UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT (R-9F)
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

POTTERS MARSH
REHABILITATION AND ENHANCEMENT

APRIL 1992

US Army Corps
of Engineers
Rock Island District

POOL 13
MISSISSIPPI RIVER
CARROLL AND WHITESIDE
COUNTIES, ILLINOIS

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

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ENVIRONMENTAL MANAGEMENT PROGRAM
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POTTERS MARSH REHABILITATION AND ENHANCEMENT

POOL 13, MISSISSIPPI RIVER MILES 522.5 THROUGH 526.0
CARROLL AND WHITESIDE COUNTIES, ILLINOIS

APRIL 1992

ACKNOWLEDGEMENT

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US Army Corps of Engineers
Rock Island District

WE'RE PROUD TO SIGN OUR WORK

EXECUTIVE SUMMARY

Potters Marsh encompasses 2,305 acres of floodplain wetlands, wooded areas, and open water. It is located in the Illinois counties of Carroll and Whiteside within Pool 13 of the Upper Mississippi River between river miles 522.5 and 526.0 (see figure 1 following Executive Summary). The area is presently managed by the U.S. Fish and Wildlife Service (USFWS) as part of the Upper Mississippi River National Wildlife and Fish Refuge.

Following construction of Lock and Dam 13, a permanent backwater slough was created between what is now an island and the Illinois mainland. Siltation in the slough has reached critical proportions, with aquatic vegetation dominating the slough and drastically reducing the fisheries habitat. Siltation also has degraded the waterfowl marsh habitat at this location, historically considered to be some of the best available on the Mississippi River.

The goals for this project are the rehabilitation and enhancement of waterfowl and fishery habitats. In order to accomplish these goals, the following design objectives were identified: (1) restore and create fisheries habitat; (2) reduce sediment input; (3) increase migratory bird feeding or resting area; and (4) increase waterfowl brood habitat and fall feeding sites. Eleven alternatives were considered to meet the stated objectives: (A) no Federal action; (B) construct closure dike with water control structure; (C) redesign existing causeway; (D) construct barrier island; (E) dredge sediment trap - segment 1 and deep hole below causeway; (F) hydraulically dredge backwater channels - segments 2 and 3; (G) hydraulically dredge backwater channel - segment 4; (H) create potholes; (I) develop managed marshland on CPS; (J) develop grassland on CPS; and (K) construct moist soil unit on CPS.

Evaluation of the project alternatives was accomplished through the application of habitat value assessment methodologies. The Wildlife Habitat Appraisal Guide, a habitat assessment methodology designed by the Missouri Department of Conservation in cooperation with the U.S. Soil Conservation Service, was used in the analysis of wetland and terrestrial habitats. The alternatives were evaluated on an individual and combined feature basis. As a result of the analysis, alternatives E, F, H, and I were recommended for project construction. Dredge sediment trap - segment 1 and deep hole below causeway (Alternative E), hydraulically dredge backwater channels - segments 2 and 3 (Alternative F), create potholes (Alternative H), and develop managed marshland on CPS (Alternative I) all meet project objectives and are cost effective.

Two features described in the original fact sheet have been eliminated from the recommended project, although project objectives have not changed. These two features are the barrier island and closure dike with water control structure. These features were dropped in light of the following determinations: (1) wind-induced sediment resuspension and transport are not the major sources of sedimentation in the project area's lower slough and embayment; and (2) the majority of sedimentation at this location occurs during flood events, at which time water would be flowing over and around the closure dike.

Development of the selected plan will provide approximately 32 acres of manageable aquatic and wetland habitat and approximately 38 acre-feet of off-channel, deep water aquatic habitat. Migratory waterfowl habitat value will be enhanced by increasing the seasonal availability of reliable water, food resources, and resting, loafing, and nesting opportunities. Fisheries benefits will be accrued through the creation of off-channel, deep water slough habitat.

It is proposed that selected quantitative physical, chemical, and natural resource parameter measurements, as specified in the project report, be collected following completion of construction to evaluate project performance with respect to the stated objectives. The Corps of Engineers would have responsibility for this data collection. Additional field observations would be gathered by the USFWS and submitted to the Corps of Engineers as part of the annual project monitoring plan.

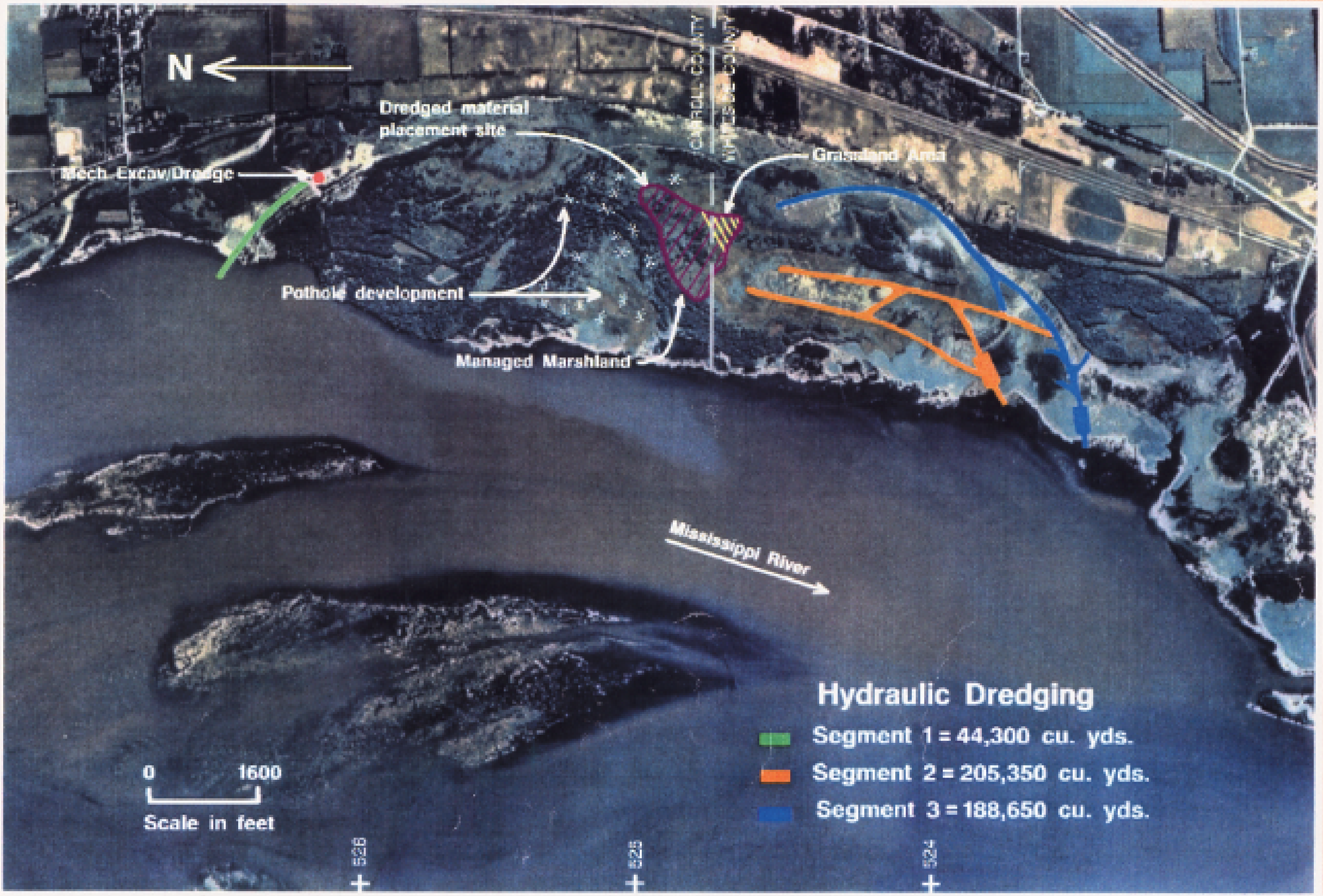
Average annual operation and maintenance of the project, estimated to cost $6,100, will be satisfied through agreement between the USFWS and the non-Federal project sponsor, the Illinois Department of Conservation (IDOC).

The U.S. Army Corps of Engineers 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. Rehabilitation of the project is considered reconstructive work which cannot be accurately estimated at this time.

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 area is managed as a National Wildlife Refuge within the meaning of Section 906(e) of the 1986 Water Resources Development Act. Therefore, approval of the construction of Potters Marsh Habitat Rehabilitation and Enhancement project is recommended by the Rock Island District Engineer at 100-percent Federal expense. The current working estimate for this project is $3,957,000 ($3,278,000) for construction; $515,000 for planning, engineering, and design; and $164,000 for construction management).

UMRS
EMP

POTTERS MARSH, IL



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1. INTRODUCTION

a. **Purpose**. The purpose of this report is to present a detailed proposal for the rehabilitation and enhancement of Potters Marsh. This 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 is continual sedimentation of backwater aquatic and wetland habitats. Sedimentation is the primary aquatic resource problem throughout the Upper Mississippi River (UMR), and is believed to be responsible for changes in the sport fishery, declines in the commercial fishery, and losses of habitat for migratory waterfowl throughout the pooled portions of the river.

In the study area, the opportunity exists to both restore aquatic habitat and to improve aquatic and wetland habitat quality.

c. **Scope of Study**. Potters Marsh is a backwater complex located on the Illinois side of the Mississippi River just upstream of Lock and Dam No. 13 between river miles 522.5 and 526.0. It is located in Carroll and Whiteside Counties approximately 5 miles north of Fulton, Illinois, on lands owned by the U.S. Army Corps of Engineers. Under a cooperative agreement with the Corps of Engineers, the land is managed by the U.S. Fish and Wildlife Service (USFWS) as part of the Upper Mississippi River National Wildlife and Fish Refuge. However, the extreme upper portion of the Potters Marsh complex is still maintained by the Corps of Engineers as a recreation site. A vicinity and general location map for Potters Marsh are shown on plate 1, and a site-specific plan is shown on plate 2.

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 birds and is consistent with agency management goals.

Field surveys, aerial photography, and terrain modeling were done to plan and assess proposed project alternatives. Hydrographic soundings were performed in developing sedimentation estimates and estimating excavation/

dredging quantities. Surveyed sections will be used to evaluate post-construction performance.

Soil borings were taken to assess sediment types, to verify foundations of any proposed structures, and to determine excavation/dredging difficulty. Water quality sampling was initiated at the commencement of the study and will continue through construction.

Fish and waterfowl observations within the study area have been made by the USFWS. These observations, along with future studies, will assist in evaluating project performance.

d. **Format of Report.** The report is organized to follow a general problem solving format. The purpose and problems are presented in Section 1. Section 2 provides an overview of how and why Potters Marsh was selected as a project within the Environmental Management Program. Section 3 establishes the baseline for existing resources. Section 4 provides the objectives of the project. Sections 5 and 6 propose and evaluate project alternatives, and Sections 7 and 8 describe the selected plan in accordance with the National Environmental Policy Act. Section 9 assesses the environmental effects from the proposed plan. Section 10 provides a summary of project accomplishments and benefits. Sections 11, 12, and 13 describe estimated operation and maintenance considerations, performance monitoring, and detailed cost estimates for both initial construction and annual operation and maintenance. Sections 14, 15, 16, and 17 provide a summary of implementation requirements and coordination. Sections 18 and 19 present the conclusions and recommendations. A Joint Finding of No Significant Impact follows the main report.

Drawings (plates) have been furnished to provide sufficient detail to allow review of the existing features and the proposed plan. Plates 1 through 3 show the project location, the recommended plan, and alternative plans. Plates 4 and 5 provide 16 years of hydrographic record of the Mississippi River at the proposed project site. Plates 6 and 7 display soil borings which were used to evaluate the confined placement site (CPS) dike foundation effects and hydraulic dredging/mechanical excavation methods. Plate 8 shows the boring locations. Plates 9 and 10 provide a plan view of the selected dredging plan. Plate 11 shows the CPS plan and topography map. Plates 12 and 13 display section views for the selected plan. Plate 16 shows the stoplog structure and well site plan. Plate 17 provides the well electrical plan. Plates 14 and 15 display composite sedimentation cross sections and are the basis for calculating sedimentation rates. Plate 18 shows the monitoring plan.

e. **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 this 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;

(B) implementation of a long-term resource monitoring program;

(C) implementation of a computerized inventory and analysis system;

(f) (1) implementation of a program of recreational projects;

(2) assessment of the economic benefits generated by recreational activities in the system; and

(h) (1) monitoring of traffic movements on the system.

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. Programmatic updates of the General Plan for budget planning and policy development are accomplished through annual addenda.

Coordination with the States and the USFWS during the preparation of the General Plan and annual addenda 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 and General Plan identify examples of potential habitat rehabilitation and enhancement techniques. Consideration of the Federal interest and Federal policies has resulted in the following conclusions:

(1) First Annual Addendum. The Master Plan report ... and the authorizing legislation to 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 side channels 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 opening/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 excluded categorically 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.

(3) Subsequent Annual Addenda. Subsequent annual addenda, of which the Sixth Annual Addendum is the most recent, provide a vehicle for reporting program progress and ensuring thorough coordination between the participating State and Federal agencies.

b. **General Selection Process.** The following steps provide an overview of the process of project selection. The steps are interactive with communication in both directions and occur through a continual process.

(1) State/USFWS Project Nomination. Projects are nominated for inclusion in the Rock Island District's habitat program by the respective State conservation agencies and the USFWS based on agency management objectives. Rock Island District assists the States and USFWS agencies in proposing habitat projects through an in-house task force that includes staff members from the Engineering, Planning, Operations, and Construction Divisions. As projects are being conceptualized, this group meets on-site with State and USFWS personnel to examine as fully as possible what site-specific enhancements would be both environmentally desirable and engineeringly feasible.

(2) Fish and Wildlife Interagency Committee (FWIC) Ratings. To assist in the project formulation process, the FWIC, a group composed of State and Federal biologists who are assigned to aquatic and terrestrial projects (refuges, wildlife areas) along the Mississippi River and Illinois Waterway, has convened a series of meetings starting in 1986 to consider critical habitat needs along the Mississippi River and Illinois Waterway. At these meetings, the available habitat is evaluated on a pool-by-pool basis. These analyses reveal deficiencies (such as feeding, resting, and loafing areas for migratory waterfowl, absence of deep water off the main channel for diving ducks and fish) as well as types of habitat in abundant supply (e.g., mature bottomland hardwoods). (With this information, projects being considered can most accurately reflect broader regional needs in addition to representing the best site-specific choices.)

Projects then are ranked by the FWIC according to the biological benefits that they could provide. Each project is considered and evaluated relative to increasing habitat benefits for fish, waterfowl, and other wildlife. Every project is ranked according to the benefits provided as high, medium, or low.

(3) River Resources Coordinating Team (RRCT) Rankings. The FWIC rankings also are forwarded to the RRCT, an interagency policy group which meets to coordinate Mississippi River and Illinois Waterway activities. The RRCT examines the FWIC rankings and includes considerations of the

broader policy perspectives of the agencies submitting the projects. The RRCT makes a recommended ranking.

(4) U.S. Army Corps of Engineers District Ranking. The FWIC and RRCT recommended rankings are evaluated by the District. The District then formulates a recommended program consistent with the EMP program guidance and District requirements.

(5) U.S. Army Corps of Engineers, North Central Division Prioritizing. The District then submits a recommended program to the North Central Division. Additional coordination by the Division through the Environmental Management Program Coordinating Committee is effected. North Central Division then submits project fact sheets to the Chief of Engineers and Assistant Secretary of the Army for Civil Works for approval. Fact sheets and schedules are subsequently published in the annual addendums, thereby completing the project selection process.

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

Recognition of changes occurring in habitat composition and subsequent declines in waterfowl and fisheries habitat quality and availability along the Mississippi River prompted the proposal of several habitat rehabilitation and enhancement projects by the Federal and State agencies responsible for natural resource management in the Pool 13/14 area. Three of these projects, Spring Lake, IL (RM 532.5-536.0); Pleasant Creek, IA (RM 548.7-552.8) in Pool 13; and Princeton Refuge, IA (RM 504.0-506.4) in Pool 14 are currently in various stages of planning and design for implementation under the Environmental Management Program. A fourth project, Brown's Lake, IA (RM 544.0-546.0), has essentially been completed.

All of these proposed or completed projects address the specific need for enhanced aquatic and wetland habitat. The proposed project at Potters Marsh and the recently completed Brown's Lake project primarily enhance aquatic habitat, while the remaining projects mainly enhance waterfowl habitat. Development of the Potters Marsh project will add a greater diversity of project benefits to the overall benefits generated at the other four project sites in Pools 13 and 14.

Traditionally, Potters Marsh provided submergent and emergent aquatic vegetation protected behind and below an island. Lack of similar habitat in the area makes this valuable backwater complex particularly important to fish and waterfowl. Historically, the aquatic habitat was of excellent quality, but, in more recent years, siltation and subsequent aquatic vegetative growth have greatly reduced the quality of the aquatic habitat.

Implementation of the Potters Marsh project will provide tremendous opportunities for fisheries and waterfowl habitat restoration and enhancement. The project will reduce the siltation rate and prolong its productivity for fish and wildlife.

3. ASSESSMENT OF EXISTING RESOURCES

a. **Resource History and Description of Existing Features.** While fee title to the land is held by the Corps of Engineers, the 2,300-acre Potters Marsh complex falls within the Savanna District of the Upper Mississippi River Fish and Wildlife Refuge System and is managed by the USFWS through a Cooperative Agreement with the Corps of Engineers.

Prior to impoundment by Lock and Dam 13 in 1938, Potters Marsh was agricultural land bisected with tracts of floodplain forest, sloughs, and backwater lakes. The subsequent creation of Pool 13 behind the dam inundated all but a small remnant of land, creating a backwater slough (now known as Potters Slough) around the island remnant. Access to the island is possible by a constructed causeway near the upper end that connects the island to the mainland.

Since the island remnant and slough are not leveed off from the Mississippi River system, the complex is subject to the seasonal fluctuations of the river. Deposition of sediments in Potters Slough, primarily during flood events, has caused a gradual decline in the quality and the availability of aquatic habitat in Potters Marsh. The shallow water depths and unconsolidated sediments have facilitated establishment of dense beds of aquatic vegetation which now choke the Potters Marsh backwaters. In addition, the shallow water conditions and low flows during the summer months cause dissolved oxygen levels to drop, making the area of limited value to fish, especially centrarchids.

b. **Land Use and Refuge Management Objectives.** The upper portion of Potters Marsh complex is managed by the Corps of Engineers as a recreation area known as Thompson Causeway Recreation Area. Sixty-four acres is intensively developed as campsites, picnic areas, and other day-use facilities. Another 336 acres is managed for dispersed recreational uses. Thomson Causeway is one of the most popular recreation areas along the Mississippi River within the Rock Island District. It is anticipated that this land use will not change over the predicted life of the project.

The remaining portion of Potters Marsh is managed by the Savanna District of the U.S. Fish and Wildlife Service (USFWS). For the purpose of habitat analysis, the remaining project area has been classified into habitat types and acreages, as shown in table 3-1.

TABLE 3-1

Existing Land Use Classification

Target Year	Existing Habitat Classification				
	Aquatic Acres	Non-Forested Wetland (Shallow, Open Water) Acres	Forested Wetland, Acres	Grassland Acres	Total, Acres
Existing Conditions (TY 0)	982	314	824	185	2,305

Short- and long-range management goals of the project are to:

1) Increase water depths and set back succession: (a) primarily for fisheries wintering habitat, (b) increase habitat diversity by breaking up dense stands of vegetation, and (c) increase dissolved oxygen levels.

2) Decrease sedimentation and improve overall water quality.

3) Increase waterfowl nesting and brood habitat.

4) Increase feeding and resting areas for migrating birds.

c. **Wetland and Waterfowl Resources.** Impact of the proposed construction on aquatic, wetland, and terrestrial resources of the refuge was evaluated using a modified Habitat Evaluation Procedure (HEP) developed by the Missouri Department of Conservation and the Soil Conservation Service. This Wildlife Habitat Appraisal Guide (WHAG) compares existing and projected future habitat values with habitat values resulting from the proposed project. The WHAG calculates both positive and negative impacts to habitat. The WHAG evaluation was performed by the USFWS and the Corps of Engineers in coordination with IDOC biologists. Results of the WHAG evaluation are summarized in tables 9-1, 9-2, and 9-3 for the species of primary interest, and a more detailed analysis is included in appendix I.

Productivity of aquatic resources available in the Potters Marsh complex will continue to deteriorate without significant EMP involvement. Sedimentation is projected to continue, and, as the bottom elevation increases, emergent aquatic vegetation will gradually give way to successional willow growth.

Potters Marsh is valuable habitat for waterfowl, both as breeding and brood habitat for mallards and wood ducks. Sedimentation of the backwaters and the projected conversion of aquatic habitat to non-forested wetlands and succession of non-forested wetland habitat to forested wetland habitats will cause a shift in the qualitative and quantitative values of each of the habitat types for the selected target species. The present value for blue-wing teal is about 31 habitat units (HUs) (see table 3-2). This species represents the group of migrating and resident dabbling ducks (mallard, teal, etc.) that utilize the Potters Marsh area. The WHAG analysis also evaluated a wide range of target species to provide a more representative picture of the existing habitat values of the Potters Marsh wetlands. The results presented below show that while qualitatively the Habitat Suitability Index (HSI) values for teal and goose are low, HSI values for the remaining species range from average to quite good (0.31 for wood duck to 0.70 for coot). However, by TY 50 even these values gradually decline if the project is not constructed.

TABLE 3-2

Habitat Suitability for Potters Marsh Target Species
Existing Conditions Through Target Year (TY) 50

MEAN HABITAT SUITABILITY INDEX (HSI)

		TARGET YEARS					
	PRESENT	T YR 1		T YR 25		T YR 50	
SPECIES	INDEX	INDEX	% CHANGE	INDEX	% CHANGE	INDEX	% CHANGE
TEAL	0.10	0.10	0.0%	0.10	0.0%	0.10	0.0%
GOOS	0.10	0.10	0.0%	0.10	0.0%	0.10	0.0%
BITT	0.62	0.62	0.0%	0.73	18.5%	0.31	-49.2%
YLEG	0.22	0.22	0.0%	0.24	8.9%	0.10	-54.5%
MUSK	0.55	0.55	0.0%	0.37	-34.2%	0.20	-63.6%
RAIL	0.43	0.43	-0.0%	0.53	23.1%	0.25	-42.9%
HERO	0.48	0.48	0.0%	0.51	6.7%	0.40	-16.6%
DUCK	0.31	0.31	0.0%	0.49	58.4%	0.49	59.0%
DICK							
COOT	0.70	0.70	0.0%	0.56	-19.2%	0.26	-62.9%
BUNT	0.23	0.23	0.0%	0.24	4.2%	0.10	-56.3%
PROT	0.32	0.32	0.0%	0.40	25.6%	0.44	36.9%

MEAN HSI = SUM AVERAGE HSI BY HABITAT TYPE X ACRES DIVIDED BY ACRES OF AVAILABLE HABITAT (ACRES USED BY THE SPECIES).
(i.e. MEAN HSI IS AVERAGE HSI WEIGHTED BY ACRES)

SPECIES ABREVIATIONS

1	TEAL	BLUE WING TEAL	7	HERO	GREEN-BACKED HERON
2	GOOS	CANADA GOOSE	8	DUCK	WOOD DUCK
3	BITT	LEAST BITTERN	9	DICK	DICKCISSEL
4	YLEG	LESSER YELLOWLEGS	10	COOT	AMERICAN COOT
5	MUSK	MUSKRAT	11	BUNT	INDIGO BUNTING
6	RAIL	KING RAIL	12	PROT	PROTHONOTARY WARBLER

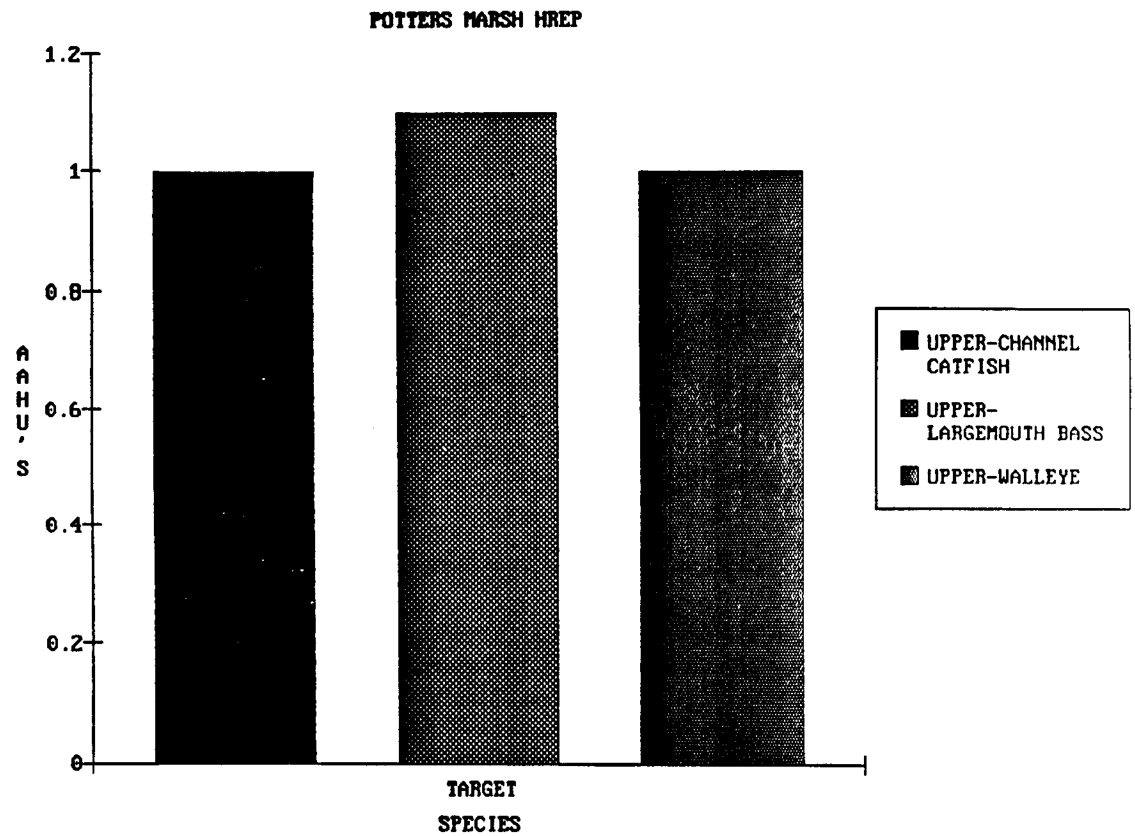
d. **Aquatic Resources**. Historically, Potters Slough has been a diverse and productive fishery that was attractive to both commercial fishermen and anglers. However, the fishery declined as sedimentation gradually filled in the deeper channels of the slough, causing poor water quality in the summer and periodic fish kills in the winter when portions of the slough freeze solid. Application of the WHAG methodology to aquatic habitat types is still in the early stages of development. Therefore, one deviation on this project from earlier applications is the use of a volumetric measurement in place of the acreage figure normally used to calculate HUs. The WHAG study team felt that the use of volume (acre-feet) better reflected the degree of change in the aquatic environment and the ultimate availability of adjacent habitat created by the dredging. In addition, the model utilized limiting factors which are specific habitat requirements for the selected target specie that must be met; otherwise, the qualitative index, the HSI, is driven down to 0.1 (lowest value). This factor was especially important in evaluating Potters Slough since the slough has such wide swings in dissolved oxygen levels, limited access to the main channel, and is subject to freezing solid in the winter.

For the purpose of evaluation and quantification, the proposed dredging for the project was divided into upper and lower cuts. The upper cut consists of the channel dredging above the causeway and excavating the sediment trap below the causeway. The lower cuts include dredging the network of channels in the lower reaches of Potters Slough and excavating two deep holes near the outlet of Potters Slough. Qualitative determinations indicate that due to the shallow nature of the slough, the limited access to the main channel during critical times of the year, and the predominance of vegetation, the qualitative HSI value would be 0.1 for all three of the selected target species--channel catfish, largemouth bass, and walleye by target year (TY) 50. A continued decline in habitat value for fisheries is predicted for the upper cut and sediment trap without the project. In addition, the transition from aquatic to terrestrial habitats will occur as willows encroach on the sediment-laden sloughs and cause a further decrease in aquatic habitat. Average Annual Habitat Units (AAHUs) are presented below in table 3-3 and in figure 3-1 for each of the target species. AAHUs represent an average HU value based on annualization of HUs over a series of selected target years. AAHUs account for changes in habitat values over the life of a project.

TABLE 3-3

Average Annual Habitat Units for Channel Catfish, Largemouth Bass and Walleye in Upper and Lower Reaches

	Upper	Lower
Channel Catfish	1.0	54.1
Largemouth Bass	1.1	56.2
Walleye	1.0	52.3



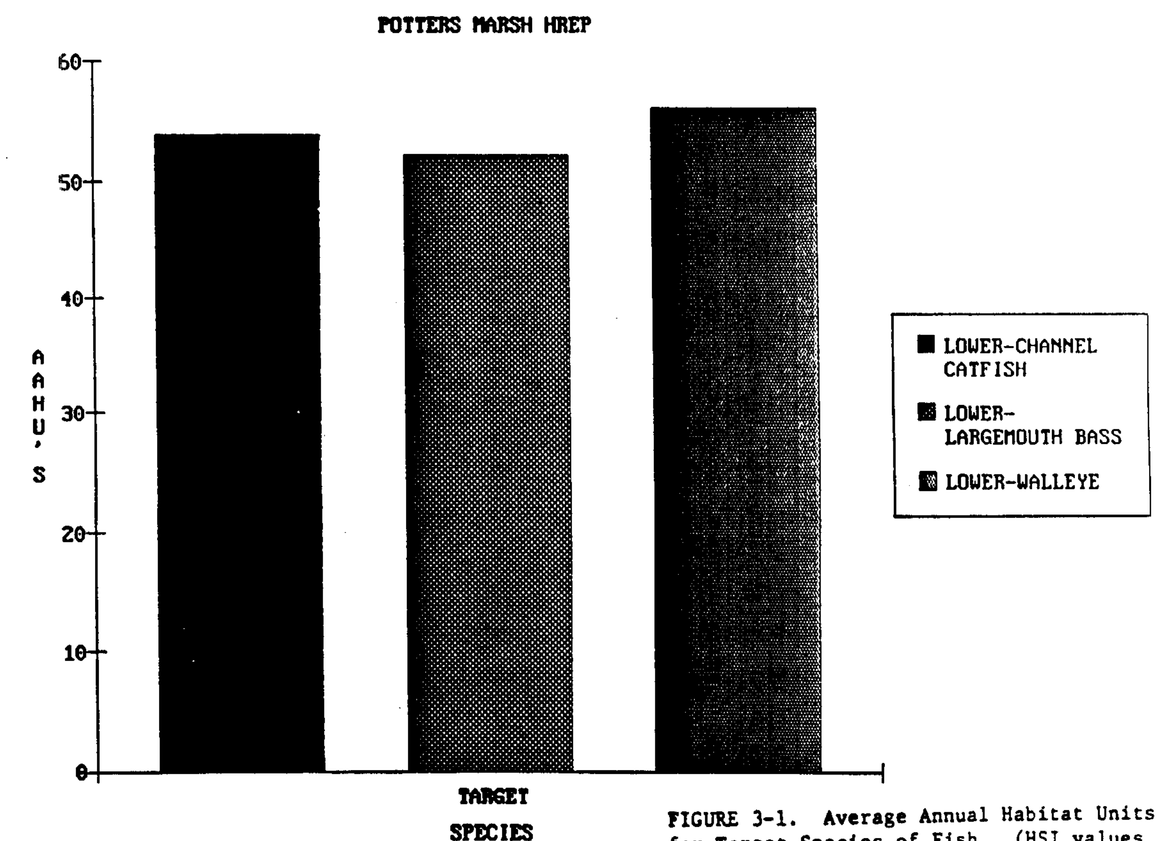


FIGURE 3-1. Average Annual Habitat Units for Target Species of Fish. (HSI values are the same for 3 target species: channel catfish, largemouth bass, walleye.)

The qualitative HSI values calculated for the lower cuts in Potters Slough indicate a slightly higher value of the existing aquatic habitat, especially near the outlet of the slough. This is further evidenced by the degree of fishing pressure this area receives. Table 3-3 and figure 3-1 depict the AAHUs for the three species (channel catfish, largemouth bass, and walleye). HSI values ranged from 0.1 for all species in the upper reaches of the lower cuts to an average value of 0.47 in the lower reach of the cut near the outlet of Potters Slough where the access to the river, deeper water, and improved dissolved oxygen levels provide more suitable fisheries habitats. In conjunction with slightly better qualitative values, the significantly larger volumetric measure of available habitat in the lower reaches explains the orders of magnitude of difference between the upper and lower tables and figures.

e. **Water Quality**. Water quality is possibly the most important single factor that controls the value of the aquatic resources in Potters Slough. The influx of sediments from the Mississippi River has created the shallow water conditions in the slough which result in very high dissolved oxygen levels in the spring and very low dissolved oxygen levels during the summer months. In addition, the slough contains a significant amount of peat deposit which places further demand on the dissolved oxygen available in the water.

f. **Endangered Species**. The federally endangered bald eagle (*Haliaeetus leucocephalus*) is commonly found in the area during the winter months. Eagles commonly use the area during the winter months as a roosting area and feed on fish that pass through the dam downstream of Lock and Dam 13. In 1991, over 100 eagles were observed at one time in the vicinity of Lock and Dam 13.

In a letter dated November 27, 1991, the Illinois Department of Conservation lists the Illinois mud turtle (*Kinosternon flavescens spooneri*) as State endangered and the Blanding's turtle (*Emydoidea blandingi*) and smooth softshell turtle (*Trionyx nuticus*), both State watch list species, for the project area.

g. **Cultural Resources**. Only one previously recorded site (11-CA-20, Shear's Point) was within the impact area of the proposed project. First recorded in 1972, this Early to Middle Woodland site was reported to have suffered severe erosion. As much as 70 feet of the site area has evidently been lost to the river.

Prior to initiating Phase I archeological work, a number of old Mississippi River maps covering the project vicinity were checked for structure locations. No buildings were found within the impact area. Two or possibly three late nineteenth or early twentieth century structures were mapped near the northern tip of Potters Island but outside the impact area. These structures once stood where the Potters Marsh North campground complex is now located.

Geomorphic mapping in Benn, *et al*. [1989:Volume II: Geologic Landform Maps (unpaginated):maps titled "Geomorphic Surfaces of Pool 13" and "Pool 13

Post-Settlement Alluvium"] showed the entire surface of the project area as "Late Woodfordian (10,000 - 15,000 years)" with no post-settlement alluvium. As a result of this information, Phase I survey utilized only pedestrian survey and shovel testing to investigate the project area since the potential for buried sites on the Late Woodfordian landform was negligible.

h. **Sedimentation.** A study was conducted to evaluate sedimentation in the Potters Marsh slough and embayment area during 1938 through 1990. The scope of this study consisted of determining net deposition from 1938 (pre-lock and dam) through 1990. The average total sedimentation rate for the overall Potters Marsh area has been 0.25 inch/year, although sedimentation varies greatly throughout the project site. Sedimentation deposition in the upper slough area above the causeway (segment 1) and the first 2,500 feet of slough channel below the causeway averages overall 0.5 inch/year, although there are some areas near the causeway where sedimentation averages as much as 0.6 inch/year. See table 3-4 below for sedimentation rates and plates 14 and 15 for composite sedimentation cross sections.

TABLE 3-4

Area Sedimentation Rates

Sedimentation Source	Location	Sedimentation Rate Inch/Yr.	50-Year Sedimentation (ft)
River	Above existing causeway	0.5	2.0
River	Causeway to 2,500 feet below	0.5	2.0
River	Middle slough portion or balance of segment 4	0.06	0.25
River	Lower end or segments 2 & 3	0.25	1.0

The existing causeway acts as a water control structure. With an average surface elevation of 587.0, the causeway is overtopped by less than the 5-year flood event (reference plate E-1, Appendix E). According to Appendix E - Hydrology and Hydraulics, this is when the majority, if not all, of the sediment is deposited below the causeway. Above the causeway, most of the sedimentation also is attributed to high water events, with a small amount from normal conditions. In the central slough region from 2,500 feet below the causeway to the beginning of segment 3, there is no sedimentation or only as little as 0.06 inch/year. In fact, cutting has been occurring in the main slough, with slight sediment deposition in the side bay areas (see plate 14, section 4A). In the lower portion of Potters Marsh slough and embayment area where segments 2 and 3 are located, the sedimentation rate is 0.25 inch/year. (See plates 14 and 15 for composite sedimentation cross sections of this area.) This sedimentation results from the main river flow (especially during high water) expanding into this area with decreasing velocities. It is obviously not a result of sediment from the upper slough.

The Mississippi River is the predominant sedimentation source. There is virtually no sedimentation from upland erosion. No creeks or streams flow into the Mississippi within or immediately upstream of the project area. Most of the adjacent area is an upland sand prairie which dominates the terrain along the entire project area and beyond. Finally, a study of upland erosion showed very little or no sedimentation into the project area. Therefore, there is no drawing showing adjacent watersheds and upland erosion in this report.

4. PROJECT OBJECTIVES

a. ***Objectives and Potential Enhancement***. *The project goals,* objectives, and enhancement potential are summarized in table 4-1. The first two columns of numbers indicate the number of Average Annual Habitat Units (AAHUs) calculated over the 50-year project life. For example: Over 50 years, an average of 56 Habitat Units (HUs) will be produced on the lower channel and embayment areas without the implementation of any alternatives. If hydraulic dredging is implemented, this will increase to an average of 415 HUs per year over 50 years. The second set of numbers shows that at present there is approximately 150 acre-feet of deep water (greater than 1.5 to 2.0 feet), but with the project there will be 244 acre-feet of deep water. Potential alternatives were developed in consideration of improving existing habitat weaknesses and utilizing resource opportunities. Detailed development of alternatives is presented in Section 5.

This project is consistent with the goals of the North American Waterfowl Plan signed into effect in May 1986. As a joint effort between the United States and Canada, the Plan focuses on the value of maintaining enough high quality habitat to ensure the abundance of North American ducks, geese, and swans. Generally, no single habitat type provides all of the life requisites (i.e., food, cover, nesting, etc.) for a particular species. Therefore, a unique opportunity exists within a small portion of Potters Marsh to modify existing habitats and to create additional, yet diverse, habitat for waterfowl and aquatic species.

b. **Criteria for Potential Alternatives**. Table 4-2 presents general and specific criteria developed to evaluate potential alternatives. Potential alternatives are presented in Section 5 and evaluated in Section 6.

c. **Proposed Management Plan**. Table 4-3 presents the proposed management plan for the managed marshland. This plan was prepared in conjunction with the USFWS staff.

This proposed management plan is based on management practices implemented at other waterfowl refuges where is has proven to be an effective strategy for establishing emergent vegetation.

TABLE 4-1

Project Goals, Objectives, and Enhancement Potential

Goal	Objective	Potential Alternative	Enhancement Potential					
			Habitat Units Generated by WHAG Analysis			Physical Value Based		
			Unit	Without Alternative Year 50	With Alternative Year 50	Unit	Without Alternative Year 0	With Alternative Year 50
Rehabilitate & enhance aquatic habitat	Restore & create fisheries habitat	Hydraulic dredge channel segments 2 & 3.	Average *1 Annual Habitat Unit (AAHU) (largemouth bass)	56	415	Acre-feet deep water	150	244
		Hydraulic *2 dredge channel segment 4.		*2	*2		*2	*2
	Reduce sediment input	Closure dike *2 with water control structure.		*2	*2		*2	*2
		Existing *2 causeway modifications.		*2	*2		*2	*2
		Barrier *2 island.		*2	*2		*2	*2
		Create sediment trap above and below causeway.	AAHU (largemouth bass)	1	28	Acre-feet deep water	0	30
Enhance habitat for migratory birds through wetland rehabilitation	Increase *3 migratory bird feeding or resting area	Create grassland on CPS.	AAHU (blue-wing teal)	*4	25	Acres	0	39.5
		Create moist soil unit on CPS.	AAHU (blue-wing teal)	*4	26	Acres	0	39.5
		Create managed marshland & mast tree or grassland area on CPS.	AAHU (blue-wing teal)	*4	22	Acres	0	39.5
	Increase waterfowl brood habitat & fall feeding sites.	Create potholes.		*5	*5	Acres	Approx. 2.0	6.8

*1 The average number of habitat units generated over the 50-year project life for target species only.
*2 Not assessed due to economic and/or engineering infeasibility.
*3 This objective depends on the hydraulic channel dredging being completed.
*4 Without alternative area would be 50 acres controlled by natural succession and AAHU values would be minimal.
*5 Hab[illegible] values (AAHU) not calculated for this alternative (due to such a small acreage of potholes when co[illegible]red to the total wetland area).

TABLE 4-2

Potential Alternatives Development Criteria

Item	Purpose of Criteria
A. General Criteria	
Locate and construct features consistent with EMP directives.	Comply with Public Law 99-662 regarding enhancement of fish and wildlife habitat.
Construct features consistent with Federal, State, and local laws.	Comply with environmental laws.
Develop features that can be monitored.	Provide baseline of project effects (e.g., sedimentation, stability, water quality).
Locate and construct features consistent with best engineering practice.	Provide basis for project evaluation and alternative selection.
B. Hydraulically Dredge Channel	
Locate channel to enhance fishery and aquatic habitat.	Improve existing habitat suitability for fish.
Design channel as natural to environment as possible.	Ensure navigation channel and archeological sites are not affected.
Locate deep dredge holes where they can achieve the most good.	Ensure fisheries access to the main channel year around.
Locate site on Government-owned lands.	Meet program guidance and provide clear ownership of material placement site.
Locate dredged material confined placement site (CPS) on lands that impact the habitat the least.	Meet program objectives with minimal impact on existing habitats and ensure archeological sites are not affected.

TABLE 4-2 (Cont'd)

Item	Purpose of Criteria
C. Sediment Trap	
Locate in area of highest sedimentation.	Trap and prevent as much sediment as possible from continuing down slough and impacting additional slough habitat.
Design dredge channel and deep hole as natural to environment as possible.	Ensure navigation channel and archeological sites are not affected.
Locate site on Government-owned lands.	Meet program guidance and provide clean ownership of material placement site.
D. Managed Marshland with Mast Tree or Grassland Area	
Locate on lands that waterfowl and migratory birds utilize.	Improve existing habitat suitability for migratory birds.
Locate on CPS surface.	Utilize CPS surface for best possible features.
Locate managed marshland on Government-owned lands.	Meet program objectives and provide clear ownership of CPS and managed marshland area.
E. Create Potholes	
Locate on lands that enhance additional waterfowl use during migration and brooding periods.	Improve existing habitat suitability and availability for migratory birds.
Locate in areas of existing waterfowl usage.	Rehabilitate, improve, and expand existing migratory bird habitat.
Locate potholes on Government lands and design features as natural to environment as possible.	Meet program objectives and provide clear ownership of potholes, and ensure archeological sites are not affected.

TABLE 4-3

Proposed Annual Management Plan for the Managed Marshland

Month	Management Action	Purpose
September - October	Fill 32.5 acres with 1.5± foot of water in approximate 20-day period with 500 gpm submergible pump in well and maintain 1.0 foot of water depth throughout the fall season.	Inundate quality emergent vegetation providing feeding and/or resting area for migratory birds.
April - May	Dewater 32.5 acres in 5- to 10-day period by operating stop-log structure with 4-foot-wide hydraulic opening.	Prevent undesired growth during spring/summer and establish moist soil vegetation.
Every 3-5 Years	Fill 32.5 acres with 3.0± feet of water in approximate 50-day period with 500 gpm submergible pump in well.	Terminate any undesired vegetation and promote new growth of quality emergent vegetation.

5. ALTERNATIVES

a. **Alternative A - No Federal Action.** No Federal action would consist of no Federal funds being provided to meet the project purposes.

b. **Alternative B - Closure Dike with Water Control Structure.** This alternative consists of constructing an above water rock fill closure dike with a submerged gate structure for water control across the north end of Potters Marsh slough (see plate 3). The purpose of this dike/structure would be to reduce the influx of river bedload materials during most high water events and still be able to control the overall flow regimes into the complex.

c. **Alternative C - Redesign Existing Causeway.** This alternative consists of raising the existing causeway elevation and increasing the flow into the slough through additional tubes which would be gate controlled. The purpose of this modification would be to reduce the influx of river bedload materials during most high water events and would allow additional controlled flow of water into the complex.

d. **Alternative D - Barrier Island Creation.** This alternative consists of constructing a barrier island in the river adjacent to the lower reach of the slough (see plate 3). The island would be created from dredged material. The main purpose of this island would be to help break up wind fetch and consequently reduce turbidity and siltation in the area.

e. **Alternative E - Create Sediment Trap.** Mechanical excavation or hydraulic dredging immediately below the existing causeway and dredging in segment 1 above the existing causeway would be performed as shown on plate 3. Below the causeway, approximately 4,700 cubic yards of fine-grained clay sediments and sand would be mechanically excavated or hydraulically dredged and placed in a confined placement site, as described in Alternative F. Above the causeway, approximately 44,300 cubic yards of fine-grained sediments and sands would be hydraulically dredged from 2,100 lineal feet of backwater channel and placed in a confined placement site, as described in Alternative F.

f. **Alternative F - Hydraulic Dredging.**

(1) Dredging in segment 2, in the lower Potters Marsh bay area, would be performed as shown on plate 3. About 205,350 cubic yards of fine-grained sediments and sand would be hydraulically dredged from 10,900 lineal feet of backwater channel and one deep hole and placed in a confined placement site, as described below. The main purpose of this dredging would be to restore and create fisheries habitat.

(2) Dredging in segment 3, in the lower Potters Marsh slough area, would be accomplished as shown on plate 3. About 188,650 cubic yards of fine-grained sediments and sand would be hydraulically dredged from 9,800 lineal feet of backwater channel and one deep hole and placed in a confined

placement site, as described below. The main purpose of this dredging would be to restore and create fisheries habitat.

(3) As part of the hydraulic dredging alternative, placement of the dredged material would be according to one of the following two methods:

(a) Terrestrial Confined Dredged Material Placement Site. This consists of a terrestrial-based confined placement site (CPS) in the central peninsula area, as shown on plate 3. The total surface area would be 50 acres, which includes the dike and a 15-foot perimeter work zone. The interior surface area would be 35 acres, and the dike would be 14 feet high with 3 horizontal on 1 vertical side slopes. After dredged material has settled, the top and remaining side slopes of the sand dike would be reshaped and seeded with grass. The purpose of this CPS would be to contain all of the dredged material both during and after dredging.

(b) Upland Dredged Material Placement Site. This placement site would be located on Government-owned lands on top of the high sand bank adjacent to the Potters Marsh complex. The containment levee for this site would be constructed from adjacent sand borrow. The purpose of this placement site would be to contain all of the dredged material in an upland (non-wetland) site.

g. **Alternative G - Segment 4 Hydraulic Dredging**. Dredging in segment 4, in the middle Potters Marsh slough area, would be performed as shown on plate 3. About 207,000 cubic yards of clayey peat, fine-grained sediments, and sand would be hydraulically dredged from 11,500 lineal feet of backwater channel and one deep hole and placed in a confined placement site, as described in Alternative F. The main purpose of this dredging would be to restore and create fisheries habitat.

h. **Alternative H - Create Potholes**. This alternative consists of constructing shallow potholes by mechanical excavation and explosives in the central peninsula area, as shown on plate 3. The purpose of these potholes would be to provide secluded open water for duck broods and to rehabilitate and enhance the existing wetland values for non-game wetland species.

i. **Alternative I - Managed Marshland on CPS**. This alternative consists of constructing a water-controlled managed marshland of approximately 32.5 interior CPS acres, as shown on plate 3. This would be accomplished by installing a well for water supply, a submergible pump for water control, and a stoplog structure for dewatering. This alternative also consists of providing a mast tree or grassland area of approximately 7 interior CPS acres, as shown on plate 3. This would be accomplished at the highest end of the CPS by seedlings or grassland seeding after dredged material settlement has taken place. The purpose of this alternative would be to provide a feeding and/or resting area for resident and migrating wetland species.

j. **Alternative J - Interior Grassland on CPS.** This alternative consists of creating a grassland area of approximately 39.5 interior CPS acres, as shown on plate 3. This would be accomplished by seeding the CPS interior after dredged material settlement has taken place. The purpose of this grassland would be to enhance terrestrial habitat for nesting waterfowl and diversify overall habitat types in the area.

k. **Alternative K - Moist Soil Unit on CPS.** A moist soil unit would be constructed on the approximate 39.5-acre surface of the CPS, as shown on plate 3. This would be accomplished by installing a well for water supply, a submergible pump for water control, and a stoplog structure for dewatering. The purpose of this moist soil unit would be to provide an annually controlled feeding and/or resting area specifically for migratory waterfowl, primarily dabbling ducks.

6. EVALUATION OF ALTERNATIVES

Alternative A, No Federal Action, would not meet the project goals of improving aquatic habitat and diversity and enhancing migratory bird habitat.

Alternative B, Closure Dike with Water Control Structure, was evaluated. If a dike were built higher than the existing causeway, the water would flood around it on the island side. Since the majority of sedimentation occurs during flood events, sedimentation regime would not be any different than under current conditions. Normal flow would still be controlled by the existing causeway tubes, so water quality in the upper slough area would not be affected negatively or positively by this alternative. Basically, the existing causeway now provides the same function as the dike would.

Alternative C, Redesign Existing Causeway, was evaluated. If the causeway were raised, the water would flood around it on the island side. Since the majority of sedimentation occurs during flood events, sedimentation regime would not be any different than under current conditions. If additional tubes were added to the existing causeway to increase flow, existing sedimentation would not be positively or negatively impacted. The additional tubes would have no impact during flood events. During non-flooding events, the water enters the slough so slowly that most sediment drops out at the upper end. Consequently, increasing the flow through the causeway would make very little difference in additional sedimentation.

As far as water quality is concerned, no information currently exists which would suggest that the water quality in the off-channel area immediately upstream of the causeway is significantly better than what is found downstream of the causeway. Although it has been shown that DO concentrations downstream of the causeway fall to unacceptable levels during the summer, the shallow stump fields which separate the project site from the main channel may or may not experience a similar DO decline. This situation will be investigated further. Since deeper, higher DO water is not nearby, it would probably require a significant increase in existing flow to pull higher DO water into the project. In addition, during the winter months the upper and middle portions of the slough have been frozen to the bottom, so additional flow would have no impact on water quality during this time.

Alternative D, Barrier Island Creation, was evaluated. After site visits and further discussion, it was decided that wind-induced resuspension and transport of the sediments are not the major sources of sedimentation in the lower slough and embayment area. Rather, as discussed in Section 3h of this report and in the hydrology appendix, the sedimentation in this zone results from the main river flow (especially during high water) expanding into this area with decreasing velocities.

In addition, foundation and erosion problems associated with island creation can make their construction economically undesirable.

Alternative E, Create Sediment Trap, was evaluated to meet the project objective of reducing sediment input into Potters Slough. The excavation of a deep hole immediately below the existing causeway would act as a sediment trap mainly during overtopping/flooding events, and would collect any minor amounts of sediment during normal flows. Certainly all sediments during flood events would not be trapped, but any that are prevented from continuing down the slough will help keep the upper 2,500 feet of slough from silting in completely and will prevent further migration of silt down the slough. In addition, the deep hole will assure continuous unblocked flow through the existing tubes.

The hydraulic dredging in segment 1 would act as a sediment trap both during flooding events and during normal flows. All sediments would not be trapped, but any that are prevented from continuing down the slough will help alleviate future sedimentation problems in the upper slough area. In addition, the deeper water may help promote and/or hold higher DO values in the upper slough area. With the higher volume of water in the dredge cut, the benthic biological oxygen demand impact on the water column may be less severe. The AAHU values for largemouth bass are 25 times higher with this alternative than without, as shown on table 4-1. Table 6-1, incremental analysis, shows a reasonable overall cost per AAHU for this alternative.

Alternative F, Hydraulic Dredging, was evaluated to meet the project objectives of restoring and creating fisheries habitat. Lower slough and embayment dredging would rehabilitate and enhance aquatic habitat by creating both shallow and deep water. Decreasing the uniformity of Potters Slough will cause a corresponding change in vegetation patterns and an improved ratio of open water to vegetation density. Segment 2 dredging would provide 18 acre-feet of deep water habitat primarily for fish winter refuge. Segment 3 dredging also would provide 16.5 acre-feet of deep water habitat for fish winter refuge. The proposed dredging also would increase water exchange from the main river to the lower slough area, thereby improving DO concentration during potential critical seasonal stress periods. The deep holes provide year-round access to the main river channel if the water in the interior dredge cuts ever becomes DO deficient in the summer. In addition, the deep holes provide a place for fish to overwinter off channel and out of the current. Segments 2 and 3 dredging also would reduce the quantity of submerged aquatics and arrowhead that are currently dominating the slough and embayment. Table 4-1 shows a dramatic increase in average annual habitat values for this channel dredging. Table 6-1, incremental analysis, shows a reasonable cost for each habitat unit gained.

Standard engineering and project design considerations determined the need to dredge to 8 feet with allowance for sedimentation and winter low-water regulation, resulting in maintained water depth of 6 feet over the project life (see table 8-2). Costs of additional (or less) dredging depth would be substantial, at approximately $100,000 per foot of depth.

A central consideration in undertaking dredging is its implication for fisheries overwintering habitat. A brief review of the literature revealed that definitive depth figures [to maintain adequate dissolved oxygen (DO) and other parameters] necessary for fish survival are difficult to find. Generally, fish will migrate to depths or locations where the highest available temperatures can be found, but other habitat factors, such as DO, flow rates, etc., are also important in winter habitat selection (Sheehan, *et al.*, 1990). These researchers also found species-specific differences in temperature tolerance and swimming ability (at temperatures of 0-4 degrees C), thus complicating the arrival at a set depth figure.

Temperatures are usually higher in backwater areas versus main river channels, but DO can be lower (Bodensteiner and Sheehan, 1988) and dredging can provide the extra depth necessary to allow sufficient DO. Boland (1985) agreed to the benefits of side channel dredging, but cautioned against "overdredging" which could result in the loss of littoral habitat.

Pitlo and Gent (1991) came the closest to delineating specific depths in terms of fisheries benefits. As part of a monitoring study at the Brown's Lake EMP project, it was found that tagged/radioed largemouth bass clearly moved in response to declining oxygen conditions to areas of higher DO. The researchers also found stratification of dredged side channels based on temperature, DO, and current velocity when oxygenated river water was introduced via a water control structure. They suggested that fish could then select optimal zones by moving vertically in the water column 4 to 6 feet (the maximum zonal depth was 8 feet). Temperatures were highest at 6 to 8 feet (36-38 degrees F) while DO was greatest at 0 to 2 feet (9-13 ppm).

The above studies indicate the clear advantages of maintaining side channel habitat for overwintering fish, but the complex interplay of various water quality parameters makes it difficult to determine cutoff points, at least in relation to habitat manipulation actions. The latter study seems to indicate that our maintained depth of 6 feet for Potters Marsh falls within the middle range of preferred temperature and DO levels, while keeping costs to a minimum.

A terrestrial confined dredged material placement site was evaluated. In an attempt to minimize impacts to existing marshland, hardwood trees, or existing potholes, the proposed confined placement site (CPS) would be the only available 50-acre site in the Potters Marsh complex. Most of the existing vegetation in the proposed site is secondary growth and of limited quality. Construction of the CPS would provide beneficial use by establishing an area that could be managed under controlled conditions to meet the project goal of enhancing habitat for migratory birds.

An upland dredged material placement site was evaluated. Most of the lands adjacent to the Potters Marsh complex are Government-owned. The area is managed by the USFWS as a research natural area (RNA). This is a protected unique habitat area of prairie species and reestablished warm season native grasses. Most of the shoreline is a high sand bank which is also part of the protected area. Any area large enough for land disposal would be on privately owned lands over one-half mile inland across the railroad and State Highway 84. This makes land disposal not only very uneconomical, but basically unfeasible.

Alternative G, Segment 4 Hydraulic Dredging, was evaluated. From 2,500 feet below the causeway and down to segment 3, the majority of dredged material would be clayey peat. From a feasibility and economic standpoint, dredging would be impractical. It would require a CPS of over 300 acres or chemical clarification due to the very poor flocculent settling characteristics of the peat. Chemical clarification would require a large volume of a settling aid which would generate a higher cost and possible environmental problems.

With present water depths averaging 1.5 feet, the USFWS requested that boat traffic not be able to traverse up the slough to the causeway and nearby public use areas. This would generate much more boat traffic in the entire slough, thus disturbing the preserved nature of the upper Potters Marsh complex.

In addition, there would be little or no intermixing of water from the main river, except from the flow down the slough. Even with an increased flow and deeper water, there still may be periods of deficient DO concentrations within the segment 4 zone.

Alternative H, Create Potholes, was evaluated. Several potholes now available in the project areas on the island experience high use by waterfowl and shorebirds. The project objective of wetland rehabilitation is further achieved through pothole construction to increase waterfowl brood habitat and fall feeding sites. The WHAG model is not sensitive enough to calculate HUs on such a small acreage of enhancement when compared to the total wetland area.

The pothole locations were selected in the field with the assistance of USFWS personnel. All existing low areas were investigated within the central peninsula region. The upper island area has several potential cultural sites and has not been cleared by the SHPO for construction work. In the central region, as many potholes as possible were laid out in the field. The attempt was to use all existing low and open areas and not to construct any potholes close together. After several field days, 23 existing potholes were chosen as the optimum number based on the available and practical locations.

In response to public comment, further research on pothole construction was done, particularly regarding the choice of numerous small potholes. Potholes will primarily provide waterfowl nesting and brood rearing habitat, but their configuration should also consider provision of plant and water level diversity for the benefit of a variety of migrating birds and wildlife.

Hammond and Lacy (1959) felt that optimum pothole size ranged from 500 to 2,000 square feet of water surface, with 150- to 200-foot spacings between potholes. Evans, *et al.*, (1952) found that breeding pair use was greatly influenced by pothole size, and showed greatest per acre use by river ducks on areas of <0.5 acre of water, while divers preferred 2 to 3 acres of water.

A subsequent meeting with USFWS personnel, a concerned citizen, and a Rock Island District staff member resulted in some minor relocation of planned blasted potholes at Potters Marsh, as well as enlargement of very small excavated potholes to a maximum of 0.75 acre. These changes will not alter quantities or cost of this project feature.

Alternative I, Managed Marshland on CPS, was evaluated. For migratory birds, the managed CPS surface provides maximum control over vegetation production within the CPS. Therefore, the benefits of the Potters Lake project are increased by the use of a water-controlled facility. The project objective of increasing feeding or resting areas for migratory birds will be met which will help meet the goal of enhancing the habitat for migratory birds through wetland rehabilitation. Table 6-1 shows the AAHUs for each alternative for best utilization of the CPS. Considering all species studied, the managed marsh alternative has the highest overall habitat value benefits when comparing the various alternatives for the CPS. Table 6-2 shows a cost/habitat gain comparison for each alternative. Based on a cost per AAHU gained comparison, the managed marsh was the selected alternative.

The mast tree or grassland area on the CPS was evaluated as part of this alternative. The mast tree area would require an interior dike, as shown on plate 3, to prevent water inundation. Even if the 7 acres were slightly higher than the managed marshland, during the 3- to 5-year water filling for termination of unwanted vegetation or during spring rains, etc., the trees would be inundated by water without a dike and drainage ditch. This would not only be costly, but may interfere with the operation of the managed marshland. It also was decided that a select grassland would better coexist with the managed marshland than would trees. After dredged material settlement, selected grasses would be planted. This would further diversify the managed marshland, surrounding potholes, and overall migratory bird habitat available at this location.

Alternative J, Managed Grassland on CPS, was evaluated. While this alternative would meet the goal of enhancing the habitat for migratory birds, especially upland species and nesting waterfowl, greater habitat benefits are generated by creation of a managed marsh complex. Table 6-1 shows that the managed grassland generates 25 AAHUs for the blue-wing teal, but few benefits for any other wetland species. Upland species like the dickcissel and indigo bunting will benefit from a managed grassland, with 37 and 28 AAHUs, respectively.

Alternative K, Moist Soil Unit on CPS, was evaluated. This alternative specifically would meet the goal of enhancing the habitat for migratory waterfowl but would not generate as many overall habitat benefits as the managed marshland, as shown on table 6-1. While higher AAHUs can be generated for teal/goose, they come at the expense of limited diversity for other wetland species (no value for bitterns, yellowlegs, etc.). The intent is to utilize the best possible alternative for the CPS surface. In addition, from an engineering viewpoint, the dredged soil will not support heavy equipment. A moist soil unit would require cultivation, seeding, etc., of the soil surface while the managed marshland does not.

TABLE 6-1

Average Annual Habitat Units for Each Alternative of the Confined Placement Site (CPS)

Species	Natural * Succession	Grassland	Moist Soil	Managed Marsh
Blue-wing teal		24.7	26.0	21.8
Canada goose		23.7	28.5	13.7
Least bittern				19.0
Lesser yellowlegs				12.5
Muskrat				23.7
King rail				
Green-backed heron	13.0	00.1	03.8	23.6
Wood duck	10.5			02.0
Dickcissel		36.7		09.6
American coot				24.1
Indigo bunting	05.3	28.2	00.2	10.4
Prothonotary warbler	06.0			01.2
All species	34.8	78.6	58.5	161.6

* Natural succession is the baseline condition similar to without project.

