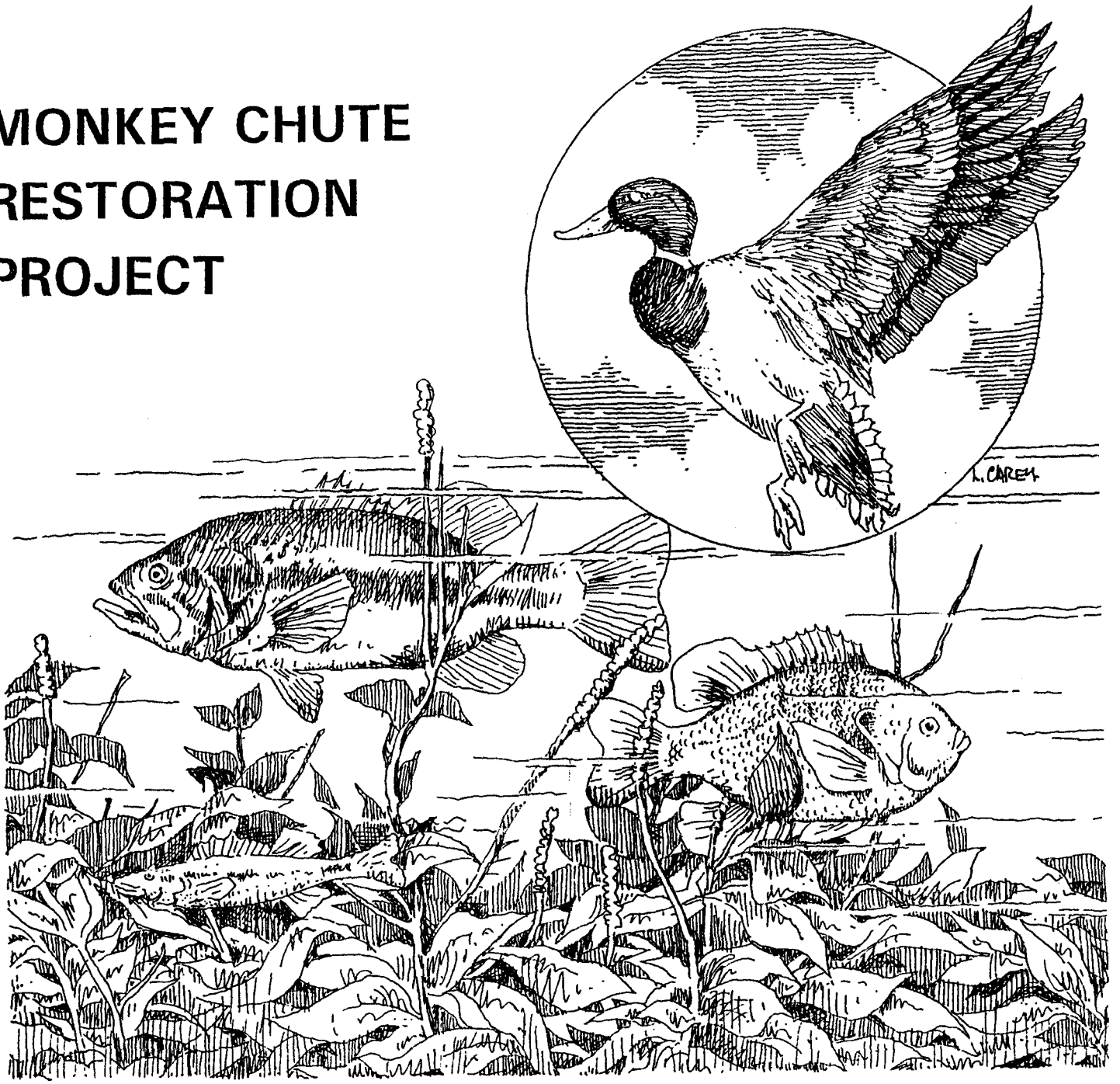
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POST CONSTRUCTION PERFORMANCE
EVALUATION REPORT (PER 1F)

MONKEY CHUTE RESTORATION PROJECT



MARCH 1995

US Army Corps
of Engineers
Rock Island District

POOL 21
UPPER MISSISSIPPI RIVER
MILE 325
MARION COUNTY, MISSOURI

DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
CLOCK TOWER BUILDING – P.O. BOX 2004
ROCK ISLAND, ILLINOIS 61204-2004

REPLY TO
ATTENTION OF

UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POST-CONSTRUCTION PERFORMANCE EVALUATION

MONKEY CHUTE RESTORATION PROJECT

POOL 21, RIVER MILE 325
MARION COUNTY, MISSOURI

MARCH 1995

ACKNOWLEDGMENT

Many individuals of the Rock Island District, Corps of Engineers; the U.S. Fish and Wildlife Service; and the Missouri Department of Conservation contributed to the development of this first Post-Construction Performance Evaluation Report for the Monkey Chute Restoration Project. These individuals are listed below:

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FORESTRY:	Kevin Porteck

U.S. FISH AND WILDLIFE SERVICE

ACTING PROJECT LEADER:	Tom Bell

MISSOURI DEPARTMENT OF CONSERVATION

BIG RIVERS PROGRAM COORDINATOR:	Gordon Farabee
WILDLIFE BIOLOGIST:	Ken Dalrymple
FISHERIES BIOLOGIST:	Ken Brummett

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POST-CONSTRUCTION PERFORMANCE EVALUATION

MONKEY CHUTE RESTORATION PROJECT

POOL 21, RIVER MILE 325
MARION COUNTY, MISSOURI

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ENVIRONMENTAL MANAGEMENT PROGRAM
POST-CONSTRUCTION PERFORMANCE EVALUATION

