UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT WITH
INTEGRATED ENVIRONMENTAL ASSESSMENT (R-5)

# BIG TIMBER REFUGE REHABILITATION AND ENHANCEMENT

JULY 1989

US Army Corps of Engineers
Rock Island District

Pool 17
UPPER MISSISSIPPI RIVER
LOUISA COUNTY, IOWA

CENCR-176850 27 June 1989

# STATEMENT OF FINDINGS

I. Project Description.

A. This statement concerns a proposal by the Rock Island District, Corps of Engineers (CENCR), to perform work pursuant to the Environmental Management Program (EMP) - Habitat Rehabilitation and Enhancement Program (HREP) at the location known as Big Timber, Louisa County, Iowa. Big Timber is a management unit of the Louisa Division of the Mark Twain National Wildlife Refuge. This project primarily involves dredging to restore lost aquatic habitat and wetland values.

B. An Environmental Assessment (EA) addressing effects of the proposed project has been prepared and circulated for public review, along with a Section 404(b)(1) Evaluation. This 30-day review period was completed on May 30, 1989. The Public Notice for this project was issued May 27, 1989, for 21-day review.

II. Statutory Authorities and Administrative Determination.

A. I have reviewed and evaluated, in light of the overall public interest, the documents and factors concerning this permit application, as well as the stated views of other interested Federal and non-Federal agencies and the concerned public.

B. The possible consequences of this proposed work have been studied in accordance with regulations published in 33 CFR Part 230 (Appendix B), 33 CFR Parts 320 to 340, 40 CFR Part 230 (if applicable), and 33 CFR Part 240 (Implementation of Executive Order 11988, Flood Plain Management).

III. Public Interest Review. The public notice issued for the project on May 27, 1989, was sent to the following places: post offices; appropriate city and county officials; adjoining property owners; appropriate State and Federal agencies; local, regional, and national shipping entities; and other interested parties. A mailing list for the public notice is included in the permit application file. The following points are considered pertinent:

A. Federal Agencies (responding to the EA integrated within the Detailed Project Report (DPR) and coordination letters).

1. Letter from the U.S. Environmental Protection Agency Region VII, dated May 30, 1989, stating concurrence with [the] intent to issue a Finding of No Significant Impact (FONSI) for this project.

2. Letter from the U.S. Department of the Interior, Office of Environmental Project Review, dated May 30, 1989, stating that the Department does not object to this project.

3. Letter from the U.S. Fish and Wildlife Service (FWS), Region III, dated May 22, 1989, stating that previous concerns have been addressed and that the draft Agreement for Operation, Maintenance, and Repair is a correct statement of FWS responsibilities. The letter also noted the Corps' intent to pursue a joint FONSI with Region III. Subsequent interagency discussion has resulted in the decision to prepare separate agency FONSI documents.

4. Letter from the U.S. Department of Health and Human Services, dated May 12, 1989, stating that the proposed project will not pose extraordinary risks to public health or safety.

5. Letter from the U.S. Fish and Wildlife Service, dated January 5, 1989, providing a signed compatibility determination for the proposed project.

B. State Agencies (responding to the EA or project coordination letters).

- Letter from the State of Iowa, Department of Natural Resources, dated June 13, 1989, stating that the Iowa Department of Natural Resources agrees to cooperate with the Fish and Wildlife Service to assure that operation, maintenance, and any mutually agreed upon rehabilitation as described in the Definite Project Report are accomplished in accordance with Section 906(e) of the Water Resources Development Act of 1986.

C. Federal Agencies (responding to the Section 404 Public Notice)

- Letter from the U.S. Fish and Wildlife Service, dated June 20, 1989, stating no objection to issuance of the related permits.

No other Federal agencies have responded to the public notice for this project.

D. State Agencies (responding to the Section 404 Public Notice and Section 401 certification application).

1. Letter from the State of Iowa, Department of Natural Resources, dated January 18, 1989, providing the State of Iowa's 401 Water Quality Certification pursuant to the following conditions:

- Material dredged mechanically will be placed in the specific areas agreed to during interagency coordination meetings and noted on plate 2 of the Draft DPR; and

VI. REPRESENTATIVES

The following individuals or their designated representatives shall have authority to act under this MOA for their respective parties:

FWS: Regional Director
U.S. Fish and Wildlife Services
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

DA: District Engineer
U.S. Army Engineer District, Rock Island
Clock Tower Building - P.O. Box 2004
Rock Island, Illinois 61204-2004

VII. EFFECTIVE DATE OF MOA

This MOA shall become effective when signed by the appropriate representatives of both parties.

THE DEPARTMENT OF THE ARMY

BY: John R. Brown
JOHN R. BROWN
Colonel
U.S. Army Engineer District,
Rock Island
Corps of Engineers

DATE: 18 October 1989

THE U.S. FISH AND WILDLIFE SERVICE

BY: for
JAMES C. GRITMAN
Regional Director
U.S. Fish and Wildlife
Service

DATE: 9/18/89

- The dredged material is appropriately stabilized to prevent reintroduction into the waterway.

2. Letter from the State Historical Society of Iowa, Bureau of Historic Preservation, dated June 1, 1989, stating that there are no historic properties which might be affected by the proposed undertaking and recommending project approval.

E. Individuals or Organized Groups.

- Letter from Mr. M. G. Cubbage, Grandview, Iowa, dated June 18, 1989, expressing concern for improvement of a nearby boat ramp and fisheries management activity by the Iowa Department of Natural Resources (IDNR). These concerns are beyond the purviews of the project and the authority of the Corps of Engineers. A copy of the letter has been provided to IDNR for their consideration.

IV. Summary of Environmental Impact Review.

A. An EA has been prepared for the project. This review has not identified any potentially significant adverse effects under terms of the proposed activity. Thus, a FONSI was prepared and is included in the EA.

B. The Section 404(b)(1) Evaluation prepared for this project concluded that the proposed activity will comply with the guidelines set forth in 40 CFR Part 230 with appropriate conditions as discussed in the evaluation document and this Statement of Findings.

V. Summary of Findings. I find that performance of the project under the conditions set forth, and as prescribed by regulations published in 33 CFR Part 230 (Appendix B), 33 CFR Parts 320 to 340, 40 CFR Part 230 (if applicable), and 33 CFR Part 250 (Implementation of Executive Order 11988, Flood Plain Management), is in the public interest.

8 July 89
DATE

Neil A. Smart
Colonel, Corps of Engineers
District Engineer

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:

CENCR-PD-R

# UPPER MISSISSIPPI RIVER SYSTEM
# ENVIRONMENTAL MANAGEMENT PROGRAM
# DEFINITE PROJECT REPORT
# WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-5)

## BIG TIMBER REHABILITATION AND ENHANCEMENT
## POOL 17, MISSISSIPPI RIVER MILE 444
## LOUISA COUNTY, IOWA

JULY 1989

ACKNOWLEDGMENT

Primary study team personnel who are familiar with the technical aspects of the study are listed below:

STUDY MANAGEMENT: Andrew J. Bruzewicz

PROJECT ENGINEER: Bob Hoffman

HYDRAULIC STUDIES: Leo Foley

ENVIRONMENTAL STUDIES: Bob Clevenstine

CULTURAL RESOURCES: for Ronald Deiss

SOCIO-ECONOMIC ANALYSIS: Patricia Risser

GEOTECHNICAL: for Rachel LaFauce

COST ESTIMATE: Jerry Crittenden

WATER QUALITY: for Clint Beckert, Ph.D

# EXECUTIVE SUMMARY

Big Timber is a 1,039-acre backwater complex approximately 8 miles south of Muscatine, Iowa, on the west bank of the Mississippi River in Pool 17 (see plate 1). All of the lands involved in this project are owned by the United States. The lands were acquired by the Corps of Engineers for the Mississippi River Nine-Foot Navigation Channel project. All of the lands are managed by the U.S. Fish and Wildlife Service as part of the Mark Twain National Wildlife Refuge under a cooperative agreement between the Department of the Army and the Department of the Interior dated February 14, 1963.

Sedimentation from Mississippi River flood events has reduced deeper off-channel aquatic habitats, decreasing fish populations in the Big Timber backwaters complex during the past 10 to 20 years. Similarly, habitat for migratory waterfowl, already under stress due to drought conditions and loss of habitat in the Upper Midwest, has been affected, as has habitat for eagles and herons, other birds, mammals, reptiles, amphibians, and invertebrates which depend on aquatic and wetland habitats. Migratory waterfowl use of the area has been declining, at least in part due to the dwindling aquatic and wetland habitats.

With the recession of flood events, fish either are stranded or become concentrated in the unconnected permanent waters, providing forage for predators. Severe summer and winter fish kills have been reported, attributable to low dissolved oxygen levels. The net fisheries value of the project area, once more highly productive, is now low.

Big Timber was chosen as the location for this project due to the loss of deepwater at locations not on the main channel. In addition, the deepwater in Coolegar Slough created by hydraulically dredging borrow material for the Muscatine Levee in the early 1960's provides an established fishery which will provide stock for the new opportunities that will be created by the project (see plate 2). Sediment surveys indicate that the longevity of the existing backwater habitat of the Big Timber Refuge will be extended by up to 50 years.

Project objectives are to increase fish habitat in the backwater area off Coolegar Slough, increase habitat available to wintering fish not subject to freeze-out, increase diversity of the fish habitat, increase diversity of the bottomland hardwoods, and enhance duck habitat.

The project objectives will be achieved by selectively dredging Big Denny, Little Denny, and Round Ponds and the interconnecting channels. The resultant deepwater and varying water depths will provide wintering fish habitat and diversify aquatic habitat. By placing dredged material upon portions of the floodplain, higher elevations will be created and bottomland hardwood diversification realized. Potholes, a valuable waterfowl habitat feature, will be created within existing willow thickets.

The alternatives considered to accomplish the objectives included variously configured mechanical and/or hydraulic dredging of areas to depths of 7 to 8 feet and 30-40 to 50-85 feet wide, shallow cuts of 2 to 3 feet for dabbling ducks, and creation of three holes more than 16 feet deep; various placement options including sidecasting in water to form small islands, sidecasting on land to form check dams and provide limited protection of the dredged fish access channel in sediment drop zones, sidecasting in higher areas with established timber, hydraulic placement in lower interior area to depths of 2 to 4 feet which would be retained by containment dikes up to 3 to 5 feet high or on a federally owned, previously cultivated, open field; and blasting of holes in mudflats overgrown with willows.

The selected plan for the habitat project, as depicted on plate 2, consists of hydraulically dredging a 35-foot-wide channel through Round Pond to the head of Big Denny with a branch to the head of Little Denny, reduced to a width of 30 feet through the 200 feet of Timber Chute. Depth would be 7.5 feet. This material will be placed in the area between the Mississippi River and Big and Little Denny, confined by a natural levee and a low dike constructed along the banks of Big and Little Denny. This area will be replanted with hickory and oak. The channel from Timber Chute to Big and Little Denny will be widened an additional 50 feet by mechanical excavation. This excavation will be 3 feet deep. In areas where mudflats are encroaching on existing water, mechanically excavated material will be sidecast and stacked along the bank of the mudflat as high as possible while retaining stability. Elsewhere, it will be placed on the riverside bank to heights of 2 feet or less. Potholes will be created by using explosives to blast holes in willow thickets. Boat access to Little Denny will be precluded by placing large diameter trees, salvaged from the areas where clearing is required, across the entrance.

The habitat project will increase total aquatic habitat by 21 surface acres. An area with formerly high values as a fishery, which currently has very low value due to the absence of water during part of the year with attendant stranding and isolation in the remnant water of fry, juvenile, and adult fish which had moved into the area or spawned there during the flood, will be returned to a high value fishery. Deepwater habitat will be created with sufficient depth to prevent winter freeze-out and summer kills due to low dissolved oxygen values. Varied depths will increase habitat diversity. Check dams will reduce sediment-bearing overland flows into the project area from the Mississippi River, extending the life of the Big Timber fishery. Planting of buttonbush and mast-producing trees on dredged material will increase the diversity of terrestrial habitat and provide additional food for wood ducks and other water birds and deer and other animals utilizing lowland forest. Potholes created within the willow thickets will provide secluded areas for wood duck broods.

It is proposed that post-construction field observations and quantitative physical and chemical parameter measurements be collected and utilized in evaluating the project's performance with respect to the stated goals and objectives. The field observations would be completed by the U.S. Fish and

Wildlife Service and submitted to the Corps of Engineers as part of the annual management report for Cooperative Agreement lands. Collection of the quantitative data, including quarterly dissolved oxygen testing and quinquennial hydrographic soundings, surface acreage determinations, and timber inventories, would be the responsibility of the Corps of Engineers.

No operational costs are identified for this project. The average annual maintenance costs are estimated to be $7,500 per year. The non-Federal share of operation, maintenance, and rehabilitation will be 25 percent. The U.S. Fish and Wildlife Service will be the responsible agency for securing all operation and maintenance costs in cooperation with the non-Federal sponsor, the Iowa Department of Natural Resources. Rehabilitation is reconstructive work which cannot be accurately estimated. The U.S. Army Corps of Engineers, as stated in the Memorandum of Agreement, will be responsible for the Federal share of any mutually agreed upon rehabilitation of the project that exceeds the annual operation and maintenance requirements identified in the Definite Project Report and that is needed as a result of specific storm or flood events.

The District Engineer has reviewed the project outputs and determined that implementation of the identified plan is justified and in the Federal interest. The project will be located in a U.S. Fish and Wildlife Service refuge and qualifies for 100 percent Federal funding for implementation under Section 906(e)(3) of the 1986 Water Resources Development Act. Therefore, approval for construction of the Big Timber habitat rehabilitation and enhancement project is recommended by the Rock Island District Engineer at an estimated Federal construction cost of $933,000. The District Engineer further recommends that funds in the amount of $15,000 be allocated as quickly as possible for the preparation of plans and specifications.

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-5)

BIG TIMBER REHABILITATION AND ENHANCEMENT
POOL 17, MISSISSIPPI RIVER MILE 444
LOUISA COUNTY, IOWA

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)



List of Tables

## List of Plates



## List of Appendixes

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-5)

# BIG TIMBER REHABILITATION AND ENHANCEMENT
POOL 17, MISSISSIPPI RIVER MILE 444
LOUISA COUNTY, IOWA

## 1. INTRODUCTION.

a. Purpose. The purpose of this report is to present a detailed proposal for the rehabilitation and enhancement of aquatic and wetland habitat at the Big Timber Unit of the Louisa Division of the Mark Twain National Wildlife Refuge. The report provides planning, engineering, and sufficient construction details of the selected plan to allow final design and construction to proceed subsequent to approval of this document.

b. Resource Problems and Opportunities. The primary resource problem in the study area, as well as in the Upper Mississippi River System (UMRS), is continual sedimentation of backwater aquatic and wetland habitats. Sedimentation reduces surface water acreages and aquatic habitat depths. Resource effects are realized by total aquatic habitat lost and reduced aquatic habitat quality.

In the study area, the opportunity exists to restore aquatic habitat, improve aquatic and wetland habitat quality, and protect restored or remaining aquatic habitat by reducing sediment input to the study area.

c. Scope. Big Timber and adjacent Coolegar Slough is a 1,039-acre backwater complex located between Mississippi River miles 443 and 445 in Pool 17. The project is located in Louisa County, Iowa, approximately 8 miles south of Muscatine, on lands owned by the United States Government. These lands were acquired by the Corps of Engineers for the Mississippi River Nine-Foot Navigation Channel project. They are managed by the U.S. Fish and Wildlife Service (USFWS) as part of the Mark Twain National Wildlife Refuge under a cooperative agreement between the Department of the Army and the Department of the Interior dated February 14, 1963.

The scope of this study focuses on proposed project features that will restore lost aquatic habitat and improve the resource values of both aquatic and wetland habitat. The project was planned for the benefit of the Mississippi River fishery as well as resident and migratory waterfowl and is consistent with agency management goals.

d. Authority. The authority for this report is provided by the 1985 Supplemental Appropriations Act (Public Law 99-88) and Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662). The proposed project would be funded and constructed under this authorization.

Section 1103 is summarized as follows:

Section 1103. UPPER MISSISSIPPI RIVER PLAN

(a)(1) This section may be cited as the Upper Mississippi River Management Act of 1986.

(2) To ensure the coordinated development and enhancement of the Upper Mississippi River System (UMR), it is hereby declared to be the intent of Congress to recognize that system as a nationally significant ecosystem and a nationally significant commercial navigation system. Congress further recognizes that the system provides a diversity of opportunities and experiences. The system shall be administered and regulated in recognition of its several purposes.

(e)(1) The Secretary, in consultation with the Secretary of the Interior and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, is authorized to undertake, as identified in the Master Plan. -

(A) a program for the planning, construction, and evaluation of measures for fish and wildlife habitat rehabilitation and enhancement;

2. GENERAL PROJECT SELECTION PROCESS.

a. Eligibility Criteria. A design memorandum did not exist at the time of the enactment of Section 1103. Therefore, the North Central Division, U.S. Army Corps of Engineers, completed a "General Plan" for the implementation of the Upper Mississippi River System - Environmental Management Program (UMRS-EMP) in January 1986. The USFWS, Region 3, and the five affected states (Illinois, Iowa, Minnesota, Missouri, and Wisconsin) participated through the Upper Mississippi River Basin Association (UMRBA). Programmatic updates of the General Plan for budget planning and policy development are accomplished through Annual Addendums.

Coordination with the States and the USFWS during the preparation of the General Plan and Annual Addendums led to an examination of the Comprehensive Master Plan for the Management of the Upper Mississippi River System. The Master Plan, completed by the Upper Mississippi River Basin Commission in 1981, was the basis of the recommendations enacted into law in Section 1103. The Master Plan report and the General Plan identified examples of potential habitat rehabilitation and enhancement techniques. Consideration of the Federal interest and Federal policies has resulted in the conclusions below:

(1) First Annual Addendum. The Master Plan report ... and the authorizing legislation do not pose explicit constraints on the kinds of projects to be implemented under the UMRS-EMP. For habitat projects, the main eligibility criteria should be that a direct relationship should exist between the project and the central problem as defined by the Master Plan, i.e., the

sedimentation of backwaters and sidechannels of the UMRS. Other criteria include geographic proximity to the river (for erosion control), other agency missions, and whether the condition is the result of deferred maintenance ....

(2) Second Annual Addendum. The types of projects that are definitely within the realm of Corps of Engineers implementation authorities include the following:

- backwater dredging
- dike and levee construction
- island construction
- bank stabilization
- side channel openings/closures
- wing and closing dam modifications
- aeration and water control systems
- waterfowl nesting cover (as a complement to one of the other project types)
- acquisition of wildlife lands (for wetland restoration and protection.) Note: By letter of February 5, 1988, the Office of the Chief of Engineers directed that such projects not be pursued.

A number of innovative structural and nonstructural solutions which address human-induced impacts, particularly those related to navigation traffic and operation and maintenance of the navigation system, could result in significant long-term protection of UMRS habitat. Therefore, proposed projects which include such measures will not be categorically excluded from consideration, but the policy and technical feasibility of each of these measures will be investigated on a case-by-case basis and recommended only after consideration of system-wide effects.

b. Project Selection. Projects are nominated for inclusion in the Rock Island District's habitat projects by the respective State conservation agencies and the USFWS based on agency management objectives. To assist in the project formulation process, the UMRBA convened a series of meetings in 1986 to consider critical habitat needs along the Mississippi River. At these meetings, biologists who are responsible for managing the river evaluated the available habitat on a pool-by-pool basis. This analysis revealed deficiencies, such as feeding, resting, and loafing areas for migratory waterfowl, absence of deepwater habitat off the main channel for fish and diving ducks, as well as types of habitat in abundant supply (e.g., mature bottomland hardwood). The results of this analysis were compiled by the Fish and Wildlife Interagency Committee and are presented in a draft report entitled Goals for Management of Fish and Wildlife Resources and Habitat Rehabilitation and Enhancement for Pools 11-22, March 1987. With this information, projects being considered most accurately reflect broader regional needs in addition to representing the best site-specific choices.

Rock Island District assists the State and the USFWS management agencies through use of an in-house task force with members from the Design, Hydraulics, Channel Maintenance, Environmental, and Waterways Planning Branches. As projects are being conceptualized, this group meets on-site with State and USFWS personnel to examine as fully as possible what site-specific benefits would be both desirable and engineeringly feasible.

To assist the District in the final selection of projects to be included in the program, the Fish and Wildlife Interagency Committee (FWIC) ranks projects according to the biological benefits that they could provide. This group, composed of biologists who work at projects along the Mississippi River and Illinois Waterway, considers each project nominated for inclusion and also suggests project alternatives to increase habitat benefits for fish, waterfowl, and other wildlife. Each project is ranked according to the benefits provided as high, medium, or low.

The FWIC rankings are forwarded to the District and to the River Resources Coordinating Team (RRCT), an interagency policy group which meets to coordinate Mississippi River activities. The RRCT examines the FWIC rankings and considers the broader policy perspectives of the agencies submitting the projects. The RRCT-recommended rankings also are submitted to the District. The District then formulates and submits a recommended program to the EMP program manager at North Central Division.

Projects consequently have been screened by State, USFWS, and Corps of Engineers biologists closely acquainted with the rivers. Resource needs and deficiencies have been considered on a pool-by-pool basis to ensure that regional needs are being met and that the best expertise available was used to optimize the habitat benefits created at the most suitable locations.

c. Specific Site Selection. Through the above selection process, Big Timber was recommended and supported as providing significant aquatic benefits with opportunity for waterfowl enhancement, if the proposed project features were implemented.

Other floodplain locations were evaluated within this reach of the river for potential aquatic and waterfowl enhancement benefits. Leveed floodplain or upland locations were considered not feasible for this project, due to private ownership, access restrictions, and conflict with project purposes. The very nature of riverine habitat enhancement requires connection to the river.

In Pool 17, other potential locations for riverine habitat rehabilitation and enhancement occur downstream on Bogus, Turkey, and Otter Islands, upstream on Blanchard Island, and on another portion of the Mark Twain National Wildlife Refuge located in Illinois, directly across the river from Big Timber.

Environmental conditions resulting from topography, hydraulics, sediment type, and sedimentation rates were considered for these sites. It was determined that similar habitat projects at the island sites would likely have much shorter project lives, or would have much higher initial construction costs

with higher annual maintenance costs. The Illinois portion of the Mark Twain National Wildlife Refuge has not experienced the proportional loss of openwater habitat that Big Timber displays.

Various factors contribute to making the Big Timber backwater complex the preferred site for fisheries enhancement in Pool 17. Of all areas considered in this section of Pool 17, the Big Timber complex displays the most potential for diversity improvement. Coolegar Slough is part of this backwater complex and lies immediately adjacent to a section of the Muscatine Levee. Coolegar Slough was dredged in the mid-1960's to provide fill for the the levee. This dredging event left a series of variable depth holes along the lower (downstream) portion of the slough which are known to provide overwintering habitat requirements for a variety of sportfish. It is anticipated that deep holes dredged throughout the project alignment also will provide necessary overwintering habitat and allow year-round fish movement to and from the proposed project dredge cuts into Coolegar Slough. Also, relatively clear water is present in the Big Timber backwater complex during normal flows because it is closed at the upper end, and water enters only by backing in from the downstream end. Historic waterfowl use and the opportunity to provide enhanced waterfowl benefits contributed to selection of the Big Timber site.

## 3. ASSESSMENT OF EXISTING RESOURCES.

a. Resource History. The project area consists of an off-channel backwater complex contained between the Muscatine Island Levee to the west and the Mississippi River to the east (plate 2). This area contains approximately 772 acres of palustrine forested bottomland interspersed with 212 acres of sloughs, 44 acres of aquatic bed or vegetated mudflats, and 11 acres of fallow agricultural land.

The Big Timber area was principally a wooded area prior to the completion of Lock and Dam 17 in 1938. The area became a series of backwater channels, ponds, and lakes when Pool 17 was formed.

The U.S. Army Corps of Engineers acquired the acreage of the project site for navigational purposes prior to completion of the lock and dam. These lands are presently managed by the USFWS as part of the Mark Twain National Wildlife Refuge under terms of a Cooperative Agreement dated February 14, 1963, between the Department of the Army and the Department of Interior.

Since impoundment, Big Timber has contributed significantly to the fish community on the Upper Mississippi River by providing spawning and nursery benefits, as well as winter and summer refuge. It also provides critical habitat for egrets and herons, many species of waterfowl and other birds, mammals, reptiles, amphibians, and invertebrates which depend upon the aquatic habitat. Sedimentation in Big Timber has resulted in the conversion of aquatic habitat to wetland and wetland to terrestrial habitat. Additional aquatic habitat could be provided by dredging in areas of the Big Timber backwaters which are no longer accessible during normal flows.

In 1938, following completion of Lock and Dam 17, areas in the backwater complex off Coolegar Slough were as deep as 6 feet and were accessible during normal flow periods. Today, water depths in these areas during normal flow range from a few inches to 3 feet. Without intervention, continued sedimentation will result in the loss of the remaining aquatic habitat in the proposed dredging area within 25 years.

Table 3-1 presents a breakdown of habitat acreages taken from aerial photography, field measurements, and estimation by agency staff familiar with the project.

TABLE 3-1

Big Timber Natural Resources

| Aquatic Habitat | Area-Acres |
|---|---|
| Sloughs (Nonflowing) | 212 |
| Aquatic Bed (Submergent Vegetation) | 31 |
| Total Aquatic | 243 |

| Wetland Habitat | Area-Acres |
|---|---|
| Palustrine Forested | 772 |
| Mudflat (Emergent Vegetation) | 13 |
| Agriculture (Fallow) | 11 |
| Developed | -- |
| Total Wetland | 796 |
| Total Aquatic and Wetland | 1,039 |

b. Land Use. The project site is located within a national wildlife refuge, and, as such, land uses are all related to management of natural resources for national benefit.

c. Existing Aquatic Habitat. Permanent or year-round aquatic habitat is essentially limited to Coolegar Slough and to a portion of Round Pond, as other areas such as Big Denny, Little Denny, and the Slash Ponds are subject to drying or freezeout during normal or low water stages in Pool 17. During construction of the Muscatine Island Levee, sand levee fill was dredged from Coolegar Slough, leaving variable depths throughout its length.

Aquatic habitat in the project area is being steadily degraded by sedimentation. These sediments are fine silts and clays deposited during high flow and flood events on the Mississippi River. Since no other tributary streams enter the project area, most deposition occurs from overland flows from the Mississippi River. (Reference Section 3.i., Sedimentation.)

Existing aquatic values vary with Pool 17 stages. During flood events, the entire area, including forested portions, is used by various species for spawning or refuge. Depending on flood stage duration, flooded bottomlands contribute significantly to the Mississippi River fishery for both commercial and sport species. As flows recede, fry, juvenile, and adult fish are either stranded or become concentrated in permanent waters and provide increased forage for other fish species, birds, reptiles, and mammals.

Severe summer and winter fish kills have been reported by both local residents and Iowa Department of Natural Resources (IDNR) staff biologists. These kills have been attributed to low dissolved oxygen levels brought on by high sediment oxygen demands and biological oxygen demands coupled with thermal stresses. Because of the stressed conditions caused by shallow depths, the net fisheries value of the area off Coolegar Slough is low. While the project site does have some fishery value during spring and fall floods, this value is reduced by subsequent fish kills.

d. Existing Terrestrial and Wetland Value. Terrestrial habitat involves typical silver maple association forest, with more desirable mast-producing trees limited to higher elevations in the project area.

Wetland habitats, other than forested wetlands, consist of vegetated shallows dominated by American lotus, and temporary shallows or mudflats which are currently dominated by rice cutgrass, smartweed, and arrowhead. Buttonbush may be found along the waterways throughout the project area.

The proposed project involves restoring approximately 11 surface acres of sediment-filled aquatic habitat which is currently in emergent wetland or mudflat habitat. The project will impact the cutgrass and arrowhead-dominated temporary shallows. During the summer and fall of 1988, most of the project area was essentially dry, with a shallow pocket of water in the lower end of Big Denny connected through Little Denny and the Slash Ponds to Round Pond by an intermittent channel from 1 to 3 feet wide. Round Pond averaged between 1 and 3 feet deep.

Wildlife values associated with the above habitat include feeding, resting, and nursery cover for furbearers and a variety of birds and mammals. The area supports significant populations of white-tailed deer, squirrel, and wild turkey. Limited trapping also occurs, primarily along Coolegar Slough. Migratory waterfowl use Big Timber for feeding and resting during spring and fall flights. Significant nesting is generally limited to wood duck.

Migratory waterfowl use of Big Timber has been declining, partly due to overall reductions in the North American waterfowl population and partly due to its dwindling aquatic and wetland habitats with their respective food values. Food production varies annually according to water level fluctuations, but is generally good at Big Timber. However, optimal food availability is determined by water levels on or in food plant areas containing such species as duck potato, buttonbush, pin oak, and smartweed. Due to recent drought conditions and reductions in open water at Big Timber, waterfowl have been unable to utilize much of the available food. Active management for waterfowl at Big Timber is minimal due to lack of water level control.

e. Water Quality. Water quality sampling was performed in 1987 and 1988, with results presented in appendix B. Elutriate analyses showed no parameters significantly exceeding surface water quality standards.

f. Endangered Species. Two federally listed endangered species are known from the project area: the bald eagle (Haliaeetus leucocephalus) and the Higgins' eye pearly mussel (Lampsilis higginsi). The bald eagle is a winter migrant in the project area. The Higgins' eye pearly mussel has been collected from a mussel bed in the Iowa channel border, river miles 444.7 and 445.4. State-listed endangered species for Louisa County are generally excluded from the project site by habitat requirements, with the exception of the bald eagle and Higgins' eye pearly mussel.

g. Cultural Resources. The Rock Island District has conducted large-scale geomorphological and cultural studies to aid in long-term management of historic properties within the Mississippi River floodplain. The Archaeology and Geomorphology in Pools 17-18, Upper Mississippi River (Benn et al., 1988) is an example for management considerations and also of concern for the Big Timber backwater complex. This important study, along with studies such as the Archaeological Survey, Andalusia Refuge EMP (Anderson and Stanley 1988), provides extensive and intensive geomorphological data in predicting site density.

All recent archeological and geomorphological investigations of Pool 17 have revealed that Big Timber is younger than 3,000 years, and hand borings have documented an overall total of 3 feet of Post Settlement Alluvium (PSA) (Benn et al., 1988:40). According to the Benn (1988:40) geomorphological study of Big Timber:

> ...the thickness of PSA was greatest adjacent to the present channel and along sloughs away from the channel. In some areas, such as in the W1/2 of sec. 29 T75N R2W, PSA is relatively thin deposits adjacent to the present levee and prehistoric deposits are at or near the present land surface.

The proposed 73-acre disposal site is located in the most heavily alluviated land adjacent to the channel.

In respect to Big Timber, similar landforms within close proximity or with similar geomorphologic contexts (Anderson and Stanley 1988:10; Benn et al., 1988:Appendix I, 2), revealed no cultural resources. Cultural Resources Reconnaissance, Environmental Management Program, Upper Mississippi River System, Brown's Lake in Pool 13 also documented the large amounts of sedimentation in similar environments with the same results.

These studies have confirmed that prehistoric cultural resources are absent or extremely difficult to locate in highly alluviated areas (Benn et al., 1988:40; Anderson and Stanley 1988:10). This may be due to the fact that bottomland areas adjacent to the Mississippi River were not conducive to prehistoric settlement, or, more likely, that the quantity of PSA has buried sites (Benn et al., 1988:40; Anderson and Stanley 1988:10).

h. Adjacent Water Projects.

Mississippi River 9-Foot Channel - The proposed Big Timber project is adjacent to the Mississippi River 9-Foot Channel, as authorized by the Rivers and Harbors Act of July 3, 1930. Proposed project features of this report will not affect navigation.

Muscatine Island Levee - The study area is bounded along its western edge by the Muscatine Island Levee. Proposed project features will have no effect on the levee or local flood frequencies.

i. Sedimentation. A sedimentation study was conducted to evaluate sedimentation in the Big Timber area during the period 1938 through 1988. The scope of this study, as presented in this section, consisted of determining net sedimentation from 1938 (pre-lock and dam) through 1988, and evaluating proposed project impacts on sedimentation.

Baseline elevations were established from 1938 plane table topographic maps. Additional sections were taken by survey crews during 1988. Twenty-six ranges were used to construct cross sections of this area. Eleven of these ranges correspond to the sediment monitoring ranges shown on plate 10. The 1938 elevations were compared with 1988 elevations to show net changes in elevation.

It is estimated that approximately 0.51 inch per year of sediment has been deposited on an average over the Big Timber area since 1938. Estimates of sedimentation in channelized areas below the normal water surface, 537.0 feet MSL, showed an increase in sedimentation rate over the average. This rate is estimated to be about 0.62 inch per year. Table 3-2 provides a summary of net sedimentation.

The Muscatine Island Levee protects the Big Timber area from upland erosion sediment sources. Sedimentation is therefore almost entirely due to sediment from the Mississippi River.

TABLE 3-2

Big Timber Area Net Sedimentation

| | | Areal Sedimentation | | Pond Sedimentation (Below 537 MSL) | |
|---|---|---|---|---|---|
| Range | Station | Average Depth, ft | Annual Sediment, in/yr | Average Depth, ft | Annual Sediment, in/yr |
| A | 31+11 | 3.37 | 0.81 | 3.57 | 0.85 |
| | 35+31 | 2.67 | 0.64 | 2.89 | 0.69 |
| | 39+15 | 2.58 | 0.61 | 2.92 | 0.70 |
| B | 43+61 | 2.33 | 0.56 | 2.51 | 0.60 |
| | 47+62 | 2.32 | 0.56 | 2.32 | 0.56 |
| C | 51+50 | 1.82 | 0.44 | 1.84 | 0.44 |
| | 55+76 | 2.14 | 0.51 | 2.14 | 0.51 |
| | 65+63 | 2.43 | 0.58 | - | - |
| D | 69+63 | 1.56 | 0.37 | 1.82 | 0.44 |
| | 73+62 | 1.63 | 0.39 | 2.57 | 0.61 |
| E | 77+82 | 1.87 | 0.45 | 2.79 | 0.67 |
| F | 81+79 | 1.88 | 0.45 | 2.77 | 0.66 |
| | 83+69 | 1.46 | 0.35 | 2.03 | 0.49 |
| | 87+67 | 1.12 | 0.27 | - | - |
| G | 91+69 | 1.77 | 0.42 | 2.16 | 0.52 |
| | 95+69 | 3.17 | 0.76 | 3.17 | 0.76 |
| H | 100+00 | 3.08 | 0.74 | 3.18 | 0.76 |
| | 103+72 | 2.59 | 0.62 | 2.59 | 0.62 |
| I | 105+23 | 2.73 | 0.66 | - | - |
| J | 107+17 | 3.78 | 0.91 | - | - |
| | 109+19 | 2.85 | 0.68 | - | - |
| | 110+89 | 0.97 | 0.23 | - | - |
| K | 114+36 | 1.24 | 0.30 | - | - |
| L | 117+72 | 1.46 | 0.35 | - | - |
| | 120+68 | 1.04 | 0.25 | - | - |
| | 122+30 | 1.61 | 0.39 | - | - |
| OVERALL AVERAGE | | 2.13 | 0.51 | 2.58 | 0.62 |

Borings 88-1, 88-2, and 88-3 indicate that the top 2 to 3 feet of sediment is predominantly fat clays with high water contents which approach the liquid limits of the soil. It appears that sediments in this zone have been recently deposited or that they have not effectively stabilized to denser soils. The loosely consolidated sediments in borings 88-1 and 88-2 are underlain by 1 to 2 feet of well consolidated fat clays followed by 1.5 feet of lean, sandy clay and finally by coarse to fine sand. Boring 88-3 is underlain by 2 feet of lean, sandy clay followed by medium to fine sand. Boring 88-9 indicates sediments to approximately 8.5 feet to be fat clay with high water contents, approaching the liquid limit. These sediments are underlain by a slightly organic fat clay with a very high water content surpassing the liquid limit.