TABLE 6-2

Comparison of Alternatives and Incremental Analyses

		Annual Cost *1		Habitat Value Gain *5		Cost Per Gained Habitat Value	
Alternative	Increment	Total Annual $	Incremental $	AAHU	Incremental AAHU	$/AAHU	Incremental $/AAHU
Hydraulically Dredge Channel	Segment 2 205,350 CY	97,600		215		454	
			89,800		200		449
	Seg. 2 & 3 394,000 CY	187,400		415		452	
Sediment Trap	Deep hole below cause-way	2,700		3		900	
			20,300		25		812
	Segment 1 & deep hole below causeway	23,000		28		821	
Managed *2 *3 Grassland	Not applicable	8,200		44		186	
Moist Soil *2 *3	Not applicable	16,500		24		688	
Managed Marsh *2 *3	Not applicable	14,500		127		114	
Increase *2 Waterfowl Brood Habitat & Fall Feeding Sites	Pothole Creation 4.8 acres	17,900		*4		*4	

*1 Annualized cost includes initial construction cost and annual operations and maintenance cost based on a 50-year project life, 8.75 percent interest rate.

*2 Incremental analysis not performed for this alternative.

*3 Habitat values based on habitat gain to 50-acre total CPS area for all species in table 6-2. Overall values would be higher if species were considered as shown on table 9-2.

*4 Habitat values (AAHU) not calculated for this alternative (due to such a small acreage of potholes when compared to the total area.)

*5 Aquatic habitat units based on acre-feet.

7. SELECTED PLAN WITH DETAILED DESCRIPTION

a. **General Description.** Alternatives E, F, H, and I were selected to be recommended for project construction. Create sediment trap (Alternative E), hydraulic dredging - segments 2 and 3 (Alternative F), create potholes (Alternative H), and construction of a managed marshland on the CPS (Alternative I) all meet project objectives and are cost effective. This plan provides balanced aquatic fishery habitat restoration, while enhancing additional wetland habitat values for waterfowl (resident and migratory), furbearers, and numerous nongame wetland species.

b. **Sediment Trap Creation.** Immediately below the existing causeway, a deep hole sediment trap will be mechanically excavated or hydraulically dredged (see dredging plan on plate 9). The hole will be 200 feet wide by 60 feet long by 10 feet deep with 1 horizontal on 2 vertical (1:2) side slopes. (See typical section on plate 13.) The normal water surface is elevation 583.0 (flat pool) and the average water depth is 1.5 feet. Excavation/dredging depth is to elevation 573.0 or 8.5 feet of material, totaling approximately 4,700 cubic yards. The material will be about 75 percent fat clay and 25 percent medium clay and/or sand.

The contractor may submit for approval which method, mechanical excavation or hydraulic dredging, they choose. Hydraulic dredging up the slough from segment 3 to the causeway will not be permitted. Suggested methods could be the use of a small, portable hydraulic dredge set in place with a crane, or mechanical excavation from the causeway with a dragline, then transport the material by truck to the CPS or another site submitted by the contractor and approved by the Corps of Engineers.

Segment 1 hydraulic dredging in upper Potters Slough will take place as shown on plate 9, with a typical section shown on plate 13. Dredged bottom width will be 50 feet with 1:2 side slopes for the 2,100 lineal feet of alignment. Dredging depth will be a 10-foot cut to elevation 573.0 to ensure a minimum depth of 6 feet throughout the project life as shown in table 8-1. Current water depth averages about 1.5 feet below flat pool. The dredged material will be about 71 percent fat clay, 24 percent lean to medium clay, and 5 percent sand, for a total of 44,300 cubic yards.

c. **Hydraulic Dredging.** Segments 2 and 3 dredging in lower Potters Slough and embayment will take place as shown on the dredging plan on plate 10. General dredging alignment bottom width in both segments will be 50 feet with 1:2 side slopes. (See typical section on plate 13.) Dredging depth will be 8 feet to elevation 575.0 to ensure a minimum depth of 6 feet throughout the project life, as shown in table 8-2. Current water depth averages approximately 1.5 feet below flat pool in the general alignment areas. Segment 2 will be 10,900 lineal feet of dredging alignment and one deep hole. Segment 3 will be 9,800 lineal feet of dredging alignment and one deep hole. Each deep hole will be 500 feet by 200 feet with a 12-foot dredging depth to elevation 571.0 and 1:2 side slopes. (See typical section on plate 13.) Current water depth averages 2.0 feet below flat pool in the deep hole areas. Dredged material in segment 2 will be about

36 percent sand, 35 percent lean to medium clay, and 29 percent fat clay, for a total of 205,350 cubic yards. Dredged material in segment 3 will be about 46 percent sand, 42 percent lean to medium clay, and 12 percent fat clay, for a total of 188,650 cubic yards.

d. **Create Potholes.** Ten potholes of various shapes will be mechanically excavated to about 4 feet in the central part of the island, as shown on plate 2. A typical section is shown on plate 12. Excavated material will be placed around the outside perimeter of the pothole. An additional seven 300- by 50-foot potholes will be blasted by explosives in the riverside embayment area near the central part of the island where excavation with conventional equipment would be difficult, as shown on plate 2. A typical section is shown on plate 12. Holes will be over-blasted to about 5 feet in an attempt to result in an approximate 4-foot-deep pothole.

The dredged material confined placement site (CPS) is located in an area of secondary growth just below the central island area, as shown on plates 2 and 11. It was shaped and positioned so as not to inundate the lower lying marshland areas downstream and to the east, or the heavier timber and natural potholes to the north.

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 H. The dredged material will require about 25 hours of settling time to meet effluent requirements and will require an initial volume about 1.75 times larger than the *in situ* sediments. Based on these results, a CPS with 35.5 interior acres and a 14-foot-high dike will be required. (See typical section on plate 12.) The dike will be constructed by excavating an interior borrow trench around the inside dike perimeter as shown on the typical section. This material will be predominantly sand which will require a minimum of 1:3 side slopes and a 10-foot-wide crest, as discussed in Appendix G - Geotechnical Considerations. The total surface area required for the CPS is 50 acres, including the dike surface area and a 15-foot perimeter work zone.

Depth of dredged material immediately after placement will be about 12 feet. The material will then settle throughout the first year to a depth of 8 to 10 feet. At that time, the upper dike surface will be lowered accordingly to within 2 to 3 feet of the top of material. The remaining dike will be reshaped to a flatter slope and seeded with grasses.

e. **Managed Marshland on CPS.** After settlement of the dredged material, an approximate 32.5-acre managed marshland will be constructed on the CPS surface, as shown on plate 2. This will involve installing a shallow well for water supply. (See well location on plate 2 and plan view/detail on plate 16.) It has been estimated that 500 gpm of ground water could be pumped from the sand aquifer with approximately 20 feet of draw down. (See analysis in appendix G.) In approximately 20 days, 500 gpm would inundate the 32.5 CPS acres with 1.5 feet of water. Only 1.0 foot of water would be necessary, but when considering infiltration, evaporation, and precipitation, it is necessary to fill the CPS with 1.5 feet of water initially to ensure a 1.0-foot depth throughout the fall season. A 5 hp submergible pump will be required for this well. (See electrical plan and details on plate 17.)

For dewatering purposes, a 4.0-foot stoplog structure will be constructed. The general location is shown on plate 2, with the plan view and details shown on plate 16. The managed marshland can be dewatered in 3 to 5 days. If dredged material continues to settle, additional stoplogs can be removed. Water will exit into the existing old slough bed below the last mechanically excavated pothole.

The lower portion (800 feet) of the existing road will have to be improved with the addition of a granular surface. The contractor will submit his proposal to construct a road, at or close to the proposed road location shown on plates 2 and 11, to move equipment in and out of the CPS area. This road will become a service road for the well, stoplog structure, and managed marshland; therefore, it must be constructed at or above elevation 586.0 and have a minimum width of 10 feet with a granular surface and turn-around area near the well site location. The construction will require limited borrow from each side of the proposed alignment (limited to 100 feet) to raise the roadbed to elevation 586.0 in the existing low areas. A culvert and borrow fill will be necessary to cross the old slough bed located just prior to the CPS perimeter (see plate 2). The granular-surfaced roadway will be extended up onto the top of the reshaped sand dike and continue down to the stoplog structure.

A grassland area will be constructed on the remaining CPS surface. The area to be selected will be sized and may be located as shown on plate 2, assuming this is the highest area after initial settlement of dredged material. Otherwise, the location may be shifted. The area will be seeded with selected grasses. This grassland area will help compensate for any lost vegetation due to the CPS construction and will further enhance the habitat values on the site.

8. DESIGN AND CONSTRUCTION CONSIDERATIONS

a. **Existing Site Elevations.** Mobilization of construction equipment (hydraulic dredge and barge-mounted equipment) into the Potters Marsh complex can be accomplished when river levels are at or above flat pool with limited efforts of excavating or dredging to maneuver equipment from the main channel to the upper and lower ends of the project. Once mobilized, the utilization of this equipment is relatively independent of river stage. Five feet and deeper water depths and the lack of stumps between the lower portion of the project and the main channel make it the best location for mobilizing equipment. It is estimated that, at most, approximately 4,000 cubic yards of sediment will have to be hydraulically dredged during the last 1,000± feet to arrive at the lower project limits. This material will go into the CPS. This is minimal when compared to the project dredging. Water depths are such that necessary floating plant equipment can be successfully maneuvered to the upper project limits by traversing along the island boundary.

There may be intermittent stumps between the main channel and the outer project limits. These will be removed wherever necessary to maneuver floating plant, by dragline/clamshell. Stumps will be more of a problem maneuvering equipment from the main channel rather than interfering with project dredging. There should be very few stumps within the project area and then only at the extreme outer limits. It is estimated that no more than 25± stumps, mostly in the upper outlying areas, would have to be removed during the entire project.

b. **Dredging Depths and Equipment.** It is anticipated that all Potters Marsh complex dredging, except for the small cut below the causeway, will be accomplished with a 16-inch cutterhead hydraulic dredge. The 10-foot-deep sediment trap cut below the causeway will be accomplished by dragline/clamshell or by use of an 8-inch or smaller portable dredge. If dragline clamshell, the excavated material will be placed in the water on the upstream side where it can be hydraulically dredged and placed in the CPS.

The selected dredging depths were based upon maintained water depth, as shown on tables 8-1 and 8-2.

TABLE 8-1

Basis of Dredging Depth for Segment 1

Elevation (MSL)	Description
583.0	Pool 13 flat pool
-1.0	Possible low-flow winter regulation
-6.0	Maintained water depth
-2.0	50 years of sediment (0.5 inch per year)
-1.0	Possible additional sediment due to sediment trap
573.0	Minimum dredging depth

TABLE 8-2

Basis of Dredging Depth for Segments 2 and 3

Elevation (MSL)	Description
583.0	Pool 13 flat pool
-1.0	Possible low-flow winter regulation
-6.0	Maintained water depth
-1.0	50 years of sediment (0.25 inch per year)
575.0*	Minimum dredging depth for general alignment

* Deep holes will be dredged to elevation 571.0.

c. **Dredged Material Confined Placement Site.**

(1) Containment Dike. The containment dike for the dredged material placement site will be constructed from adjacent interior borrow, which will be 80 to 90 percent sand. Slope stability analyses reveal that the dike will be stable, with a crest of 8 feet and side slopes of 3:H on 1:V. Final design may incorporate an impervious liner on the interior sand dike face to prevent through-seepage of water.

After the dredged material within the CPS has settled for 1 year, the perimeter dike will be degraded so that it remains 3 to 5 feet higher than the interior materials. This excess material from the degrading will be used to flatten the landside slopes to about 1:V on 4:H, thereby increasing the factor of safety considerably for operation of the managed marshland.

(2) Placement Site. The final design of the placement site will provide contractor options for placement methods to help meet effluent standards. If water quality cannot be met, the inflow rate can be decreased, a settling aid polymer can be used, and/or the ponding depth

can be increased. A two-cell design was not considered due to the high cost, approximately $160,000, and the surface area reduction from the cross dike. All of the presently designed interior area of 35 acres is required for soil expansion and flocculent settling. A cross dike would decrease the CPS volume, unless the material were borrowed from within, and decrease the available surface area. This would require an increase in the 50-acre surface area to complete the proposed dredging. This is not possible at this time. To achieve a suspended solids removal efficiency of greater than 95 percent for dredging effluent, an average detention time of 25 hours is required. The dredge's outflow pipe will be required to move around, to distribute material in the CPS as evenly as possible and for coverage of the dredged sand with clay material.

d. Construction of Project Features.

(1) Pothole Construction. Ten island potholes will be mechanically excavated with a dragline/clamshell. An equipment path for access to each pothole location may need to be created. Excavated soil material will be placed around the perimeter of the pothole, as shown on plate 12. In the central island river side embayment area, where excavation with conventional equipment would be difficult, seven potholes will be blasted with explosives. The contractor will submit his blasting plan for approval. This area, although soft and wet, is above flat pool and is not directly connected to the river during normal conditions, so no water quality problems are expected.

(2) CPS Access Road Construction. Borrow for the proposed road portion will be limited to 100 feet on either side of the proposed road location. The 8-foot-wide surface would be covered with a graded road fill and leveled with granular material. There will be an approximate 2-foot-wide earthen shoulder on each side and a turnaround on top of the reshaped sand dike at the stoplog structure.

(3) Well Construction. The well will be drilled with conventional water well equipment to a depth of approximately 100 feet. A 12-inch ± steel casing will be set in the hole with a 5 hp submergible pump set at approximately 30 feet. A 4- to 6-inch ± riser pipe will be used. This pipe will exit the well head, rise up through the top portion of the reshaped dike, and exit onto a small concrete pad on top of the settled dredged material in the CPS interior.

The pump was sized in order to fill the managed marshland initially with 1.5 feet of water in approximately 20 days in order to maintain 1.0 foot of water depth throughout the fall season. This will be accomplished by a 500-gallon-per-minute (gpm) pump. The effects of evaporation, infiltration, and seepage were all considered in the pump sizing. It is assumed that under less than ideal conditions rainfall during September through November will exceed evaporation. Evaporation averages approximately 0.18 foot per month during this period, while rainfall averages 0.24 foot per month. Soil infiltration will average approximately 0.15 foot per month. The 500-gpm pump was selected because it was the most cost-effective pump that would satisfy the USFWS requirements of keeping a minimum of 1.0 foot of water in the managed marshland during September through November with approximately 20 days of pump time. In addition, the pump size (5 hp) was based on the available electricity in the nearby Corps of Engineers recreation site. There would be an additional cost to bring in more power for a larger size pump which would be required for additional capacity.

The electrical service for the submergible pump will run underground along the service road, as shown on plate 17, to a pole on the north side of the old slough. Service will cross the slough bed from pole to pole with a transformer and a platform with a control switch. The transformer and control platform will be mounted on separate poles above the 500-year flood event. Waterproof electrical service will run down to a submergible pump.

(4) Stoplog Structure Construction. The stoplog structure will be constructed, as shown on plate 16, so if additional dredged material settlement takes place additional stoplogs can be removed accordingly. The managed marshland with 1.0± foot of water will be able to be dewatered in 5 to 10 days with a 4-foot-wide opening. The stoplog structure will be serviced via the top of the dike with a granular-surfaced roadway.

e. Borrow Sites/Construction Materials.

(1) Borrow Sites. Sand embankment for the dike will be obtained from the interior of the placement site. A dragline/clamshell working on mats 20 feet inside the interior CPS dike toe will excavate an approximate 60-foot-wide by 10- to 12-foot-deep borrow ditch. Most of the borrow material will be sand. The top 2.0± feet of existing material is lean clay followed by 2.0± feet of clayey sand overlying fine to medium sand. Any organic material at the surface will be removed before borrow is used for the dike construction.

(2) Construction Materials. Only common construction materials are required for this project. Roadway graded bedding material, crushed stone, and concrete are available from nearby suppliers and will be transported by truck to the project site. Required embankment materials are available on site.

f. Containment Dike Erosion Control. When the island becomes inundated after the 5-year flood event, based on projected flow velocities erosion control for flow protection is not required for the containment dike slopes. Final design may incorporate flatter exterior slopes to accommodate vegetation growth, maintenance, and protection against any wave wash erosion during high water.

g. Construction Sequence. The probable construction sequence is summarized in table 8-3.

TABLE 8-3

Probable Construction Sequence

Sequence	Construction Work Item	Special Instructions	Purpose
1	CPS & CPS dike	Includes proposed roadway to CPS. Use adjacent interior sand borrow for CPS dike.	Allows for dike stabilization
2	Mechanical excavation below causeway (if method chosen)	Prevent damage to roadways.	To be able to transport and place in CPS before dike complete
3	Hydraulic dredging segments 1, 2, and 3	Move dredge pipe around CPS.	Allows for more even distribution of material & clay coverage of sand.
		Dredge in respective segment order.	Dredge segments of highest priority first.
4	Potholes		
	a. Blasted	Summer construction.	Access to potholes during potentially driest conditions and during turtle non-hibernation season.
		When river is at or below flat pool.	To prevent a water quality problem during blasting.
	b. Mechanical Excavation	Winter or late summer construction.	Easier access to pothole sites.
5	Managed marshland	Construct 1 year after dredging complete. Includes well and stoplog structure.	Must wait for most of CPS settlement to occur
6	Grassland seeding	Construct 1 year after dredging complete on highest end of CPS.	Must wait for most of CPS settlement to occur

h. **Permits**. A public notice, as required by Section 404 of the Clean Water Act, will be made prior to submission of this report for final approval. A Section 401 water quality certificate from the State of Illinois and a Section 404(b)(1) Evaluation is included in this document. A floodplain construction permit from the Illinois Department of Transportation, Division of Water Resources, is included in this document.

9. ENVIRONMENTAL EFFECTS

a. **Summary of Effects.** The Potters Marsh HREP is designed to restore and enhance fisheries habitat through channel dredging and creation of a sediment trap to preserve remaining habitats. The excavation and blasting of potholes in the project area increases the value of the Potters Marsh for waterfowl, especially during the brood season when open water areas surrounded by vegetation provide refuge and abundant invertebrate life to hens and their broods. The use of a confined placement method of hydraulic dredging, not only reduces the impacts to water quality but creates an opportunity to utilize the placement site to further enhance the wetland values of Potters Marsh. The construction of a well and stoplog structure on the CPS provides for water level manipulation and a high degree of control over the vegetation patterns desired in the managed marsh. Management of the levees and higher elevations on site through revegetation of native grasses and selective tree plantings will increase the diversity of habitat types, providing nesting areas for waterfowl as well as benefits to nongame species like the dickcissel and indigo bunting.

The overall improvements to the project area are beneficial to both fish and wildlife resources and are consistent with the management objectives of the Upper Mississippi Fish and Wildlife Refuge System.

b. **Economic and Social Impacts.**

(1) **Community and Regional Growth.** No significant impacts to the growth of the community or region would be realized as a result of the project.

(2) **Displacement of People.** The project would necessitate no residential displacements.

(3) **Community Cohesion.** No significant impacts to community cohesion would be noticed. The project site is located in a rural setting with limited residential development.

(4) **Property Values and Tax Revenues.** The potential value of property within the project area could increase as a result of the proposed project. This land is in Federal ownership, however, so an increase in its value would not increase local tax revenues.

The project borrow site would be located on Federal lands managed by the USFWS and zoned for low density recreation. Removal of borrow material from the site would not impact land values or tax revenues associated with this property.

(5) **Public Facilities and Services.** The project would positively impact public facilities by enhancing aquatic and wetland habitat on Federal lands managed by the Corps of Engineers and the USFWS. The project would benefit the Mississippi River fishery, as well as resident and migratory waterfowl, and is consistent with agency management goals. If no

action is taken, ongoing siltation will transform the affected wetland habitat into lower quality willow growth.

The project borrow site would be located on Federal lands managed by the USFWS. The removal of borrow material would result in no significant adverse impacts to the affected wetland habitat, and is compatible with management goals for the project area.

(6) **Life, Health, and Safety.** The Potters Marsh complex poses no current threat to life, health, or safety of recreationists or others in the area. The project would not affect current conditions in regards to these areas of concern.

(7) **Business and Industrial Activity.** No significant changes in business and industrial activity during project construction would result. No long-term impacts to business or industrial activity would be realized. The project would require no business relocations.

(8) **Employment and Labor Force.** Project construction would result in a slight, temporary increase in employment opportunities in the project area. The available labor force in Carroll and Whiteside Counties, Illinois, is sufficient to support project construction without adverse impact to area employers.

(9) **Farm Displacement.** No farms would be affected by the proposed environmental enhancement project. Affected properties are held in Federal ownership and managed for fish and wildlife.

(10) **Aesthetics.** The project would include conversion of a poorly vegetated area into an approximately 30-acre managed marshland within the Potters Marsh complex. The project also would include a grassland area constructed on dredged material at a CPS. These improvements would provide an enhanced aesthetic environment for recreationists hunting or fishing within the complex boundaries.

(11) **Noise Levels.** Heavy machinery would generate a temporary increase in noise levels during project construction. This increase is noise levels, which would include blasting to create island potholes, would disturb wildlife and recreationists at the Potters Marsh complex. However, the project site is located in an area with limited residential or other development, and no significant, long-term noise impacts would result.

c. **Natural Resources Impacts.** Table 9-1 depicts the without project successional changes in habitat types within the Potters Marsh project area over the next 50 years. The approximate 400-acre loss in aquatic habitat will negatively impact fisheries resources but will positively increase the acreage of non-forested wetland habitat available by TY 25. This increase will benefit waterbirds and furbearers as will the increases in forested wetland habitat (from 824 acres to 1,200 by TY 50)). On the other hand, implementation of the proposed dredging and utilization of the CPS method of disposal will not only benefit waterfowl and wetland species, but will dramatically improve the area fisheries resources as will be discussed below.

TABLE 9-1

Potters Marsh HREP Habitat Types and Acreages
TY (Target Years) Indicate Predicted Changes in Habitat Types Without Construction of the Project

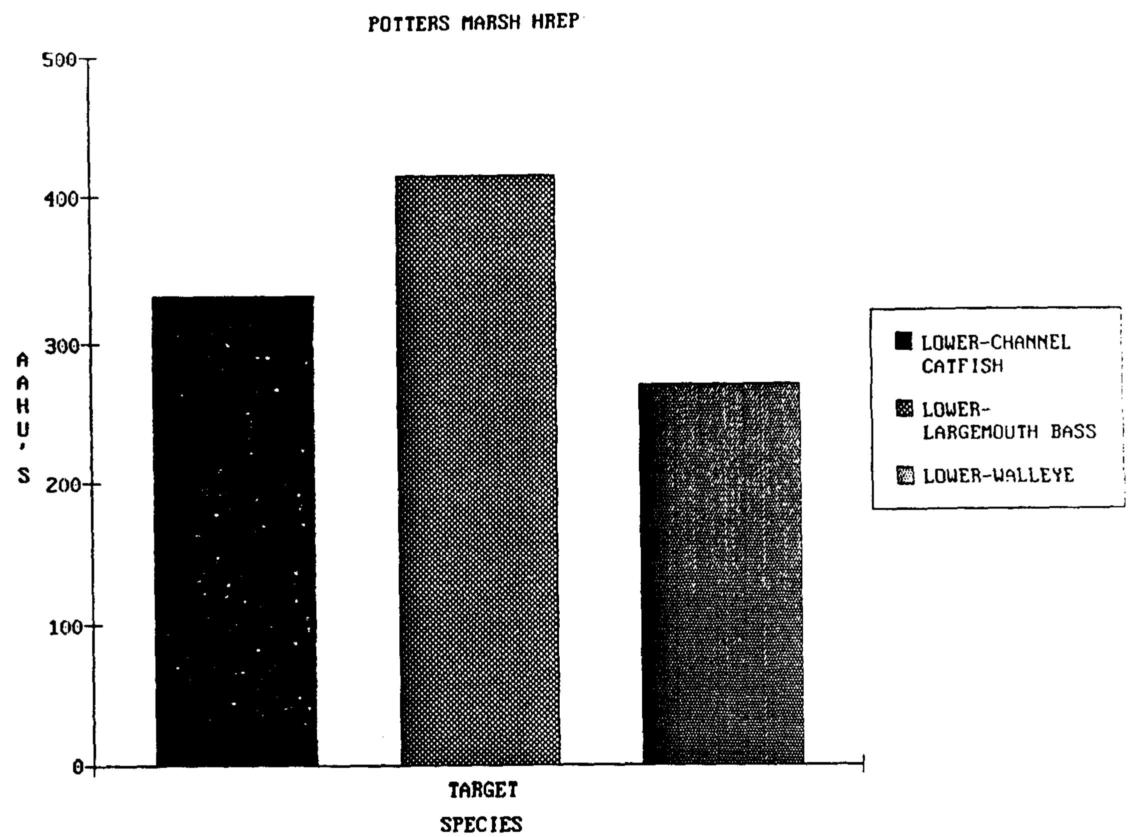
Habitat/TY	TY0	TY1	TY25	TY50
Aquatic	982	982	700	570
Non-forested wetland	314	314	439	350
Forested wetland	824	824	984	1200
Grassland	185	185	185	185
Cropland	4	4	4	4
Total	2309	2309	2309	2309

(1) **Aquatic Resources.** Additional discussion of the aquatic and water quality impacts is contained in Appendix B - Clean Water Act, Section 404(b)(1) Evaluation.

Hydraulic/Mechanical Dredging

The primary objective of the Potters Marsh HREP is to restore and create aquatic habitat for fisheries in the Potters Marsh backwaters. Application of the WHAG methodology determined that, without dredging the upper and lower segments, the AAHUs predicted for the next 50 years would be approximately 1 AAHU for the upper segment and between 52 and 56 AAHUs for the lower segments depending on the target species (table 9-2 and figure 9-1).

Implementation of the proposed dredging plan will dramatically improve the qualitative and quantitative values of the Potters Marsh backwaters. As is evidenced in table 9-2, all three target species benefit by over 500 percent. Additional improvements include higher quality spawning and rearing areas for fish, especially the centrarchids which include bluegill and bass, and deeper water off channel overwintering areas which are critically needed. These overwintering areas allow fish to escape the currents, lower temperatures, and DO levels of the main channel.



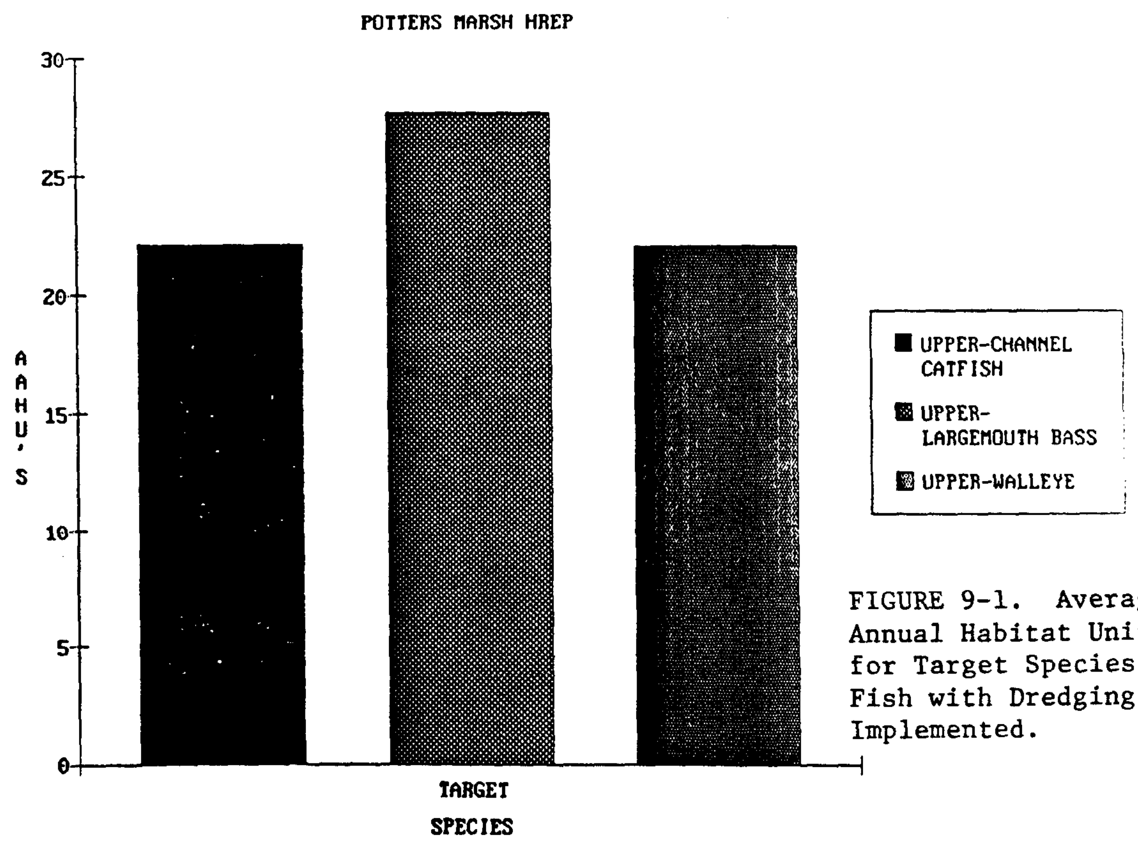


FIGURE 9-1. Average Annual Habitat Units for Target Species of Fish with Dredging Implemented.

TABLE 9-2

Average Annual Habitat Unit Comparisons
for the Upper and Lower Proposed Dredging

Target Species	Average Annual Habitat Units	
	Upper Segment/Sediment Trap	
	Without Project	With Project
Channel catfish	1.0	22.2
Largemouth bass	1.1	27.7
Walleye	1.0	22.1
	Lower Segments/Deep Holes	
	Without Project	With Project
Channel catfish	54.1	334.5
Largemouth bass	56.2	414.8
Walleye	52.3	271.3

(2) **Wetland and Terrestrial Resources**

Confined Placement Site (CPS). As mentioned above, the use of a CPS for the hydraulic dredging operations has created a unique situation whereby the ultimate use of the CPS will include management capabilities. The WHAG analysis was used to determine the best way of managing the CPS to maximize benefits to as many species as possible. Four alternatives were evaluated:

1) Allow the area to revegetate naturally.

2) Manage the area as grassland habitat.

3) Manage the area as a moist soil unit with annual drawdown to encourage establishment of moist soil plants.

4) Manage the area as a marsh unit, maintaining 1 to 2 feet of water in the CPS and allowing emergent vegetation to colonize the CPS.

The Average Annual Habitat Unit (AAHU) calculations for each of the alternatives are presented in table 9-3. Each alternative has beneficial species that would gain by implementing that particular alternative.

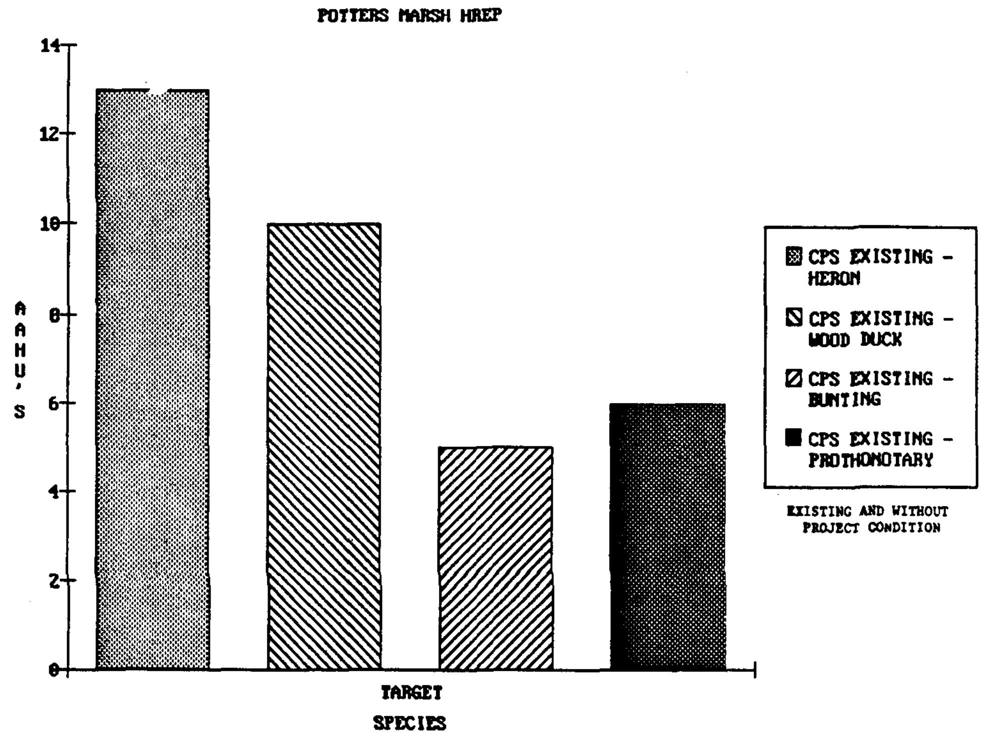
TABLE 9-3

Average Annual Habitat Units for Each Alternative of the Confined Placement Site (CPS)

SPECIES	ALT 1 Natural Succession	ALT 2 Grassland	ALT 3 Moist Soil	ALT 4 Managed Marsh
Blue-wing teal		24.7	26.0	21.8
Canada goose		23.7	28.5	13.7
Least bittern				19.0
Lesser yellowlegs				12.5
Muskrat				23.7
King rail				
Green-backed heron	13.0	00.1	03.8	23.6
Wood duck	10.5			02.0
Dickcissel		36.7		09.6
American coot				24.1
Indigo bunting	05.3	28.2	00.2	10.4
Prothonotary Warbler	06.0			01.2

It was determined by the WHAG study team that if the CPS were allowed to revegetate naturally (alternative 1) the same natural succession process would take place as is currently under way on the CPS site. Therefore, from figure 9-2, AAHU values of 13, 10, and 5, and 6 for heron, wood duck, bunting, and warbler, respectively, displayed under alternative 1 indicate the relative value of the 50-acre CPS site if the project is constructed but allowed to revegetate naturally.

Alternative 2 is a managed grassland proposal for the CPS site after the material has settled out and dried enough to work with machinery. A managed grassland habitat would create nesting areas for dabbling ducks as well as for upland nongame species like the dickcissel and the indigo bunting. This increased diversity will benefit more species and produce higher HU values than the natural succession approach proposed in alternative 1.



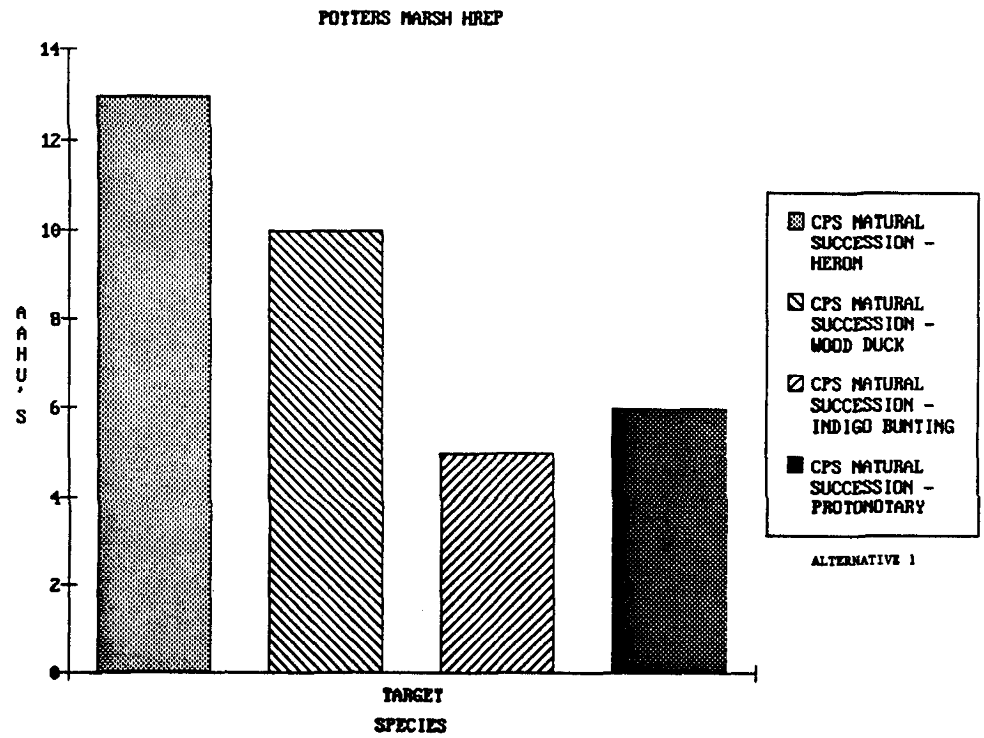
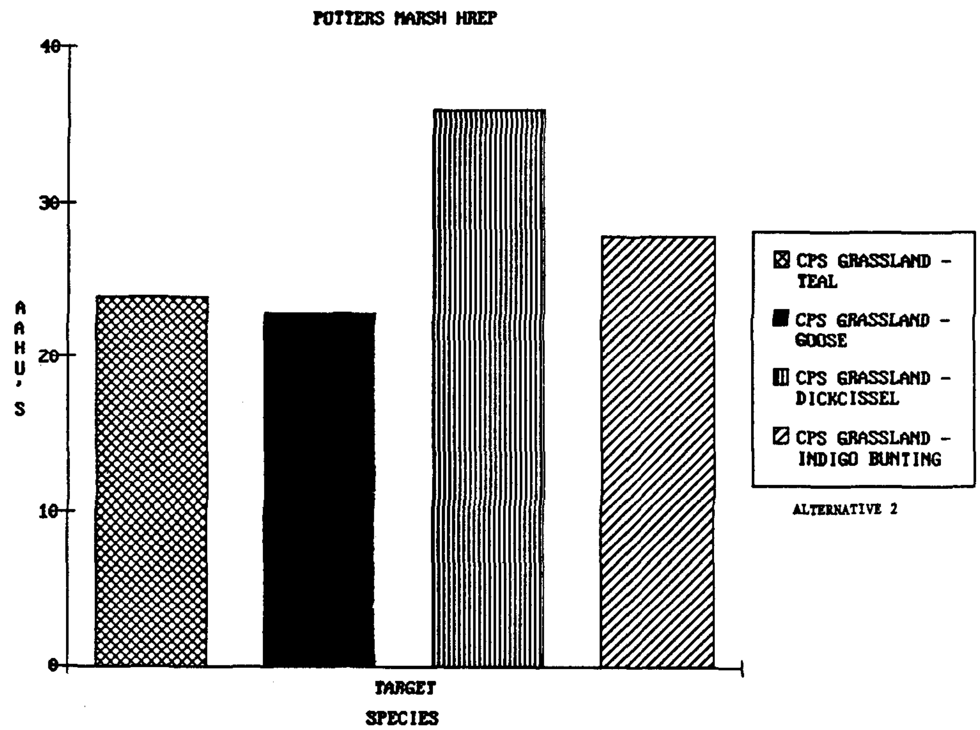


FIGURE 9-2. Average Annual Habitat Units for 50-Acre Confined Placement Site (CPS) Under Each of the Proposed Management Alternatives.



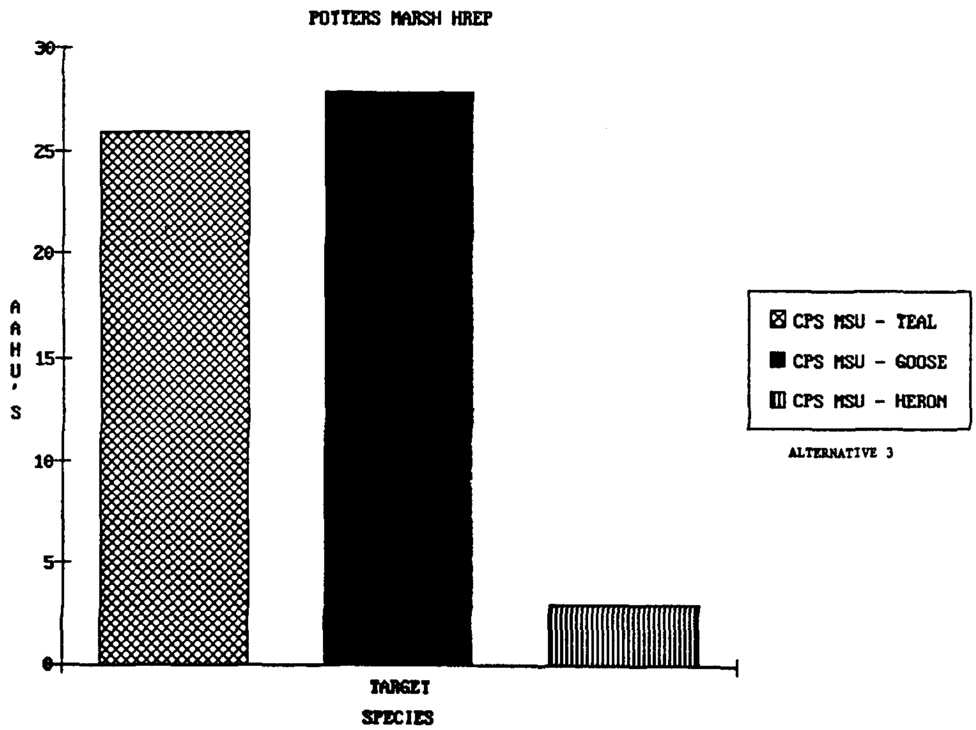
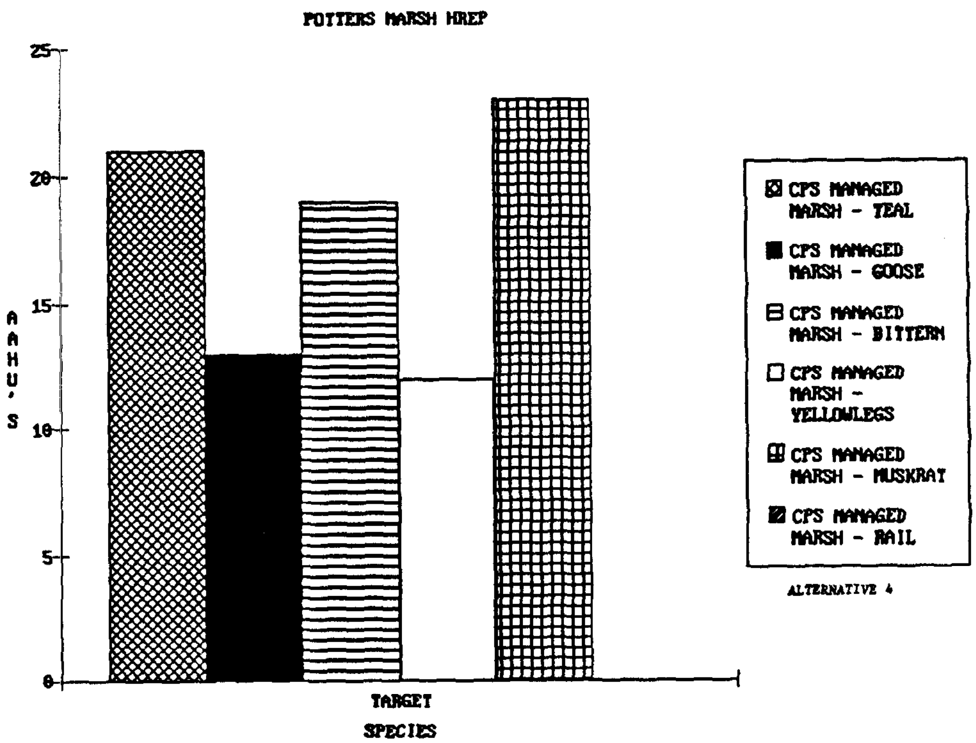


FIGURE 9-2 (Cont'd)



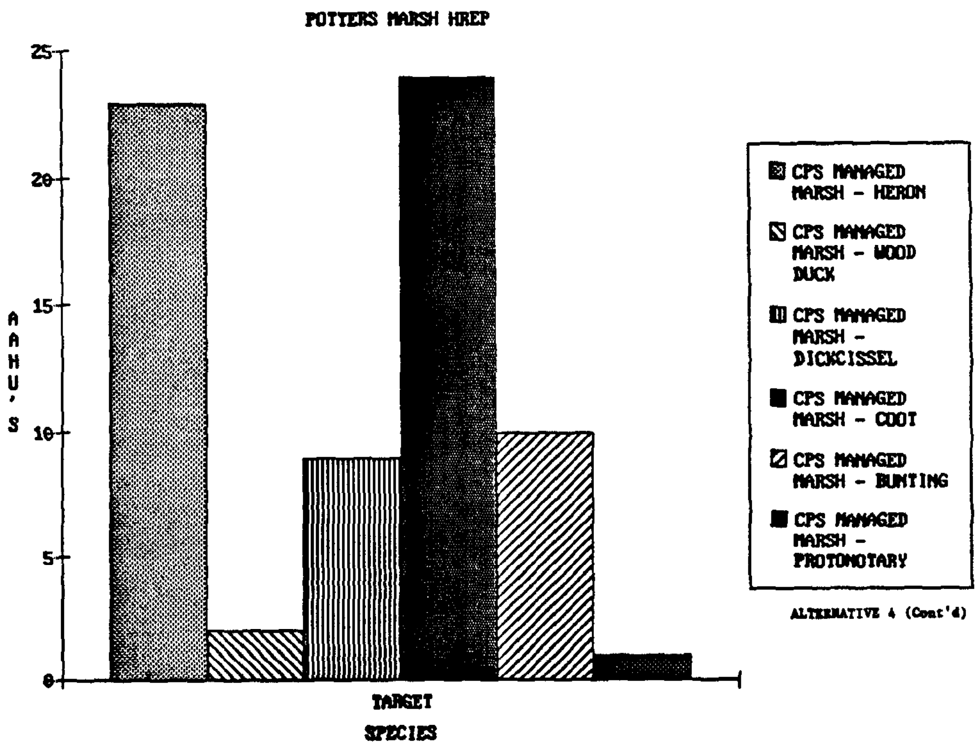


FIGURE 9-2 (Cont'd)

FIGURE 9-2 (Cont'd)

Management of the CPS site as a moist soil unit with drawdown and pumping capacity to encourage the annual growth of moist soil plants, like smartweed, is the proposed plan in alternative 3. As expected, slightly higher AAHU values are produced for waterfowl with a small number of benefits generated for species like the heron which also would utilize the flooded conditions of the moist soil unit during those seasonal periods of the year. However, this slight gain in habitat value for waterfowl is at the expense of the other wetland target species, as is evidenced in table 9-3.

Therefore, the greatest number of benefits to the greatest number of species is generated through implementation of alternative 4--the managed marsh complex (table 9-3 and figure 9-2). By maintaining water and water level control over the CPS site, additional target species like yellowlegs, bitterns, and coot, will be able to utilize the site. Although the managed marsh option produces slightly lower AAHUs for waterfowl target species than the typical moist soil alternative, the benefit of increased species diversity through implementation of the managed marsh condition outweighs this minor difference. In addition, the managed marsh will be colonized with more diverse species of aquatic vegetation than the moist soil unit. This, in turn, generates a greater and more diverse invertebrate community which is not addressed in the WHAG analysis.

Pothole Creation

A subjective approach to evaluation of the pothole features was required since the WHAG analysis would not be sensitive enough to reflect the quantitative changes brought about by such small acreage figures. However, the qualitative benefits resulting from creation of these open water habitats with surrounding stands of vegetation are critical to successful brood rearing of nesting waterfowl. The interspersion of open water and vegetation created through the construction of potholes provides protected water with adjacent escape cover for hens and their broods. Aquatic vegetation offers microhabitats for colonization of invertebrate populations which are critical during the brooding season.

Nongame species, like yellow-headed blackbirds and marsh wrens, also will benefit from additional marshland habitat in the area. Dense stands of cattail and bulrush offer nesting sites that will be used by these and other wetland species.

In addition, muskrat, mink, and other furbearers will be quick to colonize the area's deeper water and cattails with their abundant invertebrate life.

(3) **Endangered Species.** The Coordination Act Report (appendix A), provided by the USFWS, states that the endangered bald eagle (*Haliaeetus leucocephalus*) is known to utilize habitats in the study area. However, none of these habitats will be impacted as a result of project implementation and, therefore, no impact on the bald eagle is expected.

By letter dated November 27, 1991 (appendix A), the Illinois Department of Conservation requested that a nongame survey be conducted to determine the presence of the Illinois mud turtle (*Kinosternon flavescens spooneri*) (State endangered) and Blanding's turtle (*Emydoidea blandingi*) and smooth softshell turtle (*Trionyx nuticus*) (both State watch list species). To avoid any possible impacts to these species, the time of year that the pothole blasting was to occur was changed from winter to summer or early fall. This was to avoid any hibernating turtles in the proposed pothole area. By changing the time of year that pothole blasting is to occur, a nongame turtle survey is no longer needed (see letter dated December 10, 1991, appendix A).

d. **Cultural Resources**. In order to assess the potential effects of the proposed project on historic properties, a contract was awarded to Stanley Consultants, Inc., to conduct a Phase I survey of the project impact areas (figure 9-3). The work was conducted by American Resources Group, Ltd. (Ross 1991).

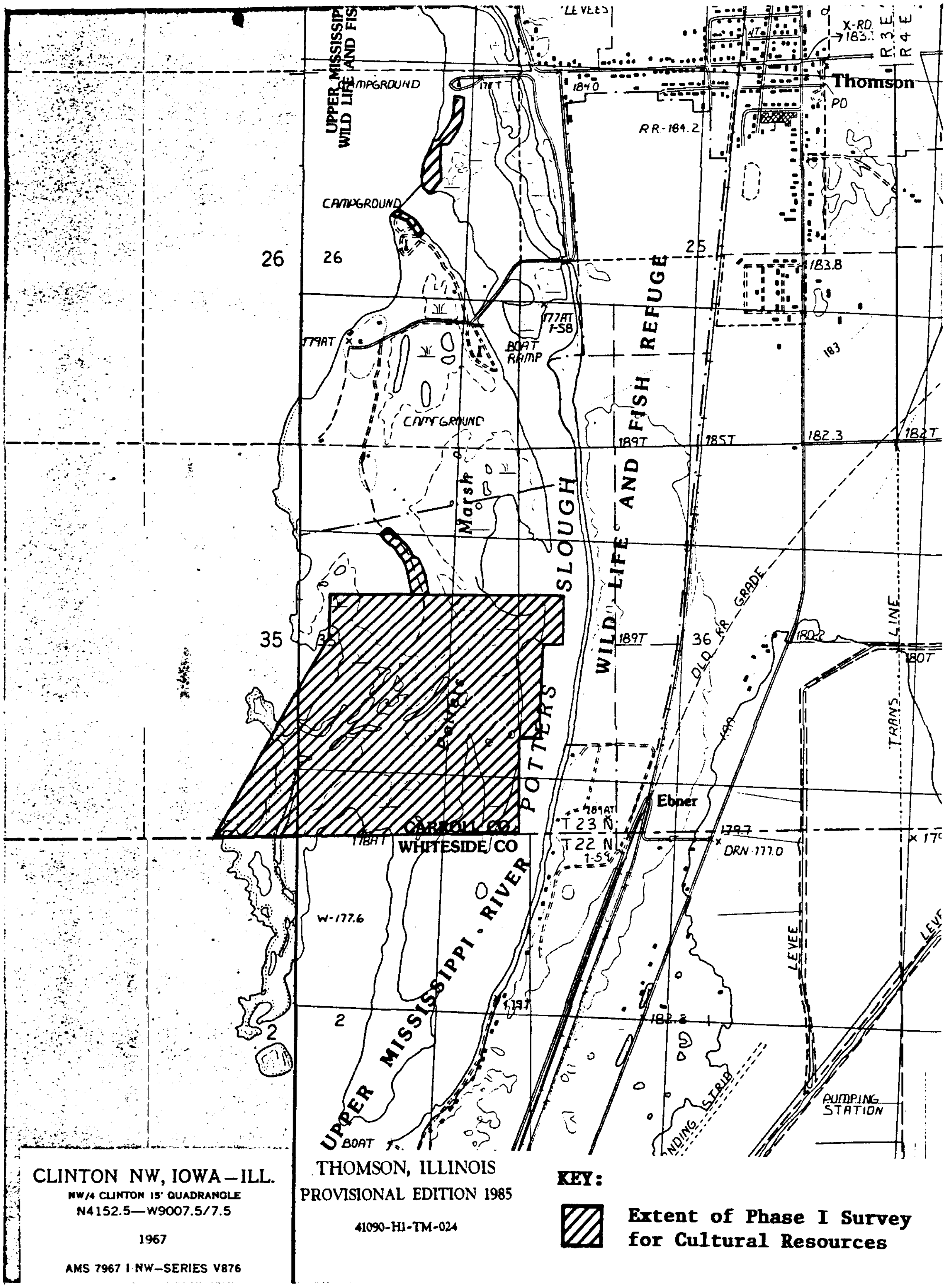
Because the geomorphological information indicated no potential for buried sites, the archeological investigation was limited to shovel testing and pedestrian survey supplemented by hand excavation of test units on the Shear's Point Site (11-CA-20). The scope of work for the survey was reviewed and approved by the State Historic Preservation Office in a letter dated September 6, 1990 (appendix A).

The scope of work specified that no survey would be conducted in the areas of proposed channel dredging (areas inundated by Mississippi River Pool 13). However, it did provide that dredging locations be reviewed and alignments placed to avoid higher points of pre-inundation topography. This was accomplished during the selection of dredge cuts for the proposed plan in this definite project report. Corps of Engineers land acquisition maps dating from the years just prior to lock and dam construction were used to identify more elevated topographical positions. These areas were assumed to have a higher probability of containing inundated cultural resources. The land acquisition maps contained 1-foot contour interval elevation markings. Final locations of the dredge cuts will be filed with the State Historic Preservation Office should the configuration of alignments change.

The Phase I survey located no additional historic properties within the project impact areas (figure 9-3). The Shear's Point Site received additional work. Following the establishment of its horizontal limits and excavation of test units, Ross (1991:25) concluded that the site did not "meet the National Register of Historic Places criteria of significance."

In a letter dated May 29, 1991 (appendix A), the State Historic Preservation Office determined that "no significant historic, architectural, and archeological resources are located in the project area."

e. **Mineral Resources**. The proposed project will have no effect on mineral resources in the area.



KEY:

Extent of Phase I Survey for Cultural Resources

FIGURE 9-3

f. **Adverse Effects Which Cannot Be Avoided.** The most significant, unavoidable adverse effect is the clearing of vegetation required for construction of the CPS. However, the CPS was designed and located in the area with minimal impacts. The habitat types affected by the construction of the CPS include a portion of the area (9 acres) of upland habitat; 6 acres of emergent wetland; and 23 acres of scrub-shrub. Utilizing the Corps' Natural Resource Inventory System, further classification of the scrub-shrub habitat determined that the successional stage to scrub-shrub is very early and therefore primarily grassland (especially brome grass). Conversion of the above habitat types to a managed marsh habitat following construction provides an opportunity to utilize a dredged material placement site for wildlife habitat with net benefits above the impact of converting the grassland habitat. Under managed conditions, a much higher quality emergent marsh condition also can be produced which more than compensates for the 6 acres of emergent marsh impacts by construction of the CPS. As a result, a net gain in habitat values is generated at a minimal cost to existing habitat types.

The dredging operations and sediment trap excavation will temporarily degrade water quality, primarily from increased turbidity.

g. **Short-Term Versus Long-Term Productivity.** Short-term productivity of the Potters Marsh area is limited due to the shallow nature of the slough and the predominance of aquatic vegetation. Continued sedimentation eventually will convert the slough to early successional willow growth and other woody vegetation. Improved water quality and depth through implementation of this project can offset the adverse effects of sedimentation and restore valuable fisheries habitat in Pool 13. A critical need for overwintering areas for fisheries populations will be met by excavation of the deeper holes near the outlet of the slough. Creation of varied water depths will also determine the vegetative response in Potters Slough. The dredged channels will allow an improved ratio of vegetation to open water to maximize fisheries and waterfowl benefits.

h. **Irreversible or Irretrievable Resource Commitments.** Other than fuel, construction materials, and manpower none of the proposed actions are considered irreversible.

i. **Compliance With Environmental Quality Statutes.** Environmental laws and regulations applicable to the proposed project are listed in table 9-4.

(1) National Historic Preservation Act and Archaeological and Historic Preservation Act. Construction of the preferred plan will not affect any significant historic properties. This action has been fully coordinated with the Illinois State Historic Preservation Office. The project, therefore, may proceed in full compliance with all appropriate historic preservation laws.

(2) Native American Graves Protection and Repatriation Act. Among other provisions, this act requires written notification to the head of the Federal agency with primary management authority for Federal lands upon

TABLE 9-4

Compliance of the Preferred Plan With WRC-Designated Environmental Statutes

Federal Policies	Compliance
Archeological and Historic Preservation Act, 16 U.S.C. 469, et seq.	Full compliance
Clean Air Act, as amended, 42 U.S.C. 165h-7, et seq.	Full compliance
Clean Water Act (Federal Water Pollution Control Act) 33 U.S.C. 1251, et seq.	Full compliance
Coastal Zone Management Act, 16 U.S.C. 1451, et seq.	Not applicable
Endangered Species Act, 16 U.S.C. 1531, et seq.	Full compliance
Estuary Protection, 16 U.S.C. 1221, et seq.	Not applicable
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. 661, et seq.	Full compliance
Land and Water Conservation Fund Act, 16 U.S.C. 4601, et seq.	Full compliance
Marine Protection Research and Sanctuary Act, 33 U.S.C. 1401, 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
River and Harbors Act, 33 U.S.C. 401, et seq.	Full compliance
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq.	Full compliance
Wild and Scenic Rivers Act, 16 U.S.C. 1271, et seq.	Not applicable

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.

which inadvertent discoveries of Native American human remains or objects may be found during construction or other activities. Should such discoveries be made during this project, the provisions of this act will be followed.

j. **Mitigation**. The habitat evaluation (WHAG analysis) performed for this project indicates that, over the 50-year life of the project, there will be a net gain in wildlife habitat. Although not discussed in detail (but a critical part of the WHAG analysis), the future without-project condition of the refuge indicates that a decline in non-forested wetland habitat and aquatic habitat will occur by the end of the 50 years. Much of the non-forested wetland will succeed to other habitat types of lower value to waterfowl and fish. In other words, if the project is not built, there is a strong likelihood that wetland habitat needed to meet refuge objectives at Potters Marsh will decline.

The WHAG analysis was performed on 12 species for the Potters Marsh project. These included non-target species such as bittern, prothonotary warbler, green backed heron, and others. This preliminary analysis gave an adequate indication as to whether or not any non-target species impacts would be unacceptable. When the consequences of an action are considered for this many species, it is inevitable that some species will gain at the expense of others. No matter how the project is designed, some species will be affected. As stated previously, even the "no action" alternative will result in species impacts. Based on the preliminary analysis, it is felt that no mitigation for any non-target species is needed.

10. SUMMARY OF PROJECT ACCOMPLISHMENTS

The proposed project consists of backwater channel hydraulic dredging, creation of a sediment trap, construction of a managed marshland with a grassland area on the CPS, and creation of potholes to increase waterfowl brood habitat and fall feeding sites.

Hydraulic dredging in lower Potters will include 20,700 lineal feet of channel and embayment and two deep holes for a total of 394,000 cubic yards. This dredging will restore and create habitat for overwintering fish and meet the project goal of rehabilitating and enhancing the aquatic habitat.

Creation of a sediment trap will include 2,100 lineal feet or 44,300 cubic yards of hydraulic dredging above the existing causeway and mechanical excavation/hydraulic dredging of a deep hole (4,700 cubic yards) immediately below the causeway. These features will help act as a sediment trap mainly during high water events, but would also help collect any minor amounts of sediment during normal flows. All sediments will not be trapped, but any that are prevented from continuing down the slough will help keep the upper 2,500 feet of slough and flow tubes from silting in completely and will help prevent further migration of sediment down the slough.

Construction of a 32.5-acre managed marshland on the CPS will involve the drilling of a well for a water source, installing a submergible pump for water control, and constructing a stoplog structure for dewatering purposes. Also included in this feature will be a 7-acre grassland area constructed on the highest portion of the CPS surface. These features will increase migratory bird feeding or resting areas and help meet the project goal of enhancing habitat for migratory birds through wetland rehabilitation.

Increasing waterfowl brood habitat and fall feeding sites involves constructing 17 potholes--10 mechanically constructed potholes totaling 3.2 acres and 7 blasted potholes totaling 1.6 acres. With the large, open expanse of water, Pool 13 offers an excellent opportunity to create nesting cover. The potholes will fill with water and provide secluded open water for duck broods. These potholes will help meet the goal of enhancing habitat for migratory birds through wetland rehabilitation.