MONKEY CHUTE RESTORATION PROJECT

POOL 21, RIVER MILE 325
MARION COUNTY, MISSOURI

1. INTRODUCTION

a. Purpose. The purposes of this report are as follows:

(1) Summarize the performance of the Monkey Chute Environmental Management Program (EMP) project based on the project goals and objectives;

(2) Review the monitoring plan for possible revisions;

(3) Summarize project operation and maintenance efforts, to date; and

(4) Review engineering performance criteria to aid in design of future projects.

b. Scope. This report summarizes all available monitoring data, project inspections, and project observations made by the U.S. Army Corps of Engineers (Corps), the U.S. Fish and Wildlife Service (USFWS) and the Missouri Department of Conservation (MDOC) for the period November 1988 through March 1994.

c. Project Authorities and Construction Documents. Published reports which relate to the Monkey Chute Restoration EMP Project or which were used as references in production of this document are presented below.

(1) *Definite Project Report (R1), Monkey Chute Restoration Project, Pool 21, Upper Mississippi River, Marion County, Missouri*, February 1987. The Definite Project Report (DPR) presented a proposal to dredge the downstream end of Monkey Chute to retain 88 acres of backwater lake as year-round fish habitat and maintain its suitability for waterfowl and furbearers. The report marked the conclusion of the planning process and serves as a basis for approval of the preparation of final plans and specifications and subsequent project construction.

(2) *Monkey Chute Dredging, Mississippi River, Marion County, Missouri*, Plans and Specifications, September 1987 and June 1988. These documents were prepared to provide sufficient detail of project features to allow construction of the project by a

contractor. At the request of the contractor, the first contract was terminated. The second contract was awarded 15 July 1988. Work was 100 percent completed on 5 May 1989.

(3) *Monkey Chute Habitat Rehabilitation and Enhancement Project, Great Flood of 93 Damage Assessment*, March 1994. This report was prepared to provide a summary describing the damage, proposed corrective actions, and estimated cost for repairs to Flood of 1993 damage.

2. PROJECT GOALS, OBJECTIVES, AND MANAGEMENT PLAN

a. General. As stated in the DPR, the Monkey Chute Restoration Project was initiated primarily because sedimentation in the lower end of Monkey Chute was becoming acute. In severe cases when Pool 21 water levels were below normal, sediment deposits prevented access to the chute. The sediment deposits isolated the chute from the river, resulting in stranded fish and stagnant water.

b. Goals and Objectives. Monkey Chute Restoration Project was the first project designed and constructed by the Rock Island District under the EMP. The goal of this project was to restore otherwise vanishing Upper Mississippi River backwater habitat. The project objectives were to encourage the flow of oxygen-rich main channel water into the backwater areas, retain 88 acres of backwater lake as year-round fish habitat, and maintain suitable habitat for waterfowl and furbearers.

c. Management Plan. A formalized management plan was not required for this project.

3. PROJECT DESCRIPTION

a. Project Features. The constructed project consisted of excavating a channel 600 feet long by 30 feet wide to a depth of 6 feet below flat pool, and placing dredged material in an in-water confined dredged material placement site. A silt retaining fence was constructed approximately 200 feet upstream of an existing berm to hold the dredged material in place (see Plate 1).

b. Construction and Operation. Dredging began during the late summer of 1988 and was essentially complete in June 1989. The contractor experienced a dredging problem when the remains of a regulating structure (wing dam) were discovered within the project limits. The contractor did not have the equipment to remove the structure. The Rock Island District Channel Maintenance crew removed the structure (within the 30-foot-wide project limits) with their derrick barge. During placement of dredged material in the in-water dredged material placement site, the silt fence was subjected to periods of a maximum head differential of 2 feet. The silt fence performed satisfactorily under this condition. The silt retaining fence was left in place to reduce the amount of dredged material re-entering the Monkey Chute backwater. The project requires no operational activities.

4. OPERATION, MAINTENANCE, AND MONITORING RESPONSIBILITIES

a. General. Because this project has no operational requirements, an Operation and Maintenance Manual was not prepared. There has been no previous Performance Evaluation Plan.

Monitoring activities and responsibilities are presented in Appendix A. Table A-1 presents overall types, purposes, and responsibilities of monitoring and data collection. Table A-2 presents actual monitoring grouped by project phase, as well as data collection intervals.

b. Corps of Engineers. As part of the Flood of 1993 Damage Assessment, the Corps reviewed pre-flood surveys of the Monkey Chute dredged channel. The sounding profiles are shown on Plate 1. Post-flood soundings were performed in March 1994. The March 1994 soundings indicated water depths similar to the January 1993 soundings. No post-construction water quality data has been collected for this project. Pre- and post-construction aerial photography is shown on Plate 4.

The relative success of the project compared to original project objectives will be measured using this data along with other data, field observations, and project inspections performed by the MDOC. The Corps has overall responsibility to measure and document project performance. The physical locations of the sampling stations referenced on the Resource Monitoring and Data Collection Schedule are presented on Plate 1.

c. U.S. Fish and Wildlife Service. The USFWS has not conducted any post-construction monitoring.

d. Missouri Department of Conservation. The MDOC has collected sediment transect data on an annual basis since project completion. The location of these transects is shown on Plate 1. The MDOC sediment transect data are shown on Plates 2 and 3.