4. PROJECT OBJECTIVES. Project goals, objectives, and enhancement potential are outlined in table 4-1.

TABLE 4-1

Big Timber Project Objectives

| Goals | Objective | Unit of Measure | Enhancement Potential Existing | Target |
|---|---|---|---|---|
| Enhance Aquatic Habitat | Restore deep (>6 ft) aquatic habitat | ac-ft | 0 | 100 |
| | Restore shallow aquatic habitat | ac-ft | 0 | 30 |
| | Improve levels of dissolved oxygen during critical seasonal stress periods | mg/l | 0 | 5.0 |
| | Provide year-round habitat access (cross-sectional area) | sq ft | 0 | 500 |
| Enhance Terrestrial Habitat | Produce mast tree dominated areas | ac | 170 | 204 |
| Enhance Migratory Waterfowl Habitat | Increase reliable resting & feeding water area | ac | 0 | 21 |
| | Provide isolated resting, feeding, and brooding pools | ea | 0 | 10 |

Project goals and objectives were defined during initial project selection in Pool 17 and planning enhancement measures for this area of the pool. These goals and objectives were identified in an unpublished draft report prepared by the FWIC. The draft report is entitled Goals for Management of Fish and Wildlife Resources and Habitat Rehabilitation and Enhancement for Pools 11-22.

In order to meet the project's aquatic habitat enhancement goal, deepwater habitat, intended to provide year-round aquatic habitat where shoaling and ice cover limit availability and currently result in drying or freezeout during normal or low water stages, will be created. The restoration of shallow aquatic habitat will increase the diversity of available fish habitat in the Big Timber Refuge backwater complex. By providing year-round access, seasonal movement of aquatic species between existing aquatic habitats and the newly dredged areas will increase, and enhanced colonization of the rehabilitated backwaters will result.

Restoration of aquatic habitat volume will improve the availability of dissolved oxygen in the project area.

Terrestrial habitat in the Big Timber Refuge will be enhanced by establishing mast tree dominated areas. Increased occurrence of mast tree species in non-mast tree stands such as monotypic stands of maple-elm dominance in surrounding areas will be realized as a direct result of the increased availability of mast tree seed sources.

The goal of migratory waterfowl habitat enhancement will be met by increasing the availability of reliable resting and feeding water areas. The creation of potholes within existing willow thickets will provide secluded open water for duck broods.

5. ALTERNATIVES.

a. Alternative A - No Federal Action. No Federal action would consist of no Federal funds being provided to meet the project purposes. State and local funds would be required to enhance aquatic habitat.

b. Alternative B - Mechanical Excavation Plan. This plan consists of dredging a channel 50 feet wide and 4 to 5 feet deep, except in the area referred to as Timber Chute where the channel would be 30 to 40 feet wide. In Round Pond, the dredged material would be used to create islands on alternating sides. In low-lying mudflat areas, the dredged material would be sidecast in mounds 5 to 6 feet high with the intention that the mounds would provide some limited protection to the dredged channel in areas that are currently high sediment drop zones. In areas of higher elevations, the dredged material would be sidecast in mounds not to exceed 3 feet in height. Finally, explosives would be used to blast holes in mudflat areas overgrown by willow thickets to create open water areas for duck broods.

c. Alternative C - Hydraulic Dredge Plan. A channel 70 feet wide and 7 to 8 feet deep would be dredged in unconstricted areas. In Timber Chute the width would be limited to edge of bank or 30 to 40 feet, and in Willow Chute the width would be limited to 50 feet. Three deep holes (greater than 16

feet) would be dredged to create wintering habitat for fish. Shallow cuts would be made to provide water 2 to 3 feet deep for dabbling ducks. Dredged material would be placed in an area bounded by the Mississippi River on one side and Big Denny and Little Denny on the other.

A containment basin would be required to confine hydraulically dredged material. This basin would be formed by tieing containment dikes into naturally occurring, higher elevations along the Mississippi River. These dikes would need to be constructed along the Big and Little Denny banks to an elevation of 543.5 MSL. Maximum height of the dike would be approximately 5 feet, with most under 3 feet in height. The dredged material would be an average of 2 feet deep with a maximum depth of 4 feet. An alternative would be to place the dredged material upon the former agricultural field located directly upstream of the Big Timber project area. This alternative would require 2,000 feet more pumping of the dredged material and would increase the cost of dredging by approximately $2.00 per cubic yard. Total material to be dredged in this plan would be 190,000 cubic yards.

d. Alternative D - Combination Plan I. This alternative would consist of making the first cut with a mechnical dredge. All elements of Alternative B, islands, sidecasting, and check dams, would be included, except that the channel would be 70 feet wide with only a 3-foot cut depth in all areas but Round Pond where the total 7.5-foot cut would be mechanically excavated. A second pass would be made with a hydraulic dredge to finish the channel to elevation 528 MSL. Material from the hydraulic dredging could be placed in either of the sites previously discussed. Total material to be dredged in this plan is 162,000 cubic yards.

A variation of this plan is to make the mechanical cut through Round Pond and a short distance into the Slash Ponds. This would allow the creation of islands in Round Pond and a check dam in the Willow Chute area; the other check dams would not be created. The hydraulic dredge then would finish the channel.

e. Alternative E - Combination Plan II. In this alternative, the hydraulic dredge would make a 7.5-foot cut 35 feet wide into the head of both Big and Little Denny. A 3-foot cut approximately 50 feet wide immediately adjacent to the planned hydraulic cut would be made by mechanical excavation. This alternative would provide all the elements of the previous alternative, except for the islands in Round Pond, and would provide additional variation in water depth. Total volume to be dredged/excavated would be 170,000 cubic yards.

## 6. EVALUATION OF ALTERNATIVES.

Alternative A - No Federal Action would not meet the project objectives of improving aquatic habitat and enhancing terrestrial habitat diversity.

With no action, wildlife values would shift and fishery values in the Big Timber project area would continue to decline as sedimentation advances and succession from water to wetlands continues. The project area currently displays a range of conditions resulting from several factors: impoundment of Pool 17 with associated hydrologic changes; sedimentation; clearing events for fuel and wood products during the steam era; agricultural attempts; and current management for natural resource benefits. It is anticipated that with no Federal action, management activities will be oriented to forest wildlife and that fishery and furbearer values will be lost.

Alternative B - Mechanical Excavation Plan would improve the aquatic habitat in the project area. The increase in terrestrial habitat and hardwood diversity would be limited. The plan would not provide habitat for wintering fish.

By limiting dredge work to mechanical means, natural resource effects would be limited to the immediate channel alignment and sidecast areas. In the Round Pond reach, sidecast islands could provide potential benefit to waterfowl or furbearers in addition to wave reduction benefits. Where sidecasting would be used to form check dams across low areas, the resulting elevations will be suitable for the establishment of mast-producing trees.

This alternative would not require the use of a contained dredged material placement area. Approximately 10 acres of arrowhead and cutgrass would be dredged or excavated for aquatic benefit. The depths resulting from this alternative would provide conditions suitable for establishment of lotus, various Potamogeton (pondweed) species, and coontail. The dredged channel would be beneficial for fish spawning and nursery, but seasonal refuge value would be limited. The channel would increase foraging habitat for wading birds and provide brooding and feeding habitat for resident waterfowl, primarily wood ducks.

Alternative C - Hydraulic Dredge Plan would meet the plan objective and is consistent with existing Government land use. The channel dimensions required to meet the project objective of providing a year-round aquatic habitat result in a greater dredged material volume than storage volume available in the placement area. Therefore, the open field immediately up river from the project area would need to be utilized for dredged material placement or the channel dimensions would need to be scaled back.

As noted above, it would be possible to increase channel width and depth throughout the project, thereby providing corresponding increases in aquatic values. The proposed holes would provide seasonal refugia for a variety of species, and the shallower dredge cut areas would improve wetland values through increased invertebrate production.

The use of a hydraulic dredge would require the construction of a containment basin for dredged material placement. The proposed site for containment basin construction is an area containing the lowest natural elevations. The area is currently dominated by silver maple-elm association forest with oak species and hickory scattered on high elevations. An ephemeral pond ringed with buttonbush is located within this area.

Alternative D - Combination Plan I provides for the initial mechanical excavation of a portion of the proposed channel, followed by hydraulic dredging to finish the channel. This alternative would meet the plan objectives and be consistent with existing Government land-use plans. However, the USFWS indicated that they did not want the islands, noted under Alternative B above, constructed in Round Pond. They felt that boat traffic in Round Pond would prevent the islands from being used for the intended purpose, which is duck habitat. Environmental effects of this alternative, with the exception of island creation, are identical to those discussed for the selected plan, Alternative E.

Alternative E - Combination Plan II meets all plan objectives and results in efficient use of project funds. The initial hydraulic dredging followed by mechanical excavation to finish the channel allows for all the proposed components to be included except the islands in Round Pond. This alternative meets the requirements of all organizations involved in the planning process. Environmental effects of this plan are discussed in Section 9.

## 7. SELECTED PLAN.

a. General Description. Alternative E - Combination Plan II was selected to be recommended for project construction. The dredging of a channel from Coolegar Slough into Big and Little Denny with sidecasting of mechanically excavated material, confined placement of hydraulically dredged material, and blasting of open water holes in the mudflats all meet project objectives and are cost effective. This plan provides balanced aquatic fishery habitat while maintaining or enhancing existing waterfowl habitat.

b. Hydraulic Dredging. A 35-foot channel would be created by hydraulic dredge to the head of Big Denny with a branch to the head of Little Denny. The channel would be constricted to a 30-foot width through the 200-foot Timber Chute reach. The dredging would be an average 7.5-foot cut (to elevation 528 MSL).

c. Dredged Material Placement. The area between the Mississippi River and Big and Little Denny forms a natural dish. The highest elevations (approximately 544 MSL) occur along the Mississippi River. Along the banks of Big Denny the elevations range from 542 to 540 MSL, and along Little Denny the elevations range from 540 to 538 MSL. With construction of a dike along the banks of Big and Little Denny to an elevation of 543.5, this area could be used for dredged material placement.

Column settling analyses were performed to determine the required dredged water detention time and total volume for initial dredged material containment as presented in appendix E. The dredged material will require approximately 28 hours of settling to meet effluent requirements and will require an initial volume approximately 1.5 times larger than the in situ sediments. Depth of dredged material immediately after placement would average approximately 2 feet, with depths as great as 4 feet. The survival rate of trees in the deeper sediments is uncertain, but it is anticipated that the majority of trees in areas with 1 foot or less of sediment will survive. Some reseeding by existing hickory and oak is anticipated. Replanting will occur in the areas which are currently barren (approximately 2.5 acres) and areas identified by post-dredging evaluation, to total approximately 30 acres.

d. Mechanical Excavation. From the mouth of the Willow Chute area to the heads of Big and Little Denny, mechanical excavation would be used to provide a shallower area (approximately 3 feet) immediately adjacent to the hydraulically dredged channel. Mechanically excavated material would be sidecast on the banks in all areas, except where expanding mudflats exist. This material would be limited to 2 feet in depth and, where possible, placed on the riverside bank. Buttonbush will be replanted along the channel where material is sidecast.

e. Check Dams. In areas where mudflats are encroaching on existing ponds or channels, the mechanically excavated material would be placed along the bank of the mudflat. Check dams are provided at those locations where overland flood flows are depositing sediment at the project site.

f. Pothole Creation. Explosives would be used to blast openings in the mudflats where willows are encroaching. These holes would fill with water and would provide secluded open water for duck broods.

g. Little Denny Boater Access Control. Little Denny is one of the areas most heavily used by waterfowl. To maintain the habitat value of this area, boat access will be blocked by the placement of large diameter trees across the entrance to Little Denny. The trees will be obtained from the areas where clearing is required for other project components.

## 8. DESIGN AND CONSTRUCTION CONSIDERATIONS.

a. Existing Site Elevations. As shown on plate 9, the entire construction zone is located within the floodplain of the Mississippi River. Existing ground elevation of the containment area ranges from approximately elevation 544 to 537.5 MSL.

The cost estimate for the proposed features is based on use of conventional earthmoving and compacting equipment. It is estimated that such construction can normally occur during the months of July through February. Unusually wet fall years could affect construction contract expenditures.

b. Dredging/Excavation Depths and Equipment. With the exception of selected deep hole dredging, dredging depth was based on water clearance as shown in table 8-1.

TABLE 8-1

Basis of Channel Dredging/Excavation

| Elevation (MSL) | Description |
|---|---|
| 537.0 | Pool 17 flat pool |
| -1.0 | Present low-flow winter regulation |
| -6.0 | Maintained water depth* |
| -2.0 | 50 years of sediment (.5 inch per year) |
| 528.0 | Minimum dredge depth |

* A depth of 6 to 8 feet is typical of existing side channels.

A cutterhead dredge, approximately 8 to 10 inches in size, will be required to remove the soft overburden and original firm alluvium. Intermittent tree stumps would be removed by dragline/clamshell. Explosives would be allowed for stump removal. A stump survey will be conducted during preparation of final plans and specifications.

c. Dredged Material Placement Site. The final design will provide Contractor options for dredged material placement methods while meeting effluent standards.

It is anticipated that the final design will require a single-cell placement area. For ponding depths of 1 foot, minimum settling time will be 28 hours to meet an overall removal objective efficiency of 96 percent (see appendix E). The final volume required for placement may vary due to sediment types and settling characteristics.

d. Permits. A Section 404 process of the Clean Water Act will be completed prior to submission of this report for final approval. A Section 404(b)(1) evaluation is contained in appendix D. IDNR has provided water quality certification under Section 401 of the Clean Water Act by letter dated January 18, 1989. The USFWS will issue a Special Use Permit after all plans and specifications have been finalized and prior to advertisement of the construction contract.

9. ENVIRONMENTAL EFFECTS.

a. Summary of Effects. Effects of the proposed project on natural and cultural resources are summarized in table 9-1.

TABLE 9-1

Effects of the Proposed Project on Natural and Cultural Resources

| Type of Resource | Authority | Measurement of Effects |
|---|---|---|
| Air | Clean Air Act, as amended (42 U.S.C. 1657h-7, et seq.) | No significant effect |
| Areas of particular concern within the coastal zone | Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1451, et seq.) | Not present in planning area |
| Endangered and threatened species critical habitat | Endangered Species Act of 1973, as amended (16 U.S.C. 1531, et seq.) | No significant impacts anticipated |
| Fish and wildlife | Fish and Wildlife Coordination Act (16 U.S.C. 661, et seq.) | No significant effect |
| Floodplains | Executive Order 11988, Flood Plain Management | No significant effect |
| Historic and cultural properties | National Historic Preservation Act of 1966, as amended (16 U.S.C. 470, et seq.) | No significant effect |
| Prime and unique farmland | CEQ Memorandum of August 1, 1980; Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act | No significant effect |
| Water quality | Clean Water Act of 1977, as amended (33 U.S.C. 1251, et seq.) | No significant effect |

TABLE 9-1 (Cont'd)

| Type of Resource | Authority | Measurement of Effects |
|---|---|---|
| Wetlands | Executive Order 11990, Protection of Wetlands, Clean Water Act of 1977, as amended (43 U.S.C. 1857h-7, et seq.) | Enhancement anticipated; 11 acres converted to deep aquatic habitat and 10 acres converted to shallow aquatic bed. |
| Wild and scenic rivers | Wild and Scenic Rivers Act, as amended (16 U.S.C. 1271, et seq.) | Not present in planning area |

b. Economic and Social Effects. This analysis examines the socio-economic impacts associated with the proposed environmental enhancement project.

The project site, located in Louisa County in eastern Iowa, is about 8 miles south of the community of Muscatine, Iowa, within Mississippi River Pool 17.

(1) Community and Regional Growth

No short- or long-term impacts to the growth of the community or region would be realized as a result of the project. Long-term impacts to the immediate project area would be more pronounced than impacts to the community as a whole.

(2) Displacement of People

No residential displacements would be necessitated by the proposed environmental enhancement project.

(3) Community Cohesion

The project site is located in a rural setting with limited residential development. In Fiscal Year 1988, the site drew approximately 8,200 recreationists (Refuge staff pers. comm., 1988). While the proposed environmental enhancement project might indirectly increase the number of recreationists visiting the Big Timber complex, this increase is not expected to adversely impact area residents or property owners. Due to the nature of the project and its limited area of influence, no significant impacts to community cohesion would be noticed.

(4) Property Values and Tax Revenues

The potential value of property within the project area could increase slightly as a result of the project. This land is in Federal ownership, however, so an increase in its value would not increase local tax revenues.

(5) Public Facilities and Services

The project site is federally owned and zoned for low-density recreation. The area serves as an important fishing and hunting site; the USFWS estimates that Fiscal Year 1988 visitation totaled 7,100 for fishing and 1,070 for hunting. Approximately 24,800 activity hours of recreation took place at the Big Timber complex during the fiscal year.

(6) Life, Health, and Safety

Currently, the Big Timber complex poses no threats to life, health, or safety of recreationists or others in the area. The project would not affect current conditions in regard to these areas of concern.

(7) Employment and Labor Force

Project construction would slightly increase short-term employment opportunities in the project area. The project would not directly affect the permanent employment or labor force in Muscatine County.

(8) Business and Industrial Development

Changes in business and industrial activity during construction of the project would not be noticed. Long-term impacts to business and industrial development would be related to tourism and recreational activities. The project would require no business relocations.

(9) Farm Displacement

No farms would be affected by the proposed environmental enhancement project, as the project site is located entirely on federally owned land.

(10) Noise Levels

Heavy machinery would generate an increase in noise during the construction and dredging process. This increase would disturb wildlife and recreationists at the Big Timber complex. Explosives used for brood pothole construction will constitute a significant, temporary noise impact. The project site is located in an area with limited residential or other development; no significant noise receptors, i.e., schools and hospitals, are located within the project area. Also, no sensitive natural resources, i.e., rookeries or eagle nests, are located in the project area. Therefore, no significant long-term noise impacts are anticipated.

c. Natural Resource Effects.

(1) Aquatic System

The proposed project will initially increase total year-round aquatic habitat by approximately 21 acres. Deepwater areas provided will improve the aquatic habitat values of the Big Timber Unit by restoring overwintering and summer

thermal refuge areas for a variety of game and commercial fish species. Shallower depths provided will increase spawning and nursery habitat in the project area. Deepwater areas offer thermal refuge during mid-summer. These areas typically display adequate dissolved oxygen and are not subject to the diurnal variations in temperature and dissolved oxygen which occur in shallow areas. Deepwater areas also are critical to winter survival of a variety of fish. This quality is currently lacking in the project area off Coolegar Slough and will be improved by implementation of the proposed project. (Reference Section 12 - Project Performance Assessment.)

Simple physical expansion of aquatic habitat is anticipated to result in increased fish production in the Big Timber area of Pool 17. Because preconstruction fish sampling was not possible in the proposed dredging locations due to low or no water, no quantitative comparison of pre- and post-construction fish populations will be attempted. Physical expansion, coupled with reduced overland sediment transport, also should improve general water quality throughout the backwater complex.

Effects from dredged material placement effluent are anticipated to be negligible due to containment basin design, total retention times, and use of a flowing water mixing zone at the containment basin outfall. Increases in suspended solids will occur in the Mississippi River for a nominal distance from the contain-ment basin outfall downstream, until dilution reduces suspended solids to river background levels. Reference Appendix B - Water Quality and Appendix D - Clean Water Act Section 404(b)(1) Evaluation.

(2) Terrestrial/Wetland System

Project impacts or effects to terrestrial biota are all related to the placement of excavated sediments and the construction of check dams.

In the containment area, the depth of dredged material immediately after placement would average approximately 2 feet with depths as great as 4 feet. Because trees will not be cleared before placement, some trees in the deeper sediments will perish. These trees will provide habitat for cavity-nesting species. Some replanting with mast-producing species, i.e., hickory and oak, is planned for the containment area. By breaking up the potential silver maple association "monoculture" in the Big Timber Unit, the containment area may provide the diversity of habitat preferred or required by many avian and mammalian species.

Wetland areas disturbed (not directly dredged or excavated) by dredging activities are anticipated to recover immediately following construction and should not be adversely affected. It is planned to use buttonbush cuttings to reestablish and to improve wetland values for wood ducks and other wildlife. Other valuable plant species such as smartweed, lotus, and arrowhead are expected to naturally propagate into suitable areas.

Check dam construction will affect approximately 2 acres of vegetated mudflat and willow thicket habitat. Blocking of overland flood flows by these check dams will reduce sediment input to the project area, but may increase sediment accretion in the lower riverward elevations. These lower elevations are

generally the willow thickets. With increased sediment accretion, it is likely that the willows will thin or die out and give way to an intermediate, forb-dominated habitat type, prior to succession to silver maple-elm association forest.

Pothole construction will reduce total willow thicket cover by about 0.2 acre. If sedimentation is estimated to increase to 2 inches per year due to the sediment trap characteristics of these areas, the effective life of the potholes would be approximately 60 years.

d. Cultural Effects. The project area and adjacent Mississippi River shoreline was surveyed on September 13, 1988, by the Corps staff archeologist. No historic properties were discovered, and extensive PSA deposits were noted in the meander scars and abandoned channels, as well as within the proposed containment area.

Corps maps dating from 1878 to 1943 indicate no cultural resources within the proposed project area, except for a few dirt access roads. These maps also documented the accelerated siltation within the meander scars and abandoned channels in plan view. An unpublished manuscript distributed by the State Historical Society of Iowa called the Iowa River Transportation Historic Context Report by Bowers, Muessig, and Soike, documents that no major steamboat wrecks occurred near the Big Timber area.

Construction impacts a large tract of land, although dredging is entirely confined to water features, such as meander scars, abandoned channels, diked containment construction, and dredged material placement. Therefore, the only potential impacts to cultural resources would occur during mechanical placement mounding, dike construction, and containment area filling. The potential for historic properties is very low.

This being the case, the youthful nature of the land, the degree and depth of the sedimentation, and the low site density prediction ascribed through prior geomorphological and archeological studies, supports the unlikelihood of direct site destruction in the project area. It is therefore concluded that no historic properties will be affected by the proposed Big Timber habitat rehabilitation and enhancement project.

e. Adverse Effects Which Cannot Be Avoided. The loss of trees and understory associated with containment basin construction and filling is unavoidable. Temporary elevations in turbidity/suspended solids in the containment basin effluent mixing zone are unavoidable. Temporary elevations in dust, noise, and equipment exhaust also are unavoidable.

f. Short-Term Use Versus Long-Term Productivity. The project is intended to increase the long-term ecological productivity of the Big Timber Unit of the Mark Twain National Wildlife Refuge. Therefore, the short-term effects resulting from project construction may be considered inconsequential.

g. Irreversible or Irretrievable Resource Commitments. Time, labor, fuel, and other necessary construction materials are considered irretrievable. Conversion of bottomland elevations in the containment area will be irreversible, considering the shift in vegetational components and wildlife value.

h. Compliance with Environmental Quality Statutes. Compliance is summarized in table 9-2.

(1) Endangered Species. The Fish and Wildlife Coordination Act Report (CAR), dated September 14, 1988, noted only the bald eagle (Haliaeetus leucocephalus) as a federally listed endangered species present in the project area (see Appendix F). The CAR indicated that no impacts to the bald eagle are anticipated for this project.

Further discussion with USFWS staff indicated that the Higgins' eye pearly mussel (Lampsilis higginsi) also has been documented in the project area. The following discussion constitutes the Biological Assessment for this project.

Bald eagles are generally limited to winter residency in the project area. Eagle use in the project area varies from winter to winter depending on ice conditions. Temporary disruption of eagle foraging behavior is the primary potential effect of construction activity around the project sites. There are no records of eagle nesting in the project area. Given the mobility of the species and the proximity of available foraging habitat throughout the study area, it is anticipated that disturbance of foraging birds will not affect the wintering bald eagle population.

Higgins' eye pearly mussels have been documented in the study area by their presence in a mussel bed upstream of the containment basin outfall or effluent mixing zone (Ecological Analysts, Inc., 1981). Their actual presence in the effluent mixing zone is unknown. Potential effects to mussel species are limited by the nature and location of most project activities. However, the containment basin outlet/outfall/effluent point present possible effects by delivery of suspended solids and contaminants. Since dredged effluent retention will meet water quality standards of the State of Iowa, any effect to the aquatic system will be negligible.

Analysis results of sediment and water quality testing are discussed in detail in Appendix B - Water Quality and Appendix D - Clean Water Act, Section 404(b)(1) Evaluation. Given the minimum settling time planned for dredged material within the containment basin, suspended solids entering the water column of the Mississippi River are not anticipated to settle out to any significant degree in the mixing zone. No significant contaminant or potential for contamination was found during analysis of sediments proposed to be dredged for this project.

Relationship of Plans to Environmental Protection
Statutes and Other Environmental Requirements

| Federal Policies | Compliance |
|---|---|
| Archaeological and Historic Preservation Act, 16 U.S.C. 469, et seq. | Full compliance |
| Clean Air Act, as amended, 42 U.S.C. 1857h-7, et seq. | Full compliance |
| Clean Water Act (Federal Water Pollution Control Act) 33 U.S.C. 1251, et seq. | Full compliance |
| Endangered Species Act, 16 U.S.C. 1531, et seq. | Full compliance |
| Federal Water Project Recreation Act, 16 U.S.C. 460-1(12), et seq. | Full compliance |
| Fish and Wildlife Coordination Act, 16 U.S.C. 601, et seq. | Full compliance |
| Land and Water Conservation Fund Act, 16 U.S.C. 460/-460/-11, et seq. | Not applicable |
| National Environmental Policy Act, 42 U.S.C. 4321, et seq. | Full compliance |
| National Historic Preservation Act, 16 U.S.C. 470a, et seq. | Full compliance |
| National Wildlife Refuge System Administration Act, (16 U.S.C. 668DD-668EE) | Full compliance |
| River and Harbors Act, 33 U.S.C. 403, et seq. | Full compliance |
| UMR Wildlife and Fish Refuge Act, 16 U.S.C. 721, et seq. | Full compliance |
| Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq. | Not applicable |
| Wild and Scenic Rivers Act, 16 U.S.C. 1271, et seq. | Full compliance |
| Flood Plain Management (Executive Order 11988) | Full compliance |
| Protection of Wetlands (Executive Order 11990) | Full compliance |
| Environmental Effects Abroad of Major Federal Actions (Executive Order 12114) | Not applicable |
| Farmland Protection Act | Full compliance |
| Analysis of Impacts on Prime and Unique Farmland (CEQ Memorandum, 11 Aug 80) | Full compliance |

NOTES:

a. Full compliance. Having met all requirements of the statute for the current stage of planning (either preauthorization or postauthorization).

b. Partial compliance. Not having met some of the requirements that normally are met in the current stage of planning. Partial compliance entries should be explained in appropriate places in the report and referenced in the table.

c. Noncompliance. Violation of a requirement of the statute. Noncompliance entries should be explained in appropriate places in the report and referenced in the table.

d. Not applicable. No requirements for the statute required; compliance for the current stage of planning.

Because no contaminants of concern are present in the material proposed for dredging and the limited potential for significant settling in the effluent mixing zone, the proposed project is anticipated to have no effect on mussel species present in the project area. Therefore, the proposed project will have no effect on the Higgins' eye pearly mussel. Mussel bed locations were taken from the USFWS's Resources Inventory for the Upper Mississippi River, Guttenberg, Iowa, to Saverton, Missouri (1984), and the report prepared by Ecological Analysts, Inc., entitled Survey of Freshwater Mussels (Pelecypoda: Unionacea) at Selected Sites in Pools 11 through 24 of the Mississippi River (1981).

State endangered species information was solicited from the IDNR by the Rock Island District, Corps of Engineers. IDNR staff indicated that the bald eagle and Higgins' eye pearly mussel were of primary concern. Review of previous information on Louisa County endangered species indicates that most species are upland or prairie associates and therefore not likely to be affected by the proposed project. Rare species such as the bobcat and river otter may use the project area for travel or forage; therefore, construction may interrupt these species' foraging or travel patterns through the area. No permanent alteration of foraging or travel is anticipated at this time.

In consideration of the foregoing information, the proposed project is expected to have no effect on State or federally listed endangered species.

(2) National Historic Preservation Act and Archaeological and Historic Preservation Act. Preliminary archeological reconnaissance and archival research were provided to the Iowa State Historic Preservation Officer (SHPO). The SHPO found that no historic properties will be affected by the proposed undertaking in a letter dated December 7, 1988.

(3) Federal Water Project Recreation Act. The construction of the proposed project would have no effect on provisions of this act.

(4) Fish and Wildlife Coordination Act. The project is being coordinated with the USFWS, the IDNR, and other interested agencies and organizations. The CAR, dated September 14, 1988, is located in Appendix F - Correspondence.

The CAR concurred that the type of work proposed should have no effect on federally listed endangered species and indicated that the proposed work should have no significant long-term impact to fish and wildlife resources in the project area(s). No mitigation features were recommended by the CAR for the proposed project.

Recommendations contained in the CAR centered around bottomland hardwood and wood duck values. USFWS staff also recommended revegetation of disturbed areas with buttonbush.

(5) Wild and Scenic Rivers Act. No rivers listed as "wild and scenic" or rivers in the inventory for listing as "wild and scenic" will be affected by the project.

(6) Executive Order 11988 (Flood Plain Management). Executive Order 11988 directs Federal agencies to: (1) avoid development in the floodplain unless it is the only practical alternative; (2) reduce the hazards and risks associated with floods; and (3) minimize the impact of floods on human safety.

(7) Executive Order 11990 (Protection of Wetlands). Executive Order 11990 directs Federal agencies to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands when a practicable alternative exists. Wetland definitions apply to bottomland and shoreline areas within the project area.

The proposed project is intended to reduce aquatic and wetland losses by a combination of dredging and check dam construction. A shift in wetland values will occur as a result of modifications to surface elevations within the containment basin, and the deepening of shallows along the dredge alignment. This shift is anticipated to increase emergent and submerged wetland values by increasing shallows area and longevity at Big Timber. Elevational increases resulting from dredged material placement will not exceed current regulatory guideline elevations established for wetland determination. While vegetation patterns will change following placement, palustrine forested wetland values will remain similar to preplacement conditions.

## 10. PLAN ACCOMPLISHMENTS AND OUTPUTS.

The project area is currently dry during the mid- to late-summer months, except for a shallow 2- to 3-foot-wide channel. During the winter months, the area is completely frozen. The proposed project will improve aquatic habitat values of the Big Timber Unit by providing areas with water depths of 8 to 10 feet to restore over-winter and summer thermal refuge areas for fish. Shallower areas (3 to 4 feet) provided will increase fish spawning and nursery habitat. Placement of the excavated/dredged material in the containment site will result in the loss of some existing timber. However, it is anticipated that increasing the elevation to approximately 542 MSL in the containment area will result in the establishment of more desirable mast-producing trees in the area. Some mast tree planting, as well as buttonbush replanting, will enhance the terrestrial habitat value.

The creation of approximately 21 acres of year-round open water should increase habitat available to wood duck broods. The seclusion of the Little Denny area and creation of potholes in the mudflat areas will provide protected areas for wood ducks.

## 11. OPERATION AND MAINTENANCE CONSIDERATIONS.

a. Project Data Summary. Table 11-1 presents a summary of project data.

TABLE 11-1

Big Timber
Project Data Summary

| | | |
|---|---|---|
| **Dredged Material Placement Site** | | |
| Containment Levee | 6,400 | feet |
| Average Material Depth | 1.8 | feet |
| Area | 73 | acres |
| Capacity | 157,000 | cubic yards |
| **Hydraulic Dredging** | | |
| Volume | 102,400 | cubic yards |
| Typical Invert | 528 | MSL |
| Deep Hole Invert | 517 | MSL |
| **Mechanical Excavation** | | |
| Volume | 67,300 | cubic yards |
| Typical Invert | 533 | MSL |
| **Check Dams** | | |
| Number | 4 | |
| Approximate Elevation | 543 | MSL |
| **Potholes** | | |
| Number | 10 | |
| Dimensions | 15 x 60 | feet |
| Depth | 10 | feet |
| **Revegetation** | | |
| Buttonbush | 2.5 | acres |
| Hardwood Trees | 30 | acres |

b. Operation and Maintenance. The USFWS would be the responsible Federal agency for securing all operation and maintenance costs under provisions of Section 906(e) of the Water Resources Development Act of 1986 (P.L. 99-662). The estimated annual operation and maintenance costs are presented in table 11-2.

TABLE 11-2

Estimated Annual Operation, Maintenance, and Rehabilitation Costs
(June 1989 Price Level)

| Item | Quantity | Unit | Unit Costs($) | Costs($) |
|---|---|---|---|---|
| Operation | | | | 1/ |
| Maintenance | | | | |
| Inspection | 40 | hr. | 17 | 680 |
| Seedling care | 30 | ac. | 30 | 900 |
| Herbicide treatment of seedling area | 30 | ac. | 80 | 2,400 |
| Debris removal/placement (Little Denny boater access control) | 40 | hr. | 50 | 2,000 |
| Subtotal Maintenance 2/ | | | | 6,000 |
| Rehabilitation | | | | 3/ |
| Subtotal | | | | 6,000 |
| Contingencies | | | | 1,500 |
| Total per year | | | | 7,500 |

1/ No operation costs are identified.

2/ Rounded to nearest hundred.

3/ Rehabilitation cannot be accurately estimated. Rehabilitation is reconstructive work that significantly exceeds the annual operation and maintenance requirements identified above and which is needed as the result of major storm or flood events.

## 12. PROJECT PERFORMANCE ASSESSMENT.

The purpose of this section is to summarize monitoring aspects of the project. The principal types, purposes, and responsibility of project monitoring are presented in table 12-1. The plans for post-construction field observations and quantitative measurements are presented in tables 12-2 and 12-3, respectively.