11. OPERATIONS, MAINTENANCE, AND REHABILITATION CONSIDERATIONS

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

TABLE 11-1

Potters Marsh Project Data Summary

Feature	Measurement	Unit of Measure
Hydraulic Dredging (Segment 2)		
Length	10,900	Lineal feet
Depth below flat pool	8	Feet
Bottom width	50	Feet
Side slopes	2:1	Horizontal: Vertical
Deep hole	1	Each
Depth below flat pool	12	Feet
Bottom width	200	Feet
Bottom length	500	Feet
Side slopes	2:1	Horizontal: Vertical
Total segment 2 dredge volume	205,350	Cubic yards
Hydraulic Dredging (Segment 3)		
Length	9,800	Lineal feet
Depth below flat pool	8	Feet
Bottom width	50	Feet
Side slopes	2:1	Horizontal: Vertical
Deep hole	1	Each
Depth below flat pool	12	Feet
Bottom width	200	Feet
Bottom length	500	Feet
Side slopes	2:1	Horizontal: Vertical
Total segment 3 dredge volume	188,650	Cubic yards
Hydraulic dredging from main channel to project area	4,000	Cubic yards
Sediment Trap (Hydraulic Dredging Segment 3)		
Length	2,100	Lineal feet
Depth below flat pool	10	Feet
Bottom width	50	Feet
Side slopes	2:1	Horizontal: Vertical
Total segment 1 dredge volume	44,300	Cubic yards
Possible stump removal to access area	25-50	Each

TABLE 11-1 (Cont'd)

Feature	Measurement	Unit of Measure
Sediment Trap (Deep Hole Below Causeway)		
Length	60	Lineal feet
Depth below flat pool	10	Feet
Bottom width	200	Feet
Side slopes	2:1	Horizontal: Vertical
Total excavation/dredging	4,700	Cubic yards
Wetland Rehabilitation (Pothole Construction - Mechanical Excavation		
Number of potholes	10	Each
Average depth	4	Feet
Average side slope	2:1	Horizontal: Vertical
Shape	Variable	Each
Total area	3.2	Acres
Total volume	20,500	Cubic yards
Wetland Rehabilitation (Pothole Construction - Blasting)		
Number of potholes	7	Each
Average depth	5	Feet
Average side slope	1:1	Horizontal: Vertical
Width	50	Feet
Length	200	Feet
Total area	1.6	Acres
Total volume	19,500	Cubic yards
Dredged Material Confined Placement Site (CPS)		
Dike length	6,000	Feet
Dike height	14	Feet
Dike top width	8	Feet
Dike bottom width	94	Feet
Dike side slopes	2:1	Horizontal: Vertical
Embankment volume	162,000	Cubic yards
Clearing and grubbing	14	Acres
CPS interior surface area	35	Acres
Reshape dike surface	8.5	Acres
Dike surface and work perimeter (seed with grass)	10.5	Acres
Embankment volume	162,000	Cubic yards

TABLE 11-1 (Cont'd)

Feature	Measurement	Unit of Measure
Managed Marshland		
Area	32.5	Acres
Stoplog Structure		
Concrete sill elevation	590.0	MSL (1912)
Hydraulic opening	4	Feet
Stoplogs	13	Each, 6" spacing
Discharge pipe		
Diameter	18	Inches, CMP
Length	200	Feet
Well		
Depth	100	Feet
Hole diameter	24	Inches
Casing diameter	12	Inches
Casing depth	30	Feet
PVC well screen		
Length	20	Feet
Diameter	12	Inches
Submergible pump		
Diameter	6±	Inches
Power	5	HP
Capacity	500	GPM
Discharge pipe		
Diameter	6	Inches
Length	200	Feet
Well head	1	Each
Concrete splash apron		
Length	8	Feet
Width	8	Feet
Thickness	4	Inches
Electrical Power		
Electric	1	Phase, 8000/240 volt
Transformer	15	KVA
Buried primary feeder length	7,500	Feet
Platform	1	Each
Grassland Area (7-acre interior CPS)		
Grassland seeding	7	Acres
Service Roadway		
Improve existing road with granular surface		
Length	800	Feet
Width w/shoulders	12	Feet
Crushed stone	200	Cubic yards

TABLE 11-1 (Cont'd)

Feature	Measurement	Unit of Measure
Extend existing road to stoplog structure (includes turnaround at stoplog structure)		
Length	4,300	Feet
Width w/shoulders	12	Feet
Embankment borrow	1,870	Cubic yards
Crushed stone	1,100	Cubic yards
Drainage pipe (CMP)		
Diameter	24	Inches
Length	20	Feet
Clearing and grubbing	1.5	Acres

b. **Operation**. Table 11-2 summarizes the general operating requirements to manage water levels in the managed marshland.

Estimated annual operation costs are presented in table 13-2.

c. **Maintenance**. The proposed features have been designed to ensure low annual maintenance requirements, with the estimated annual maintenance costs presented in table 13-2. These quantities and costs may change during final design.

TABLE 11-2

Operating Requirements to Manage Water Levels

Desired Function	Operating Scenario	Operating Time	Remarks
Annual Filling of Managed Marshland	In late summer-early fall, fill 32.5 acres with 1.5± feet of water and maintain 1.0-foot depth throughout the fall season.	Submergible pump in well operating time of 20 days at 500 gpm	7-acre grassland area will remain relatively dry due to being located at highest end of the CPS
Annual Dewatering of Managed Marshland	In early spring, remove appropriate stoplogs on 4-foot hydraulic opening stoplog structure	Complete dewatering time of 5-10 days	Intermittent low areas may remain wet/moist
Removal of Undesired Vegetation in Managed Marshland	Approximately every 3-5 years, fill with 3.0± feet of water to kill off undesired vegetation	Well pump time would be 50 days at 500 gpm	Water level would remain below the top of the reshaped dike

12. PROJECT PERFORMANCE ASSESSMENT

This section summarizes the monitoring and data collection aspects of the project. The primary project objectives are to: (1) restore and create fisheries habitat in lower Potters Slough and embayment areas; (2) reduce sediment input in the upper Potters Slough area; (3) increase migratory bird feeding or resting area; and (4) increase waterfowl brood habitat and fall feeding sites. Hydrographic soundings and water quality monitoring will be the primary elements in determining the success in meeting the first two objectives. Vegetation monitoring and visual inspection will be the main methods of determining the success of objective (3). Post-construction aerial surveys and visual inspection of the Potters Marsh complex will be used to investigate the success of objective (4).

Table 12-1 presents the principal types, purposes, and responsibility of monitoring and data collection. Table 12-2 summarizes actual monitoring and data parameters grouped by project phase and also shows data collection intervals.

Table 12-3 presents the post-construction evaluation plan. The monitoring parameters of this plan were developed to measure the effectiveness of the stated goals and objectives. As shown in table 12-1, these post-construction quantitative measurements will be the responsibility of the Corps of Engineers. The USFWS field personnel also should follow table 12-3, as shown, to make annual field observations. The annual field observations and the quantitative monitoring parameters will form the basis of project evaluation.

TABLE 12-1

Monitoring and Performance Evaluation Matrix

Project Phase	Type of Activity	Purpose	Responsible Agency	Implementing Agency	Funding Source	Remarks
Pre-Project	Sedimentation Problem Analysis	System-wide problem definition. Evaluates planning assumptions.	USFWS	USFWS (EMTC)	LTRM	Lead into pre-project monitoring; define desired conditions for plan formulation.
	Pre-Project Monitoring	Identify and define problems at HREP site. Establishes need of proposed project features.	Sponsor	Sponsor	Sponsor	Should attempt to begin defining baseline.
	Baseline Monitoring	Establish baselines for performance evaluation.	Corps	Field station or sponsor thru Cooperative Agreements or Corps.	LTRM	See Table 12-2.
Design	Data Collection for Design	Include quantification of project objectives, design of project, and development of performance evaluation plan.	Corps	Corps	HREP	See Table 12-2.
Construction	Construction Monitoring	Assess construction impacts; assures permit conditions are met.	Corps	Corps	HREP	See State Section 401 Stipulations.
Post-Construction	Performance Evaluation Monitoring	Determine success of project as related to objectives.	Corps (quantitative) and sponsor (field observations).	Field station or sponsor thru Cooperative Agreement, sponsor thru O&M, or Corps.	LTRM	See Table 12-3.
	Biological Response Monitoring	Determine critical impact levels, cause-effect relationships, and effect on long-term losses of significant habitat.	USFWS	USFWS (EMTC)	LTRM	Problem Analysis and Trend Analysis studies of habitat projects.
		Demonstrate success or failure of projects re: response of biota.	Corps	Corps/USFWS (EMTC)/Others	LTRM	Biological Response Study tasks beyond scope Performance Evaluation, Problem Analysis and Trend Analysis.

TABLE 12-2

Resource Monitoring and Data Collection Summary [1]

Type Measurement	WATER QUALITY DATA: Pre-Project Phase APR-SEP	Pre-Project Phase OCT-MAR	Design Phase APR-SEP	Design Phase OCT-MAR	Post-Const. Phase APR-SEP	Post-Const. Phase OCT-MAR	ENGINEERING DATA: Pre-Project Phase	Design Phase	Post-Const. Phase	NATURAL RESOURCE DATA: Pre-Project Phase	Design Phase	Post-Const. Phase	Sampling Agency	Remarks
POINT MEASUREMENTS														
Water Quality Station [2]														
W-M525.1Y													Corps	
Turbidity	2W		2W	M	2W	M								
Secchi Disk Transparency	2W		2W	M	2W	M								
Suspended Solids	2W		2W	M	2W	M								
Dissolved Oxygen	2W		2W	M	2W	M								
Specific Conductance	2W		2W	M	2W	M								
Water Temperature	2W		2W	M	2W	M								
pH	2W		2W	M	2W	M								
Total Alkalinity			2W	M	2W	M								
Chlorophyll	2W		2W	M	2W	M								
Velocity	2W		2W	M	2W	M								
Water Depth	2W		2W	M	2W	M								
Water Elevation	2W		2W	M	2W	M								
Percent Ice Cover				M		M								
Ice Depth				M		M								
Percent Snow Cover				M		M								
Snow Depth				M		M								
Wind Direction	2W		2W	M	2W	M								
Wind Velocity	2W		2W	M	2W	M								
Wave Height	2W		2W	M	2W	M								
Air Temperature			2W	M	2W	M								
Percent Cloud Cover			2W	M	2W	M								

TABLE 12-2 (Cont'd)

Type Measurement	WATER QUALITY DATA: Pre-Project Phase APR-SEP	Pre-Project Phase OCT-MAR	Design Phase APR-SEP	Design Phase OCT-MAR	Post-Const. Phase APR-SEP	Post-Const. Phase OCT-MAR	ENGINEERING DATA: Pre-Project Phase	Design Phase	Post-Const. Phase	NATURAL RESOURCE DATA: Pre-Project Phase	Design Phase	Post-Const. Phase	Sampling Agency	Remarks
POINT MEASUREMENTS														
Water Quality Station [3] W-M524.1U & W-M523.7Y														
Turbidity			2W	M	2W	M							Corps	
Secchi Disk Transparency			2W	M	2W	M								
Suspended Solids			2W	M	2W	M								
Dissolved Oxygen			2W	M	2W	M								
Specific Conductance			2W	M	2W	M								
Water Temperature			2W	M	2W	M								
pH			2W	M	2W	M								
Total Alkalinity			2W	M	2W	M								
Chlorophyll			2W	M	2W	M								
Velocity			2W	M	2W	M								
Water Depth			2W	M	2W	M								
Water Elevation			2W	M	2W	M								
Percent Ice Cover				M	2W	M								
Ice Depth				M	2W	M								
Percent Snow Cover				M	2W	M								
Snow Depth				M	2W	M								
Wind Direction			2W	M	2W	M								
Wind Velocity			2W	M	2W	M								
Wave Height			2W	M	2W	M								
Air Temperature			2W	M	2W	M								
Percent Cloud Cover			2W	M	2W	M								

TABLE 12-2 (Cont'd)

Type Measurement	WATER QUALITY DATA: Pre-Project Phase APR-SEP	Pre-Project Phase OCT-MAR	Design Phase APR-SEP	Design Phase OCT-MAR	Post-Const. Phase APR-SEP	Post-Const. Phase OCT-MAR	ENGINEERING DATA: Pre-Project Phase	Design Phase	Post-Const. Phase	NATURAL RESOURCE DATA: Pre-Project Phase	Design Phase	Post-Const. Phase	Sampling Agency	Remarks
POINT MEASUREMENTS														
Sediment Test Stations [4]														
Elutriate			1										Corps	
Bulk Sediment			1											
Sediment Oxygen Demand			1											
Column Settling Stations [5]													Corps	
Column Settling Analysis							1	1						
Boring Stations [6]													Corps	
Geotechnical Borings							1	1						
Fish Stations [7]													ILDOC	
Fish Surveys										3				
TRANSECT MEASUREMENTS														
Sedimentation Transects [8]													Corps	
Hydrographic Soundings							1	1						
Sedimentation Transects [9]													Corps	
Hydrographic Soundings									5Y					
Vegetation Transect [10]														
Vegetation Survey										Y	Y	Y	USFWS	
AREA MEASUREMENTS														
Mapping														
Aerial Photography (1:1250)										1		5Y	USFWS	
Land Topographic (1' contours)								1					Corps	

Legend

W = Weekly
M = Monthly
Y = Yearly
nW = n-Week interval
nY = n-Year interval
1, 2, 3 --- = number of times data is collected within designated project phase

TABLE 12-2 (Cont'd) (Notes)

1 See plate 18 for active monitoring sites

Station Code	COE Transects
S-M525.2X to S-M525.2Y	1
S-M525.1X to S-M525.1Y	2
S-M524.9X to S-M524.9Y	3
V-M524.5S to V-M524.5Y	4
S-M524.2V to S-M524.2Y	5
S-M524.2U to S-M524.1V	6
S-M523.9T to S-M523.8V	7
S-M523.8W to S-M523.7Y	8
S-M523.7W to S-M523.7X	9
S-M523.8T to S-M523.6Y	10
S-M523.7T to S-M523.7V	11
S-M523.6V to S-M523.6X	12

2 COE Water Quality Station (Pre-Project Phase)

Station Code	COE Transect	Geotechnical Boring
W-M525.1Y	2	P-89-1

3 COE Water Quality Stations (Design Phase)

Station Code	COE Transect	Geotechnical Boring
W-M523.7Y	7	P-89-7
W-M524.1U	5	P-89-8
W-M525.1Y	2	P-89-1

[4] COE Sediment Test Stations

Station Code	Geotechnical Boring
M523.7X	P-91-2
M524.4Y	P-89-5
M525.1Y	P-89-1

[5] COE Column Settling Analysis Stations (Pre-Project and Design Phase)

Station Code	Geotechnical Boring	Phase
C-M524.9Y	P-89-3	Pre-Project
C-M524.4Y	P-89-5	Pre-Project
C-M523.7U	P-90-2	Design
C-M525.1Y	P-89-1	Design
C-M525.0X	P-91-3	Design
C-M523.7Y	P-89-7	Design

[6] COE Geotechnical Borings

During pre-project and design phases, 22 borings were completed from M523.6V to M525.3X at various locations. See boring logs on plates 6 and 7 and boring locations on plate 8.

[7] ILDOC Fish Sampling (Pre-Project Phase)

3 Slough Sampling Surveys:	1976 - Mile 526.0
	1977 - Mile 525.5
	1979 - Mile 525.5

[8] COE Hydrographic Soundings (Pre-Project and Design Phase)

From S-M523.5V at approximately 500- to 800-foot intervals to S-M525.2X (COE transect #1) pre-project ranges were dispersed throughout the project site while design phase sounding ranges were more site-specific.

TABLE 12-2 (Cont'd) (Notes)

9 COE Hydrographic Soundings (Post-Construction Phase)

Station Code	COE Transect
S-M525.2X to S-M525.2Y	1
S-M525.1X to S-M525.1Y	2
S-M524.9X to S-M524.9Y	3
S-M524.2V to S-M524.2Y	5
S-M524.2U to S-M524.1V	6
S-M523.9T to S-M523.8V	7
S-M523.8W to S-M523.7Y	8
S-M523.7W to S-M523.7X	9
S-M523.8T to S-M523.6Y	10
S-M523.7T to S-M523.7V	11
S-M523.6V to S-M523.6X	12

10 Vegetation Transects

Station Code	COE Transect	
V-M524.5S to V-M524.4Y	4	USFWS Vegetation Transect

TABLE 12-3

Post-Construction Evaluation Plan

Goal	Objective	Alternative	Enhancement Feature	Enhancement Potential: Unit	Enhancement Potential: Year 0 Without Alternative	Enhancement Potential: Year X With Alternative[1]	Enhancement Potential: Year 50 Target With Alternative	Feature Measurement Reference Table 12-2	Annual Field Observations by Site Manager
Rehabilitate & Enhance Aquatic Habitat	Restore & create fisheries habitat	Create deep water in lower channel and embayment areas	Hydraulically dredge channel segments 2 & 3	Acre-feet of deep water	0	--	220	Perform COE Transects 5-13 hydrographic soundings	Describe presence of snags, debris, channel sedimentation, or vegetation
			Improved water quality	mg/l DO	Approx. 1-4	--	Projected 4-8	Perform water quality test at stations, notes 2 & 3, Tbl 12-2	Describe presence of fish stress or kills
	Reduce sediment input	Create deep water above & below causeway	Hydraulically dredge seg. 1 & mech excav/ dredge hole below causeway	Acre-feet of deep water	0	--	24	Perform COE Transects 1-3 hydrographic soundings	Describe presence of snags, debris, channel sedimentation, or vegetation
Enhance Habitat for Migratory Birds Through Wetland Rehabilitation	Increase migratory bird feeding or resting area	Best use of CPS surface	Managed marshland	Acres of managed water level	0	--	32.5	Perform vegetation transect COE Transect 4, note 10, Table 12-2 & aerial photography	Describe presence or absence of waterfowl & migratory birds
			Grassland area	Acres of grassland	*	--	7.0	Perform vegetation transect COE Transect 4, note 10, Tbl 12-2 & aerial photography	Grassland survival
	Increase waterfowl brood habitat & fall feeding sites	Pothole creation	Improve and increase existing potholes	Acres of potholes	Approx. 2.0	--	6.8	Perform aerial photography	Describe presence or absence of waterfowl

[1] This column is completed for the year the enhancement feature is monitored.

* 14 acres of scrub-shrub currently exists in the 50-acre CPS area.

13. COST ESTIMATES

A detailed estimate of project design and construction costs is presented in table 13-1. A detailed estimate of operation, maintenance, and rehabilitation costs is presented in table 13-2. Table 13-3 presents the estimated annual monitoring costs as described in Section 12. Quantities may vary during final design.

TABLE 13-1

POTTERS MARSH
REHABILITATION AND ENHANCEMENT EMP
MISS. RIVER MILE 523.5 - 526.5

PROJECT COST SUMMARY
DIVISION OF COST

JULY 1991
(REVISED NOV 1991)

ACCOUNT	FEATURE	CURRENT WORKING ESTIMATE (CWE)		FULLY FUNDED ESTIMATE (FFE)	
		FEDERAL	NON-FEDERAL	FEDERAL	NON-FEDERAL
06.	FISH AND WILDLIFE FACILITIES	3,278,000		3,699,223	
30.	PLANNING, ENGINEERING AND DESIGN	515,000		546,163	
31.	CONSTRUCTION MANAGEMENT	164,000		204,885	
	SUBTOTAL	3,957,000	0	4,450,271	0

SUMMARY OF COST APPORTIONMENT

	CWE	FFE
1. TOTAL COST SUMMARY		
TOTAL PROJECT COSTS	3,957,000	4,450,271
NON-FEDERAL LANDS & DAMAGES	0	0
TOTAL PROJECT COSTS SEE NOTE 1.	3,957,000	4,450,271
2. NON-FEDERAL COSTS		
REQUIRED NON-FEDERAL CASH CONTRIBUTION	0	0
NON-FEDERAL LANDS & DAMAGES	0	0
TOTAL NON-FEDERAL COST	0	0
3. FEDERAL COST		
TOTAL FEDERAL COSTS	3,957,000	4,450,271
GENERAL DESIGN, DEFINITE PROJECT REPORT	(340,000)	(390,000)
REMAINING FEDERAL COSTS	3,617,000	4,060,271

NOTES:

1. TOTAL PROJECT COST IS 100% FEDERAL COST; PROJECT LANDS ARE GOVERNMENT OWNED.
2. CONSTRUCTION SCHEDULED FOR JUN 93 - SEP 95. FULLY FUNDED ESTIMATE (FFE) IS BASED ON MIDPOINT OF CONSTRUCTION DATE OF JUL 94, RESULTING IN INFLATION FACTORS OF 1.2493 FOR SALARIES AND 1.1285 FOR ALL OTHER COSTS PER CECW-B MEMO, 5 FEB 91, SUBJECT: FACTORS FOR UPDATING STUDY/PROJECT COST ESTIMATES FOR THE FY 1993 BUDGET SUBMISSION. INFLATION FACTORS ARE BASED ON INITIAL JULY 1991 PRICE LEVEL COSTS.

TABLE 13-1 (Cont'd)

POTTERS MARSH
REHABILITATION AND ENHANCEMENT EMP
PROJECT COST ESTIMATE
JULY 1991 PRICE LEVEL
(REVISED NOV 1991)

ACCOUNT CODE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	CON %	REASONS
06.	FISH AND WILDLIFE FACILITIES							
06.-.-.-	ACCESS ROAD, UPGRADE EXIST. & BUILD NEW							
06.0.C.B	CRUSHED STONE (EXIST. ACCESS RD.)	300	TON	20.90	6,270	1,254	20.0%	2,3
06.0.C.B	CLEARING AND GRUBBING	1.5	ACR	5215.00	7,823	1,956	25.0%	1,4
06.0.C.B	EMBANKMENT	1870	CY	3.70	6,919	1,384	20.0%	1,6
06.0.C.B	DRAINAGE PIPE, 24" CMP	40	LF	38.40	1,536	384	25.0%	4,6
06.0.C.B	CRUSHED STONE	1605	TON	20.90	33,545	6,709	20.0%	2,3
	TOTAL				56,092	11,686		
06.-.-.-	CONFINED PLACEMENT SITE							
06.0.1.B	SELECTIVE CLEARING	14	ACR	1295.00	18,130	4,533	25.0%	1,4
06.0.1.B	EMBANKMENT	162000	CY	4.90	793,800	158,760	20.0%	1,6
06.0.5.-	STOP LOG STRUCTURE	1	LS	19000.00	19,000	4,750	25.0%	4,6
06.0.C.B	DRAINAGE PIPE, 18"CMP	200	LF	33.00	6,600	1,650	25.0%	3,6
	TOTAL				837,530	169,693		
06.-.-.-	HYDRAULIC DREDGING							
06.0.A.-	MOBILIZATION & DEMOBILIZATION	1	LS	100000.00	100,000	15,000	15.0%	2,5
06.0.1.B	STUMP REMOVAL	50	EA	190.00	9,500	4,750	50.0%	4,5
06.0.1.B	HYDRAULIC DREDGING	442300	CY	2.90	1,282,670	323,134	25.2%	1,5
06.0.1.B	POLYMER FOR DREDGE DISCHARGE	6300	LBS	3.00	18,900	14,175	75.0%	4
	TOTAL				1,411,070	357,059		
06.0.1.B	MECH. EXCAVATION AT ACCESS ROAD	4700	CY	8.50	39,950	5,993	15.0%	1
	TOTAL				39,950	5,993		
06.-.-.-	POTHOLES							
06.0.1.B	MECHANICALLY EXCAVATED	16	EA	5750.00	92,000	18,400	20.0%	1,6
06.0.1.B	BLASTED HOLES	7	EA	15400.00	107,800	26,950	25.0%	1,3,5
	TOTAL				199,800	45,350		

TABLE 13-1 (Cont'd)

POTTERS MARSH
REHABILITATION AND ENHANCEMENT EMP
PROJECT COST ESTIMATE
JULY 1991 PRICE LEVEL
(REVISED NOV 1991)

ACCOUNT CODE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	CON %	REASONS
06.-.-.-	NEW WELL							
06.0.5.B	DRILL WELL, CASING & WELL SCREEN	1	LS	21800.00	21,800	21,800	100.0%	4,6
06.0.5.Q	SUBMERSIBLE 5HP PUMP	1	EA	2260.00	2,260	2,260	100.0%	3,6
06.0.5.R	ELECTRICAL FEED AND PLATFORM	1	LS	55900.00	55,900	11,180	20.0%	3,4
	TOTAL				79,960	35,240		
06.-.-.-	LANDSCAPING							
06.0.1.B	SEEDING, DIKE & PERIMETER AREA	10.5	ACR	1500.00	15,750	2,363	15.0%	1,3,6
06.0.1.B	SEEDING, INTERIOR GRASSLAND	7	ACR	1300.00	9,100	1,365	15.0%	1,3,6
	TOTAL				24,850	3,728		
	SUBTOTAL, FISH AND WILDLIFE FACILITIES				2,649,252			
	CONTINGENCIES; AVERAGE OF	23.7%				628,748		
06.	TOTAL, FISH AND WILDLIFE FACILITIES				3,278,000			

REASONS FOR CONTINGENCIES: 1. UNKNOWN SITE CONDITIONS, 2. UNKNOWN HAUL DISTANCE, 3. UNIT PRICE UNKNOWN, 4. QUANTITY UNKNOWNS, 5. DIFFICULT SITE ACCESS, 6. UNKNOWN FINAL DESIGN

30.	PLANNING, ENGINEERING AND DESIGN		515,000
	DEFINITE PROJECT REPORT	390,000	
	PLANS AND SPECIFICATIONS	110,000	
	ENGINEERING DURING CONSTRUCTION	15,000	
31.	CONSTRUCTION MANAGEMENT		164,000
	CONTRACT ADMINISTRATION	61,000	
	REVIEW OF SHOP DRAWINGS	6,000	
	INSPECTION AND QUALITY ASSURANCE	97,000	
		TOTAL	3,957,000

TABLE 13-2

Estimated Annual Operation and Maintenance Costs
(July 1991 Price Level)

	Qty	Unit	Unit Cost ($)	Total Cost ($)
Operation				
Well submergible pump power (annual plus average for 3-5 year maintenance fill)	600	kWh	.07	42
Basic monthly electric service	12	Mo	4.76	60
Well submergible pump operation	8	Hr	25.00	200
Stoplog structure operation	6	Hr	25.00	150
Maintenance				
Project inspection (includes dike)	32	Hr	25.00	800
Dike mowing (once/yr. min.)	10.5	Ac	50.00	525
Access road crushed stone	20	Ton	20.00	400
Debris removal (includes roadway)	40	Hr	50.00	2,000
Stoplog replacement	13	Ea	10.00	130
Well pump replacement ($2,500 in year 25 annualized)	1	Job	Sum	40
Electrical repair ($1,250 in year 25 annualized)	1	Job	Sum	25
CPS grassland burning	7	Ac	50.00	350
Managed marshland maintenance of unwanted vegetation every 3-5 years	16	Hr	25.00	400
Subtotal Maintenance:				5,122
Rehabilitation 1/				____
			Subtotal:	5,122
Contingencies (19.1%)				978
			TOTAL:	6,100

1/ 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 a result of major storms or flood events.

TABLE 13-3

Estimated Post-Construction Annual Monitoring Costs ($)
(July 1991 Price Level)

Item	Annual Cost ($)
Water Quality Data [1]	4,500
Engineering Data [1]	1,000
Natural Resource Data [1]	1,500
Subtotal	7,000
Contingencies (15%)	1,050
Subtotal	8,050
Planning, Engineering, Design [2]	1,250
Contract Management	1,000
Total	10,300

[1] Reference tables 12-2 and 12-3.

[2] Includes cost of annual evaluation report.

14. REAL ESTATE REQUIREMENTS

a. **General.** All project features are located on lands owned by the U.S. Army Corps of Engineers.

b. **Local Cooperation Agreements/Cost-Sharing.** The project is proposed for 100 percent Federal funding for first costs. The project area is part of the Upper Mississippi River National Wildlife and Fish Refuge. 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.

c. **Construction Easements.** Under a cooperative agreement with the Corps of Engineers, the U.S. Fish and Wildlife Service (USFWS) has been given management authority regarding fish and wildlife at the Potters Marsh complex. The Corps of Engineers currently maintains the extreme upper portion as a recreation area and will continue to do so. The USFWS will provide in the final report a letter of consent authorizing work on the land that the USFWS manages under the cooperative agreement with the Corps of Engineers. This letter will be part of the compatibility determination. In addition, the IDOC has been given management authority regarding the Nicholsons Landing boat ramp area near the lower portion of the project. The IDOC will provide a letter of consent authorizing the use of the boat ramp and parking area during project construction. There will be no project features built at this location.

15. SCHEDULE FOR DESIGN AND CONSTRUCTION

Table 15-1 presents the schedule of project completion steps.

TABLE 15-1

Project Implementation Schedule

Requirement	Scheduled Date
Submission of Draft DPR to Corps of Engineers, North Central Division, for Review	Jul 91
Distribution of DPR for Public and Agency Review	Dec 91
Submission of Final and Public Reviewed DPR to North Central Division	Apr 92
Receive Plans and Specifications Funds	May 92
Construction Approval by Assistant Secretary of the Army (Civil Works)	Oct 92
Submit Final Plans and Specifications to North Central Division for Review and Approval	Mar 93
Obtain Approval of Plans and Specifications	Apr 93
Advertise Contract	Apr 93
Award Contract	Jun 93
Complete Construction	Sep 95

16. IMPLEMENTATION, RESPONSIBILITIES, AND VIEWS

a. **Corps of Engineers.** The Corps of Engineers, Rock Island District, is responsible for project management and coordination with the USFWS, the State of Illinois, and other affected agencies. The Rock Island District will submit the subject detailed project report; program funds; finalize plans and specifications; complete all NEPA requirements; advertise and award a construction contract; and perform construction contract supervision and administration.

b. **U.S. Fish and Wildlife Service.** The USFWS is the Federal sponsor of the project and will determine that all project features are compatible with Refuge purposes. The USFWS will ensure that operation and maintenance functions, described in table 13-2 of this report, are performed in accordance with Section 906(e) of the 1986 Water Resources Development Act. These functions will be further specified in the Project Operation and Maintenance Manual to be provided by the U.S. Army Corps of Engineers prior to final acceptance of the project by the sponsor. Authorization has been provided to the Corps of Engineers for construction on USFWS-owned lands.

The recommendations provided via the Draft Coordination Act Report that the dredging of segments 1, 2, and 3 be implemented and that the CPS be managed as a marsh habitat are the result of extensive interagency coordination efforts throughout the planning process.

c. **Illinois Department of Conservation.** The IDOC, the non-Federal proponent of the project, has provided technical and other advisory assistance during all phases of the project and will continue to provide assistance during project implementation.

17. COORDINATION, PUBLIC VIEWS, AND COMMENTS

a. **Coordination Meetings.** Close coordination between the Corps of Engineers, the USFWS, and the IDOC was effected during the study period. A listing of meetings is shown below.

(1) December 7, 1988. On-site meeting conducted with IDOC, USFWS, and CENCR to scope proposed project.

(2) March 27, 1990. Off-site meeting conducted with USFWS, IDOC, and CENCR to develop design alternatives.

(3) January 25, 1991. Off-site meeting conducted with IDOC, USFWS, and CENCR to discuss feasibility of alternatives.

(4) March 21, 1991. Off-site meeting conducted with IDOC, USFWS, and CENCR to discuss feasibility of alternatives.

(5) May 21, 1991. Off-site meeting conducted with IDOC, USFWS, and CENCR to coordinate design changes and confirm management plan.

(6) October 1, 1991. Off-site meeting conducted with IDOC, USFWS, and CENCR to discuss draft DPR comments, any necessary coordination, and public review DPR preparation.

b. **Coordination by Letters and Telephone Conversations.** Letters and telephone conversations of coordination (appendix A) were received from the following agencies:

Illinois State Historic Preservation Office
Illinois Department of Conservation
Illinois Environmental Protection Agency
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

By letter dated May 29, 1991, the Illinois State Historic Preservation Office stated that a concurrence was reached that the project will not affect significant historic properties.

In a letter dated November 27, 1991, the Illinois Department of Conservation (IDOC) expressed several concerns with the Draft DPR. The IDOC requested that a nongame survey be conducted to determine the presence of endangered and watch list turtle species. To avoid any possible impacts to these species, the time of year the pothole blasting was to occur was changed to summer or early fall. This was to avoid any hibernating turtles in the proposed pothole area. It was agreed, and confirmed by letter, that a survey was no longer needed based on the change in the time of the year that blasting is to occur (letter dated December 10, 1991).

Another concern of the IDOC was the lead content of dredged material. Sediment analysis showed that lead amounts ranged from 10.3 mg/kg to 36.7

mg/kg. Elevated levels of lead are considered if concentrations exceed 38 mg/kg for stream conditions or 100 to 150 mg/kg for lake conditions (Kelly and Hite, 1981, 1984). Therefore, lead concentrations will not pose a serious environmental concern.

The IDOC's final concern was that grassland, not mast trees, be managed in the CPS. This has been reflected in this DPR.

The U.S. Environmental Protection Agency (EPA) has requested mitigation for loss of wetland resources at the CPS (letter dated September 13, 1991). The EPA requested mitigation at a 3:1 ratio for loss of any forested wetland and 1.5:1 for any other type of wetland loss. The Corps supports these mitigation ratios for their respective wetland types. However, the Corps feels that mitigation has been accomplished and that no further mitigation is required, for two reasons:

(1) No forested wetlands will be impacted by the project; therefore, no mitigation is needed for this resource.

(2) The 50-acre CPS will be constructed in scrub/shrub wetland. Once construction is complete, a managed marsh will be constructed on the CPS. Although this represents a 1:1 restoration of lost wetland, the Corps contends that the entire Potters Marsh project is a restoration and enhancement project, bringing current wetland values on the site to higher levels. Therefore, the Corps feels that mitigation for any impacts will be met.

The Illinois Environmental Protection Agency (IEPA), in a letter dated October 4, 1991, expressed their concern about water quality impacts caused by pothole blasting. The IEPA requested that pothole construction take place during the winter or by mechanical means, reducing impacts to water quality. To minimize water quality impacts and also to avoid hibernating turtles, pothole blasting will occur during the summer or early fall when Pool 13 water levels will be at or below elevation 583 MSL. At or below this elevation, there will be no direct water connection between the river and the pothole site. By telephone (Telephone Conversation Record, dated November 27, 1991) the IEPA concurred with this and stated that there would be no water quality impacts any time of the year if water levels were at or below elevation 583 MSL.

The USFWS provided a Final Coordination Act Report (CAR). In the CAR, the USFWS recommended:

(1) The combined dredging of Segments 1, 2, and 3 be accomplished for aquatic enhancement; and,

(2) The CPS be managed as a marsh as described in Alternative 4.

These recommendations are reflected in the preferred alternatives.

c. **Environmental Review Process.** This project meets the requirements of the National Environmental Policy Act, as evidenced by the Environmental Assessment which is an integral part of the report and a Finding of No Significant Impact, both of which include a 30-day public review and comment period.

18. CONCLUSIONS

The Potters Marsh complex has experienced deterioration of its habitat value as a result of continued sedimentation and subsequent colonization by emergent and submergent vegetation. Fisheries have been impacted by reduced water quality, depths, and lack of preferred habitats. Waterfowl usage of this area has declined due to loss of non-forest wetland habitats to sedimentation and succession.

The proposed construction features meet the project objectives of restoring and creating fisheries habitat, reducing sediment input, increasing migratory bird feeding or resting areas, and increasing waterfowl brood habitat and fall feeding sites through pothole construction. The project area and its environments should realize improved fisheries and expanded waterfowl usage throughout the 50-year project life expectancy by implementing the Potters Marsh EMP-HREP.

The proposed construction includes: hydraulically dredging 394,000 cubic yards of lower Potters channel and embayment areas; constructing a (35 interior acres) dredged material confined placement site (CPS) with 6,000 lineal feet, 162,000 cubic yards of embankment dike at 14 feet high and 3:1 side slopes; reshaping dike surface; and seeding with grass after settlement of dredged material; hydraulically dredging/mechanically excavating 49,000 cubic yards of upper Potters channel for a sediment trap; increasing waterfowl brood habitat and fall feeding sites by creating 17 (4.8 acres) of various sized potholes in the central island area; creating a 32.5-acre managed marshland on the CPS surface which includes a well and stoplog structure; creating a 7-acre grassland area on the CPS surface; and improving and extending existing service roadway to the CPS and managed marshland area.

Complete implementation of these project features will result in the following habitat outputs: off-channel deep water for wintering fish; reduced sediment input in the upper slough area; emergent vegetation and grassland in the managed marshland for waterfowl and migratory birds; and increased waterfowl brood habitat and fall feeding sites on the peninsula.

19. RECOMMENDATIONS

I have weighed the accomplishments to be obtained from this habitat rehabilitation and enhancement project against its cost and have considered the alternatives, impacts, and scope of the proposed project. In my judgment, this project, as proposed, justifies expenditures of Federal funds. I recommend that the Secretary of the Army for Civil Works approve construction to include: hydraulically dredging approximately 394,000 cubic yards of lower Potters channel and embayment areas; creating a sediment trap by hydraulically dredging/mechanically excavating approximately 49,000 cubic yards in upper Potters Slough; creating a managed marshland on the confined placement site by constructing a well, submergible pump, stoplog structure, and grassland area; and increasing waterfowl brood habitat and fall feeding sites by excavating/blasting 17 (or 4.8 acres) of potholes.

The estimated construction cost of this project is $3,278,000. Total project cost estimate, including general design, is $3,957,000. All project costs are to be 100 percent Federal costs.

At this time, I further recommend that funds in the amount of $110,000 be allocated for the preparation of plans and specifications.

for John R. Brown
Colonel, U.S. Army
District Engineer

FINDING OF NO SIGNIFICANT IMPACT

Having reviewed the information contained in this Environmental Assessment, I find that the proposed project will have no significant adverse impacts on the environment. This action is not a major Federal action, and therefore preparation of an Environmental Impact Statement (EIS) is not required. This decision may be reevaluated if developments warrant it.

Factors that were considered in making the determination that an EIS is not required were:

a. Implementation of the selected plan will benefit nationally significant fisheries, waterfowl and wetland resources.

b. The proposed action is complementary to the Upper Mississippi River Fish and Wildlife Refuge goals and objectives.

c. There were no significant adverse comments received on the project from public review.

d. Adverse effects on fish and wildlife resources from construction are temporary.

3 April 1992
Date

John R. Brown
John R. Brown
Colonel, U.S. Army
District Engineer

LITERATURE CITED

Benn, David W., Jeffrey D. Anderson, Robert C. Vogel, and Lawrence Conrad
1989 *Archaeology, Geomorphology and Historic Surveys in Pools 13-14, Upper Mississippi River* (2 volumes). Report to U.S. Army Engineer District, Rock Island. Submitted by the Center for Archaeological Research, Southwest Missouri State University, Springfield.

Bodensteiner, L. R. and R. J. Sheehan
1988 *Implication of Backwater Habitat Management Strategies for Fish Populations*. Proc. 44th Ann. Meet. of Upper Mississippi River Cons. Comm., 8-10 March, Peoria. pp. 60-65.

Boland, T.
1985 *Effects of "Deep Hole" Dredging on Seasonal Fish Utilization of Two Similar Mississippi River Side Channels*. Iowa Cons. Comm. Fish. Sect., Des Moines. Mimeo, 27pp.

Evans, C. D., A. Hawkins and W. Marshall
1952 *Movements of Waterfowl Broods in Manitoba*. Spec. Sci. Rept. Wildl. No. 16, 47pp.

Hammond, M. C. and C. H. Lacy
1959 *Artificial Potholes and Ditches as Waterfowl Habitat*. 21st Midwest Wildl. Conf., Minneapolis. Mimeo, 11pp.

Kelly, M. and R. Hite
1981 *Chemical Analysis of Surficial Sediments from 63 Illinois Lakes*. Illinois Environmental Protection Agency, Monitoring Unit, Marion.

Kelly, M. and R. Hite
1984 *Evaluation of Illinois Stream Sediment Data: 1974-1980*. IEPA/WPC84004. Illinois Environmental Protection Agency.

Pitlo, J. and R. D. Gent
1991 *Largemouth Bass Use of Newly Dredged Canals and Responses to Change in Water Quality During Winter Period in Upper and Lower Brown's Lake, Pool 13, Upper Mississippi River*. Rept. prep. for USDI, Fish and Wildl. Svc. Mimeo, 28pp.

Ross, James E.
1991 *Phase I Archaeological Investigations Potter's Marsh EMP, Carroll County, Illinois*. Report to U.S. Army Engineer District, Rock Island. Prepared for Stanley Consultants, Inc., by American Resources Group, Ltd., Carbondale, Illinois.

Sheehan, R. J., W. M. Lewis and L. R. Bodensteiner.
1990. *Winter Habitat Requirements and Overwintering of Riverine Fishes*. Proj. Compl. Rept., F-79-R, Fish. Res. Lab., So. Ill. Univ., Carbondale. 80pp.

CORRESPONDENCE

APPENDIX

A

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-9F)

POTTERS MARSH REHABILITATION AND ENHANCEMENT

POOL 13, MISSISSIPPI RIVER MILES 522.5 THROUGH 526.0
CARROLL AND WHITESIDE COUNTIES, ILLINOIS

APPENDIX A
CORRESPONDENCE

TABLE OF CONTENTS

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Illinois Historic
Preservation Agency

Old State Capitol • Springfield, Illinois 62701 • (217) 782-4836

217/785-4997

CARROLL AND WHITESIDE COUNTIES IHPA LOG #90041901
Potter's Marsh Rehabilitation
Thomson

May 18, 1990

Mr. Dudley M. Hanson, P.E.
Chief, Planning Division
District Engineer
U.S. Army Engineer District, Rock Island
Attention: Planning Division
Clock Tower Building - Post Office Box 2004
Rock Island, Illinois 61204-2004

Gentlemen:

Thank you for requesting comments from our office concerning the possible effects of the project referenced above on cultural resources. Our comments are required by Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties".

Enclosed are copies of IHPA site location maps that pertain to the Potter's Marsh Rehabilitation Project. The project area is outlined in blue. Several sites occur within the project limits. These area: Ca-11, the Thomson Causeway mound and village; Ca-13, a mounded site; Ca-20, a Middle Woodland Village; Ca-64, the Refuge Mound site; Ca-117, and Ca-118. All of these sites have been associated with previous U.S. Army Corps of Engineer undertakings (see enclosed listing). Precise area of survey coverage is not available for the above mentioned projects. Please consult your records for previous Corps of Engineer Potter's Marsh undertakings for area of coverage.

The IAS has conducted one (1) survey immediately adjacent to the Potter's Marsh. Sites Ca-21 and Ca-10 are located at the northern extreme of the marsh. Both sites contain Middle Woodland Hopewell mounds.

Thank you for contacting our office. Our response does not constitute a finding of no effect. Should plans proceed for the Potter's Marsh Rehabilitation, our comments, as required by Section 106 of the National Historic Preservation Act of 1966, as amended, will be required. We look forward to assisting you in these future endeavors.

Sincerely,

Thomas R. Wolforth

Thomas R. Wolforth
Staff Archaeologist

TRW:bb

Enclosures

Illinois Historic
Preservation Agency
Old State Capitol Springfield, Illinois 62701 (217) 782-4836
Suite 4-900 State of Illinois Center 100 W. Randolph Chicago, IL 60601 (312) 814-1409

217/785-4997

CARROLL AND WHITESIDE COUNTIES IHPA LOG #90041901
Potter's Marsh Rehabilitation
Thomson

September 6, 1990

Mr. Dudley M. Hanson, P.E.
Chief, Planning Division
District Engineer
U.S. Army Engineer District, Rock Island
Attention: Planning Division
Clock Tower Building - Post Office Box 2004
Rock Island, Illinois 61204-2004

Gentlemen:

Thank you for requesting comments from our office concerning the possible effects of the project referenced above on cultural resources. Our comments are required by Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties".

Thank you for the opportunity to comment on the Scope of Work for a Phase I archaeological survey for the Potter's Marsh REhabilitation and Enhancement Project. Our staff has reviewed this document and has determined that adequate consideration was given to cultural resources in the planning stages of this project.

If you have any further questions, please contact Thomas R. Wolforth, Staff Archaeologist, Illinois Historic Preservation Agency, Old State Capitol, Springfield, Illinois 62701, 217/782-9345.

Sincerely,

Theodore W. Hild
Deputy State Historic
Preservation Officer

TWH:TRW:bb0965A/28

Illinois Historic
Preservation Agency
Old State Capitol • Springfield, Illinois 62701 • (217) 782-4836

217/785-4997

CARROLL AND WHITESIDE COUNTIES
Potter's Marsh Rehabilitation
Thomson

IHPA LOG #90041901TRW
American Resources Group
Acres: 285.0 Sites: 0, new sites

May 29, 1991

Mr. Dudley M. Hanson, P.E.
Chief, Planning Division
District Engineer
U.S. Army Engineer District, Rock Island
Attention: Planning Division
Clock Tower Building - Post Office Box 2004
Rock Island, Illinois 61204-2004

Gentlemen:

Thank you for submitting the results of the archaeological reconnaissance. Our comments are required by Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties".

Our staff has reviewed the archaeological Phase I reconnaissance report performed for the project referenced above.

The Phase I survey and assessment of the archaeological resources appear to be adequate. Accordingly, we have determined, based upon this report, that no significant historic, architectural, and archaeological resources are located in the project area.

Please retain this letter in your files as evidence of compliance with Section 106 of the National Historic Preservation Act of 1966, as amended.

Sincerely,

Theodore Hild

Theodore W. Hild
Deputy State Historic
Preservation Officer

TWH:TRW:bb1036A/62

cc: Michael McNerney, ARG-Ltd.

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

REPLY TO ATTENTION

SEP 13 1991

5ME-16JCK

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

Dear Colonel Brown:

In accordance with our responsibility under the National Environmental Policy Act and Section 309 of the Clean Air Act, we have reviewed the Definite Project Report and Environmental Assessment (EA) for the Potters Marsh Rehabilitation and Enhancement Project. The project is located at Pool 13 of the Mississippi River, in Carroll and Whiteside Counties, Illinois.

Potters Marsh was formed as part of a backwater of the Mississippi River after the construction of Lock and Dam 13 in 1938. Ever since the surrounding area known as Potters Slough was inundated due to the dam construction, the fishery and waterfowl habitat of Potters Marsh has significantly degraded due to sedimentation from the Mississippi River, and this degradation continues to be a problem. The goal of the EA is the rehabilitation and enhancement of the waterfowl and fishery habitats of Potters Marsh through several objectives. These objectives include restoring and creating fisheries habitat, reducing sediment input, constructing migratory bird feeding and/or resting area, and rehabilitating wetlands.

To achieve these goals and objectives, the EA studied eleven alternatives for project implementation. The alternatives include the (A) no action alternative; (B) constructing a closure dike with water control structure; (C) redesigning an existing causeway connecting the marsh to the mainland; (D) construct a barrier island; (E) dredging below the causeway; (F) dredging two backwater channels; (G) dredging an additional backwater channel; (H) increasing waterfowl brood habitat and fall feeding sites; (I) developing managed marshlands on the Confined Placement Site (CPS) for the dredged material; (J) developing grassland on the CPS; and (K) constructing moist soil unit on the CPS. Alternatives E, F, H and I are recommended for project construction in the EA.

We concur with the recommended alternatives, but have environmental concerns with the EA. Dredging activities and creating additional marshlands in an existing wetland area is environmentally preferable to construction of water control structures and causeways and creating grassland in existing wetlands. We agree that the project will provide environmental benefits to fishery and waterfowl habitat.

We are concerned, however, that the EA does not identify wetland impacts according to wetland type and acreage and propose mitigation for wetland impacts. The EA evaluated wetland impacts based upon a modified Habitat Evaluation Procedure (HEP), and concludes that no mitigation will be necessary due to net habitat benefits according to the HEP. This method of evaluating wetland impacts is not acceptable to our Agency. All impacted wetlands should be identified by acreage and type and be compensated through appropriate mitigation such as wetland creation or restoration. The Confined Placement Site involves placing fill into existing wetlands, which for the marshland alternative amounts to converting one wetland type to another. Depending on the type of wetland impacted, this conversion may be acceptable for inclusion as part of a comprehensive wetland mitigation plan. Bottomland hardwoods and other forested wetlands should be avoided, and be mitigated through in-kind replacement for unavoidable impacts. Forested wetlands should be mitigated on a ratio of at least 3:1 for forested wetlands created or restored to those impacted to help ensure long-term survival of the mitigation site. For other wetland types, the ratio is at least 1.5:1. The EA should be supplemented with the above information, and this supplement should be made available for our review.

The sediment analysis data displayed in Tables F-1 and F-2 adequately demonstrates that the dredged material should be safe for use in the CPS. An initial grain size analysis indicated a large percentage of fine-grained material in which contaminants can adhere, and the test was followed up by additional analysis to determine the bioavailability of contaminants. The results of the latter analysis shows that contaminant levels were within Illinois General Use water quality standards. We noted that PCBs were not include in the list of constituents that were analyzed, but historical sediment data for the Pools of the Locks and Dams of the Mississippi River do not indicate a presence of PCBs.

Thank you for the opportunity to review the Definite Project Report and Environmental Assessment for the Potters Marsh Rehabilitation and Enhancement Project. If you have any question regarding our comments, please contact Milo Anderson of my staff at (312) 886-2967.

Sincerely yours,

Milo O. Anderson Jr.

for Thomas L. Jackson, Acting Chief
Environmental Review Branch

Illinois Environmental Protection Agency · P. O. Box 19276, Springfield, IL 62794-9276

217/782-1696

Refer to: Potters Marsh Rehabilitation and Enhancement, EMP
Draft EA

October 4, 1991

District Engineer
U.S. Army Engineer District, Rock Island
Attn: Planning Division
Clock Tower Building
P.O. Box 2004
Rock Island, Illinois 61204

Gentlemen:

We have reviewed the draft Definite Project Report and Environmental Assessment for the Potters Marsh project. Based on the selection of alternatives E, F, H and I, we recommend the following for your consideration.

The sediment analyses conducted for Potters Marsh indicates the material is relatively uncontaminated, although fine grained and not readily settleable. The estimates of the detention times for the confined disposal facility appear to provide adequate treatment capacity. The suggested methods of using a mechanical excavator to dredge from the causeway and then remove the material by hydraulic dredge may require additional precautions to prevent the material from being resuspended during the time it is temporarily stockpiled.

We are concerned that the proposed pothole blasting of approximately 2,800 cubic yards of material may result in water quality impacts. Previous water quality data from similar work and a complete description of the water/sediment control measures which will be taken during this phase of the project will be required. If no practical methods can be used to control the blast effects on water quality, we recommend that other methods (i.e., amphibious excavators, working during frozen conditions) be explored.

Monitoring of the confined disposal facility effluent will be required and therefore the plan on Plate 18 may need modification.

Permits to construct and operate the confined disposal facility will be required pursuant to 35 Ill. Adm. Code 309.202 and 309.203. The attached forms WPC-PS-1 and Schedules J and P must be completed and submitted with appropriate plans and specifications of the facilities.

If you have any questions on these matters, please contact Bruce Yurdin of my staff.

Very truly yours,

Thomas G. McSwiggin by [signature]

Thomas G. McSwiggin, P.E.
Manager, Permit Section
Division of Water Pollution Control

TGM:BY/mls/2882q/41-42

cc: IEPA, Records
IDOC, Bill Donnells
USFWS, Rock Island

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Rock Island Field Office (ES)
4469 - 48th Avenue Court
Rock Island, Illinois 61201

IN REPLY REFER TO:

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

November 20, 1991

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

Dear Col. Brown:

This letter constitutes our final Fish and Wildlife Coordination Act (FWCA) report for the Potter's Marsh Habitat Rehabilitation and Enhancement Project (HREP) in Pool 13, Upper Mississippi River, Whiteside County, Illinois. It has been prepared under the authority of and in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat.401, as amended; 16 U.S.C. 661 et seq.); the Endangered Species Act of 1973, as amended; and in accordance with the Fish and Wildlife Service's Mitigation Policy.

The Potter's Marsh HREP is a component of the Upper Mississippi River System Environmental Management Program (EMP) authorized in Section 1103 of the Water Resources Development Act of 1986. The goal of the EMP is to implement "...numerous enhancement efforts...to preserve, protect and restore habitat that is deteriorating due to natural and man-induced activities."

The project area is owned in fee title by the U. S. Army Corps of Engineers and operated under a General Plan and Cooperative Agreement with the U.S. Fish and Wildlife Service as a part of the Savanna District, Upper Mississippi River Wildlife and Fish Refuge (UMRWFR). The National Wildlife Refuge System Administration Act requires that a compatibility study be approved and special use permit issued prior to construction. These documents are approved by our Regional Director and will be forwarded to you under separate cover.

DESCRIPTION OF THE PROJECT AREA

The study area is located adjacent to the left descending bank of the Mississippi River between river miles 523.0 and 526.5. It includes approximately 2300 acres of habitats important to migratory birds and fish. It consists of an unnamed island, the side channel known as Potter's Slough and shallow wetlands around the island. These habitats were created with the construction and closure of Lock and Dam 13 at RM 522.8.

Recreational development in the study area is centered at the upstream end of the island where the Corps of Engineers operates the Thompson Causeway campground. As the name indicates, the island is connected to the mainland via a causeway which is a popular fishing spot for visitors. Private recreational development consists primarily of cabins and a boat ramp on the landward side of the slough in the downstream half of the study area.

Potter's Marsh is listed as an important waterfowl hunting and furbearer trapping area, with blind allocation on the open water area regulated by the Savanna District of the UMRWFR through an application and drawing system. The entire area is shown to be an important sportfishery of bluegill, largemouth bass, crappie, yellow perch, pumpkinseed and northern pike, as well as spawning habitat for bluegill, largemouth bass, crappie and pumpkinseed. Ice fishing, particularly at the lower end of the marsh, is a popular winter recreational activity.

PROJECT GOALS AND OBJECTIVES

The project proposed for Potter's Marsh has several goals. The principal goal is to rehabilitate and enhance aquatic habitat by restoring aquatic diversity and fish wintering habitat plus reducing sediment input. These objectives are to be accomplished by dredging channels in the slough.

A second goal of the HREP is to enhance habitat for waterfowl. The objectives for this goal are to develop the confined placement site (CPS) needed for disposal of the dredged material and increase the waterfowl brooding habitat. A series of management alternatives were advanced for the CPS, and the construction of potholes in the existing nonforested wetlands and an old meander channel in a forested wetland is proposed to increase waterfowl brooding habitat.

METHODOLOGY

Analysis of existing study area conditions, future conditions without the project and impacts of the several proposed alternatives and increments was accomplished using the Wildlife Habitat Appraisal Guide (WHAG) procedures developed by the Missouri Department of Conservation and the USDA Soil Conservation Service. This analysis employed a multi-agency team approach with team members representing the Corps of Engineers, the Illinois Department of Conservation, in addition to personnel from our refuge and enhancement divisions.

The WHAG analysis is a system for rating the quality of habitat on a 0.1 (low) to 1.0 (high) scale. This rating is known as the habitat suitability index (HSI). The suitability of a given habitat type for a set of evaluation species is determined on the basis of the characteristics of the habitat type. The WHAG procedures include the identification of limiting factors (i.e. critical life requisites for a species). Absence of that habitat characteristic makes the habitat unsuitable and results in an HSI of 0.1.

Existing habitat conditions were evaluated on-site by the team, and future conditions with and without the project were estimated using the expertise of team members. Several planning iterations were required as the project evolved and engineering data was refined.

For project planning and impact analysis, project life was established at 50 years. To facilitate comparison, target years were established at 0 (existing conditions) 1,25 and 50 years. Habitat Units (HU's) were calculated by multiplying HSI's times the area of habitat. Average annual habitat units (AAHU's) for each evaluation species were calculated to reflect expected habitat conditions over the life of the project.

The WHAG procedures were also used to evaluate the aquatic habitat using fish evaluation species. To provide a more realistic comparison of aquatic habitat conditions and changes over the life of the project, aquatic habitat units in this analysis were based on volume. The planning team decided that cubic yards is the most appropriate unit of measure for the aquatic features. Cubic yards closely relates to the measurement of dredging, and represents the useable area of aquatic habitat more accurately than surface area measurements.

Comments on the draft definite project report recommended using acre-feet as the habitat unit for analyzing aquatic habitat conditions. This was accomplished by the WHAG team. Naturally, the AAHU's in the aquatic analysis are several orders of magnitude smaller because of the change from cubic yards to acre feet.

ENDANGERED SPECIES

Several species protected under the Endangered Species Act of 1973, as amended, are listed as occurring in the project area. Of these, only the endangered bald eagle (Haliaeetus leucocephalus) is known to utilize habitats in the study area. None of these habitats will be impacted as a result of project implementation, therefore, no impact on the bald eagle is expected.

This precludes the need for further action on this project as required under the Endangered Species Act. Should this project be modified or new information indicate that endangered species may be affected, consultation should be initiated.

EXISTING FISH AND WILDLIFE RESOURCES

The primary habitat types in the study area are aquatic, bottomland forest, nonforested wetland, grassland and cropland. Table 1 is a presentation of the habitat types and acreage of each at each of the target years (TY) selected for analysis. Note general loss of aquatic and non-forested wetlands over the project life without project.

Table 1. Potter's Marsh HREP habitat types and acreages.

Habitat/TY	TY0	TY1	TY25	TY50
Aquatic	982	982	700	570
Non-forested wetland	314	314	439	350
Forested wetland	824	824	984	1200
Grassland	185	185	185	185
Cropland	4	4	4	4
Total	2309	2309	2309	2309

Aquatic

The results of the analysis of existing conditions using WHAG show poor conditions for the aquatic evaluation species. This is due to the shallow conditions in the slough which results in low dissolved oxygen (DO) and/or freezing to the bottom in the winter. The shallow nature of the site also produces low habitat diversity. The HSI's depicted in Table 2 below for the evaluation species indicates that the aquatic habitat is largely unsuitable for fish habitat. In the WHAG analysis, an HSI of 0.1 indicates virtually no value for the evaluation species.

Table 2. Potter's Marsh HREP existing aquatic habitat suitability.

Species/	HSI	Habitat Units*	
Channel Catfish	0.17	145,310	90
Walleye	0.16	134,132	83
Largemouth Bass	0.19	158,780	98

*HSI times habitat volume in acre feet.

Terrestrial

Unlike the analysis of the aquatic habitat, the existing conditions for the terrestrial and avian evaluation species revealed a broad range of values that reflect the variety of habitat requirements for the indicator species. Table 3 depicts the HSI and habitat units for each of the species.

Table 3. Potter's Marsh HREP existing terrestrial habitat suitability, existing HU's and AAHU's without project.

SPECIES	HSI	HU	AAHUs
Blue-wing-teal	0.10	31.4	31.4
Canada goose	0.10	31.4	31.4
Least bittern	0.62	194.4	231.5
Lesser yellowlegs	0.22	69.0	76.9
Muskrat	0.55	174.2	142.2
King rail	0.43	136.1	168.7
Green-backed heron	0.48	541.0	647.8
Wood duck	0.31	252.7	443.2
Dickcissel	insufficient habitat	-	-
American coot	0.70	218.5	199.9
Indigo bunting	0.23	188.3	188.8
Prothonotary warbler	0.32	261.9	388.8

Like the HSI values for the aquatic evaluation species, teal and Canada geese have values of 0.10 in this analysis because of limiting factors. For purposes of this analysis, we have used 31.4 HU's for these two indicator species because Potter's Marsh does provide valuable feeding and resting habitat for migratory waterfowl. This assumption is supported by previous evaluations and the waterfowl hunting that currently takes place in the Potter's Marsh area.

FUTURE WITHOUT PROJECT

Aquatic

The quantity of aquatic habitat in the Potter's Marsh study area will continue to decline in the future. The WHAG analysis of existing conditions indicates that limiting factors (such as low DO) precludes fish use during critical periods. Continued sedimentation will convert over 400 acres of aquatic habitat to terrestrial over the life of the project (Table 1), and is likely to make even the southern area nearly unusable by aquatic species. The analysis run for the lower channel indicates the HSI for each of the evaluation species would reach 0.1 by TY 25.

Terrestrial

Without the project, the primary terrestrial habitat types analyzed, forested and non-forested wetland, will increase due primarily to the conversion and succession of non-forested to forested wetland and aquatic to non-forested wetland. The most dramatic change is the forested wetland acreage, which will increase by nearly 50 percent over the life of the project. These changes mean additional habitat for several of the evaluation species, particularly herons, wood ducks and prothonotary warblers. The rest of the species will have generally the same or slightly fewer acres of habitat. There are subtle quality (HSI) changes in these habitats over the 50 year life of the project that are indicative of the successional stages referred to previously.

FUTURE WITH PROJECT

Aquatic

Two structural increments of dredging to improve aquatic habitat diversity were analyzed in this evaluation. The first increment, Segment 1, consists of an hydraulic dredged 1600-foot-long channel from the river to the causeway, with a deep hole at the riverward end, and a mechanically dredged deep hole on the downstream side of the causeway. The second increment, Segments 2 and 3, consists of three hydraulically dredged interconnected channels in the downstream portion of Potter's Marsh. These channels will be connected to the river in two locations, each with a deep hole at the riverward end.

A third increment (Segment 5) was considered, but was not recommended for construction. This channel would have been dredged through a peat area of the marsh. This increment was eliminated from further consideration because of the additional 20 acres required for storage of the dredged material, and potential water quality problems from the effluent and engineering information also indicates that Segment 5 has not been affected by significant sedimentation. There is some indication that construction of Segment 1 may induce some scouring in the peat, which would improve aquatic conditions in Segment 5 over the life of the project without the need for dredging.

Sedimentation from flood flows will reduce aquatic habitat suitability over the life of the project. That is reflected in the HU declines, particularly in Segment 1, which will degrade at a higher rate due to its position at the upper end of the slough where expected higher sedimentation will occur.

Terrestrial

The WHAG analysis of the terrestrial habitats focused on the alternative uses of the confined placement site (CPS). Based on the selection of the preferred dredging increments, a 50-acre site is required. Approximately 10 acres is required for construction of the levee around the site, with 40 acres to hold the dredged material. The alternatives analyzed were as follows.

ALT. 1. Natural succession to bottomland forest (forested wetland).
ALT. 2. Management as grassland.
ALT. 3. Active moist soil management unit.
ALT. 4. Active marsh management unit.

Because the site selected for the CPS is an early successional stage of forested wetland habitat, an evaluation of natural succession of the CPS to bottomland forest was conducted. This alternative would require minimal operation and maintenance, and produce habitat values similar to the future without project conditions.

To address the goal of enhancing habitat for waterfowl, the team analyzed the alternative of managing the CPS as grassland, primarily for waterfowl nesting. Establishing warm season grasses, and periodic management, such as burning to control woody invasion, would be required.

As another alternative to enhance waterfowl habitat, active management of the CPS as a moist soil management unit was evaluated. This alternative requires a water control structure for drawdown, and pumping facilities to flood the unit in the fall after desired vegetation has germinated. This alternative would also require periodic management to control woody invasion, as well as relatively precise deposition of the dredged material.

Finally, the alternative of managing the CPS as a marsh (non-forested wetland) was evaluated. The marsh alternative would also require a water control structure and a source of water to maintain or raise water levels. A well would be sufficient to provide water because water levels would normally be maintained year-round. This source would also be adequate for special management measures to flood unwanted vegetation, or to reestablish water levels following drawdown to encourage emergent vegetation growth.

An additional project feature proposed is the construction of potholes in both non-forested and forested wetlands. The acreage of potholes to be excavated is to be approximately five acres, with the portion in forested wetland to be excavated mechanically, and the portion in the non-forested wetland to be excavated using explosives. The creation of these small open water areas in the project area will provide much needed pair and brood habitat for waterfowl that do nest in the local area.