5. EVALUATION OF PROJECT OBJECTIVES

a. Encourage the Flow of Oxygen-Rich Main Channel Water into Monkey Chute Backwater Areas

(1) Monitoring Results. Corps pre-flood surveys (January 1993) of the Monkey Chute dredged channel indicated that the channel had already experienced heavy siltation at the upstream end. The January 1993 soundings revealed that the upstream 240 feet of channel (40 percent of the channel length) had a water depth of only 1.5 to 3 feet at flat pool conditions, compared to the post-construction water depth of 6 feet. Post-flood soundings are similar to the pre-flood soundings, i.e., approximately 40 percent of the channel length had a water depth of only 1.5 to 3 feet. Both surveys indicate the presence of a scour hole between the chute opening and the dredged channel. The water depth at the scour hole was 7.5 feet pre-flood and 9.5 feet post-flood at flat pool conditions. The water

depth at the chute opening has decreased from a pre-construction depth of 8 to 10 feet to a depth of 3 to 5 feet. While no post-construction water quality monitoring has been collected for this project, water quality monitoring at Cottonwood Island and Gardner Division (two EMP projects upstream of Monkey Chute) over the past 3 years measured ice depths of 1/2 inch to 9 inches. Typical ice depths for the Pool 21 navigation channel range from 12 to 18 inches during mid-January through March; greater depths would be expected in backwater areas.

MDOC sediment transects reveal water depths in 1992 at the upstream end of the channel similar to pre-project water depths. MDOC transects also indicate lateral movement of the channel bottom to the right as the channel progresses upstream. MDOC conversations with fishermen indicate that a healthy, year-round sport fishery still exists within the Monkey Chute backwater area.

(2) Conclusions. Prior to the Great Flood of 1993, the accumulation of sediment in the upstream end of the dredged channel had already exceeded pre-project depths. Additional sediment accumulation as a result of the Great Flood of 1993 appears to be insignificant. Water depth at the chute opening is decreasing, and the water depth at the scour hole between the chute opening and the dredged channel is increasing.. Although water depths in the upstream end of the dredged channel approach pre-project conditions, the continued existence of a healthy, year-round sport fishery suggests that sufficient dissolved oxygen still exists within the Monkey Chute backwater area. However, during periods when ice depths approach 18 inches, the flow of oxygen-rich main channel water and fish access to and egress from the backwater area will be limited.

b. Retain 88 Acres of Backwater Lake

(1) Monitoring Results. Aerial photography from 1984, 1989, 1993, and 1994 reveal conversion of the uppermost reach of the Monkey Chute backwater area from open water to marsh to lowland brush habitat. The continued existence of a healthy, year-round sport fishery could be due, in part, to the presence of three deep holes (19-20 feet deep) in the backwater area. MDOC staff inquiries as to the history of the deep holes indicate the Monkey Chute backwater area was used as a borrow source for construction of the Fabius Drainage District levee.

(2) Conclusions. The project has not stopped the conversion of open water to marsh and lowland brush habitat. The presence of the deep holes provides overwintering habitat for fish.

c. Maintain Suitable Habitat for Waterfowl and Furbearers

(1) Monitoring Results. All vegetation growing on the dredged material is voluntary and consists of cottonwood, silver maple, box elder, and mulberry.

(2) Conclusions. Vegetation growing on the dredged material provides marginal benefits to wildlife.

6. OPERATION AND MAINTENANCE SUMMARY

a. Operation. The project has no operational requirements.

b. Maintenance.

(1) Inspection. MDOC inspects the Monkey Chute Restoration Project on an annual basis. Other project inspections are scheduled following high water events.

(2) Maintenance Based on Inspections. No maintenance has been performed on this project.

7. CONCLUSIONS AND RECOMMENDATIONS

a. Goals and Objectives. Based on data and observations collected since project completion, the goals and objectives have been somewhat achieved. The continued presence of an active sport fishery suggests the project provides sufficient dissolved oxygen to the backwater area for year-round fish habitat. However, the uppermost reaches of the backwater area are vanishing, and the vegetation growing on the dredged material provides only marginal benefits to wildlife.

b. Performance Evaluation and Monitoring Schedules. The Corps will obtain aerial photos of the project site in 1998. MDOC should continue to collect sediment transect data on an annual basis. MDOC should continue interviews with fishermen, as well as assess waterfowl and furbearer utilization of the Monkey Chute backwater area. This information will be used to re-evaluate project performance in 1999.

c. Operation and Maintenance. There are no operational requirements attached to this project. With water depths at the upstream end of the project approaching pre-project depths less than 5 years after construction, maintenance dredging to the 6-foot design channel depth is not recommended.

d. Project Design Enhancement. Discussions with Corps personnel have resulted in the following general conclusions regarding project features which may affect future project design:

(1) Channel Excavation. The proximity of this project to the Lock and Dam 21 forebay and accompanying slackwater conditions in combination with fluctuating water/pool levels have contributed to the siltation in the upstream end of the project area. The presence of the wingdam on either side of the dredged channel also may be contributing to accretion in this area by providing a debris trap during high water events.

If retention of the vanishing backwater habitat is to occur, excavation of a pilot channel and construction of a water control structure as a means of providing oxygen-rich main channel water and manipulating water levels in the upper backwater reaches should be evaluated prior to the next Performance Evaluation Report. The ability to manipulate water levels in the upper backwater reaches could delay or stop conversion of this area to marsh and lowland brush habitat.

(2) Dredged Material Placement Site.. All vegetation in this area is voluntary and consists primarily of invasive species. Plate 4 photography shows vegetation established on the dredged material in 1989, inundation of the dredged material site by the flood in 1993, and subsequent loss of vegetation in this area in 1994. Future projects should consider planting a mast component on dredged material. Corps foresters recommend placing a minimum of 4 feet of dredged material above existing ground elevation. While the finished grade of the dredged material placement site is not known, the 4-foot minimum placement height should ensure survival of mast tree plantings during most high water events.