TABLE 12-1

Monitoring Plan

| Type Monitoring | Purpose | Responsibility | Comments |
|---|---|---|---|
| Pre-Project | Establish need of proposed project/ features | Sponsor (coordinated with Corps of Engineers) | See Sections 2 and 3 |
| Design | Establish baseline conditions consistent with project goals and objectives and meet specific permit/ environmental requirements | Corps of Engineers | See Plates 10-13 and Appendix D |
| Construction | Assess construction impacts and meet permit requirements | Corps of Engineers | To be included in construction contract documents |
| Post-Construction | Assess performance of project relative to goals and objectives. | 1. Sponsor (field observations)<br>2. Corps of Engineers (quantitative) | 1. Table 12-2<br>2. Table 12-3 |

TABLE 12-2

Annual Post-Construction Field Observations 1/

| Goals | Objectives | Field Observations |
|---|---|---|
| Enhance Aquatic Habitat | Restore deep (>6 feet) aquatic habitat volume | Development of emergent vegetation within deep dredged areas |
| | Restore shallow aquatic habitat volume | Encroachment of bankline or obvious shoaling in shallow dredged areas |
| | Provide year-round habitat access (cross-sectional area) | Development of emergent vegetation within access area |
| | Improve dissolved oxygen concentration during critical seasonal stress periods | Fish stress (at surface) or fish kills |
| Enhance Terrestrial Habitat | Produce mast tree dominated areas | Seedling survival |
| Enhance Migratory Waterfowl Habitat | Increase reliable resting and feeding water area | Waterfowl presence or absence |
| | Provide isolated resting, feeding, and brooding pools | Waterfowl presence or absence as evidence by their calls 2/ |

1/ Submit to Corps of Engineers with annual management report for Cooperative Agreement lands.

2/ Calls of frog species, specifically the bull-, green, and leopard, that commonly utilize shoreline areas for feeding and resting, would also indicate the continued existence of the pools without requiring human intrusion.

Post-Construction Quantitative Measurements

| Goals | Objectives | Unit of Measure | Monitoring Plan | Monitoring Interval/ Years |
|---|---|---|---|---|
| Enhance Aquatic Habitat | Restore deep ( 6 feet) aquatic habitat volume | ac-ft | Perform hydrographic soundings of excavated channel | 5 |
| | Restore shallow ( 6 feet) aquatic habitat volume | ac-ft | Perform hydrographic soundings of excavated channel | 5 |
| | Provide year-round habitat access (cross-sectional area) | sq-ft | Perform hydrographic soundings of excavated section | 5 |
| | Improve dissolved oxygen concentration during critical seasonal stress periods | mg/l | Perform dissolved oxygen measurements | .25 1/ |
| Enhance Terrestrial Habitat | Produce mast tree dominated areas | ac | Timber inventory | 5 |
| Enhance Migratory Waterfowl Habitat | Increase reliable resting and feeding water area | ac | Determine surface areas | 5 |
| | Provide isolated resting, feeding, and brooding pools | ea | Inventory potholes created by blasting | 5 |

1/ Monitoring interval to correlate with critical seasonal stress periods.

13. COST ESTIMATES.

A detailed estimate of the initial construction cost is presented in table 13-1. Quantities may vary during final design and construction. Estimated costs for project monitoring are identified in table 13-2.

TABLE 13-1

Big Timber
Detailed Estimate of Cost
(June 1989 Price Level)

| Item | Quantity | Unit | Unit Cost ($) | Total Cost ($) |
|---|---|---|---|---|
| Confined Placement Site | | | | |
| Clearing | 3 | ac | 2,000.00 | 6,000 |
| Confinement Levee Fill | 9,500 | $yd^3$ | 3.50 | 33,200 |
| Mast Planting/Revegetation | 30 | ac | 1,000.00 | ~~17,700~~ |
| | | | | 56,900 |
| Mechanical Dredging | 67,300 | $yd^3$ | 3.50 | 235,500 |
| Hydraulic Dredging | 102,400 | $yd^3$ | 3.50 | 358,400 |
| Little Denny Boater Access Control | 1 | job | 1,000.00 | 1,000 |
| Pothole Blasting | 10 | EA | 4,000.00 | 40,000 |
| Subtotal | | | | 691,800 |
| Contingencies | | | | 169,800 |
| Estimated Construction Cost | | | | ~~861,600~~ 573,900 |
| Engineering and Design | | | | 104,000 1/ |
| Supervision and Administration | | | | 62,000 1/ |
| TOTAL | | | | 1,028,000 2/ |

1/ Includes General Design Cost of $108,000

2/ Rounded to nearest thousand

TABLE 13-2

Estimated Annual Monitoring Costs
(June 1989 Price Levels)

| Monitoring Type | Monitoring Activity | Monitoring Interval (Year) | Cost per Monitoring Effort ($) | Average Annual Cost $/Yr |
|---|---|---|---|---|
| Pre-Project | | | | 1/ |
| Design | | | | 1/ |
| Construction | | | | 1/ |
| Post Construction | | | | |
| a. Quantitative | Hydrographic Survey | 5 | $7,000 | $1,780 |
| | Water Quality Monitoring | 0.25 | 255 | 1,200 |
| | Timber Survey | 5 | 1,200 | 300 |
| | Areal Survey | 5 | 1,200 | 300 |
| b. Field Observations 2/ | | | | |
| Subtotal (monitoring) | | | | $3,580 |
| Contingencies | | | | 900 |
| Total (per year) | | | | $4,480 |

1/ These costs are incorporated in project planning, design, and construction cost.

2/ To be included in USFWS annual management report for Cooperative Agreement lands; no significant increase in cost will be involved.

JIM ROSALA
EMTC
(608) 783-7550

## 14. REAL ESTATE REQUIREMENTS.

a. Interagency Agreement. The project is proposed for 100 percent Federal funding for first costs. The Big Timber project area is on lands owned by the United States. The lands were acquired by the Corps of Engineers for the Mississippi River Nine-Foot Navigation Channel project. All of the lands are managed by the USFWS as part of the Mark Twain National Wildlife Refuge under a cooperative agreement between the Department of the Army and the Department of the Interior dated February 14, 1963. The Water Resources Development Act of 1986 (Public Law 99-662) is the basis for first-cost Federal funding and provides:

> Section 906. FISH AND WILDLIFE MITIGATION.
>
> (e) ... the first cost of such enhancement shall be a federal cost when -
>
> (3) such activities are located on lands managed as a national wildlife refuge.

A draft agreement for operation, maintenance, and rehabilitation between the Corps of Engineers and the USFWS has been included in this report as appendix G. Estimated operations and maintenacne costs are presented in table 11-2.

b. Construction Easements. All project features are located on lands owned by the Federal Government. Access to the site is available from the existing local road without crossing any private lands. No construction easements should be required. Prior to advertisement of the construction contract, the USFWS will issue a Special Use Permit authorizing work on Department of Interior lands.

## 15. SCHEDULE FOR DESIGN AND CONSTRUCTION.

Table 15-1 presents the schedule of project completion steps, subject to availability of construction funds.

TABLE 15-1

Project Implementation Schedule

| Requirement | Scheduled Date |
|---|---|
| Submit Draft DPR to Corps of Engineers, North Central Division for review | Dec 88 |
| Distribute DPR for Public and Agency Review | Apr 89 |
| Submit final and public-reviewed DPR to the Chief of Engineers for review, approval, and funding for plans and specifications | Jul 89 |
| Receive plans and specification funds | Aug 89 |
| Construction approval by Assistant Secretary of the Army (Civil Works) | Sep 89 |
| Submit final plans and specifications to North Central Division for review and approval | Oct 89 |
| Advertise contract | Nov 89 |
| Award contract | Jan 90 |
| Complete construction | Sep 91 |
| Complete revegetation | Sep 92 |

16. IMPLEMENTATION RESPONSIBILITIES AND VIEWS.

a. Corps of Engineers. The Corps of Engineers, Rock Island District, is responsible for project planning/construction and coordination with the USFWS, the State of Iowa, and other affected agencies. The Rock Island District will submit the subject detailed project report; program funds; finalize plans and specifications; complete all National Environmental Policy Act (NEPA) requirements; advertise and award a construction contract; and perform construction contract supervision and administration; and perform post-construction project evaluations.

b. U.S. Fish and Wildlife Service. The USFWS is the Federal sponsor and will ensure that all project features are compatible with Refuge purposes. In accordance with the National Wildlife Refuge System Administration Act (16 USC 668), and the Upper Mississippi River Wildlife and Fish Refuge Act (16 USC 721, et seq.), a Refuge Compatibility Determination and Refuge Approval will be required prior to project construction.

The USFWS will ensure that the operation and maintenance functions described in table 11-2 of this report are performed in accordance with Section 906(e) of the Water Resources Development Act of 1986 (P.L. 99-662).

c. Iowa Department of Natural Resources. The IDNR, the non-Federal project sponsor, is responsible for all pre-project monitoring necessary to establish the need for the proposed project features. As a proponent of the project, IDNR has provided technical and other advisory assistance during all phases of project development and will continue to provide assistance during project implementation. The IDNR has agreed to cooperate with the operation and maintenance of the project in accordance with Section 906(e) of the Water Resources Development Act of 1986 in a letter dated June 13, 1989.

17. COORDINATION, PUBLIC VIEWS, AND COMMENTS.

a. Coordination Meetings. Close coordination between the Corps of Engineers, the USFWS, and IDNR personnel was effected during the study period. A listing of meetings follows:

(1) March 29, 1988, discussed project scope and objectives.

(2) May 11, 1988, discussed project scope and objectives.

(3) May 24, 1988, rescoped project objectives.

b. Environmental Review Process. This project meets the requirements of NEPA as evidenced by the Integrated Environmental Assessment and Finding of No Significant Impact.

# FINDING OF NO SIGNIFICANT IMPACT

Having reviewed the information contained in this environmental assessment, I find that construction of the Big Timber Habitat Rehabilitation and Enhancement project will have no significant impacts on the environment; therefore, preparation of an Environmental Impact Statement (EIS) is not required. This determination may be reevaluated if warranted by later developments. Factors that were considered in making this determination were:

a. The project will improve the quality of fish and wildlife habitat through habitat restoration and enhancement.

b. Aside from the conversion of bottomland forest and wetland, this project will have negligible adverse effects on aquatic and terrestrial resources.

c. Public review of this document has resulted in no significant adverse comments.

d. The project is in compliance with Sections 401 and 404 of the Clean Water Act.

6 July 89
Date

Neil A. Smart
Colonel, U.S. Army
District Engineer

# FINDING OF NO SIGNIFICANT IMPACT

For the reasons presented below and based on an evaluation of the information contained in the supporting references, I have determined that the Environmental Management Program project, Big Timber Habitat Rehabilitation and Enhancement, is not a major Federal action which would significantly affect the quality of the human environment within the meaning of Section 102(2)(c) of the National Environmental Policy Act of 1969. An Environmental Impact Statement will, accordingly, not be prepared.

## Reasons

The project would counteract sedimentation that has reduced deeper off-channel aquatic habitats. It would enhance habitat diversity for fishery resources. Spoil deposition has been designed to avoid adverse impacts to the important wood duck habitat.

There would be no adverse impacts to endangered or threatened species or their habitat nor to significant cultural resources.

The Army Corps of Engineers has determined that no substantial water quality problems would result from removal of bottom material nor from discharge of water with the use of a suitable retention facility.

## Supporting References

1. Environmental Assessment

Acting Regional Director — Date 7/28/85

Distribution:
AE (Master File)
EHC/BFA--Washington, DC
COE, Rock Island
SS
MKT through WAM2

# HYDROLOGY AND HYDRAULICS

APPENDIX A

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT (R-5)

BIG TIMBER HABITAT ENHANCEMENT PROJECT
POOL 17, MISSISSIPPI RIVER MILE 444
LOUISA COUNTY, IOWA

APPENDIX A
HYDROLOGY AND HYDRAULICS

TABLE OF CONTENTS



List of Tables



List of Plates

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT (R-5)

BIG TIMBER HABITAT ENHANCEMENT PROJECT
POOL 17, MISSISSIPPI RIVER MILE 444
LOUISA COUNTY, IOWA

# APPENDIX A
# HYDROLOGY AND HYDRAULICS

## GENERAL

The Big Timber habitat project area, shown on plate 1 of the main report, is located within the Mark Twain National Wildlife Refuge between river miles 443 and 445 in Pool 17.

The purpose of this appendix is to present the H&H development and evaluation of proposed improvements which will provide increased fisheries benefits for Pool 17. The improvements will consist of hydraulic dredging and mechanical excavation of deepwater channels and holes. The disposal site for the hydraulic dredging will be in the low area bounded by the Mississippi River and Big and Little Denny Slough (with some soil movement required to create a berm). The mechanically excavated material will be primarily sidecast on the banks. The project area is less than 1 square mile and located entirely riverward of the levee maintained by the Muscatine Island Levee District.

## CLIMATE

The climate in south-central Iowa is characterized by extreme temperatures and moderate precipitation. The National Weather Service operates a weather station with over 35 years of record in Columbus Junction, Iowa, located about 25 miles northwest of Big Timber. Temperatures range from a maximum of 103 degrees Fahrenheit (F) in the summer to a minimum of -25 degrees F in the winter. The normal temperature is 50.4 degrees F. Most of the precipitation occurs in summer and fall months, with May, June, and July normally the wettest months, having a monthly average of over 4 inches. Winters are normally the driest parts of the year. The average annual snowfall is 37.1 inches. Table A-1, shown below, lists the monthly precipitation amounts at the Columbus Junction gage for the 36 years of record during the period 1951 to 1987.

TABLE A-1

Average Monthly Precipitation

| Month | Inches | Month | Inches |
|---|---|---|---|
| January | 1.37 | July | 4.35 |
| February | 1.08 | August | 4.09 |
| March | 2.65 | September | 3.89 |
| April | 3.80 | October | 3.10 |
| May | 4.27 | November | 1.95 |
| June | 4.43 | December | 1.80 |

## HYDROLOGY

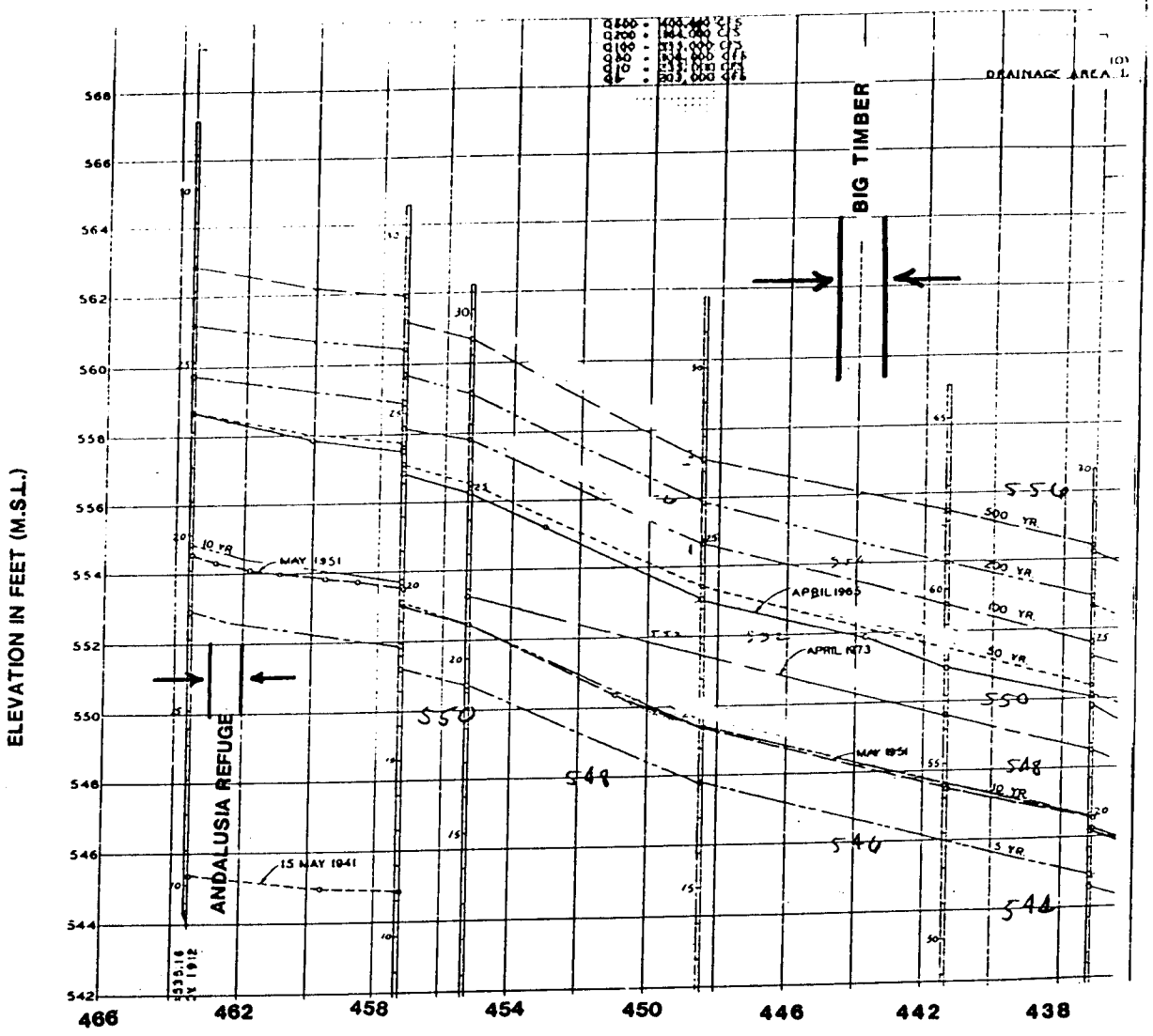
Mississippi River discharge frequency relationships and corresponding water surface profiles were promulgated by the Upper Mississippi River Basin Commission (UMRBC) in a November 1979 study entitled Upper Mississippi River Water Surface Profiles, River Mile 0.0 to River Mile 847.5. Plate A-1 presents pertinent data from this study. Actual water elevations are recorded daily at Blanchard Island, Iowa (RM 448.5). Plates 4 and 5 of the main report show daily stage hydrographs for the period of record 1969 through 1987 [gage zero equals 528.2 feet above mean sea level (MSL)].

These data were used to compute monthly and year-round elevation duration relationships for the project site as presented on plates A-2 through A-5. The 50 percent duration elevation can be interpreted as the average elevation. The months of February, August, and September have the lowest normal elevations, referenced to feet above MSL, of 536.3, 536.3, and 536.4, respectively. The year round-normal elevation is about 536.7 feet. Typical floods appear to last for at least 25 days and raise the water surface about 5 feet.

## SEDIMENT CONDITIONS

Detailed historical records of past sedimentation rates are essentially nonexistent. A paper by J. Roger McHenry dated March 1981 entitled "Recent Sedimentation Rates in Two Backwater Channel Lakes, Pool 14, Mississippi River" indicates widely varying deposition rates, with an average of about 1.2 inch per year. In general, increased flow area decreases the mean flow velocity, resulting in a decrease in the sediment-transport capacity. Consequently, excess sediment is normally deposited in backwater areas until an equilibrium is achieved between the sediment-transport capacity and sediment input.

Due to the large flow area and decreased flow velocities, the Big Timber backwater area is a natural sediment drop zone for upstream Mississippi River sediment. However, the relatively small drainage caused by the existing levee minimizes any direct upland sedimentation. As stated in the main report, a sedimentation rate of 0.62 inch per year was estimated from historical data.




| REVISION | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

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

DRAWN BY: GEH
TRACED BY:
CHECKED BY: JMS
SUBMITTED:
CHIEF HYDRAULICS BRANCH
APPROVED:
CHIEF, ENGINEERING DIVISION
DATE:

**UPPER MISSISSIPPI RIVER**

# STANDARD FLOOD PROFILES

ROCK ISLAND DISTRICT

5, 10, 50, 100, 200, & 500 YEAR FLOOD

RIVER MILES 516.32 TO 463.5

DRAWING NO NCR-4/6

**PLATE A-1**

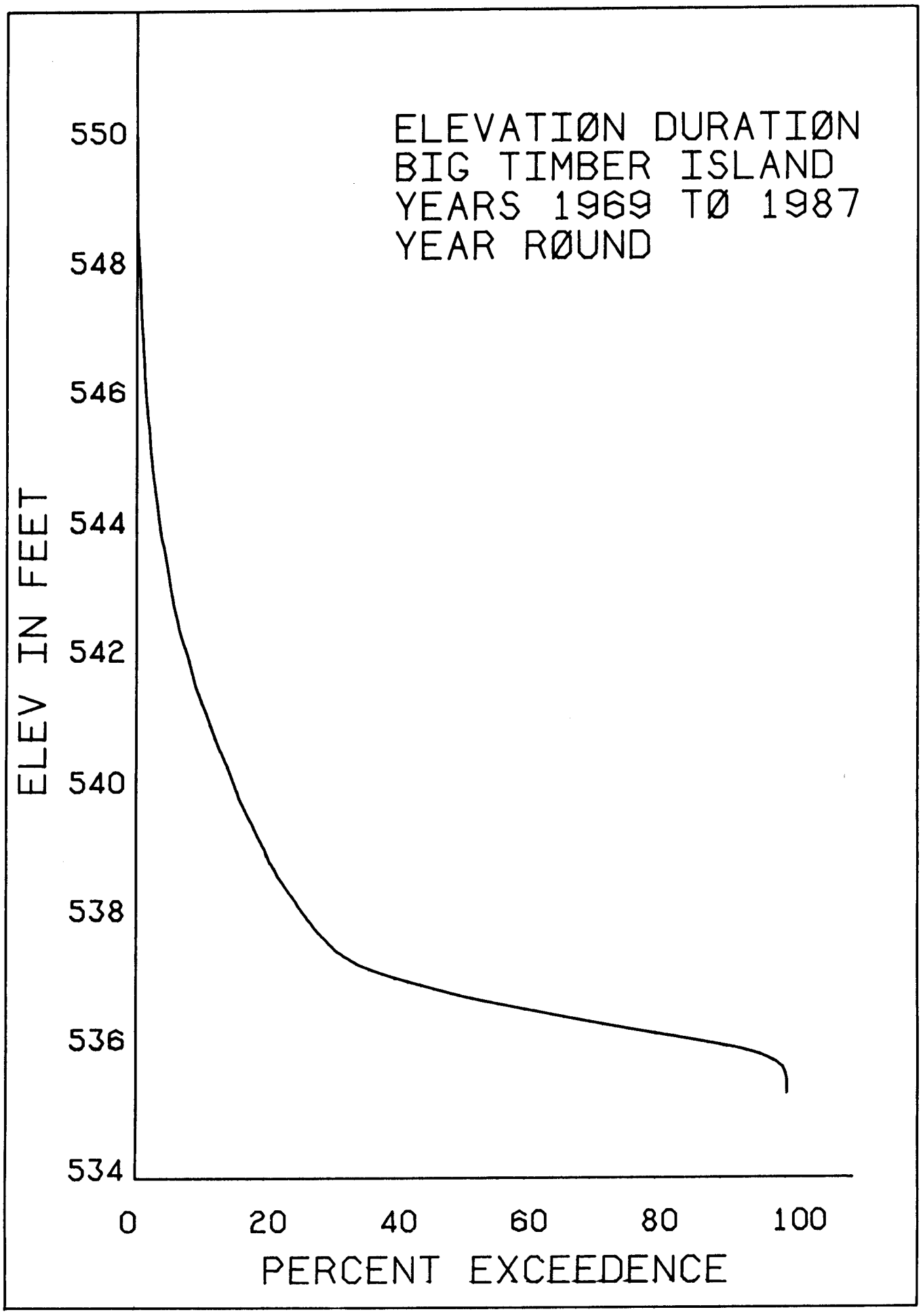
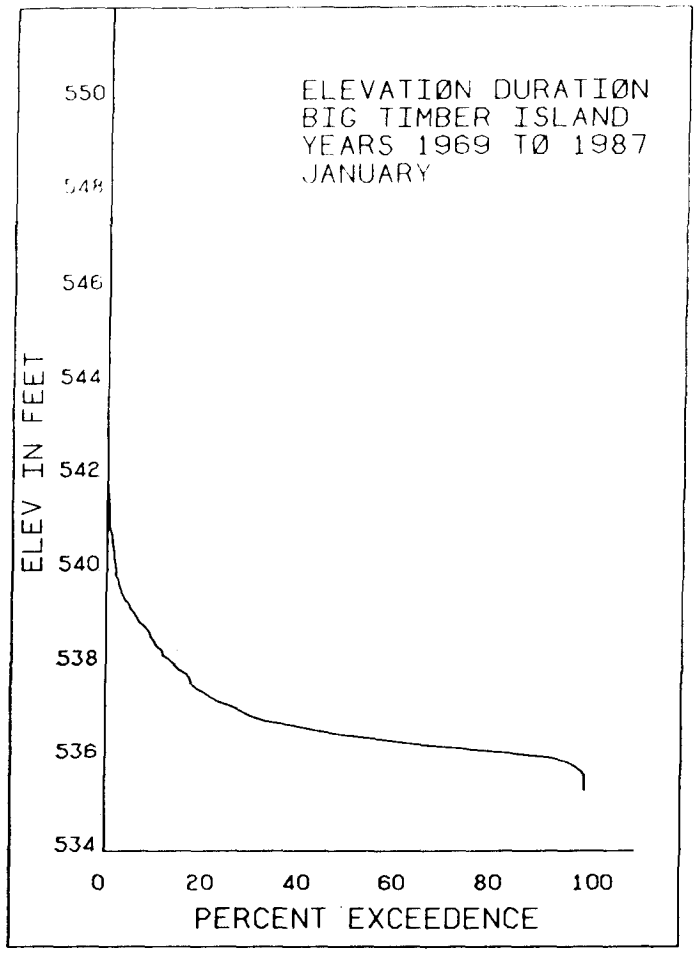
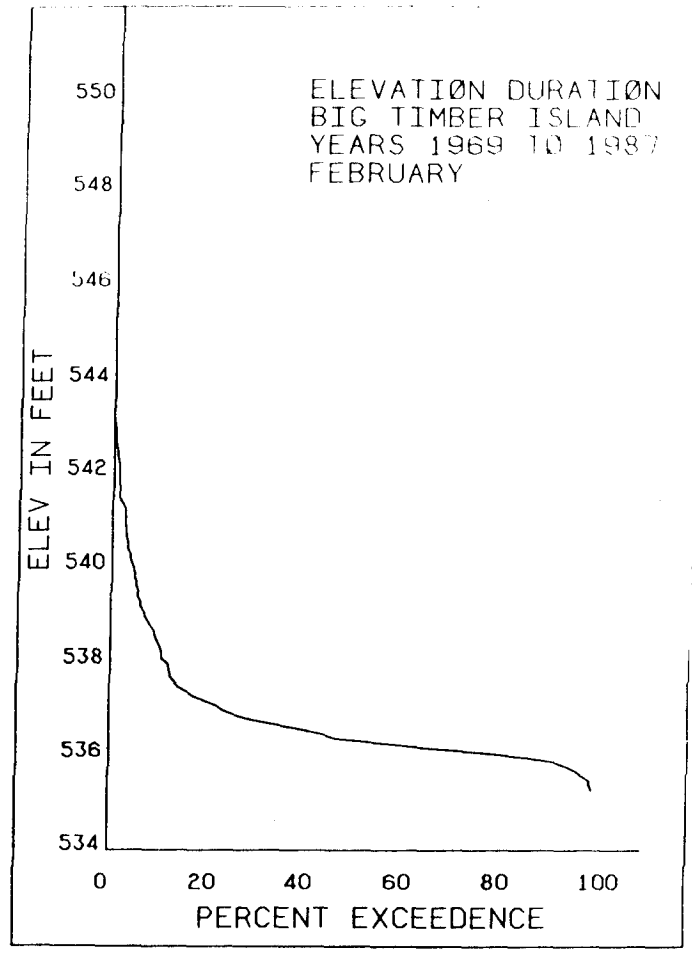
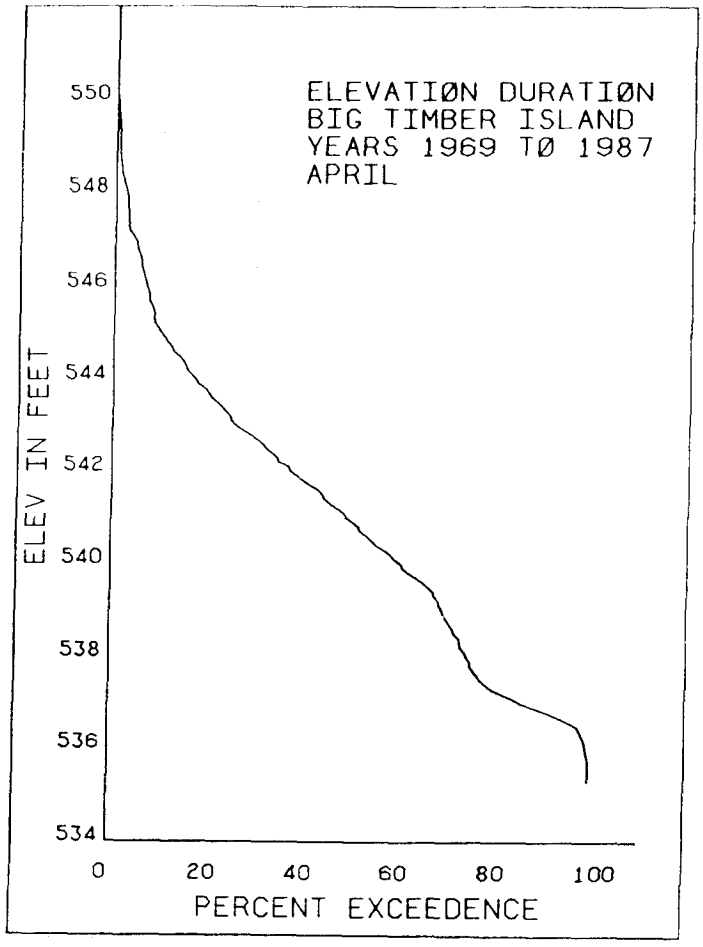

ELEVATIØN DURATIØN
BIG TIMBER ISLAND
YEARS 1969 TØ 1987
YEAR RØUND
ELEV IN FEET
550
548
546
544
542
540
538
536
534
0
20
40
60
80
100
PERCENT EXCEEDENCE

PLATE A-2


ELEVATIØN DURATIØN
BIG TIMBER ISLAND
YEARS 1969 TØ 1987
JANUARY
ELEV IN FEET
550
548
546
544
542
540
538
536
534
0
20
40
60
80
100
PERCENT EXCEEDENCE


ELEVATIØN DURATIØN
BIG TIMBER ISLAND
YEARS 1969 TØ 1987
FEBRUARY
ELEV IN FEET
550
548
546
544
542
540
538
536
534
0
20
40
60
80
100
PERCENT EXCEEDENCE


ELEVATIØN DURATIØN
BIG TIMBER ISLAND
YEARS 1969 TØ 1987
APRIL
ELEV IN FEET
550
548
546
544
542
540
538
536
534
0
20
40
60
80
100
PERCENT EXCEEDENCE

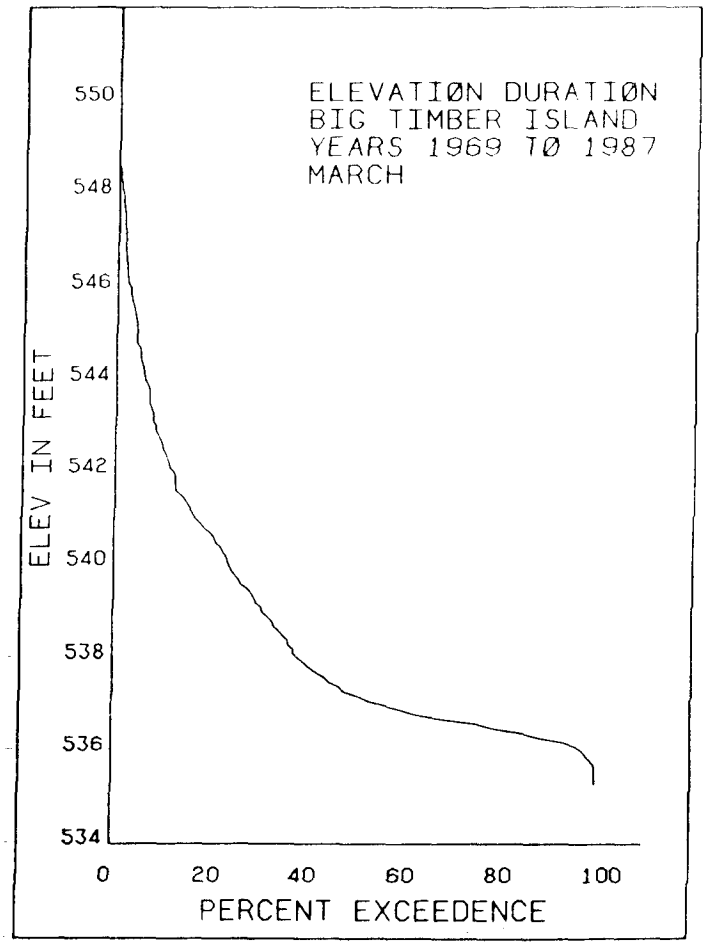
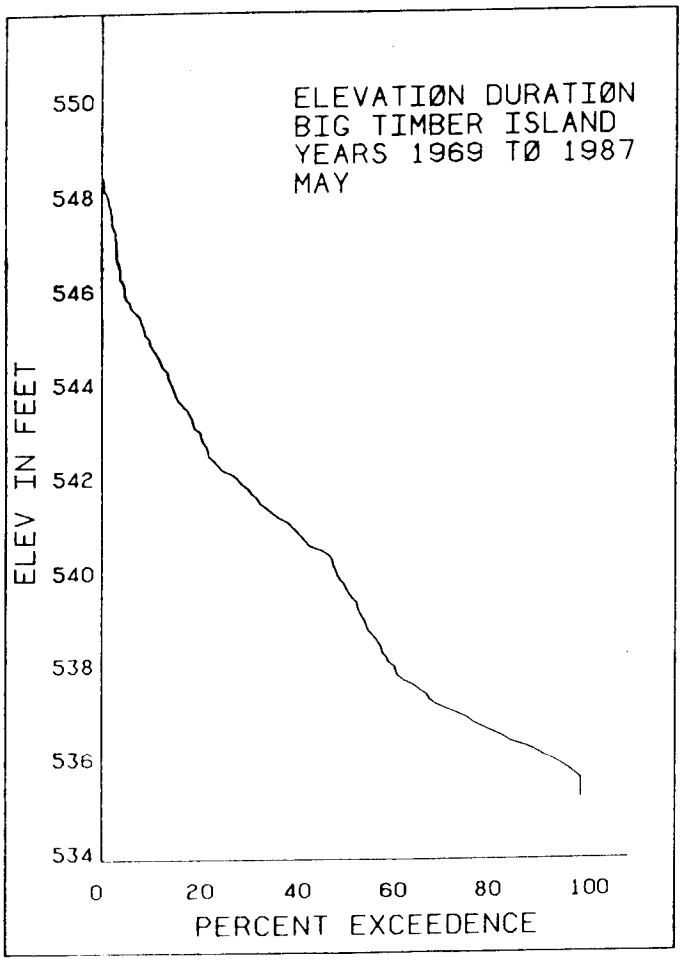
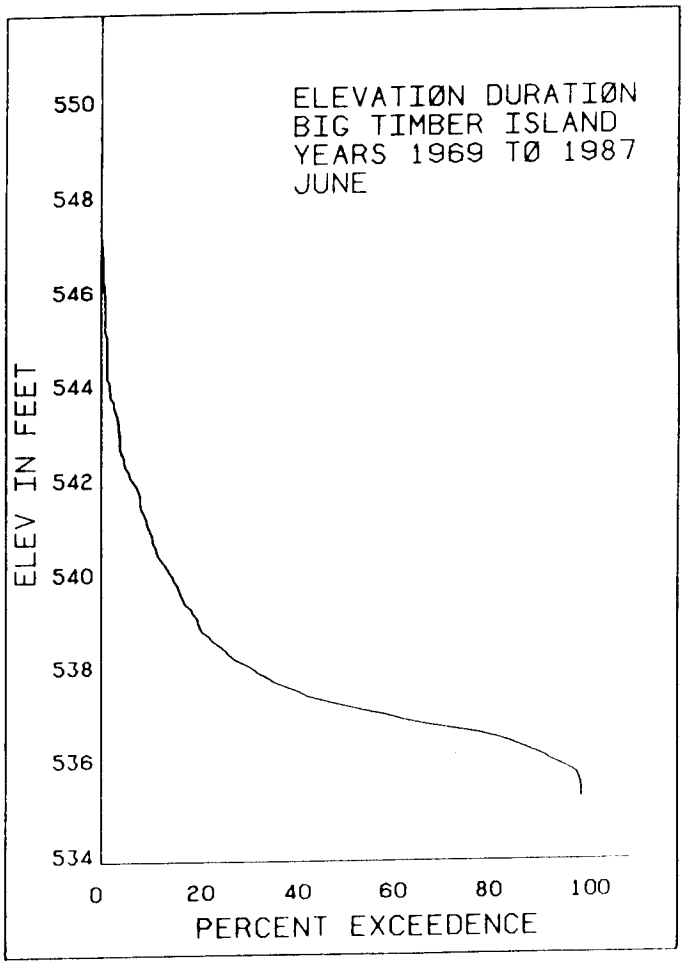
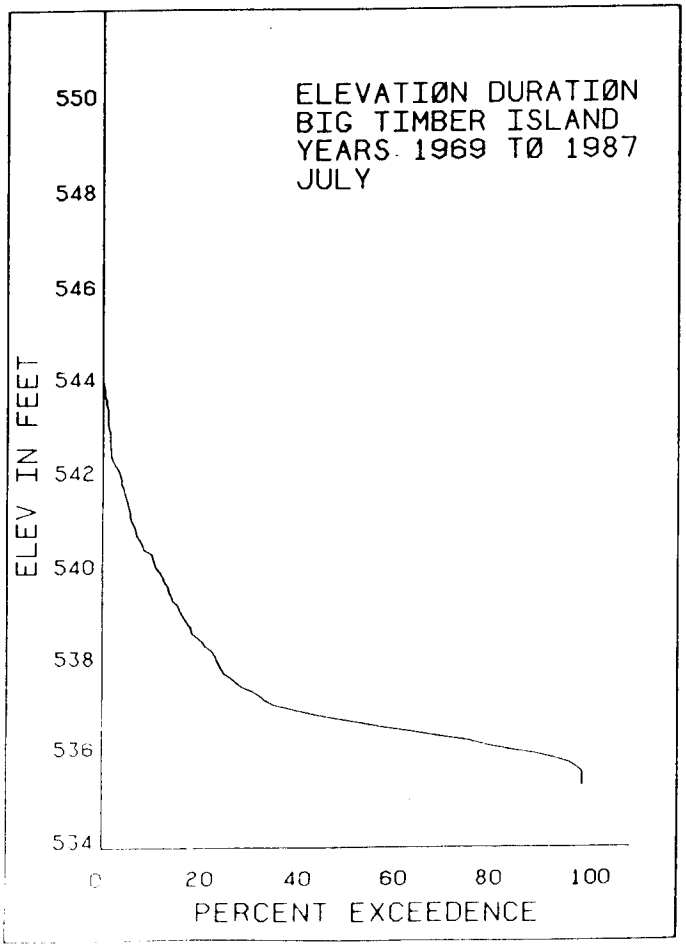