DISCUSSION

Aquatic

Comparison of the average annual habitat units calculated for the aquatic habitat analysis indicates a substantial increase in habitat for all three evaluation species. Figures 1, 2 and 3 are graphic illustration of the AAHU's for aquatic species in Potter's Marsh with and without project for the preferred alternative and the two increments separately. All three comparisons show significant increases in AAHU's with the project. While dredging Segment 1 (Increment 1) produces a greater percentage increase in AAHU's than dredging Segments 2 and 3 (Increment 2), the AAHU increase for Increment 2 is a full order of magnitude larger than for Increment 1.

The improvements provided by the dredging are not only large in terms of the resultant HU's, but are also long lived. The HU's projected at the end of fifty years remain 75% greater than the existing conditions, indicating project benefits extending well beyond the period analyzed for this report.

Terrestrial

Table 4 is a comparison of the average annual habitat units calculated for each of the alternatives on the CPS. The numbers are relatively small due to the size (50 acres) of the CPS, as compared to the terrestrial component of the study area (1300 acres). Note that the first three alternatives provide benefits to a small number of species, and with the exception of Alternative 1 will require significant maintenance and management.

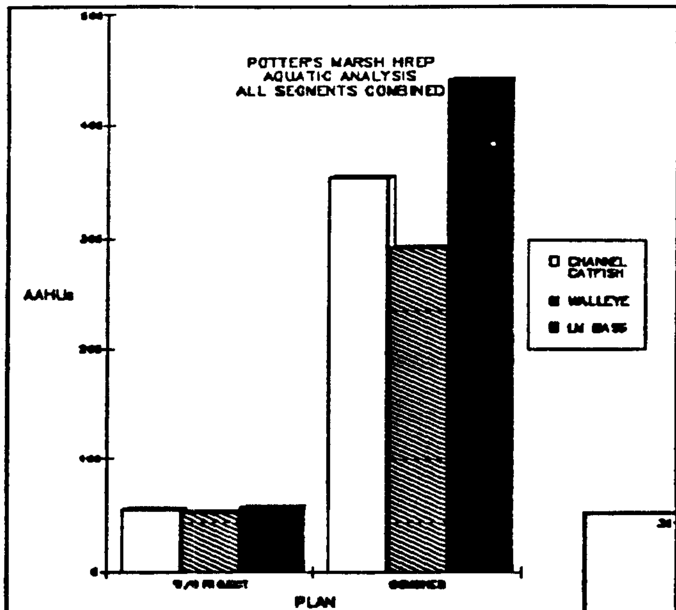

Figure 1. Potter's Marsh Aquatic Analysis.

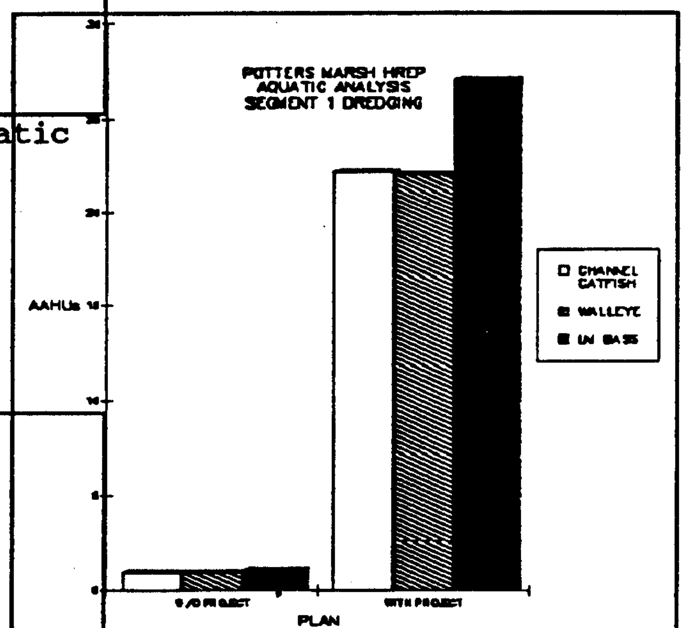

Figure 2. Potter's Marsh Aquatic Analysis.

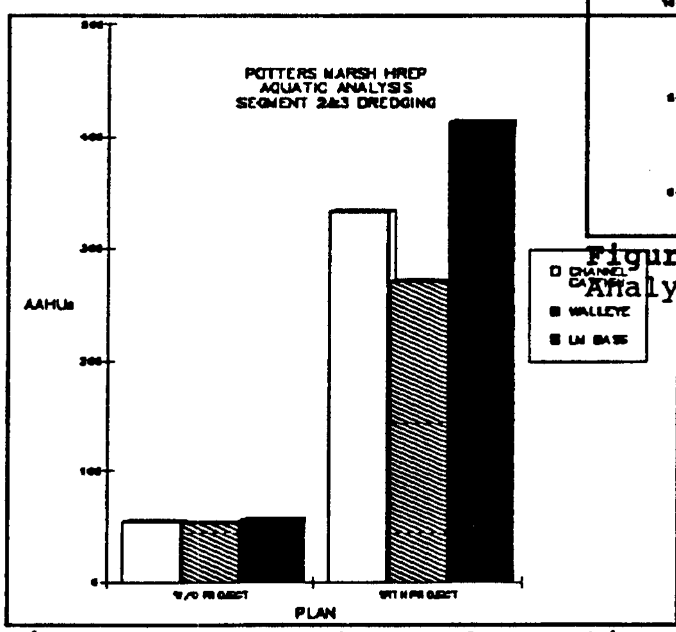

Figure 3. Potter's Marsh Aquatic Analysis.

Alternative 4 provides habitat for the widest range of any of the alternatives. Only the king rail did not have suitable habitat on the CPS. The wood duck and prothonotary warbler have the least suitable habitat on the CPS, but there is substantial forested wetland existing and more to come as a result of conversion from aquatic habitat. One of the goals was to improve migratory waterfowl habitat. That has been accomplished through the habitat improvements for teal, Canada geese and coots on the CPS.

Table 4. Average Annual Habitat Units for the alternatives on the CPS.

SPECIES	ALT 1	ALT 2	ALT 3	ALT 4
Blue-wing teal		24.7	26.0	21.8
Canada goose		23.7	28.5	13.7
Least bittern				19.0
Lesser yellowlegs				12.5
Muskrat				23.7
King rail				
Green-backed heron	13.0	00.1	03.8	23.6
Wood duck	10.5			02.0
Dickcissel		36.7		09.6
American coot				24.1
Indigo bunting	05.3	28.2	00.2	10.4
Prothonotary Warbler	06.0			01.2

CONCLUSIONS AND RECOMMENDATIONS

The primary goal of this project is to rehabilitate the aquatic habitat in the Potter's Marsh project area. Our analysis shows an incredible improvement in habitat quality, diversity and it's accessibility to a wide variety of fish species. An additional benefit is the apparent long life of the project. We would recommend that the combined dredging be implemented.

To the extent that the CPS is a byproduct of this project, the WHAG analysis shows clearly that the managed marsh alternative provides the most benefit to the broadest range of species. The marsh management alternative has impressive benefits for a wide variety of species. Over the life of the project there will be a nearly 50% increase in forested wetland in the project area, so extensive replacement of forested habitat on the CPS is not warranted.

Therefore, we recommend:

1. that the combined dredging of Segments 1, 2 and 3 be accomplished for aquatic enhancement; and,

2. that the CPS be managed as a marsh as described in Alternative 4.

We appreciate the opportunity to comment on this project. We look forward to continued coordination as this project proceeds toward construction.

Sincerely,

Richard C. Nelson
Field Supervisor

cc: UMRNWFR-Winona (Beseke)
UMRNWFR-Savanna (Wargowsky)
ILDOC-Springfield (Donels)
ILDOC-Aledo (Sallee)

WF:sjg

Illinois Department of Conservation
life and land together

Brent Manning
Dire

John W. Comerio
Deputy Director

Bruce F. Clay
Assistant Director

LINCOLN TOWER PLAZA • 524 SOUTH SECOND STREET • SPRINGFIELD 62701-1787
CHICAGO OFFICE • ROOM 4-300 • 100 WEST RANDOLPH 60601

November 27, 1991

Colonel John R. Brown
District Engineer
U.S. Army Engineer District
Rock Island
Clock Tower Building, P.O. Box 2004
Rock Island, Il 61204-20042

Dear Colonel Brown:

My staff has reviewed the "Review Draft Definite Project Report" for the U.S. Fish and Wildlife Service's Potters Marsh Project in the Environmental Management Program. The project meets its goals and objectives of restoring and creating fisheries habitat, reducing sediment, constructing migratory bird feeding and resting areas and accomplishing wetland rehabilitation.

The review however identified the following concerns that should be resolved prior to the final report:

1. An inventory of nongame species should be preformed, considering two watch-list species, Blandings turtle and the smooth softshell turtle, are known from the site. There are also records for the Illinois mud turtle, an Illinois endangered species, from the area.

   Blasting/dredging of potholes should be done at times other than late fall/winter when turtles are in their hibernacula and these activities would be fatal to them.

2. Deposition of dredge spoil material, taken from historic waterfowling areas, should be preceded by an analysis (or consideration) of lead content.

3. Development of a grassland area in the confined placement site is preferred to the development of a mast tree area.

We approve of the project with the condition that these concerns be resolved and look forward to your continued cooperation on the project and the Program.

Sincerely,

Brent T Manning

Brent Manning
Director

BM:BD:mip

cc: Carl Becker

CONVERSATION RECORD	TIME A.M.	DATE 11-27-91

TYPE ( )VISIT ( )CONFERENCE (X)TELEPHONE ( )INCOMING (X)OUTGOING | CF: -----------

NAME CONTACTED	ORGANIZATION	TELEPHONE
Bruce Yurdin	Illinois EPA	217/782-1696

SUBJECT: Illinois EPA comments to the Draft Potters Marsh HREP Report (DPR)

SUMMARY: I called Mr. Yurdin to verify our prior discussion we had several weeks earlier regarding his comments concerning the above subject. He was aware of our previous conversation. I informed him that I wanted to discuss his agencies concerns again, then document the phone conversation in the public review report document.

1. With regard to the potential water quality problem concerning the blasting of potholes; as previously discussed I explained to him that the bay area where the proposed potholes are located is above flat pool (average elevation approximately 584.0), see plate 11 of the report. I explained to him that we would only blast when the pool elevation was at or below flat pool (583.0). In addition blasting would have to occur during the late spring, summer, or early fall to avoid any hibernating turtles. He agreed this would be satisfactory and would not create a water quality problem based on this information.

2. The ILEPA'S second concern was the water quality impact from the potential temporary stockpiling of excavated material from below the causeway. This is no longer one of the suggested methods of the deep hole sediment trap construction. The material will be removed with a portable dredge or mechanically excavated and transported by truck to an approved placement site. This is reflected in the public review report and is acceptable with the ILEPA.

3. The third concern regarding monitoring was discussed previously with Mr. Yurdin. Plate 18 is not meant to be a monitoring plan for the CPS effluent. It is a monitoring plan for future physical and biological monitoring of the success of the project. The CPS effluent will be monitored according to the ILEPA regulations. Mr. Yurdin now understands this to be the case.

ACTION REQUIRED: Implement the IEPA's comments into the DPR.

NAME OF PERSON DOCUMENTING CONVERSATION	SIGNATURE	DATE
JOSEPH H. WARING	Joseph H Waring	11-27-91

ACTION TAKEN

Included this conversation of record in the DPR.

SIGNATURE	TITLE	DATE
Joseph H Waring	Envr. Engineer	12-3-91

50271-101 CONVERSATION RECORD (12-76)

Illinois Department of Conservation
life and land together

Brent Manning
Director

John W. Comerio
Deputy Director

Bruce F. Clay
Assistant Director

LINCOLN TOWER PLAZA • 524 SOUTH SECOND STREET • SPRINGFIELD 62701-1787
CHICAGO OFFICE • ROOM 4-300 • 100 WEST RANDOLPH 60601

[redacted]

December 10, 1991

Colonel John R. Brown
District Engineer
U.S. Army Engineer District
Rock Island
Clock Tower Building, P.O. Box 2004
Rock Island, IL 61204-20042

Dear Colonel Brown:

Our original review and comments of the "Review Draft Definite Project Report for the U.S. Fish and Wildlife Service's Potters Marsh Project" for the Environmental Management Program dated November 27, 1991, should be replaced by this letter. The first review identified three areas of concern that needed resolution prior to our full endorsement of the project.

These concerns of three threatened turtle species hibernacula in the pothole construction area, lead content in dredge spoil deposition and mast tree development in a marsh were resolved by a conference phone call made on December 2, 1991, at 2:15 p.m. with Messrs. Mike Cockerill, Joe Jordan, Joe Warnig of your office and Randy Nyboer and Bill Donels from our Department. The resolution of timing pothole construction outside of turtle hibernation, continuing monitoring lead content in dredge areas and changing the mast tree plantings to grassland was agreed to by all the conferees.

We therefore approve of the project as it meets its goals and objectives of enhancement and rehabilitation of fish and wildlife habitat. Your continuing cooperation on the project and the Program is appreciated.

Sincerely,

Brent Manning
Brent Manning
Director

BM:DB:mk
cc: Carl Becker

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Upper Mississippi River Refuge Complex
51 East 4th Street
Winona, Minnesota 55987

IN REPLY REFER TO:

September 23, 1991

District Engineer
U.S. Army Corps of Engineers
Rock Island District
Attn: Planning Division--Jerry Skalak
Clock Tower Building
P. O. Box 2004
Rock Island, Illinois 61204-2004

Dear Colonel Brown:

This provides U.S. Fish and Wildlife Service (Service) comments on the draft Definite Project Report and Environmental Documentation (R-90) for the Potters Marsh Habitat Rehabilitation and Enhancement Project. This project will benefit the biological resources of the Upper Mississippi River National Wildlife and Fish Refuge (Refuge).

The Project is being built on federal lands managed as part of the Refuge, therefore, a Refuge compatibility determination and Refuge approval is required before the project can be constructed. Attached is a signed compatibility determination for the selected alternative discussed in this draft report. Approval of the project will be formally provided by the Regional Director after completion of the final project report.

The final draft definite project report must include a copy of the draft Memorandum of Agreement for the operation, maintenance, and rehabilitation. In accordance with the Fourth Annual Addendum the Service will cover operation and maintenance costs as discussed in this report. The Regional Director's letter on the final draft definite project report will include the certification of support for operation and maintenance.

The Service considers the Potters Marsh Complex to extend down to the road at Lock and Dam 13. This entire area will be enhanced by the project. Please check river miles quoted in the document with acreage figures.

The Service questions the need for a small crossdike within the containment unit. This dike may restrict how woody vegetation encroachment can be controlled.

The Service prefers that the elevated areas within the containment cell be managed as grasslands for migratory birds. These grasslands will be managed by mowing and burning.

After the completion of this project, the Service is concerned about potential fisherman/duck hunter confrontations during the waterfowl season. This issue should be addressed in this report and by the agencies involved in the planning effort.

If contractors have to dredge to gain access to the project area, it is our understanding that the material dredged will be disposed of in the containment cell.

When Plans and Specifications for this project are developed the contract must include a dredging priority for channels. The contract should also include provisions to ensure that no sand areas within the containment cell occur or, if they do, they are capped with fine material.

This report illustrates the cooperation evident between the U.S. Army Corps of Engineers, the States, and the Service. These efforts at working together on this project as well as the environmental management program as a whole help ensure the success of mutual concerns for improvements on the Upper Mississippi River System.

Sincerely,

Richard F. Berry

Richard F. Berry
Complex Manager

cc: RO--SS
RIFO
LTRM
Winona FAO
Illinois DNR
Savanna District

UPPER MISSISSIPPI RIVER NATIONAL
WILDLIFE AND FISH REFUGE
Established 1924
COMPATIBILITY STUDY
POTTER'S MARSH REHABILITATION

Establishment Authority:

Public Law No. 268, 68th Congress, The Upper Mississippi River Wildlife and Fish Refuge Act.

Purpose for Which Established:

"The Refuge shall be established and maintained (a) as a refuge and breeding place for migratory birds included in the terms of the convention between the United States and Great Britain for the protection of migratory birds concluded August 16, 1916, and (b) to such extent as the Secretary of Agriculture may by regulations prescribe, as a refuge and breeding place for other wild birds, game animals, fur-bearing animals, and for the conservation of wild flowers and aquatic plants, and (c) to such extent as the Secretary of Commerce may by regulations prescribe a refuge and breeding place for fish and other aquatic animal life."

Description of Proposed Use:

The proposal is a Habitat Rehabilitation and Enhancement project authorized by the Water Resource Development Act of 1986 (Pub. L. 99-662). The proposed project consists of the creation of a sediment trap, backwater channel hydraulic dredging, construction of a managed marshland with a mast tree or grassland area on the confined placement site (CPS), and creation of potholes for waterfowl brood habitat and fall feeding sites.

Excavation of a sediment trap will include about 2,100 lineal feet of hydraulic dredging above the existing causeway and mechanical excavation/ hydraulic dredging of a deep hole immediately below the causeway. These features will help act as a sediment trap mainly during high water events, but would also help collect any minor amounts of sediment during normal flows. This will help prevent further migration of sediment down the slough.

Dredging of numerous channels through the marsh environs will restore and create aquatic habitat. Hydraulic dredging in lower Potters will include 20,700 lineal feet of channel and embayment and two deep holes for over-wintering of fish populations.

Placement of the dredged material will be in a confined placement site (CPS) located on existing island remnant. Subsequent management of the CPS is intended to provide water level control over 32.5 acres of created marshland for migratory bird habitat enhancement. The ability to control water levels (ranging from 1 to 2 feet of water) allows managers to flood or draw down the area to maintain marshland habitat conditions for resident and migrating water birds. The levee construction required for the CPS will be revegetated to create open grassland areas, further increasing the diversity of habitats within the project area. Additional enhancement is possible through implementation of a forest management plan that incorporates clearing and replanting trees within the CPS.

The project will also create waterfowl brood habitat and fall feeding sites by constructing 23 potholes -- 16 mechanically constructed potholes totalling 3.2 acres and 7 blasted potholes totalling 1.6 acres.

Complete details of the project, including maps and engineering drawings, are contained in the draft report entitled, "Upper Mississippi River System Environmental Management Program Definite Project Report with Integrated Environmental Assessment, Potter's Marsh Habitat Rehabilitation and Enhancement, Pool 13, Upper Mississippi River, Carroll and Whiteside Counties, Illinois," prepared by the Rock Island District, Corps of Engineers.

Anticipated Impacts on Refuge Purposes:

As a result of the project the fish and wildlife populations should increase. The above-mentioned report contains detailed information on the project's impacts.

Justification:

The proposed project works toward the accomplishment of the purposes and stated objectives of the Refuge.

Determination:

The proposed project is compatible with purposes for which the Refuge was established.

Determined by:	[signature] Refuge Manager	9/4/91 Date
Reviewed by:	Richard F. Berry Complex Manager	9/4/91 Date
Reviewed by:	Edward S. Crozier WAM-1	9/16/91 Date
Concurred by:	[signature] Acting Regional Director	9-17-91 Date

Illinois Department of Transportation
Division of Water Resources
3215 Executive Park Drive / P.O. Box 19484 / Springfield, Illinois / 62794-9484

March 31, 1992

SUBJECT: Permit No. 21012
Dredge, Containment Dike
Mississippi River Floodway
Whiteside County

Mr. Robert W. Kelley, P.E.
Chief, Engineering Division
U. S. Army Corps of Engineers
Rock Island District
Clock Tower Building, P. O. Box 2004
Rock Island, Illinois 61204-2004

Dear Mr. Kelley:

We are enclosing Permit No. 21012 authorizing the subject project. This approval is based on our determination that the project is in the public interest, it will have negligible effects on the flood carrying capacity of the floodway, and no further floodway construction is anticipated in the area. In addition to the general conditions of the permit, this approval is subject to the following special condition:

> This permit does not relieve the permittee of the responsibility to obtain other federal, state or local authorizations required for the construction of the permitted activity; and if the permittee is required by law to obtain approval from any federal or other state agency to do the work, this permit is not effective until the federal and state approvals are obtained.

If any changes in the plans or location of the work are found necessary, revised plans should be submitted promptly to this office so that they may receive approval before work thereon is begun. When the work is done, please provide written notification that the project has been completed in accordance with the approved plans and conditions of the permit.

Please acknowledge receipt of this permit by having the attached acceptance blank properly executed and returned to us within sixty (60) days from the date of the permit.

Sincerely,

David R. Boyce

David R. Boyce, P.E.
Chief, Floodplain Management
Section

DRB:JSP:lmt/363
Enclosure
cc: Stewart Richter, Whiteside County Zoning Officer
Susan Fabian, Carroll County Zoning Officer
Illinois Department of Conservation
Illinois Environmental Protection Agency

STATE OF ILLINOIS

Permit
Nº 21012

Department of Transportation

Division of Water Resources

2300 South Dirksen Parkway
Springfield, Illinois 62764

Permission Is Hereby Granted, this 31st day of March 1992

To

U. S. Army Corps of Engineers
Rock Island District
Clock Tower Building, P. O. Box 2004
Rock Island, Illinois 61204-2004

To dredge and to construct a containment dike in Potters Marsh in the Mississippi River floodway in Sections 2 and 11, Township 22 North and Sections 25, 26, 35 and 36, Township 23 North, Range 3 East of the 3rd Principal Meridian in Carroll and Whiteside Counties,

in accordance with an application dated Dec. 11, 1991 , and the specifications and plans entitled

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT (R-5PR)
POTTER'S MARSH REHABILITATION AND ENHANCEMENT
POOL 13, RIVER MILES 523.5 - 526.5

filed with the Department of Transportation and made a part hereof, and subject to the terms and special conditions contained herein:

Examined and Recommended:

David R. Boyce

~~Chief, Bureau of Resource Management~~XXXXXXX
David R. Boyce, Chief Floodplain Management Section

APPROVED:

Kirk Brown Secretary

Approval Recommended:

Donald R. Vonnahme

Donald R. Vonnahme Director

~~cc: IEPA IDOC Whiteside Co. Zoning Dept. (Stewart Richter)~~

(39153—5M Sets—12-83) Carroll County Zoning Office (Steven Fabian) (Over) community file (Whiteside)

Illinois Environmental Protection Agency · P. O. Box 19276, Springfield, IL 62794-9276

217/782-0610

April 13, 1992

Mr. James H. Blanchar, P.E.
Chief, Operations Division
Rock Island District
Corps of Engineers
Clock Tower Building
Rock Island, Illinois 61201

Re: Rock Island District Corps of Engineers
(Carroll and Whiteside Counties)
Potters Marsh EMP - Mississippi River
Log #C-743-91 [CoE Appl. #216010]

Dear Mr. Blanchar:

This Agency received a request on December 23, 1991, from the Rock Island District Corps of Engineers requesting necessary comments for environmental consideration concerning the environmental rehabilitation of Potters Marsh, including the hydraulic dredging of 20,700 feet of channel and two sediment traps involving 394,000 cubic yards of material, the mechanical excavation of 16 potholes and the blasting of seven potholes, and the construction of a 35.5 acre confined placement site for the dredged material. We offer the following comments.

Based on the information included in this submittal, it is our engineering judgment that the proposed project may be completed without causing water pollution as defined in the Illinois Environmental Protection Act, provided the project is carefully planned and supervised.

These comments are directed at the effect on water quality of the construction procedures involved in the above described project and is not an approval of any discharge resulting from the completed facility, nor an approval of the design of the facility. These comments do not supplant any permit responsibilities of the applicant towards this Agency.

This Agency hereby issues certification under Section 401 of the Clean Water Act (PL 95-217), subject to the applicant's compliance with the following conditions:

1. The applicant shall not cause:

   a. violation of applicable water quality standards of the Illinois Pollution Control Board, Title 35, Subtitle C: Water Pollution Rules and Regulations;

b. water pollution as defined and prohibited by the Illinois Environmental Protection Act; and

c. interference with water use practices near public recreation areas or water supply intakes.

2. The applicant shall provide adequate planning and supervision during the project construction period for implementing construction methods, processes and cleanup procedures necessary to prevent water pollution and control erosion.

3. Any spoil material excavated, dredged or otherwise produced must not be returned to the waterway but must be deposited in a self-contained area in compliance with all State statutes, regulations and permit requirements with no discharge to the waters of the State unless a permit has been issued by this Agency. Any back filling must be done with clean material and placed in a manner to prevent violation of applicable water quality standards.

4. All areas affected by construction shall be mulched and seeded as soon after construction as possible. The applicant shall undertake necessary measures and procedures to reduce erosion during construction. Interim measures to prevent erosion during construction shall be taken and may include the installation of staked straw bales, sedimentation basins and temporary mulching. All construction within the waterway shall be conducted during zero or low flow conditions.

5. The applicant shall implement erosion control measures consistent with the "Standards and Specifications for Soil Erosion and Sediment Control" (IEPA/WPC/87-012).

6. The pothole blasting will be conducted when water levels are at or below elevation 583.0 (average pool).

7. The applicant shall obtain permits to construct and operate the confined placement site in accordance with 35 Ill. Adm. Code 309.202 and 309.203.

8. This certification becomes effective when the Department of the Army, Corps of Engineers, includes the above conditions #1 through 7 as conditions of the requested permit issued pursuant to Section 404 of PL. 95-217.

This certification does not grant immunity from any enforcement action found necessary by this Agency to meet its responsibilities in prevention, abatement, and control of water pollution.

Very truly yours,

Thomas G. McSwiggin by [illegible]

Thomas G. McSwiggin, P.E.
Manager, Permit Section
Division of Water Pollution Control

TGM:BY:jar/1091r,74-76

cc: IDOT, Division of Water Resources, Springfield
USEPA, Region V
CoE, RID, Engineering Division
DWPC, Records Unit
DWPC, Field Operations Section, Region Rockford

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

A P P E N D I X B

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-9F)

POTTERS MARSH REHABILITATION AND ENHANCEMENT

POOL 13, MISSISSIPPI RIVER MILES 522.5 THROUGH 526.0
CARROLL AND WHITESIDE COUNTIES, ILLINOIS

APPENDIX B
CLEAN WATER ACT
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UPPER MISSISSIPPI RIVER SYSTEM
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POTTERS MARSH REHABILITATION AND ENHANCEMENT
POOL 13, MISSISSIPPI RIVER MILES 522.5 THROUGH 526.0
CARROLL AND WHITESIDE COUNTIES, ILLINOIS

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

SECTION 1 - PROJECT DESCRIPTION

LOCATION

The proposed project is located on the Illinois side of the Mississippi River (River Miles 522.5-526.0) in the Illinois counties of Carroll and Whiteside. The 2,000-acre Potters Marsh island complex was created by the impoundment of Lock and Dam 13 and is presently managed by the U.S. Fish and Wildlife Service (USFWS) as part of the Upper Mississippi National Wildlife Refuge system. The upper end of the island, Thompson Causeway Recreation Area, is managed by the Corps of Engineers. See plates 1 and 2 in the Definite Project Report (DPR).

GENERAL DESCRIPTION

By definition and Federal regulatory jurisdiction, the site is classified as wetland or as 'waters of the United States' and is therefore subject to evaluation and regulation under Section 404 of the Clean Water Act.

The Potters Marsh HREP project is an adjacent backwater enhancement project consisting of the creation of a sediment trap, backwater channel hydraulic dredging, construction of a managed marshland with a grassland area on the confined placement site (CPS), and creation of potholes for waterfowl brood habitat and fall feeding sites.

Excavation of a sediment trap will include 2,100 lineal feet of hydraulic dredging above the existing causeway and mechanical excavation or hydraulic dredging of a deep hole immediately below the causeway. These features will help act as a sediment trap mainly during high water events, but would also help collect any minor amounts of sediment during normal flows. All sediments will not be trapped, but any that are prevented from continuing down the slough will help keep the upper 2,500 feet of slough and flow tubes from silting in completely and will help prevent further migration of sediment down the slough.

Dredging of numerous channels through the marsh environs will restore and create aquatic habitat. Hydraulic dredging in lower Potters will include 20,700 lineal feet of channel and embayment and two deep holes for overwintering of fish populations.

Placement of the dredged material will be in a CPS located on existing island remnant. Subsequent management of the CPS by the USFWS is intended to provide water level control over 32.5 acres of created marshland for waterfowl habitat enhancement. The ability to control water levels (ranging from 1 to 2 feet of water) allows managers to flood or draw down the area to maintain marshland habitat conditions for resident and migrating water birds. The levee construction required for the CPS will be revegetated to create open grassland areas, further increasing the diversity of habitats within the project area. Additional enhancement is possible through implementation of a grassland area that incorporates 7 acres of selected grasses within the CPS.

Creation of waterfowl brood habitat and fall feeding sites involves constructing 23 potholes--16 mechanically constructed potholes totaling 3.2 acres and 7 blasted potholes totaling 1.6 acres.

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 DPR.

The purpose of this project, under Section 1103, is "to ensure the coordinated development and enhancement of the Upper Mississippi River (UMR)," which includes the Illinois River. This project is the result of a coordinated planning effort between the U.S. Fish and Wildlife Service, the Illinois Department of Conservation, and the U.S. Army Corps of Engineers.

GENERAL DESCRIPTION OF DREDGED AND FILL MATERIAL

The sediments within Potters Slough consist of up to 2 feet of post-impoundment alluvium deposits. Mechanical excavation or hydraulic dredging immediately below the existing causeway and dredging in segment 1 above the existing causeway would be performed as shown on DPR plate 2. Immediately below the existing causeway, a deep hole sediment trap will be mechanically excavated or hydraulically dredged (see dredging plan on DPR plate 9). The hole will be 200 feet wide by 60 feet long by 10 feet deep, with 1 horizontal on 2 vertical (1:2) side slopes. (See typical section on DPR plate 13.) The normal water surface is elevation 583.0 feet mean sea level (flat pool) and the average water depth is 1.5 feet. Excavation/dredging depth is to elevation 573.0 or 8.5 feet of material, totaling approximately 4,700 cubic yards. The material will be about 75 percent fat clay and 25 percent medium clay and/or sand.

Above the causeway, approximately 44,300 cubic yards of fine-grained sediments and sands would be hydraulically dredged from 2,100 lineal feet of backwater channel and placed in a CPS. Segment 1 hydraulic dredging in upper Potters slough will take place as shown on DPR plate 9, with a typical section shown on plate 13. Dredged bottom width will be 50 feet with 1:2 side slopes for the 2,100 lineal feet of alignment. Dredging depth will be a 10-foot cut to elevation 573.0 to ensure a minimum depth of 6 feet throughout the project life, as shown in table 8-1a of the DPR. Current water depth averages about 1.5 feet below flat pool. The dredged material will be about 71 percent fat clay, 24 percent lean to medium clay, and 5 percent sand, for a total of 44,300 cubic yards.

Dredging in the lower Potters Marsh bay area would be performed as shown on DPR plate 2. A total of 394,000 cubic yards of fine-grained sediments and sand would be hydraulically dredged from two deep holes and 20,700 lineal feet of backwater channel and placed in a CPS. Segments 2 and 3 dredging in lower Potters slough and embayment will take place as shown on the dredging plan on DPR plate 10. General dredging alignment bottom width in both segments will be 50 feet with 1:2 side slopes. (See typical section on DPR plate 13.) Dredging depth will be 8 feet to elevation 575.0 to ensure a minimum depth of 6 feet throughout the project life, as shown in table 8-1b of the DPR. Current water depth averages approximately 1.5 feet below flat pool in the general alignment areas. Segment 2 will be 10,900 lineal feet of dredging alignment and one deep hole. Segment 3 will be 9,800 lineal feet of dredging alignment and one deep hole. Each deep hole will be 500 feet by 200 feet with a 12-foot dredging depth to elevation 571.0 and 1:2 side slopes. (See typical section on DPR plate 13.) The deep holes will provide an escape route for fish to the main river if the water in the interior dredge cuts ever becomes DO deficient. Current water depth averages 2.0 feet below flat pool in the deep hole areas. Dredged material in segment 2 will be about 36 percent sand, 35 percent lean to medium clay, and 29 percent fat clay, for a total of 205,350 cubic yards. Dredged material in segment 3 will be about 46 percent sand, 42 percent lean to medium clay, and 12 percent fat clay, for a total of 188,650 cubic yards.

Sixteen potholes of various shapes will be mechanically excavated to about 4 feet in the central part of the island, as shown on DPR plate 2. A typical section is shown on DPR plate 12. Excavated material will be placed around the outside perimeter of the pothole. Seven 300- by 50-foot potholes will be blasted by explosives in the riverside embayment area near the central part of the island, as shown on DPR plate 2. A typical section is shown on DPR plate 12. This area, although soft and wet, is above flat pool and is not directly connected to the river during normal conditions, so no water quality problems are expected. Holes will be overblasted to about 5 feet in an attempt to result in an approximate 4-foot-deep pothole.

DESCRIPTION OF THE PROPOSED DISCHARGE SITES

A CPS in the central peninsula area will be constructed as shown on DPR plate 3. The total surface area would be 50 acres, which includes the dike and a 15-foot perimeter work zone. The interior surface area would be 35 acres, and the dike would be 14 feet high with 1:3 side slopes. After dredged material has settled, the top and remaining side slopes of the sand dike would be reshaped and seeded with grass. The purpose of this CPS would be to contain all of the dredged material both during and after dredging. Depth of dredged material immediately after placement will be about 12 feet. The material will then settle throughout the first year to a depth of 8 to 10 feet. At that time, the upper dike surface will be lowered accordingly to within 2 to 3 feet of the top of material.

After settlement of the dredged material, an approximate 32.5-acre managed marshland will be constructed on the CPS surface, as shown on DPR plate 2.

DESCRIPTION OF DISPOSAL METHOD

Mobilization of construction equipment (hydraulic dredge and barge-mounted equipment) into the Potters Marsh complex can be accomplished when river levels are at or above flat pool with limited efforts of excavating or dredging to maneuver equipment from the main channel to the upper and lower ends of the project. Once mobilized, the utilization of this equipment is relatively independent of river stage.

There may be intermittent stumps between the main channel and the outer project limits. These will be removed wherever necessary to maneuver floating plant by dragline/clamshell. Stumps will be more of a problem in maneuvering equipment from the main channel rather than interfering with project dredging. There should be very few stumps within the project area, and then only at the extreme outer limits.

It is anticipated that all Potters Marsh complex dredging, except for the small cut below the causeway, will be accomplished with a 16-inch cutter-head hydraulic dredge. The 10-foot-deep sediment trap cut below the causeway will be accomplished by dragline/clamshell or by use of an 8-inch or smaller portable dredge. The dredge outflow pipe will be required to be moved around, to distribute material in the CPS as evenly as possible, and to cover the dredged sand with clay material.

The containment dike for the dredged material placement site will be constructed from adjacent interior borrow, which will be 80 to 90 percent sand. A dragline/clamshell working on mats 20 feet inside the interior

CPS dike toe will excavate an approximate 60-foot-wide by 10- to 12-foot-deep borrow ditch. The top 2.0± feet of existing material is lean clay followed by 2.0± feet of clayey sand overlying fine to medium sand. Any organic material at the surface will be removed before borrow is used for the dike construction. Slope stability analyses reveal that the dike will be stable, with a crest of 10 feet and side slopes of 1:3 horizontal. Final design may incorporate an impervious liner on the interior sand dike face to prevent through-seepage of water.

Sixteen island potholes will be mechanically excavated with a dragline/ clamshell. A bulldozer may be needed to provide an equipment path for access to each pothole location. Excavated soil material will be placed around the perimeter of the pothole, as shown on DPR plate 12. In the central island river side embayment area, where excavation with conventional equipment would be difficult, seven potholes will be blasted with explosives. This area, although soft and wet, is above flat pool and is not directly connected to the river during normal conditions, so no water quality problems are expected.

Borrow for the proposed access road will be limited to 100 feet on either side of the proposed road location. The 10-foot-wide surface would be covered with a graded road fill and leveled with granular material. There will be an earthen shoulder on each side.

SECTION 2 - FACTUAL DETERMINATIONS

PHYSICAL SUBSTRATE DETERMINATIONS

Geomorphological investigations and geotechnical surveys determined that the soils within the limits of the dredging are recent alluvial deposits over 2 feet deep in places.

WATER CIRCULATION, FLUCTUATION, AND SALINITY DETERMINATIONS

WATER

Water quality conditions in the Potters Marsh complex is primarily affected by the shallow nature of the slough as a result of sedimentation and the expanse of emergent and submergent vegetation which dominates the area.

Water quality problems are related to low levels of DO during the late summer and to the lack of water and low DO levels in the winter when portions of the slough freeze to the bottom.

CURRENT PATTERNS AND CIRCULATION

Improvements in current patterns will result from dredging channels in the backwaters of Potters Slough but will have no overall effect on the Mississippi River current patterns. The main channel of the river is over 2.5 miles across from the inlet of Potters slough, so improvements to flow conditions in the Potters Marsh complex will not affect main channel conditions.

NORMAL WATER LEVEL FLUCTUATIONS

The Mississippi River is typified by fluctuations in water levels during flood events. For example, in the Potters Marsh area, flood events can cause the water levels to gradually rise from a normal pool level of 583.0 to a flood level of 587.5 for a 5-year flood event, or a flood level of 596.9 for a rare 500-year event. During non-flood periods, water levels in the Potters Marsh area do not fluctuate significantly because the area is a short distance upstream of Lock and Dam 13. Water levels remain below 583.5 approximately 70 percent of the time.

SALINITY GRADIENTS

The Mississippi River is an inland freshwater system. Therefore, salinity gradients were not considered on this project.

ACTIONS TAKEN TO MINIMIZE IMPACTS

Several measures to minimize impacts at each of the project features will be implemented during and after construction.

The most significant action taken on this project to minimize impacts will be the use of a CPS for the hydraulic dredging of the backwater channels and the sediment trap. Retention times will be long enough to facilitate settling of over 95 percent of the suspended sediments before the water is returned to the river system.

The CPS dikes will normally not be subject to any erosional effects. Following completion of the project, the dikes will be permanently seeded to grasses and the entire CPS will be managed as a manmade marsh to diversify and enhance habitat values in the Potters Marsh area. In addition, a 7-acre portion of the CPS will be managed as a grassland to further benefit the project area.

SUSPENDED PARTICULATE/TURBIDITY DETERMINATIONS

In an effort to assess existing water quality conditions in the vicinity of the proposed project, a monitoring program was initiated in 1990 by personnel in the Corps of Engineers Water Quality and Sedimentation Section (ED-HQ). (See appendix F.) The monitoring program called for the collection of water samples on a biweekly basis at two sites.

On February 7, 1991, sediment and water samples were collected in order to predict the impact of proposed construction activities on water quality. Sediment samples were collected at three sites in the vicinity of the area proposed for dredging for the purpose of performing grain size and elutriate analyses. Water samples were collected at one site for use in the elutriate test and for ambient water analyses.

<u>Grain Size Analyses</u>. Grain size analyses were performed on sediment samples collected at each site on February 7, 1991. The percent sediment passing a No. 230 sieve for each sample is given in table F-1 (appendix F). All samples contained substantial amounts of clay and silt-sized material.

<u>Elutriate and Ambient Water Analyses</u>. Elutriate analyses were performed on samples collected at each site on February 7, 1991, while ambient water was analyzed from a sample collected at the surface at P-89-2. Table F-2

(appendix F) shows the results from ambient water analyses and also lists the applicable Illinois General Use Water Quality Standards. The elutriate analysis results, as shown in table F-2, also were evaluated against these standards. Most elutriate parameters were below the general use water quality standard. An isolated exception to this was observed at site P-89-2 where lead exceeded the standard in the ambient water sample.

Baseline Water Quality Monitoring. The results from ambient water samples collected at site W-M525.1Y during 1990 are shown in table F-3 (appendix F).

Based on the limited data available, it appears that low DO concentrations may limit fish usage under existing conditions. These low DO levels may be related to excessive primary productivity during the spring as high pH and chlorophyll levels precede the low DO conditions.

It appears that should the proper dredging and dredged material disposal management techniques be utilized, there will be little impact on the water quality of Potters Marsh. Any impacts that are noted would be temporary in nature.

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. Effects 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 Refuges (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 230.30)

G. Other Wildlife (refer to Section 230.32)

The project's effects on A through E above are anticipated to be of overall benefit. One of the primary purposes 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, especially off-channel over-wintering areas with low-flow conditions and access to the main channel.

Hydraulic dredging of the lower slough and embayment dredging would rehabilitate and enhance aquatic habitat by creating 25 acre-feet of deep water habitat for fish winter refuge. The proposed dredging also would increase water exchange from the main river to the lower slough area, thereby improving DO concentration during potential critical seasonal stress periods. Dredging also would reduce the quantity of submerged aquatics and arrowhead that are currently dominating the slough and embayment. Resultant increases in open water from dredging would allow diversification of aquatic vegetation communities for additional waterfowl and fisheries benefits.

AE(1) through (4) are found in the project area. The project site is part of the Upper Mississippi National Wildlife Refuge System, managed by the USFWS. The project was coordinated with USFWS and Illinois Department of Conservation staff and has been found to be compatible with their objectives.

A federally endangered species found in the area is the bald eagle (*Haliaeetus leucocephalus*). The Illinois mud turtle (*Kinosternon flavescens spooneri*) (State endangered) and Blanding's turtle (*Emydoidea blandingi*) and smooth softshell turtle (*Trionyx nuticus*) (both State watch list species) may be found in the project area. Originally, concerns were raised by the IDOC that pothole blasting would impact turtle hibernation habitat. These concerns were alleviated by changing the blasting from winter to summer or early fall. Therefore, the proposed project is anticipated to have no effect on either State or federally listed endangered species. This determination is supported by both the USFWS and the State of Illinois.

Other wildlife in the project area includes both game and non-game species such as white-tailed deer, squirrel, waterfowl and migratory shorebirds, 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.

Because portions of Potters Marsh have and continue to be used for waterfowl hunting, it is possible that a large amount of lead shot is buried within the sediments. The majority of this lead is isolated from most organisms and unable to enter the food chain. Should these sediments be dredged and the dredged material exposed, any lead could be introduced into the food chain in a number of ways. In an effort to determine if significant lead contamination exists within the sediments proposed to be dredged at Potters Marsh, bulk sediment analyses were performed on three 40-inch core samples collected on November 6, 1991. The locations of the sampling sites correspond with the water quality sites monitored on a biweekly basis (see appendix F and DPR plate 18). All three dredge cuts are represented by these sites, and the sample from cut No. 1 should serve as a measure of ambient sediment lead levels since hunting is not permitted in this area.

Lead levels of 32 mg/kg, 10.3 mg/kg, and 36.7 mg/kg were observed at sites W-M525.1Y. W-M523.7Y, and W-M524.1U, respectively. It is apparent that lead levels from all cuts are within the expected range for fine-grained sediments. For comparison purposes, lead levels at similar backwater locations were compared to those found at Potters Marsh. At Peoria Lake, levels ranged from 19 mg/kg to 22 mg/kg. At Bertom and McCartney Lakes, levels ranged from 3.5 mg/kg to 24 mg/kg. At Andalusia Lake, levels ranged from 6 mg/kg to 17 mg/kg.

An extensive statistical analysis of Illinois stream and lake sediments was performed by Kelly and Hite (1981, 1984). Their analysis resulted in a classification system for stream and lake sediments which shows that stream sediments have elevated lead levels when concentrations exceed 38 mg/kg, and lakes have elevated lead levels when concentrations exceed 100-150 mg/kg. Based on these results, and from comparisons to similar backwater dredging projects, it does not appear that lead in the spoil material will pose a serious environmental concern.

Through the planning, coordination, and design process, wetland impacts were considered and minimized to the extent possible.

PROPOSED DISPOSAL SITE DETERMINATIONS

As part of the hydraulic dredging alternative, placement of the dredged material will be hydraulically pumped into a CPS. Following dewatering and consolidation of the CPS, the area will be utilized as a managed marsh complex. This will involve installing a shallow well for water supply. In approximately 20 days, 500 gpm would inundate the 32.5 CPS acres with 1.0 foot of water. A 4.0-foot hydraulic opening stoplog structure will be installed to facilitate dewatering the CPS to manage vegetation cycles. Water will exit into the existing old slough bed below the last mechanically excavated pothole.

A 7-acre grassland area will be constructed on a portion of the CPS. The area to be selected will be sized and may be located as shown on DPR plate 2, assuming this is the highest area after initial settlement of dredged material. Otherwise, the location may be shifted. The area will be seeded with a select grass variety. This grassland area will mitigate any lost vegetation due to the CPS construction and will help enhance the migratory bird habitat.

DETERMINATION OF CUMULATIVE EFFECTS ON THE AQUATIC ECOSYSTEM

The Potters Marsh HREP project includes both aquatic and terrestrial components which will benefit both game and nongame species over the predicted 50-year project life. Fisheries benefits consist of improved spawning and rearing habitat within the dredged channels. The deepwater holes created will provide critically needed overwintering areas for centrarchids which maintain access to the main river channel.

Dredging of the backwater channel will create a diversity of water depths resulting in an initial reduction in vegetation within the channels. This improved aquatic regime of open water and aquatic vegetation will benefit fish, waterfowl, and invertebrate populations through improved flow conditions and higher DO levels.

Pothole creation will restore valuable habitat, especially brooding areas for waterfowl which require open water and adjacent vegetative cover. These areas also will provide feeding and resting areas for migrating waterfowl in the fall and spring.

DETERMINATION OF SECONDARY EFFECTS ON THE AQUATIC ECOSYSTEM

Secondary effects generated as a result of construction of this project include benefits generated by construction of the CPS. The proposed managed marsh plan generates the most benefits of any of the plans considered. In addition to expected waterfowl benefits, nongame species and furbearers benefit alike. The Potters Marsh project presents a unique opportunity to utilize a dredged material placement area to generate secondary benefits to a project through management of the site by a well and stoplog structure.

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. Alternatives which were considered in addition to the proposed action were as follows:

a. No Federal Action

b. Individual project features were evaluated independently of each other. The individual features were the upper end dredging and sediment trap, lower end hydraulic dredging and deep water areas, construction of the confined placement site (CPS), and excavation and blasting of potholes.

3. Certification under Section 401 of the Clean Water Act will be obtained from the Illinois Environmental Protection Agency and will be included in the final version of this report. The project will thus be in compliance with the water quality requirements of the State of Illinois.

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 the U.S. Fish and Wildlife Service, Ecological Services Office.

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. 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.

3 April 1992
Date

John R. Brown
John R. Brown
Colonel, U.S. Army
District Engineer

REFERENCES CITED

Kelly, M. and R. Hite
1981 *Chemical Analysis of Surficial Sediments from 63 Illinois Lakes*. Illinois Environmental Protection Agency, Monitoring Unit, Marion.

Kelly, M. and R. Hite
1984 *Evaluation of Illinois Stream Sediment Data: 1974-1980*. IEPA/WPC84004. Illinois Environmental Protection Agency.

APPENDIX C

LETTERS OF INTENT
AND MEMORANDUM OF AGREEMENT

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:

MEMORANDUM OF AGREEMENT
BETWEEN
THE UNITED STATES FISH AND WILDLIFE SERVICE
AND
THE DEPARTMENT OF THE ARMY

SUBJECT: **Enhancing Fish and Wildlife Resources of the Upper Mississippi River System at Potters Marsh, Illinois**

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 (USFWS) and the Department of the Army (DA) will operate in constructing, operating, maintaining, and rehabilitating the Potters Marsh, Illinois, 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 Potters Marsh 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 backwater channel hydraulic dredging, creation of a sediment trap, construction of a managed marshland with a grassland area on the confined placement site (CPS), and creation of potholes to increase waterfowl breeding habitat and fall feeding sites.

IV. **RESPONSIBILITIES**

A. The DA is responsible for:

1. **Construction**: Construction of the project which consists of dredging 20,700 lineal feet (394,000 cubic yards) for overwintering fish habitat; dredging 2,100 lineal feet (49,000 cubic yards) for a sediment trap; drilling one well with submergible pump; constructing CPS; improving an existing and constructing a service road to managed marshland/CPS; establishing 32.5-acre managed marshland and 7-acre grassland area on the CPS with a stoplog structure; seeding the CPS dike with grass after dredged material settlement; and creating 23 isolated potholes for waterfowl use.

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, the DA will construct the Potters Marsh Fish and Wildlife Enhancement project as described in the Definite Project Report, *Potters Marsh Rehabilitation and Enhancement*, dated July 1991, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The USFWS 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 the DA encounters potential delays related to construction of the project, the DA will promptly notify the USFWS of such delays.

4. **Maintenance of Records**: The 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. The DA shall maintain such books, records, documents, and other evidence for a minimum of 3 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 USFWS.

B. The USFWS is responsible for:

1. **Operation, Maintenance, and Repair**: Upon completion of construction as determined by the District Engineer, Rock Island, the USFWS shall accept the project and shall operate, maintain, and repair the project as defined in the Definite Project Report, *Potters Marsh Rehabilitation and Enhancement*, dated July 1991, 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 USFWS shall obtain 25 percent of all costs associated with the operation, maintenance, and repair of the project from the Illinois Department of Conservation.

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:

USFWS: Regional Director
U.S. Fish and Wildlife Service
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

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
District Engineer

DATE: ____________________________

THE U.S. FISH AND WILDLIFE SERVICE

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

DATE: ____________________________

COST ESTIMATE

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POTTERS MARSH
REHABILITATION AND ENHANCEMENT EMP
MISS. RIVER MILE 522.5 - 526.0
APPENDIX D

DETAILED ESTIMATE OF COST

1. General. This Appendix contains the detailed cost estimate prepared for the Potters Marsh, Rehabilitation and Enhancement Project at Mississippi River Miles 522.5 - 526.0, including Federal construction, planning, engineering, and design, and construction management costs. The current working estimate (CWE) prepared for this Definite Project Report (DPR) level study was developed after review of project plans, discussion with the design team members, and review of costs for similar construction projects. The Micro-Computer Aided Cost Estimating System (M-CACES), incorporating local wage and equipment rates, was utilized to assemble and calculate project element cost. Costs, including appropriate contingencies, are presented in accordance with EC 1110-2-536, Civil Works Project Cost Estimating - Code of Accounts.

2. Price Level. Project element cost are based on July 1991 prices. These costs are considered fair and reasonable to a well-equipped and capable contractor and include overhead and profit. Calculation of the Fully Funded Estimate (FFE) was done in accordance with guidance from CECW-B, dated 5 Feb 91, for Factors for Updating Study/Project Cost Estimates for FY 1993 Budget Submission.

3. Contingency Discussion. After review of project documents and discussion with personnel involved in the project, cost contingencies were developed which reflect the uncertainty associated with each cost item. Per EC 1110-2-263, these contingencies are based on qualified cost engineering judgement of the available design data, type of work involved and uncertainties associated with the work and schedule. Costs were not added to contingency amounts to cover items which are identified project requirements. The following discussion of major project features indicates the basis for contingency selection and assumptions made. For other elements not addressed below, the assignment of contingencies was deemed appropriate to account for the uncertainty in design and quantity calculation and further discussion is not included.

a. Feature 06, Fish and Wildlife Facilities.

The quantities for this work were developed by Design Branch.

06.-.-.- Access Road, Upgrade Existing and Build New. There is access to part of the project area by a dirt road. This existing road will be surfaced with crushed stone. Access to the Confined Placement Site and other project features will be made by extending this existing road. The low road embankment will be constructed from adjacent material by dozer. The road will be surfaced with crushed stone and it is anticipated that a 24" drainage pipe will be needed where the new road crosses a shallow drainage swale. This work is considered routine construction and contingencies of 20 to 25 percent are considered satisfactory.

06.-.-.- Confined Placement Site. Minimal selective clearing will be done for construction of the dike. It is estimated that a dragline will place the embankment using adjacent borrow. Cost for placement reflects a 3 cy dragline working from matts in this soft soil area. A small dozer will shape the embankment. Contingencies of 20 to 25 percent are considered satisfactory for this work.

06.-.-.- Hydraulic Dredging. It is anticipated that dredging will be done with a 16" cutterhead dredge. Dredging cost was estimated on a 7 day/ 24 hour operation. A booster pump is included for approximately half the time. The $2.90/cy cost compares favorably with previous bid abstracts for similar dredge work in the Rock Island District. River soundings at the site indicate that a contractor may have to dredge his way into the site. This yardage is not great however and is included in the total 442,300 cubic yards to be dredged. A 25 percent contingency is assigned to this work. It is anticipated that a polymer will be added to an estimated 25 percent of the dredged material discharge to improve the effluent clarity. A 75 percent contingency is assigned this item to allow for quantity unknowns. Stump removal cost is included based on site observation by the project engineer. A 50 percent contingency is included to cover increase quantity.

06.-.-.- Potholes. Pothole construction will be done by mechanical excavation and blasting. Selective clearing is included in the work. It is estimated that a dragline, working from matts, will excavate the potholes. Blasted potholes will measure 50 ft wide by 300 ft long and be about 5 ft deep. The cost for blasting 7 holes was developed from bid abstracts for similar work at the Big Timber EMP project, which cost had been verified by discussion with a blasting contractor. Contingencies of 20 and 25 percent respectively for this work are considered satisfactory.

06.-.-.- New Well. The cost for new well construction is based on drilling and casing an 8" hole 100 feet deep. Included in the cost is 50 lineal feet of plastic well screen and 200 lineal feet of 6" steel discharge pipe to the Confined Placement Site. A 100 percent contingency is used for this item to cover increase depth and/or different type of well screen material. A 100 percent contingency is used also for the anticipated 5 hp pump to cover different pump size and/or setting depth. The cost for electrical feed to the new well was developed in sufficient detail, sizing feeder cable, controls, switches, and grounding needs, and is assigned a 20 percent contingency to cover any remaining unknowns and differing material prices.

The average contingency for the project's construction is 23.7 percent.

b. Feature 30, Planing, Engineering & Design.

The engineering and design for this project includes all planning and design work necessary to complete the Definite Project Report and construction plans and specifications. This cost also includes engineering support during construction, preparation of as-built drawings and operation and maintenance manuals. The design effort for the construction was analyized to determine the man-year effort required. This estimate is based upon monies expended to date, discussions between the project engineer and project manager, and historical data and experience gained on other projects of similar nature.

c. Feature 31, Construction Management.

Construction management is studies and analyses of project reports, plans and specifications, and conferences of construction staff to become familiar with design requirements; biddability, contractiability, and operability reviews; preaward activities to acquaint prospective bidders with the nature of the work; administration of construction contracts; administration of A/E contracts which provide for supervision and inspection; establishment of bench marks and baselines required for layouts of construction, relocations, and clearing; review of shop drawings, manuals, catalog cuts, and other information submitted by the construction contractor; assure specifications compliance by supervision and inspection on construction work, conferences with the contractors to coordinate various features of the project and enforce compliance with schedules; sampling and testing during construction phase to determine suitability and compliance with plans and specifications; negotiate with the contractor on all contract modifications, including preparation of all contract documents required therefore; estimate quantities, determine periodic payments to contractors, and prepare, review and approve contract payments; review and approve construction schedules and progress charts; prepare progress and completion reports;

project management and administration not otherwise identified; and district overhead. These costs may be incurred at the job site, an area office, or at the District Office. For the construction of the Potters Marsh Rehabilitation and Enhancement EMP Project, the estimated cost of construction management is $164,000 for a construction contract with a little over 2 year duration and an estimated value of $3.3 million.

APPENDIX E

HYDROLOGY AND HYDRAULICS

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-9F)

POTTERS MARSH REHABILITATION AND ENHANCEMENT

POOL 13, MISSISSIPPI RIVER MILES 522.5 THROUGH 526.0
CARROLL AND WHITESIDE COUNTIES, ILLINOIS

APPENDIX E
HYDROLOGY AND HYDRAULICS

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POTTERS MARSH REHABILITATION AND ENHANCEMENT

POOL 13, MISSISSIPPI RIVER MILES 522.5 THROUGH 526.0
CARROLL AND WHITESIDE COUNTIES, ILLINOIS

APPENDIX E
HYDROLOGY AND HYDRAULICS

GENERAL

The Potters Marsh Environmental Management Program (EMP) project is located on the Illinois side of the Mississippi River between River Miles (RM) 522.5 and 526.0. The nearest community is Thomson, Illinois.

CLIMATE

The climate in northwestern Illinois is characterized by extreme temperatures and moderate precipitation. The National Weather Service operates a weather station in Mt. Carroll, Illinois, approximately 12 miles to the northeast. Temperatures range from an average monthly maximum of 86 degrees Fahrenheit (F) in July to an average monthly minimum of 10 degrees F in January. The average daily maximum temperature is 63 degrees F and the average daily minimum temperature is 42 degrees F. The average annual precipitation is 34.7 inches, and the average annual snowfall is 33.71 inches. Table E-1 below lists the average monthly precipitation and snowfall amounts at the Mt. Carroll station.

TABLE E-1

Mt. Carroll, Illinois
Average Monthly Precipitation and Snowfall

Month	Precip. (Inches)	Snowfall (Inches)	Month	Precip. (Inches)	Snowfall (Inches)
January	1.50	9.01	July	3.62	-
February	1.29	6.45	August	3.96	-
March	2.27	6.07	September	3.89	-
April	3.16	1.65	October	2.55	0.25
May	4.07	0.07	November	2.35	2.36
June	4.47	-	December	1.81	7.64

FLOOD PROFILES

Mississippi River elevation frequency relationships are based on the publication entitled, *Upper Mississippi River Water Surface Profiles, River Mile 0.0 to River Mile 847.5*. This report was published in 1979. These profiles were developed under the guidance of the Technical Flood Plain Management Task Force of the Upper Mississippi River Basin Commission. Bulletin 17B was used to establish discharge frequency relationships at gaging stations along the Mississippi River. Rating curves and extensions were used to establish elevation frequency relationships at these gages. Profiles between gaging stations parallel observed and previously developed design profiles. The profiles were developed as a result of a concerted effort by many State and Federal agencies for the implementation of existing floodplain management programs along all reaches of the Upper Mississippi River. Flood elevations for the project are listed below in table E-2 and are shown graphically on plate E-1.

TABLE E-2

Elevation-Frequency
Mississippi River - RM 523 to RM 527

Frequency (yrs)	RM 523 Elevation	RM 527 Elevation
2	584.2	584.4
5	587.4	587.6
10	589.5	589.7
25	591.6	591.8
50	593.2	593.4
100	594.3	594.5
200	595.5	595.7
500	596.8	597.0

ELEVATION-DURATION PROFILES

Elevation-duration profiles have been developed for the Mississippi River by the Rock Island District Hydraulics Branch. Duration percentages signify the percentage of time that the elevation is equalled or exceeded. A comparison of elevations between the lower (RM 522.5) and upper (RM 526.0) boundaries of the project for different durations are shown below in table E-3. The same values are shown graphically on plate E-2.

TABLE E-3

Elevation Duration

Duration - Percent of Time Equalled or Exceeded	RM 522.5 Elevation	RM 526.0 Elevation
1	587.10	587.77
2	585.16	585.90
5	583.70	584.48
10	583.53	584.14
20	583.35	583.83
30	583.18	583.53
50	583.05	583.25
70	582.86	583.03

A different way to present the same data at one point is the elevation duration curve. The curve for river mile 525.0 is shown on plate E-4.

EXISTING HYDRAULICS

Lock and Dam 13 is located on the Mississippi River at RM 522.5, 1 mile downstream of the lower end of the Potters Marsh EMP project. Dam 13 is used to maintain a pool elevation of 583.0 feet MSL. The plan under which the dam is operated allows high water levels due to flood events to recede until an authorized pool elevation is reached, then maintain that elevation for lower flows. The limits under which the dam is normally operated are between 582.6 and 583.1 MSL. During the winter season, the pool is operated between limits of 582.0 and 583.0 MSL.

PROPOSED PROJECT HYDRAULICS

The project includes backwater dredging in Potters Slough upstream of the causeway and at the lower end, construction of a confined placement site (CPS) on the island for disposal of the dredged material, and excavation of potholes on the island. The plan will not affect the general existing hydraulics of the pool. However, the dredging will change flow velocities in the slough. The CPS may change flow distribution during island flood inundation.

Alternatives which were investigated which could impact the study area hydraulically but which were not included as part of the proposed project include a closure dike with a water control structure at the upstream end of Potters Slough, and raising the existing causeway with the installation of additional culverts with gates. A discussion of these alternatives is included in the following section.

ANALYSIS OF HYDRAULICS

The purpose of this analysis is to determine the hydraulic effects of the project features upon the surrounding area. An HEC-2 backwater analysis was performed on Potters Slough to determine the effects of dredging upon flow and flow velocity. The HEC-2 analysis was used in a trial-and-error manner to find flows through the backwater area which resulted in slopes which were consistent with the elevation duration profiles on plate E-2. These slopes are somewhat greater than the steady state flood profiles on plate E-1, therefore resulting in higher discharges in the slough. This is considered a conservative assumption since greater hydraulic impacts including velocities and sediment transport is indicated. This model is only applicable for conditions where the causeway is not overtopped and the island is not inundated.

The model showed that the dredging will not change flow in Potters Slough for the river stage conditions discussed above. However, the flow velocities will be lowered somewhat due to the increased flow area. Table E-4 shows flow and velocities in Potters Slough for different conditions and locations.

TABLE E-4

Potters Slough Flow

% of Time Equalled or Exceeded	Lower End Slough Elev.	Upper End Slough Elev.	Flow (cfs)	Average Channel Velocity (fps) Upstream of Causeway Exist.	Upstream of Causeway Proj.	Culverts in Causeway Exist.	Culverts in Causeway Proj.	Downstream of Causeway Exist.	Downstream of Causeway Proj.	Lower End of Slough Exist.	Lower End of Slough Proj.
70	582.94	583.03	30	<.05	.05	1.50	1.50	.05	.05	.15	.05
50	583.10	583.25	35	<.05	.05	1.50	1.50	.05	.05	.15	.05
30	583.27	583.53	50	<.05	.05	1.90	1.90	.05	.05	.20	.10
20	583.44	583.83	55	<.05	.05	2.10	2.10	.05	.05	.20	.10
10	583.63	584.14	65	<.05	.05	2.30	2.30	.05	.05	.20	.10
5	583.88	584.48	70	<.05	.05	2.40	2.40	.05	.05	.20	.10
2	585.25	585.90	75	<.05	.05	1.60	1.60	.05	.05	.10	.10

The effects of dredging and CPS construction during periods of high water also were evaluated by using a conveyance analysis. One Mississippi River cross section was chosen as being representative of the study area. It was divided into five parts: the right overbank, channel, left overbank, island, and slough. The plotted cross section is shown on plate E-3. The flow for different frequency floods was divided into each of the five parts by estimating each section's conveyance. Once flow in each part is known, then velocity can be calculated. Table E-5 shows flow and velocity on the island and in Potters Slough for different frequency floods for existing and project conditions.