APPENDIX A

MONITORING AND PERFORMANCE EVALUATION MATRIX

RESOURCE MONITORING AND DATA COLLECTION SUMMARY

TABLE A-1

MONITORING AND PERFORMANCE EVALUATION MATRIX

Project Phase	Type of Activity	Purpose	Responsible Agency	Implementing Agency	Funding Source	Implementation Instructions
Pre-Project	Sedimentation Problem Analysis	System-wide problem definition. Evaluates planning assumptions.	USFWS	USFWS (EMTC)	LTRM	--
	Pre-Project Monitoring	Identifies and defines problems at HREP site. Establish need of proposed project features.	Sponsor	Sponsor	Sponsor	--
	Baseline Monitoring	Establishes baselines for performance evaluation.	Corps	Field Station or Sponsor thru Cooperative Agreements or Corps	HREP/-Sponsor	--
Design	Data Collection for Design	Includes quantification of project objectives, design of project, and development of performance evaluation plan.	Corps	Corps	HREP	--
Construction	Construction Monitoring	Assess construction impacts; assures permit conditions are met.	Corps	Corps	HREP	See State Section 401 Stipulations
Post-Construction	Performance Evaluation Monitoring	Determine success of project as related to objectives.	Corps (quantitative) Sponsor (field observations)	Field Station or Sponsor thru Cooperative Agreement, Sponsor thru O&M, or Corps	HREP/-Sponsor	--
	Biological Response Monitoring	Evaluate predictions and assumptions of habitat unit analysis. Studies beyond scope of performance evaluation.	Corps	Corps	HREP	--

TABLE A-2

RESOURCE MONITORING AND DATA COLLECTION SUMMARY[1/]

Type Measurement	Water Quality Data						Engineering Data			Natural Resource Data			Sampling Agency	Remarks
	Pre-Project Phase		Design Phase		Post-Const. Phase		Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase		
	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar								
POINT MEASUREMENTS														
Water Quality Stations [2/]													Corps	
Turbidity			1											
Secchi Disk Transparency														
Suspended Solids														
Dissolved Oxygen			1											
Specific Conductance			1											
Water Temperature			1											
pH			1											
Total Alkalinity														
Chlorophyll														
Velocity														
Water Depth														
Water Elevation														
Percent Ice Cover														
Ice Depth														
Percent Snow Cover														
Snow Depth														
Wind Direction														
Wind Velocity														
Wave Height														
Air Temperature														
Percent Cloud Cover														
Elutriate Test Stations [3/]			1											

TABLE A-2 (Cont'd)

Type Measurement	Water Quality Data						Engineering Data			Natural Resource Data			Sampling Agency	Remarks
	Pre-Project Phase		Design Phase		Post-Const. Phase		Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase		
	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar								
POINT MEASUREMENTS (cont'd)														
Column Settling Stations [4/] Column Settling Analysis														
Boring Stations [5/] Geotechnical Borings														
Fish Stations [6/] Electrofishing										1			MDOC	
TRANSECT MEASUREMENTS														
Sedimentation Transects [7/] Hydrographic Soundings							1/1		2/1Y				Corps/MDOC	
Vegetation Transects [8/] Mast Tree Survey														
AREA MEASUREMENTS														
Mapping [9/] Vegetation Mapping														
Aerial Photography/ Remote Sensing										1		3	Corps	

Legend

Y = Yearly
nY = n-Year Interval
1,2,3 = Number of times data was collected within designated project phase

[1/] See Plate 1, Location Plan for active monitoring sites.

[2/] Water Quality Stations (Design Phase)

A
B
C

[3/] Elutriate Stations (Design Phase)

A
B
C

[4/] Column Settling Analysis (Design Phase)

None

[5/] Corps Geotechnical Borings (Design Phase)

Station Code
M325A
M325B
M325C

[6/] Fish Stations (Pre-Design Phase)

MDOC
Electrofishing surveys, 1983, 1984

[7/] Sedimentation Channel Profiles and Transects (Pre- and Post-Construction Phase)

Corps (Channel Profiles)
1986
1988
1989
1993
1994

MDOC (Transects - Annual)
1
2
3
4

[8/] Vegetation Transects

None

[9/] Mapping (Pre- and Post-Construction Phase)

1984 Aerial Photography
1989 Aerial Photography
1993 Aerial Photography
1994 Aerial Photography

APPENDIX B

COOPERATING AGENCY CORRESPONDENCE

MISSOURI DEPARTMENT OF CONSERVATION

MAILING ADDRESS
P.O. Box 180
Jefferson City, Missouri 65102-0180

STREET LOCATION
2901 West Truman Boulevard
Jefferson City, Missouri

Telephone: 314/751-4115
Missouri Relay Center 1-800-735-2966 (TDD)
JERRY J. PRESLEY, Director

January 4, 1995

Mr. Joe Jordan
Rock Island District, Corps of Engineers
Clock Tower Building
P.O. Box 2004
Rock Island, IL 61201

Dear Joe:

Beginning in 1988 Missouri Department of Conservation staff have annually collected bathymetric data at Monkey Chute. Data were collected in early fall, with the first transect measurement taken at the chute's entrance and three additional transects taken further into the chute.

Transects 1 and 2 show little deposition, maintaining post project depths at approximately 7 feet. As the pre project depth at transect 2 was only 2 feet, it's encouraging to see the deep water here being maintained. Transects 3 and 4 show considerable reduction in depth as early as 1992, four years after the project was finished. In 1989, immediately following project construction, maximum depths at transects 3 and 4 were approximately 7 feet and 8 feet respectively. At these sites four years later, maximum depths recorded at 4 feet are approaching pre project conditions.