ELEVATIØN DURATIØN
BIG TIMBER ISLAND
YEARS 1969 TØ 1987
MARCH
ELEV IN FEET
550
548
546
544
542
540
538
536
534
0
20
40
60
80
100
PERCENT EXCEEDENCE

**PLATE A-3**


ELEVATIØN DURATIØN
BIG TIMBER ISLAND
YEARS 1969 TØ 1987
MAY
ELEV IN FEET
550
548
546
544
542
540
538
536
534
0
20
40
60
80
100
PERCENT EXCEEDENCE


ELEVATIØN DURATIØN
BIG TIMBER ISLAND
YEARS 1969 TØ 1987
JUNE
ELEV IN FEET
550
548
546
544
542
540
538
536
534
0
20
40
60
80
100
PERCENT EXCEEDENCE


ELEVATIØN DURATIØN
BIG TIMBER ISLAND
YEARS 1969 TØ 1987
JULY
ELEV IN FEET
550
548
546
544
542
540
538
536
534
0
20
40
60
80
100
PERCENT EXCEEDENCE

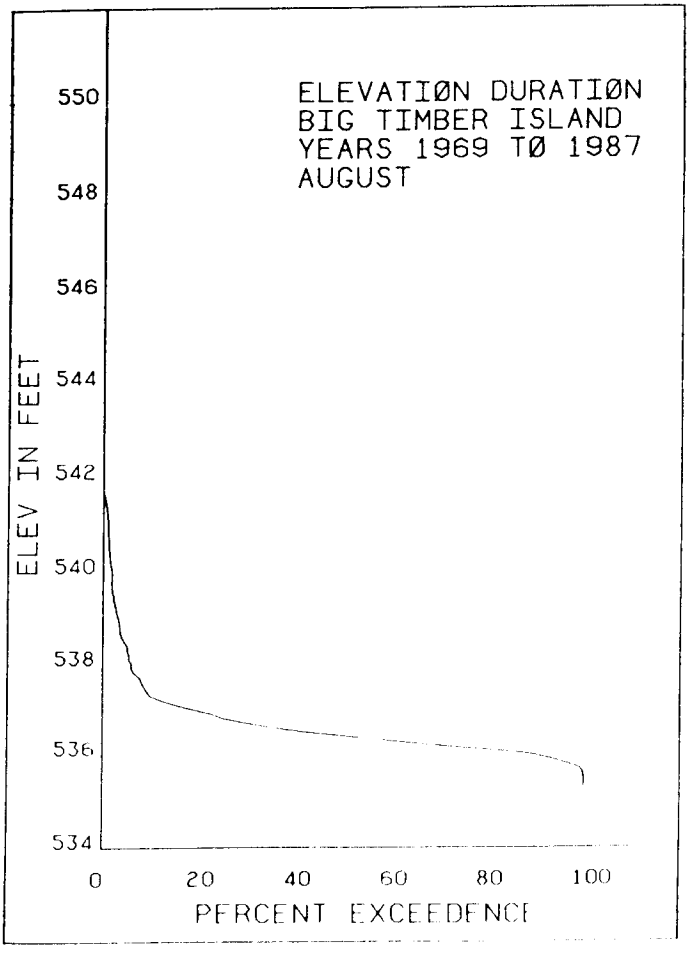
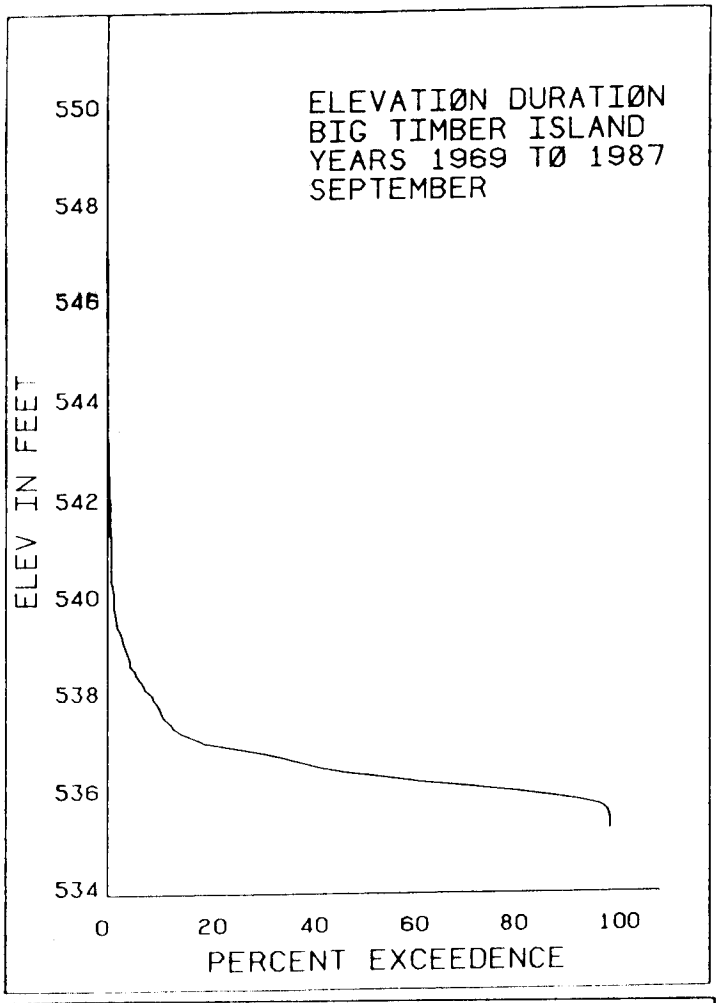
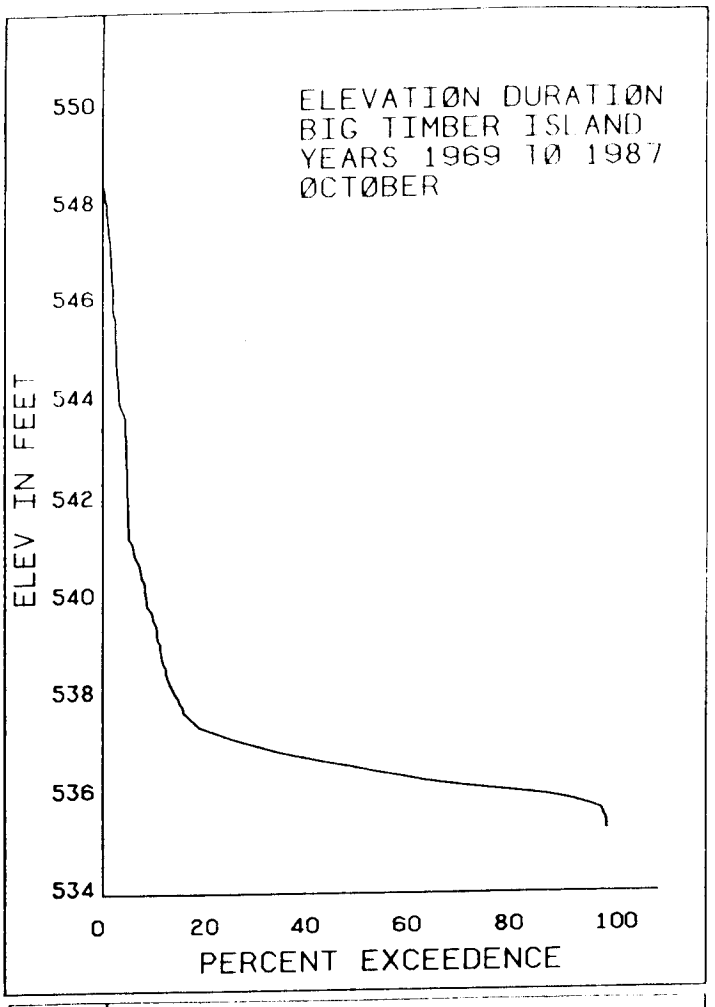
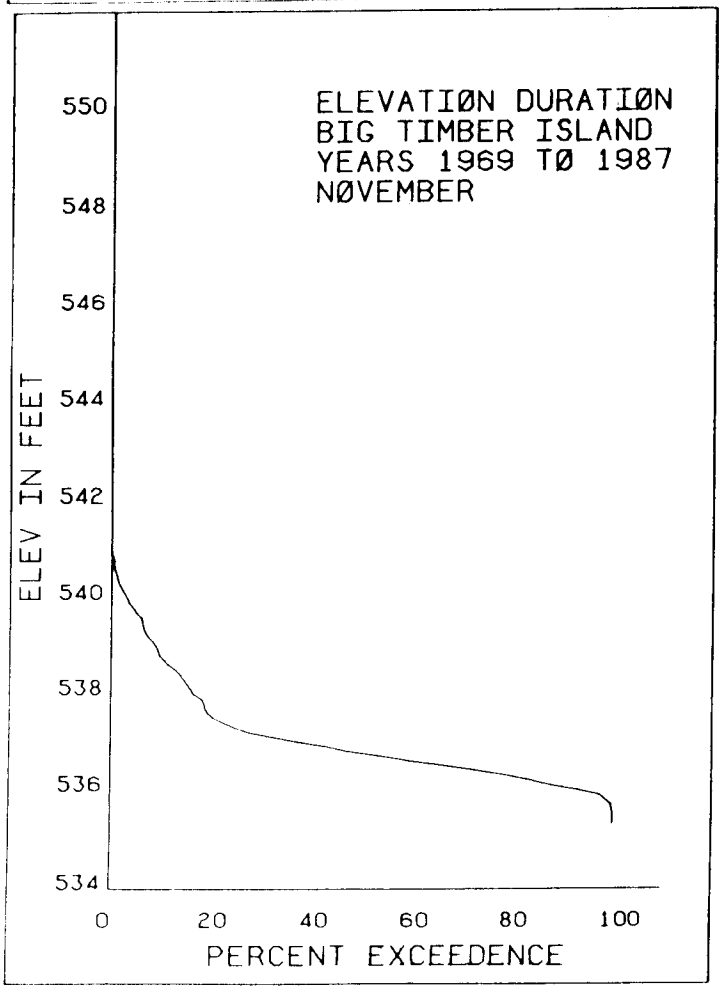

ELEVATIØN DURATIØN
BIG TIMBER ISLAND
YEARS 1969 TØ 1987
AUGUST
ELEV IN FEET
550
548
546
544
542
540
538
536
534
0
20
40
60
80
100
PERCENT EXCEEDENCE

**PLATE A-4**


ELEVATIØN DURATIØN
BIG TIMBER ISLAND
YEARS 1969 TØ 1987
SEPTEMBER
ELEV IN FEET
550
548
546
544
542
540
538
536
534
0
20
40
60
80
100
PERCENT EXCEEDENCE


ELEVATIØN DURATIØN
BIG TIMBER ISLAND
YEARS 1969 TØ 1987
ØCTØBER
ELEV IN FEET
550
548
546
544
542
540
538
536
534
0
20
40
60
80
100
PERCENT EXCEEDENCE


ELEVATIØN DURATIØN
BIG TIMBER ISLAND
YEARS 1969 TØ 1987
NØVEMBER
ELEV IN FEET
550
548
546
544
542
540
538
536
534
0
20
40
60
80
100
PERCENT EXCEEDENCE

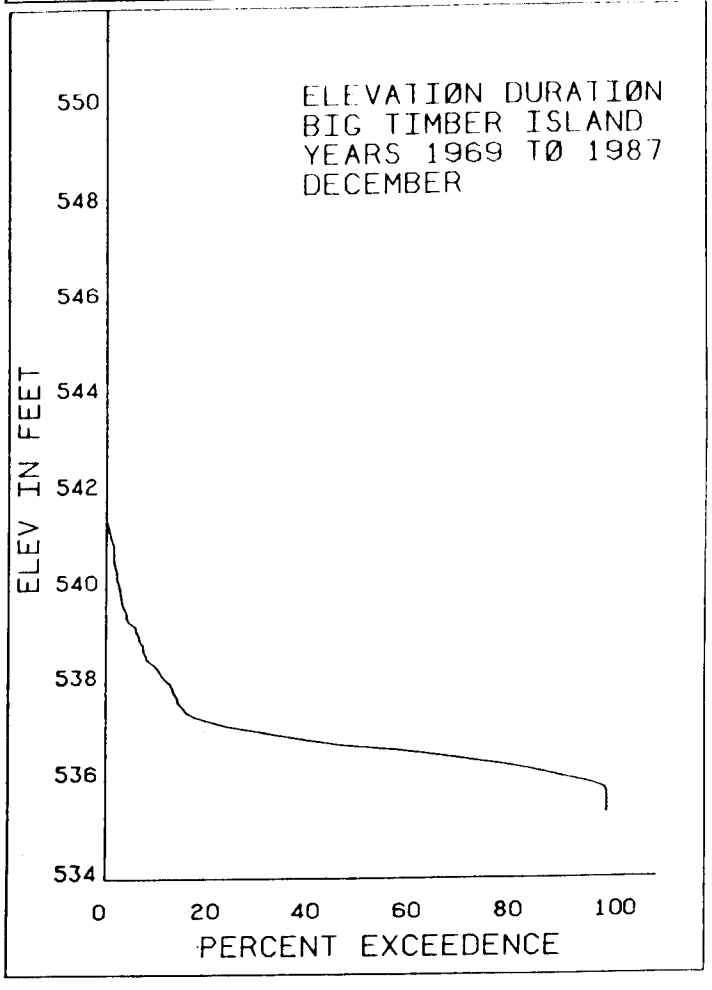

ELEVATIØN DURATIØN
BIG TIMBER ISLAND
YEARS 1969 TØ 1987
DECEMBER
ELEV IN FEET
550
548
546
544
542
540
538
536
534
0
20
40
60
80
100
PERCENT EXCEEDENCE

**PLATE A-5**

# WATER QUALITY

APPENDIX B

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT (R-5)

BIG TIMBER REHABILITATION AND ENHANCEMENT
POOL 17, MISSISSIPPI RIVER MILE 444
LOUISA COUNTY, IOWA

APPENDIX B
WATER QUALITY

TABLE OF CONTENTS



List of Tables

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT (R-5)

BIG TIMBER REHABILITATION AND ENHANCEMENT
POOL 17, MISSISSIPPI RIVER MILE 444
LOUISA COUNTY, IOWA

APPENDIX B
WATER QUALITY

## OVERVIEW

Several water quality aspects of the project are of concern in assessing the impacts of the proposed enhancement efforts on the aquatic environment. In order to predict the magnitude of these impacts, it is necessary to document existing water quality and sediment quality in the backwater complex and evaluate these data in light of the construction techniques to be used and the final product which will result from these efforts. To establish baseline conditions for future comparative purposes, water samples were taken every 2 weeks during the summer and less frequently during the remainder of the year beginning in 1987. Sediment and elutriate samples were taken once in 1988. These data provide the basis for the assessment of water and sediment quality within the study area.

## METHODS

Ambient water samples were collected on 13 occasions between January and September 1987. All samples were taken from boat at the single location shown in plate 2 of the main report. Due to shallow water and abundant aquatic plant growth, it was not possible to collect samples during the summer months from the exact project location. The sampling location selected was as close to the project site as water conditions would allow. Due to the lack of flow through the backwater area and the relative proximity of the sampling location to the project site, it is quite likely that little, if any, difference in water quality exists between the sampling sites. In all cases, grab samples were taken from immediately below the surface using a Kemmerer sampler. Field analyses [temperature, pH, dissolved oxygen (D.O.), specific conductance and secchi disk depth] were performed immediately, while the samples requiring laboratory analysis were appropriately preserved, placed on ice, and transported the same day they were collected.

Sediment and elutriate samples were taken at four locations on August 12, 1988. The locations are shown on plate 2 of the main report and coincide exactly with the proposed dredging. All sediment samples were taken using a 48-inch coring device. The resulting cores were between 24 and 36 inches in length. At locations BT-3 and BT-4, no water was present and the soil was quite dry and compacted. Samples at these locations were taken using a shovel

and were from the upper 1 foot of the soil. All water samples taken for the purpose of preparing the elutriate samples were collected and handled in the manner described above. All sediment samples were placed on ice and shipped to the laboratory the same day that they were collected.

Grain size analyses were performed in accordance with U.S. Army Corps of Engineers, Engineer Manual 1110-2-1906, Appendix 5, November 1970. Chemical analyses were performed according to the "Standard Methods for the Examination of Water and Wastewater," 16th Edition, American Public Health Association, Washington, D.C., 1985. Elutriate samples were prepared by mixing 1 part sediment with 4 parts ambient water, shaking for 30 minutes, and allowing 4 hours to settle.

## RESULTS

Results of all field and laboratory analyses are presented in tables B-1 through B-4. Table B-1 lists the results of grain size analyses of samples collected on August 8, 1988. It is apparent from the results that the sediment is very fine grained throughout the backwater area. Table B-2 lists the results of all laboratory and field tests performed on ambient water samples. From the results it can be seen that D.O. and pH values were observed in 1988 as compared to 1987. This is to be expected given the climatic conditions experienced during this timeframe. Chlorophyll concentrations were high during both years, indicating that wide diurnal fluctuations in D.O. concentrations probably occurred.

Table B-3 lists the results of bulk sediment analyses performed on samples collected on August 12, 1988. As can be seen from the data, no contaminant was found in high concentrations, and most organic parameters were at or below detectable levels.

Table B-4 lists the results of elutriate analyses performed on samples collected on August 12, 1988. From the results it can be seen that the only parameters exhibiting concentrations significantly higher than ambient levels were ammonia-N and total zinc. While zinc concentrations from all samples were below the Iowa Department of Natural Resources general water quality standards, the ammonia-N concentration from station BT-3 exceeded the standard.

## CONCENTRATIONS

Based on field observations and analytical results, water quality within the project area appears adequate to support aquatic life during the majority of the time. During the summer there may be periods when D.O. approaches levels considered to be detrimental to certain fish species, especially during the early morning hours. During the winter there may be ice and snow conditions which, in combination with decaying organic matter, could develop into a "winter kill." Although this was not observed during the study period, the

abundance of aquatic vascular plants and lack of substantial flow through the backwater area make this a realistic possibility. Results from the analyses of sediment and elutriate samples show no excessive concentrations of contaminants when compared with existing regulatory criteria. It appears that no substantial water quality problems will result from either the removal of bottom material or from the discharge of water from a suitable retention facility given minimal settling times and allowance for mixing.

Table B1. Grain size anaylses.

| Location | Percent passing a #230 sieve (<0.062um) |
|---|---|
| BT-1 | 93.1 |
| BT-2 | 94.7 |
| BT-3 | 92.0 |
| BT-4 | 92.2 |

Table B2. Ambient water quality results, 1987 - 1988.

| Parameter | Date 6/8 | 6/22 | 7/6 | 7/20 | 8/10 | 8/24 | 9/8 | 9/21 | 6/25 | 7/2 | 7/9 | 7/20 | 7/30 | General Water Water Quality Criteria |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | 1240 | 1150 | 1200 | 1115 | 1215 | 1230 | 1215 | 1230 | 1800 | 1640 | 1320 | 1650 | 1500 | - |
| Water Depth (M) | 1.5 | 1.0 | 1.2 | 1.1 | 1.0 | 1.1 | 1.0 | 1.1 | 0.6 | 0.6 | 0.6 | 0.8 | 0.8 | - |
| Water Temp. (C) | 25.6 | 27.8 | 25.6 | 27.8 | 26.7 | 23.3 | 23.3 | 18.9 | 29.0 | 28.0 | 30.0 | 30.0 | 32.0 | - |
| D.O. (mg/l) | 9.0 | 5.9 | 6.4 | 8.4 | 9.1 | 6.8 | 7.9 | 8.2 | 10.8 | 10.6 | 6.9 | 8.5 | 10.2 | - |
| pH (units) | 8.0 | 7.3 | 7.1 | 7.9 | 7.5 | 7.0 | 7.4 | 7.2 | 8.5 | 8.5 | 8.4 | 8.9 | 8.6 | 4.0 * |
| Sp. Cond (umhos/cm) | 348 | 375 | 352 | 352 | 350 | 375 | 336 | 373 | 340 | - | - | 430 | 410 | - |
| Secchi Depth (m) | 0.3 | 0.4 | 0.6 | 0.4 | 0.6 | 0.5 | 0.6 | 0.6 | 0.3 | 0.1 | 0.1 | 0.3 | 0.3 | - |
| Turbidity (NTU) | - | - | - | - | - | - | - | - | - | 22 | 24 | 17 | - | - |
| Sus. Solids (mg/l) | 46 | 25 | 13 | 19 | 14 | 21 | 10 | 21 | 17 | - | 27 | - | - | - |
| Total solids (mg/l) | - | - | - | - | - | - | - | - | - | - | 320 | - | 330 | - |
| NO2+NO3 (mg/l NO3) | - | - | - | - | - | - | - | - | - | - | 0.2 | - | - | - |
| Ammonia-N (mg/l) | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | 5.0 ** |
| T. Phos (mg/l-P) | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | |
| Chl a (mg/cu M) | 94 | 32 | 26 | 13 | 28 | 34 | 18 | 19 | 31 | - | 19 | - | - | |
| Chl b (mg/cu M) | <4 | <2 | 4 | 2 | 4 | 3 | 2 | 1 | 6 | - | 5 | - | - | |
| Chl c (mg/cu M) | 14 | 3 | 3 | 2 | 6 | 5 | 1 | 1 | 31 | - | 4 | - | - | |
| Pheo a (mg/cu M) | 4 | 14 | 5 | 13 | <4 | 6 | 10 | 5 | <1 | - | 10 | - | - | |

* Dissolved oxygen concentration shall be at least 5.0 mg/l for 16 hours per day.
** Concentration shall not exceed 2.0 mg/l April through October.

Table B3. Bulk sediment analyses, August 12, 1988 (mg/kg).

| Parameter | Location BT-1 | BT-2 | BT-3 | BT-4 | U.S. EPA Region V Draft Sediment Criteria ** |
|---|---|---|---|---|---|
| Arsenic | 1.8 | 2.0 | 2.1 | 3.1 | <3 |
| Barium | 100 | 87 | 93 | 110 | <20 |
| Cadmium | <0.83 | <0.84 | <0.84 | <0.86 | - |
| Chromium | 14 | 13 | 12 | 12 | <25 |
| Copper | 11 | 11 | 11 | 11 | <25 |
| Lead | 7.3 | 6.6 | 6.9 | 7.6 | <40 |
| Mercury | <0.030 | <0.027 | <0.024 | <0.022 | <1.0 |
| Nickel | 15 | 15 | 15 | 16 | <20 |
| Selenium | <0.83 | <0.84 | <0.85 | <0.86 | - |
| Zinc | 67 | 72 | 70 | 74 | <90 |
| Ammonia Nitrogen | 22 | 18 | 49 | 57 | <75 |
| Total Volatile Solids | 3.3% | 2.3% | 3.0% | 17% | <5% |
| Total Solids | 50 | 39 | 47 | 43 | - |
| Oil and Grease | 86 | 160 | 79 | 170 | <1000 |
| TOC | 8700 | 14400 | 14500 | 14800 | - |
| Cyanide | <0.25 | <0.25 | 0.35 | <0.25 | <0.10 |
| Iron | 13400 | 11400 | 13300 | 14300 | <17000 |
| Manganese | 270 | 240 | 490 | 610 | <300 |
| Aldrin | <8.0* | <8.0* | <8.0* | <8.0* | - |
| Chlordane | <80 * | <80 * | <80 * | <80 * | - |
| DDD | <16 * | <16 * | <16 * | <16 * | - |
| DDE | <16 * | <16 * | <16 * | <16 * | - |
| DDT | <16 * | <16 * | <16 * | <16 * | - |
| Dieldrin | <16 * | <16 * | <16 * | <16 * | - |
| Endrin | <16 * | <16 * | <16 * | <16 * | - |
| Heptachlor | <8.0* | <8.0* | <8.0* | <8.0* | - |
| Heptachlor Epoxide | <8.0* | <8.0* | <8.0* | <8.0* | - |
| Lindane | <8.0* | <8.0* | <8.0* | <8.0* | - |
| Methoxychlor | <80 * | <80 * | <80 * | <80 * | - |
| Toxaphene | <160* | <160* | <160* | <160* | - |
| 2,4-D | - * | - * | - * | - * | - |
| 2,4,5-TP | - * | - * | - * | - * | - |
| Total PCB's | <160* | <160* | <160* | <160* | - |

* Microgram per kilogram (ppb).
** Values listed are classified as "nonpolluted".

Table B4. Elutriate test results, August 12, 1988 (mg/l).

| Parameter | Location | | | | Ambient water | General Water Quality Criteria |
|---|---|---|---|---|---|---|
| | BT-1 | BT-2 | BT-3 | BT-4 | BT-2 | |
| Arsenic (Total) | <0.003 | 0.004 | <0.003 | <0.003 | 0.006 | 0.1 |
| Barium (Total) | 0.09 | 0.21 | 0.12 | 0.05 | 0.08 | 1.0 |
| Cadmium (Total) | <0.005 | 0.07 | <0.005 | <0.005 | <0.005 | 0.01 |
| Chromium (Total) | <0.009 | 0.09 | 0.01 | 0.01 | 0.01 | 0.05 |
| Copper (Total) | 0.01 | 0.08 | 0.02 | <0.009 | <0.009 | 0.02 |
| Lead (Total) | 0.001 | 0.008 | 0.005 | <0.001 | 0.004 | 0.1 |
| Mercury (Total) | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.05 * |
| Nickel (Total) | <0.025 | 0.18 | <0.025 | <0.025 | <0.0025 | - |
| Selenium (Total) | <0.005 | <0.005 | <0.002 | <0.002 | <0.005 | 0.1 |
| Zinc (Total) | 0.03 | 0.37 | 0.45 | 0.03 | 0.01 | 1.0 |
| Ammonia-N | 3.2 | 2.9 | 7.0 | 1.7 | 0.13 | 5.0 ** |
| Total Vol Solids | 400 | 200 | 400 | 200 | 200 | - |
| Total Solids | 4200 | 9400 | 1600 | 600 | 400 | - |
| Oil and Grease | 2.0 | 5.0 | <2.0 | <2.0 | 0.8 | - |
| TOC | 18 | 31 | 29 | 36 | 14 | - |
| Cyanide | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | - |
| Iron | 0.16 | 6.9 | 0.46 | <0.05 | 1.1 | - |
| Manganese | 0.87 | 1.9 | 2.4 | 0.59 | 0.40 | - |
| Aldrin | <0.25* | <0.25* | <0.25* | <0.25* | <0.05* | - |
| Chlordane | <2.5 * | <2.5 * | <2.5 * | <2.5 * | <0.50* | - |
| DDD | <0.50* | <0.50* | <0.50* | <0.50* | <0.10* | - |
| DDE | <0.50* | <0.50* | <0.50* | <0.50* | <0.10* | - |
| DDT | <0.50* | <0.50* | <0.50* | <0.50* | <0.10* | - |
| Dieldrin | <0.50* | <0.50* | <0.50* | <0.50* | <0.10* | - |
| Endrin | <0.50* | <0.50* | <0.50* | <0.50* | <0.10* | - |
| Heptachlor | <0.25* | <0.25* | <0.25* | <0.25* | <0.05* | - |
| Heptachlor Epoxide | <0.25* | <0.25* | <0.25* | <0.25* | <0.05* | - |
| Lindane | <0.25* | <0.25* | <0.25* | <0.25* | <0.05* | - |
| Methoxychlor | <2.5 * | <2.5 * | <2.5 * | <2.5 * | <0.50* | - |
| Toxaphene | <5.0 * | <5.0 * | <5.0 * | <5.0 * | <1.0 * | - |
| 2,4-D | - * | - * | - * | - * | - * | - |
| 2,4,5-TP | - * | - * | - * | - * | - * | - |
| Total PCB's | <5.0 * | <5.0 * | <5.0 * | <5.0 * | <1.0 * | - |

* Micrograms per liter.
** 5.0 mg/l November through March, 2.0 mg/l April through October.

# GEOTECHNICAL CONSIDERATIONS

APPENDIX C

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT (R-5)

BIG TIMBER REHABILITATION AND ENHANCEMENT
POOL 17, MISSISSIPPI RIVER MILE 444
LOUISA COUNTY, IOWA

APPENDIX C
GEOTECHNICAL CONSIDERATIONS

TABLE OF CONTENTS



## List of Plates

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT (R-5)

BIG TIMBER REHABILITATION AND ENHANCEMENT
POOL 17, MISSISSIPPI RIVER MILE 444
LOUISA COUNTY, IOWA

APPENDIX C
GEOTECHNICAL CONSIDERATIONS

## LOCATION

The Big Timber area, part of the Mark Twain National Wildlife Refuge, is located 8 miles south of Muscatine, Port Louisa Township, Louisa County, Iowa, between river miles 443 and 446. The project site is just north of Muscatine Slough and south of Great Sand Mound, a remnant river terrace 30 to 40 feet above the floodplain. The site is positioned in the Alluvial Plains division of the Dissected Till Plain section of the Central Lowlands Physiographic Province (Udden 1901) (Prior 1976).

## PHYSIOGRAPHY

Big Timber, a low-level area adjacent to the Mississippi River channel, is covered with alluvium. The landscape of the floodplain is elongated and relatively flat, with elevations between 537-545 MSL (Mean Sea Level). These floodplains have characteristic ridges and swales which mark meanders or migrations of the river channel. To the north and west of the Cleona Channel, the river channel was diverted by glacial ice to the river's present course during the Illinoian glacial stage (Udden 1899) (Hanson 1972) (Bettis 1987). Below Lock and Dam 16, Muscatine, Iowa, the river course turns south and flows in a broad alluvial valley with a wide floodplain of about 5 miles. Upstream from Lock and Dam 16 the river flows in a narrower, confined channel about 1 to 2 miles wide with little or no floodplain. This area is called the "upper narrows". Major valley entrenchment, on the order of 100 feet or more in depth, took place between 60,000 and 100,000 years ago (Bettis 1987). During that interval, the valleys were cut to the present bedrock floors. The major period of valley filling began about 35,000 years ago. Dissected bluffs rise to over 750 feet MSL on the sides of this broad alluvial valley.

## STRATIGRAPHY

The upland areas are capped by varying thicknesses of Wisconsinan stage loess (see geologic column on plate C-1), underlain by unconsolidated glacial tills of the pre-Illinoian stages (Willman 1970). Beneath the tills lie

Pennsylvanian age shales and sandstones. Slopes of the bluffs tend to be unstable, and slumps and landslides occur both within the Pennsylvanian age shales and the glacial tills.

Within the river valley are Holocene and Pleistocene age deposits, underlain by Devonian age bedrock (Anderson 1983). The Holocene-Pleistocene alluvium, the Cahokia alluvium, forms a broad, level terrace consisting of silt, clay, and clayey sand with fragments of wood and shells. Under the alluvium is the Mackinaw member of the Henry formation. These valley train deposits consist of well-graded coarse to fine sands and gravels deposited by the retreating Wisconsinan glaciers (Willman 1970). The deposits are usually evenly bedded and are more uniform in texture.

The Henry formation is underlain by Devonian age shales and limestones. Bedrock elevation is about 600 feet MSL according to the bedrock topographic map of southeast Iowa. Eight miles upstream from the project site at Lock and Dam 16, Muscatine, Iowa, the bedrock consists of the Wapsipinicon group of Middle Devonian age. The rock type is fine-grained sublithologic limestone, and is 10 to 20 feet below the surface. Six miles downstream from the project site, at Lock and Dam 17, New Boston, Illinois, the bedrock consists of Grassy Creek and Sweetland Creek formations of Upper Devonian age. These rocks are thinly bedded shales and lie deeper under the valley deposits than they do at Lock and Dam 16. At Lock and Dam 17 borings down to 460 MSL have not encountered bedrock.