TABLE E-5

Flood Flows
Island and Slough Flows and Velocities

		Flow (cfs)				Velocity			
Frequency		Island		Slough		Island		Slough	
(yrs)	Total	Exist.	Proj.	Exist.	Proj.	Exist.	Proj.	Exist.	Proj.
10	205,000	5,600	1,900	4,000	4,800	0.4	0.2	0.9	1.0
50	266,000	11,400	3,800	6,300	7,200	0.4	0.3	0.9	1.0
100	291,000	13,500	4,500	7,200	8,100	0.5	0.3	0.9	1.0

As shown in the above table, flow in the slough will increase due to project construction. This will occur only during times of flooding when the causeway is overtopped. Construction of the CPS will allow less flow on the island and more on either side of the island. For lower flow (causeway not overtopped) flow down the slough will not change because there will be no flow on the island for the CPS to affect.

Also as shown in table E-5, flow velocities on the island will be decreased due to CPS construction. This will occur on either side of the CPS. The CPS also will create a transition zone where flow velocities will be decreased. Using some "rule of thumb" approximations, this zone will extend from a point 1,000 feet upstream of the CPS, taper out to the edges of the CPS and then taper down to a point 3,000 feet downstream of the CPS. This zone should be located entirely on the island and should not affect Potters Slough.

One alternative which was investigated but not selected was the closure dike with a water control structure at the upstream end of Potters Slough. The goal of this alternative was to reduce sedimentation in Potters Slough. Another alternative which was investigated but not selected was raising the existing causeway and adding gated culverts in addition to the existing culverts. The goal of this alternative was to reduce sedimentation in Potters Slough and provide for the capability to allow more flow down Potters Slough principally for water quality purposes. Neither of these alternatives would be very effective. The dikes could only be built up to the elevation of the surrounding ground, and therefore would be very similar to the existing causeway. Control of the flow down Potters Slough would not be significantly changed. Sedimentation occurs mainly during causeway overtopping flood events, and, therefore, sedimentation would not be reduced significantly as water would just flow around the causeway or closure dikes. The additional culverts would allow more water to flow in the slough during periods of low flow. This would not change sedimentation patterns as sedimentation occurs mainly during flood events.

EFFECT OF CPS ON FLOOD HEIGHTS

The effects were evaluated of CPS construction upon flood heights. The State of Illinois floodplain regulations require that any construction in the floodplain not cause an increase in flood elevation of more than 0.1 foot for a flood of any recurrence interval.

The flood height impacts for this project were estimated using the same technique that was used to estimate velocities during flood flows described previously. This included a comparison of areas of conveyance for pre- and post-construction conditions. The flood elevation increases were approximated by calculating the increases in velocity head. This was done for the 5-, 10-, 50 and 100-year floods. The results are shown in table E-6.

The CPS blocks out a very small portion of the floodplain and, as shown above, causes no increase in flood profile elevations for all cases investigated. This was calculated based on the conservation of flow and energy and confirms that CPS construction does not cause an increase in flood elevations and that no further analysis is required.

TABLE E-6

Flood Elevation Increases Due to CPS Construction

Frequency	Flow (cfs)	Elevation	Flow Area (ft^2) w/o CPS	Flow Area (ft^2) with CPS	Reduction in Area Due to CPS	Average Velocity (fps) w/o CPS	Average Velocity (fps) with CPS	Flood Elev Increase (feet)
10-yr	205,000	589.6	209,000	203,000	2.9%	0.98	1.01	0.00
50-yr	266,000	593.3	281,000	269,000	4.3%	0.95	0.99	0.00
100-yr	291,000	594.4	303,000	289,000	4.6%	0.96	1.00	0.00

SEDIMENTATION

Historic sedimentation rates for the project are 0.5 inch/year above the causeway, virtually no sedimentation in the middle portion of the slough, and 0.25 inch/year in the lower portion of the slough, which is a common occurrence for sloughs. Flow velocities decrease after water passes the entrance of the slough, causing deposition in the upper end of the slough. In the lower slough area. The river flow is expanding and velocities decrease, also causing sediment deposition. It is also common to have a higher deposition rate in the upstream end versus the lower end. The causeway can be partially attributed to this happening by slowing the water down in the upper end. This would hold true more for the lower frequency floods than for the floods of greater magnitude because the effect of the causeway upon flow would lessen as water elevations rise.

The sedimentation in Potters Slough has probably occurred principally during periods of flooding and not gradually over time. The greater the flow velocity, the greater the water's ability to carry sediment. Flow velocities in the river in general during periods when the causeway is not overtopped are low and result in very little sediment transport compared to higher flows when the causeway is overtopped.

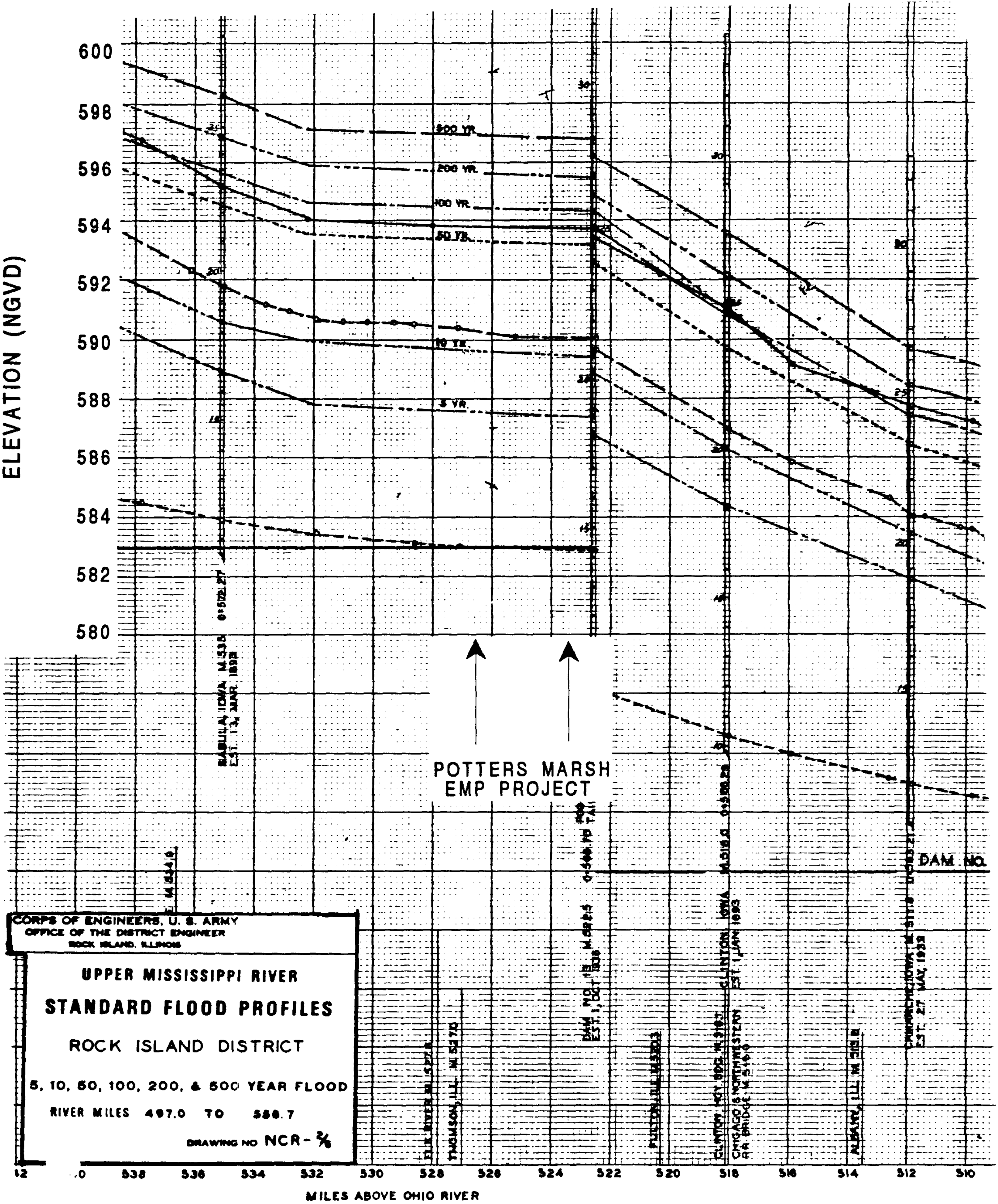
ELEVATION (NGVD)
600
598
596
594
592
590
588
586
584
582
580
500 YR.
200 YR.
100 YR.
50 YR.
10 YR.
5 YR.
POTTERS MARSH
EMP PROJECT
DAM NO.
CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
ROCK ISLAND, ILLINOIS
UPPER MISSISSIPPI RIVER
STANDARD FLOOD PROFILES
ROCK ISLAND DISTRICT
5, 10, 50, 100, 200, & 500 YEAR FLOOD
RIVER MILES 497.0 TO 586.7
DRAWING NO NCR-2/6
MILES ABOVE OHIO RIVER
538
536
534
532
530
528
526
524
522
520
518
516
514
512
510

PLATE E-1

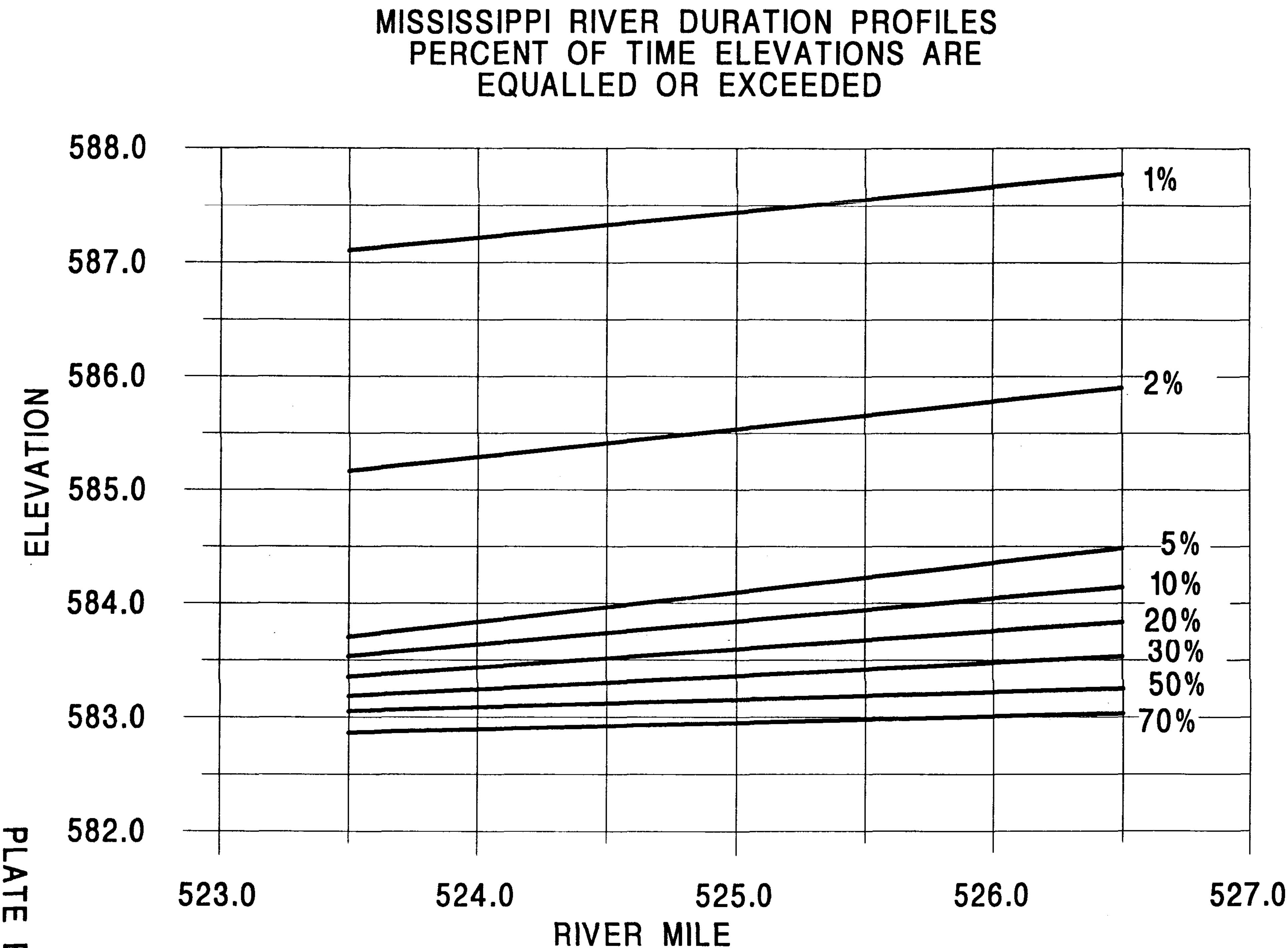
MISSISSIPPI RIVER DURATION PROFILES
PERCENT OF TIME ELEVATIONS ARE
EQUALLED OR EXCEEDED
ELEVATION
588.0
587.0
586.0
585.0
584.0
583.0
582.0
1%
2%
5%
10%
20%
30%
50%
70%
523.0
524.0
525.0
526.0
527.0
RIVER MILE

PLATE E-2

POTTERS MARSH EMP
CROSS SECTION
MISSISSIPPI RIVER AT MILE 526.0

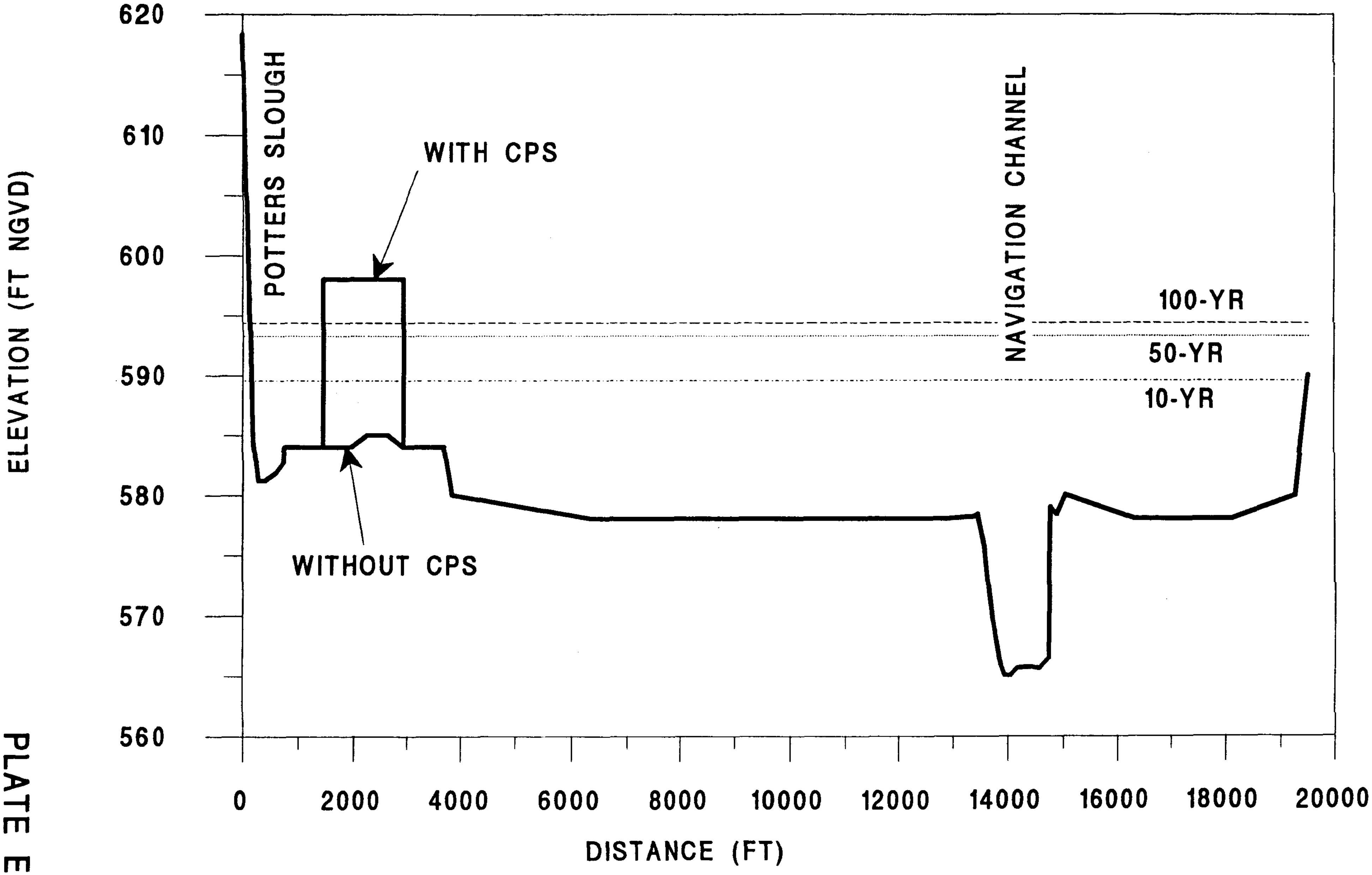

PLATE E-3

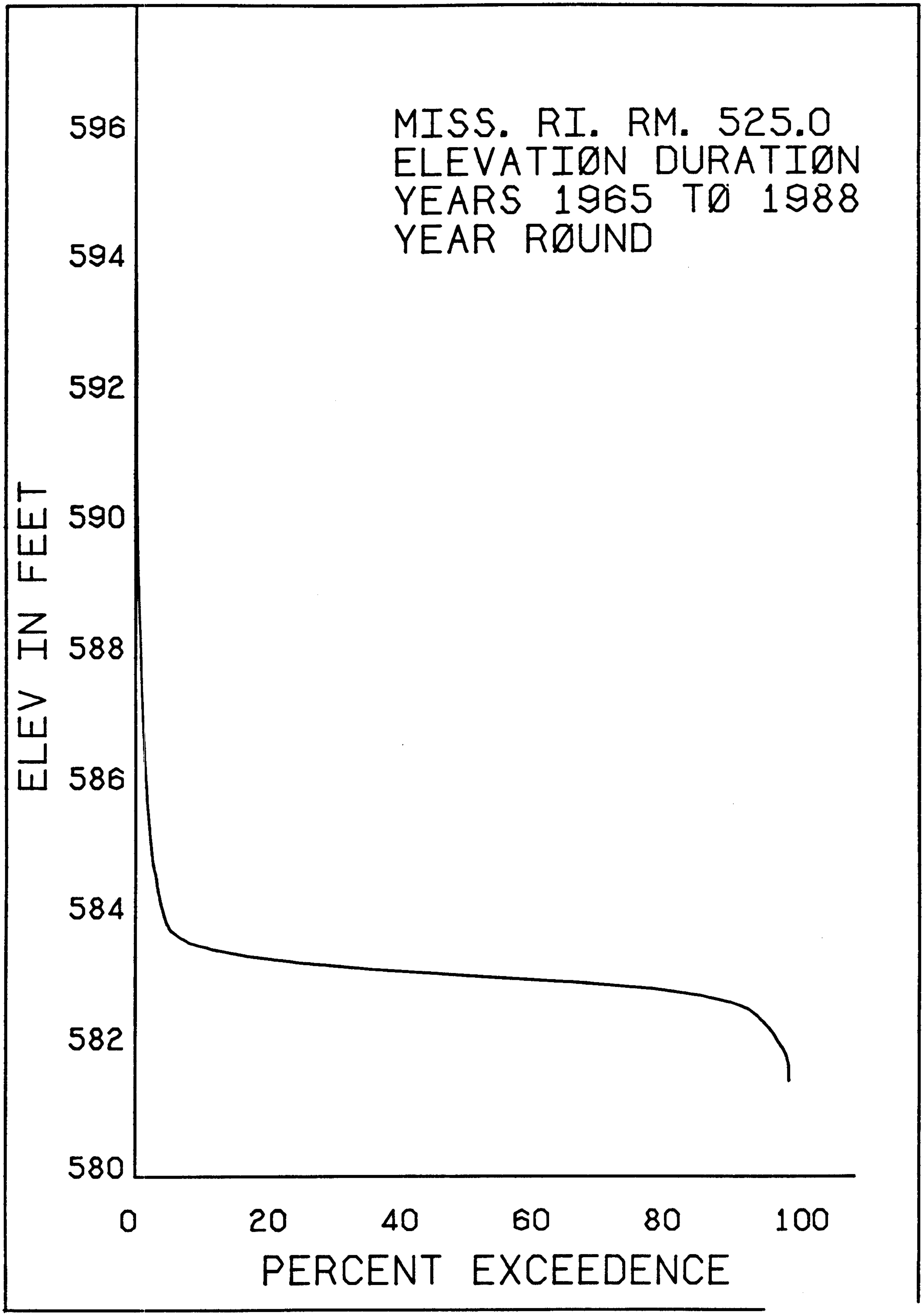
MISS. RI. RM. 525.0
ELEVATIØN DURATIØN
YEARS 1965 TØ 1988
YEAR RØUND
ELEV IN FEET
596
594
592
590
588
586
584
582
580
0
20
40
60
80
100
PERCENT EXCEEDENCE

PLATE E-4

WATER QUALITY

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APPENDIX F
WATER QUALITY

INTRODUCTION

Water quality within Potters Marsh is primarily impacted by the deposition of sediment and the subsequent establishment of luxuriant aquatic vascular plant beds. The sedimentation process has occurred over several decades following the construction of Lock and Dam 13 and the creation of the backwater slough. The fine-grained sediments found throughout the majority of the slough enhance the establishment of rooted aquatic vegetation to the point where the shallow water is essentially choked with emergent and submergent plants. In addition, documented winter fish kills have occurred within the Potters Marsh complex. Proposed dredging operations for this project are designed to create deep water habitat for fish winter refuge, improve fish movement to and from the area, and reduce the extent of aquatic vascular plant beds.

In order to predict the impact of proposed construction activities on water quality, water column and sediment samples were collected at several locations representative of the construction area. In addition, as one objective of the proposed project was to improve water quality, a single monitoring station was established which will enable comparison of pre- and post-project water quality data.

METHODS

EXISTING CONDITIONS

Water and sediment samples were collected by ED-HQ personnel on February 7, 1991, for the purpose of grain size and elutriate analysis. Sediment samples were taken with a 36-inch, plastic-lined, core sampler at sites P-89-1, P-89-2, and P-89-5 as shown on plate 8 of the main report. Duplicate grain size and elutriate samples were collected at site P-89-5. To obtain a representative sample at each station, at least three subsamples were collected at a given location. Each subsample was placed in a container and mixed to form a homogeneous composite sample. The composite was then placed into appropriate sample bottles and temporarily stored on ice.

Grain size analyses were performed by Corps of Engineers Geotechnical Branch personnel according to U.S. Army Corps of Engineers (1986). Results are expressed as the percentage of material passing a number 230 sieve (<0.062 um).

Water samples for ambient water column analysis and water for the elutriate test were collected from the downstream side of the causeway near the surface because water was of insufficient depth at other locations. Each sample was poured into an appropriate container, preserved as necessary, and placed on ice.

All samples requiring chemical analysis were shipped on ice to Applied Research and Development Laboratory, Inc., Mt. Vernon, Illinois, for analysis. The elutriate test was used to simulate river conditions that would occur during dredging. The test consisted of combining 50 ml of a wet, well-mixed sediment sample and 200 ml of processed water collected from the lake. The mixture was shaked for 30 minutes and allowed to settle. One portion of the mixture was allowed to settle for 4 hours and a second portion was allowed to settle for 48 hours. The supernatant was drawn off and analyzed. Ambient water and elutriate analyses were performed according to American Public Health Association, *et al.* (1985), or U.S. Environmental Protection Agency (1979).

BASELINE MONITORING

On April 13, 1990, long-term monitoring was initiated at one location within Potters Marsh. Samples were collected approximately every 2 weeks at this location through September 15, 1990. Biweekly sampling was resumed in June 1991 and will continue through the design phase. Water samples were collected just below the surface at site W-M525.1Y, as shown on plate 18 of the main report, using a Kemmerer-type sampler. A total of 11 separate sampling trips have been completed to date.

Several parameters, including water temperature, Secchi disk depth, water depth, dissolved oxygen, pH, specific conductance, and total alkalinity, were determined in the field. Additional parameters were analyzed in the laboratory by collecting representative water samples. These samples were placed in appropriate bottles, preserved as necessary, and placed on ice. All laboratory analyses were performed according to American Public Health Association, *et al.* (1985) or U.S. Environmental Protection Agency (1979).

Prior to contract award, all laboratory facilities were inspected by Government personnel to ensure that contractor staff and equipment were adequate to perform all work. Government personnel also accompanied the contractor in the field during the first collection trip to observe all field techniques and to clarify sampling locations. Quality control samples were provided to the contractor periodically throughout the testing period, and results were compared to known values as a check on laboratory accuracy. A field duplicate was collected during each collection trip and results were compared as a check of field/laboratory precision.

RESULTS AND DISCUSSION

EXISTING CONDITIONS

Results of all sediment and elutriate analyses are shown in tables F-1 and F-2. From table F-1, it can be seen that all samples consisted of extremely fine-grained material, with 36% to 76% of the material passing a number 230 sieve (<0.062 um). This is quite common of backwater areas along the Mississippi River. The tremendous surface area associated with fine-grained material often results in various contaminants adhering to the surface of the sediment particles. To determine the bioavailability of these contaminants, the elutriate test was used.

Table F-2 shows the results of the elutriate test. From the results, it can be seen that concentrations of most parameters were below Illinois General Use water quality standards. An isolated exception to this was observed at site P-89-2 where copper exceeded the standard in the ambient water sample. In addition, there did not appear to be any measurable difference between elutriate samples which were allowed to settle for 4 hours and those allowed to settle for 48 hours.

BASELINE MONITORING

Table F-3 lists the results of baseline monitoring conducted during 1990. With less than two field seasons of data available, definite trends have not been identified; however, two observations are noteworthy. Early in the spring, pH values and chlorophyll concentrations were very high and dissolved oxygen concentrations were near 100% of saturation. Beginning around the middle of July, dissolved oxygen concentrations fell below 4.0 mg/l and remained there through the end of September. No other water quality problems have been observed.

CONCLUSIONS

Analysis of the composition of the bottom material within the project site indicates that it is fine-grained and contains a significant amount of peat. This is reflected in the results of the sediment BOD and TOC tests.

TABLE F-1

Results of Sediment Analysis
(mg/l Unless Stated Otherwise)
February 7, 1991

Parameter	Location			
	P-89-2	P-89-5	P-89-5(dup)	P-90-1
Total Volatile Solids	17	34	30	5.3
Total Solids	30	20	20	57
Total Organic Carbon	30,700	7,290	50,400	9,480
Biochemical Oxygen Demand	1,300	410	390	430
Grain Size	51.2	55.3	76.0	36.4

TABLE F-2

Ambient Water and Elutriate Results
(mg/l Unless Stated Otherwise)
February 7, 1991

	LOCATION									
Parameter	P-89-2 (Ambient Water)	P-89-2 (Elutriate)	P-89-5 (Elutriate)	P-89-5(dup) (Elutriate)	P-90-1 (Elutriate)	P-89-2 (Elutriate)	P-89-5 (Elutriate)	P-89-5(dup) (Elutriate)	P-90-1 (Elutriate)	IL. St. Standard
Time	0905	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Water Temperature (C)	1.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ice Thickness (inches)	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ice Condition	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Water Depth (inches)	12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sp. Cond. (umhos/cm)	156	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dissolved Oxygen	2.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.0(5.0)*
Settling Time (hours)	N/A	4	4	4	4	48	48	48	48	N/A
Arsenic	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	1.0
Barium	0.055	0.48	0.29	0.37	0.32	0.25	0.31	0.25	0.37	5.0
Cadmium	<0.005	<0.005	0.011	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.05
Chromium	0.031	<0.010	0.025	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	-
Copper	<0.025	<0.025	<0.025	<0.025	<0.025	<0.010	<0.025	<0.025	<0.025	0.02
Lead	0.40	<0.0020	<0.0020	<0.0020	<0.0020	<0.025	<0.0020	<0.0020	<0.0020	0.1
Mercury	0.00031	0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00032	0.0005
Nickel	<0.040	0.75	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	1.0
Zinc	<0.020	0.94	0.090	0.074	0.073	0.075	0.079	0.053	0.089	1.0
pH (Units)	7.32	6.6	6.8	6.9	6.5	6.6	6.8	6.8	6.8	-
Ammonia Nitrogen	1.5	1.8	0.95	0.73	1.6	1.9	0.81	0.73	1.3	1.5(15)**
Tot Volatile Solids	120	91	91	26	93	82	43	66	19	-
Total Suspended Solids	8.3	15	<15	<15	<15	<15	<15	<15	<15	-
BOD	14	15	26	15	11	8.8	17	14	10	-
Oil and Grease	<7.0	<18	<7.0	<7.0	22	8.0	<7.0	<7.0	9.8	-
Tot Organic Carbon	8.8	10	12	9.3	14	5.0	7.4	8.1	7.8	-
Hardness (as CaCo3)	134	-	-	-	-	-	-	-	-	-

* Illinois EPA, 1988.

** Ammonia nitrogen shall never exceed 15 mg/l. If ammonia nitrogen is less than 15 mg/l and greater than or equal to 1.5 mg/l, then un-ionized ammonia nitrogen shall not exceed 0.04 mg/l.

TABLE F-3

Baseline Monitoring Results at Station W-M525.1Y

PARAMETER	DATES										
Date	41390	50890	52590	60890	63090	72090	80490	81890	90190	91590	92990
Time	1830	1545	1600	1525	1600	1520	1415	1500	1440	1410	1415
Air Temp. (Deg. C)	6	25	18	26	37	30	29	35	32	25	18
Water Temp. (Deg. C)	8	24	18	25	31	24	23	28	23	18	15
Depth (M)	0.36	0.36	0.36	0.36	0.62	–	–	–	–	–	–
Sp. Cond. (umhos/cm @ 25 Deg. C)	300	283	324	288	298	370	304	311	338	388	391
Secchi Disc Depth (M)	0.36	–	0.36	–	–	–	–	–	–	–	–
Dissolved Oxygen (mg/l)	14	14.4	7.4	8.7	7.2	0.9	0.7	6	3.9	0.7	1.4
pH (Units)	8.9	9.2	7.7	8	7.6	7	7	7.4	7	7.2	7.2
Turbidity (NTU)	57	31	50	13	6	8	15	4	5	28	9
Wave Heigth (IN)	2-4	–	0	–	0	0	0-1	<1	–	–	–
Suspended Solids (mg/l)	68	46	54	16	6	10	22	14	15	32	14
Total Alkalinity (mg/l as CaCo3)	108	100	124	140	112	156	144	136	144	162	156
Chlorophyll a (ug/l)	171	96	138	25	11	20	20	50	11	48	33
Chlorophyll b (ug/l)	<1	<1	6	2	11	21	10	13	1	9	8
Chlorophyll c (ug/l)	23	13	21	4	3	<1	2	3	<1	6	4
Corrected Chlorophyll a (ug/l)	91	30	81	10	8	17	15	14	4	37	26
Phaeophytin a	125	106	89	25	6	4	8	60	11	17	10

While the results of the grain size analyses indicate that much of the sediment is fine-grained, there were no contaminate concentrations of concern observed in the elutriate tests. Thus, the potential impacts to aquatic life during the construction phase appear to be minimal. Also, the settling time, within the CDF, required to achieve applicable water quality standards would be on the order of 4 hours or less. Baseline monitoring indicates that periodic dissolved oxygen problems do exist within the project area, and evidence indicates this is related to abundant primary productivity with subsequent decomposition of the organic material.

REFERENCES

American Public Health Association, American Water Works Association, and Water Pollution Control Federation. 1985. *Standard Methods for the Examination of Water and Wastewater*. 16th Edition, APHA, Washington, D.C. 1,268 pp.

Illinois Environmental Protection Agency. 1988. *Illinois Water Quality Report, 1986-1987*. Illinois Environmental Protection Agency, Springfield, Illinois. 305 pp.

U.S. Army Corps of Engineers. 1986. EM 1110-2-1906, *Laboratory Soils Testing, Appendix V, Grain Size Analysis*.

1U.S. Army Corps of Engineers. 1981. *Procedures for Handling and Chemical Analysis of Sediment and Water Samples*. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi.

U.S. Environmental Protection Agency. 1979. *Methods for Chemical Analysis of Water and Wastes*. U.S. Environmental Protection Agency, Cincinnati, Ohio.

GEOTECHNICAL CONSIDERATIONS

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APPENDIX G
GEOTECHNICAL CONSIDERATIONS

PURPOSE AND SCOPE

This appendix presents the general geology and specific geotechnical analysis pertinent to the project. The geological information contained in this report has been obtained and condensed from the Illinois Geological Survey reports, bulletins, and circulars and from a review of the Carroll County Soil Survey. The geotechnical information has been determined from soil borings obtained by the Rock Island District's Geotechnical Branch who also performed a laboratory analysis and an interpretation.

An outline of the dredge cuts in the plan view can be seen on plates 9 and 10 of the main report. The width of the cut is 50 feet with 1 vertical (V) on 2 horizontal (H) side slopes. The depth of the cut is 6.5 to 8.5 feet. The total length of the dredge cuts is about 23,000 feet, with total dredge volume of 440,000 cubic yards. The hydraulically dredged material will be pumped to a Confined Placement Site (CPS), which will be constructed primarily of sand. The 6,000-foot dike will be 14 feet high with 1V on 3H slopes and a 10-foot top width. After completion of dredging, the CPS will be converted into a managed marsh land unit; this will require a well to provide water control.

LOCATION

The Potters Marsh Environmental Management project is located in western Carroll and Whiteside Counties, Illinois, between Mississippi River Miles (RM) 522.5 and 526.0. The 2,325-acre site which comprises Potters Marsh is just north of Thomson, Illinois, in Pool 13 and was created in 1938 by the construction of Lock and Dam 13 at Fulton, Illinois (RM 522.5).

PHYSIOGRAPHY

The project area is situated within the Dissected Till Plains Section of the Central Lowland Province and is located in the Mississippi alluvial river valley. The project area has little topographic relief and consists of shallow backwaters, bottom land, and islands which are subjected to permanent high water tables and annual flooding.

GEOLOGY

The region around the project area is situated near the bluffs of the Mississippi Valley at the western edge of the Rock River Hill Country, a region of highly undulating glaciated uplands. This area was covered by the Illinoian glacier during the Pleistocene Epoch. The bedrock consists of about 2,300 feet of Paleozoic limestone, dolomite, sandstone, and shale ranging in age from late Cambrian to middle Silurian. These marine sedimentary rocks were laid down layer by layer in the ancient seas that covered this area from time to time. These layers are sometimes separated by thin (1 to 3 inch) layers of bentonite clay. The Plumb River Fault Zone lies to the north as does the southern edge of the "Driftless Area" (a large area in northwestern Illinois and southwestern Wisconsin that apparently was missed by the Pleistocene glaciers).

The Mississippi River Valley was initially filled with glacial outwash sands and gravels deposited in valley trains and alluvial terraces which formed as the glacial meltwater volume decreased and allowed deposition. These deposits become increasingly coarse-grained with depth, which, in some areas, exceeds 100 feet. Upstream of the Rock River, these deposits consist primarily of igneous and metamorphic material which originated in the Canadian Shield area to the north. These valley train deposits are assigned to the Mackinaw Member of the Henry Formation. Post glacial reworking of the upper portion of these deposits plus additional upland erosion has left the modern valley filled with relatively more fine-grained gravels, sands, and silts and clays assigned to the Cahokia Alluvium. This unit of floodplain and channel deposits consists largely of silt, clay, and clayey sand, with wood and shell fragments. Lenses of sand and gravel are locally common but generally have a high silt content. The degree of sorting varies but is generally poor. Thickness of the unit varies, but the present Mississippi River is believed to erode as much as 50 feet in the active channels during flood stages. Prior to the completion of Lock and Dam 13 during the 1930's, the area of Potters Marsh was a heavily wooded abandoned meander which probably did not carry any appreciable flow except during high water; however, this flow was probably not sufficient to transport material larger than medium-sized sand. Since the completion of Lock and Dam 13, it has essentially been a backwater deposition area for silts, sands, and clays.

SUBSURFACE EXPLORATIONS

An extensive subsurface exploration was conducted to determine the composition and engineering characteristics of the soils.

During January 1989, borings P-89-1 through P-89-9 were completed. These were off-shore hand augers performed to identify the characteristics for dredged disposal. The top 2 feet of borings P-89-2, P-89-7, and P-89-8 consisted of OH (dark gray organic fat clay) with average water contents of 90 percent; the next 2 to 4 feet consisted of CL or CH (fat clay) with traces of organics and sand; and the bottom consisted of SP (fine sand). The top 3 to 4 feet of borings P-89-3 through P-89-6 consisted of black clayey peat with water contents ranging from 153 percent to 403 percent. This was underlain by sand with a thin layer of clay in between. Boring P-89-1 was identified as CH, fat clay, and fat clay with sand. Boring P-89-9 had 3 feet of sandy lean clay underlain by SC (clayey sand).

Borings P-89-10 through P-89-12 were hand augers performed in March 1989 to evaluate the suitability of materials for construction of the CPS. All three borings are SP-SC (medium to fine sand) overlain by 1 to 3 feet of CL (lean clay or sandy lean clay).

In January 1990, three off-shore hand augers were completed (P-90-1, P-90-2, P-90-3). All three borings revealed SP-SC (clayey fine sand) at the bottom of the boring. The top 3 to 5 feet of borings P-90-1 and P-90-2 consisted of CL (sandy lean clay). Boring P-90-3 had a thin (1 foot) top layer of clayey peat.

Additional off-shore hand augers (P-91-1 through P-91-7) were performed in January and February 1991. These borings show a mix of CL and CH (sandy lean to fat clay) and SP and SC (clayey sand). The sand is in thin layers and was most likely to have been deposited during flood events.

Interpretation of the soil boring showed that sedimentation was generally limited to both ends of the project site. The center of the project site where peat was encountered showed slight to no sedimentation. Peat is a highly organic unconsolidated deposit which is formed by partial decomposition of vegetable matter in a water-saturated, low oxygen environment, such as a bog.

For specific soil information and locations of the borings, see plates 6 through 8 of the main report.

Additional borings will be completed after the ground freezes. One deep boring will be completed for water well design. Several borings will be performed at the CPS borrow site.

GROUNDWATER

The medium to fine sands (and gravels with depth) that underlie the project site provide a continuous supply of groundwater. Based on interpretations of soil borings, the groundwater level is approximately equal to the pool elevation and is subject to seasonal fluctuations. Because the groundwater is near the surface, the proposed potholes will fill with water.

WATER SUPPLY WELL

Utilization of a water well for operation of a managed marsh land unit was investigated. The parameters used for calculation were obtained from borings completed at Lock and Dam 13 and from the report entitled, *Feasibility Report for Hydropower, Lock and Dam 13, Mississippi River.*

The permeability according to d_{10} grain size curves was estimated at 1000×10^{-4} cm/sec (EM-1110-2-1913). The above-mentioned report estimated the permeability to be 610×10^{-4} cm/sec. To be conservative, a permeability of 240×10^{-4} cm/sec was used. The depth to bedrock was estimated to be 100 feet (elevation 475 MSL). The radius of influence is expected to reach the river (approximately 1,400 feet). The needed pumping rate is 450 gpm (500 gpm was used for calculations). A 12-inch-diameter well will be needed to provide room for the pump and cooling requirements.

Using the above assumptions and assuming a fully penetrating well, the well will provide 500 gpm with only 20 feet of drawdown. Plate G-1 shows the calculations. A deep boring will be completed to verify the assumptions for well design prior to completion of plans and specifications. Because of wet conditions, this boring will not be completed until after the ground freezes.

SLOPE STABILITY

The proposed 14-foot-high dike for the CPS was analyzed for slope stability. The slopes will be constructed at 1V to 3H with a top width of 10 feet. The soil used for construction will come from adjacent borrow with a 20-foot undisturbed zone between the toe of the dike and the borrow ditch. The borrow material consists of 1 to 3 feet of CL (lean to sandy lean clay) underlain by SC (clayey sand), SP (medium to fine sand), and SP-SC (clayey fine to medium sand). The clay content of the SC and SP-SC materials is 10 to 20 percent. The procedure used was the infinite slope method of analysis.

The first scenario considered was End of Construction with no seepage. A friction angle of 34 degrees was used for analysis. This friction angle was used as an average friction angle of the materials to be used

(37 degrees for SP, 31 degrees for SC). This is for a medium to dense sand which, based on Rock Island District historic experience, can be achieved during construction. This analysis showed the factor of safety to be 2.02.

The effect that steady stage seepage would have on the factor of safety also was investigated. This condition has a factor of safety of 1.01. However, through-seepage is not expected to be a problem. Typical permeabilities for the borrow material range from 4×10^{-4} cm/sec to 2.5×10^{-7} cm/sec. The material to be dredged consists of 62 percent clay. It is assumed that the sand dike will become plugged. Rock Island District personnel have witnessed this "plugging" and subsequent nearly complete elimination of through-seepage on our mainline Mississippi River sand levees during flood events. This sealing has occurred at sediment loads much lower than are anticipated to occur for this project.

The CPS was designed so that water quality can be met with 1 to 2 feet of ponded water within the containment area. Therefore, the operating strategy to be used for dredging will pond only 1 to 2 feet of water above the settling soil. Provided the weir is raised in 1-foot increments, maximum water depth will be limited to 2 feet.

The minimum factor of safety required is 1.3. For the above stated reasons, it is concluded that the actual factor of safety is between 2.02 and 1.01 and should be greater than 1.3. Therefore, no slope stability problems are anticipated. The slope stability analysis is shown on plate G-2.

After the dredged material within the CPS has settled for 1 year, the perimeter dike will be degraded so that it remains 3 to 5 feet higher than the interior materials. This excess material from the degrading will be used to flatten the landside slopes to about 1V on 4H, thereby increasing the factor of safety considerably for operation of the managed marshland.

The stability of the dredge cuts was also considered. The dredge cuts will have a 50-foot bottom width with 1V on 2H side slopes. The majority of the material to be dredged is sandy lean clay or lean clay. This material should stand up with little to no slumping. Some of the fat clay that is to be dredged had moisture contents that were very close to or over the liquid limit. Although the factor of safety is 1.5 (plate G-3) this material could possibly slump while it is being dredged. To avoid this, the surrounding material should be disturbed as little as possible.

The proposed potholes will be excavated to a depth of 4 feet or blasted to a depth of 5 feet. Width and length of the excavated potholes will vary from site to site. The blasted potholes will be approximately 300 feet long by 50 feet wide. No borings will be needed for construction of pot-holes. Knowing the general type of material to be excavated/blasted has worked satisfactorily at other EMP projects, e.g., Big Timber.

BORROW MATERIAL AND DIKE CONSTRUCTION

Material for construction of the CPS dike will be obtained from adjacent borrow from the interior of the dike. This will provide a economical borrow site as well as provide more room for dredge disposal. A minimum 20-foot zone between the toe of the dike and the borrow ditch will remain relatively undisturbed and in place.

Based on information obtained from borings P-89-10 through P-89-12, the borrow material will consist of a minimum of 80 percent medium to fine sand. Considering the high sand content, the dike can be constructed in relatively high lifts of 3 to 5 feet uncompacted. Additional borings will be completed to verify the material for construction.

Preparation of the foundation of the dike and borrow site must include stripping to a depth of 6 inches. All tap roots, lateral roots, and trees within the work area will be removed to a depth of 3 feet. It is possible that soft areas within the foundation will be encountered; however, this material will be displaced by the weight of the dike.

Subject: Potter's Marsh EMP water well analysis | Date: 29 May 91
Computed by: Gene Rand | Checked by: [signature] | Sheet 1 of 1

Assumptions:

1. Water table aquifer - at surface
2. Radius of influence will reach the river - 1400 ft
3. Depth to bedrock 100 ft
4. Permeability 240×10^{-4} cm/sec = 510 gpd/ft^2
5. Pumping rate 500 gpm

$$Q = \frac{k\,(H^2 - h_w^2)}{458 \ln (R_o/R_w)} \; *$$

k = Permeability - gpd/ft^2
H = Depth from static water level to bedrock - ft
h_w = Depth from drawdown level to bedrock - ft
R_o = Radius of influence - ft
R_w = Radius of well - ft
Q = well flow - gpm

<u>Calculate Drawdown</u>

$$500 = \frac{510\,(100^2 - h_w^2)}{458\left(\ln \frac{1400}{.5}\right)}$$

h_w = 80 ft

Drawdown = H - h_w
= 100 - 80 = 20 ft ⇒ OK

* Eqn. is from "Construction Dewatering" by J. Patrick Powers, P.E.

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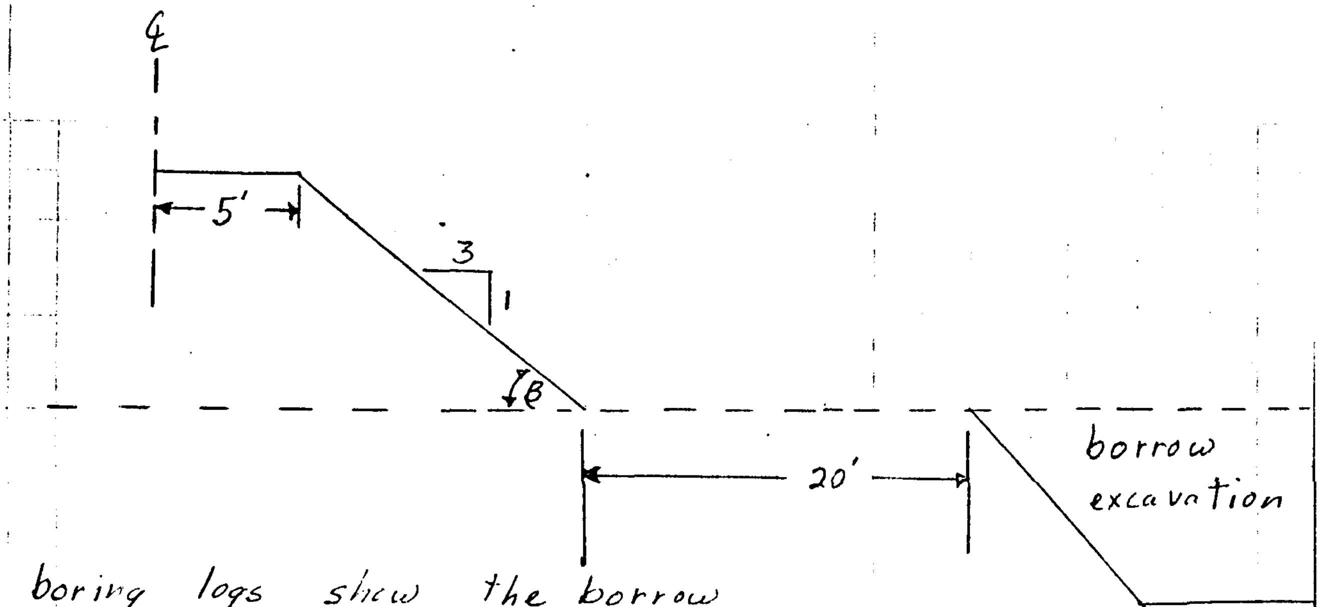
PLATE G-1

Subject		Date
Potters Marsh CPS Slope Stability		14 May 1991
Computed by Gene Kai	Checked by Hans D...	Sheet 1 of 1



boring logs show the borrow will be medium to fine sand

$\Rightarrow \phi = 34°$

1. assume no seepage $\Rightarrow$ End of Construction

$$F.S. = \frac{\tan\phi}{\tan\beta} = \frac{\tan 34}{(1/3)} = \underline{\underline{2.02}}$$

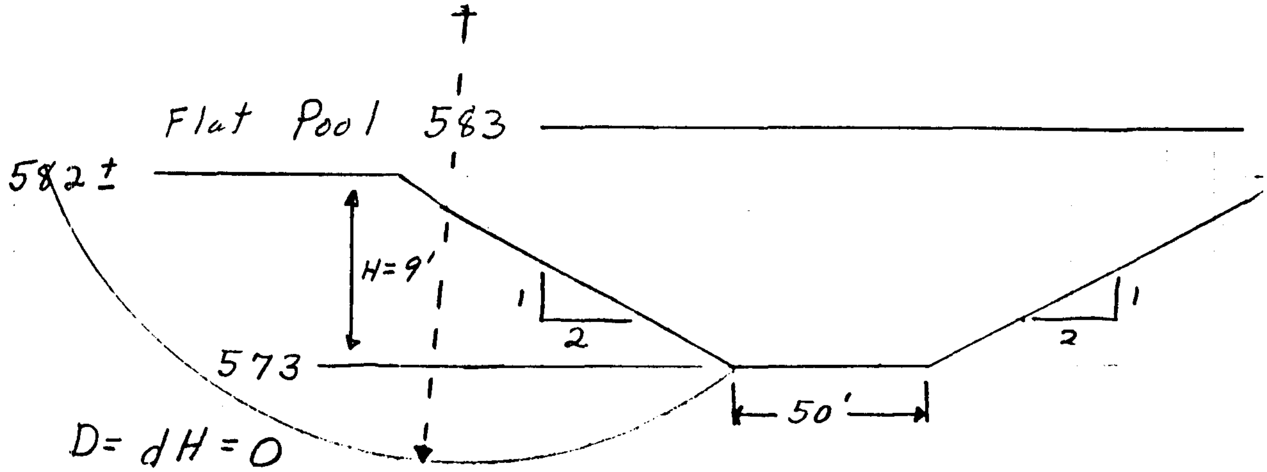
2. assume seepage

$$F.S. \approx \tfrac{1}{2}(F.S. \text{ for End of Construction})$$

$$F.S = \tfrac{1}{2}(2.02) = \underline{\underline{1.01}}$$

Subject: Potter's Marsh Dredge Cut Stability | Date: 15 Oct.

Computed by: Gene Rand | Checked by: J. Stiman | Sheet 1 of 1



$D = dH = 0$

NOT TO SCALE

$$P_d = \frac{\gamma H - \gamma_w H}{\mu_q \mu_w \mu_t}$$

μ_t = adjustment for tension crack = 1

μ_w = adjustment for submergence = 1

μ_q = reduction for surcharge = 1

$$P_d = \frac{125(9) - 62.4(9)}{(1)(1)(1)} = 563.4$$

$X_0 = 1.25(9) = 11.25$

$Y_0 = 1.6(9) \quad 14.4$

$N_0 = 8.5$ From stability chart

C = Cohesion = 100

$$F.S. = \frac{N_0\, C}{P_d} = \frac{8.5(100)}{563.4} = 1.5$$

$$F.S. = 1.5 \geq 1.3 \Rightarrow OK$$

NOTE: All eqn. from "An Engineering Manual For Slope Stability Studies" by J. M. Duncan and A. L. Buchignani March, 1975

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HYDRAULIC DREDGING ANALYSIS

A
P
P
E
N
D
I
X

H

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-9F)

POTTERS MARSH REHABILITATION AND ENHANCEMENT

POOL 13, MISSISSIPPI RIVER MILES 522.5 THROUGH 526.0
CARROLL AND WHITESIDE COUNTIES, ILLINOIS

APPENDIX H
HYDRAULIC DREDGING ANALYSIS

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POTTERS MARSH REHABILITATION AND ENHANCEMENT

POOL 13, MISSISSIPPI RIVER MILES 522.5 THROUGH 526.0
CARROLL AND WHITESIDE COUNTIES, ILLINOIS

APPENDIX H
HYDRAULIC DREDGING ANALYSIS

INTRODUCTION

Column settling analyses were performed on materials to be dredged in order to determine the total volume, surface area, and settling time required for confined dredged material placement. This appendix presents pertinent data, analyses, computations, and results relative to the dredged material containment basin design.

SAMPLING AND TESTING

Six bulk soil examples were collected and analyzed at various times, but only the results of three, which represent the material to be dredged, will be presented here. An initial bulk soil sample was taken in January 1989 from boring hole P-89-5 at a depth of 4.5 to 6.5 feet. An additional bulk soil sample was taken in August 1990 from boring hole P-90-2 at a depth of 4.0 to 7.0 feet and in December 1990 from the P-89-1 boring site at a depth of 2.0 to 6.0 feet. See plate 8 of the main report for boring locations and plates 6 and 7 for boring logs. Column settling analyses were performed in February 1989, August 1990, and December 1990 by the University of Iowa Environmental Engineering Laboratory. A flocculent settling test, a zone settling test, and a 15-day compression test were performed on each sample. Laboratory test results are shown on plates H-1 through H-6. Soil types and percentages to be dredged are shown on plate H-7.

COMPUTATIONS

Computations were performed utilizing laboratory results in accordance with EM 1110-2-5027, as shown on plates H-8 through H-27. Laboratory tests indicate that the fat clay sediments exhibit both flocculent and zone settling, and the lean to medium clays exhibit zone settling. Therefore, containment area sizing computations were performed based on initial expansion and zone settling characteristics of all sediments and the flocculent settling characteristics of the fat clay supernatant sediments. Design assumptions are listed in the computations.

RESULTS

The results of the basin design calculations based on initial expansion indicate that the total required disposal volume for 447,000 cubic yards of dredged material is 786,720 cubic yards. This represents an expansion of approximately 76 percent. The minimum required basin interior surface area with a material height of 12 feet and an estimated overdredge of 7 percent is 35.1 acres or 680,012 cubic yards. This number reflects the basin volume gain from borrow for dike construction.

The results of the basin design calculations based on zone settling indicate that the minimum required surface area for disposal volume is 13.1 acres.

The results of the basin design calculations based on fat clay flocculent settling indicate that the dredged material requires a field mean retention time of 25 hours in order to achieve design effluent suspended solids concentrations. This will require a minimum basin interior surface area of 34.9 acres. For the fat clay, which is only 25 percent of the total soil to be dredged, a final effluent suspended solids concentration of 250 mg/l was used as the water quality design criterium. A review of the column settling analysis results for the lean to medium clay was performed. This soil type represents 37 percent of the total soils to be dredged. There were no flocculent settling characteristics exhibited. It can be assumed that the final effluent suspended solids concentration will be between 50 and 100 mg/l if the retention time is the same as that for the fat clay of 25 hours.

CONCLUSIONS AND RECOMMENDATIONS

Based on this design analysis, the initial expansion of the clay will control the size of the basin. The final confined dredged material placement site, for a 12-foot-high material height, should have a minimum available interior basin volume of 35 acres. The total affected surface area, which includes the dike surface area and a 15-foot perimeter work zone, is equal to 50 acres. The 35 acres will allow for initial expan-sion of the clay and will provide sufficient settling time to meet design effluent suspended solids concentration. If, during final design these geometric requirements cannot be met or effluent suspended solids concentration needs to be reduced, consideration will be given to the construction of a two-cell containment area or to the use of spur dikes to increase settling times for smaller surface areas. If this is done, however, a considerable reduction in the amount of dredging will have to be implemented to accommodate the cross dike or dikes volume.

POTTERS MARSH
AT 2.0-6 FT DEPTH
HOLE NO. P-89-1

TSS (g/l) VS. TIME (hrs)
SAMPLE PORTS

TIME (hrs)	A	B	C	D	E	F	G
0.0	147.0	135.4	145.8	138.8	140.4	143.1	142.5
0.5	136.7	139.6	143.8	136.6	137.1	138.4	169.9
1	137.0	142.4	138.9	137.3	140.7	158.1	190.5
2	2.2	134.8	137.5	142.7	192.1	199.4	201.5*
4	0.87	2.9	98.6	201.5*	249.6*	225.8*	231.0*
6	0.99	1.1	1.4	197.7*	254.9*	256.3*	246.9*
12	0.93	0.94	1.2	1.3	283.5*	301.7*	290.5*
24	0.14	0.72	0.68	0.22	298.9*	328.9*	313.1*
48	<0.05	0.07	0.07	0.07	304.5*	349.4*	318.8*
72	<0.05	<0.05	<0.05	<0.05	297.5*	356.9*	339.1*
96	<0.05	<0.05	<0.05	<0.05	106.0	349.4*	345.0*
120	<0.05	<0.05	<0.05	<0.05	<0.05	346.5*	365.9*
240	<0.05	<0.05	<0.05	<0.05	<0.05	379.6*	432.9*
360	<0.05	<0.05	<0.05	<0.05	<0.05	428.1*	494.3*

* Initial filter run indicated a TSS greater than the methodology allowed. Percent dry weights (dry soil sample/wet soil sample) were then analyzed in lieu of total suspended solids.

% DRY WEIGHT
SAMPLE PORTS

TIME(hrs)	D	E	F	G
1	-	-	-	-
2	-	-	-	17.9
4	17.9	21.6	19.8	20.2
6	17.6	22.0	22.1	21.4
12	-	24.1	25.4	24.6
24	-	25.2	27.3	26.2
48	-	25.6	28.7	26.6
72	-	25.1	29.2	28.0
96	-	-	28.7	28.4
120	-	-	28.5	29.8
240	-	-	30.7	34.1
360	-	-	33.8	37.8

SEDIMENT HEIGHT (in) VS. WATER COLUMN HEIGHT (in)

HOLE NO. P-89-1

TIME (hrs)	WATER HT.	SED. HT.	DEPTH TO INTERFACE (ft)
0.0	91.50	91.50	0
0.5	90.00	88.00	0.17
1	89.25	83.50	0.48
2	88.50	73.75	1.23
4	88.00	58.00	2.50
6	87.00	49.75	3.10
12	86.00	42.00	3.67
24	85.00	38.25	3.90
48	83.50	35.25	4.15
72	82.50	33.50	4.08
96	81.25	31.50	4.15
120	80.25	30.00	4.18
240	78.50	25.25	4.44
360	77.00	22.50	4.54

POTTERS MARSH EMP

HOLE NO. P-89-5
DEPTH: 4.5 to 8.5

TSS (g/l) VS. TIME (hrs)
SAMPLE PORTS

TIME (hrs)	A	B	C	D	E	F	G
0.0	97.6	105.4	106.3	102.7	106.2	107.8	110.3
0.5	71.7	74.3	75.9	78.7	80.9	86.4	100.5
1	68.9	70.0	71.0	74.3	76.5	82.6	109.6
2	67.0	68.2	71.3	73.0	76.0	79.6	186.9
4	0.20	62.6	70.0	71.3	73.8	75.4	208.0*
6	0.12	46.8	66.5	68.9	72.9	76.9	214.2*
8	<0.10	0.12	59.7	67.1	69.9	121.7	220.6*
12	<0.10	<0.10	0.15	62.4	82.5	145.6	216.6*
24	<0.50	<0.17	<0.50	<0.50	136.7	157.0	245.6*
48	<0.10	<0.10	<0.10	<0.10	9.5	178.4	273.9*
72	<0.17	<0.17	<0.17	<0.17	<0.17	178.9	291.9*
96	<0.06	<0.06	<0.06	<0.06	<0.06	178.3	306.0*
120	<0.06	<0.06	<0.06	<0.06	<0.06	181.0	308.8*
240	<0.06	<0.06	<0.06	<0.06	<0.06	212.9*	358.4*
360	<0.06	<0.06	<0.06	<0.06	<0.06	23.6#	381.1*

At time of sampling, sediment line and sample port coincided resulting in a biased sample.

* Initial filter run indicated a TSS greater than the methodology allowed. Percent dry weights (dry soil sample/wet soil sample) were then analyzed in lieu of total suspended solids.

% DRY WEIGHT
SAMPLE PORTS

TIME (hrs)	F	G
4	-	18.4
6	-	18.9
12	-	19.4
24	-	19.1
48	-	21.3
72	-	23.4
96	-	24.7
120	-	25.9
240	18.8	29.3
360	-	30.8

SEDIMENT HEIGHT (in) VS. WATER COLUMN HEIGHT (in)

HOLE NO. P-89-5

TIME (hrs)	WATER HT. (in)	SED. HT. (in)	DEPTH TO INTERFACE (ft)
0.0	88.50	88.50	0
0.5	88.00	86.00	0.17
1	87.75	84.00	0.31
2	87.25	80.50	0.56
4	87.00	73.25	1.15
6	86.25	66.75	1.63
8	85.50	60.75	2.06
12	85.00	48.75	3.02
24	83.75	34.25	4.13
48	83.00	30.50	4.36
72	82.00	28.00	4.50
96	81.00	26.25	4.56
120	79.75	24.50	4.60
240	78.50	20.75	4.81
360	77.00	18.75	4.85

POTTERS MARSH
AT 4.0-7.0 FT DEPTH
HOLE NO. P-90-2

TSS (g/l) VS. TIME (hrs)
SAMPLE PORTS

TIME (hrs)	A	B	C	D	E	F	G
0.0	57.5	42.9	55.5	58.9	59.4	47.8	60.7
0.5	35.2	38.3	39.5	43.8	49.0	49.2	56.9
1	32.5	33.6	34.5	37.5	39.9	41.7	50.5
2	28.5	34.0	33.7	36.2	35.5	39.2	131.0
4	28.2	32.7	36.7	33.8	35.8	37.0	124.6
6	<0.05	29.2	34.2	33.8	35.0	35.7	115.4
12	<0.05	30.2	32.1	32.7	30.3	33.7	120.8
24	<0.05	0.20	18.4	19.2	22.6	87.4	127.8
48	<0.05	<0.05	<0.05	<0.05	82.5	91.5	154.0
72	<0.05	<0.05	<0.05	<0.05	83.0	100.0	145.4
96	<0.05	<0.05	<0.05	<0.05	3.5	92.1	148.6
120	<0.05	<0.05	<0.05	<0.05	<0.05	97.9	164.0
240	<0.05	<0.05	<0.05	<0.05	<0.05	106.9	199.5
360	<0.05	<0.05	<0.05	<0.05	<0.05	113.0	200.2*

* Initial filter run indicated a TSS greater than the methodology allowed. Percent dry weights (dry soil sample/wet soil sample) then were analyzed in lieu of total suspended solids.