I haven't elaborated in length over the data, as I believe they clearly show heavy accretion at transects 3 and 4 and no accretion at transects 1 and 2.

I believe the Monkey Chute project is at least partially successful in that depths close to the chute's entrance are stable.

Sincerely,

Gordon B. Farabee

Gordon B. Farabee
Big Rivers Program Coordinator

MDOC Transect locations are shown on Plate 1.
MDOC Transect data are shown on Plates 2 and 3.

APPENDIX C

DISTRIBUTION LIST

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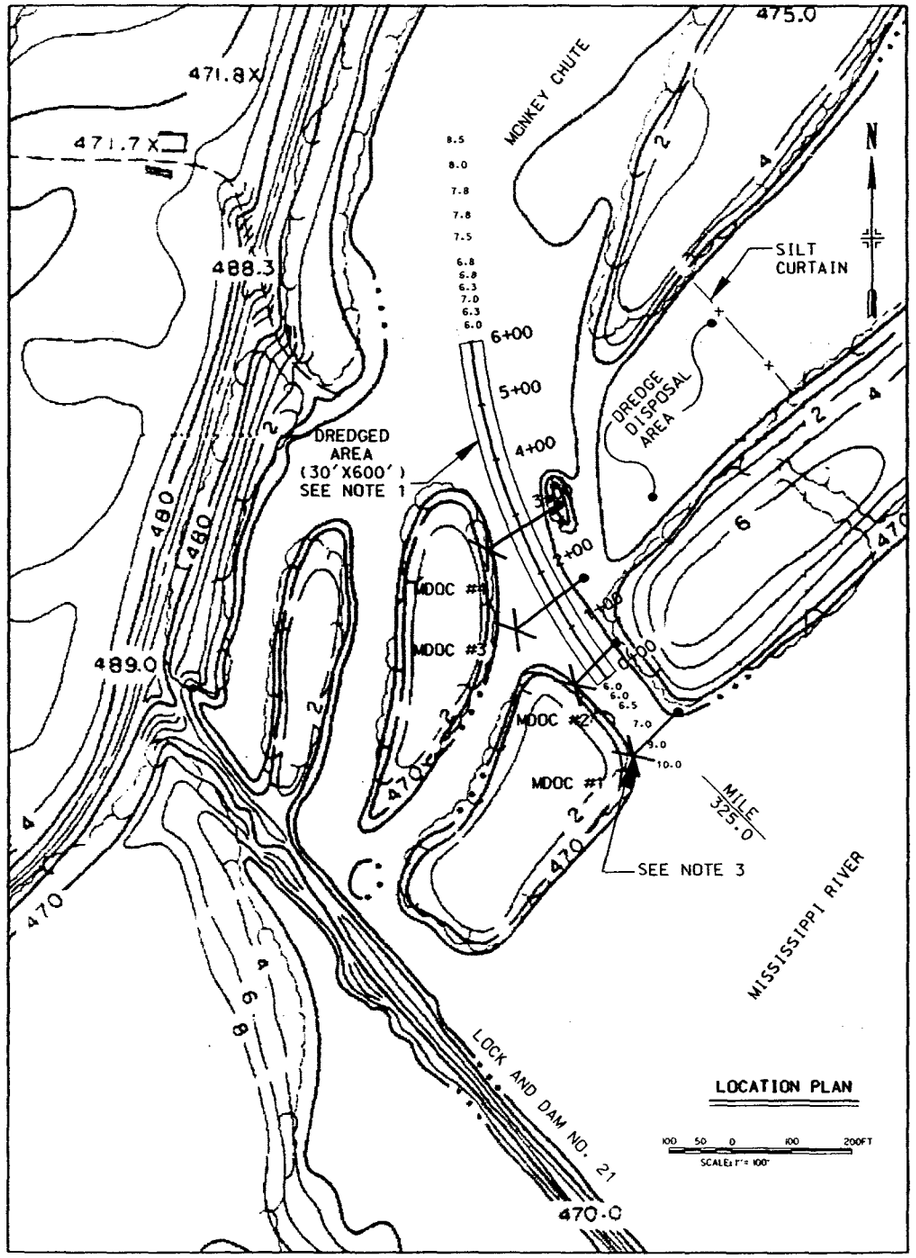
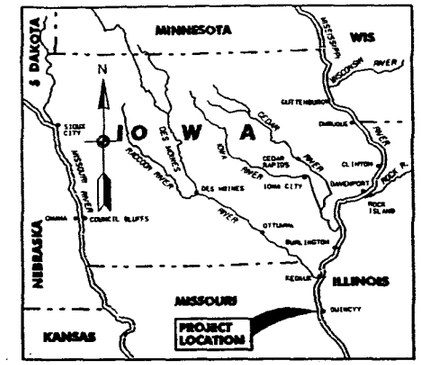
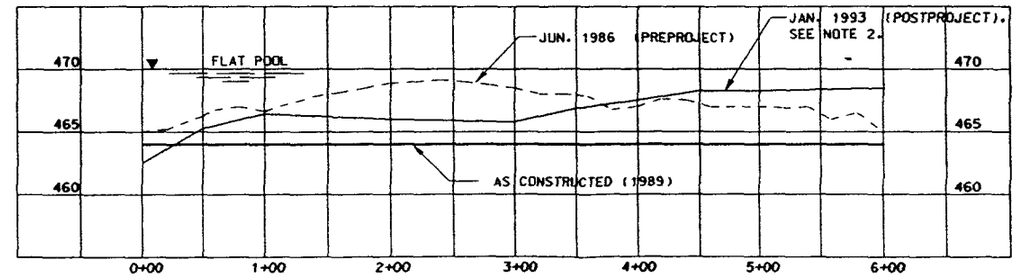