## MINERAL RESOURCES

The unconsolidated deposits of sand and gravel which underlie the floodplains and terraces are one of Iowa's largest and most important natural resources. The deposits yield road construction and maintenance materials and sources of shallow ground water supplies. There are no quarrying operations close enough to affect the project area.

## SCOPE OF WORK

An outline of the dredge cut in plan view can be seen on plate 2 of the main report. The width of the cut will be 50 feet. Initially, hydraulic dredging will be implemented for the first 4 feet in depth of material. An exception to this is a downstream reach which will be hydraulically dredged for 7.5 feet. This is a 1,200-foot-long cut through Round Pond. Hydraulically dredged material will be placed at the site shown on plate 2 of the main report.

An additional 4 feet in depth will be mechanically excavated and the material used to form check dams for trapping sediment. Material also will be placed along the bank.

## SUBSURFACE EXPLORATIONS AND SOIL TESTS

A total of nine (9) borings were taken in the Big Timber project area. Borings were drilled with a 4-inch Iwan hand auger up to 9 feet deep. Access to part of the area is limited by surface water. In the areas where surface water existed, a 2-inch sand tube was used to extend the hole up to an additional 5 feet. Samples in all borings were taken at 2-foot intervals of depth or at visual changes of material. Boring logs and their locations can be seen on plate 6 of the main report.

Laboratory soil tests were performed by Rock Island District Geotechnical Branch staff. The moisture content was determined for each sample as well as Atterberg Limits for boring BT-88-8. Visual classifications were performed on all samples.

## CHECK DAM EMBANKMENT

The proposed check dam embankment will be constructed of impervious to semi-impervious materials obtained by mechanical dredging. The check dams will be used to trap sediment from river flooding and are strategically placed as such. A location plan of check dams can be seen on plate 2 of the main report.

The check dams will be composed largely of fat clays (CH) intermixed with sandy lean clay (CL) and coarse to fine sand (SP). The moisture content of these soils is as high as 88 percent. Because the dams will be placed on a soft foundation, a displaced section will probably occur. Although no specific embankment section is required, the contractor should build the check dams as tall and with as steep slopes as possible while maintaining a stable embankment condition.

## CONTAINMENT DIKE EMBANKMENT

The proposed containment dike for dredge placement will be 3 feet high and constructed of impervious material excavated from the proposed dredge placement site shown on plate 2 of the main report. Embankment material is a medium to fat clay (CH) with a similar soft foundation. The moisture content ranges up to 40 percent. A liquid limit of 52 and a plastic limit of 23 resulted from the Atterberg Limits test. The contractor should try to achieve a section with 1V on 3H side slopes and a 5-foot crown width. A typical section can be seen on plate 7 of the main report.

## OTHER EMBANKMENTS

Material obtained from mechanical dredging will be sidecast along the bank for most of the project reach as shown on plate 8 of the main report. The classification of the dredged material used to build the embankment is described previously under the section "Check Dam Embankment." Although no specific embankment section is required, the contractor should build the embankment no more than 3 feet high and as wide as possible.

## FOUNDATION FOR EMBANKMENTS

The proposed containment dike and check dam foundations were investigated by several hand auger borings, most of them terminating in sand (SP). None of the borings extended to bedrock. The entire area within the project limits is composed of a medium to fat clay (CH, CL-CH) top stratum 3 to 10 feet deep, slightly organic in limited areas (CH-OH), and a sandy lean clay (CL) substratum 2 to 3 feet deep underlain by coarse to fine sand. Borings BT-88-1, 2, 3, 8, 9 are the borings taken within the project limits and the only borings considered for this appendix. Borings BT-88-4 through 7 will be shown but will not be discussed as they are not within the project limits.

The foundation for the containment dike and dredge placement is represented in boring BT-88-8. The foundation consists of a 3.5-foot top stratum of medium clay (CL-CH) with a moisture content of 31 percent and liquid and plastic limits of 52 and 23 percent, respectively. The substratum is a fat clay (CH) with a moisture content of 36 to 40 percent and liquid and plastic limits of 57 and 23 percent, respectively. Groundwater was found to be 3 feet below the ground surface.

The bearing capacity of the containment dike foundation was analyzed according to EM 1110-2-5008 "Design and Construction of Retaining Dikes for Containment of Dredged Material." This analysis is shown on plate C-2. The factor of safety determined for the top stratum is 3.33 and the factor of safety for the substratum is 1.77. Both factors of safety are greater than the 1.0 minimum required. The foundation is expected to support the containment dike and dredge placement based on this analysis.

Borings BT-88-2, 3, and 9 represent soils in the areas where check dams will be placed. Surface water exists .5 to 2 feet deep followed by 2.5 to 8 feet of fat clay (CH), which was found to be slightly organic (CH-OH) in the area of boring BT-88-3. Moisture content ranged from 39 to 84 percent within the top stratum. Borings BT-88-2 and 3 have a 1.5- to 2-foot sandy lean clay substratum followed by coarse to fine sand. Boring BT-88-9 indicates a 2-foot substratum of fat clay, slightly organic (CH-OH) with a moisture content of 100 percent.

Preparation of the foundation for the containment dike will require clearing and grubbing. Clearing involves complete removal of all above ground matter that may interfere with the construction and/or integrity of the dike. Grubbing consists of the removal of below ground matter that may interfere with the construction and/or integrity of the dike. Stripping is not normally required on soft, wet foundations.

Generalized Geologic Column for the Big Timber Area

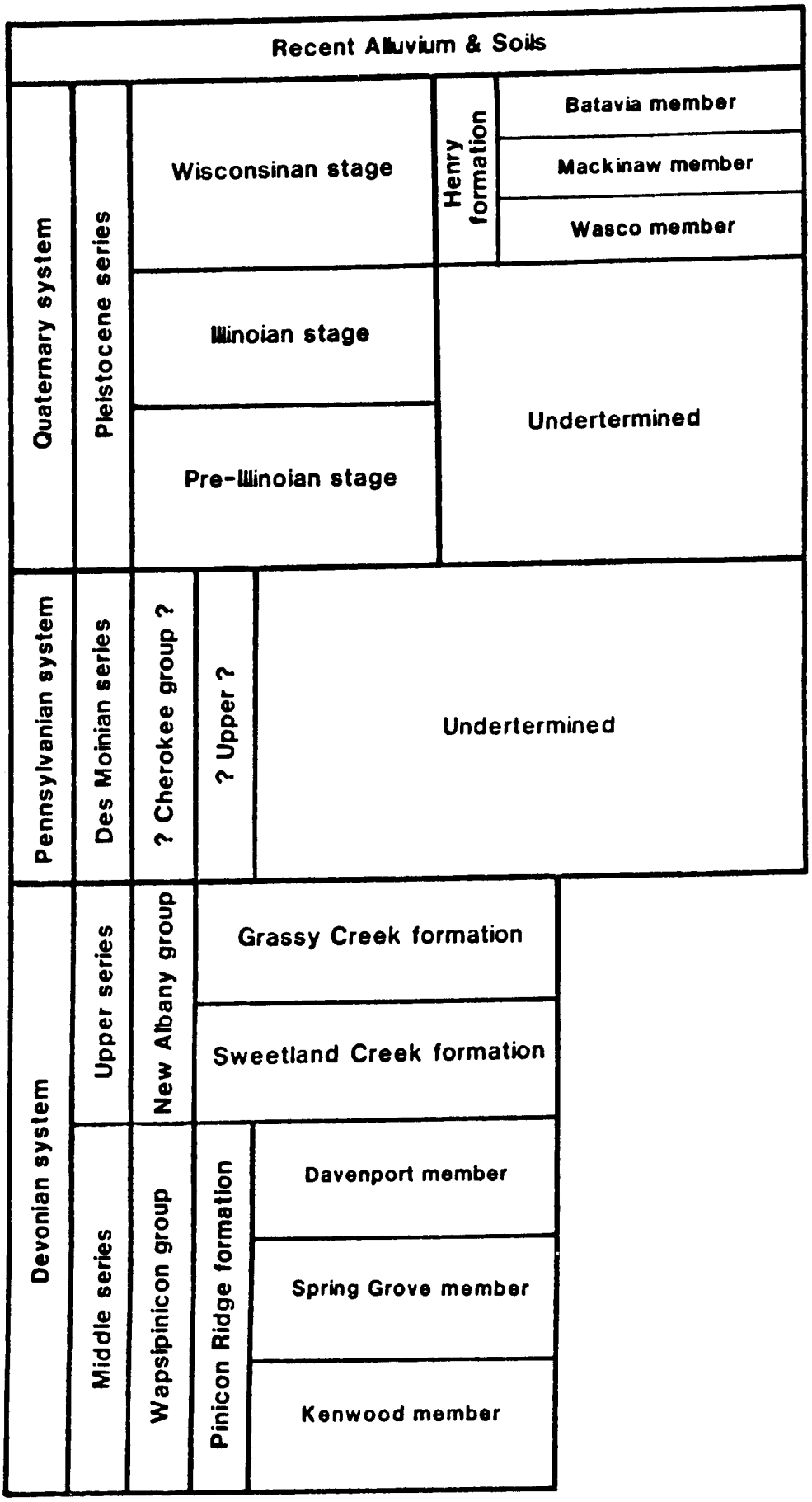
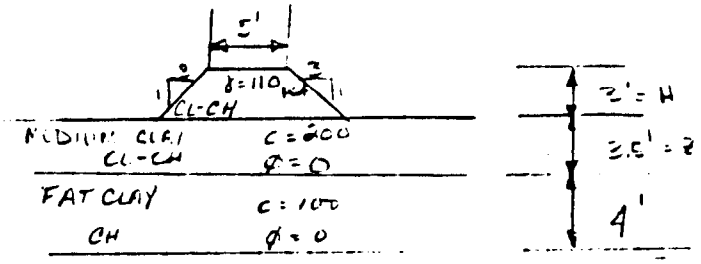



PLATE C-1

| Subject | | Date |
|---|---|---|
| CIG TIMBER RETAINING CAPACITY ANALYSIS | | 6/6/88 |
| Computed by | Checked by | Sheet of |
| RL. | | |

## CONTAINMENT DIKE

* SOIL DATA TAKEN FROM B-81-S




### Ultimate Bearing Capacity of the Two Clay Strata

Upper Clay: $q_d = 5.5c = 5.5(200) = 1100$ psf

Lower Clay: $q_d = 5.5c = 5.5(100) = 550$ psf

### Pressure @ Top of Upper Clay

$q = \gamma H = 110(3) = 330$ psf

$z = 3.5$

$b = 5/2 = 2.5'$

$a = 1/\text{SLOPE} \times H = 1/3 \times 3 = 9$

$a/z = 9/3.5 = 2.6$

$b/z = 2.5/3.5 = .71$

FROM INFLUENCE CHART PLATE

$I = .47$

$I_q = 2(.47) = .94$

$q_z = I_q(q) = .94(330) = 310$ psf

### Factor of Safety

Upper Layer: $FS = q_d/q = 1100/330 = 3.33 > 1$ OK

Lower Layer: $FS = q_d/q = 550/310 = 1.77 > 1$ OK

∴ EMBANKMENT APPEARS TO BE STABLE

# CLEAN WATER ACT
# SECTION 404(b)(1) EVALUATION

A

P

P

E

N

D

I

X

D

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT (R-5)

BIG TIMBER REHABILITATION AND ENHANCEMENT
POOL 17, MISSISSIPPI RIVER MILE 444
LOUISA COUNTY, IOWA

APPENDIX D
CLEAN WATER ACT
SECTION 404(b)(1) EVALUATION

TABLE OF CONTENTS

## List of Tables

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT (R-5)

BIG TIMBER REHABILITATION AND ENHANCEMENT
POOL 17, MISSISSIPPI RIVER MILE 444
LOUISA COUNTY, IOWA

APPENDIX D
CLEAN WATER ACT
SECTION 404(b)(1) EVALUATION

## SECTION 1 - PROJECT DESCRIPTION

### LOCATION

The proposed project is located at approximate Mississippi River mile 443R, Louisa County, Iowa, within the Louisa Unit of the Mark Twain National Wildlife Refuge, about 5.5 miles upstream of Lock and Dam 17 (see plate 1 of the main report).

### GENERAL DESCRIPTION

The proposed project involves backwater rehabilitation by dredging and pothole excavation. Dredging will be performed to provide both deep and shallow water habitat. Deep water areas will provide summer and winter fish refugia, while shallow water areas are anticipated to benefit waterfowl through wetland improvement, as well as providing spawning or brooding areas for fish. Materials to be dredged or excavated are primarily fine sediments and will be moved by clamshell dredge, hydraulic cutterhead dredge, and bulldozer. At this time, it is also proposed to construct potholes within shrub willow areas by explosive charge. See plate 2 of the main report for project details.

Disposal of dredged and excavated material will occur as represented by dike/levee construction and the disposal area noted on plate 2 of the main report. A total of approximately 84 acres will be used for dike construction and disposal.

### AUTHORITY AND PURPOSE

The authority for this action is provided by the 1985 Supplemental Appropriations Act (Public Law 99-88), and Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662). Section 1103 is summarized in the Definite Project Report.

The purpose of this project, under Section 1103, is "to ensure the coordinated development and enhancement of the Upper Mississippi River (UMR)". The project is the result of a planning effort undertaken by the State of Iowa, the U.S. Fish and Wildlife Service (USFWS), and the U.S. Army Corps of Engineers.

## GENERAL DESCRIPTION OF DREDGED AND FILL MATERIAL

Materials to be dredged consist primarily of fine sediments accreted in backwater sloughs within the Big Timber Division of the Mark Twain National Wildlife Refuge, between UMR river miles 443 and 446. Typically these sediments are transported through normal fluvial processes and deposited in slack water areas throughout the pooled portions of the UMR. Sediment samples were taken during August 1988, and analysis results are presented in Table 2, Bulk Sediment Analyses, and Table 3, Elutriate Test Results. Fill material will be generated on-site as the containment basin dikes are constructed of bottomland soils bulldozed and compacted to the elevations portrayed on plate 8 of the main report.

## DESCRIPTION OF THE PROPOSED DISCHARGE SITES

The proposed discharge sites consist of bottomland forest and willow shrub/sapling thickets where containment dikes will be constructed and hydraulically transported dredged material will be placed. (Reference Section 9, Environmental Effects of the main report.) Much of the area proposed for contained disposal displays typical bottomland vegetation associated with the silver maple-elm forest type. The understory is dominated by nettle, poison ivy, and impatiens species. At the slough-forest edge and in forest openings, canary grass, cutgrass, and cucumber vine tend to dominate. In the upper end of Big Denny Slough, portions of Round Pond, and in other sediment-filled wetland areas, willow thickets have replaced arrowhead-dominated shallows.

## DESCRIPTION OF DISPOSAL METHOD

Hydraulically dredged material will be piped into the containment basin shown on plate 2 of the main report. This area is approximately 73 acres in size and will provide roughly 28 hours of settling time to meet effluent requirements of the State of Iowa.

Mechanically excavated material will be sidecast as represented on plate 8 of the main report. These areas are the forest-shore borders along the dredge cut. Sidecasting will be performed in a manner which minimizes disturbance to the dredged sediment. By carefully placing the material, as opposed to dropping the material, structural stability can be maintained.

## SECTION 2 - FACTUAL DETERMINATIONS

### PHYSICAL SUBSTRATE DETERMINATIONS

Soil borings were taken during the summer of 1988. Results of these borings are shown on plate 7 of the main report. The soils and aquatic substrates found throughout the project area are alluvial soils typical to the Midwest.

### WATER CIRCULATION, FLUCTUATION, AND SALINITY DETERMINATIONS

Water. The proposed project is intended to restore lentic backwater habitat lost to sedimentation. A combination of both deep (8 to 10 feet) and shallow (1 to 3 feet) aquatic habitat will be provided. During early August 1988, Big Denny Slough was observed to be dry, with much of the project area having less than 3 feet of water present. A narrow channel of open remained, running from Little Denny Slough to Round Pond.

Water and sediment samples were taken in August 1988. These samples were analyzed for ambient water, bulk sediment, and elutriate parameters and were compared to Iowa water quality standards. Sample sites were located along the proposed dredge channel route in Big Denny, Little Denny, the unnamed marsh area, and Round Pond. Results are displayed in tables D-1, D-2, and D-3.

Iowa does not have sediment quality standards; therefore, sediment quality was evaluated using the 1977 U.S. EPA publication entitled Guidelines for the Pollutional Classification of Great Lakes Sediment. This publication classified a sediment as being "nonpolluted," "moderately polluted," or "heavily polluted," depending on the concentration of selected parameters in the sediment. Table D-4 lists the parameters studied in the U.S. EPA publication and their classification scheme.

Current Patterns and Circulation. Current patterns in the project area are seasonal and vary with river stages or discharges. During non-flood events, current patterns are typical of shallow, pond-type systems. A certain amount of circulation is achieved through wind patterns and flow exchange with adjacent waters in Coolegar Slough. During flood events, flows are carried overland through the project area, and current patterns follow those of the main channel.

Implementation of the proposed project is anticipated to improve flow exchange between the noted backwaters and Coolegar Slough. Also, the proposed dike work will result in protection from direct overland flows occurring on a 2-year flood frequency. Floodwater will be diverted toward the river, but not prevented from entering the project area from the opening to Coolegar Slough.

It is anticipated that, by deflecting direct overland flow, the sedimentation rate in the dredged areas will be reduced.

Normal Water Level Fluctuations. Normal fluctuations occur as a result of discharge changes and the response rate of the lock and dam system. Ordinarily, daily fluctuations are limited to .5 foot over or under an established pool elevation at each dam. Seasonal fluctuations widely vary with weather conditions in the UMR watershed.

The proposed project will have no effect on normal river stages or flood heights.

Salinity Gradients. The UMR is an inland freshwater system, therefore salinity was not considered.

Actions Taken To Minimize Impacts. The use of chemically stable materials, dredged material containment basin design, and physical stabilization of disposed material by revegetation are actions intended to reduce impacts to the riverine system. The project purpose is to regain habitats impacted by sedimentation in the riverine system.

SUSPENDED PARTICULATE/TURBIDITY DETERMINATIONS

Due to the isolation of most of the project area from flowing water, suspended particulates and turbidity elevations from dredging will be limited to the immediate location of the dredge.

The containment basin for hydraulically dredged material placement will be approximately 73 acres of size, and, as currently proposed, will have a retention time of about 28 hours. This retention time is required to achieve water quality standards for the State of Iowa.

TABLE D-1

Ambient Water Quality Results, 1987 - 1988

| Parameter | Date | | | | | | | | | | | | | General Water Water Quality Criteria |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6/8 | 6/22 | 7/6 | 7/20 | 8/10 | 8/24 | 9/8 | 9/21 | 6/25 | 7/2 | 7/9 | 7/20 | 7/30 | |
| Time | 1240 | 1150 | 1200 | 1115 | 1215 | 1230 | 1215 | 1230 | 1800 | 1640 | 1320 | 1650 | 1500 | - |
| Water Depth (M) | 1.5 | 1.0 | 1.2 | 1.1 | 1.0 | 1.1 | 1.0 | 1.1 | 0.6 | 0.6 | 0.6 | 0.8 | 0.8 | - |
| Water Temp. (C) | 25.6 | 27.8 | 25.6 | 27.8 | 26.7 | 23.3 | 23.3 | 18.9 | 29.0 | 28.0 | 30.0 | 30.0 | 32.0 | - |
| D.O. (mg/1) | 9.0 | 5.9 | 6.4 | 8.4 | 9.1 | 6.8 | 7.9 | 8.2 | 10.8 | 10.6 | 6.9 | 8.5 | 10.2 | - |
| pH (units) | 8.0 | 7.3 | 7.1 | 7.9 | 7.5 | 7.0 | 7.4 | 7.2 | 8.5 | 8.5 | 8.4 | 8.9 | 8.6 | 4.0* |
| Sp. Cond (umhos/cm) | 348 | 375 | 352 | 352 | 350 | 375 | 336 | 373 | 340 | - | - | 430 | 410 | - |
| Secchi Depth (m) | 0.3 | 0.4 | 0.6 | 0.4 | 0.6 | 0.5 | 0.6 | 0.6 | 0.3 | 0.1 | 0.1 | 0.3 | 0.3 | - |
| Turbidity (NTU) | - | - | - | - | - | - | - | - | - | 22 | 24 | 17 | - | - |
| Sus. Solids (mg/1) | 46 | 25 | 13 | 19 | 14 | 21 | 10 | 21 | 17 | - | 27 | - | - | - |
| Total solids (mg/1) | - | - | - | - | - | - | - | - | - | - | 320 | - | 330 | - |
| NO2+NO3 (mg/1 NO3) | - | - | - | - | - | - | - | - | - | - | 0.2 | - | - | - |
| Ammonia-N (mg/1) | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | 5.0** |
| T. Phos (mg/1-P) | - | - | - | - | - | - | - | - | - | - | 0.1 | - | - | |
| Chl a (mg/cu M) | 94 | 32 | 26 | 13 | 28 | 34 | 18 | 19 | 31 | - | 19 | - | - | |
| Chl b (mg/cu M) | <4 | <2 | 4 | 2 | 4 | 3 | 2 | 1 | 6 | - | 5 | - | - | |
| Chl c (mg/cu M) | 14 | 3 | 3 | 2 | 6 | 5 | 1 | 1 | 31 | - | 4 | - | - | |
| Pheo a (mg/cu M) | 4 | 14 | 5 | 13 | <4 | 6 | 10 | 5 | <1 | - | 10 | - | - | |

(Pheophytin a

* Dissolved oxygen concentration shall be at least 5.0 mg/1 for 16 hours per day.

** Concentration shall not exceed 2.0 mg/1 April through October.

TABLE D-3

Elutriate Test Results, August 12, 1988 (mg/1)

| Parameter | Location | | | | Ambient Water | General Water Quality Criteria |
|---|---|---|---|---|---|---|
| | BT-1 | BT-2 | BT-3 | BT-4 | BT-2 | |
| Arsenic (Total) | <0.003 | 0.004 | <0.003 | <0.003 | 0.006 | 0.1 |
| Barium (Total) | 0.09 | 0.21 | 0.12 | 0.05 | 0.08 | 1.0 |
| Cadmium (Total) | <0.005 | 0.07 | <0.005 | <0.005 | <0.005 | 0.01 |
| Chromium (Total) | <0.009 | 0.09 | 0.01 | 0.01 | 0.01 | 0.05 |
| Copper (Total) | 0.01 | 0.08 | 0.02 | <0.009 | <0.009 | 0.02 |
| Lead (Total) | 0.001 | 0.008 | 0.005 | <0.001 | 0.004 | 0.1 |
| Mercury (Total) | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.05 * |
| Nickel (Total) | <0.025 | 0.18 | <0.025 | <0.025 | <0.0025 | - |
| Selenium (Total) | <0.005 | <0.005 | <0.002 | <0.002 | <0.005 | 0.1 |
| Zinc (Total) | 0.03 | 0.37 | 0.45 | 0.03 | 0.01 | 1.0 |
| Ammonia-N | 3.2 | 2.9 | 7.0 | 1.7 | 0.13 | 5.0 ** |
| Total Vol Solids | 400 | 200 | 400 | 200 | 200 | - |
| Total Solids | 4200 | 9400 | 1600 | 600 | 400 | - |
| Oil and Grease | 2.0 | 5.0 | <2.0 | <2.0 | 0.8 | - |
| TOC | 18 | 31 | 29 | 36 | 14 | - |
| Cyanide | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | - |
| Iron | 0.16 | 6.9 | 0.46 | <0.05 | 1.1 | - |
| Manganese | 0.87 | 1.9 | 2.4 | 0.59 | 0.40 | - |
| Aldrin | <0.25* | <0.25* | <0.25* | <0.25* | <0.05* | - |
| Chlordane | <2.5 * | <2.5 * | <2.5 * | <2.5 * | <0.50* | - |
| DDD | <0.50* | <0.50* | <0.50* | <0.50* | <0.10* | - |
| DDE | <0.50* | <0.50* | <0.50* | <0.50* | <0.10* | - |
| DDT | <0.50* | <0.50* | <0.50* | <0.50* | <0.10* | - |
| Dieldrin | <0.50* | <0.50* | <0.50* | <0.50* | <0.10* | - |
| Endrin | <0.50* | <0.50* | <0.50* | <0.50* | <0.10* | - |
| Heptachlor | <0.25* | <0.25* | <0.25* | <0.25* | <0.05* | - |
| Heptachlor Epoxide | <0.25* | <0.25* | <0.25* | <0.25* | <0.05* | - |
| Lindane | <0.25* | <0.25* | <0.25* | <0.25* | <0.05* | - |
| Methoxychlor | <2.5 * | <2.5 * | <2.5 * | <2.5 * | <0.50* | - |
| Toxaphene | <5.0 * | <5.0 * | <5.0 * | <5.0 * | <1.0 * | - |
| 2, 4-D | - * | - * | - * | - * | - * | - |
| 2, 4, 5-TP | - * | - * | - * | - * | - * | - |
| Total PCB's | <5.0 * | <5.0 * | <5.0 * | <5.0 * | <1.0 * | - |

* Micrograms per liter.
** 5.0 mg/1 November through March, 2.0 mg/1 April through October.

TABLE D-4

U.S. EPA Guidelines for the Pollutional Classification of Great Lakes Harbor Sediment
(in mg/kg dry weight)

| Parameter | Nonpolluted | Moderately Polluted | Heavily Polluted |
|---|---|---|---|
| Ammonia Nitrogen | <75 | 75-200 | >200 |
| Arsenic | <3 | 3-8 | >8 |
| Barium | <20 | 20-60 | >60 |
| Cadmium | * | * | >6 |
| Chromiumn | <25 | 25-75 | >75 |
| Copper | <25 | 25-50 | >50 |
| Cyanide | <0.10 | 0.10-0.25 | <0.25 |
| Lead | <40 | 40-60 | >60 |
| Mercury ** | - | - | - |
| Nickel | <20 | 20-50 | >50 |
| Oil and Grease | <1000 | 1,000-2,000 | >2,000 |
| PCBs ** | - | - | - |
| Total Volatile *** Residue | <5 | 5-8 | >8 |
| Zinc | <90 | 90-200 | >200 |

* Lower limits not established for cadmium

** If the concentrations of mercury or total PCBs are greater than or equal to 1 mg/kg or 10 mg/kg, respectively, the sediment is classified as polluted

*** Total volatile residue is expressed as a percent

## CONTAMINANT DETERMINATIONS

No dredged material contaminants have been identified which require special handling or treatment beyond that currently proposed for the project. Of five elutriate samples analyzed, only one contained ammonia nitrogen concentrations in excess of the state water quality standard. However, because dredged effluent will be discharged to the Mississippi River, dilution will be quite rapid and a very small mixing zone will be adequate to ensure compliance with the state standard.

Contaminants identified from elutriate and bulk sediment analysis are generally part of the modern riverine system and are commonly suspended, transported, and deposited through normal fluvial processes in the Mississippi River.

## AQUATIC ECOSYSTEM AND ORGANISM DETERMINATIONS

Review and consideration of 40 CFR, Section 230, Subparts D, E, F, and G involved analysis of the following effects:

A. Effects on Plankton.
B. Effect on Benthos.
C. Effects on Nekton.
D. Effects on Aquatic Food Web (refer to Section 230.31)
E. Effects on Special Aquatic Sites Found in Project Area or Disposal Site.

   (1) Sanctuaries and Refuge (refer to Section 230.40)
   (2) Wetlands (refer to Section 230.41)
   (3) Mud Flats (refer to Section 230.42)
   (4) Vegetated Shallows (refer to Section 230.43)
   (5) Coral Reefs (not found in Project Area)
   (6) Riffle and Pool Complexes (refer to Section 230.45)
   were not considered for this project.

F. Threatened and Endangered Species (refer to Section 230.0)
G. Other Wildlife (refer to Section 230.32)

The effects on A through E above are anticipated to be of overall benefit. The purpose of the project is to restore aquatic habitat lost to sedimentation. Dredging will recreate deep and shallow water habitat, resulting in increased diversity in plankton, benthos, and the aquatic food web in the project area. Nekton, primarily fish, will benefit from increased available habitats.

E (1) through (4) are found in the project area. The project site is part of the Mark Twain National Wildlife and Fish Refuge (MTNWFR). Refuge

compatibility is a project planning requirement for actions taken on the MTNWFR. The project was coordinated with MTNWFR staff and has been found to be compatible with Refuge objectives. Reference the FWS Coordination Act Report found in Appendix F - Correspondence.

Corps wetland regulatory jurisdiction applies to the project site, as the three-point (soils, vegetation, and hydrology) wetland analysis reveals the entire project area to be an adjacent wetland to the Mississippi River.

In the project area, existing wetland types include palustrine forested (silver maple-elm association forest), emergent (cattail, arrowhead, and lotus vegetated shallows), and mudflats (shorelines or dried shallow aquatic areas).

Direct impacts from dredged material placement and minor elevation changes will alter the composition of the palustrine forested wetlands in the containment area.

Endangered species for the project area include the bald eagle and the Higgins' eye pearly mussel. State-listed species, besides the preceding, are not anticipated to occur in the project area, unless as transients, and are not expected to be affected beyond disruption of travel patterns. Also reference Section 3 of the main report for further discussion of endangered species. Due to the location, timing, and nature of the proposed project, the project is anticipated to have no effect on either State or federally listed endangered species. This determination is supported by both the State of Iowa and the USFWS.

Other wildlife in the project area includes both game and non-game species such as white-tailed deer, squirrel, waterfowl, numerous songbirds, small mammals, and furbearers. The proposed project is anticipated to contribute to overall habitat diversity in the project area, and thus will be of benefit to most species currently found in the project area.

Through the planning, coordination, and design process, wetland impacts were considered and minimized to the extent possible. The proposed project will include low cutoff berms which will serve to deflect a portion of direct overland flood flows. This is anticipated to reduce sediment input to the remaining wetland areas.

## PROPOSED DISPOSAL SITE DETERMINATIONS

The proposed disposal site for hydraulically dredged material, shown on plate 2 of the main report, is considered to be a palustrine forested wetland. The area currently supports medium-aged silver maple association forest, with shagbark hickory, pin oak, and other oak species on higher elevations within the disposal area. As currently planned, disposal is not anticipated to significantly affect mast-producing trees in the disposal area. The disposal site is approximately 73 acres in size and is expected to accommodate from 1 to 4 feet of dredged material, depending on elevation, over the entire area. Ground cover and the shrub layer in the disposal area consists of nettle,

poison ivy, impatiens spp., smartweed, buttonbush, greenbriar, bidens, and marsh aster. Following disposal, it is anticipated that mast trees on the higher elevations will survive to reseed the areas where silver maple and elm were lost to disposal.

Material which is mechanically dredged will be placed along the channel cut as shown on plate 2 of the main report.

DETERMINATION OF CUMULATIVE EFFECTS ON THE AQUATIC ECOSYSTEM

The primary purpose of this project is to restore aquatic habitat lost to sedimentation since construction of the lock and dam system (Nine-Foot Channel Project) on the UMR. The project is intended to provide deep aquatic habitat during critical seasonal conditions along with shallow spawning and brooding habitat. Cutoff berms or levees are intended to reduce direct sediment input during flood events, thereby extending the life of the project and the project area as aquatic habitat.

DETERMINATION OF SECONDARY EFFECTS ON THE AQUATIC ECOSYSTEM

The project dredged areas will serve as sediment traps during extreme high flow periods and may reduce sediment input to the Round Pond and Coolegar Slough area.

## SECTION 3 - FINDINGS OF COMPLIANCE OR NONCOMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE

1. No significant adaptations of the guidelines were made relating to this evaluation.

2. Evaluation of Practicable Alternatives. Alternatives which were considered in addition to the proposed action were as follows:

A. No Federal Action. This alternative was not chosen due to nonresponse to Public Law 99-662.

B. Mechanical Excavation. This alternative was not selected because of limitations in mechanical excavation capacity considering project objectives. Advantages of this alternative were lower cost and improved tree survival in disposal areas.

Mechanical dredging would create a channel 50 feet wide and 4 to 5 feet deep.

C. Hydraulic Dredging. This alternative was not selected due to the inadequate area available for disposal containment and highest all-around cost of the four plans.

Hydraulic dredging would create a 70-foot-wide channel throughout the proposed alignment except where connecting chutes were reopened between Round Pond and Little Denny.

D. Proposed Project: Combined Plan. This alternative is discussed in Section I - Project Description.

3. Certification under Section 401 of the Clean Water Act has been obtained from the State of Iowa, Department of Natural Resources. The project is therefore in compliance with the water quality requirements of the State of Iowa.

4. The project would not introduce toxic substances into nearby waters or result in appreciable increases in existing levels of toxic materials.

5. No significant impact to federally listed endangered species will result from this project. This determination is supported by a letter received from the USFWS, dated September 14, 1988.

6. The project is located along a freshwater inland river system. No marine sanctuaries are involved or would be affected.

7. No municipal or private water supplies would be affected. There will be no adverse impact to recreational fishing and no unique or special aquatic sites are located in the project location. No long-term adverse changes to the ecology of the river system will result from this action.

8. Project construction materials will be chemically and physically stable. No contamination of the river is anticipated.

9. The placement of construction material into water or wetlands is necessary to reduce the sediment input into newly dredged areas and to serve as containment basin berms. No other practical alternatives have been identified. The proposed project is in compliance with the guidelines for Section 404(b)(1) of the Clean Water Act, as amended.

The proposed project will not significantly impact water quality or the integrity of the aquatic ecosystem. The proposed project is a backwater rehabilitation project intended to restore aquatic habitat.

6 July 89
Date

Neil A. Smart
Colonel, U.S. Army
District Engineer

# HYDRAULIC DREDGING ANALYSES

APPENDIX E

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT (R-5)

BIG TIMBER REHABILITATION AND ENHANCEMENT
POOL 17, MISSISSIPPI RIVER MILE 444
LOUISA COUNTY, IOWA

APPENDIX E
HYDRAULIC DREDGING ANALYSIS

## INTRODUCTION

Two methods were used to analyze the storage volume capacity of the confined placement facility for the hydraulically dredged material. The first analysis was conducted using the SETTLE application of the Automated Dredging and Disposal Alternatives Management System (ADDAMS) developed by the Water Resources Engineering, Environmental Engineering Division, Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station (WES). ADDAMS is an interactive computer-based design and analysis system. The SETTLE application of ADDAMS is for the design of confined disposal facilities for solids retention and initial storage.

The second analysis was done manually using procedures outlined in EM 1110-2-5027. These procedures were developed by the Dredged Material Research Program at WES and are the basis of the SETTLE application of ADDAMS.

## ADDAMS RESULTS

Data requirements for a complete design analysis include laboratory results from a flocculent settling test, a 15-day compression settling test, a zone settling test, disposal area information, dredge information, and physical and engineering properties. Input data and results of the computer runs for two sets of settling data obtained for the Big Timber area are presented in this appendix.