% DRY WEIGHT
SAMPLE PORTS

TIME (hrs)	E	F	G
1	-	-	-
2	-	-	-
4	-	-	-
6	-	-	-
12	-	-	-
24	-	-	-
48	-	-	-
72	-	-	-
96	-	-	-
120	-	-	-
240	-	-	-
360	-	-	17.8

SEDIMENT HEIGHT (in) VS. WATER COLUMN HEIGHT (in)

HOLE NO. P-90-2

TIME (hrs)	WATER HT.(in)	SED. HT.(in)	DEPTH TO INTERFACE (ft)
0.0	89.50	89.50	0
0.5	88.75	87.75	0.08
1	87.75	86.00	0.14
2	86.75	84.00	0.23
4	85.75	81.00	0.40
6	84.75	77.75	0.58
12	83.75	70.50	1.10
24	82.75	55.00	2.31
48	81.25	33.75	3.96
72	80.25	31.75	4.04
96	79.25	30.50	4.06
120	78.25	29.25	4.08
240	77.00	26.00	4.25
360	76.00	23.75	4.35

Subject HYDRAULIC DREDGE ANALYSIS		Date
Computed by JHW	Checked by	Sheet of

DREDGE VOLUMES AND SOIL TYPES

	TOTAL DREDGE VOLUME CU YD	% OF OVERALL TOTAL
SEGMENT 1	44,300	10
SEGMENT 2	205,350	47
SEGMENT 3	188,650	43
TOTAL	438,300	

MECH EXCAV/HYDRAULIC DREDGE BELOW CAUSEWAY = 4,700 CY

HYDRAULIC DREDGING FROM MAIN CHANNEL TO OUTER PROJECT LIMITS = APPROX. 4000 CY

OVERALL DREDGE VOLUME:
438,300 + 4700 + 4000 = 447,000 CY

MATERIAL TYPE	PROJECT %	AVE. MOIST.	FINE GRAINED SEDIMENT %
LEAN TO MED. CLAY	37	32	60
FAT CLAY	25	89	40
SAND	38	—	—

OVERALL AVE. MOISTURE OF FINE GRAINED SEDIMENTS = 54.8%

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Subject: HYDRAULIC DREDGE ANALYSIS		Date
Computed by: JHW	Checked by	Sheet of

GENERAL DESIGN ASSUMPTIONS:

BASED ON SIMILAR DREDGING CONSTRUCTION PROJECTS AND DISCUSSIONS WITH DREDGING CONTRACTORS

- ASSUME 16" DREDGE WILL BE USED
- AVERAGE DISCHARGE VELOCITY ≅ 15 FPS
- AVERAGE SOLIDS PRODUCTION RATE (IN FIELD) HAS BEEN 200 CY/HR
- DUE TO PIPE LINE SET UP AND MOVEMENT AND EQUIPMENT DIFFICULTIES DOWN TIME HAS BEEN HIGH
- ALL COMPUTATIONS ARE BASED ON GUIDELINES SPELLED OUT IN EM 1110-2-5027 "CONFINED DISPOSAL OF DREDGED MATERIAL," DATED 30 September 1987.

Subject: HYDRAULIC DREDGE ANALYSIS		Date
Computed by: JHW	Checked by	Sheet of

A. CALCULATION OF VOLUME FOR INITIAL STORAGE

I. CALCULATION OF DESIGN CONCENTRATION, C_d

a) TIME OF DREDGING

ASSUMING SOLIDS PRODUCTION RATE OF 200 CY/HR, TOTAL VOLUME = 438,244 CY & CONTRACTOR WORKS 24 HRS/DAY 6 DAYS/WK WHICH IS TYPICAL OF DREDGING CONTRACTORS

$$447{,}000\ \text{CY} \times \frac{\text{hr}}{200\ \text{cy}} \times \frac{\text{DAY}}{24\ \text{hr}} \times \frac{\text{WK}}{6\ \text{DAY}} = 15.52\ \text{WKS}$$

$$15.52\ \text{WK} \times \frac{7 \times 24\ \text{hr}}{\text{WK}} = 2{,}607\ \text{hrs}$$

ALLOW FOR 50% DOWNTIME (WHICH IS TYPICAL)

$$2{,}607 \times 1.5 = 3911\ \text{hrs} = 163\ \text{DAYS OR } 5.4\ \text{MONTHS}$$

FOR TOTAL JOB

$$\tfrac{1}{2}(163\ \text{DAYS}) = 81.5\ \text{DAY} = t = \text{DESIGN VALUE}$$

Subject HYDRAULIC DREDGE ANALYSIS		Date
Computed by JHW	Checked by	Sheet of

CONVERT % DRY WT TO g/L:

% DRY WT OR SOLIDS = 18.4 % FROM U OF IOWA DATA Plate H-3

$$\% \text{ SOLIDS} = W_S = \frac{W_S^g}{W_T^g} = .184$$

USE 100g FOR W_T THEN $W_S = 100g(.184g) = 18.4g$

$$W_W = 100 - W_S = 100g - 18.4g = 81.6g$$

$$W_C = \frac{81.6}{18.4} = 4.43 \text{ OR } 443\%$$

$$\frac{(G_{S,T})(\text{UNIT WT WATER})}{1+(W_C)(G_{S,T})} = \frac{(2.65)(1000\ g/L)}{1+(4.43)(2.65)} = \underline{\underline{208\ g/L}}$$

CONVERSIONS TO g/L WERE MADE FROM % DRY WT FOR SETTLEMENT TEST ANALYSIS DATA

VAlues WERE GRAPHED FOR Cd calculation See Plates G-10 THROUGH G-12

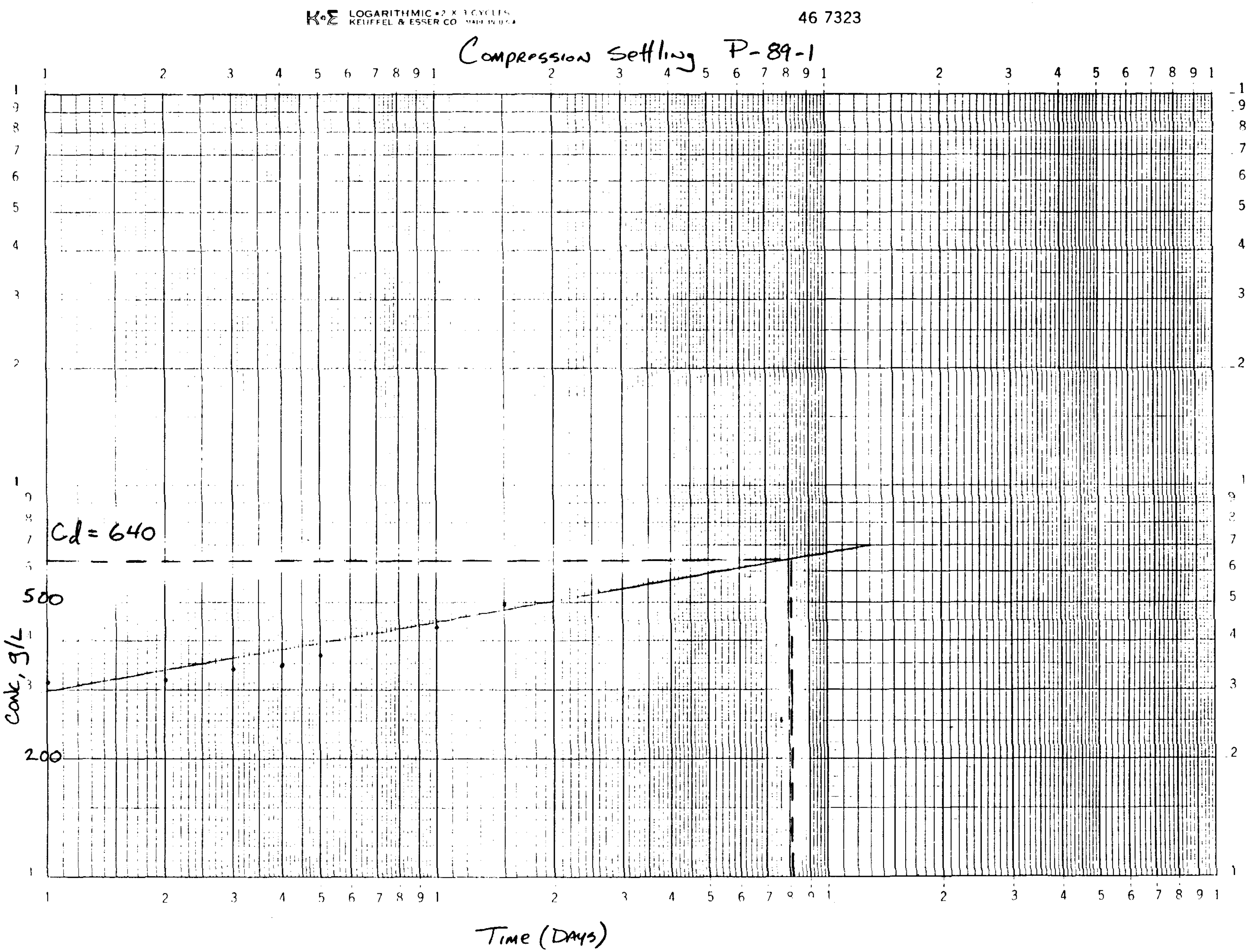
K+E LOGARITHMIC 2 X 3 CYCLES
KEUFFEL & ESSER CO.
46 7323
Compression Settling P-89-1
Cd = 640
500
200
Conc, g/L
Time (Days)

PLATE H-11

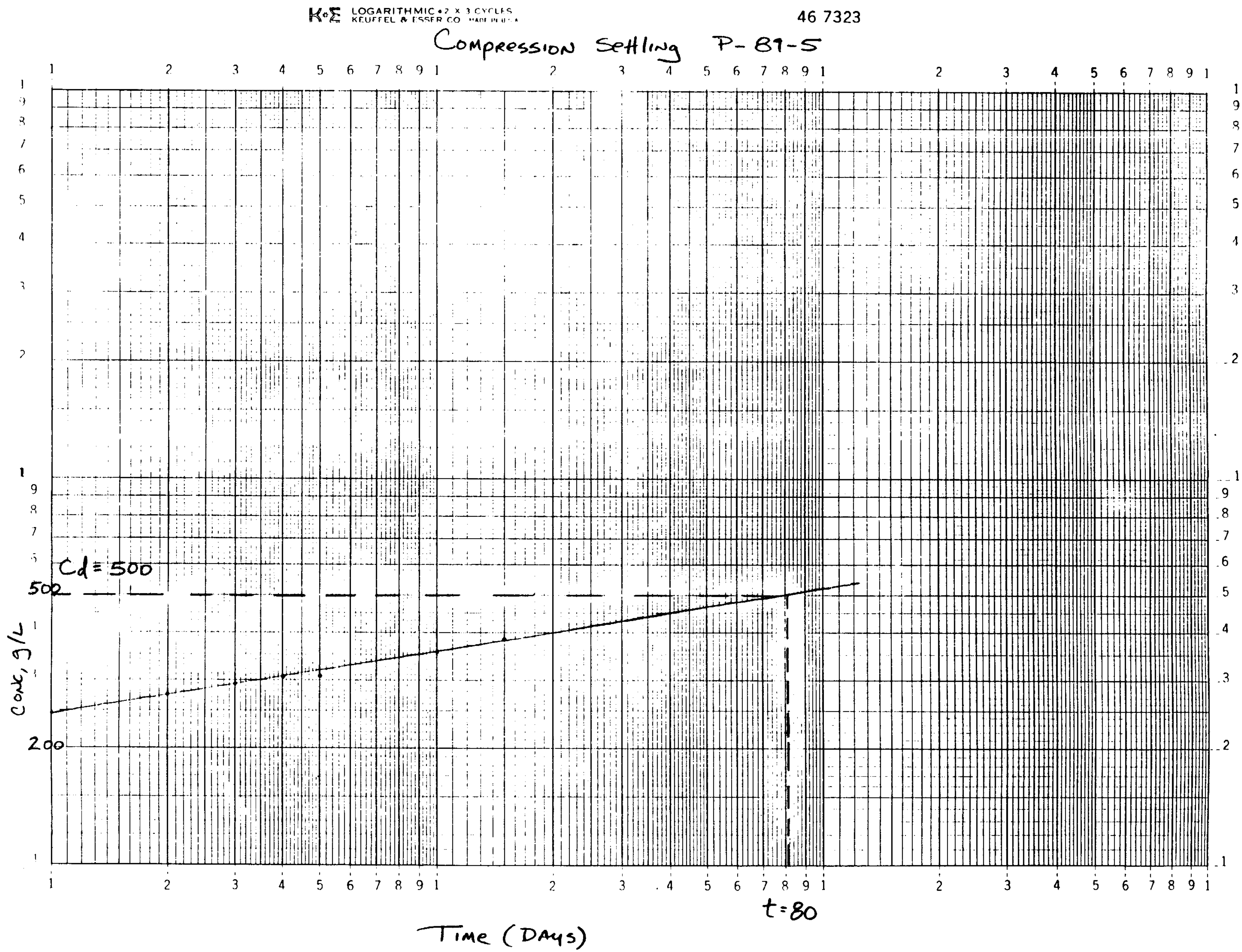
K+E LOGARITHMIC 2 X 3 CYCLES
KEUFFEL & ESSER CO.
46 7323
Compression Settling P-81-5
Cd = 500
500
200
Conc, g/L
t=80
Time (Days)

PLATE H-12

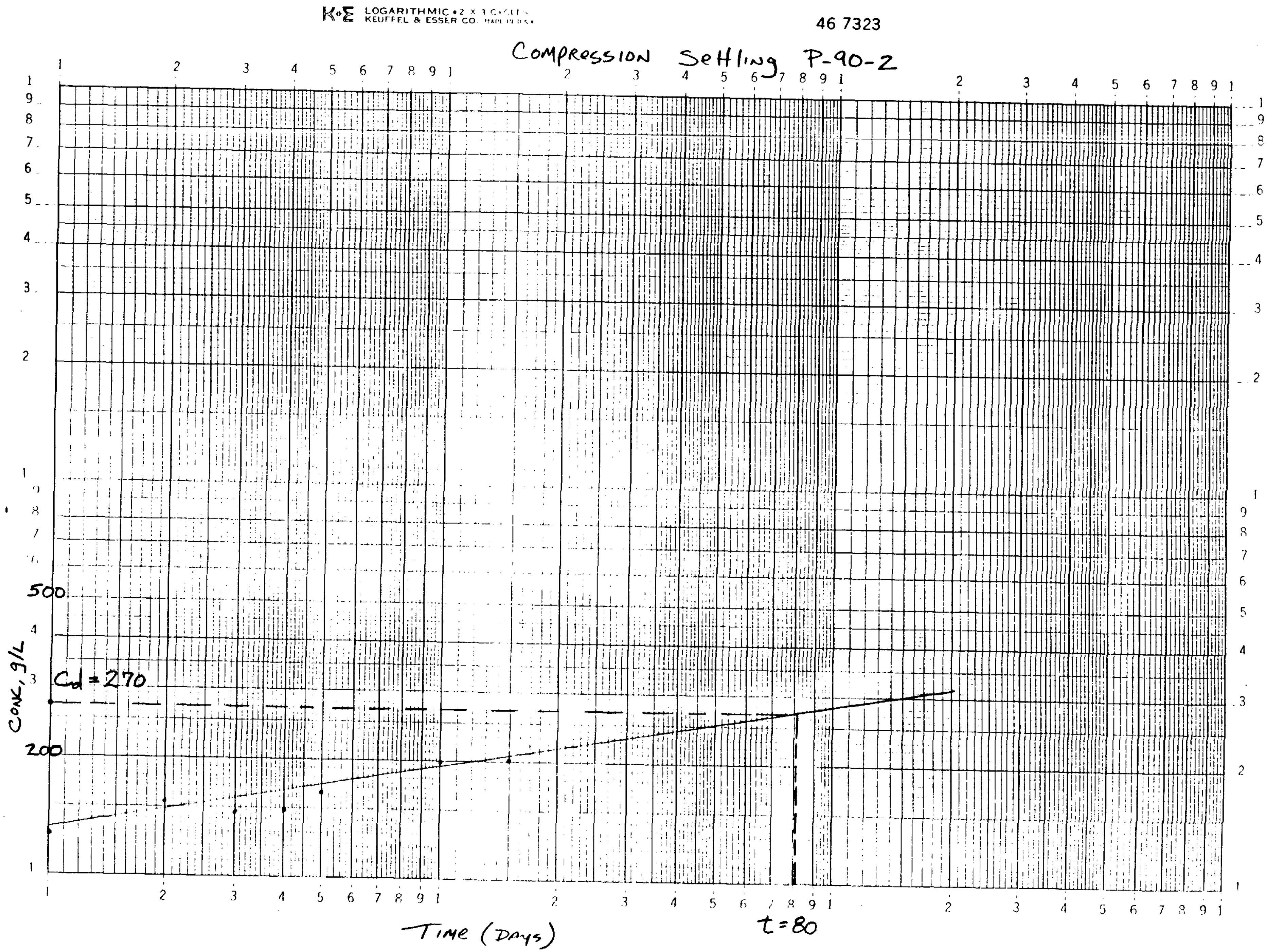
K+E LOGARITHMIC 2 X 3 CYCLES
KEUFFEL & ESSER CO.
46 7323
Compression Settling P-90-2
Cd = 270
CONC, g/L
500
200
Time (Days)
t=80

PLATE H-13

Subject HYDRAULIC DREDGE ANALYSIS		Date
Computed by JHW	Checked by	Sheet of

b.) VALUES FROM COMPRESSION SETTLING GRAPHS FOR Cd

Hole P-89-1 Cd = 640 FAT ORGANIC CLAY
Hole P-89-5 Cd = 500 MEDIUM CLAY
Hole P-90-2 Cd = 270 LEAN CLAY

The lean clay AND THE MEDIUM Clay ARE VERY SIMILAR AND ARE VERY REPRESENTATIVE OF THE LOW MOISTURE clays THROUGH OUT THE PROJECT AREA SO THEY WILL BE CONSIDERED AS ONE TYPE OF SOIL AND THEIR Cd's will be AVERAGED TOGETHER

CONSIDERING FINE GRAINED SEDIMENTS ONLY INSPECTION OF BORINGS REVEALS 60% LEAN TO MED CLAY AND 40% FAT ORGANIC CLAY

WEIGTED AVE Cd:

$$Cd = .60\left(\frac{500+270}{2}\right) + .40\,(640) = \underline{\underline{487\ g/L}}$$

II Volume ESTIMATION

a.) Ave VOID RATIO AFTER DREDGING, e_o

eq (4-2): $e_o = \frac{G_s \gamma_w}{Cd} - 1$ WEIGHTED AVE. $G_s = 2.68$

$$e_o = \left[\frac{2.68\,(1000\ g/L)}{487}\right] - 1 \qquad \underline{\underline{e_o = 4.50}}$$

Subject HYDRAULIC DREDGE ANALYSIS		Date
Computed by JHW	Checked by	Sheet of

b) AVE IN-SITU VOID RATIO OF FINE GRAINED MATERIAL TO BE DREDGED, e_i

SINCE ALL IN-SITU SOILS ARE SATURATED

$$e_i = WG_s$$

FROM BORING LOGS AVE W FOR FINE GRAINED SEDIMENTS = 54.8 %

$$e_i = (2.68)(.548) = 1.47$$

c.) EXPANSION FACTOR FOR FINE GRAINED SEDIMENTS

$$\text{eq (4-3)}: \; f_{exp} = \left[\frac{e_o - e_i}{1 + e_i}\right] + 1 = \left[\frac{4.50 - 1.47}{1 + 1.47}\right] + 1 = \underline{\underline{2.23}}$$

FROM BORINGS AND GRADATIONS DREDGE MATERIAL WILL CONTAIN APPROX 38 % SAND WHICH HAS AN EXPANSION FACTOR OF 1.0

WEIGHTED EXPANSION FACTOR FOR TOTAL PROJECT:

$$.62(2.23) + .38(1.0) = \underline{\underline{1.76}}$$

Subject HYDRAULIC DREDGE ANALYSIS		Date
Computed by JHW	Checked by	Sheet of

d.) TOTAL VOLUME REQUIRED FOR DREDGED MATERIAL:

447,000 CY IN-SITU VOLUME x 7.0% OR 0.5 FEET FOR PROBABLE OVER DREDGE BY CONTRACTOR
= 478,290 CY

(478,290 CY)(1.76) = 841,790 CY

– GAIN OF MATERIAL REMOVED TO CONSTRUCT DIKE

USE 6000 L.F. DIKE OF 14' HIGH WITH 3:1 SIDE SLOPES AND 35 ACRES OF INTERIOR SURFACE AREA

6000 L.F x 14' x 52' = 161,778 CY

841,790 – 161,778 = 680,012 CY

CONFINED PLACEMENT SITE (CPS) VOLUME CHECK:

680,012 x 27 ÷ 43,560 ÷ 12 (MATERIAL HEIGHT)

= 35.1 ACRES

Subject HYDRAULIC DREDGE ANALYSIS		Date
Computed by JHW	Checked by	Sheet of

e.) TOTAL SURFACE AREA REQUIRED FOR CPS
DIKE SURFACE AREA + 15′ PERIMETER WORK ZONE

6000 L.F. (DIKE) × (94′ (DIKE SURFACE) + 15′ (WORK ZONE))
= 654,000 Sq Ft = 15 ACRES

35.1 ACRES + 15.0 ACRES = 50.1 ACRES

USE TOTAL AREA REQUIRED = 50 ACRES

B. Calculation of Minimum Surface Area for Zone Settling

I. DETERMINE SETTLING VELOCITY, V_S

See Graph, Plate G-16

USE WEIGHTED AVE SIMILAR TO PREVIOUS CALC.

$$V_{S_{AVE}} = .6\left(\frac{0.095 + 0.25}{2}\right) + .4(0.53)$$

$$V_S = 0.32 \text{ Ft/hr}$$

II. GROSS INTERIOR SURFACE AREA REQUIRED

eq (4-5): $A_Z = \dfrac{Q_i (3600)}{V_S}$ $Q_i = 20.6$ CFS (FOR 16″ DREDGE)

$$A_Z = \frac{20.6 \text{ CFS } (3600 \text{ s/hr})}{0.32 \text{ Ft/hr}} = 231,750 \text{ Ft}^2$$

= 5.32 ACRES MINIMUM

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1 Aug 80

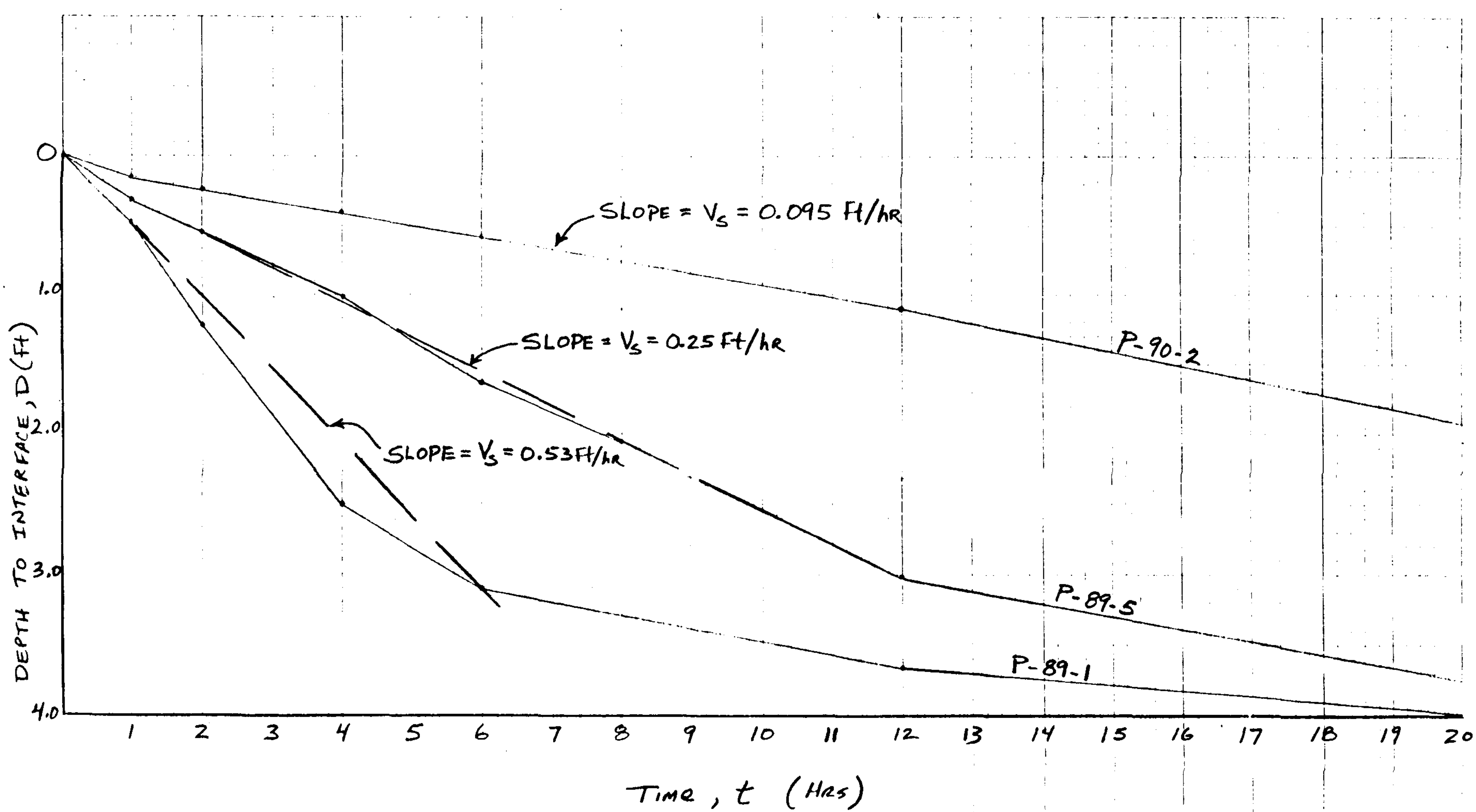

SLOPE = Vs = 0.095 Ft/hr
SLOPE = Vs = 0.25 Ft/hr
SLOPE = Vs = 0.53 Ft/hr
P-90-2
P-89-5
P-89-1
DEPTH TO INTERFACE, D (Ft)
0
1.0
2.0
3.0
4.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Time, t (Hrs)

PLATE H-18

III. DETERMINE HECF (HYDRAULIC EFFICIENCY FACTOR)

$$eq\ (4\text{-}14):\ \frac{1}{HECF} = 0.9\left[1 - e^{\left(-.3\frac{L}{W}\right)}\right]$$

$$= 0.9\left[1 - e^{\left(-.3\frac{3}{1}\right)}\right]$$

$$\frac{1}{HECF} = 0.4061 \qquad HECF = 2.46$$

IV. DESIGN INTERIOR CPS SURFACE AREA REQUIRED (BASED ON ZONE SETTLING)

$$A_{dz} = (HECF)\, A_z$$

$$= 2.46\,(5.32)$$

A_{dz} = **13.1 ACRES** (DESIGN MINIMUM BASED ON ZONE SETTLING CHARACTERISTICS)

Subject: HYDRAULIC DREDGE ANALYSIS		Date
Computed by: JHW	Checked by	Sheet of

C. CALCULATION OF MINIMUM SURFACE AREA FOR FLOCCULENT* SETTLING IN SUPENATANT WATER

I. SEPARATE SETTLING DATA - USE ONLY FLOCCULENT DATA OR DATA AFTER INITIAL ZONE SETTLING (AFTER FIRST MAJOR BREAK IN CONCENTRATION). DATA PLATE H-21

II. COMPUTE % OF INITIAL CONCENTRATION OF SUPERNATANT. DATA PLATE H-21, PLOT PLATE H-22

III. COMPUTE AND PLOT % SOLIDS REMOVAL VS. RETENTION TIME. DATA PLATE H-23, PLOT PLATE H-24

IV. COMPUTE & PLOT CONCENTRATION VS. RETENTION TIME. DATA PLATE H-23, PLOT PLATE H-25

* ONLY MATERIAL THAT EXHIBITS FLOCCULENT SETTLING IS THE FAT CLAY (HOLE P-89-1).

Subject HYDRAULIC DREDGE ANALYSIS		Date
Computed by JHW	Checked by	Sheet of

P-89-1

OBSERVED FLOCCULENT SETTLING DATA

Time, T (hr)	Depth (ft)	Susp Solids Concentration C (mg/L)	Fraction of Initial %
2	1	2200	76.9
4	1	870	30.0
4	2	2900*	100
6	1	990	34.1
6	2	1100	37.9
6	3	1400	48.3
12	1	930	32.1
12	2	940	32.4
12	3	1200	41.4
12	4	1300	44.8
24	1	140	4.8
24	2	720	24.8
24	3	680	23.5
24	4	220	7.6
48	1	<50	1.7
48	2	70	2.4
48	3	70	2.4
48	4	70	2.4

* Use 2,900 mg/L as initial supernatant suspended solids concentration, C_o

$\overline{W} = 89\%$

$G_s = 2.67$

$e_i = WG_s = .89(2.67) = 2.38$

NCR Form 1 Aug 80 381b

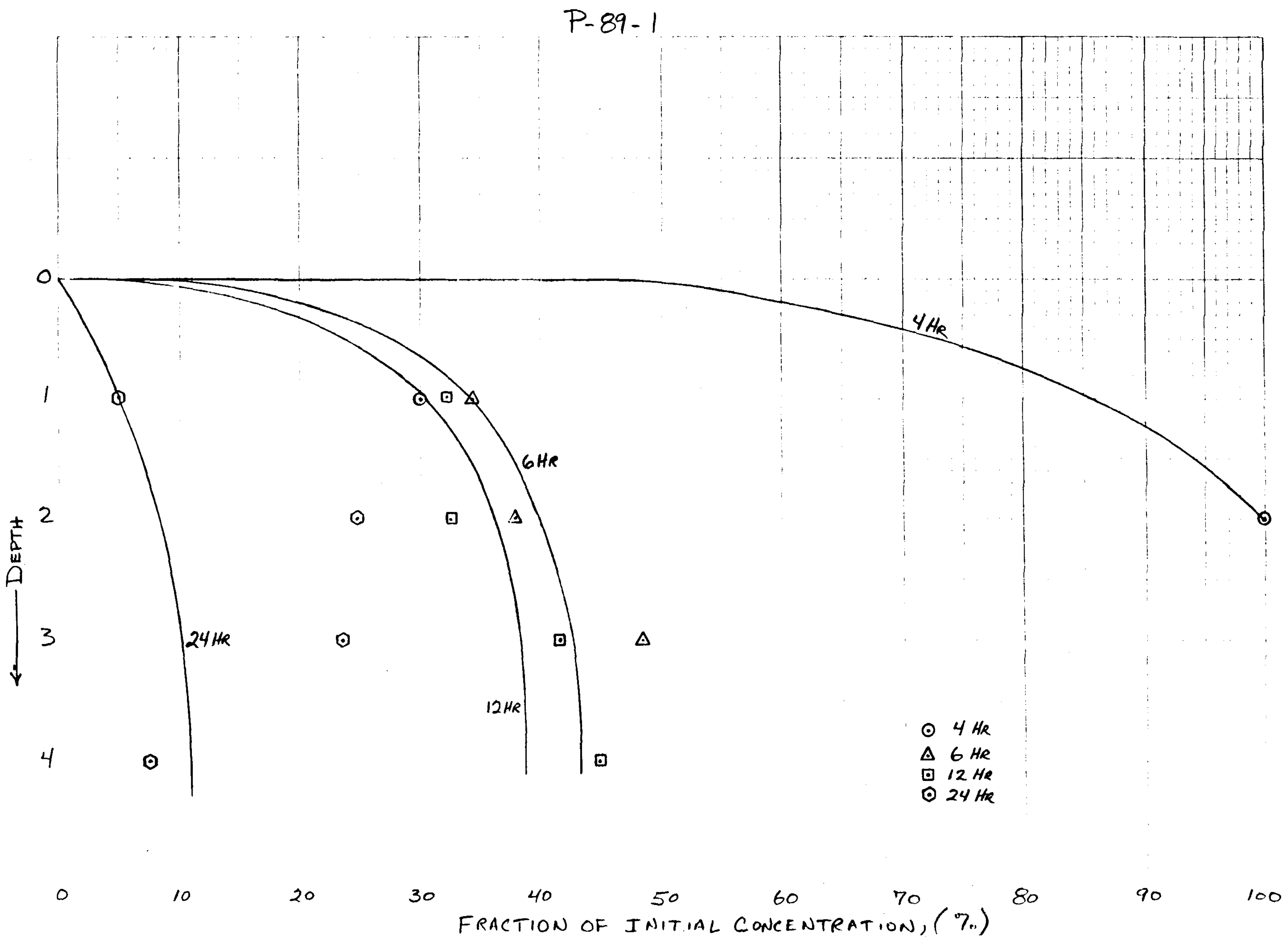

P-89-1
0
1
2
3
4
DEPTH
4 HR
6 HR
12 HR
24 HR
0
10
20
30
40
50
60
70
80
90
100
FRACTION OF INITIAL CONCENTRATION, (%)
4 HR
6 HR
12 HR
24 HR

PLATE H-22

Subject HYDRAULIC DREDGE ANALYSIS		Date
Computed by JHW	Checked by	Sheet of

SOLIDS REMOVAL %

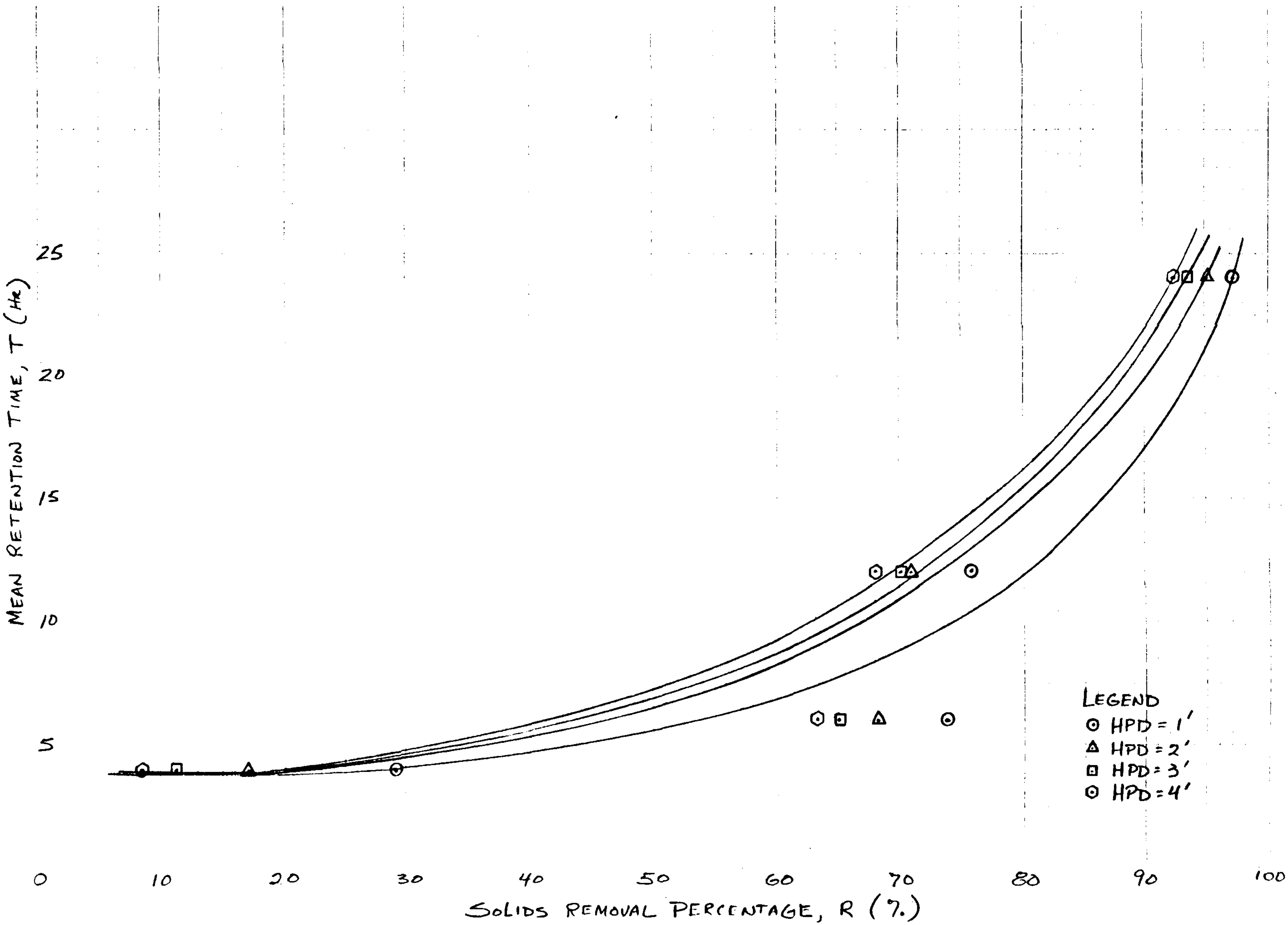
DEPTH	4 HR	6 HR	12 HR	24 HR
1	29.1%	73.9%	75.9%	97.2%
2	17%	68.2%	71.0%	95.1%
3	11.3%	65.0%	70.2%	93.6%
4	8.5%	63.2%	68.0%	92.6%

ABOVE VALUES OBTAINED FROM % CONCENTRATION VS. DEPTH GRAPH ON PLATE H-22

SOLIDS REMAINING, C_t (mg/L)

DEPTH	4 HR %/CONC	6 HR %/CONC	12 HR %/CONC	24 HR %/CONC
1	70.9% 2056 mg/L	26.1% 757 mg/L	24.1% 699 mg/L	2.8% 81 mg/L
2	83% 2407 mg/L	31.8% 922 mg/L	29% 841 mg/L	4.9% 142 mg/L
3	88.7% 2572 mg/L	35.0% 1015 mg/L	29.8% 864 mg/L	6.4% 186 mg/L
4	91.5% 2654 mg/L	36.8% 1067 mg/L	32% 928 mg/L	7.4% 215 mg/L

PLATE H-24



MEAN RETENTION TIME, T (HR)
25
20
15
10
5
0
10
20
30
40
50
60
70
80
90
100
SOLIDS REMOVAL PERCENTAGE, R (%)
LEGEND
HPD = 1'
HPD = 2'
HPD = 3'
HPD = 4'

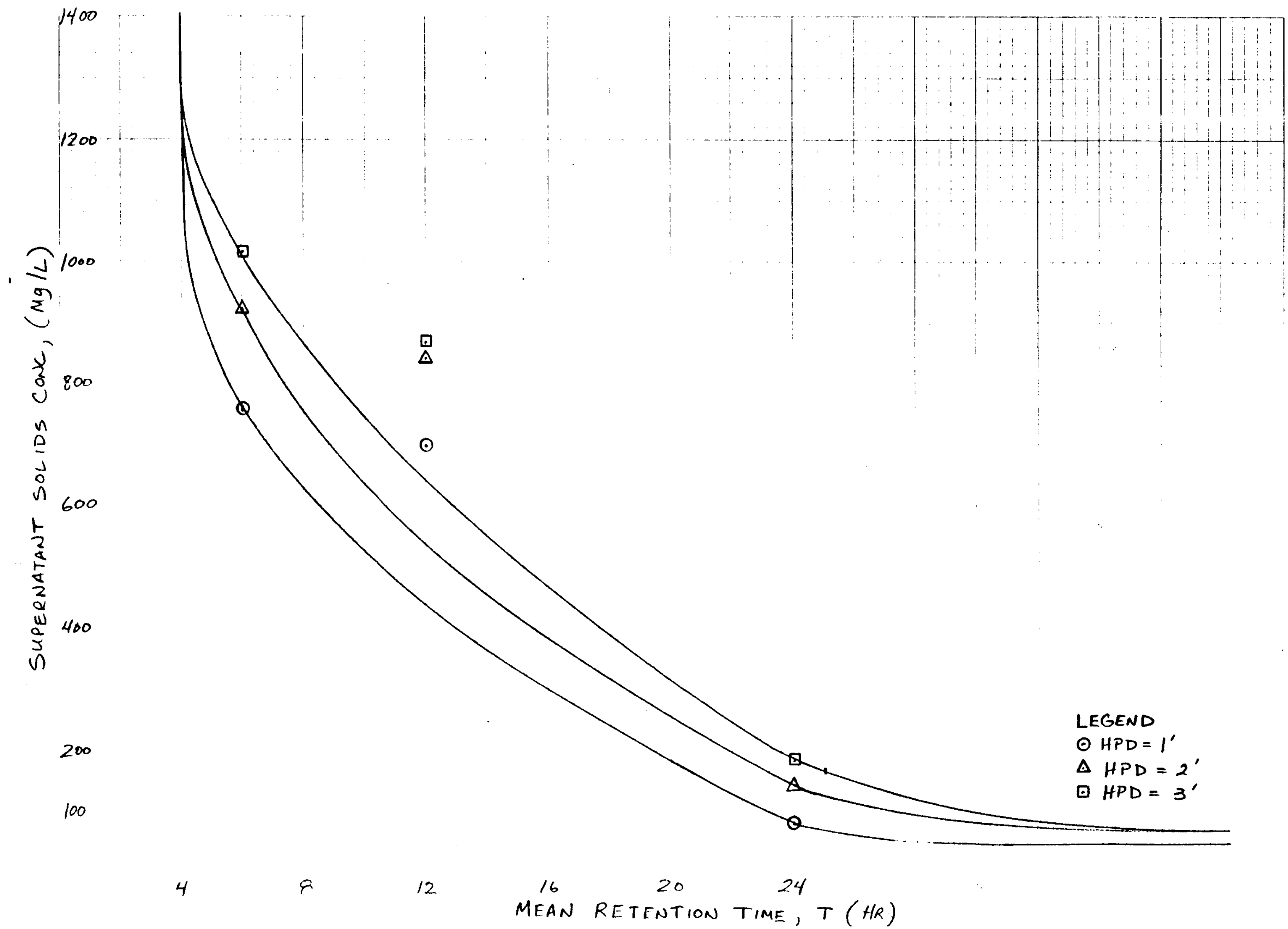

1400
1200
1000
800
600
400
200
100
SUPERNATANT SOLIDS CONC, (Mg/L)
4
8
12
16
20
24
MEAN RETENTION TIME, T (HR)
LEGEND
⊙ HPD = 1'
△ HPD = 2'
⊡ HPD = 3'

PLATE H-25

Subject: HYDRAULIC DREDGE ANALYSIS		Date
Computed by: JHW	Checked by	Sheet of

V MAXIMUM SUSPENDED SOLIDS CONCENTRATION:

eq: 4-11 $C_{COL} = \frac{C_{eff}}{RF}$ $C_{eff} = 250$ mg/L FOR FAT CLAY

RF = 1.5 FROM TABLE 4-1

HPD = 3'

$$C_{COL} = \frac{250}{1.5} = 167 \text{ mg/L}$$

VI FIND REQUIRED RETENTION TIME:

FROM GRAPH P. $T_d \cong 25$ hrs

MINIMUM VOLUMETRIC RESIDENSE TIME:

eq: 4-8 $T = HECF\ T_d = 2.46 \times 25 = 61.5$ HRS

VII COMPUTATION OF DESIGN SURFACE AREA FOR FLOCCULENT SETTLING:

eq: 4-12 $$A_{df} = \frac{T Q_i}{H_{pd}(12.1)} = \frac{61.5(20.6)}{3(12.1)}$$

$= \underline{\underline{34.9 \text{ ACRES}}}$ = MINIMUM BASED ON FLOCCULENT SETTLING CHARACTERISTICS

SPECIFIC GRAVITY AND DENSITY OF

CLIENT: Potters Marsh EMP

JOB NO.: 07901045G

DATE: 1-16-91

SAMPLE DATA: Jar samples of soil materials identified and submitted by the client's representative on 12-21-90.

TEST PROCEDURE: ASTM D 854 - Standard Test Method For Specific Gravity of Soils

TEST DATA:

HOLE NO.	SAMPLE NO.	DEPTH (FT)	VISUAL SOIL CLASSIFICATION	CALCULATED SPECIFIC GRAVITY
PM-1-90	1	4	Brown Sandy Lean Clay	2.632
P-89-1	1	4	Dark Brown Fat Clay	2.674
P-90-2	1	4	Dark Brown Sandy Lean Clay	2.793
Peat*	---	---	Peat	2.146

*Additional Tests on Peat Sample:

Moisture Content (dry weight basis) = 311.5%
Organic Content (loss on ignition) = 46.0%

Terracon

HABITAT EVALUATION AND QUANTIFICATION

A

P

P

E

N

D

I

X

I

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-9F)

POTTERS MARSH REHABILITATION AND ENHANCEMENT

POOL 13, MISSISSIPPI RIVER MILES 522.5 THROUGH 526.0
CARROLL AND WHITESIDE COUNTIES, ILLINOIS

APPENDIX I
HABITAT EVALUATION AND QUANTIFICATION

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ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT (R-9F)

POTTERS MARSH REHABILITATION AND ENHANCEMENT

POOL 13, MISSISSIPPI RIVER MILES 522.5 THROUGH 526.0
CARROLL AND WHITESIDE COUNTIES, ILLINOIS

APPENDIX I
HABITAT EVALUATION AND QUANTIFICATION

I-1. PURPOSE.

The purpose of this appendix is to present an overview and the results of the process used for quantification of habitat benefits for this enhancement project. Recommendations for further refinement of the models are included in the Conclusions section of the main report. The method was applied by an interagency team composed of staff from the U.S. Fish and Wildlife Service (USFWS), the Illinois Department of Conservation (IDOC) and the U.S. Army Corps of Engineers.

I-2. BACKGROUND.

The need for quantification of EMP-HREP outputs has been discussed by various agencies associated with the EMP as a project performance evaluation tool, a project ranking tool, and a project planning tool. This application involves quantification solely for the purpose of project planning.

The benefits to be derived from habitat rehabilitation and enhancement projects are not readily convertible to actual monetary units as is customarily required for traditional benefit-cost analyses. A method of quantification is needed to adequately evaluate project features for planning, design, and administrative purposes.

Measurable changes in habitat value can be described by suitability indices, habitat units, animal numbers, or animal use days.

The selected approach is referred to as a Habitat Unit (HU) accounting methodology. Several similar methodologies exist at this time, such as Habitat Evaluation Procedures (HEP), which was developed by the USFWS as an impact assessment tool; Habitat Evaluation System (HES), which was developed by the Corps of Engineers also as an impact assessment method; and Habitat Management Evaluation Method (HMEM), which was developed by the Bureau of Reclamation. Of the three methodologies referenced, HEP is likely to be the most familiar to all participants in the EMP.

I-3. METHODOLOGY.

Nomenclature

Habitat Unit-HU = (Acreage/Volume of a particular habitat type) * (HSI value). HUs represent a numeric estimate of usable habitat for particular species within a defined area.

Habitat Suitability Index-HSI = Index of habitat quality or suitability for particular species derived by a numeric ranking of life requisite characteristics at selected sample sites.

Average Annual Habitat Unit-AAHU = AAHUs represent an average HU value based on annualization of HUs over a series of selected Target Years (TY). AAHUs account for changes in habitat values over the life of a project.

For this project, HUs were chosen as the unit of comparison for project features or alternative plans. HUs are derived by multiplying habitat acreages or volumes by habitat quality, determined by HSIs. HSIs result from numeric ranking of site characteristics at sample sites throughout a given project area.

Numeric ranking for terrestrial and wetland habitat values was accomplished using the existing Wildlife Habitat Appraisal Guide (WHAG) field data sheets for forested and non-forested wetlands and a computer program developed by the Missouri Department of Conservation (MDOC) and the U.S. Soil Conservation Service. A brief example of site characteristics is listed below.

<u>WHAG Site Characteristics for Forested and Non-Forested Wetlands</u>

Percent of the study area non-forested wetland
Percent of the study area lake or reservoir
Water level control
Substrate conditions
Average water depth
Emergent vegetation coverage
Vegetative species diversity
Size of the wetland
Percent of the area covered by food plants
Woodland size class and canopy coverage
Ratio of mudflats to permanent water
Hydrologic conditions
Number of cavity trees
Extent of forest openings
Understory density and diversity

Aquatic habitat types and associated fisheries benefits were generated using a newly developed draft Aquatic Habitat Appraisal Guide (AHAG) compiled by the Rock Island District, Corps of Engineers, with input from the MDOC, the USFWS, and the U.S. Army Corps of Engineers Waterways Experiment Station.

Founded on the same principles as the terrestrial habitat models, the aquatic guide is a numerical quantification of HUs based on the quality of a given aquatic habitat and the affected area of that habitat type. However, it was decided by the WHAG study team to use acre-feet as a unit of measurement as opposed to an acreage figure. It was felt that acre-feet more accurately reflected the changes in aquatic habitat than a surface acre value.

While additional models will incorporate numerous target species and a range of aquatic habitat types, the Potters Marsh project evaluated three target species: the channel catfish, largemouth bass, and walleye. The characteristics for side channel habitat evaluation include a combination of physical and chemical determinations, vegetation patterns, and overall productivity (see list below). Consistent with the WHAG methodology, each habitat characteristic is ranked and assigned an associated numerical value. Calculations can then determine the existing quality of a particular aquatic habitat for specific target species of fish. The target species is representative of those species of fish which prefer similar environmental conditions and share similar life requisites, namely slack-water areas out of the main channel currents for channel catfish, for example. Vegetation, woody debris, and deeper pooled areas, access to the main channel habitats, etc., are additional factors considered for this matrix.

<u>Aquatic Habitat Characteristics</u>

Instream cover	Streambank condition
Aquatic vegetation	Substrate
Channel depth	pH
Productivity	Total Dissolved Solids
Velocity	Forage Base
Shoreline characteristics	Turbidity
Dissolved oxygen	Water temperature
Air temperature	Width of side channel
Spawning habitat	

Computer results are provided for estimated total HUs and calculated HSI values for the forested, non-forested, grassland, and aquatic components of the project. After existing conditions were determined, the study team reviewed the habitat appraisal guides to determine where habitat quality can be improved. HUs were annualized for target years using the USFWS's HEP 80 program in order to evaluate changes in project features over time.

Habitat quality ratings can be improved by: (1) increasing acreages for particular habitat types that may be limited or lacking; (2) altering a limiting factor, such as unpredictable water levels; (3) altering a management strategy such as cropping practice, or cover crop composition; or (4) a combination of the preceding, depending on management goals, target species requirements, or available funds.

Project goals for habitat enhancement include increasing fisheries resources through aquatic side channel restoration and improving wetland values for migratory waterfowl. Therefore, the study team selected the appraisal guides for wetland habitats, with the blue wing teal as a target species (species of emphasis). As was mentioned above, the aquatic component of the project was evaluated using the aquatic model with catfish, bass, and walleye as selected target species. Prior to site sampling, the study team reviewed aerial photography, topographic maps, and preliminary design drawings to select representative sample sites for WHAG application.

During site sampling, assumptions were developed regarding existing conditions and projected post-project conditions, relative to limiting factors and management practices.

I-4. ASSUMPTIONS.

a. Target years of 0, 1, 25, and 50 will be sufficient to annualize HUs and characterize habitat changes over the estimated project life.

b. Resource-partitioned guilds of fish may be represented by individual species which are suitable for evaluation of overall aquatic habitat values and changes in aquatic habitat values.

c. The life requisite information for the channel catfish largemouth bass and walleye is suitable for characterization of side channel and backwater habitats and may be used for evaluation of changes in Potters Slough and adjacent backwater conditions.

d. Alternatives evaluated represent available options to modify habitat suitability for migratory waterfowl, as represented by the resource categories of forested wetland, non-forested wetland, cropland, and grassland.

e. The blue-wing teal is a suitable species of emphasis and adequately characterizes life requisite requirements of the migratory waterfowl group for the purpose of incremental analysis of this project.

f. The muskrat, wood duck, green heron, bittern, yellowlegs, rail, coot, and prothonotary warbler are suitable species for evaluation of overall wetland values and changes in wetland values resulting from construction of the CPS. The indigo bunting and dickcissel are suitable species to represent changes in grassland habitat values.

g. The current rate of sedimentation is predicted to continue, resulting in the gradually filling of Potters Marsh and the subsequent transition of aquatic to terrestrial habitats types will occur.

h. Dredging of the accumulated sediments would restore and enhance the area for fisheries as well as trap new sediments upstream of the causeway to preserve remaining habitat values below the causeway.

I-5. RESULTS.

Alternatives evaluated at the Potters Marsh site included No Action; dredging upstream of the causeway and excavation of a sediment trap immediately below the causeway; dredging in lower Potters Slough with creation of two deep holes near the outlet of the slough; construction and subsequent management of a confined placement site (CPS) for the containment of the hydraulically dredged sediments; and excavation and blasting of potholes.

The inter-agency WHAG/HEP team assessed the existing conditions of the project area utilizing the field evaluation sheets for each of the habitat types within the project area. The results are presented as Annual Habitat Units and Average Annual Habitat Units (AAHUs) values for the selected Target Years (TY) for the upper and lower dredging alternatives and construction of the CPS The WHAG analysis evaluated selected target species from both an aquatic and wetland habitat types to derive a representative picture of the existing conditions at Potters Marsh. Future conditions without construction of the project were predicted for TY 25 and 50 based on the existing conditions, successional changes in the habitat over time, and any management practices that may be implemented with or without the proposed project.

The remainder of this section provides the numerical assessment, while Section 6 provides the narrative interpretation of the analysis.

The WHAG wetland matrix was used to determine wetland habitat value of the existing conditions and future without project for Potters Marsh. Results are presented in table I-1 and figure I-1. HU and AAHU values for teal and goose are not calculated because the model will not generate habitat units on HSI values of 0.1, which is the current value of the area for waterfowl. HSI values for the other selected target species ranged from 0.31 for wood duck to 0.70 for coot. By TY 50, only two species show an increase in the qualitative index (HSI); wood ducks increase to 0.49, and prothonotary warblers increase to 0.44.

To determine the impacts of utilizing the 50-acre site where the CPS would be constructed, a WHAG run was done on just the 50-acre site. Without the project, vegetative changes would continue as the area develops into forested wetland. Correspondingly, the model reflects HUs for heron, bunting, wood duck and prothonotary warbler species which would benefit the most from this habitat. However, when management alternatives were evaluated for post-construction management of the CPS site, different target species benefitted, and to varying degrees, under each of the alternatives as is presented in tables and figures I-2 through I-5. Alternative 1 - natural succession would be expected to produce the same values as are currently available on the site. Alternative 2 - grassland management generates values for waterfowl, primarily as nesting habitat, as well as benefits for upland target species such as the bunting and dickcissel. Alternative 3 - moist soil unit management is a selective management option to benefit specifically migrating waterfowl. This is reflected in the higher values for goose and teal but few values to any other target species. Alternative 4 - managed marsh would benefit the most species of any of the plans with only slightly lower benefits to waterfowl.

The WHAG aquatic matrix was used to determine relative fisheries values of the Potters Marsh area under existing conditions and future with and without project scenarios. The aquatic habitat in Potters Slough was divided into upper and lower segments for the purposes of comparing the proposed dredging alternatives (tables and figures I-6 through I-9). HSI values for the upper segment are 0.17, 0.16, and 0.19 for channel catfish, walleye, and largemouth bass, respectively, under existing conditions but values will drop to 0.1 for all three species by TY 25. HSI values for the lower segment are only slightly higher under existing conditions with values of 0.28, 0.25, and 0.32 for channel catfish, walleye, and largemouth bass. These values will decline to 0.17, 0.16, and 0.19 by TY 25 and ultimately to 0.1 for all three species by TY 50. Quantitative values (measured in acre-feet) also dramatically decrease over the projected 50 years under the without project condition. In the upper cut it is estimated that 88 percent of the available aquatic habitat will be lost by TY 50, while 22 percent of the lower volume will be lost in the lower cuts.

Dredging the upper segment with sediment trap below the causeway will create an almost 180 percent increase in available fisheries habitat, and by TY 50, 76 percent of this habitat will remain. Qualitative improvements include HSI values as high as 0.85 for largemouth bass immediately after dredging. This value declines slightly to 0.67 by TY 50. The HSI value for largemouth bass is 0.56, a 72 percent improvement over existing values. This value actually increases slightly to 0.63 by TY 50, while values for the other two target species remain unchanged (0.48 for channel catfish and 0.40 for walleye).

Dredging the lower segments of Potters Slough will create an immediate 60 to 70 percent improvement in the quality of the habitat for the three target species. In addition, quantitative improvements result in an approximate 50-percent increase in the amount of available habitat by TY 1, and an overall 25-percent increase in habitat (compared to existing conditions) over the 50-year project life.

I-6. DISCUSSION.

This section is intended to interpret the numerical results of the WHAG analysis into a narrative format that will provide insight as to how the numbers were derived and what they mean in terms of the predicted outcome of the project.

Results of WHAG application for the proposed alternatives were compared as increments to costs where applicable. This incremental analysis is discussed in the Detailed Project Report in Section 6 - Evaluation of Alternatives.

Habitat improvements to the 50-acre CPS area will only be realized if the dredging alternatives are implemented. Post-construction management of the site offers a unique opportunity to utilize a dredged material placement site for beneficial use. Therefore, several alternative management strategies were evaluated for use of the site, AAHU calculations were only compared against each of the different management strategies. Alternative 4 will by far generate the most benefits for wildlife.

HSI values for fisheries are limited due to many years of accumulated sedimentation and subsequent predominance of vegetation which now fills the slough. Limiting factors in the model analysis drive the qualitative index to 0.1 since the slough is subject to wide swings in DO levels and low flows. Being adjacent to the river with access to the channel, the lower segment is of slightly higher value at the present. However, as sedimentation continues to fill in the backwaters this area, too, will decrease in quality to 0.1. and the volume of usable habitat will continue to diminish. However, implementing both the upper and lower dredging will produce dramatic improvements in fisheries habitat in Potters Slough. Even though the upper segments are designed for sediment control the consequential benefits for fisheries can be predicted and measured. Without the dredging, AAHU values for the three fish target species are relatively the same. However, after dredging, the AAHU improvements are an order of magnitude larger, and qualitatively better for the largemouth bass which represents the centrarchid group of species that will most benefit from the newly improved backwaters.

Similar results are expected in the lower segment dredging with an order of magnitude improvement to all three species. Walleye habitat will benefit the most in the lower segment by creating deep water habitat with year-around access to the main channel environs.

I-7. CONCLUSION.

For this project, HU accounting using WHAG/AHAG provides adequate quantification necessary to portray planning and design rationale of habitat enhancement projects.

Further modification of the AHAG models will include age class variables: spawning, rearing, adult and development of additional aquatic models for additional lentic and lotic habitats.

In conclusion, the WHAG methodology determined that habitat improvements to the Potters Marsh aquatic environment via hydraulic dredging offers an opportunity to create additional waterfowl as well as numerous non-game benefits through the use of a confined placement site with management capacity after the material in the site settles.

Hydraulic dredging will restore both the quantity and the quality of fisheries habitat once available in Potters Slough. Deep holes will create critical overwintering refugia, while the dredged channels will provide spawning and rearing habitat as well as backwater areas for adult catfish, bass, and bluegills.

Water level control through well and stoplog structure features allows the refuge managers to maximize benefits on the CPS area and control unwanted vegetation, such as woody encroachment, by manipulating water levels during critical periods of the growing season.