VICINITY MAP



MONKEY CHUTE EMP CHANNEL PROFILE

NOTES:

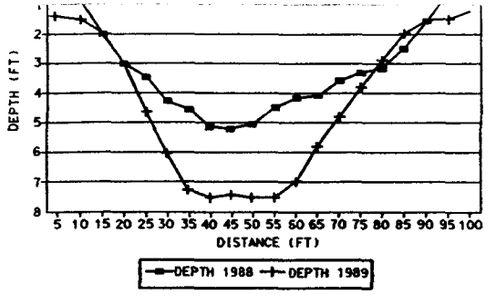
1. WATER DEPTHS SHOWN ARE JUNE 1986 (PRE PROJECT). SEE PROFILES FOR WATER DEPTHS IN DREDGED AREA.
2. SOUNDINGS TAKEN IN MARCH 1994 INDICATED WATER DEPTHS SIMILAR TO JAN. 1993 SOUNDINGS.
3. " X" DESIGNATES STARTING POINT OF MDOC TRANSECTS (TYP.).
4. SCOUR HOLE IS LOCATED BETWEEN MDOC #1 & MDOC #2.

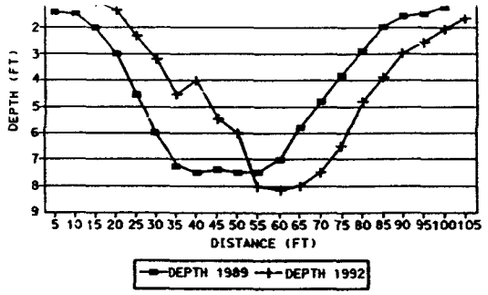
Revisions			
Symbol	Description	Date	Approved

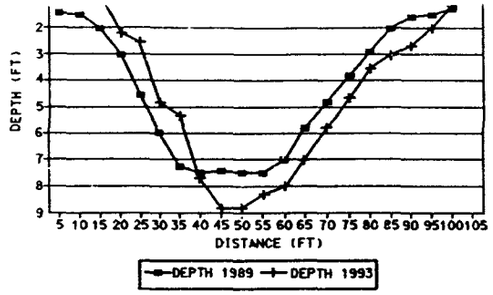
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

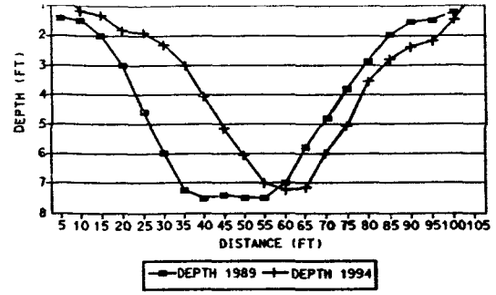
Designed by: CCK	MISSISSIPPI RIVER POOL 21 MONKEY CHUTE BACKWATER DREDGING
Drawn by: TPD/SDH	
Checked by: BLK	LOCATION PLAN
Reviewed by: DJH	Scales: AS SHOWN
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS	Dates: 3 JAN. 95
	Drawing Code:
	Sheet reference numbers:
	Solicitation Numbers: DACW25-9 -0-
	Sheet of

PLATE 1









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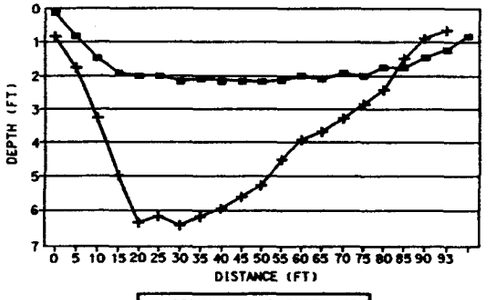

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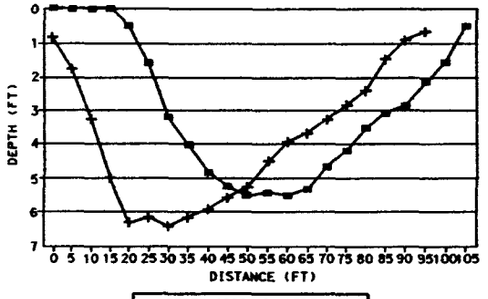

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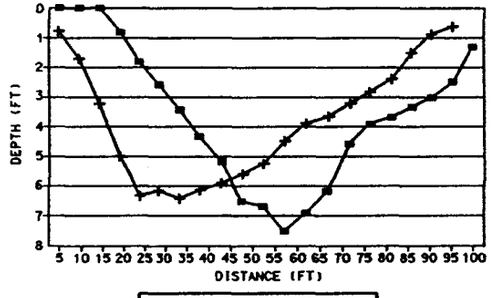

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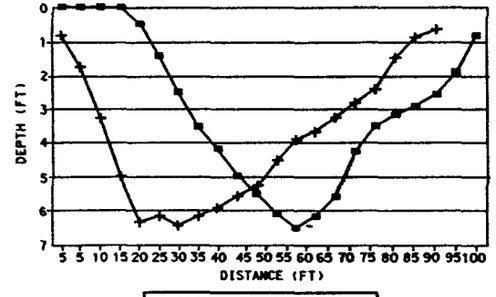