PHYSICAL AND ENGINEERING PROPERTIES

Sand Fraction

| Sample | Percent Sand | Gs |
|---|---|---|
| BT 88-2 | 4 | 2.62 |
| BT 88-9(1) | 11 | 2.51 |
| BT 88-9(2) | 2 | 2.67 |
| Average | 5.7 | 2.60 |

In Situ Water Content

| Boring | w' (range) percent | w' (ave.) percent |
|---|---|---|
| BT 88-1 | 61-29 | 44 |
| BT 88-2 | 84-39 | 64 |
| BT 88-3 | 78-26 | 52 |
| BT 88-9 | 100-58 | 61 |
| Average | | 55 |

SETTLE Program Input Data

| | |
|---|---|
| In situ volume of sediment to be dredged: | 102,400 CY |
| Percent, by volume, of sand in sediment to be dredged: | 5.7% |
| Specific gravity of fine grain sediment: | 2.596 |
| Average specific gravity of channel sediment: | 2.60 |
| Average in situ water content: | 55% |
| Influent suspended solids content: | 145.0 g/l |
| Influent pipe diameter: | 1.0 ft |
| Average influent fluid velocity: | 15.0 ft/s |
| Hour/day dredge operation: | 12 hours |
| Days/week dredge operation: | 6 days |
| Height of dike crest: | 3.80 ft |
| Minimum freeboard: | 1.0 ft |
| Minimum ponded water depth: | 1.0 ft |
| Total surface area: | 56.0 acres |
| Percent surface area ponded: | 75.0% |
| Hydraulic efficiency of the disposal area: | 80.0% |
| Maximum allowable effluent solids concentration: | 1500 mg/l |

Program Results

1. Sample 1

a. Compression Settling Data.

Initial slurry concentration = 130 mg/1
Initial slurry height = 7.78'

| Time (days) | Height of Settled Solids (feet) |
|---|---|
| 0.5 | 4.54 |
| 1.0 | 2.89 |
| 2.0 | 2.54 |
| 3.0 | 2.35 |
| 4.0 | 2.21 |
| 5.0 | 2.08 |
| 10.0 | 1.77 |
| 15.0 | 1.60 |

Least Square Curve Fit

Concentration = 307.9*time^.277  R^2 = .945

b. Zone Settling Data.

| Time (hours) | Depth of Interface (feet) |
|---|---|
| .25 | .08 |
| .50 | .19 |
| .75 | .25 |
| 1.0 | .31 |
| 2.0 | .56 |
| 3.0 | .83 |
| 4.0 | 1.04 |
| 5.0 | 1.27 |
| 6.0 | 1.48 |
| 7.0 | 1.67 |
| 8.0 | 1.88 |
| 12.0 | 2.62 |
| 24.0 | 4.18 |

c. Flocculent Settling Data.

Suspended Solids Concentration (mg/l)

| Sample Time (hours) | Port Height (feet) 7 | 6 | 5 | 4 |
|---|---|---|---|---|
| 0 | 113500 | 113500 | 113500 | 113500 |
| .5 | 83300 | 83700 | 81500 | 91300 |
| 1 | 84400 | 82800 | 85800 | 87100 |
| 2 | 70900 | 74500 | 81100 | 79500 |
| 4 | 3310 | 69200 | 73000 | 75600 |
| 6 | 2060 | 63900 | 73000 | 76600 |
| 8 | 1320 | 1450 | 66000 | 77100 |
| 12 | 1650 | 1160 | 28700 | 66100 |
| 24 | 790 | 800 | 920 | 840 |
| 48 | 220 | 420 | 410 | 380 |
| 72 | 170 | 230 | 170 | 200 |

Suspended Solids Remaining (%) vs. Port Height and Time

| Sample Time (hours) | Port Height (feet) 7 | 6 | 5 | 4 |
|---|---|---|---|---|
| 0 | 100.4 | 100 | 100 | 100 |
| .5 | 73.4 | 73.7 | 71.8 | 80.4 |
| 1 | 74.4 | 73.0 | 75.6 | 76.7 |
| 2 | 62.5 | 65.6 | 71.4 | 70.0 |
| 4 | 2.90 | 61.0 | 64.3 | 66.6 |
| 6 | 1.80 | 56.3 | 64.3 | 67.5 |
| 8 | 1.20 | 1.30 | 58.2 | 67.9 |
| 12 | 1.40 | 1.00 | 25.3 | 58.2 |
| 24 | 0.70 | 0.70 | 0.81 | 0.74 |
| 48 | 0.19 | 0.37 | 0.36 | 0.33 |
| 72 | 0.15 | 0.20 | 0.15 | 0.18 |

Suspended Solids Removed (%)

| Sample Time (hours) | Depth (feet) 3 | 2 | 1 |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0.5 | 26.7 | 25.4 | 24.6 |
| 1 | 25.8 | 25.0 | 24.5 |
| 2 | 35.0 | 31.8 | 29.8 |
| 4 | 73.1 | 46.3 | 24.8 |
| 6 | 72.2 | 44.9 | 21.7 |
| 8 | 91.7 | 77.0 | 59.2 |
| 12 | 96.4 | 91.7 | 85.6 |
| 24 | 99.3 | 99.2 | 99.2 |
| 48 | 99.6 | 99.6 | 99.6 |
| 72 | 99.8 | 99.8 | 99.8 |

MAXIMUM INITIAL STORAGE VOLUME

$$Vd = (Vd * CF) + Vb - (Vd * CF) * (1 + Ei/1 + Eo)$$

$$Eo = Gsf * w/A * ((Vd * 1000/(Pr * UPTIME/24 * Nday/7)/24)/2)^B$$

| | | |
|---|---|---|
| Cf | = Coarse-grained fraction of the soil (%) | = 5.7 |
| Vb | = Volume of the disposal basin (1000 CY) | = 162.62 |
| Ei | = In situ void ratio of sediment | = 1.43 |
| Eo | = Void ratio of fine-grained sediment after disposal | = 1.00 |
| Gsf | = Specific gravity of fine-grained sediment | = 2.60 |
| w | = Unit weight of water | = 1,000 |
| A, B | = Coefficients of the compression settling curve | |
| Pr | = Production rate of dredge (CY/hr) | = 53.21 |
| Optime | = Operating time of dredge per day (hrs) | = 12 |
| Nday | = Number of days worked per week | = 6 |
| Vd | = Maximum volume of sediment that may be dredged (1000 CY) | = 194.84 |

2. Sample 2

a. Compression Settling Data.

Initial slurry concentration = 110 mg/l
Initial slurry height = 7.78

| Time (days) | Height of Settled Solids (feet) |
|---|---|
| 0.5 | 3.62 |
| 1.0 | 2.59 |
| 2.0 | 2.23 |
| 3.0 | 2.06 |
| 4.0 | 1.92 |
| 5.0 | 1.79 |
| 10.0 | 1.46 |
| 15.0 | 1.33 |

Least Square Curve Fit

Concentration = 401.476*time ^.279 R^2 = .984

b. Zone Settling Data.

| Time (hours) | Depth of Interface (feet) |
|---|---|
| .25 | .14 |
| .50 | .23 |
| .75 | .33 |
| 1.0 | .40 |
| 2.0 | .69 |
| 3.0 | .98 |
| 4.0 | 1.21 |
| 5.0 | 1.50 |
| 6.0 | 1.75 |
| 7.0 | 2.00 |
| 8.0 | 2.29 |
| 12.0 | 3.44 |
| 24.0 | 4.48 |

c. Flocculent Settling Data.

Suspended Solids Concentration (mg/l)

| Sample Time (hours) | Port Height (feet) 7 | 6 | 5 | 4 |
|---|---|---|---|---|
| 0 | 97500 | 97500 | 97500 | 97500 |
| .5 | 72600 | 74500 | 74200 | 74200 |
| 1 | 77100 | 80200 | 78000 | 82400 |
| 2 | 76000 | 72000 | 82400 | 78400 |
| 4 | 2060 | 74900 | 72100 | 70500 |
| 6 | 490 | 730 | 68600 | 70600 |
| 8 | 590 | 480 | 63000 | 68500 |
| 12 | 440 | 410 | 17400 | 55000 |
| 24 | 320 | 340 | 350 | 390 |
| 48 | 270 | 210 | 220 | 280 |
| 72 | 180 | 170 | 160 | 170 |

Suspended Solids Remaining (%) vs. Port Height and Time

| Sample Time (hours) | Port Height (feet) 7 | 6 | 5 | 4 |
|---|---|---|---|---|
| 0 | 100 | 100 | 100 | 100 |
| .5 | 73.4 | 73.7 | 71.8 | 80.4 |
| 1 | 74.4 | 73.0 | 75.6 | 76.7 |
| 2 | 62.5 | 65.6 | 71.4 | 70.0 |
| 4 | 2.90 | 61.0 | 64.3 | 66.6 |
| 6 | 1.80 | 56.3 | 64.3 | 67.5 |
| 8 | 1.20 | 1.30 | 58.2 | 67.9 |
| 12 | 1.40 | 1.00 | 25.3 | 58.2 |
| 24 | 0.70 | 0.70 | 0.81 | 0.74 |
| 48 | 0.19 | 0.37 | 0.36 | 0.33 |
| 72 | 0.15 | 0.20 | 0.15 | 0.18 |

Suspended Solids Removed (%)

| Sample Time (hours) | Depth (feet) 3 | 2 | 1 |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0.5 | 26.7 | 25.4 | 24.6 |
| 1 | 25.8 | 25.0 | 24.5 |
| 2 | 35.0 | 31.8 | 29.8 |
| 4 | 73.1 | 46.3 | 24.8 |
| 6 | 72.2 | 44.9 | 21.7 |
| 8 | 91.7 | 77.0 | 59.2 |
| 12 | 96.4 | 91.7 | 85.6 |
| 24 | 99.3 | 99.2 | 99.2 |
| 48 | 99.6 | 99.6 | 99.6 |
| 72 | 99.8 | 99.8 | 99.8 |

MAXIMUM INITIAL STORAGE VOLUME

Vd = (Vd * CF) + Vb - (Vd * CF) * (1 + Ei/1 + Eo)

Eo = Gsf * w/A * ((Vd * 1000/Pr * UPTIME/24 * Nday/7)/24)/2)^B

| | | |
|---|---|---|
| Cf | = Coarse-grained fraction of the soil (%) | = 5.7 |
| Vb | = Volume of the disposal basin (1000 CY) | = 162.62 |
| Ei | = In situ void ratio of sediment | = 1.43 |
| Eo | = Void ratio of fine-grained sediment after disposal | = 0.99 |
| Gsf | = Specific gravity of fine-grained sediment | = 2.60 |
| w | = Unit weight of water | = 1000 |
| A, B | = Coefficients of the compression settling curve | |
| Pr | = Production rate of dredge (CY/hr) | = 53.21 |
| Optime | = Operating time of dredge per day (hrs) | = 12 |
| Nday | = Number of days worked per week | = 6 |

Vd = Maximum volume of sediment that may be dredged (1000 CY) = 196.15

MANUAL RESULTS

1. Sample 1

$V = Vi + Vi + Vsd$

where:

V = Required volume of CDF

Vi = Volume of in situ fine sediments = 102,400

$\Delta Vi$ = change in volume of sediment after placement
$= (Eo - Ei)/(1 + Ei)$

where:

Eo = average void ratio of sediment after placement

Ei = average void ratio of in situ sediments

$Eo = (Gs\ w - 1)/ s$

where:

Gs = the specic gravity of fine-grained sediment in sample = 2.60

$\gamma w$ = density of water = 62.4 lb/cf

$\gamma s$ = density of sediment (average concentration at end of dredging) = 59.9 lb/cf

$Eo = (2.60 * 62.4 - 1)/59.9 = 2.69$

$\Delta Vi = 0.943 * Vd\ ((2.69 - 1.43)/(1 + 1.43))$
$= 0.943 * Vd * 0.52 = 0.49 * Vd$

$V = (0.94 + 0.49 + 0.06)\ Vd = 1.49 * Vd$

Required volume = 152,600

Volume available = 164,800

152,600 < 164,800 OK

2. Sample 2

$\gamma_s = 53.75$

$E_o = (2.6 * 62.4 - 1)/53.75 = 3.00$

$\Delta V_i = 0.943 * V_d ((3.00 - 1.43)/(1 + 1.43))$
$= 0.943 * V_d * V_d\ 0.646 = 0.609 * V_d$

$V = (0.943 + 0.609 + 0.06)\ V_i = 1.61 * V_i$

Required Volume = 1.61 * 102,400 = 164,900 cf

164,900 ≅ 164,800 OK

CONCLUSIONS

The storage volume in the selected disposal site should be sufficient for placement of the hydraulically dredged material based on the more conservative numbers generated manually. The discrepancy in available storage volume is due to differences in the average void ratio expected at the end of the dredge operation. The SETTLE program predicts a void ratio of 0.99 to 1.0, while calculations made according to EM 1110-2-5027 predict void ratios of 2.69 and 3.00.

# APPENDIX F

## CORRESPONDENCE

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT (R-3)

BIG TIMBER REHABILITATION AND ENHANCEMENT
POOL 17, MISSISSIPPI RIVER MILE 444
LOUISA COUNTY, IOWA

APPENDIX F
CORRESPONDENCE

TABLE OF CONTENTS

United States Department of the Interior
FISH AND WILDLIFE SERVICE
ROCK ISLAND FIELD OFFICE (ES)
1830 Second Avenue, Second Floor
Rock Island, Illinois 61201

IN REPLY REFER TO:

COM: 309/793-5800
FTS: 386-5800

September 14, 1988

Colonel Neil A. Smart
District Engineer
U.S. Army Engineer District
Rock Island
Clock Tower Building, P.O. Box 2004
Rock Island, Illinois 61204-2004

Dear Colonel Smart:

This constitutes our Fish and Wildlife Coordination Act Report on the Big Timber Habitat Rehabilitation and Enhancement Project (HREP), a component of the Upper Mississippi River System Environmental Management Program (EMP). The EMP is authorized by the 1985 Supplemental Appropriation Act (Public Law 99-88) and Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662). The authority for this report is contained in Section 2 of the Fish and Wildlife Coordination Act of 1958 (Public Law 85-624).

## PROJECT DESCRIPTION

The proposed project involves rehabilitation of a backwater slough complex consisting of Round Pond, Little Denny, Big Denny and associated unnamed channels and marsh complexes. The project is designed to restore aquatic habitats lost to sedimentation and to improve the flow exchange between the named backwater areas and Coolegar Slough. Deflection levees would direct overland flows occurring on a 2-year flood frequency back toward the river, and these flows would be encouraged to drop their sediment loads outside of the slough complex. The complex would remain open to floodwater through its connection to Coolegar Slough.

The flow exchange objective would be achieved through the construction of a 10,500-foot channel. A combination of equipment (clamshell dredge, hydraulic cutterhead dredge and bulldozer) would be used for constructing the channel. The completed channel would be about 70 feet in width and 4 to 5 feet deep. In some areas holes 8 to 10 feet deep would be dredged for fish refugia. Additional shallow areas, 2 to 3 feet deep, would be constructed for waterfowl.

The materials to be dredged would be composed primarily of fine sediments. Material from the mechanical (clamshell) dredging operation will be used to construct the deflection levees. Excess material would be sidecast into selected areas which are primarily vegetated by young willows. The levees and dredged material disposal areas would utilize a total of 11 acres.

The deflection levees would be constructed, for the most part, across old slough arms which have been filled in and taken over by willows. Shallow ponds would be developed in these areas outside of the deflection levees using explosives.

The proposed disposal site for hydraulically dredged material is a triangular area some 73 acres in extent which is bounded by Big Denny and Little Denny Sloughs and the main channel of the Mississippi River. This area has a natural berm at the sides facing Big Denny and the channel. It would require closure of the southern end of the deepest parts of the depression to keep the spoil from dumping into Little Denny. An effluent area would be required, but Little Denny offers only a limited mixing zone. The influx of a significant amount of suspended fine sediments would be counterproductive to the objective of creating deep water habitat in Little Denny. The effluent could be directed into the main channel where the mixing zone would be adequate.

Big Timber is a management unit of the Louisa Division of the Mark Twain National Wildlife Refuge. The management objectives of the refuge, as stated in the refuge master plan, are as follows:

> The Mark Twain National Wildlife Refuge has as its primary objectives the responsibility to (1) provide migrating waterfowl with food, water and protection during the fall and spring months, and (2) to improve and maintain existing habitat to perpetuate optimum annual production of wood ducks.
>
> Secondary objectives are to provide (1) food, water, and protection to wintering waterfowl, (2) to maintain balanced populations of all resident wildlife species, (3) maintain portions of the refuge river bottom habitat in its natural virgin state, and (4) to provide limited day-use recreation where and when such activities are compatible with primary objectives of the refuge.

The project design presented in the draft definite project report has evolved from a series of on site discussions. The refuge objectives provided the context for these discussions so as to assure that this project would be compatible with the purposes of the refuge.

## FISH AND WILDLIFE RESOURCES

Big Timber takes its name from the mature northern bottomland forest that cloaks the unit. This timber is, by itself, a biological asset. It is the preferred habitat of the wood duck and a vast array of neotropical migrants such as warblers, vireos and flycatchers, not to mention a large number of more sedentary woodpeckers. Within the range of the wood duck 80% of this habitat type has been destroyed and the remnant stands such as the one at Big Timber have accordingly higher value.

The timber on this unit displays a typical mix of bottomland species. Silver maple, cottonwood and black willow are dominants. Pin oak, shagbark hickory and Kentucky coffeetree are also prominent on suitable sites. One of the peculiarities of regularly flooded bottomland forests is that the greatest deposition of alluvial material occurs at the point where the greatest reduction in water velocity occurs, i.e., at the edges of the sloughs. These higher banks with a deeper layer of soil above the water table encourage the growth of the more valuable timber trees. The water's edge is a preferred site for buttonbush, a wetland shrub that is an extremely valuable component of wood duck habitat.

The only breeding duck species of any consequence at Big Timber is the wood duck. It is important, therefore, to address its habitat requirements. Basically, the wood duck is a species of mature timber and marsh ecosystems. Timber cutting, levee building and dredging all reverse the aging process in these bottomland ecosystems. It was necessary, therefore, to plan this HREP project so as to capitalize on design features which would either improve or have minimal effect on wood duck habitat.

## PROBLEMS AND NEEDS

The aquatic habitat values of Big Timber have been degraded through the long term deposition of fine sediments. The current habitat values of Big Timber are limited by the continuing progress from aquatic to early successional stage woodlands. Sedimentation has resulted in a greatly reduced fishery and a marked degradation of wood duck habitat.

The original intent of this project was to reverse the degradation of fish habitat and improve the fishery. There was very little in the project to benefit waterfowl. Through a series of discussions and on site visits it has been possible to offset the potential negative impact on wood ducks and to design a project with positive waterfowl benefits. This has been accomplished without materially reducing the benefits to the fishery.

## DISCUSSION

The trees preferred by nesting wood ducks generally are species that reach a larger size and have a relatively long life expectancy. The minimum-sized tree used for nesting in Minnesota has been found to be 11 inches in diameter at breast height (dbh). Generally, however, wood ducks need a cavity that is 10 to 11 inches in diameter, thus requiring minimum-sized trees more on the order of 14 to 16 inches dbh. Not only do the larger trees produce the size cavities that are needed but they produce more of them, with overmature and decadent trees producing the most.

Another factor favoring older timber is that it can be demonstrated that there is an increasing index of wood duck use with increasing height of the cavity above the ground. The depth of a cavity is also a factor in that a deeper cavity tends to offer greater protection from raccoons. More mature trees would tend to offer greater opportunities for the development of deeper cavities at greater heights.

Wood ducks can not initiate their own cavities and tend to rely on yellow-shafted flickers and piliated woodpeckers to produce suitable cavities for them. Again, the number of woodpeckers on a given unit of woodland goes up as the stand ages.

At Big Timber the trees that can be expected to produce desirable nesting cavities, listed in descending order of importance, are: sycamore, silver maple, black willow and American elm. Other factors such as abundance and distribution of the various tree species enter in. On Big Timber, the larger, older silver maples become a very important component of wood duck nesting habitat.

Wood ducks will use nesting cavities located at some distance from water with suitable brood cover but use increases as the distance decreases. Cavities in trees hanging directly over water are the best. At Big Timber the largest trees tend to be located on the slightly elevated natural berm at the edge of the sloughs.

The density of suitable nesting cavities is also important. A 1952 study showed a density of one suitable cavity per 23.6 acres at Lake Odessa just to the south of Big Timber. Of course, in 35 years the timber has matured significantly and there tends to be a great proportion of timber to marsh on Big Timber.

The nesting requirements of wood ducks aside, there are some other factors relating to the timber on this unit that need to be explored. An essentially even aged stand of timber that has reached or is rapidly reaching maturity is good for wood ducks, but there will come a day when Big Timber will not support as many breeding pairs as it does today.

The water table underlying Big Timber is high. The large trees have very shallow root systems. As the timber is thinned on the area trees become more exposed to the wind and there tends to be a high degree of blow down.

The triangular area proposed as a disposal area for spoil from the hydraulic dredging component of the operation, contains a natural basin. Within its limits recent aerial photographs indicated a very high proportion of standing dead and fallen timber. This is a situation that lends itself to initiating new timber growth that would break up the even age nature of the timber stands on this unit and provide wood duck habitat in the future.

The component of the wood duck habitat that would be impacted by construction in this area is feeding habitat.

Invertebrate foods are critical at two points in the annual cycle for good wood duck production. These points occur when the females first appear on the breeding area and during the first six weeks in the life of the young wood ducks.

Wood ducks prefer to feed in shallow water with depths no greater than 18 inches. Given the proper incentive they will also feed on the ground beneath the forest canopy. Food items include mast, fruits, aquatic plants, seeds and insects. Given the opportunity wood ducks prefer to forage in flooded bottomland timber during the spring and fall. Female wood ducks have high protein and calcium requirements at the onset of the breeding season. In fact, the abundance and availability of macroinvertebrates during the early spring before nesting is critical to reproductive success. Drakes do not show any particular requirement for these high protein foods at this time. When the leaf litter and duff on the forest floor is flooded it produces conditions which cause an explosion of invertebrate growth and the hen wood ducks and later the hatchlings benefit. Since the wood ducks and the bottomland forest have developed together in an environment where spring and fall water level raises are the norm, it stands to reason that the anticipated spring flood and the requirement for enhanced protein and calcium in the diet will tend to coincide.

During the period when wood duck hens are brooding a large portion of their diet will consist of the samaras of silver maple and green ash. The mature forest is important in supplying critical food resources at this time also.

In the case of the proposed disposal area described above both adverse and beneficial impacts will accrue. While the area is, as described, a basin, it is not a basin wherein the deepest portion slopes directly up to the highest elevations around the perimeter. It is instead a product of its evolution from a series of bars and channels parallel to the main channel. Viewed from a distance the bottom has a washboard appearance.

The dredged material will tend to fill the low lying areas and cover the organic duff accumulated therein. Some wood duck food will be lost during the first year or two. On the other hand the topography of the basin will tend to smooth out and shallow water will tend to cover a greater area so there should be a mitigation of these short term impacts.

Long term benefits are possible. The new, higher elevations, increments on the order of two feet or less, should reverse the current trend toward the loss of timber in this area and could favor growth of more desirable mast species.

Another critical aspect of wood duck habitat is good brooding cover. In this case cover and available food have to be in the same package.

In the Mississippi Valley wood duck broods less than two weeks of age show a marked preference for flooded lowland forest where they can obtain the invertebrate foods necessary to provide adequate nutrition to sustain rapid growth. Later they move into areas with dense cover either of their preferred buttonbush or emergent aquatic plants such as lotus or arrowhead. This cover must be interspersed with small open water areas and loafing sites on muskrat houses or in shrubs. Studies elsewhere have shown that the preferred dense escape cover is composed of both woody and herbaceous plants.

Water depth and water velocity are also important parameters of good wood duck brood cover. Water depth is a controlling factor influencing the quantity, variety and distribution of aquatic food and cover for wood ducks. Wood ducks, in general, feed in water from the shoreline out to depths of 6 feet. In these deeper waters the feeding depth is restricted to the top 12 inches. The suitability of this water layer is influenced by the submerged and emergent vegetation present. For brood areas, the water depth should range from 3 to 18 inches. The water should be slow moving and sheltered from the wind. Wood duck broods seldom use areas where the current exceeds 1 mile per hour.

Wood duck broods also require some freedom from human disturbance, particularly interruption by motorboats. In designing this project consideration has been given to the disturbance factor. Little Denny Slough, once the water has been deepened, can be closed to motorboats by construction of a weir or simple log barrier. Round Pond, while rapidly loosing water depth, is an area which still retains good brooding habitat. Disturbance in Round Pond will be limited to the dredging of the 70-foot channel and, therefore, have minimal impact.

Big Timber, particularly Coolegar Slough, is an excellent area for largemouth bass, crappies and bluegills. The initial impetus for the proposed HREP was to take advantage of this fact and enhance the fishery even further. The proposed dredged channel

should enhance the fish production potential of the Big/Little Denny complex and remove the threat of entrapment for the fish which would in the natural course of events be trapped in these backwaters in low water years. The addition of deep holes would also enhance the area's ability to provide wintering habitat away from the hazards of the main channel.

The bald eagle is the only federally listed threatened or endangered species known to utilize the Big Timber area. There are no impacts anticipated.

A primary objective of the Mark Twain National Wildlife Refuge is to provide migratory waterfowl with food, water and protection during the fall and spring months. Big Timber because of it's location, topography, and heavy timber cover does provide habitat for a large number of waterfowl migrants. The proposed project provides little enhancement to this ability to support migrants.

The second primary objective of the refuge is to improve and maintain existing habitat in order to perpetuate optimum annual production of wood ducks. A great deal of effort has been expended in the planning stage to assure that this project does achieve this objective.

There will be some minor short term impacts on wood ducks. This is to be expected. The wood duck is a species adapted to forest and aquatic habitats that are characteristic of the late seral stages of ecological succession in both cases.

The HREP proposed for Big Timber is designed to reverse the ecological succession in the aquatic environment and impart to the project area the advantages of the early successional stages of riverine habitat. What is good for fish is not necessarily good for wood ducks, and vice versa. Nevertheless, by careful attention to detail it has been possible to plan the project so as to derive maximum fishery benefits while maintaining most of the characteristics which make this a good wood duck production area. In addition, the useful life of the wood duck habitat will be extended.

The proposed disposal site coincides with an area where the bottomland hardwoods reach their greatest age and size. Silver maple dominate on the site, with at least one individual exceeding 48 inches dbh and not a few in the 30 to 36-inch range. One pin oak is approaching the upper size limit for this medium sized species at 32 inches dbh and 70 feet or so in height. White oak, shagbark and other hickories of mature dimensions are also prominent on the ridge, i.e. old islands, within the corner of the site closest to Big Denny. The maintenance of these trees is in keeping with the secondary refuge objective to maintain portions of the refuge river bottom habitat in its natural virgin state.

Since the existing mature timber on the unit is largely retained, the negative impact on wood duck nesting habitat should be insignificant. Retention of the timber intact reduces the local impact on bottomland hardwoods, of which we have lost some 80% nationally. Not only wood ducks but a variety of small neotropical migrants which breed at this latitude and further north should benefit as well.

Given the loss of our bottomland hardwoods and the accelerating loss of tropical hardwoods in Central and South America, the benefits to neotropical migrants, while not completely tangible to us, may outweigh those to wood ducks. Big Timber is not an area that has attracted large numbers of birders. This is not a function of the value of the area, but one of access. The dredged channel will not only open the area to new fishing sites but should improve the birding as well.

The basin selected as a site for dredged material disposal from the hydraulic dredging operation could make a long term contribution to the habitat quality of the unit. The more valuable hardwoods are rapidly disappearing from the lower elevations on the site. The disposal of the dredged material, consisting of fine sediments which are primarily "displaced" top soil, will increase the elevations on the site by as much as 2 feet.

The potential benefits are that the ridges within the site will become more attractive to mast trees such as pin oaks, shagbark hickory and pecans. The increased level of these fine materials should increase the soil depth enough to better anchor future timber trees. Those large timber trees already on the site may benefit as well, if they stay in place long enough to grow adventitious roots in the new soil. The water table will eventually rise somewhat, but enough new growth should be possible to reverse the timber loss in the deeper areas.

The shallow aquatic areas that were being converted to willow copses are definitely being reduced in value. Some of these will be dredged and the succession completely reversed. In some cases shallow potholes will be developed which, given their placement under the willow cover, should provide some additional secluded wood duck brooding habitat. Granted, these shallow areas will be in the zone where the highest maintenance requirement associated with the project is likely to exist. Given the fact that they would be maintained as developed, with explosives, the maintenance costs should be modest.

The placement of the deflection levees should reduce the sedimentation rate in the dredged channel. Since the natural sedimentation rate, the effect of water depth aside, is on the order of 1 inch per year, the project features have a potentially long life span.

The immediate impact on wood duck brood habitat will tend to be slightly negative. The retention of Round Pond and Little Denny as brood areas will offset this impact. In addition, if excessive motorboat traffic has a serious negative impact, it will be possible to reduce this impact through regulation or closure without reducing the fish production benefits of the project.

With respect to the fishery impacts of the project, they all appear to be beneficial. To obtain the maximum waterfowl benefits it was necessary to reduce the depth of some of the deep holes initially called for. It turns out that the 6 to 8 - foot depths are probably closer to the optimum than deeper holes so this is not seen as a negative change.

## CONCLUSIONS AND RECOMMENDATIONS

The Big Timber Habitat Rehabilitation and Enhancement Project, as currently proposed, should restore and enhance fish and wildlife values on this unit of the Mark Twain National Wildlife Refuge. The dredged channel would reverse the aging process in an important internal wetland complex and provide fishery habitat that should, barring some catastrophic event, have a long life. This has been accomplished without materially degrading the habitat of the wood duck, a species that prefers mature bottomland forests and wetlands.

To expedite the approval and construction of this project we recommend;

1. Any modifications in the final design, in particular changes impacting the mature bottomland hardwoods on the site, be closely coordinated with the staff of the Mark Twain National Wildlife Refuge.

2. That the Corps consider carefully the highly desirable step of revegetating the levees and spoil areas with buttonbush, Cephalanthus occidentalis, a step that would greatly enhance the project's value to wood ducks. The remaining small numbers of this valuable component of wood duck habitat are not sufficient to revegetate these sites naturally.

We look forward to further coordination with your staff on this project.

Sincerely,

for Richard C. Nelson
Field Supervisor

cc: IADNR

State Historical Society of Iowa

The Historical Division of the Department of Cultural Affairs

December 7, 1988

James H. Blanchar, P.E.
Chief, Operations Division
Rock Island Corps of Engineers
Clock Tower Building
P. O. Box 2004
Rock Island, Illinois 61203-2004

RE: COE - LOUISA COUNTY - MARK TWAIN NATIONAL WILDLIFE REFUGE - BIG TIMBER BACK WATER COMPLEX, ENVIRONMENTAL MANAGEMENT PROJECT

Dear Mr. Blanchar:

Based on the information you provided, we find that there are no historic properties which might be affected by the proposed undertaking. Therefore, we recommend project approval.

However, if the proposed project work uncovers an item or items which might be of archeological, historical or architectural interest, or if important new archeological, historical or architectural data come to light in the project area, you should make reasonable efforts to avoid or minimize harm to the property until the significance of the discovery can be determined.

Should you have any questions or if the office can be of further assistance to you, please contact Review & Compliance program at 515-281-8743.

Sincerely,

Kay Simpson

Kay Simpson
Review & Compliance Program
Bureau of Historic Preservation

/mtm

cc: Dudley M. Hanson, P.E.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
FEDERAL BUILDING, FORT SNELLING
TWIN CITIES, MINNESOTA 55111

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

FWS/ARW-WAM2

JAN 05 1989

Colonel Neil A. Smart
District Engineer
U.S. Army Engineering District
Clock Tower Building
Rock Island, Illinois 61201

Dear Colonel Smart:

The U.S. Fish and Wildlife Service has reviewed the draft Definite Project Report for the Big Timber rehabilitation and enhancement project. This project, located in Pool 17 of the Upper Mississippi River in Louisa County, Iowa, is proposed under the Water Resources Development Act of 1986 (Public Law 99-662) as part of the Upper Mississippi River System Environmental Management Program. Big Timber Division is part of the Mark Twain National Wildlife Refuge.

The Big Timber project draft report with environmental assessment seems to be appropriate for the proposed work. There does appear to be an inconsistency between the statement on page 31 that construction will occur on Service-owned land whereas elsewhere the project is described as occurring on Corps-owned land managed by the Service. We believe the final report should clearly state that the land is owned by the Corps but managed by the Service for the benefit of migratory birds. Furthermore, the Regional Director on October 3, 1988, found this fishery habitat project to be compatible with refuge migratory bird purposes, copy of which is enclosed and should be included in the final report.

We look forward to continued cooperation in implementing this project.

Sincerely,

Matthias A. Kerschbaum

Matt Kerschbaum
Wildlife Associate Manager

Enclosure

COMPATIBILITY DETERMINATION

Station Name: Mark Twain National Wildlife Refuge Complex

Date Established: 1958

Establishing Authority: Fish and Wildlife Coordination Act, Section 3 (48 Stat. 401)

Description of Proposed Use: Rehabilitation of the Round Pond-Little Denny-Big Denny Slough Complex within the Big Timber Division of the Wapello District of the Mark Twain National Wildlife Refuge Complex, Pool 17 - Upper Mississippi River, Louisa County, Iowa. This is a habitat rehabilitation and enhancement project sponsored jointly by the Iowa Department of Natural Resources and the Fish and Wildlife Service.

Anticipated Impacts on Refuge Purpose (s): No negative impacts are anticipated, if the project is constructed per negotiated design features.

Stipulations That Would Make a Use Compatible With Refuge Purpose (s): DNA

Justification: The proposed project will restore and enhance an important wetland complex for migratory waterfowl and provide important spawning and nursery areas for fish.

Determination: The proposed use is compatible with the purposes for which the refuge was established.

Determined by: Robert L. Shelton LWD 9/19/88 Date: 9/21/88
Project Leader (Name/Title/Signature)

Reviewed by: Edward J. Crosier Date: 9/27/88
Regional Supervisor (Name/Title/Signature)

Concurred by: James C. Gutman Date: 10/3/88
Regional Director

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

January 18, 1989

Colonel Neil A. Smart, USA
U.S. Army Engineer District, Rock Island
ATTN: Planning Division
Clock Tower Building - P.O. Box 2004
Rock Island, Illinois 61204-2004

Dear Colonel Smart:

RE: Big Timber Refuge Rehabilitation and Enhancement

In accordance with our responsibilities under the National Environmental Policy Act and Section 309 of the Clean Air Act, we have reviewed the "advance draft" Definite Project Report, Integrated Environmental Assessment (EA) with 404 (b)(1) Evaluation and Finding of No Significant Impact (FNSI) for the project referenced above.

We note that the concentration of ammonia in the elutriate prepared from the dredge material exceeds the state water quality standard. Since neither the EA nor the 404 (b)(1) Evaluation adequately addresses this potential violation, we believe that the proposed discharge can not be specified as complying per Section 230.12 of 40 CFR Part 230, Guidelines for Specification of Disposal Sites for Dredged or Fill Material. Therefore, were this EA/FNSI your official submittal, we could not concur with your intent to issue a FNSI for this project.

We assume that the public review copy of the draft EA/FNSI will be modified accordingly.

Thank you for the opportunity to comment.