TABLE I-1

Habitat Assessment of Existing and Without-Project Conditions

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

1	N	NONFOREST WETLAND
2	B	BOTTOMLAND HARDWOODS-WETLAND
3	C	CROPLAND-WETLAND
4	G	GRASSLAND-WETLAND

SPECIES ABREVIATIONS

1	TEAL	BLUE WING TEAL	7	HERO	GREEN-BACKED HERON
2	GOOS	CANADA GOOSE	8	DUCK	WOOD DUCK
3	BITT	LEAST BITTERN	9	DICK	DICKCISSEL
4	YLEG	LESSER YELLOWLEGS	10	COOT	AMERICAN COOT
5	MUSK	MUSKRAT	11	BUNT	INDIGO BUNTING
6	RAIL	KING RAIL	12	PROT	PROTHONOTARY WARBLER

DATA FILE NAMES	NUMBER OF SAMPLE SITES	PROJECT NAME
PRESENT = POTMARSH	6	POTTERS MARSH HREP
TARGET YR 1 = POTPLANX	6	POTTERS MARSH HREP
TARGET YR 25 = POTPLANX	6	POTTERS MARSH HREP
TARGET YR 50 = POTPLANX	6	POTTERS MARSH HREP

FILE POTPLANX CONTAINS 3 DATA SETS

THESE DATA FILES USE MATRIX POTTERS TODAY'S DATE 07-10-1991

THESE DATA SETS ARE FOR FUTURE WITHOUT PROJECT CONDITIONS ON THE ENTIRE POTTERS MARSH COMPLEX

HABITAT TYPE ACRES

HABITAT TYPE	PRESENT 0	TARGET YEARS 1	25	50
NONFOREST WETLAND	314	314	439	350
BOTTOMLAND HARDWOODS-W	824	824	981	1200
CROPLAND-WETLAND	4	4	4	4
GRASSLAND-WETLAND	185	185	185	185
TOTAL	1327	1327	1609	1739

TABLE I-1 (Cont'd)

ACRES OF AVAILABLE HABITAT

SPECIES	PRESENT ACRES	T YR 1 ACRES	T YR 1 % CHANGE	T YR 25 ACRES	T YR 25 % CHANGE	T YR 50 ACRES	T YR 50 % CHANGE
TEAL	314.0	314.0	0.0%	439.0	39.8%	350.0	11.5%
GOOS	314.0	314.0	0.0%	439.0	39.8%	350.0	11.5%
BITT	314.0	314.0	0.0%	439.0	39.8%	350.0	11.5%
YLEG	314.0	314.0	0.0%	439.0	39.8%	350.0	11.5%
MUSK	314.0	314.0	0.0%	439.0	39.8%	350.0	11.5%
RAIL	314.0	314.0	0.0%	439.0	39.8%	350.0	11.5%
HERO	1,138.0	1,138.0	0.0%	1,420.0	24.8%	1,550.0	36.2%
DUCK	824.0	824.0	0.0%	981.0	19.1%	1,200.0	45.6%
DICK							
COOT	314.0	314.0	0.0%	439.0	39.8%	350.0	11.5%
BUNT	824.0	824.0	0.0%	981.0	19.1%	1,200.0	45.6%
PROT	824.0	824.0	0.0%	981.0	19.1%	1,200.0	45.6%

AVAILABLE HABITAT IS THE TOTAL OF THE HABITAT TYPE ACRES USED BY THE SPECIES (NOT ALL SPECIES APPLY TO ALL HABITAT TYPES)

MEAN HABITAT SUITABILITY INDEX (HSI)

SPECIES	PRESENT INDEX	T YR 1 INDEX	T YR 1 % CHANGE	T YR 25 INDEX	T YR 25 % CHANGE	T YR 50 INDEX	T YR 50 % CHANGE
TEAL	0.10	0.10	0.0%	0.10	0.0%	0.10	0.0%
GOOS	0.10	0.10	0.0%	0.10	0.0%	0.10	0.0%
BITT	0.62	0.62	0.0%	0.73	18.5%	0.31	-49.2%
YLEG	0.22	0.22	0.0%	0.24	8.9%	0.10	-54.5%
MUSK	0.55	0.55	0.0%	0.37	-34.2%	0.20	-63.6%
RAIL	0.43	0.43	-0.0%	0.53	23.1%	0.25	-42.9%
HERO	0.48	0.48	0.0%	0.51	6.7%	0.40	-16.6%
DUCK	0.31	0.31	0.0%	0.49	58.4%	0.49	59.0%
DICK							
COOT	0.70	0.70	0.0%	0.56	-19.2%	0.26	-62.3%
BUNT	0.23	0.23	0.0%	0.24	4.2%	0.10	-56.3%
PROT	0.32	0.32	0.0%	0.40	25.6%	0.44	36.9%

MEAN HSI = SUM AVERAGE HSI BY HABITAT TYPE X ACRES DIVIDED BY ACRES OF AVAILABLE HABITAT (ACRES USED BY THE SPECIES).
(i.e. MEAN HSI IS AVERAGE HSI WEIGHTED BY ACRES)

TABLE I-1 (Cont'd)

HABITAT UNITS

SPECIES	PRESENT HU	T YR 1 HU	T YR 1 % CHANGE	T YR 25 HU	T YR 25 % CHANGE	T YR 50 HU	T YR 50 % CHANGE
TEAL							
GOOS							
BITT	194.4	194.4	0.0%	321.9	65.6%	110.0	-43.4%
YLEG	69.0	69.0	0.0%	105.0	52.3%	0.0	-100.0%
MUSK	174.2	174.2	0.0%	160.3	-8.0%	70.7	-59.4%
RAIL	136.1	136.1	0.0%	234.1	72.1%	86.7	-36.3%
HERO	541.0	541.0	0.0%	720.5	33.2%	614.4	13.6%
DUCK	252.7	252.7	0.0%	476.5	88.6%	585.2	131.6%
DICK							
COOT	218.5	218.5	0.0%	246.9	13.0%	91.9	-58.0%
BUNT	188.3	188.3	0.0%	233.6	24.0%	0.0	-100.0%
PROT	261.9	261.9	0.0%	391.6	49.5%	522.0	99.3%

HABITAT UNITS ARE HSI X ACRES (A MEASURE OF QUALITY X QUANTITY)
IF MEAN HSI = 0.10 THEN HABITAT UNITS ARE ZERO

TABLE I-1 (Cont'd)

ANNUAL AVERAGE HABITAT UNITS FOR FUTURE WITHOUT PROJECT CONDITIONS

SPECIES	ANNUAL AVE. HABITAT UNITS
BLUE WING TEAL	
CANADA GOOSE	
LEAST BITTERN	231.5
LESSER YELLOWLEGS	76.9
MUSKRAT	142.2
KING RAIL	168.7
GREEN-BACKED HERON	647.8
WOOD DUCK	443.2
DICKCISSEL	
AMERICAN COOT	199.9
INDIGO BUNTING	195.8
PROTHONOTARY WARBLER	388.8

NOTE: THIS PROGRAM MUST BE RUN TWICE ONCE FOR FUTURE WITHOUT PROJECT AND ONCE FOR FUTURE WITH PROJECT CONDITIONS.
SUBTRACT AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITHOUT PROJECT CONDITIONS FROM AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITH PROJECT CONDITIONS TO DETERMINE THE CHANGE IN AVERAGE ANNUAL HABITAT UNITS WITH THE PROJECT.

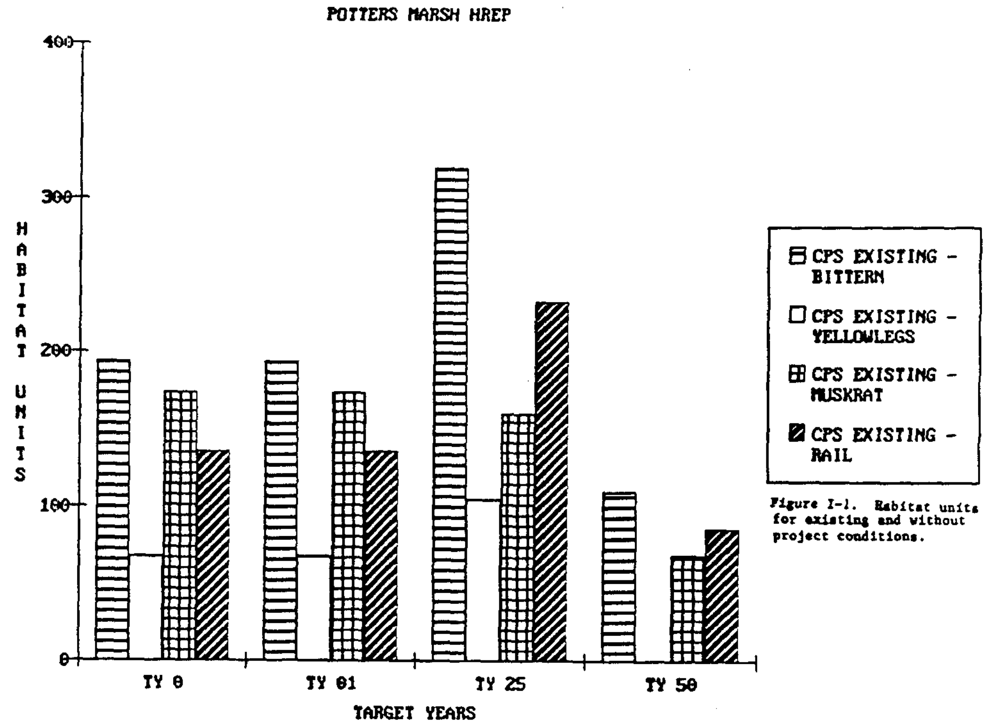

Figure I-1. Habitat units for existing and without project conditions.

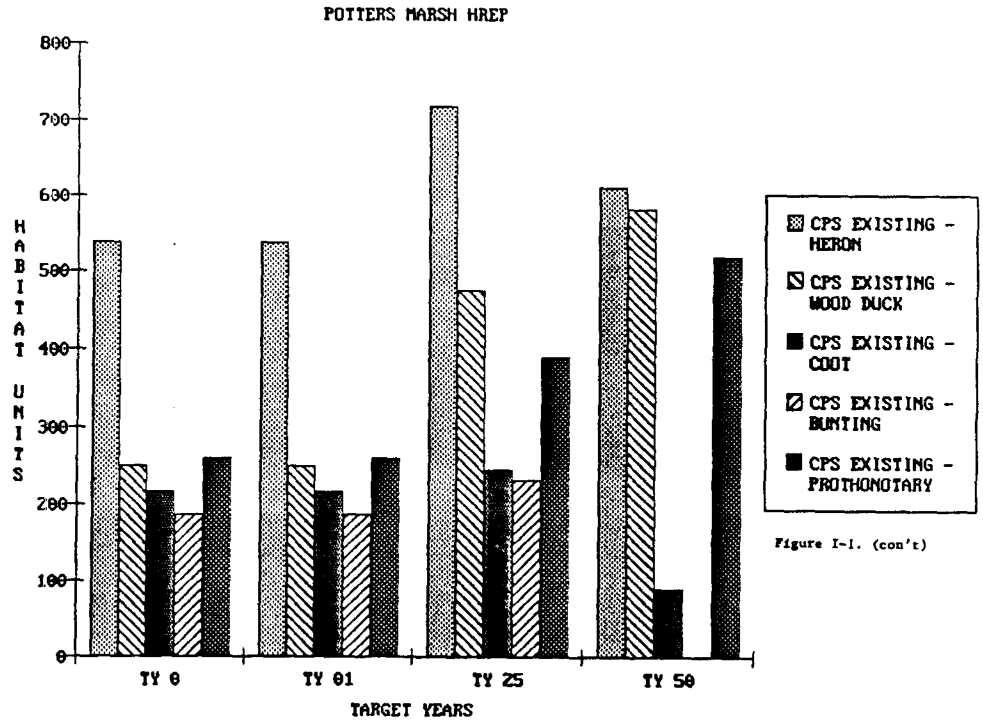

Figure I-1. (con't)

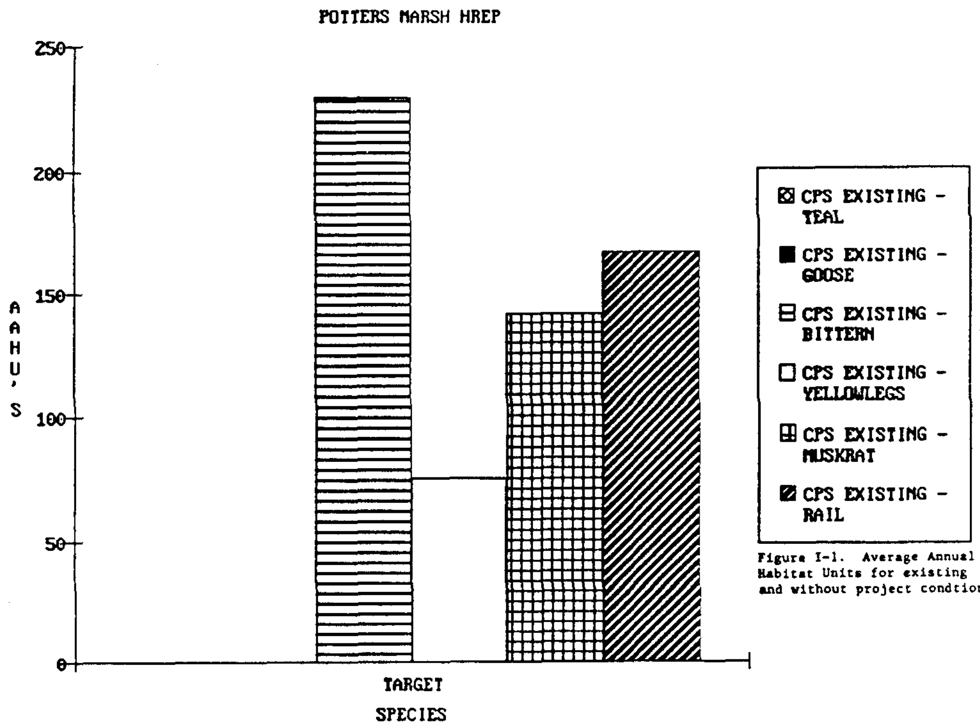

Figure I-1. Average Annual Habitat Units for existing and without project condtions

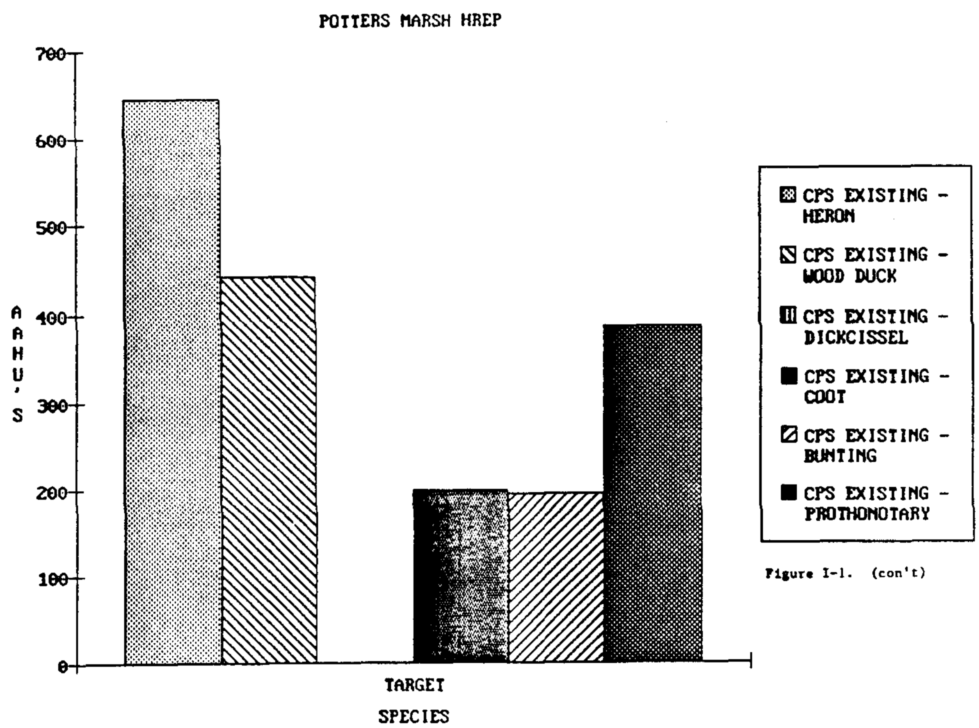

Figure I-1. (con't)

TABLE I-2

ROCK ISLAND DISTRICT CORPS OF ENGINEERS
FISH AND WILDLIFE SERVICE ROCK ISLAND

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

1	N	NONFOREST WETLAND
2	B	BOTTOMLAND HARDWOODS-WETLAND
3	C	CROPLAND-WETLAND
4	G	GRASSLAND-WETLAND

SPECIES ABREVIATIONS

1	TEAL	BLUE WING TEAL	7	HERO	GREEN-BACKED HERON
2	GOOS	CANADA GOOSE	8	DUCK	WOOD DUCK
3	BITT	LEAST BITTERN	9	DICK	DICKCISSEL
4	YLEG	LESSER YELLOWLEGS	10	COOT	AMERICAN COOT
5	MUSK	MUSKRAT	11	BUNT	INDIGO BUNTING
6	RAIL	KING RAIL	12	PROT	PROTHONOTARY WARBLER

DATA FILE NAMES	NUMBER OF SAMPLE SITES	PROJECT NAME
PRESENT = POTCPS6	1	POTTERS MARSH HREP
TARGET YR 1 = POTPLANB	1	POTTERS MARSH HREP
TARGET YR 25 = POTPLANB	1	POTTERS MARSH HREP
TARGET YR 50 = POTPLANB	1	POTTERS MARSH HREP

FILE POTPLANB CONTAINS 3 DATA SETS

THESE DATA FILES USE MATRIX POTTERS   TODAY'S DATE 07-10-1991

THESE DATA SETS ARE FOR FUTURE WITH PROJECT CONDTIONS **EVALUATING ONLY THE 50 ACRE CPS UNDER "NATURAL SUCCESSION" MANAGEMENT PLAN.**

HABITAT TYPE ACRES

HABITAT TYPE	PRESENT 0	TARGET YEARS 1	25	50
NONFOREST WETLAND		15		
BOTTOMLAND HARDWOODS-W	50	20	35	50
CROPLAND-WETLAND				
GRASSLAND-WETLAND		15	15	
TOTAL	50	50	50	50

TABLE I-2 (Cont'd)

ACRES OF AVAILABLE HABITAT

SPECIES	PRESENT ACRES	TARGET YEARS T YR 1 ACRES	T YR 1 % CHANGE	T YR 25 ACRES	T YR 25 % CHANGE	T YR 50 ACRES	T YR 50 % CHANGE
TEAL							
GOOS							
BITT							
YLEG							
MUSK							
RAIL							
HERO	50.0	20.0	-60.0%	35.0	-30.0%	50.0	0.0%
DUCK	50.0	20.0	-60.0%	35.0	-30.0%	50.0	0.0%
DICK							
COOT							
BUNT	50.0	20.0	-60.0%	35.0	-30.0%	50.0	0.0%
PROT	50.0	20.0	-60.0%	35.0	-30.0%	50.0	0.0%

*AVAILABLE HABITAT IS THE TOTAL OF THE HABITAT TYPE ACRES USED BY THE SPECIES (NOT ALL SPECIES APPLY TO ALL HABITAT TYPES)

MEAN HABITAT SUITABILITY INDEX (HSI)

SPECIES	PRESENT INDEX	TARGET YEARS T YR 1 INDEX	T YR 1 % CHANGE	T YR 25 INDEX	T YR 25 % CHANGE	T YR 50 INDEX	T YR 50 % CHANGE
TEAL							
GOOS							
BITT							
YLEG							
MUSK							
RAIL							
HERO	0.27	0.23	-16.7%	0.38	41.7%	0.44	61.1%
DUCK	0.10	0.10	0.0%	0.32	218.8%	0.39	287.5%
DICK							
COOT							
BUNT	0.49	0.36	-26.5%	0.10	-79.4%	0.10	-79.4%
PROT	0.10	0.10	0.0%	0.17	70.0%	0.22	115.0%

MEAN HSI = SUM AVERAGE HSI BY HABITAT TYPE X ACRES DIVIDED BY ACRES OF AVAILABLE HABITAT (ACRES USED BY THE SPECIES).
(i.e. MEAN HSI IS AVERAGE HSI WEIGHTED BY ACRES)

TABLE I-2 (Cont'd)

HABITAT UNITS

		TARGET YEARS					
	PRESENT	T YR 1		T YR 25		T YR 50	
SPECIES	HU	HU	% CHANGE	HU	% CHANGE	HU	% CHANGE
TEAL							
GOOS							
BITT							
YLEG							
MUSK							
RAIL							
HERO	13.5	4.5	-66.7%	13.4	-0.8%	21.8	61.1%
DUCK				11.2	100.0%	19.4	100.0%
DICK							
COOT							
BUNT	24.3	7.1	-70.6%	0.0	-100.0%	0.0	-100.0%
PROT				6.0	100.0%	10.8	100.0%

HABITAT UNITS ARE HSI X ACRES (A MEASURE OF QUALITY X QUANTITY)
IF MEAN HSI = 0.10 THEN HABITAT UNITS ARE ZERO

TABLE I-2 (Cont'd)

ANNUAL AVERAGE HABITAT UNITS FOR FUTURE WITH PROJECT CONDTIONS

SPECIES	ANNUAL AVE. HABITAT UNITS
BLUE WING TEAL	
CANADA GOOSE	
LEAST BITTERN	
LESSER YELLOWLEGS	
MUSKRAT	
KING RAIL	
GREEN-BACKED HERON	13.0
WOOD DUCK	10.5
DICKCISSEL	
AMERICAN COOT	
INDIGO BUNTING	5.3
PROTHONOTARY WARBLER	6.0

NOTE: THIS PROGRAM MUST BE RUN TWICE ONCE FOR FUTURE WITHOUT PROJECT AND ONCE FOR FUTURE WITH PROJECT CONDITIONS.
SUBTRACT AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITHOUT PROJECT CONDITIONS FROM AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITH PROJECT CONDITIONS TO DETERMINE THE CHANGE IN AVERAGE ANNUAL HABITAT UNITS WITH THE PROJECT.

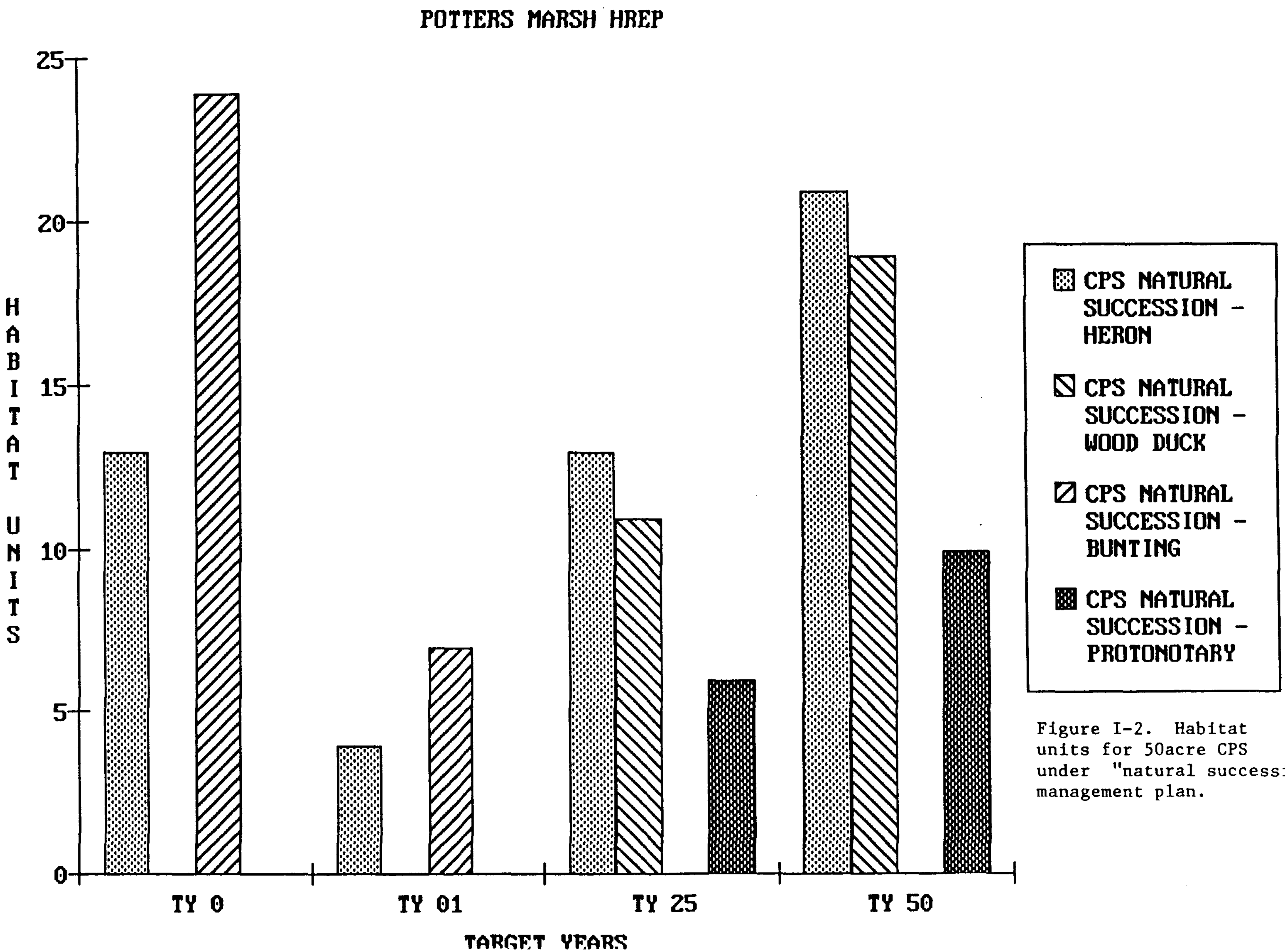

Figure I-2. Habitat units for 50acre CPS under "natural succession" management plan.

TABLE I-3

ROCK ISLAND DISTRICT CORPS OF ENGINEERS
FISH AND WILDLIFE SERVICE ROCK ISLAND

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

1	N	NONFOREST WETLAND
2	B	BOTTOMLAND HARDWOODS-WETLAND
3	C	CROPLAND-WETLAND
4	G	GRASSLAND-WETLAND

SPECIES ABREVIATIONS

1	TEAL	BLUE WING TEAL	7	HERO	GREEN-BACKED HERON
2	GOOS	CANADA GOOSE	8	DUCK	WOOD DUCK
3	BITT	LEAST BITTERN	9	DICK	DICKCISSEL
4	YLEG	LESSER YELLOWLEGS	10	COOT	AMERICAN COOT
5	MUSK	MUSKRAT	11	BUNT	INDIGO BUNTING
6	RAIL	KING RAIL	12	PROT	PROTHONOTARY WARBLER

DATA FILE NAMES	NUMBER OF SAMPLE SITES	PROJECT NAME
PRESENT = POTCPS6	1	POTTERS MARSH HREP
TARGET YR 1 = POTPLANC	1	POTTERS MARSH HREP
TARGET YR 25 = POTPLANC	1	POTTERS MARSH HREP
TARGET YR 50 = POTPLANC	1	POTTERS MARSH HREP

FILE POTPLANC CONTAINS 3 DATA SETS

THESE DATA FILES USE MATRIX POTTERS TODAY'S DATE 07-10-1991

THESE DATA SETS ARE FOR FUTURE WITH PROJECT CONDTIONS EVALUATING ONLY THE 50 ACRE CPS UNDER A "MOIST SOIL" PLAN.

HABITAT TYPE ACRES

HABITAT TYPE	PRESENT 0	TARGET YEARS 1	25	50
NONFOREST WETLAND		37	37	37
BOTTOMLAND HARDWOODS-W	50			
CROPLAND-WETLAND				
GRASSLAND-WETLAND		13	13	13
TOTAL	50	50	50	50

TABLE I-3 (Cont'd)

ACRES OF AVAILABLE HABITAT

SPECIES	PRESENT ACRES	T YR 1 ACRES	T YR 1 % CHANGE	T YR 25 ACRES	T YR 25 % CHANGE	T YR 50 ACRES	T YR 50 % CHANGE
		TARGET YEARS					
TEAL		37.0	100.0%	37.0	100.0%	37.0	100.0%
GOOS		37.0	100.0%	37.0	100.0%	37.0	100.0%
BITT		37.0	100.0%	37.0	100.0%	37.0	100.0%
YLEG		37.0	100.0%	37.0	100.0%	37.0	100.0%
MUSK		37.0	100.0%	37.0	100.0%	37.0	100.0%
RAIL		37.0	100.0%	37.0	100.0%	37.0	100.0%
HERO	50.0	37.0	-26.0%	37.0	-26.0%	37.0	-26.0%
DUCK	50.0	0.0	-100.0%	0.0	-100.0%	0.0	-100.0%
DICK							
COOT		37.0	100.0%	37.0	100.0%	37.0	100.0%
BUNT	50.0	0.0	-100.0%	0.0	-100.0%	0.0	-100.0%
PROT	50.0	0.0	-100.0%	0.0	-100.0%	0.0	-100.0%

AVAILABLE HABITAT IS THE TOTAL OF THE HABITAT TYPE ACRES USED BY THE SPECIES (NOT ALL SPECIES APPLY TO ALL HABITAT TYPES)

MEAN HABITAT SUITABILITY INDEX (HSI)

SPECIES	PRESENT INDEX	T YR 1 INDEX	T YR 1 % CHANGE	T YR 25 INDEX	T YR 25 % CHANGE	T YR 50 INDEX	T YR 50 % CHANGE
		TARGET YEARS					
TEAL		0.71	100.0%	0.71	100.0%	0.71	100.0%
GOOS		0.78	100.0%	0.78	100.0%	0.78	100.0%
BITT		0.10	100.0%	0.10	100.0%	0.10	100.0%
YLEG		0.10	100.0%	0.10	100.0%	0.10	100.0%
MUSK		0.10	100.0%	0.10	100.0%	0.10	100.0%
RAIL		0.10	100.0%	0.10	100.0%	0.10	100.0%
HERO	0.27	0.10	-63.0%	0.10	-63.0%	0.10	-63.0%
DUCK	0.10	0.00	-100.0%	0.00	-100.0%	0.00	-100.0%
DICK							
COOT		0.10	100.0%	0.10	100.0%	0.10	100.0%
BUNT	0.49	0.00	-100.0%	0.00	-100.0%	0.00	-100.0%
PROT	0.10	0.00	-100.0%	0.00	-100.0%	0.00	-100.0%

MEAN HSI = SUM AVERAGE HSI BY HABITAT TYPE X ACRES DIVIDED BY ACRES OF AVAILABLE HABITAT (ACRES USED BY THE SPECIES).
(i.e. MEAN HSI IS AVERAGE HSI WEIGHTED BY ACRES)

TABLE I-3 (Cont'd)

HABITAT UNITS

SPECIES	PRESENT HU	T YR 1 HU	T YR 1 % CHANGE	T YR 25 HU	T YR 25 % CHANGE	T YR 50 HU	T YR 50 % CHANGE
TEAL		26.4	100.0%	26.4	100.0%	26.4	100.0%
GOOS		28.9	100.0%	28.9	100.0%	28.9	100.0%
BITT							
YLEG							
MUSK							
RAIL							
HERO	13.5	0.0	-100.0%	0.0	-100.0%	0.0	-100.0%
DUCK							
DICK							
COOT							
BUNT	24.3	0.0	-100.0%	0.0	-100.0%	0.0	-100.0%
PROT							

HABITAT UNITS ARE HSI X ACRES (A MEASURE OF QUALITY X QUANTITY)
IF MEAN HSI = 0.10 THEN HABITAT UNITS ARE ZERO

TABLE I-3 (Cont'd)

ANNUAL AVERAGE HABITAT UNITS FOR FUTURE WITH PROJECT CONDTIONS

SPECIES	ANNUAL AVE. HABITAT UNITS
BLUE WING TEAL	26.0
CANADA GOOSE	28.5
LEAST BITTERN	
LESSER YELLOWLEGS	
MUSKRAT	
KING RAIL	
GREEN-BACKED HERON	3.8
WOOD DUCK	
DICKCISSEL	
AMERICAN COOT	
INDIGO BUNTING	0.2
PROTHONOTARY WARBLER	

NOTE: THIS PROGRAM MUST BE RUN TWICE ONCE FOR FUTURE WITHOUT PROJECT AND ONCE FOR FUTURE WITH PROJECT CONDITIONS.
SUBTRACT AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITHOUT PROJECT CONDITIONS FROM AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITH PROJECT CONDITIONS TO DETERMINE THE CHANGE IN AVERAGE ANNUAL HABITAT UNITS WITH THE PROJECT.

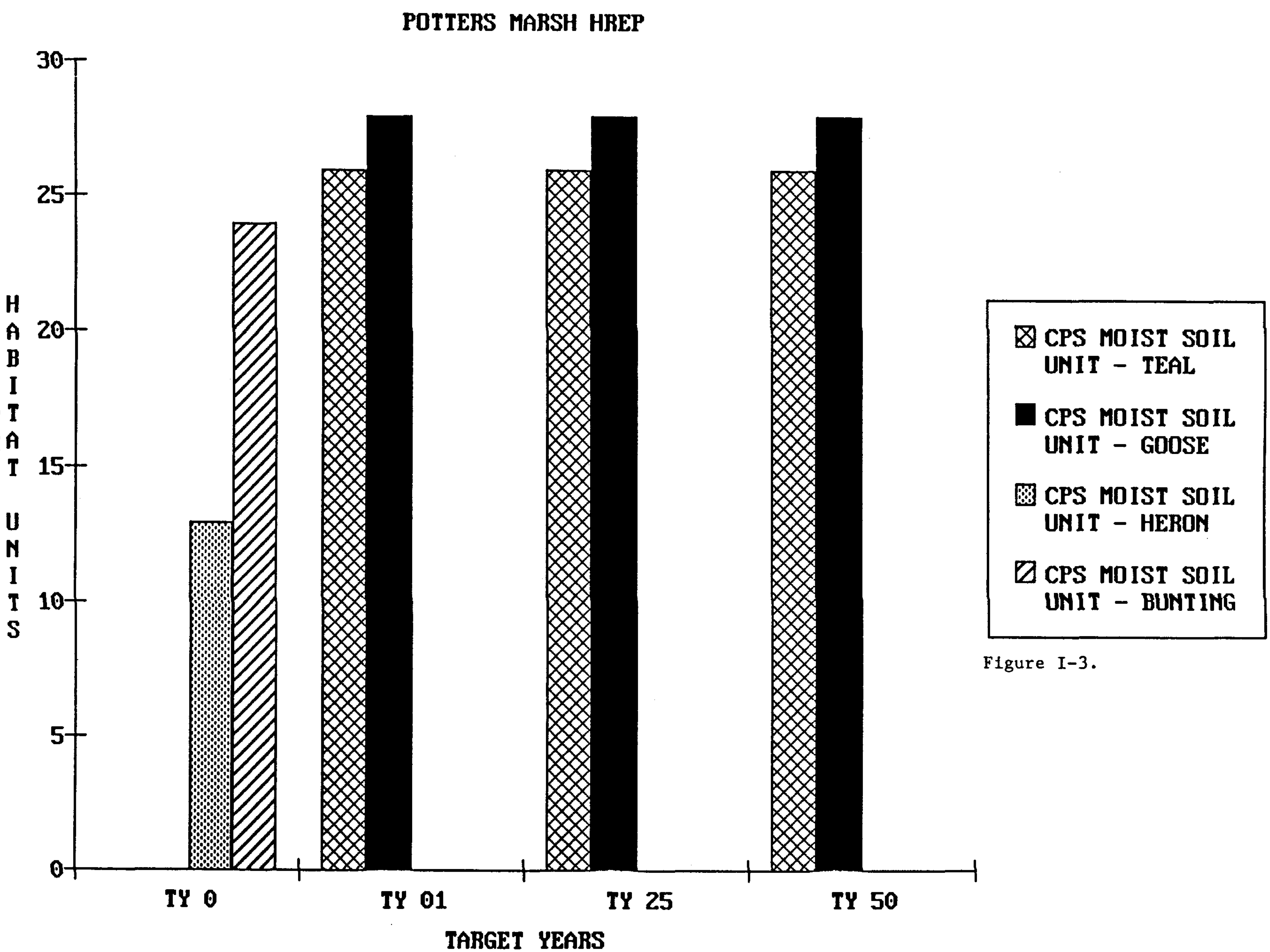
POTTERS MARSH HREP
HABITAT UNITS
30
25
20
15
10
5
0
TY 0
TY 01
TY 25
TY 50
TARGET YEARS
CPS MOIST SOIL UNIT - TEAL
CPS MOIST SOIL UNIT - GOOSE
CPS MOIST SOIL UNIT - HERON
CPS MOIST SOIL UNIT - BUNTING

Figure I-3.

TABLE I-4

ROCK ISLAND DISTRICT CORPS OF ENGINEERS
FISH AND WILDLIFE SERVICE ROCK ISLAND

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

1	N	NONFOREST WETLAND
2	B	BOTTOMLAND HARDWOODS-WETLAND
3	C	CROPLAND-WETLAND
4	G	GRASSLAND-WETLAND

SPECIES ABREVIATIONS

1	TEAL	BLUE WING TEAL	7	HERO	GREEN-BACKED HERON
2	GOOS	CANADA GOOSE	8	DUCK	WOOD DUCK
3	BITT	LEAST BITTERN	9	DICK	DICKCISSEL
4	YLEG	LESSER YELLOWLEGS	10	COOT	AMERICAN COOT
5	MUSK	MUSKRAT	11	BUNT	INDIGO BUNTING
6	RAIL	KING RAIL	12	PROT	PROTHONOTARY WARBLER

DATA FILE NAMES	NUMBER OF SAMPLE SITES	PROJECT NAME
PRESENT = POTCPS6	1	POTTERS MARSH HREP
TARGET YR 1 = POTPLAND	1	POTTERS MARSH HREP
TARGET YR 25 = POTPLAND	1	POTTERS MARSH HREP
TARGET YR 50 = POTPLAND	1	POTTERS MARSH HREP

FILE POTPLAND CONTAINS 3 DATA SETS

THESE DATA FILES USE MATRIX POTTERS   TODAY'S DATE 07-10-1991

THESE DATA SETS ARE FOR FUTURE WITH PROJECT CONDTIONS **EVALUATING ONLY THE 50 ACRE CPS UNDER "GRASSLAND" MANAGEMENT PLAN.**

HABITAT TYPE ACRES

HABITAT TYPE	PRESENT	TARGET YEARS		
	0	1	25	50
NONFOREST WETLAND				
BOTTOMLAND HARDWOODS-W	50			
CROPLAND-WETLAND				
GRASSLAND-WETLAND		50	50	50
TOTAL	50	50	50	50

TABLE I-4 (Cont'd)

ACRES OF AVAILABLE HABITAT

SPECIES	PRESENT ACRES	TARGET YEARS T YR 1 ACRES	T YR 1 % CHANGE	T YR 25 ACRES	T YR 25 % CHANGE	T YR 50 ACRES	T YR 50 % CHANGE
TEAL		50.0	100.0%	50.0	100.0%	50.0	100.0%
GOOS		50.0	100.0%	50.0	100.0%	50.0	100.0%
BITT							
YLEG							
MUSK							
RAIL							
HERO	50.0	0.0	-100.0%	0.0	-100.0%	0.0	-100.0%
DUCK	50.0	0.0	-100.0%	0.0	-100.0%	0.0	-100.0%
DICK		50.0	100.0%	50.0	100.0%	50.0	100.0%
COOT							
BUNT	50.0	50.0	0.0%	50.0	0.0%	50.0	0.0%
PROT	50.0	0.0	-100.0%	0.0	-100.0%	0.0	-100.0%

AVAILABLE HABITAT IS THE TOTAL OF THE HABITAT TYPE ACRES USED BY THE SPECIES (NOT ALL SPECIES APPLY TO ALL HABITAT TYPES)

MEAN HABITAT SUITABILITY INDEX (HSI)

SPECIES	PRESENT INDEX	TARGET YEARS T YR 1 INDEX	T YR 1 % CHANGE	T YR 25 INDEX	T YR 25 % CHANGE	T YR 50 INDEX	T YR 50 % CHANGE
TEAL		0.50	100.0%	0.50	100.0%	0.50	100.0%
GOOS		0.51	100.0%	0.47	100.0%	0.47	100.0%
BITT							
YLEG							
MUSK							
RAIL							
HERO	0.27	0.00	-100.0%	0.00	-100.0%	0.00	-100.0%
DUCK	0.10	0.00	-100.0%	0.00	-100.0%	0.00	-100.0%
DICK		0.65	100.0%	0.80	100.0%	0.73	100.0%
COOT							
BUNT	0.49	0.57	16.7%	0.67	37.3%	0.37	-24.5%
PROT	0.10	0.00	-100.0%	0.00	-100.0%	0.00	-100.0%

MEAN HSI = SUM AVERAGE HSI BY HABITAT TYPE X ACRES DIVIDED BY ACRES OF AVAILABLE HABITAT (ACRES USED BY THE SPECIES).
(i.e. MEAN HSI IS AVERAGE HSI WEIGHTED BY ACRES)

TABLE I-4 (Cont'd)

HABITAT UNITS

SPECIES	PRESENT HU	TARGET YEARS T YR 1 HU	T YR 1 % CHANGE	T YR 25 HU	T YR 25 % CHANGE	T YR 50 HU	T YR 50 % CHANGE
TEAL		25.0	100.0%	25.0	100.0%	25.0	100.0%
GOOS		25.3	100.0%	23.6	100.0%	23.6	100.0%
BITT							
YLEG							
MUSK							
RAIL							
HERO	13.5	0.0	-100.0%	0.0	-100.0%	0.0	-100.0%
DUCK							
DICK		32.5	100.0%	40.0	100.0%	36.3	100.0%
COOT							
BUNT	24.3	28.3	16.7%	33.3	37.3%	18.3	-24.5%
PROT							

HABITAT UNITS ARE HSI X ACRES (A MEASURE OF QUALITY X QUANTITY)
IF MEAN HSI = 0.10 THEN HABITAT UNITS ARE ZERO

TABLE I-4 (Cont'd)

ANNUAL AVERAGE HABITAT UNITS FOR FUTURE WITH PROJECT CONDTIONS

SPECIES	ANNUAL AVE. HABITAT UNITS
BLUE WING TEAL	24.7
CANADA GOOSE	23.7
LEAST BITTERN	
LESSER YELLOWLEGS	
MUSKRAT	
KING RAIL	
GREEN-BACKED HERON	0.1
WOOD DUCK	
DICKCISSEL	36.7
AMERICAN COOT	
INDIGO BUNTING	28.2
PROTHONOTARY WARBLER	

NOTE: THIS PROGRAM MUST BE RUN TWICE ONCE FOR FUTURE WITHOUT PROJECT AND ONCE FOR FUTURE WITH PROJECT CONDITIONS.
SUBTRACT AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITHOUT PROJECT CONDITIONS FROM AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITH PROJECT CONDITIONS TO DETERMINE THE CHANGE IN AVERAGE ANNUAL HABITAT UNITS WITH THE PROJECT.

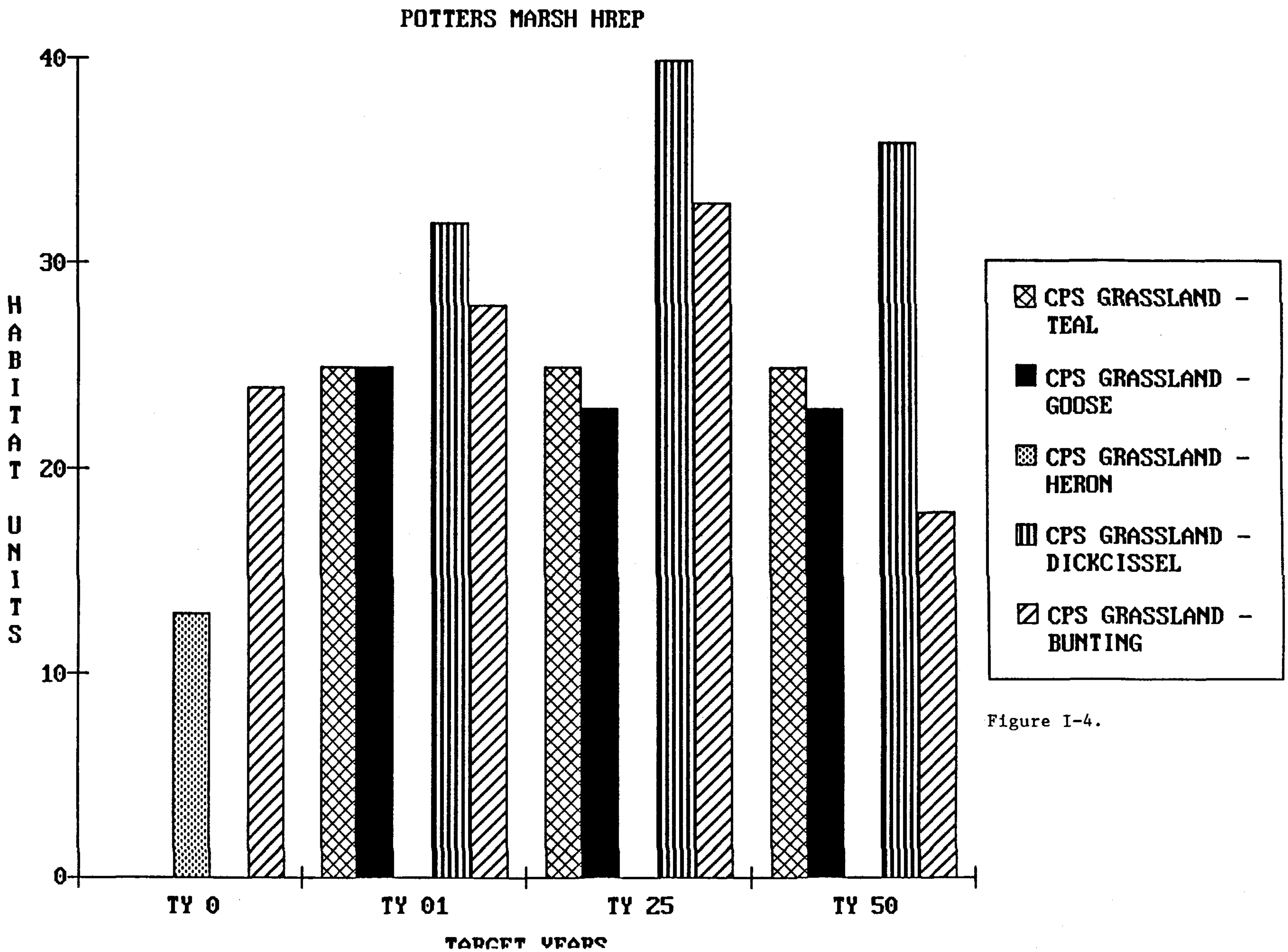
POTTERS MARSH HREP
HABITAT UNITS
0
10
20
30
40
TY 0
TY 01
TY 25
TY 50
CPS GRASSLAND - TEAL
CPS GRASSLAND - GOOSE
CPS GRASSLAND - HERON
CPS GRASSLAND - DICKCISSEL
CPS GRASSLAND - BUNTING

Figure I-4.

TABLE I-5

ROCK ISLAND DISTRICT CORPS OF ENGINEERS
FISH AND WILDLIFE SERVICE ROCK ISLAND

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

1	N	NONFOREST WETLAND
2	B	BOTTOMLAND HARDWOODS-WETLAND
3	C	CROPLAND-WETLAND
4	G	GRASSLAND-WETLAND

SPECIES ABREVIATIONS

1	TEAL	BLUE WING TEAL	7	HERO	GREEN-BACKED HERON
2	GOOS	CANADA GOOSE	8	DUCK	WOOD DUCK
3	BITT	LEAST BITTERN	9	DICK	DICKCISSEL
4	YLEG	LESSER YELLOWLEGS	10	COOT	AMERICAN COOT
5	MUSK	MUSKRAT	11	BUNT	INDIGO BUNTING
6	RAIL	KING RAIL	12	PROT	PROTHONOTARY WARBLER

DATA FILE NAMES	NUMBER OF SAMPLE SITES	PROJECT NAME
PRESENT = POTCPS6	1	POTTERS MARSH HREP
TARGET YR 1 = POTPLANM	3	POTTERS MARSH HREP
TARGET YR 25 = POTPLANM	3	POTTERS MARSH HREP
TARGET YR 50 = POTPLANM	3	POTTERS MARSH HREP

FILE POTPLANM CONTAINS 3 DATA SETS

THESE DATA FILES USE MATRIX POTTERS　　TODAY'S DATE 07-10-1991

THESE DATA SETS ARE FOR FUTURE WITH PROJECT CONDTIONS **EVALUATING ONLY THE 50 ACRE CPS UNDER "MANAGED MARSH" PLAN.**

HABITAT TYPE ACRES

HABITAT TYPE	PRESENT 0	TARGET YEARS 1	25	50
NONFOREST WETLAND		30	30	30
BOTTOMLAND HARDWOODS-W	50	7	7	7
CROPLAND-WETLAND				
GRASSLAND-WETLAND		13	13	13
TOTAL	50	50	50	50

TABLE I-5 (Cont'd)

ACRES OF AVAILABLE HABITAT

SPECIES	PRESENT ACRES	TARGET YEARS T YR 1 ACRES	% CHANGE	T YR 25 ACRES	% CHANGE	T YR 50 ACRES	% CHANGE
TEAL		43.0	100.0%	43.0	100.0%	43.0	100.0%
GOOS		43.0	100.0%	43.0	100.0%	43.0	100.0%
BITT		30.0	100.0%	30.0	100.0%	30.0	100.0%
YLEG		30.0	100.0%	30.0	100.0%	30.0	100.0%
MUSK		30.0	100.0%	30.0	100.0%	30.0	100.0%
RAIL		30.0	100.0%	30.0	100.0%	30.0	100.0%
HERO	50.0	37.0	-26.0%	37.0	-26.0%	37.0	-26.0%
DUCK	50.0	7.0	-86.0%	7.0	-86.0%	7.0	-86.0%
DICK		13.0	100.0%	13.0	100.0%	13.0	100.0%
COOT		30.0	100.0%	30.0	100.0%	30.0	100.0%
BUNT	50.0	20.0	-60.0%	20.0	-60.0%	20.0	-60.0%
PROT	50.0	7.0	-86.0%	7.0	-86.0%	7.0	-86.0%

AVAILABLE HABITAT IS THE TOTAL OF THE HABITAT TYPE ACRES USED BY THE SPECIES (NOT ALL SPECIES APPLY TO ALL HABITAT TYPES)

MEAN HABITAT SUITABILITY INDEX (HSI)

SPECIES	PRESENT INDEX	TARGET YEARS T YR 1 INDEX	% CHANGE	T YR 25 INDEX	% CHANGE	T YR 50 INDEX	% CHANGE
TEAL		0.51	100.0%	0.51	100.0%	0.51	100.0%
GOOS		0.32	100.0%	0.32	100.0%	0.32	100.0%
BITT		0.64	100.0%	0.64	100.0%	0.64	100.0%
YLEG		0.42	100.0%	0.42	100.0%	0.42	100.0%
MUSK		0.80	100.0%	0.80	100.0%	0.80	100.0%
RAIL		0.10	100.0%	0.10	100.0%	0.10	100.0%
HERO	0.27	0.61	127.7%	0.64	138.8%	0.65	142.5%
DUCK	0.10	0.10	0.0%	0.32	218.8%	0.39	287.5%
DICK		0.75	100.0%	0.75	100.0%	0.75	100.0%
COOT		0.81	100.0%	0.81	100.0%	0.81	100.0%
BUNT	0.49	0.58	19.4%	0.49	0.9%	0.49	0.9%
PROT	0.10	0.10	0.0%	0.17	70.0%	0.22	115.0%

MEAN HSI = SUM AVERAGE HSI BY HABITAT TYPE X ACRES DIVIDED BY ACRES OF AVAILABLE HABITAT (ACRES USED BY THE SPECIES).
(i.e. MEAN HSI IS AVERAGE HSI WEIGHTED BY ACRES)

TABLE I-5 (Cont'd)

HABITAT UNITS

SPECIES	PRESENT HU	T YR 1 HU	T YR 1 % CHANGE	T YR 25 HU	T YR 25 % CHANGE	T YR 50 HU	T YR 50 % CHANGE
TEAL		22.1	100.0%	22.1	100.0%	22.1	100.0%
GOOS		13.8	100.0%	13.8	100.0%	13.8	100.0%
BITT		19.3	100.0%	19.3	100.0%	19.3	100.0%
YLEG		12.7	100.0%	12.7	100.0%	12.7	100.0%
MUSK		24.0	100.0%	24.0	100.0%	24.0	100.0%
RAIL							
HERO	13.5	22.8	68.5%	23.9	76.7%	24.2	79.4%
DUCK				2.2	100.0%	2.7	100.0%
DICK		9.8	100.0%	9.8	100.0%	9.8	100.0%
COOT		24.4	100.0%	24.4	100.0%	24.4	100.0%
BUNT	24.3	11.6	-52.2%	9.8	-59.6%	9.8	-59.6%
PROT				1.2	100.0%	1.5	100.0%

HABITAT UNITS ARE HSI X ACRES (A MEASURE OF QUALITY X QUANTITY)
IF MEAN HSI = 0.10 THEN HABITAT UNITS ARE ZERO

TABLE I-5 (Cont'd)

ANNUAL AVERAGE HABITAT UNITS FOR FUTURE WITH PROJECT CONDTIONS

SPECIES	ANNUAL AVE. HABITAT UNITS
BLUE WING TEAL	21.8
CANADA GOOSE	13.7
LEAST BITTERN	19.0
LESSER YELLOWLEGS	12.5
MUSKRAT	23.7
KING RAIL	
GREEN-BACKED HERON	23.6
WOOD DUCK	2.0
DICKCISSEL	9.6
AMERICAN COOT	24.1
INDIGO BUNTING	10.4
PROTHONOTARY WARBLER	1.2

NOTE: THIS PROGRAM MUST BE RUN TWICE ONCE FOR FUTURE WITHOUT PROJECT AND ONCE FOR FUTURE WITH PROJECT CONDITIONS.
SUBTRACT AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITHOUT PROJECT CONDITIONS FROM AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITH PROJECT CONDITIONS TO DETERMINE THE CHANGE IN AVERAGE ANNUAL HABITAT UNITS WITH THE PROJECT.

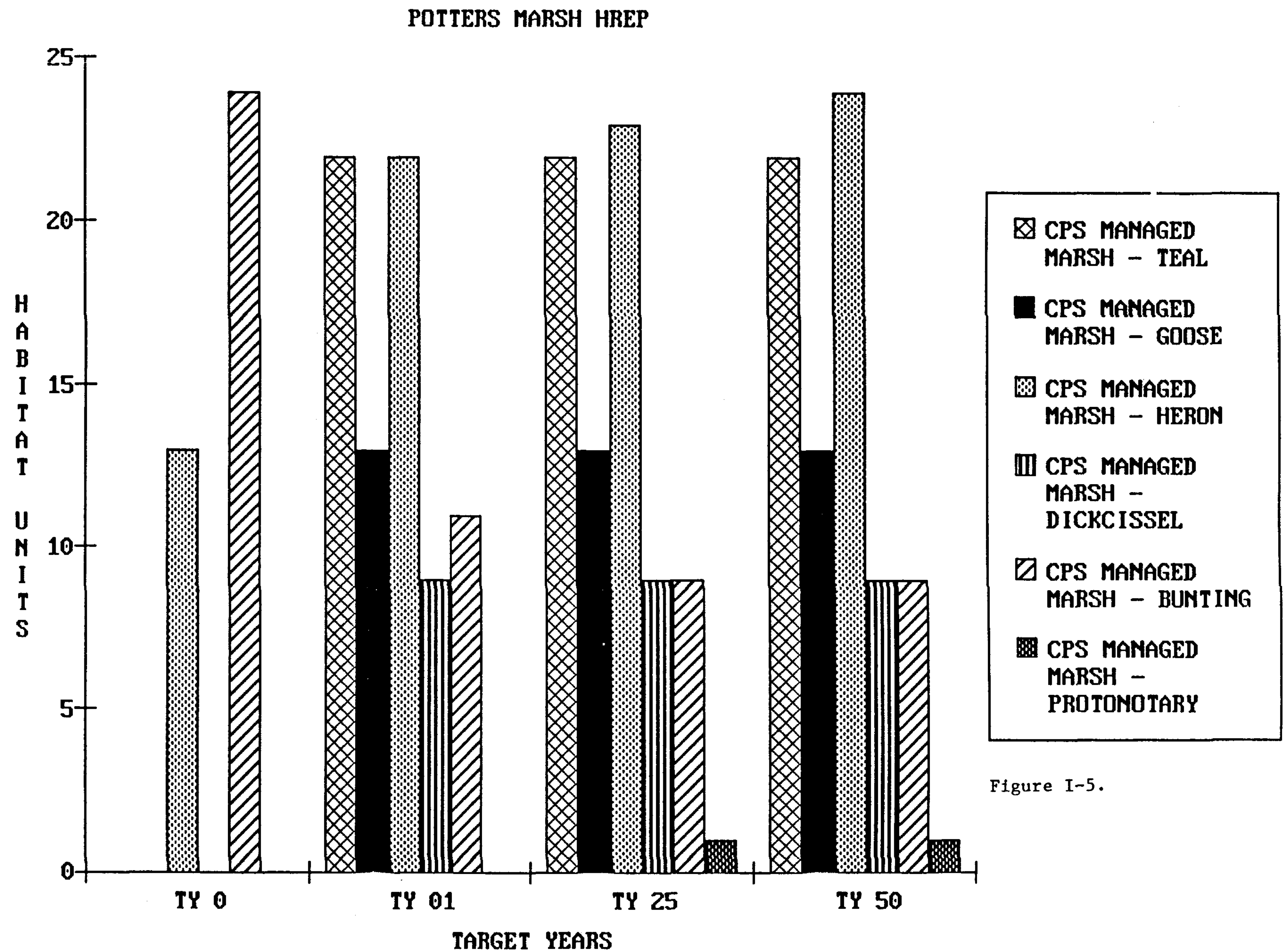
POTTERS MARSH HREP
HABITAT UNITS
25
20
15
10
5
0
TY 0
TY 01
TY 25
TY 50
TARGET YEARS
CPS MANAGED MARSH - TEAL
CPS MANAGED MARSH - GOOSE
CPS MANAGED MARSH - HERON
CPS MANAGED MARSH - DICKCISSEL
CPS MANAGED MARSH - BUNTING
CPS MANAGED MARSH - PROTONOTARY

Figure I-5.

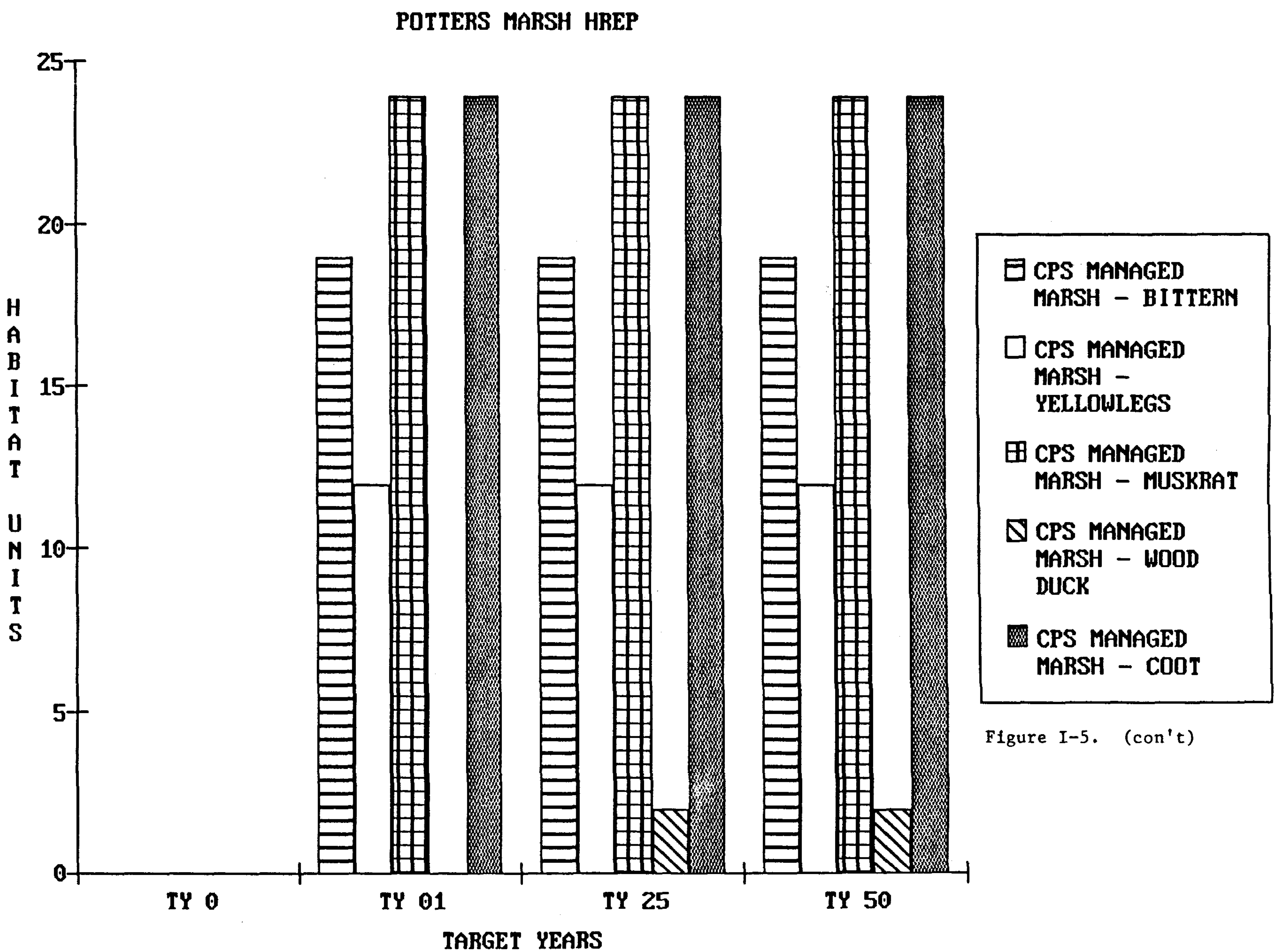

Figure I-5. (con't)

TABLE I-6

ROCK ISLAND DISTRICT CORPS OF ENGINEERS
FISH AND WILDLIFE SERVICE ROCK ISLAND

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

1	A	AQUATIC

SPECIES ABREVIATIONS

1	CCAT	CHANNEL CATFISH	3	LGMB	LARGEMOUTH BASS
2	WALL	WALLEYE	4		

DATA FILE NAMES	NUMBER OF SAMPLE SITES	PROJECT NAME
PRESENT = EXIST1	1	POTTERS MARSH HREP
TARGET YR 1 = AHAGPOT	5	POTTERS MARSH HREP
TARGET YR 25 = AHAGPOT	5	POTTERS MARSH HREP
TARGET YR 50 = AHAGPOT	5	POTTERS MARSH HREP

FILE AHAGPOT CONTAINS 3 DATA SETS

THESE DATA FILES USE MATRIX FISH-POT   TODAY'S DATE 07-31-1991

THESE DATA SETS ARE FOR FUTURE WITHOUT PROJECT CONDTIONS IN THE UPPER SEGMENT AND SEDIMENT TRAP.