Revisions			
Symbol	Description	Date	Approved

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Checked by: BLK	
Reviewed by: DJH	Scales:
Approved by: CHARLES S. COX, COL., CORPS OF ENGINEERS	Dates:
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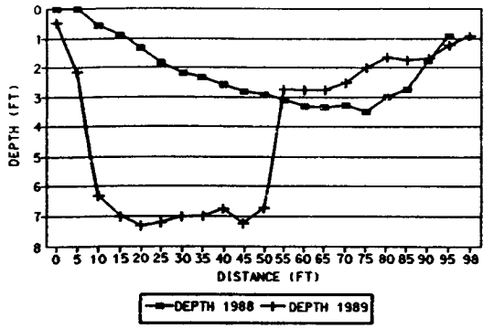
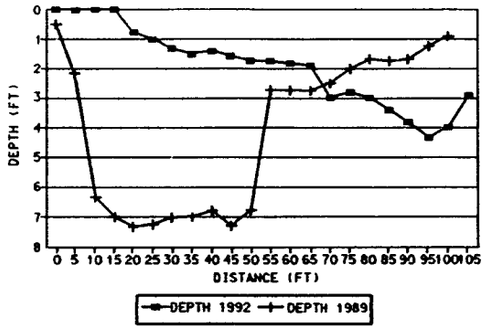
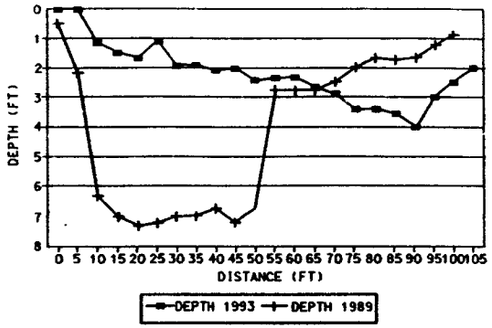
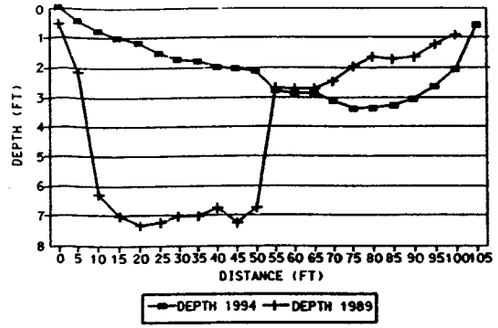
PLATE 2

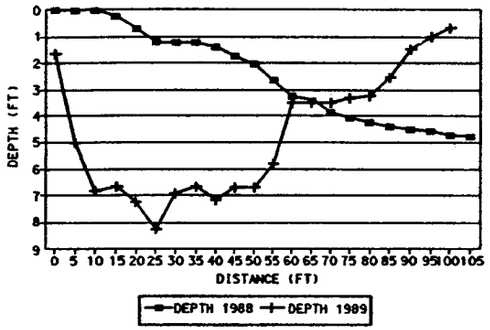








1988 vs 1989 TRANSECT #4



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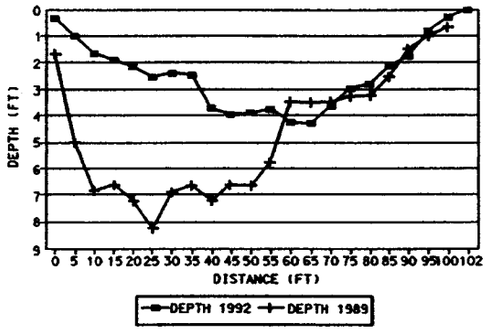

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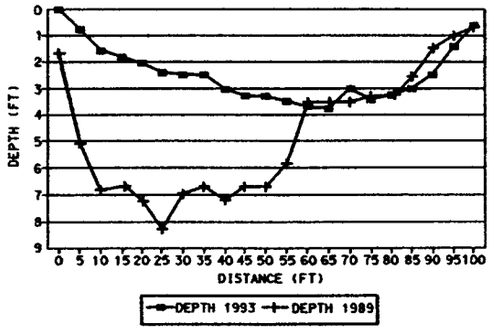

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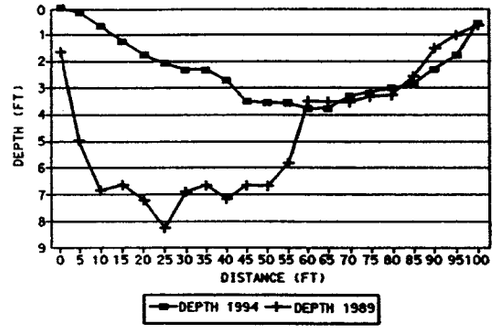
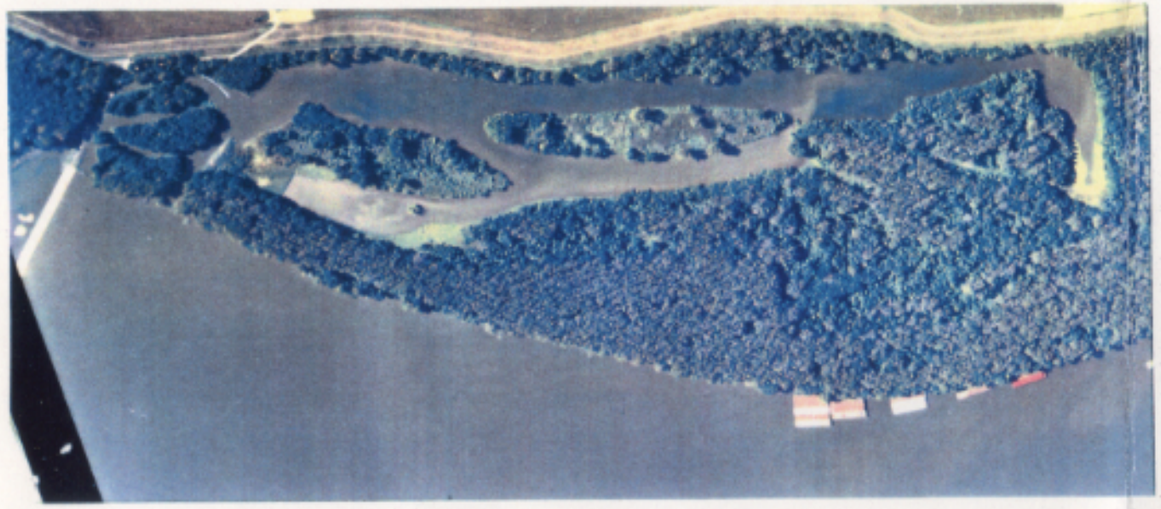