Sincerely yours,

Lawrence M. Cavin
Chief, Environmental Review
and Coordination Section



## CORPS OF ENGINEERS RESPONSE

Of 5 elutriate samples analyzed, only 1 contained ammonia nitrogen concentrations in excess of the state water quality standard. However, because dredged effluent will be discharged to the Mississippi River, dilution will be quite rapid and a very small mixing zone will be adequate to insure compliance with the state standard.

Consideration of Section 230.12 - Findings of compliance or non-compliance with the restrictions on discharge - has revealed no indication that the proposed discharge fails to comply with the Guidelines, per 230.12(a)(3)(i-iv).

The Definite Project Report, with Appendices, including the 404 (b)(1) Evaluation for the project, provides sufficient information to make a reasonable judgement regarding the compliance of the proposed discharge, with the purpose and policy set forth in 40 CFR Part 230. Based upon that information, water quality certification under Section 401 of the Clean Water Act has been requested and recieved (reference Correspondence) from the State of Iowa.

Given the foregoing information, it is the Corps determination that the project is in full compliance with the Clean Water Act of 1977, as amended. Reference modification to page D-9 of the 404 (b)(1) Evaluation.

STATE OF
IOWA

TERRY E. BRANSTAD, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LARRY J. WILSON, DIRECTOR

January 18, 1989

Colonel Neil A. Smart
U.S. Army Engineer District, Rock Island
ATTN: Planning Division
Clock Tower Building - P.O. Box 2004
Rock Island, Illinois 61204-2004

Dear Colonel Smart:

Iowa Department of Natural Resources staff reviewed the December 1988 Draft Definite Project Report (DPR) with Integrated Environmental Assessment for the Big Timber Project of the Environmental Management Program. The DPR and associated environmental assessment appears accurate and consistent with the outcome of interagency coordination meetings conducted during the project's planning and design.

This letter also serves as the State of Iowa's 401 Water Quality Certification. The DNR certifies that the proposed project will comply with Iowa's Water Quality Standards subject to the following conditions:

1. Material dredged mechanically will be placed in the specific areas agreed to during interagency coordination meetings and noted on Plate 2 of the Draft DPR; and

2. The dredged material is appropriately stabilized to prevent reintroduction into the waterway.

This condition is felt necessary due to the nature of the text in the DPR describing the mechanical dredging activities. Pages 14 and 15 in the report indicate that the placement of the sidecast material will not be restricted to the areas designated on Plate 2, but rather at almost any site along the channel. We feel the construction contractor will need more definite directions than provided in the text.

Thank you for the continued coordination and cooperation on this and other Environmental Management Program projects.

Sincerely,

LARRY J. WILSON
DIRECTOR
DEPARTMENT OF NATURAL RESOURCES

LJW:ks


WALLACE STATE OFFICE BUILDING / DES MOINES, IOWA 50319 · 515-281-5145

United States Department of the Interior

FISH AND WILDLIFE SERVICE
FEDERAL BUILDING, FORT SNELLING
TWIN CITIES, MINNESOTA 55111

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

FWS/ARW-SS

MAY 2 2 1989

Colonel Neil A. Smart
District Engineer
U. S. Army Engineering District, Rock Island
ATTN: Planning Division
Clock Tower Building
Post Office Box 2004
Rock Island, Illinois 61204-2004

Dear Colonel Smart:

This letter responds to your notice dated April 28, 1989, for written comments on the Draft Definite Project Report with Integrated Environmental Assessment for the Big Timber Refuge Rehabilitation and Enhancement Project.

The report reflects the cooperating status of the Service (U. S. Fish and Wildlife Service) and the Corps (Army Corps of Engineers) in designing a project that should increase fish habitat and enhance duck habitat. Concerns raised by the Service in its letter dated January 5, 1989, have been addressed.

The Service will assure that operation and maintenance requirements of the project as defined in the Definite Project Report will be accomplished in accordance with Section 906(e) of the Water Resources Development Act of 1986. The agreement in Appendix G is a correct statement of the responsibilities and we will sign the agreement when you send it to us.

You have elected to prepare a joint finding of no significant impact which is an appropriate method of documenting the decision for this cooperating agency project. At completion of the public comment period for the Definite Project Report with Integrated Environmental Assessment, if no substantive changes are made we will sign the joint finding when you send it to us.

Mark Twain National Wildlife Refuge will be issuing the right-of-entry permit for construction purposes at the appropriate time. We anticipate that coordination between the refuge and the Corps will continue during construction planning and implementation and we appreciate the cooperation that makes this kind of project possible.

Sincerely,

James C. Critman

James C. Critman
Regional Director

STATE OF IOWA

TERRY E. BRANSTAD, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LARRY J. WILSON, DIRECTOR

June 13, 1989

Colonel Neil A. Smart
Rock Island Corps of Engineers
Clock Tower Building - P.O. Box 2004
Rock Island, Illinois 61204-2004

Dear Colonel Smart:

The Iowa Department of Natural Resources supports the Environmental Management Programs's Big Timber Refuge Rehabilitation and Enhancement Project in Pool 17 of the Mississippi River.

Upon completion and final acceptance of the project by the Corps of Engineers and the Fish and Wildlife Service, the Iowa DNR agrees to cooperate with the Fish and Wildlife Service to assure that operation, maintenance, and any mutually agreed upon rehabilitation as described in the Definite Project Report are accomplished in accordance with Section 906(e) of the Water Resources Development Act of 1986.

Sincerely,

LARRY J. WILSON
DIRECTOR
IOWA DEPARTMENT OF NATURAL RESOURCES

LJW:ks

cc: James Gritman, Regional Director, USFWS



WALLACE STATE OFFICE BUILDING / DES MOINES, IOWA 50319 515 281-5145

United States Department of the Interior

FISH AND WILDLIFE SERVICE
FEDERAL BUILDING, FORT SNELLING
TWIN CITIES, MINNESOTA 55111

IN REPLY REFER TO:
FWS/ARW

JUL 2 8 1989

Colonel Neil A. Smart
District Engineer
U. S. Army Engineering District, Rock Island
ATTN: Planning Division
Clock Tower Building
Post Office Box 2004
Rock Island, Illinois 61204-2004

Dear Colonel Smart:

Enclosed, as you requested, is the signed Finding of No Significant Impact for the Big Timber Habitat Rehabilitation and Enhancement Project. Our Finding is based on your Draft Definite Project Report dated April 1989 as amended by the attachments to your letter of June 26, 1989.

We are deferring signing the Agreement for Operation, Maintenance, and Rehabilitation pending resolution of wording in the newly proposed Memorandum of Agreement for Operation, Maintenance, and Rehabilitation.

Please provide us a copy of the Final Definite Project Report when it is available. We look forward to continued progress on this project.

Sincerely,

Marvin E. Moriarty
Acting Regional Director

Enclosure

FINDING OF NO SIGNIFICANT IMPACT

For the reasons presented below and based on an evaluation of the information contained in the supporting references, I have determined that the Environmental Management Program project, Big Timber Habitat Rehabilitation and Enhancement, is not a major Federal action which would significantly affect the quality of the human environment within the meaning of Section 102(2)(c) of the National Environmental Policy Act of 1969. An Environmental Impact Statement will, accordingly, not be prepared.

Reasons

The project would counteract sedimentation that has reduced deeper off-channel aquatic habitats. It would enhance habitat diversity for fishery resources. Spoil deposition has been designed to avoid adverse impacts to the important wood duck habitat.

There would be no adverse impacts to endangered or threatened species or their habitat nor to significant cultural resources.

The Army Corps of Engineers has determined that no substantial water quality problems would result from removal of bottom material nor from discharge of water with the use of a suitable retention facility.

Supporting References

1. Environmental Assessment

Acting Regional Director — Date 7/28/85

Distribution:
AE (Master File)
EHC/BFA--Washington, DC
COE, Rock Island
SS
MKT through WAM2

APPENDIX G

# LETTERS OF INTENT AND DRAFT MEMORANDUM OF AGREEMENT

United States Department of the Interior

FISH AND WILDLIFE SERVICE
FEDERAL BUILDING, FORT SNELLING
TWIN CITIES, MINNESOTA 55111

IN REPLY REFER TO:

FWS/ARW-SS

MAY 2 2 1989

Colonel Neil A. Smart
District Engineer
U. S. Army Engineering District, Rock Island
ATTN: Planning Division
Clock Tower Building
Post Office Box 2004
Rock Island, Illinois 61204-2004

Dear Colonel Smart:

This letter responds to your notice dated April 28, 1989, for written comments on the Draft Definite Project Report with Integrated Environmental Assessment for the Big Timber Refuge Rehabilitation and Enhancement Project.

The report reflects the cooperating status of the Service (U. S. Fish and Wildlife Service) and the Corps (Army Corps of Engineers) in designing a project that should increase fish habitat and enhance duck habitat. Concerns raised by the Service in its letter dated January 5, 1989, have been addressed.

The Service will assure that operation and maintenance requirements of the project as defined in the Definite Project Report will be accomplished in accordance with Section 906(e) of the Water Resources Development Act of 1986. The agreement in Appendix G is a correct statement of the responsibilities and we will sign the agreement when you send it to us.

You have elected to prepare a joint finding of no significant impact which is an appropriate method of documenting the decision for this cooperating agency project. At completion of the public comment period for the Definite Project Report with Integrated Environmental Assessment, if no substantive changes are made we will sign the joint finding when you send it to us.

Mark Twain National Wildlife Refuge will be issuing the right-of-entry permit for construction purposes at the appropriate time. We anticipate that coordination between the refuge and the Corps will continue during construction planning and implementation and we appreciate the cooperation that makes this kind of project possible.

Sincerely,

James C. Critman

James C. Critman
Regional Director

STATE OF IOWA

TERRY E. BRANSTAD, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LARRY J. WILSON, DIRECTOR

June 13, 1989

Colonel Neil A. Smart
Rock Island Corps of Engineers
Clock Tower Building - P.O. Box 2004
Rock Island, Illinois 61204-2004

Dear Colonel Smart:

The Iowa Department of Natural Resources supports the Environmental Management Programs's Big Timber Refuge Rehabilitation and Enhancement Project in Pool 17 of the Mississippi River.

Upon completion and final acceptance of the project by the Corps of Engineers and the Fish and Wildlife Service, the Iowa DNR agrees to cooperate with the Fish and Wildlife Service to assure that operation, maintenance, and any mutually agreed upon rehabilitation as described in the Definite Project Report are accomplished in accordance with Section 906(e) of the Water Resources Development Act of 1986.

Sincerely,

LARRY J. WILSON
DIRECTOR
IOWA DEPARTMENT OF NATURAL RESOURCES

LJW:ks

cc: James Gritman, Regional Director, USFWS



WALLACE STATE OFFICE BUILDING / DES MOINES, IOWA 50319 515-281-5145

DRAFT
MEMORANDUM OF AGREEMENT
BETWEEN
THE UNITED STATES FISH AND WILDLIFE SERVICE
AND
THE DEPARTMENT OF THE ARMY
FOR
ENHANCING FISH AND WILDLIFE RESOURCES
OF THE
UPPER MISSISSIPPI RIVER SYSTEM
AT BIG TIMBER REFUGE, IOWA

## I. PURPOSE

The purpose of this Memorandum of Agreement (MOA) is to establish the relationships, arrangements, and general procedures under which the U.S. Fish and Wildlife Service (FWS) and the Department of the Army (DA) will operate in constructing, operating, maintaining, repairing, and rehabilitating the Big Timber Refuge, Iowa, separable element of the Upper Mississippi River System - Environmental Management Program (UMRS-EMP).

## II. BACKGROUND

Section 1103 of the Water Resources Development Act of 1986, Public Law 99-662, authorizes construction of measures for the purpose of enhancing fish and wildlife resources in the Upper Mississippi River System. Under conditions of Section 906(e) of the Water Resources Development Act of 1986, Public Law 99-662, all construction costs of those fish and wildlife features at Big Timber Refuge are 100 percent Federal, and all operation, maintenance, repair, and rehabilitation costs are to be cost shared, 75 percent Federal and 25 percent non-Federal.

## III. GENERAL SCOPE

The project to be accomplished pursuant to this MOA shall consist of creating 100 acre-feet of deep water and 30 acre-feet of shallow aquatic habitat, restoring 500 square feet of access between aquatic habitats, increasing mast tree dominated area by 30 acres, providing 21 acres of reliable resting and feeding water area, and creating 10 isolated nesting and feeding pools.

## IV. RESPONSIBILITIES

A. DA is responsible for:

1. Construction: Construction of the project which consists of creating 100 acre-feet of deep water and 30 acre-feet of shallow aquatic habitat, restoring 500 square feet of access between aquatic habitats, increasing mast tree dominated area by 30 acres, providing 21 acres of reliable resting and feeding water area, and creating 10 isolated nesting and feeding pools.

2. Major Rehabilitation: Any mutually agreed upon rehabilitation of the project that exceeds the annual operation and maintenance requirements identified in the Definite Project Report and that is needed as a result of specific storm or flood events.

3. Construction Management: Subject to and using funds appropriated by the Congress of the United States, DA will construct the Big Timber Refuge Fish and Wildlife Enhancement Project as described in the Definite Project Report, "Big Timber Refuge Rehabilitation and Enhancement," dated July 1989, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The FWS will be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. If DA encounters potential delays related to construction of the project, DA will promptly notify FWS of such delays.

4. Maintenance of Records: DA will keep books, records, documents, and other evidence pertaining to costs and expenses incurred in connection with construction of the project to the extent and in such detail as will properly reflect total costs. DA shall maintain such books, records, documents, and other evidence for a minimum of three years after completion of construction of the project and resolution of all relevant claims arising therefrom, and shall make available at its offices at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the FWS.

B. FWS is responsible for:

1. Operation, Maintenance, and Repair: Upon completion of construction as determined by the District Engineer, Rock Island, the FWS shall accept the project and shall operate, maintain, and repair the project as defined in the Definite Project Report entitled "Big Timber Refuge Rehabilitation and Enhancement," dated July 1989, in accordance with Section 906(e) of the Water Resources Development Act, Public Law 99-662.

2. Non-Federal Responsibilities: In accordance with Section 906(e) of the Water Resources Development Act, Public Law 99-662, the FWS shall obtain 25 percent of all costs associated with the operation and maintenance of the project from the Iowa Department of Natural Resources.

V. MODIFICATION AND TERMINATION

This MOA may be modified or terminated at any time by mutual agreement of the parties. Any such modification or termination must be in writing. Unless otherwise modified or terminated, this MOA shall remain in effect for a period of no more than 50 years after initiation of construction of the project.

VI. REPRESENTATIVES

The following individuals or their designated representatives shall have authority to act under this MOA for their respective parties:

FWS: Regional Director
U.S. Fish and Wildlife Services
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

DA: District Engineer
U.S. Army Engineer District, Rock Island
Clock Tower Building - P.O. Box 2004
Rock Island, Illinois 61204-2004

VII. EFFECTIVE DATE OF MOA

This MOA shall become effective when signed by the appropriate representatives of both parties.

THE DEPARTMENT OF THE ARMY

BY: _____
JOHN R. BROWN
Colonel
U.S. Army Engineer District,
Rock Island
Corps of Engineers

DATE: _____

THE U.S. FISH AND WILDLIFE SERVICE

BY: _____
JAMES C. GRITMAN
Regional Director
U.S. Fish and Wildlife
Service

DATE: _____

# DISTRIBUTION LIST

APPENDIX H

DISTRIBUTION LIST
FOR
DEFINITE PROJECT REPORT
WITH ENVIRONMENTAL ASSESSMENT AND
SECTION 404(b)(1) EVALUATION
BIG TIMBER REFUGE REHABILITATION AND ENHANCEMENT
POOL 17, MISSISSIPPI RIVER MILES 443-445
LOUISA COUNTY, IOWA 1/

Messrs. Chuck Davis ~~and Leroy Bowl~~
U.S. Fish and Wildlife Service
1830 Second Avenue
Rock Island, Illinois 61201

Mr. Bob Stratton
U.S. Fish and Wildlife Service
Mark Twain National Wildlife Refuge
311 North 5th, Suite 100
Quincy, Illinois 62301

Mr. ~~Chet McCarty~~ TOM BELL
Louisa Division
Mark Twain National Wildlife Refuge
R.R. 1, Box 75
Wapello, Iowa 52653

Messrs. Bernard Schonoff/Bill Aspelmeier
Department of Natural Resources
Fairport Fish Hatchery
R.R. 3, Box 434
Muscatine, Iowa 52761

Mr. David Crosson
State Historic Preservation Officer
Bureau of Historic Preservation
Capitol Complex
East 12th & Grand Avenue
Des Moines, Iowa 50319

Ms. Kay Simpson
State Historical Society of Iowa
Capitol Complex
East 12th & Grand Avenue
Des Moines, Iowa 50319

Mr. Keith Beseke
Upper Mississippi River National
Wildlife & Fish Refuge
51 East 4th Street
Winona, Minnesota 55987

DISTRIBUTION LIST (Cont'd)

Mr. Kevin Szcodronski
Iowa Department of Natural Resources
Wallace State Office Building
Des Moines, Iowa 50319-0034

Mr. Bill Donels
Illinois Department of Conservation
Lincoln Tower Plaza
524 South Second Street
Springfield, Illinois 62706

Mr. Chuck Gibbons, ARW/FM
U.S. Fish and Wildlife Service, Region 3
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

Ms. Holly Stoerker
Upper Mississippi River Basin Association
415 Hamm Building
408 St. Peter Street
St. Paul, Minnesota 55111

Ms. Gail Carmody
Upper Mississippi River Conservation Commission
U.S. Fish and Wildlife Service
1830 Second Avenue
Rock Island, Illinois 61201

Mr. Norm Stucky
Missouri Department of Conservation
P.O. Box 180
Jefferson City, Missouri 65102-0180

Dr. David Kennedy
Wisconsin Department of Natural Resources
3550 Mormon Coulee Drive, Room 108
LaCrosse, Wisconsin 54601

Mr. Larry Cavin
Chief, Environmental Review Branch
U.S. Environmental Protection Agency
726 Minnesota Avenue
Kansas City, Missouri 64106

Mr. Jim Harrison
Minnesota and Wisconsin Boundary Area Commission
619 Second Street
Hudson, Wisconsin 540162

DISTRIBUTION LIST (Cont'd)

Mr. David U. Sallen
Attorney at Law
707½ Avenue G
Fort Madison, Iowa 52627

Division Engineer
U.S. Army Engineer Division, North Central
ATTN: Planning Division (Tom Hempfling) (27)
539 South Clark Street
Chicago, Illinois 60605-1592

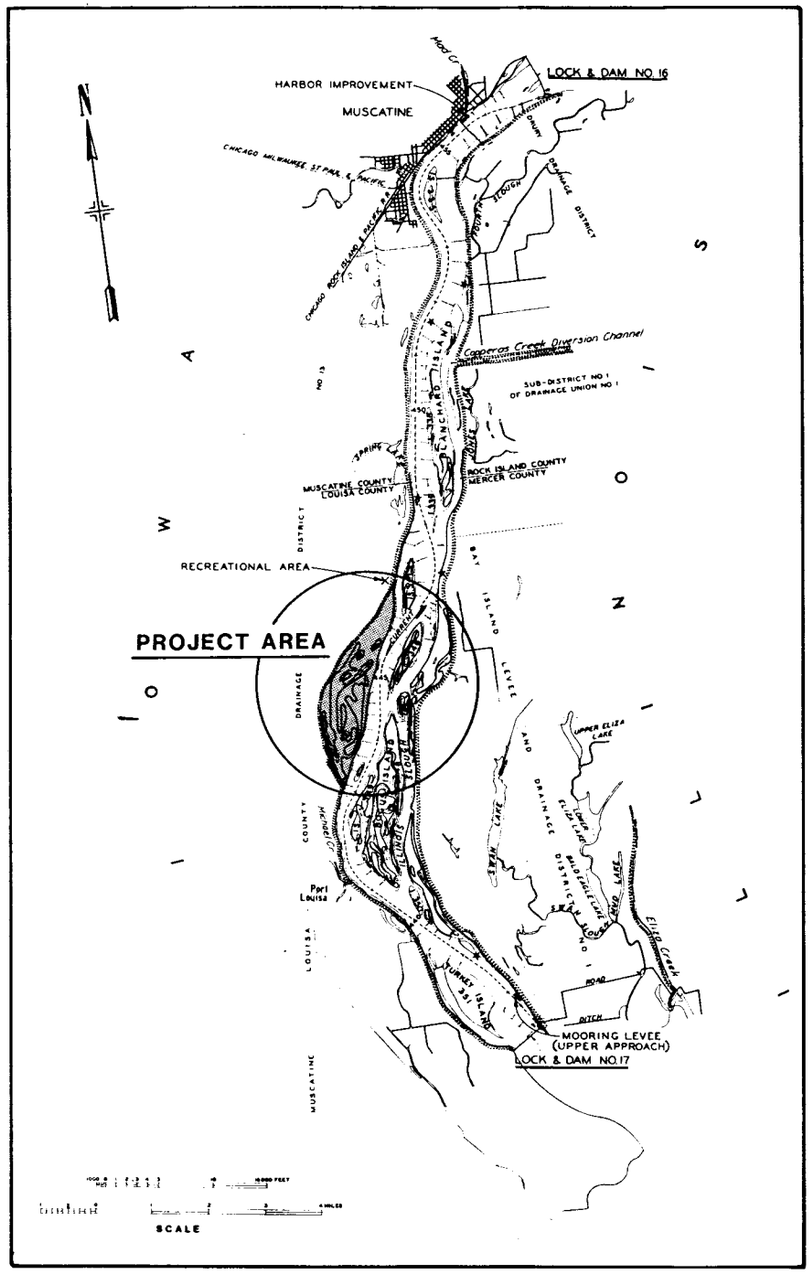
District Engineer
U.S. Army Engineer District, St. Paul
ATTN: Planning Division (Chuck Workman)
1421 USPO and Custom House
180 East Kellogg Boulevard
St. Paul, Minnesota 55101-1479

District Engineer
U.S. Army Engineer District, St. Louis
ATTN: Planning Division (Ben Hawickhorst)
210 Tucker Boulevard North
St. Louis, Missouri 63101-1986

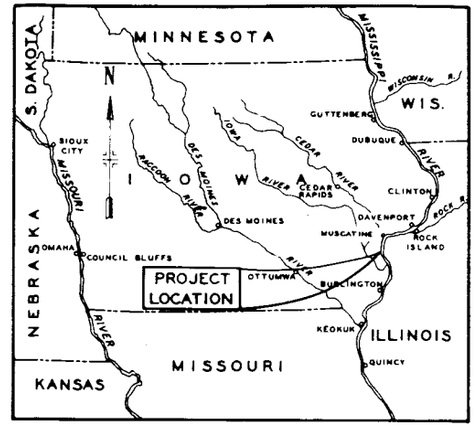
District Engineer
U.S. Army Engineer District, Rock Island
Clock Tower Building - P.O. Box 2004
Rock Island, Illinois 61204-2004
ATTN:

| | |
|---|---|
| CENCR-DE | CENCR-PD (2) |
| CENCR-RE | CENCR-PD-E |
| CENCR-ED | CENCR-PD-R |
| CENCR-ED-D | CENCR-OD |
| CENCR-ED-DG (3) | CENCR-OD-M |
| CENCR-ED-G | CENCR-OD-MC |
| CENCR-ED-H | CENCR-OD-R |
| CENCR-ED-HH | CENCR-CD |
| CENCR-ED-HQ | CENCR-IM-C (3) |
| CENCR-PA | CENCR-PO |

1/ All addressees receive one copy of the document except where noted in parentheses.




## LOCATION PLAN




## VICINITY MAP

25 0 25 50 75
SCALE IN MILES

| Revisions | | | |
|---|---|---|---|
| Symbol | Descriptions | Date | Approved |
| | | | |

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

Designed by:
Drawn by:
Checked by:
Reviewed by:
Approved by:

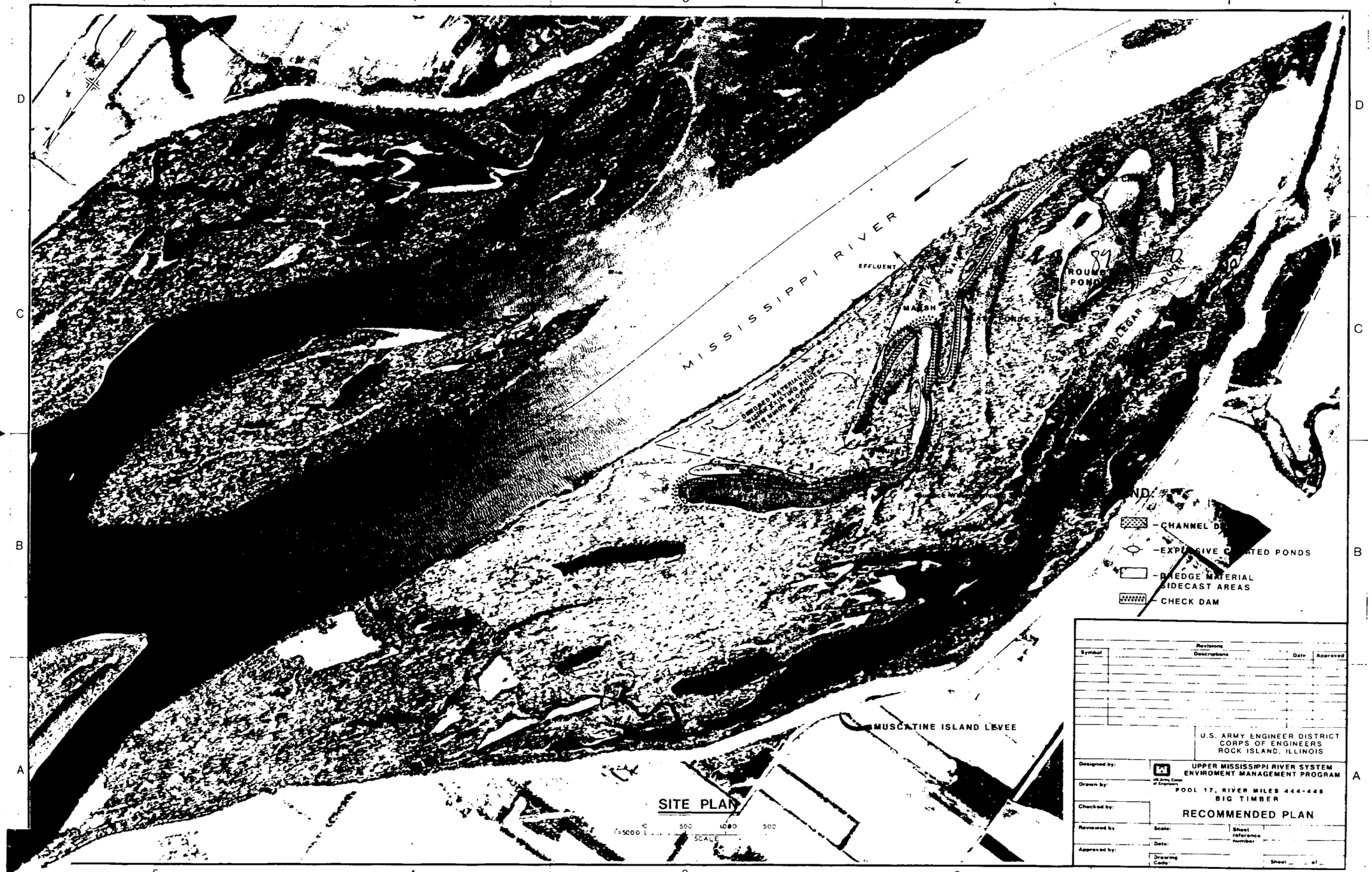
US Army Corps of Engineers

UPPER MISSISSIPPI RIVER SYSTEM
ENVIROMENT MANAGEMENT PROGRAM

POOL 17, RIVER MILES 444-445
BIG TIMBER
LOCATION PLAN

Scale: AS SHOWN
Date:
Drawing Code:
Sheet reference number:
Sheet _ _ of _

PLATE 1




| Revisions | | | |
|---|---|---|---|
| Symbol | Descriptions | Date | Approved |

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

Designed by:
Drawn by:
Checked by:
Reviewed by
Approved by:

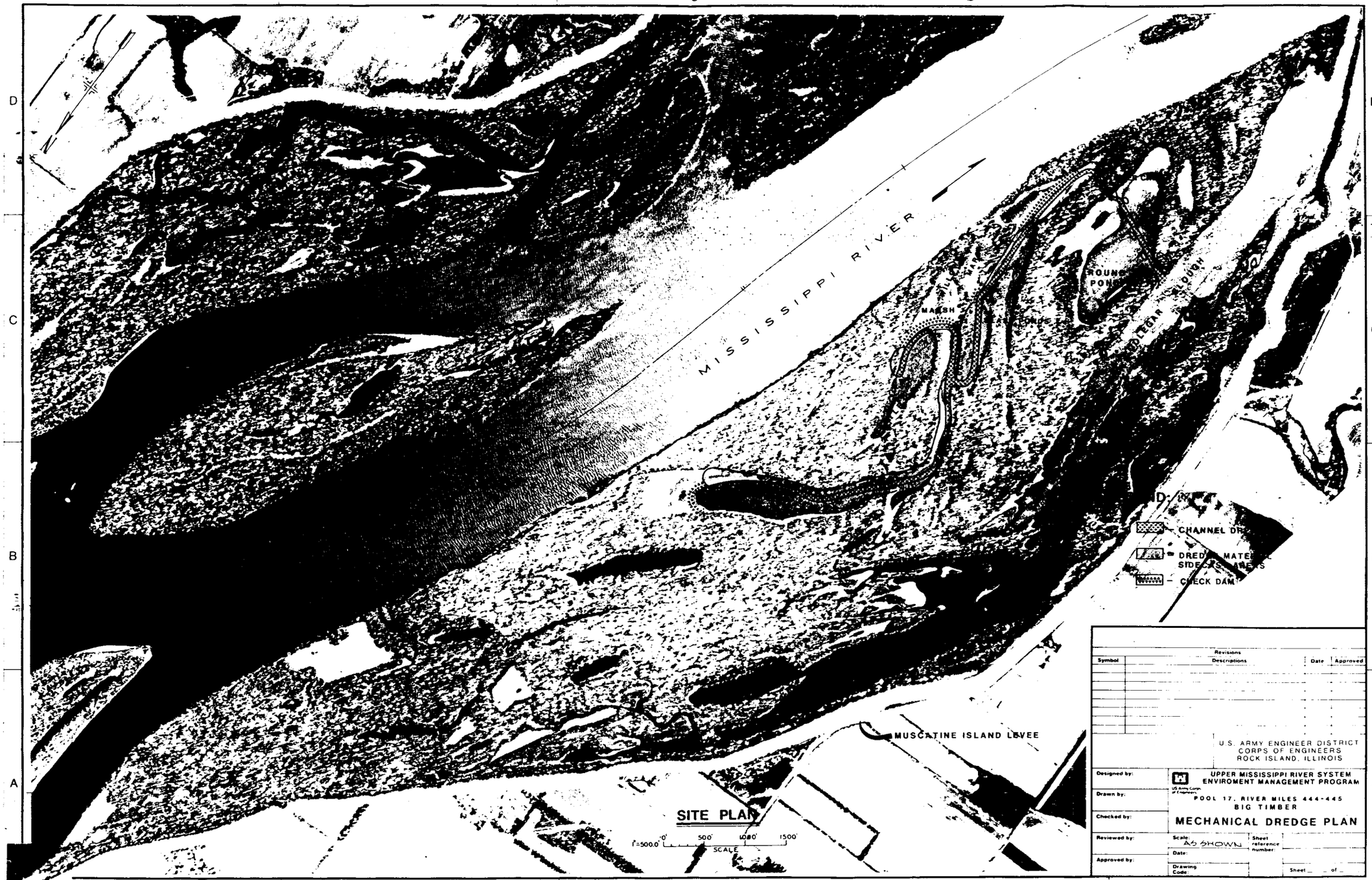
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENT MANAGEMENT PROGRAM

POOL 17, RIVER MILES 444-445
BIG TIMBER

RECOMMENDED PLAN

Scale:
Date:
Sheet reference number
Drawing Code:
Sheet ___ of ___

PLATE 2




| Revisions | | | |
|---|---|---|---|
| Symbol | Descriptions | Date | Approved |
| | | | |

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

Designed by:
Drawn by:
Checked by:
Reviewed by:
Approved by:

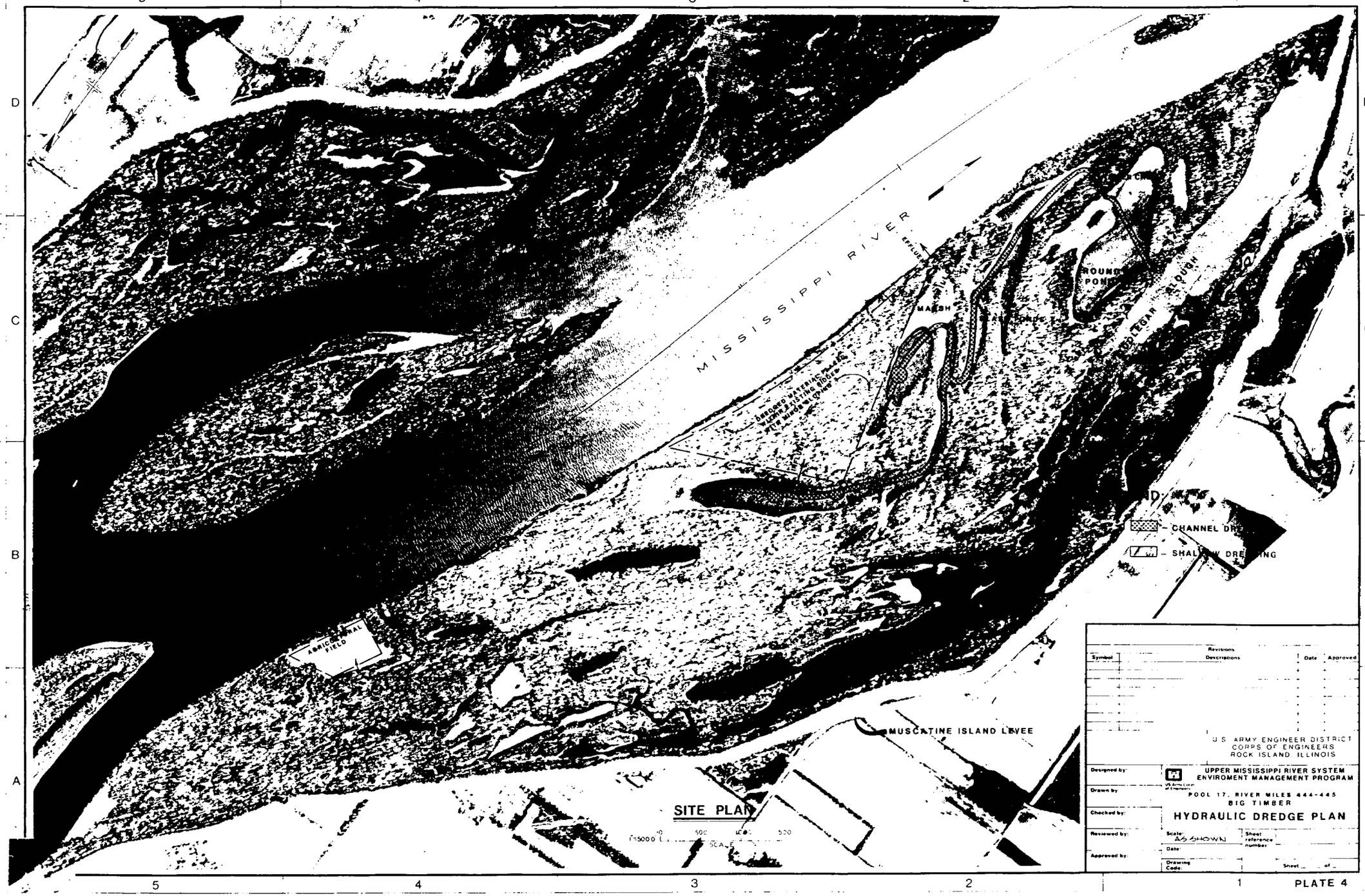
UPPER MISSISSIPPI RIVER SYSTEM
ENVIROMENT MANAGEMENT PROGRAM

POOL 17, RIVER MILES 444-445
BIG TIMBER

# MECHANICAL DREDGE PLAN

Scale: AS SHOWN
Date:
Drawing Code:
Sheet reference number:
Sheet ___ of ___

PLATE 3




| Revisions | | | |
|---|---|---|---|
| Symbol | Descriptions | Date | Approved |

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

Designed by:
Drawn by:
Checked by:
Reviewed by:
Approved by:

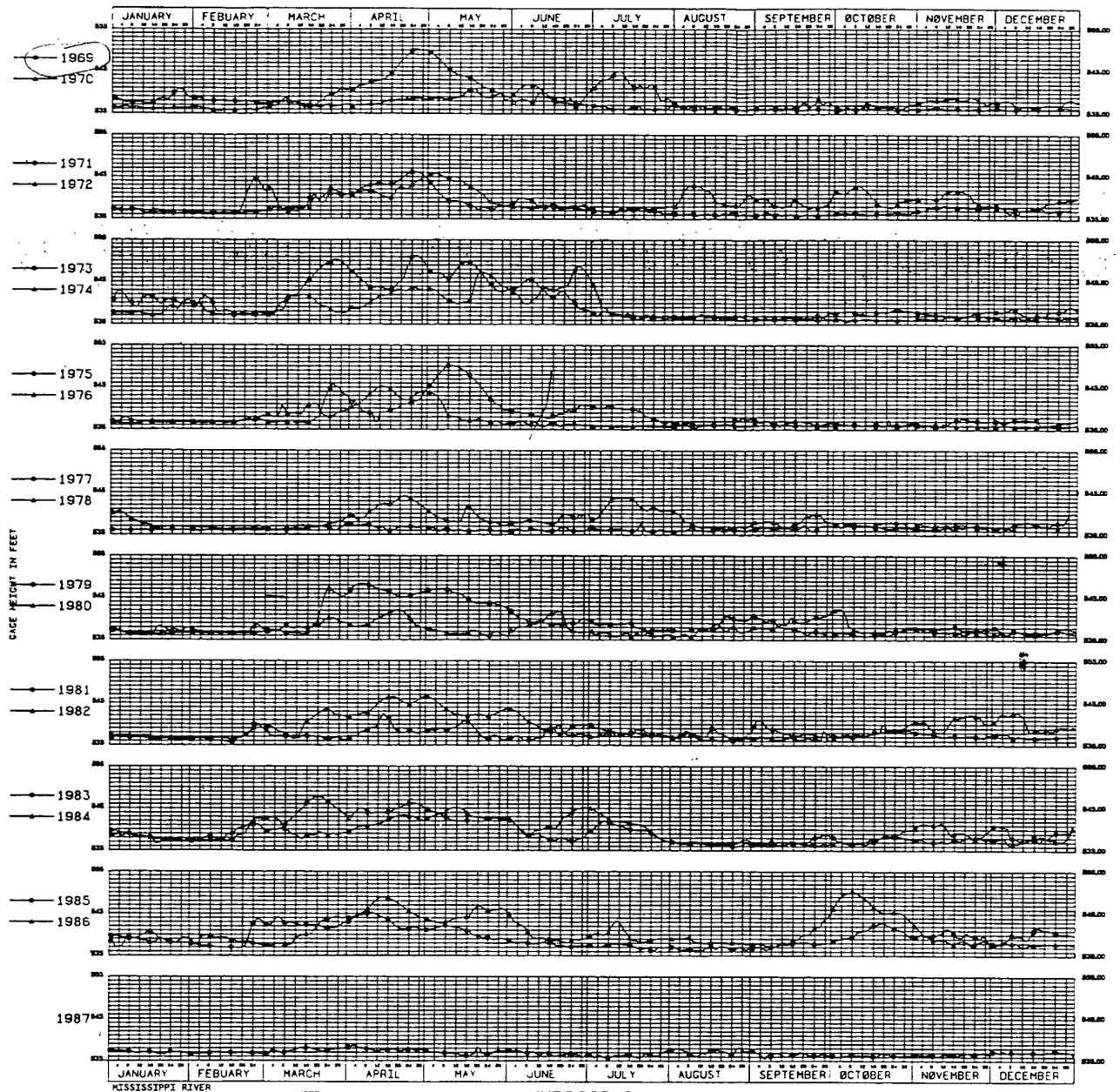
UPPER MISSISSIPPI RIVER SYSTEM
ENVIROMENT MANAGEMENT PROGRAM

POOL 17, RIVER MILES 444-445
BIG TIMBER

# HYDRAULIC DREDGE PLAN

Scale: AS SHOWN
Sheet reference number
Date
Drawing Code:
Sheet ___ of ___

PLATE 4




NØTE-

HYDRØGRAPH
BLANCHARD ISLAND

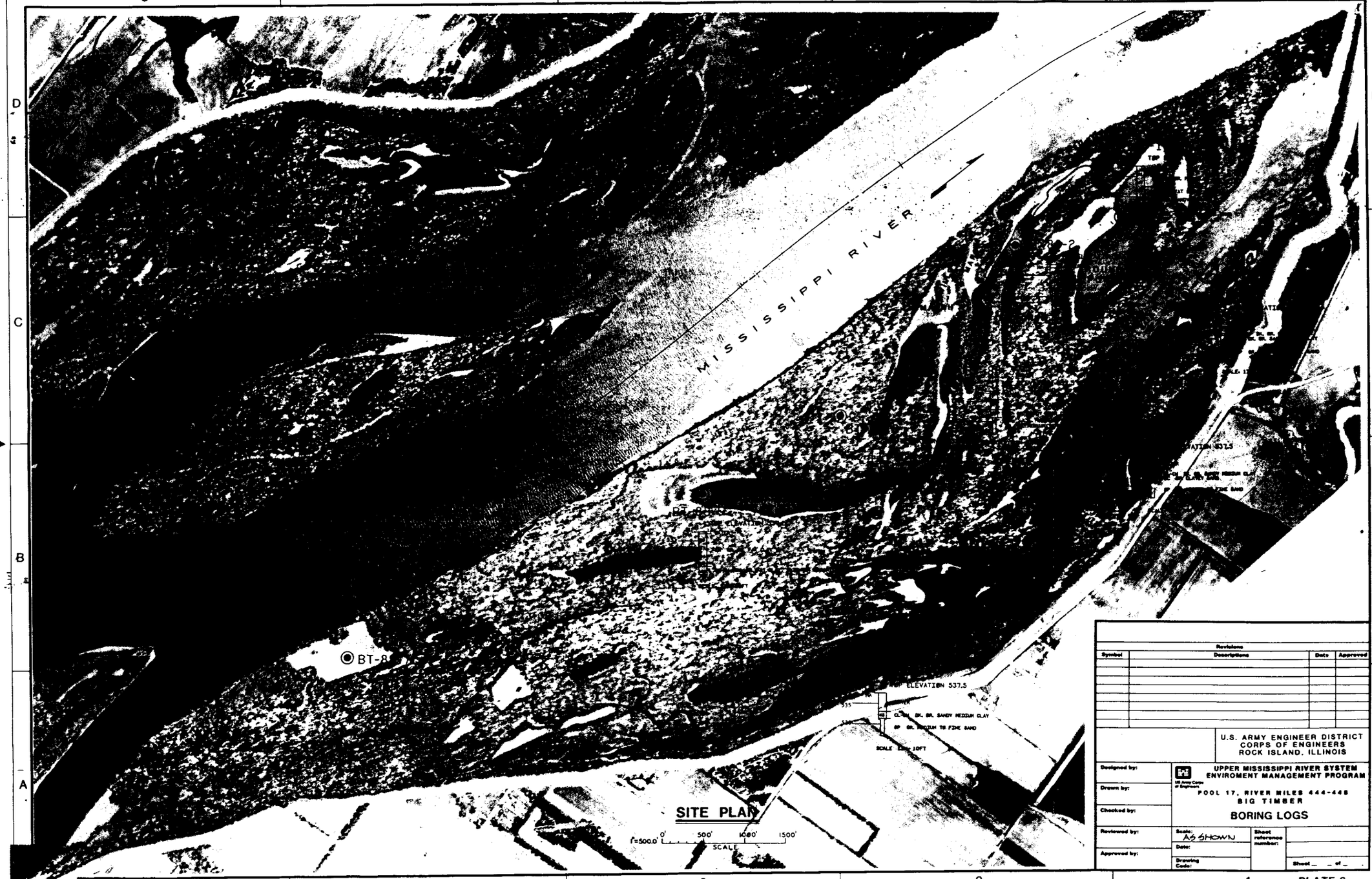
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENT MANAGEMENT PROGRAM

POOL 17, RIVER MILES 444-465
BIG TIMBER

HYDRAULIC DATA

PLATE 5




| Revisions | | | |
|---|---|---|---|
| Symbol | Descriptions | Date | Approved |
| | | | |

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

Designed by:
Drawn by:
Checked by:
Reviewed by:
Approved by:

US Army Corps of Engineers

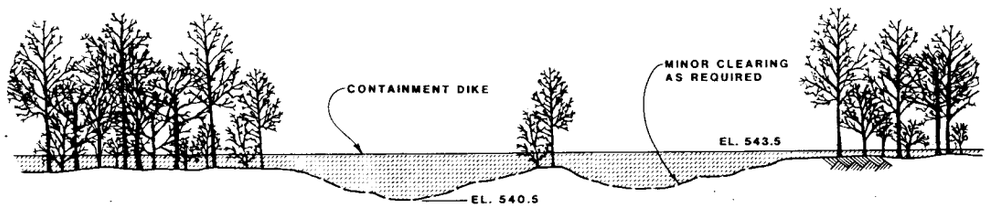
UPPER MISSISSIPPI RIVER SYSTEM
ENVIROMENT MANAGEMENT PROGRAM

POOL 17, RIVER MILES 444-448
BIG TIMBER

# BORING LOGS

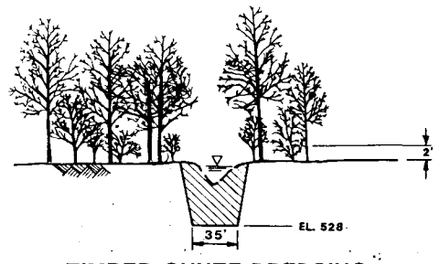
Scale: AS SHOWN
Date:
Drawing Code:
Sheet reference number:
Sheet __ of __

PLATE 6



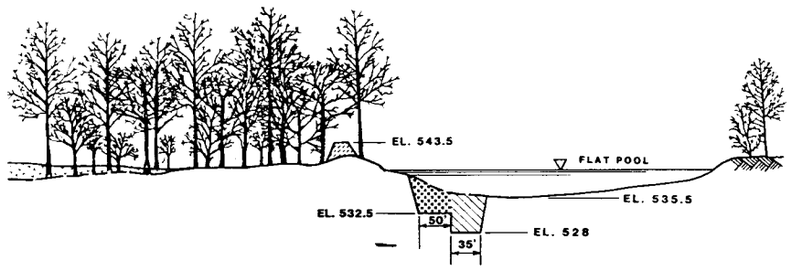

## MINOR EARTH WORK TO SUPPLEMENT NATURAL BERM

## TYPICAL ELEVATION

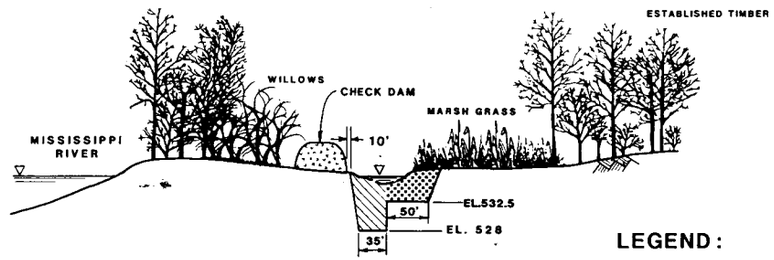



## TIMBER CHUTE DREDGING

## TYPICAL SECTION

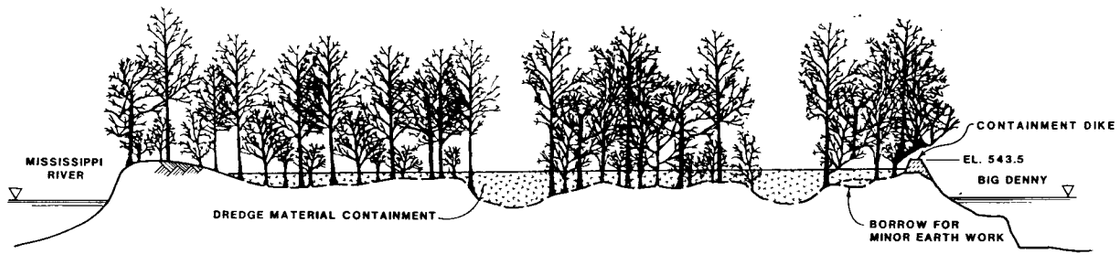



## LAKE DREDGING, TYPICAL SECTION




## WILLOW CHUTE DREDGING

## TYPICAL SECTION




## NATURAL DREDGED MATERIAL PLACEMENT AREA

## TYPICAL SECTION

**LEGEND:**

- HYDRAULIC DREDGE
- MECHANICAL DREDGE
- DREDGED MATERIAL PLACEMENT
- CONTAINMENT DIKE

| Revisions | | | |
|---|---|---|---|
| Symbol | Descriptions | Date | Approved |
| | | | |

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

Designed by:
Drawn by:
Checked by:
Reviewed by:
Approved by:

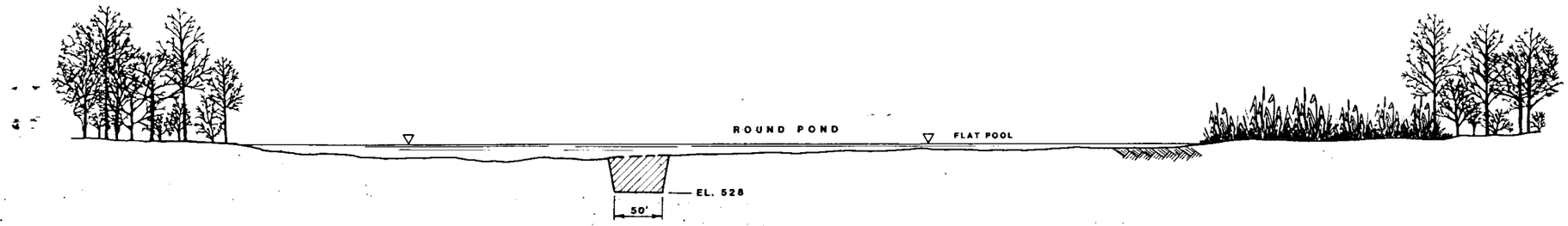
UPPER MISSISSIPPI RIVER SYSTEM
ENVIROMENT MANAGEMENT PROGRAM

POOL 17, RIVER MILES 444-445
BIG TIMBER

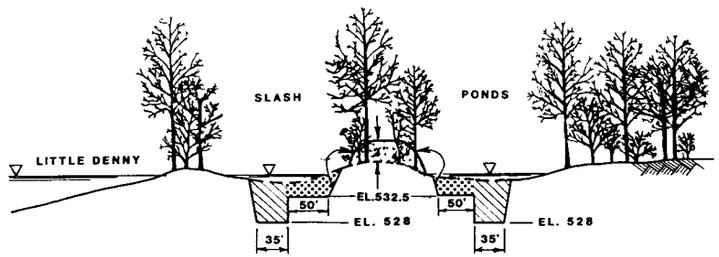
SECTIONS I

Scale: NONE
Date:
Drawing Code:
Sheet reference number:
Sheet __ __ of __

PLATE 7




## ROUND POND DREDGING, TYPICAL SECTION




## SLASH POND DREDGING, TYPICAL SECTION

**LEGEND:**

- HYDRAULIC DREDGE
- MECHANICAL DREDGE
- DREDGED MATERIAL PLACEMENT
- CONTAINMENT DIKE

| Revisions | | | |
|---|---|---|---|
| Symbol | Descriptions | Date | Approved |
| | | | |

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

Designed by:
Drawn by:
Checked by:
Reviewed by:
Approved by:

US Army Corps of Engineers
UPPER MISSISSIPPI RIVER SYSTEM
ENVIROMENT MANAGEMENT PROGRAM

POOL 17, RIVER MILES 444-445
BIG TIMBER

SECTIONS II

Scale: NONE
Date:
Drawing Code:
Sheet reference number:
Sheet _ _ of _

PLATE 8

| Revisions | | | |
|---|---|---|---|
| Symbol | Descriptions | Date | Approved |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

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

Designed by:
Drawn by:
Checked by:
Reviewed by:
Approved by:

US Army Corps of Engineers

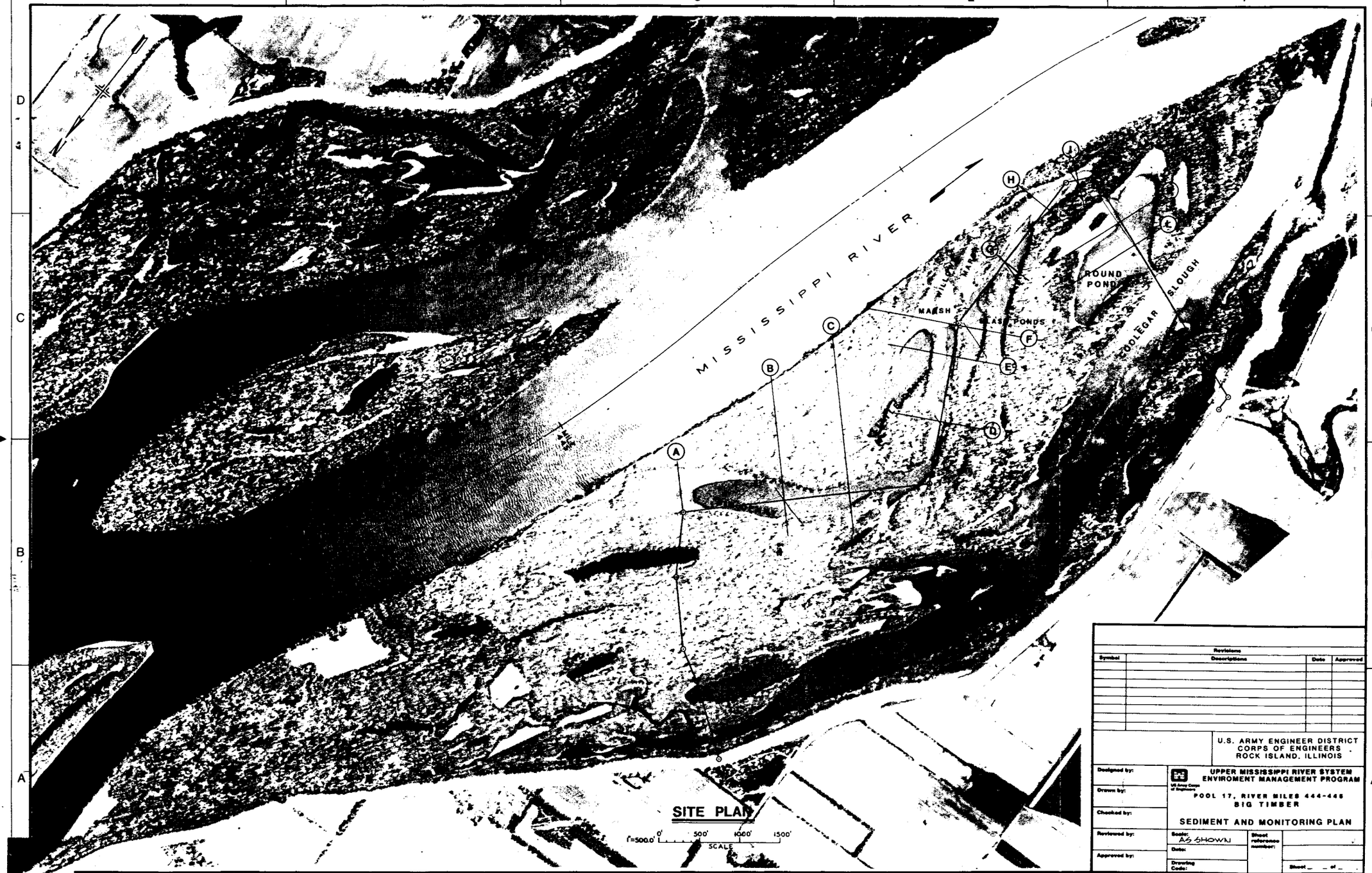
UPPER MISSISSIPPI RIVER SYSTEM
ENVIROMENT MANAGEMENT PROGRAM

POOL 17, RIVER MILES 444-448
BIG TIMBER

TOPOGRAPHY

Scale:
Date:
Drawing Code:
Sheet reference number:
Sheet _ _ of _

PLATE 9




| Revisions | | | |
|---|---|---|---|
| Symbol | Descriptions | Date | Approved |
| | | | |

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

Designed by:
Drawn by:
Checked by:
Reviewed by:
Approved by:

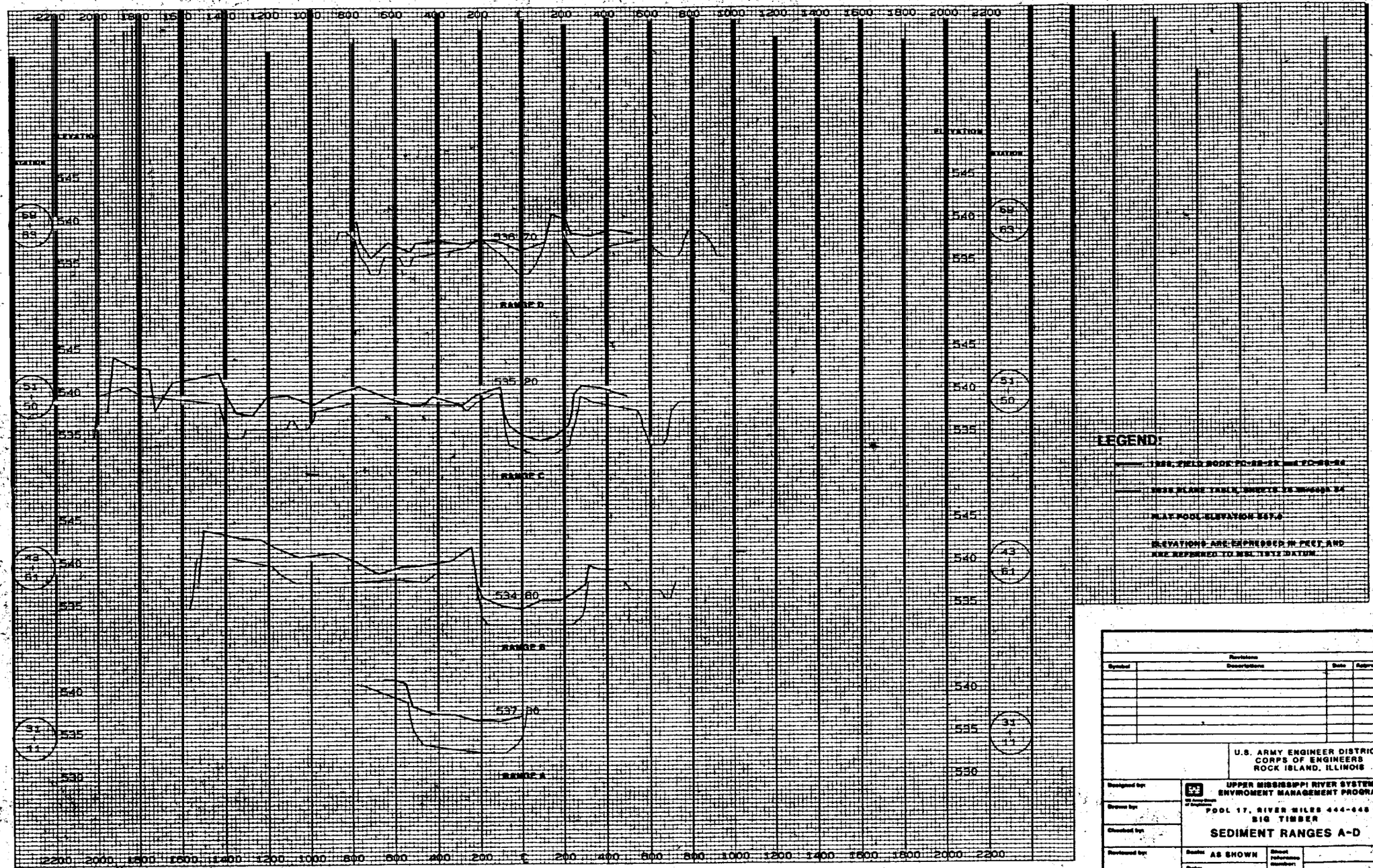
UPPER MISSISSIPPI RIVER SYSTEM
ENVIROMENT MANAGEMENT PROGRAM

POOL 17, RIVER MILES 444-448
BIG TIMBER

SEDIMENT AND MONITORING PLAN

Scale: AS SHOWN
Date:
Drawing Code:
Sheet reference number:
Sheet _ of _

PLATE 10




| Revisions | | | |
|---|---|---|---|
| Symbol | Descriptions | Date | Approved |
| | | | |

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

Designed by:
Drawn by:
Checked by:
Reviewed by:
Approved by:

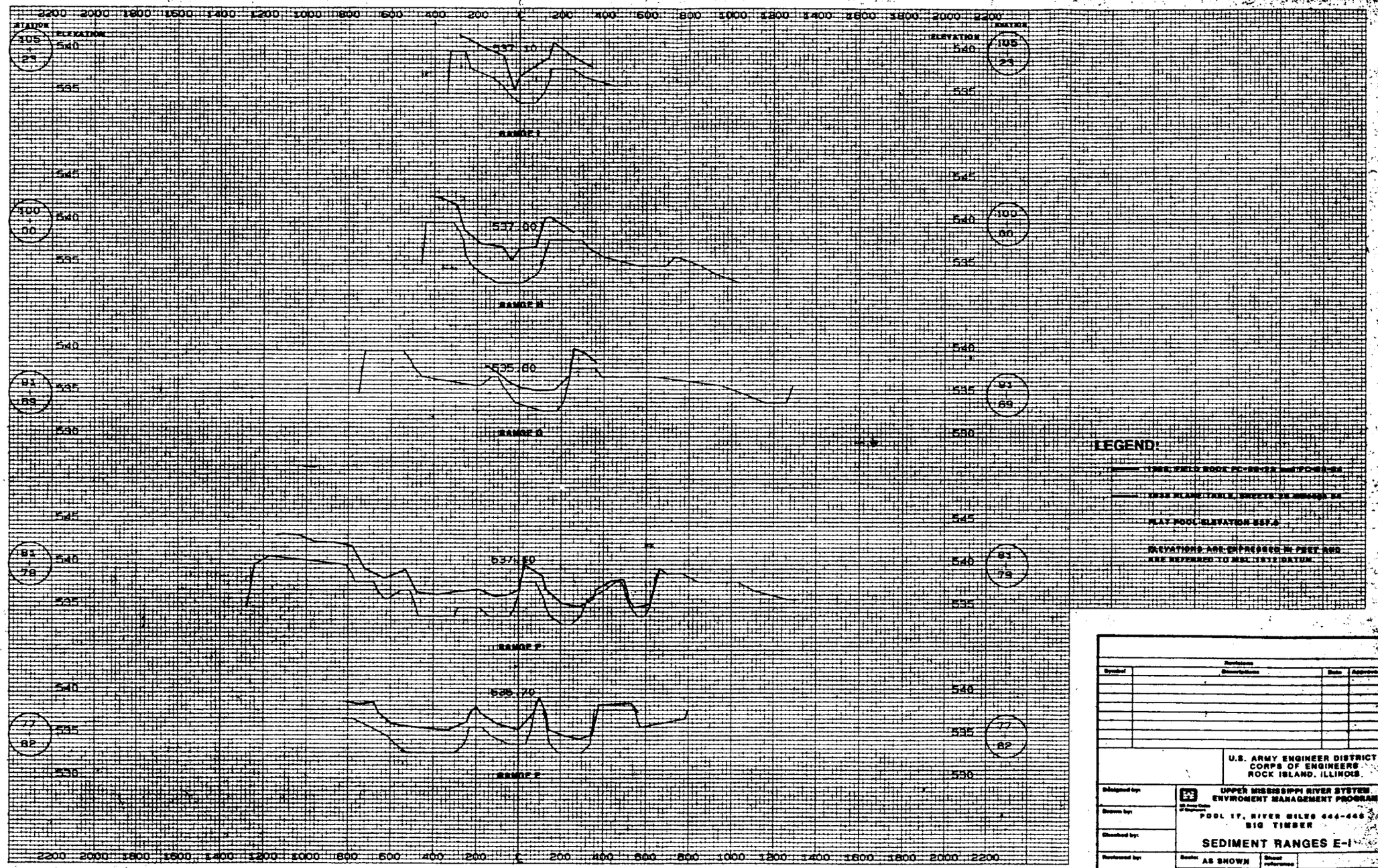
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENT MANAGEMENT PROGRAM

POOL 17, RIVER MILES 444-648
BIG TIMBER

# SEDIMENT RANGES A-D

Scale: AS SHOWN
Scale:
Drawing Code:
Sheet information number:
Sheet _ of _

PLATE 11




**LEGEND:**

1988 FIELD ROOK PC-88-18 and PC-88-24

1938 PLANE TABLE SURVEY BY MISSOURI

FLAT POOL ELEVATION 535.0

ELEVATIONS ARE EXPRESSED IN FEET AND ARE REFERRED TO MSL (1912) DATUM.

| Symbol | Revisions Description | Date | Approved |
|---|---|---|---|
| | | | |

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

Designed by:
Drawn by:
Checked by:
Reviewed by:
Approved by:

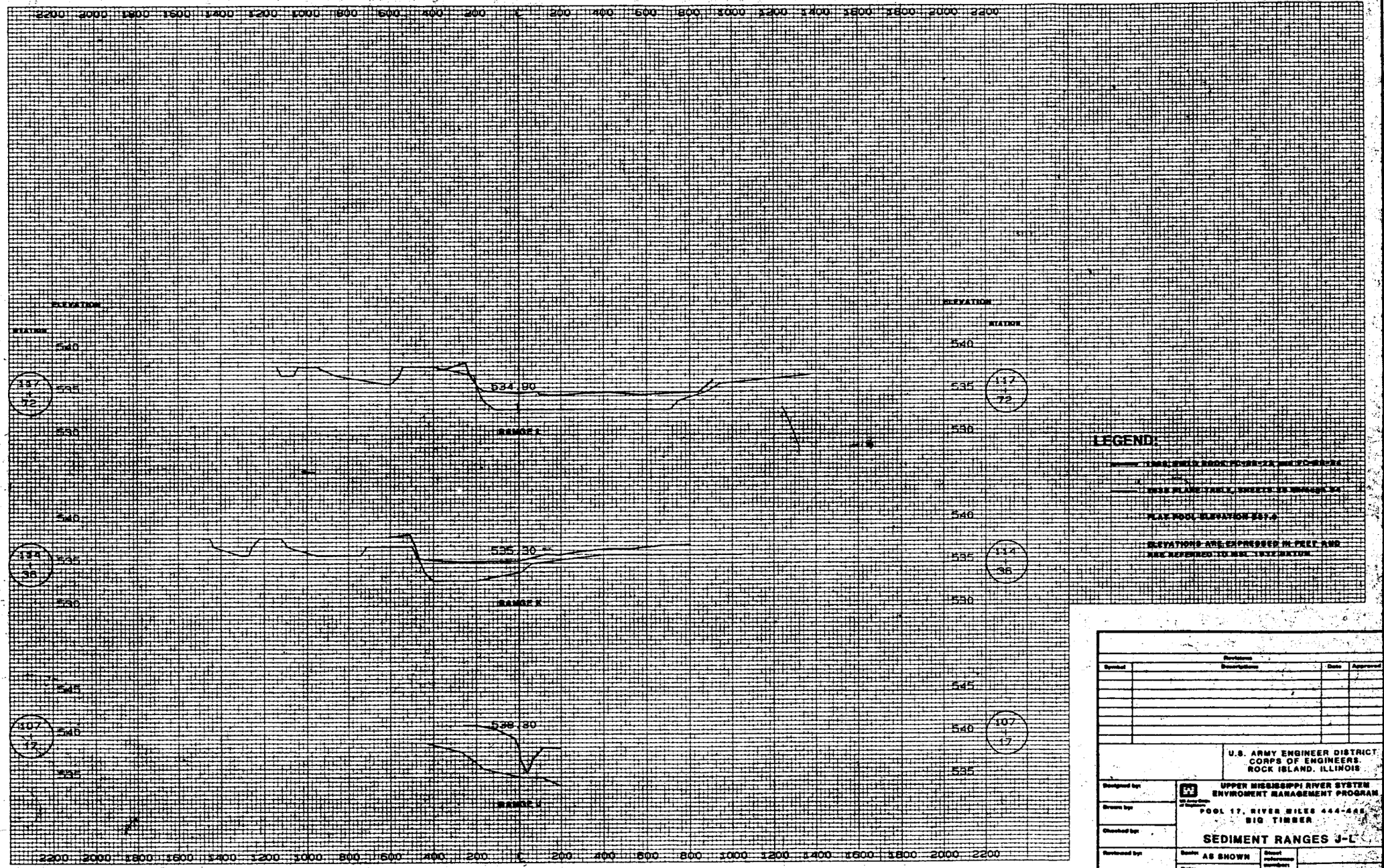
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENT MANAGEMENT PROGRAM

POOL 17, RIVER MILES 444-449
BIG TIMBER

# SEDIMENT RANGES E-I

Scale: AS SHOWN
Date:
Drawing Code:
Sheet reference number:
Sheet _ of _

PLATE 12




| Symbol | Revisions Descriptions | Date | Approved |
|---|---|---|---|
| | | | |

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

Designed by:
Drawn by:
Checked by:
Reviewed by:
Approved by:

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENT MANAGEMENT PROGRAM
POOL 17, RIVER MILES 444-465
BIG TIMBER

# SEDIMENT RANGES J-L

Scale: AS SHOWN
Date:
Drawing Code:
Sheet number/ number:
Sheet _ of _

PLATE 13