Revisions			
Symbol	Description	Date	Approved

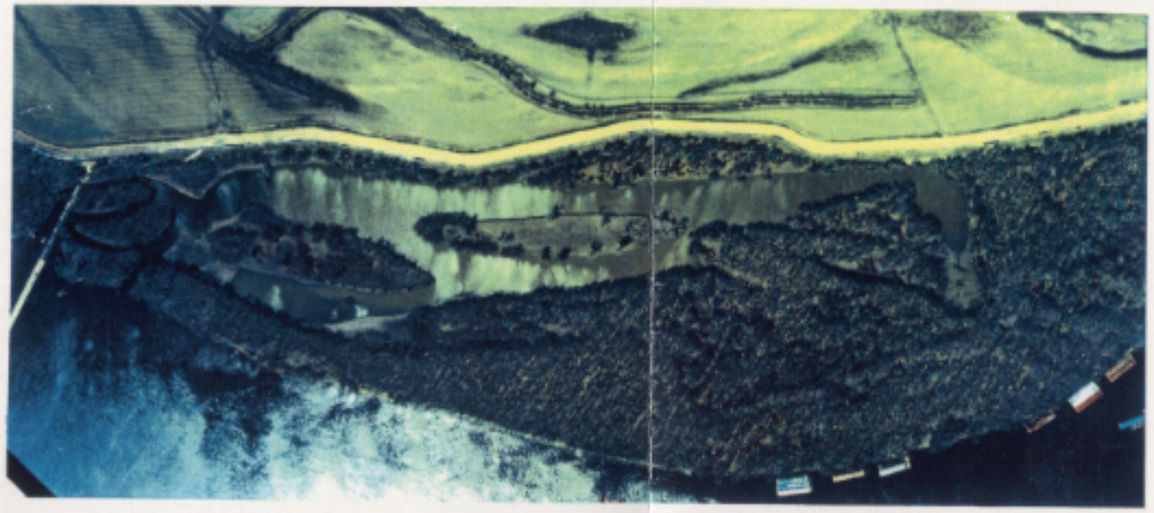
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

Designed by: CCK	MISSISSIPPI RIVER POOL 21 MONKEY CHUTE BACKWATER DREDGING
Drawn by: TPD/SDH	
Checked by: BLK	MDOC SEDIMENT TRANSECTS
Reviewed by: DJH	Scale:
Approved by: CHARLES S. COX, COL., CORPS OF ENGINEERS	Date:
	Drawing Code:
	Sheet reference numbers:
	Solicitation Number: DACW25-9 -B-
	Sheet of

PLATE 3

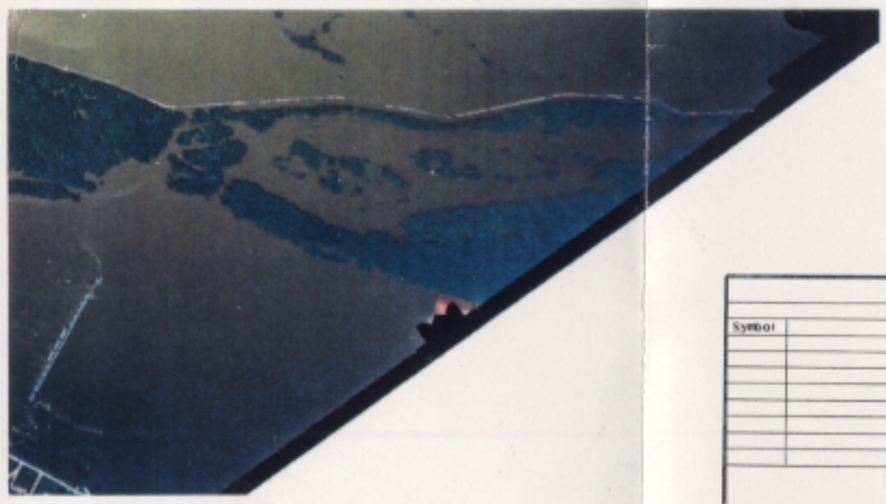


1989



1994

1984



1993

Revisions			
Symbol	Description	Date	Approved

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

Designed by: CDK	MISSISSIPPI RIVER POOL 21 MONKEY CHUTE BACKWATER DREDGING
Drawn by: TPD/SDH	AERIAL PHOTOS
Checked by: BLK	
Reviewed by: DJH	Scales:
Approved by: CHARLES S. DEE, COL., CORPS OF ENGINEERS	Dates:
	Drawing Code:
	Sheet reference numbers:
	Solicitation Numbers: DACW25-9_-C-____
	Sheet of

PLATE 4