HABITAT TYPE ACRES

HABITAT TYPE	PRESENT	TARGET YEARS		
	0	1	25	50
AQUATIC	17	17	6	2
TOTAL	17	17	6	2

TABLE I-6 (Cont'd)

ACRES OF AVAILABLE HABITAT

SPECIES	PRESENT ACRES	T YR 1 ACRES	T YR 1 % CHANGE	T YR 25 ACRES	T YR 25 % CHANGE	T YR 50 ACRES	T YR 50 % CHANGE
				TARGET YEARS			
CCAT	17.0	17.0	0.0%	6.0	-64.7%	2.0	-88.2%
WALL	17.0	17.0	0.0%	6.0	-64.7%	2.0	-88.2%
LGMB	17.0	17.0	0.0%	6.0	-64.7%	2.0	-88.2%

AVAILABLE HABITAT IS THE TOTAL OF THE HABITAT TYPE ACRES USED BY THE SPECIES (NOT ALL SPECIES APPLY TO ALL HABITAT TYPES)

MEAN HABITAT SUITABILITY INDEX (HSI)

SPECIES	PRESENT INDEX	T YR 1 INDEX	T YR 1 % CHANGE	T YR 25 INDEX	T YR 25 % CHANGE	T YR 50 INDEX	T YR 50 % CHANGE
				TARGET YEARS			
CCAT	0.10	0.17	73.3%	0.10	0.0%	0.10	0.0%
WALL	0.10	0.16	60.0%	0.10	0.0%	0.10	0.0%
LGMB	0.10	0.19	89.4%	0.10	0.0%	0.10	0.0%

MEAN HSI = SUM AVERAGE HSI BY HABITAT TYPE X ACRES DIVIDED BY ACRES OF AVAILABLE HABITAT (ACRES USED BY THE SPECIES).
(i.e. MEAN HSI IS AVERAGE HSI WEIGHTED BY ACRES)

TABLE I-6 (Cont'd)

HABITAT UNITS

SPECIES	PRESENT HU	TARGET YEARS: T YR 1 HU	T YR 1 % CHANGE	T YR 25 HU	T YR 25 % CHANGE	T YR 50 HU	T YR 50 % CHANGE
CCAT		2.9	100.0%				
WALL		2.7	100.0%				
LGMB		3.2	100.0%				

HABITAT UNITS ARE HSI X ACRES (A MEASURE OF QUALITY X QUANTITY)
IF MEAN HSI = 0.10 THEN HABITAT UNITS ARE ZERO

TABLE I-6 (Cont'd)

ANNUAL AVERAGE HABITAT UNITS FOR FUTURE WITHOUT PROJECT CONDITIONS

SPECIES	ANNUAL AVE. HABITAT UNITS
CHANNEL CATFISH	1.0
WALLEYE	1.0
LARGEMOUTH BASS	1.1

NOTE: THIS PROGRAM MUST BE RUN TWICE ONCE FOR FUTURE WITHOUT PROJECT AND ONCE FOR FUTURE WITH PROJECT CONDITIONS.
SUBTRACT AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITHOUT PROJECT CONDITIONS FROM AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITH PROJECT CONDITIONS TO DETERMINE THE CHANGE IN AVERAGE ANNUAL HABITAT UNITS WITH THE PROJECT.

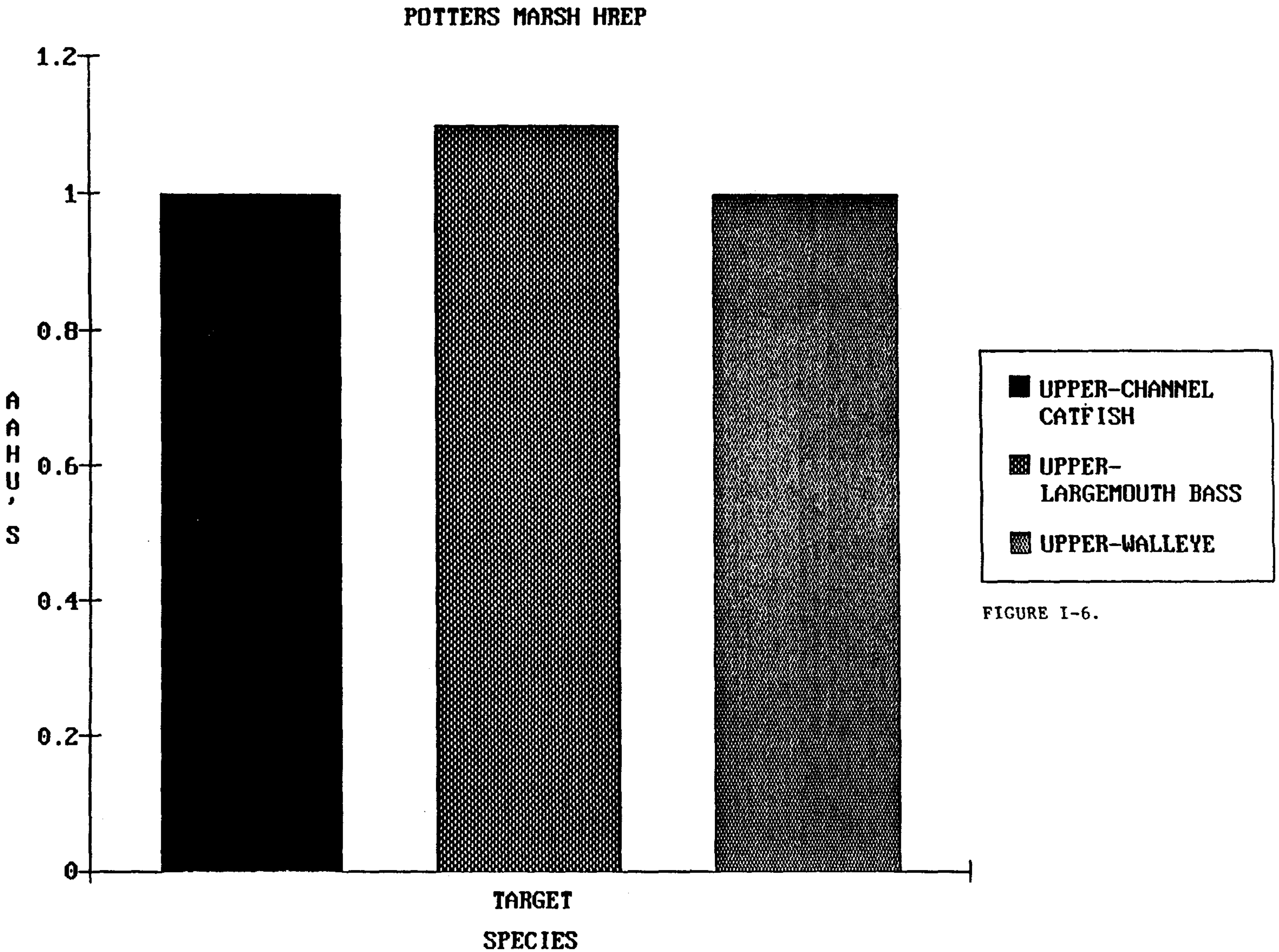
POTTERS MARSH HREP
1.2
1
0.8
0.6
0.4
0.2
0
AAHU'S
TARGET
SPECIES
UPPER-CHANNEL CATFISH
UPPER-LARGEMOUTH BASS
UPPER-WALLEYE

FIGURE I-6.

TABLE I-7

ROCK ISLAND DISTRICT CORPS OF ENGINEERS
FISH AND WILDLIFE SERVICE ROCK ISLAND

Segment 1
W

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

1	A	AQUATIC

SPECIES ABREVIATIONS

1	CCAT	CHANNEL CATFISH	3	LGMB	LARGEMOUTH BASS
2	WALL	WALLEYE	4		

DATA FILE NAMES	NUMBER OF SAMPLE SITES	PROJECT NAME
PRESENT = EXIST1	1	POTTERS MARSH HREP
TARGET YR 1 = POTDRED1	1	POTTERS MARSH HREP
TARGET YR 25 = POTDRED1	1	POTTERS MARSH HREP
TARGET YR 50 = POTDRED1	1	POTTERS MARSH HREP

FILE POTDRED1 CONTAINS 3 DATA SETS

THESE DATA FILES USE MATRIX FISH-POT TODAY'S DATE 07-29-1991

THESE DATA SETS ARE FOR FUTURE WITH PROJECT CONDTIONS OF DREDGING THE UPPER SEGMENT AND SEDIMENT TRAP

HABITAT TYPE ACRES

HABITAT TYPE	PRESENT 0	TARGET YEARS 1	25	50
AQUATIC	17	47	36	30
TOTAL	17	47	36	30

TABLE I-7 (Cont'd)

ACRES OF AVAILABLE HABITAT

SPECIES	PRESENT ACRES	TARGET YEARS T YR 1 ACRES	% CHANGE	T YR 25 ACRES	% CHANGE	T YR 50 ACRES	% CHANGE
CCAT	17.0	47.0	176.5%	36.0	111.8%	30.0	76.5%
WALL	17.0	47.0	176.5%	36.0	111.8%	30.0	76.5%
LGMB	17.0	47.0	176.5%	36.0	111.8%	30.0	76.5%

AVAILABLE HABITAT IS THE TOTAL OF THE HABITAT TYPE ACRES USED BY THE SPECIES (NOT ALL SPECIES APPLY TO ALL HABITAT TYPES)

MEAN HABITAT SUITABILITY INDEX (HSI)

SPECIES	PRESENT INDEX	TARGET YEARS T YR 1 INDEX	% CHANGE	T YR 25 INDEX	% CHANGE	T YR 50 INDEX	% CHANGE
CCAT	0.10	0.69	591.7%	0.58	483.3%	0.53	425.0%
WALL	0.10	0.66	562.5%	0.60	500.0%	0.51	412.5%
LGMB	0.10	0.85	754.7%	0.73	626.5%	0.67	566.7%

MEAN HSI = SUM AVERAGE HSI BY HABITAT TYPE X ACRES DIVIDED BY ACRES OF AVAILABLE HABITAT (ACRES USED BY THE SPECIES).
(i.e. MEAN HSI IS AVERAGE HSI WEIGHTED BY ACRES)

TABLE I-7 (Cont'd)

HABITAT UNITS

SPECIES	PRESENT HU	TARGET YEARS T YR 1 HU	T YR 1 % CHANGE	T YR 25 HU	T YR 25 % CHANGE	T YR 50 HU	T YR 50 % CHANGE
CCAT		32.5	100.0%	21.0	100.0%	15.8	100.0%
WALL		31.1	100.0%	21.6	100.0%	15.4	100.0%
LGMB		40.2	100.0%	26.2	100.0%	20.0	100.0%

HABITAT UNITS ARE HSI X ACRES (A MEASURE OF QUALITY X QUANTITY)
IF MEAN HSI = 0.10 THEN HABITAT UNITS ARE ZERO

TABLE I-7 (Cont'd)

ANNUAL AVERAGE HABITAT UNITS FOR FUTURE WITH PROJECT CONDTIONS

SPECIES	ANNUAL AVE. HABITAT UNITS
CHANNEL CATFISH	22.2
WALLEYE	22.1
LARGEMOUTH BASS	27.7

NOTE: THIS PROGRAM MUST BE RUN TWICE ONCE FOR FUTURE WITHOUT PROJECT AND ONCE FOR FUTURE WITH PROJECT CONDITIONS.
SUBTRACT AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITHOUT PROJECT CONDITIONS FROM AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITH PROJECT CONDITIONS TO DETERMINE THE CHANGE IN AVERAGE ANNUAL HABITAT UNITS WITH THE PROJECT.

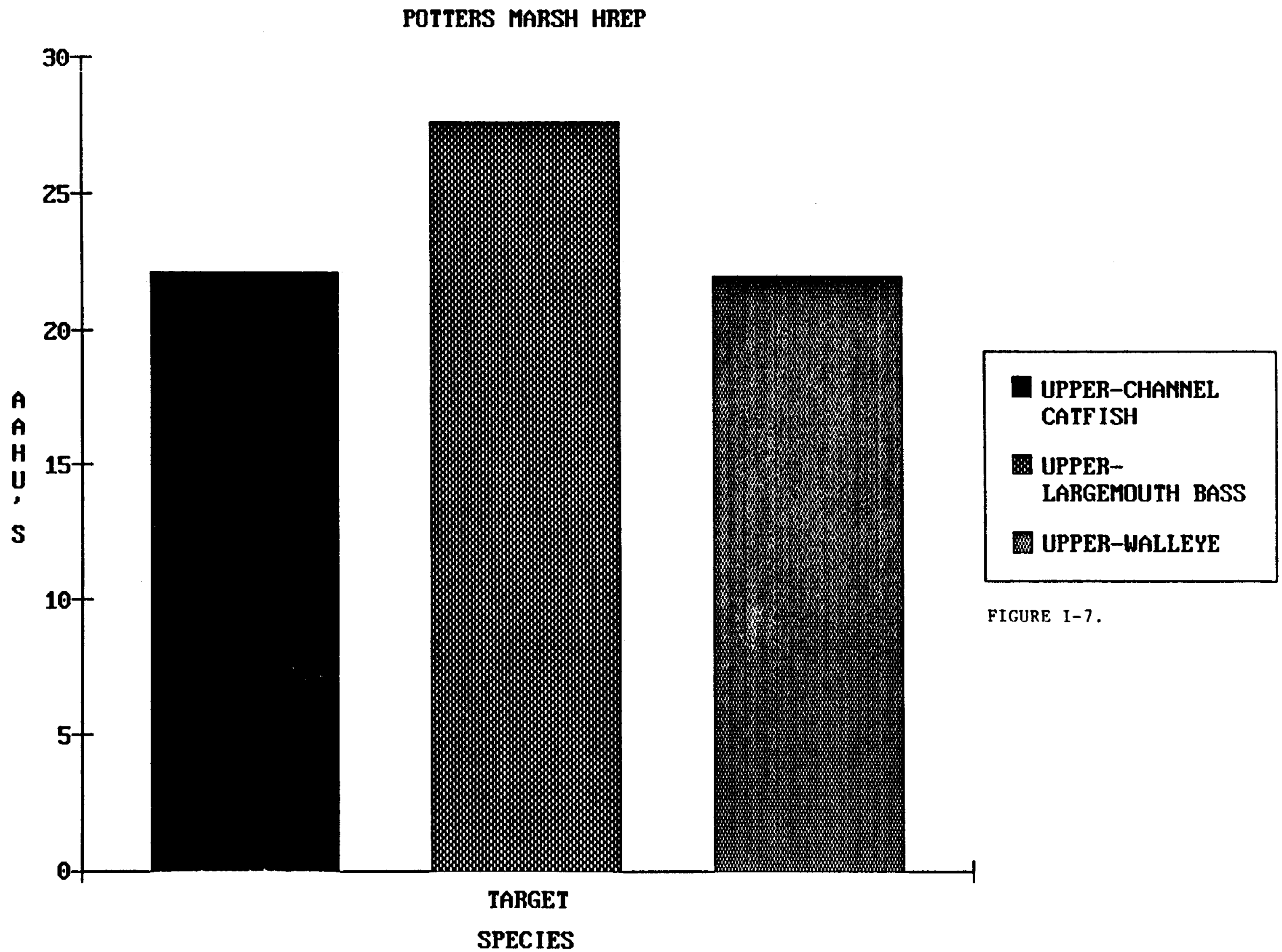
POTTERS MARSH HREP
30
25
20
15
10
5
0
AAHU'S
TARGET
SPECIES
UPPER-CHANNEL CATFISH
UPPER-LARGEMOUTH BASS
UPPER-WALLEYE

FIGURE I-7.

TABLE I-8

ROCK ISLAND DISTRICT CORPS OF ENGINEERS
FISH AND WILDLIFE SERVICE ROCK ISLAND

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

1	A	AQUATIC

SPECIES ABREVIATIONS

1	CCAT	CHANNEL CATFISH	3	LGMB	LARGEMOUTH BASS
2	WALL	WALLEYE	4		

DATA FILE NAMES	NUMBER OF SAMPLE SITES	PROJECT NAME
PRESENT = EXISTL	2	
TARGET YR 1 = AHAGPOT	5	POTTERS MARSH HREP
TARGET YR 25 = AHAGPOT	5	POTTERS MARSH HREP
TARGET YR 50 = AHAGPOT	5	POTTERS MARSH HREP

FILE AHAGPOT CONTAINS 3 DATA SETS

THESE DATA FILES USE MATRIX FISH-POT   TODAY'S DATE 07-31-1991

THESE DATA SETS ARE FOR FUTURE WITHOUT PROJECT CONDTIONS IN THE LOWER SEGMENTS

CUBIC YARD VALUES HAVE BEEN SUBSTITUTED FOR ACRE VALUES IN THE AQUATIC MODEL RUNS

HABITAT TYPE ACRES

HABITAT TYPE	PRESENT	TARGET YEARS		
	0	1	25	50
AQUATIC	503	503	437	393
TOTAL	503	503	437	393

TABLE I-8 (Cont'd)

ACRES OF AVAILABLE HABITAT

		TARGET YEARS					
	PRESENT	T YR 1		T YR 25		T YR 50	
SPECIES	ACRES	ACRES	% CHANGE	ACRES	% CHANGE	ACRES	% CHANGE
CCAT	503.0	503.0	0.0%	437.0	-13.1%	393.0	-21.9%
WALL	503.0	503.0	0.0%	437.0	-13.1%	393.0	-21.9%
LGMB	503.0	503.0	0.0%	437.0	-13.1%	393.0	-21.9%

AVAILABLE HABITAT IS THE TOTAL OF THE HABITAT TYPE ACRES USED BY THE SPECIES (NOT ALL SPECIES APPLY TO ALL HABITAT TYPES)

MEAN HABITAT SUITABILITY INDEX (HSI)

		TARGET YEARS					
	PRESENT	T YR 1		T YR 25		T YR 50	
SPECIES	INDEX	INDEX	% CHANGE	INDEX	% CHANGE	INDEX	% CHANGE
CCAT	0.28	0.17	-38.8%	0.10	-64.7%	0.10	-64.7%
WALL	0.25	0.16	-36.0%	0.10	-60.0%	0.10	-60.0%
LGMB	0.32	0.19	-41.5%	0.10	-69.1%	0.10	-69.1%

MEAN HSI = SUM AVERAGE HSI BY HABITAT TYPE X ACRES DIVIDED BY ACRES OF AVAILABLE HABITAT (ACRES USED BY THE SPECIES).
(i.e. MEAN HSI IS AVERAGE HSI WEIGHTED BY ACRES)

TABLE I-8 (Cont'd)

HABITAT UNITS

SPECIES	PRESENT HU	TARGET YEARS T YR 1 HU	% CHANGE	T YR 25 HU	% CHANGE	T YR 50 HU	% CHANGE
CCAT	142.5	87.2	-38.8%	0.0	-100.0%	0.0	-100.0%
WALL	125.8	80.5	-36.0%	0.0	-100.0%	0.0	-100.0%
LGMB	162.7	95.3	-41.5%	0.0	-100.0%	0.0	-100.0%

HABITAT UNITS ARE HSI X ACRES (A MEASURE OF QUALITY X QUANTITY)
IF MEAN HSI = 0.10 THEN HABITAT UNITS ARE ZERO

TABLE I-8 (Cont'd)

ANNUAL AVERAGE HABITAT UNITS FOR FUTURE WITHOUT PROJECT CONDITIONS

SPECIES	ANNUAL AVE. HABITAT UNITS
CHANNEL CATFISH	54.1
WALLEYE	52.3
LARGEMOUTH BASS	56.2

NOTE: THIS PROGRAM MUST BE RUN TWICE ONCE FOR FUTURE WITHOUT PROJECT AND ONCE FOR FUTURE WITH PROJECT CONDITIONS.
SUBTRACT AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITHOUT PROJECT CONDITIONS FROM AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITH PROJECT CONDITIONS TO DETERMINE THE CHANGE IN AVERAGE ANNUAL HABITAT UNITS WITH THE PROJECT.

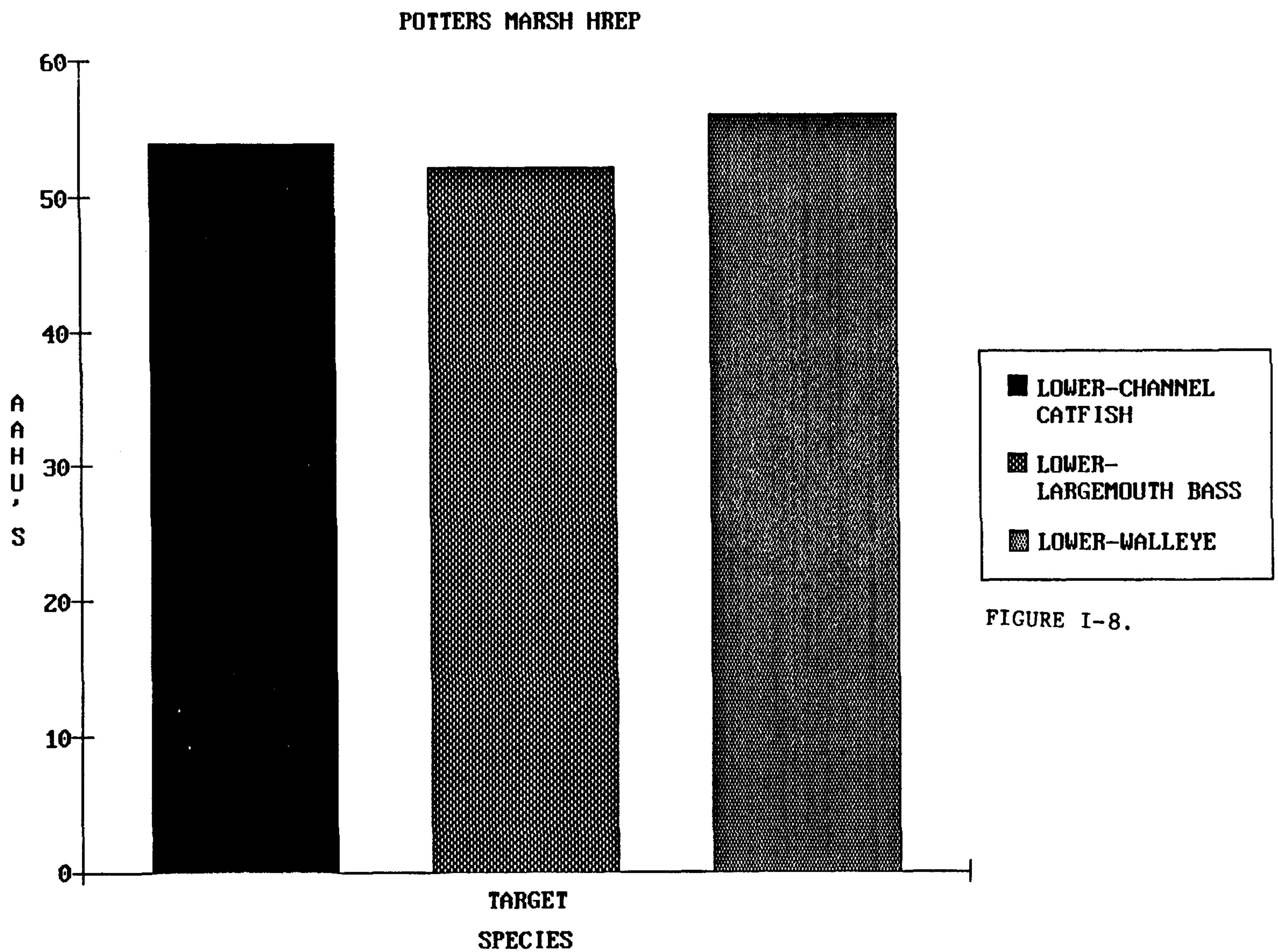
POTTERS MARSH HREP
AAHU'S
60
50
40
30
20
10
0
TARGET
SPECIES
LOWER-CHANNEL CATFISH
LOWER-LARGEMOUTH BASS
LOWER-WALLEYE

FIGURE I-8.

TABLE I-9

ROCK ISLAND DISTRICT CORPS OF ENGINEERS
FISH AND WILDLIFE SERVICE ROCK ISLAND

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

1	A	AQUATIC

SPECIES ABREVIATIONS

1	CCAT	CHANNEL CATFISH	3	LGMB	LARGEMOUTH BASS
2	WALL	WALLEYE	4		

DATA FILE NAMES	NUMBER OF SAMPLE SITES	PROJECT NAME
PRESENT = EXISTL	2	
TARGET YR 1 = POTDRED4	1	POTTERS MARSH HREP
TARGET YR 25 = POTDRED4	1	POTTERS MARSH HREP
TARGET YR 50 = POTDRED4	1	POTTERS MARSH HREP

FILE POTDRED4 CONTAINS 3 DATA SETS

THESE DATA FILES USE MATRIX FISH-POT   TODAY'S DATE 07-29-1991

THESE DATA SETS ARE FOR FUTURE WITH PROJECT CONDTIONS OF DREDGING THE LOWER SEGMENT AND DEEP HOLES

HABITAT TYPE ACRES

HABITAT TYPE	PRESENT 0	TARGET YEARS 1	25	50
AQUATIC	503	742	677	633
TOTAL	503	742	677	633

TABLE I-9 (Cont'd)

ACRES OF AVAILABLE HABITAT

		TARGET YEARS					
	PRESENT	T YR 1		T YR 25		T YR 50	
SPECIES	ACRES	ACRES	% CHANGE	ACRES	% CHANGE	ACRES	% CHANGE
CCAT	142.5	352.5	147.3%	338.5	137.5%	316.5	122.1%
WALL	125.8	296.8	136.0%	270.8	115.3%	253.2	101.4%
LGMB	162.7	412.2	153.3%	428.2	163.1%	400.4	146.0%

AVAILABLE HABITAT IS THE TOTAL OF THE HABITAT TYPE ACRES USED BY THE SPECIES (NOT ALL SPECIES APPLY TO ALL HABITAT TYPES)

MEAN HABITAT SUITABILITY INDEX (HSI)

		TARGET YEARS					
	PRESENT	T YR 1		T YR 25		T YR 50	
SPECIES	INDEX	INDEX	% CHANGE	INDEX	% CHANGE	INDEX	% CHANGE
CCAT	0.28	0.48	67.6%	0.50	76.5%	0.50	76.5%
WALL	0.25	0.40	60.0%	0.40	60.0%	0.40	60.0%
LGMB	0.32	0.56	71.7%	0.63	95.5%	0.63	95.5%

MEAN HSI = SUM AVERAGE HSI BY HABITAT TYPE X ACRES DIVIDED BY ACRES OF AVAILABLE HABITAT (ACRES USED BY THE SPECIES).
(i.e. MEAN HSI IS AVERAGE HSI WEIGHTED BY ACRES)

TABLE I-9 (Cont'd)

HABITAT UNITS

		TARGET YEARS					
	PRESENT	T YR 1		T YR 25		T YR 50	
SPECIES	HU	HU	% CHANGE	HU	% CHANGE	HU	% CHANGE
CCAT	142.5	352.5	147.3%	338.5	137.5%	316.5	122.1%
WALL	125.9	296.8	136.0%	270.8	115.3%	253.2	101.4%
LGMB	162.7	412.2	153.3%	428.2	163.1%	400.4	146.0%

HABITAT UNITS ARE HSI X ACRES (A MEASURE OF QUALITY X QUANTITY)
IF MEAN HSI = 0.10 THEN HABITAT UNITS ARE ZERO

TABLE I-9 (Cont'd)

ANNUAL AVERAGE HABITAT UNITS FOR FUTURE WITH PROJECT CONDTIONS

SPECIES	ANNUAL AVE. HABITAT UNITS
CHANNEL CATFISH	334.5
WALLEYE	271.3
LARGEMOUTH BASS	414.8

NOTE: THIS PROGRAM MUST BE RUN TWICE ONCE FOR FUTURE WITHOUT PROJECT AND ONCE FOR FUTURE WITH PROJECT CONDITIONS.
SUBTRACT AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITHOUT PROJECT CONDITIONS FROM AVERAGE ANNUAL HABITAT UNITS FOR FUTURE WITH PROJECT CONDITIONS TO DETERMINE THE CHANGE IN AVERAGE ANNUAL HABITAT UNITS WITH THE PROJECT.

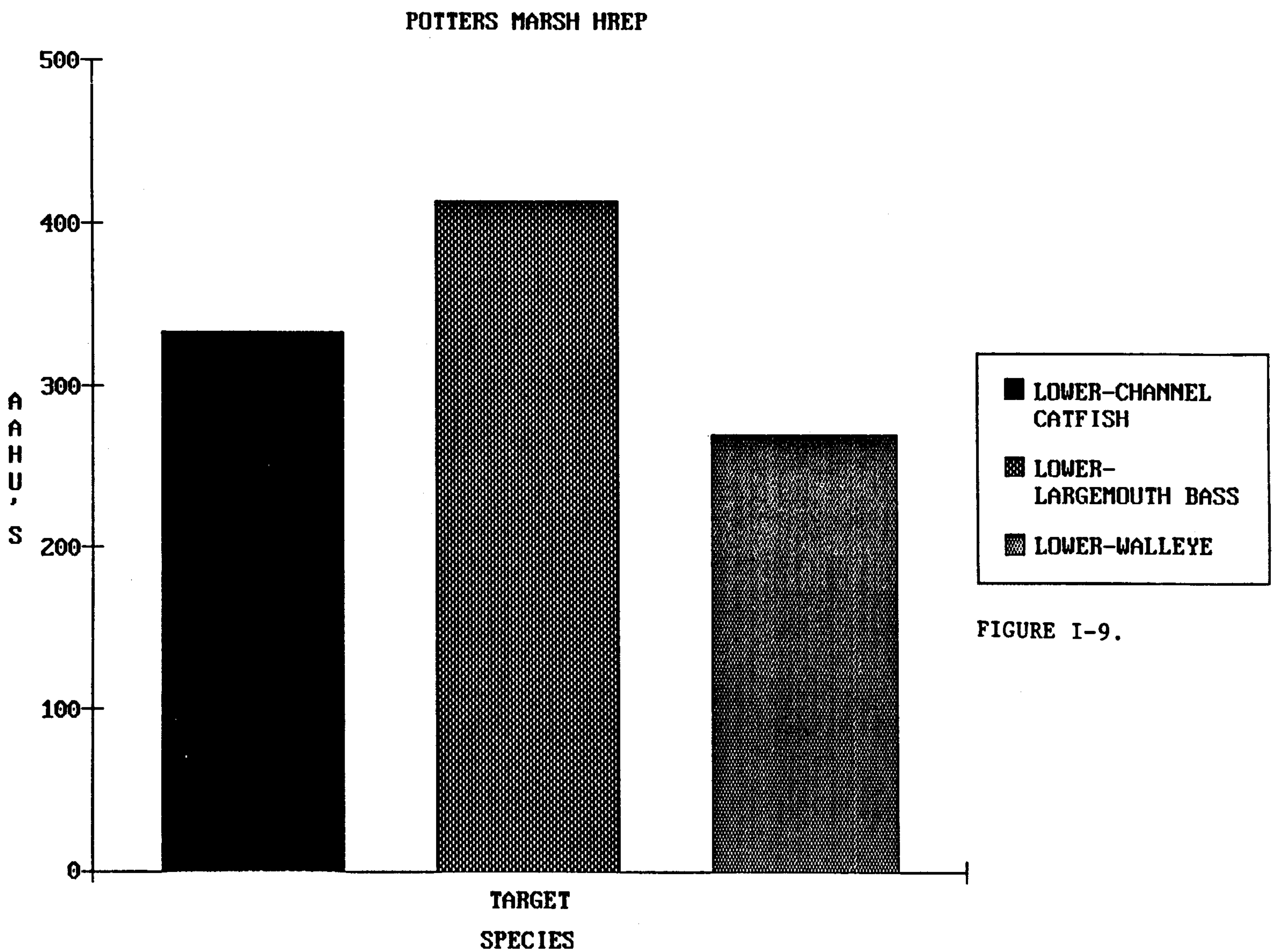
POTTERS MARSH HREP
500
400
300
200
100
0
AAHU'S
TARGET
SPECIES
LOWER-CHANNEL CATFISH
LOWER-LARGEMOUTH BASS
LOWER-WALLEYE

FIGURE I-9.

DISTRIBUTION LIST

APPENDIX

J

DISTRIBUTION LIST FOR

UMRS-EMP
POTTERS MARSH REHABILITATION & ENHANCEMENT
CARROLL AND WHITESIDE COUNTIES, IL

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MR LARRY WARGOWSKY, US FISH & WILDLIFE SERVICE UMR NATL WILDLIFE & FISH REFUGE, POST OFFICE BLDG SAVANNA IL 61074	1	1	1		1	1
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DISTRICT ENGINEER, US ARMY ENGINEER DISTRICT-ST PAUL ATTN PLANNING DIV - CHUCK CRIST, 180 E KELLOGG BLVD-1421 USPO ST PAUL MN 55101-1479	1	1	1			1
DISTRICT ENGINEER, US ARMY ENGINEER DISTRICT ST LOUIS ATTN CELMS-PD/BEN HAWICKHORST, 1222 SPRUCE STREET ST LOUIS MO 63103-2833	1	1	1			1
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HONORABLE JIM EDGAR, GOVERNOR OF ILLINOIS STATE CAPITOL, SPRINGFIELD IL 62706		1				
MS LINDA VOGT, DEPT OF ENERGY AND NATURAL RESOURCES 325 W ADAMS, SPRINGFIELD IL 62704		1				
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MR HERMAN HIER, ILLINOIS DEPT OF CONSERVATION LINCOLN TOWER PLAZA, 524 SOUTH 2ND STREET SPRINGFIELD IL 62706		1				
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MR THEODORE W HILD-DEPUTY SHPO, IL HISTORIC PRESERVATION AGENCY PRESERVATION SERVICES DIVISION, OLD STATE CAPITOL SPRINGFIELD IL 62701		1				
GEOLOGICAL SURVEY BUREAU, ENERGY AND GEOLOGICAL RESOURCES DIVN IOWA DEPT OF NATURAL RESOURCES, 123 NORTH CAPITOL STREET IOWA CITY IA 52240		1				
ROBERT SHEETS, DEPARTMENT OF NATURAL RESOURCES MAQUOKETA WILDLIFE UNIT, PERSHING ROAD EAST MAQUOKETA IA 52060	1	1	1			
KEVIN SZCODRONSKI, DEPT OF NATURAL RESOURCES, WALLACE STATE OFFICE BUILDING , 900 E GRAND AVENUE DES MOINES IA 50319-0034		1	1			
MARION CONOVER, UMR CONSERVATION COMMITTEE DEPT OF NATURAL RESOURCES, WALLACE STATE OFFICE BLDG DES MOINES IA 50319		1	1			
MR NORMAN STUCKY, MISSOURI DEPT OF CONSERVATION PO BOX 180, JEFFERSON CITY MO 65102		1	1			
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ATTN: CENCR-DE	1	1	1			
CENCR-DP	1	1	1			
CENCR-PP-M	1	1	1		1	1
CENCR-ED	1	1	1			1
CENCR-ED-D	1	1	1		1	1
CENCR-ED-DG	3	3	3		3	3
CENCR-ED-DS	1	1	1		1	1
CENCR-ED-G	1	1	1		1	1
CENCR-ED-H	1	1	1			1
CENCR-ED-HW	1	1	1		1	1
CENCR-ED-HQ	1	1	1			1
CENCR-PA	1	1	1			
CENCR-PD	2	2	2		2	2
CENCR-PD-E	1	10	10		1	1
CENCR-PD-W	2	2	2		1	2
CENCR-OD	1	1	1			1
CENCR-OD-M	1	1	1		1	1
CENCR-OD-R	1	1	1			1
CENCR-OD-S	1	1	1			1
CENCR-CD	1	1	1			
CENCR-CD-Q		1	1		1	
CENCR-CD-P		1	1		1	
CENCR-RE	1	1	1			
CENCR-IM-CL			2			1

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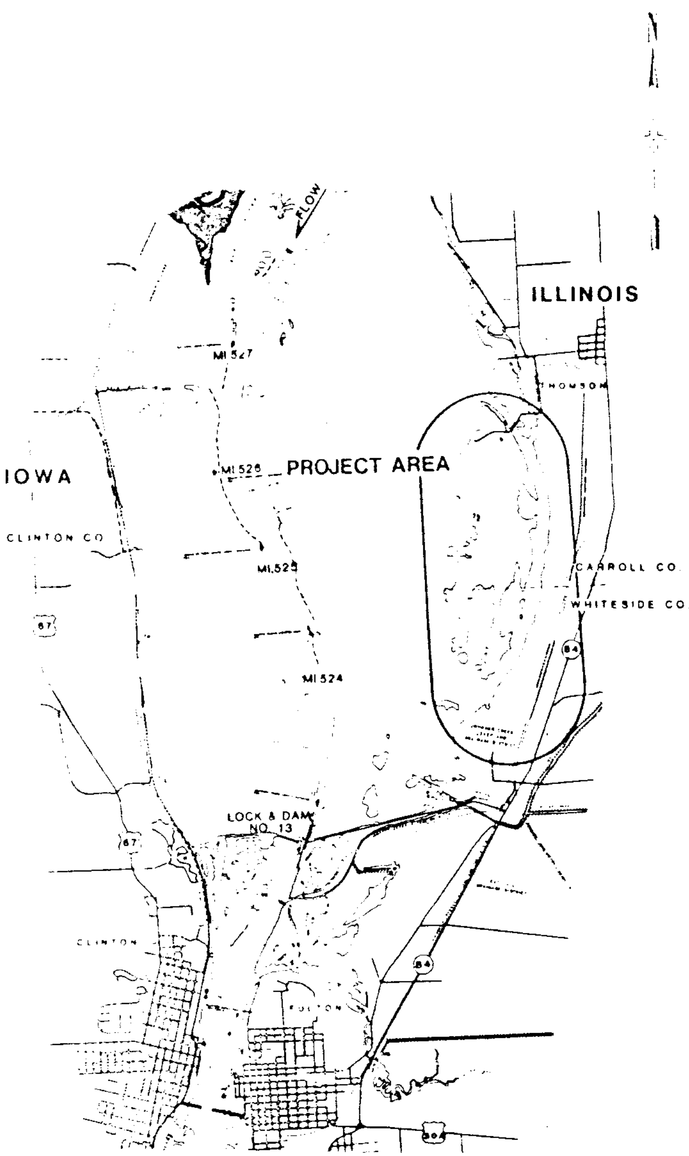
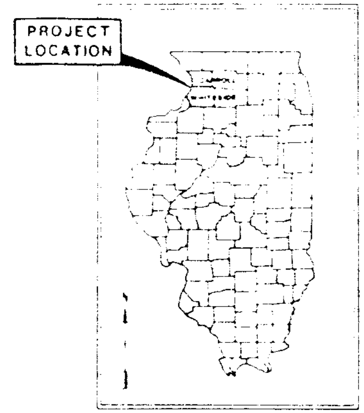


LOCATION PLAN



VICINITY MAP

INDEX		
SHEET NO	SHEET REF NO	DESCRIPTION
1	X-1	VICINITY MAP, LOCATION PLAN, AND INDEX
2	C-1	RECOMMENDED PLAN
3	C-2	ALTERNATIVE PLANS
4	C-3	HYDRAULIC DATA I
5	C-4	HYDRAULIC DATA II
6	C-5	BORING LOGS I
7	C-6	BORING LOGS II
8	C-7	BORING LOCATIONS
9	C-8	DREDGE PLAN I
10	C-9	DREDGE PLAN II
11	C-10	TOPOGRAGHIC AND CPS PLAN
12	C-11	TYPICAL SECTIONS I
13	C-12	TYPICAL SECTIONS II
14	C-13	COMPOSITE SEDIMENTATION CROSS SECTIONS I
15	C-14	COMPOSITE SEDIMENTATION CROSS SECTIONS II
16	S-1	STOPLOG STRUCTURE AND WELL SITE PLAN/DETAILS
17	E-1	ELECTRICAL
18	MP-1	MONITORING PLAN

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

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13, RIVER MILES 523.5-526.5

POTTERS MARSH

VICINITY MAP, LOCATION PLAN AND INDEX

Designed by: JHW
Drawn by: DJS
Checked by:
Reviewed by:
Approved by:

Drawing Code: X-1

PLATE 1

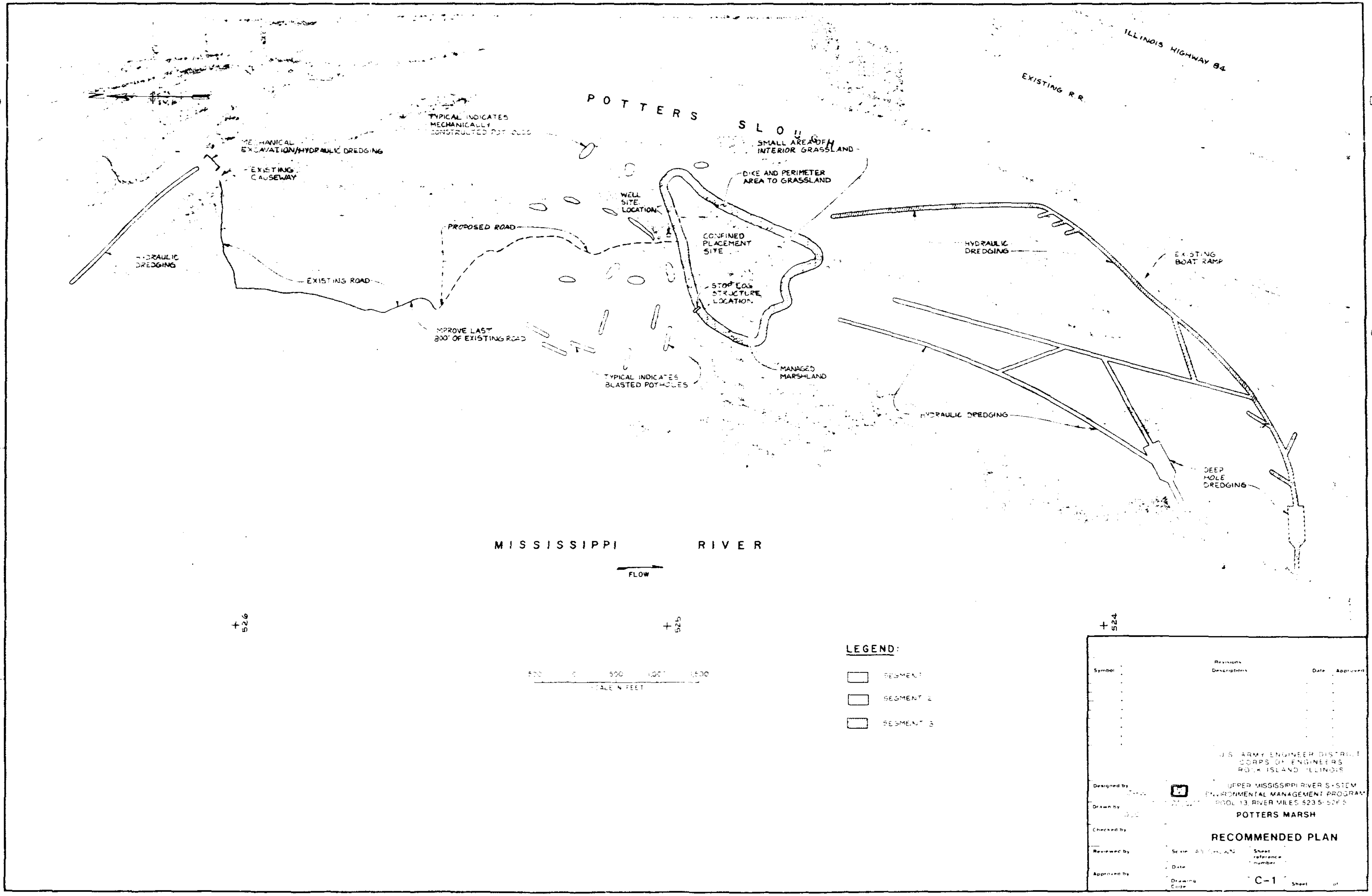
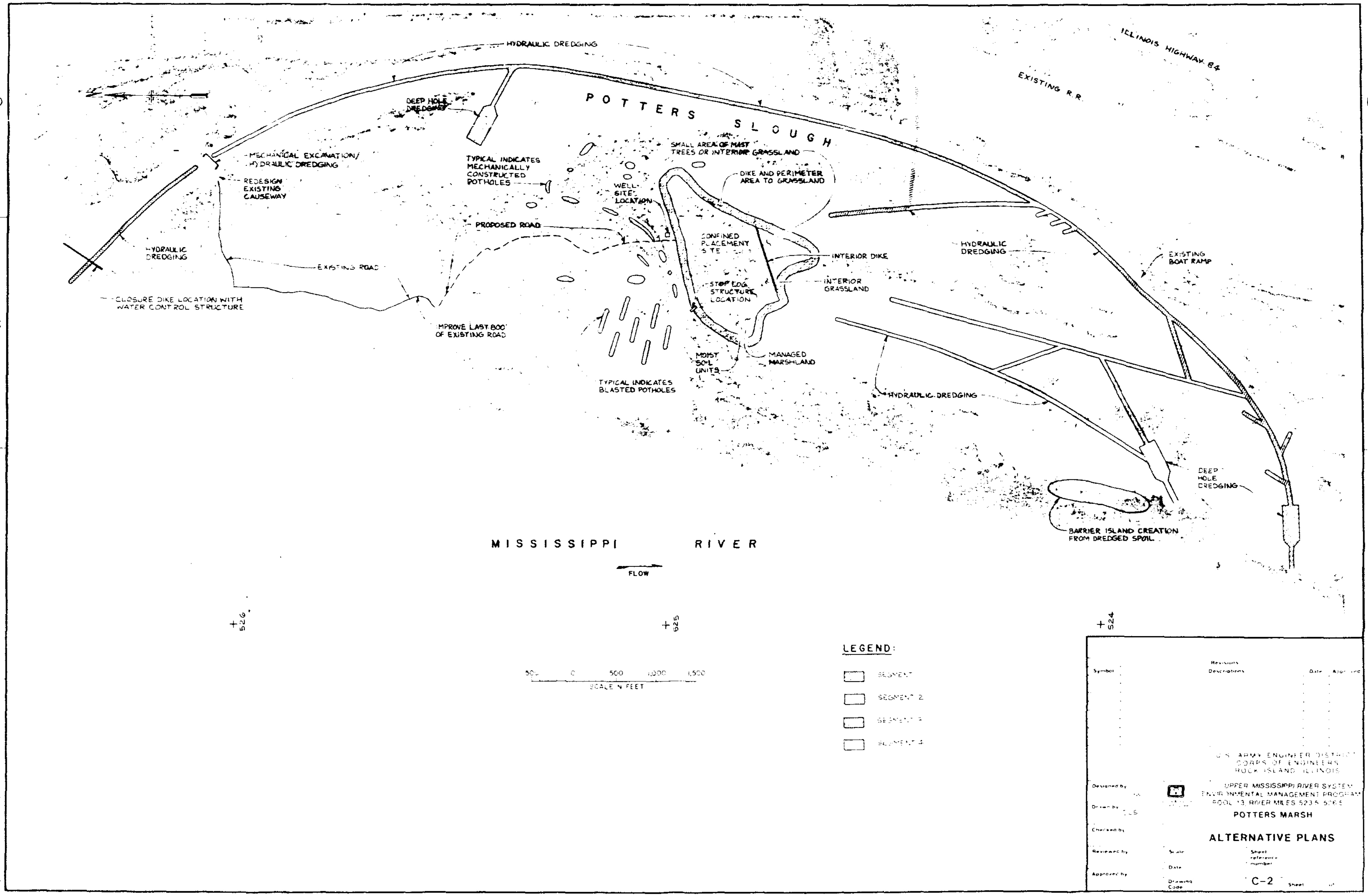

ILLINOIS HIGHWAY 84
EXISTING R.R.
POTTERS SLOUGH
TYPICAL INDICATES MECHANICALLY CONSTRUCTED POTHOLES
MECHANICAL EXCAVATION/HYDRAULIC DREDGING
EXISTING CAUSEWAY
SMALL AREA OF INTERIOR GRASSLAND
DIKE AND PERIMETER AREA TO GRASSLAND
WELL SITE LOCATION
PROPOSED ROAD
CONFINED PLACEMENT SITE
HYDRAULIC DREDGING
EXISTING BOAT RAMP
HYDRAULIC DREDGING
EXISTING ROAD
STOP LOG STRUCTURE LOCATION
IMPROVE LAST 800' OF EXISTING ROAD
MANAGED MARSHLAND
TYPICAL INDICATES BLASTED POTHOLES
HYDRAULIC DREDGING
DEEP HOLE DREDGING
MISSISSIPPI RIVER
FLOW
526
525
524
SCALE IN FEET
LEGEND:
SEGMENT 1
SEGMENT 2
SEGMENT 3
Revisions
Symbol
Descriptions
Date
Approved
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND ILLINOIS
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13, RIVER MILES 523.5-526.5
POTTERS MARSH
RECOMMENDED PLAN
Designed by
Drawn by
Checked by
Reviewed by
Approved by
Scale AS SHOWN
Date
Sheet reference number
Drawing Code
C-1
Sheet of

PLATE 2



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

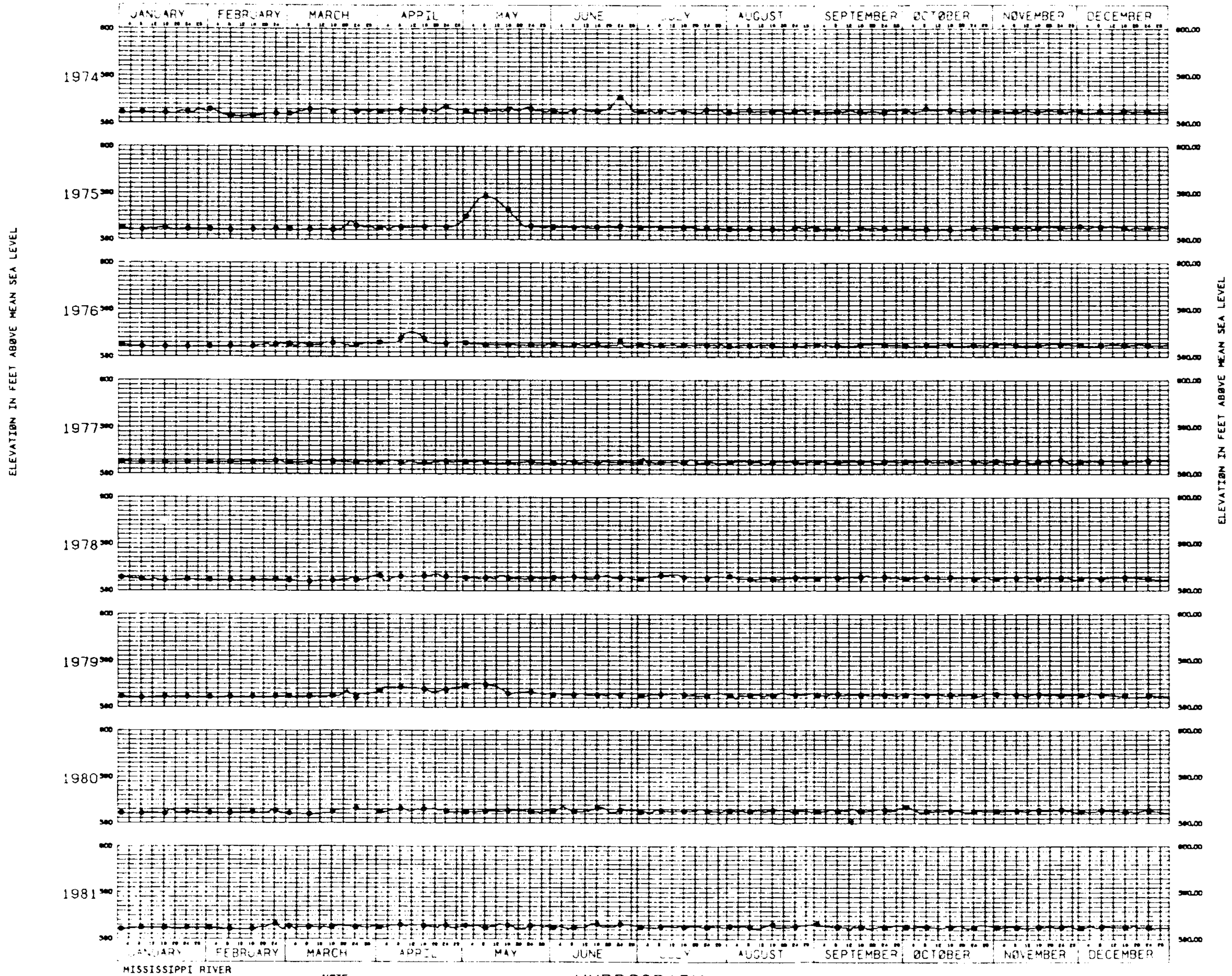
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13, RIVER MILES 523.5-526.5

POTTERS MARSH

ALTERNATIVE PLANS

Designed by	Scale	Sheet reference number
Drawn by	Date	
Checked by	Drawing Code	C-2
Reviewed by		Sheet of
Approved by		

PLATE 3



NØTE- RIVER MILE 525.0

HYDRØGRAPH
PØTTERS MARSH - ABØVE L/D 13

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

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13, RIVER MILES 523.5-528.5

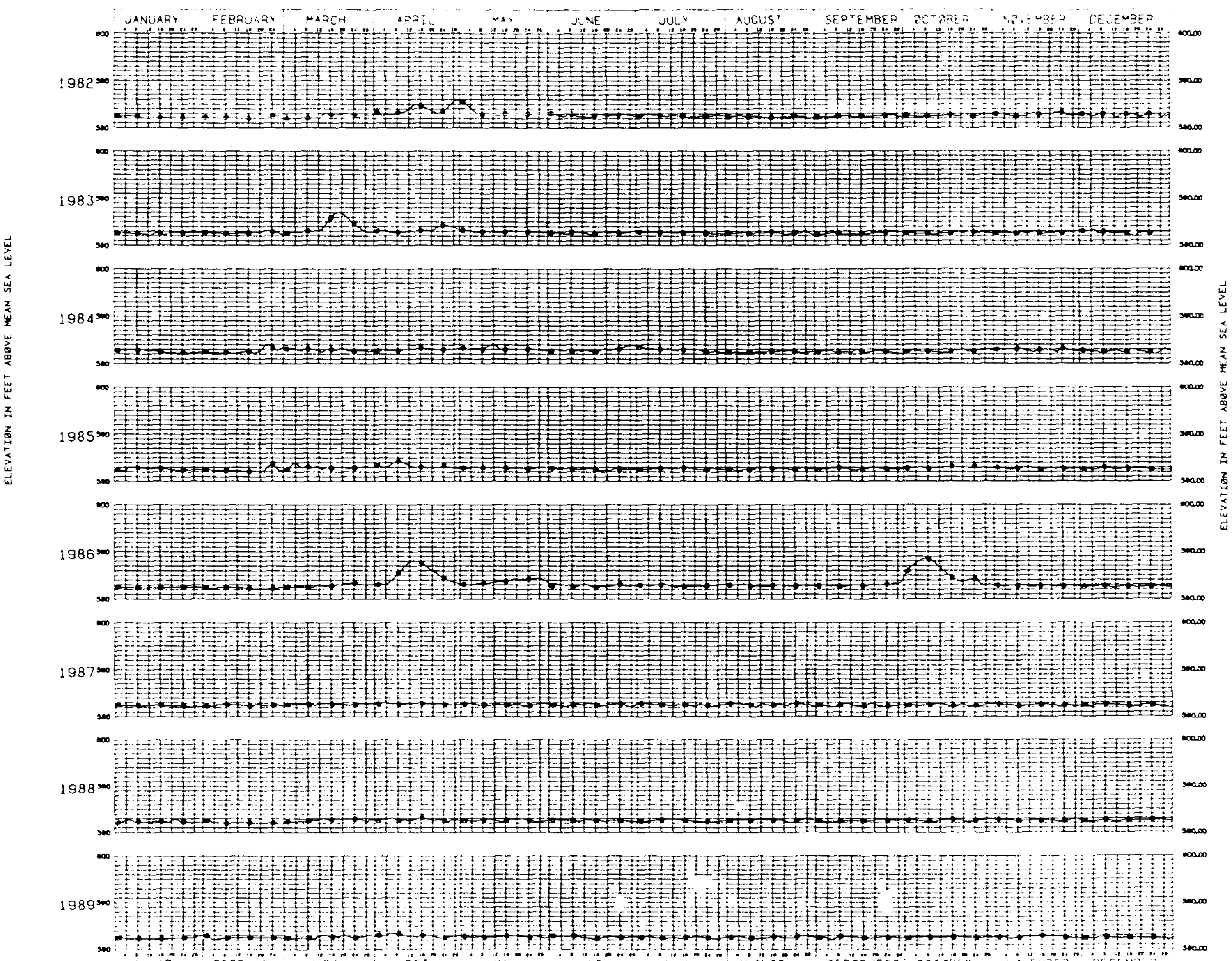
POTTERS MARSH

HYDRAULIC DATA I

Scale: AS SHOWN

C-3

PLATE 4



MISSISSIPPI RIVER

NOTE- RIVER MILE 525.0

HYDROGRAPH
POTTERS MARSH - ABOVE L/D 13

Symbol	Revisions Descriptions	Date	Approved

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

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Reviewed by
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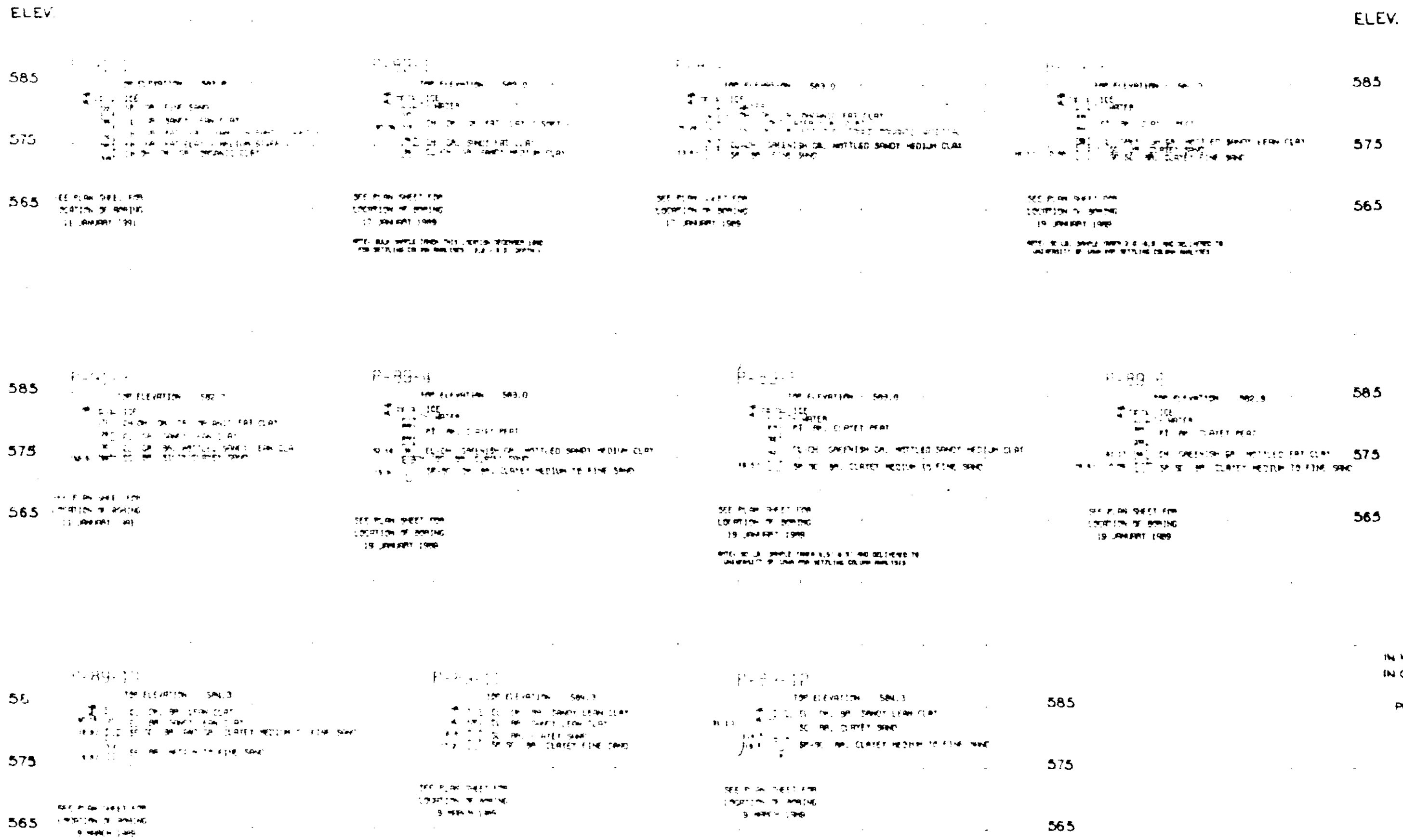
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13, RIVER MILES 523.5-528.5

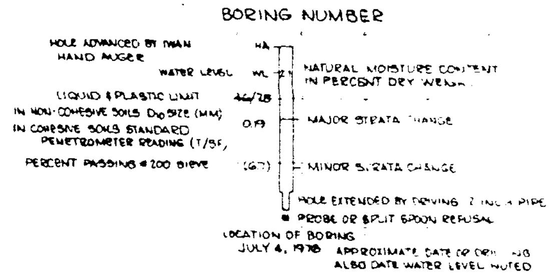
POTTERS MARSH

HYDRAULIC DATA II

Scale AS SHOWN
Sheet reference number
Date
Drawing Code C-4
Sheet of



LEGEND



Symbol	Revisions Description	Date	Approved

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

Designed by: JHW
Drawn by: BLY
Checked by:
Reviewed by:
Approved by:

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13 RIVER MILES 523.5-528.5

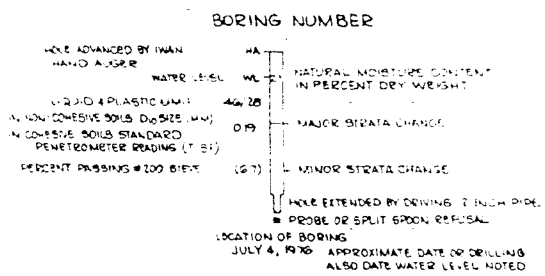
POTTERS MARSH

BORING LOGS I

Scale:
Date:
Drawing Code:
Sheet reference number: C-5
Solicitation Number:
Sheet of

PLATE 6

LEGEND



Symbol	Revisions Description	Date	Approved

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

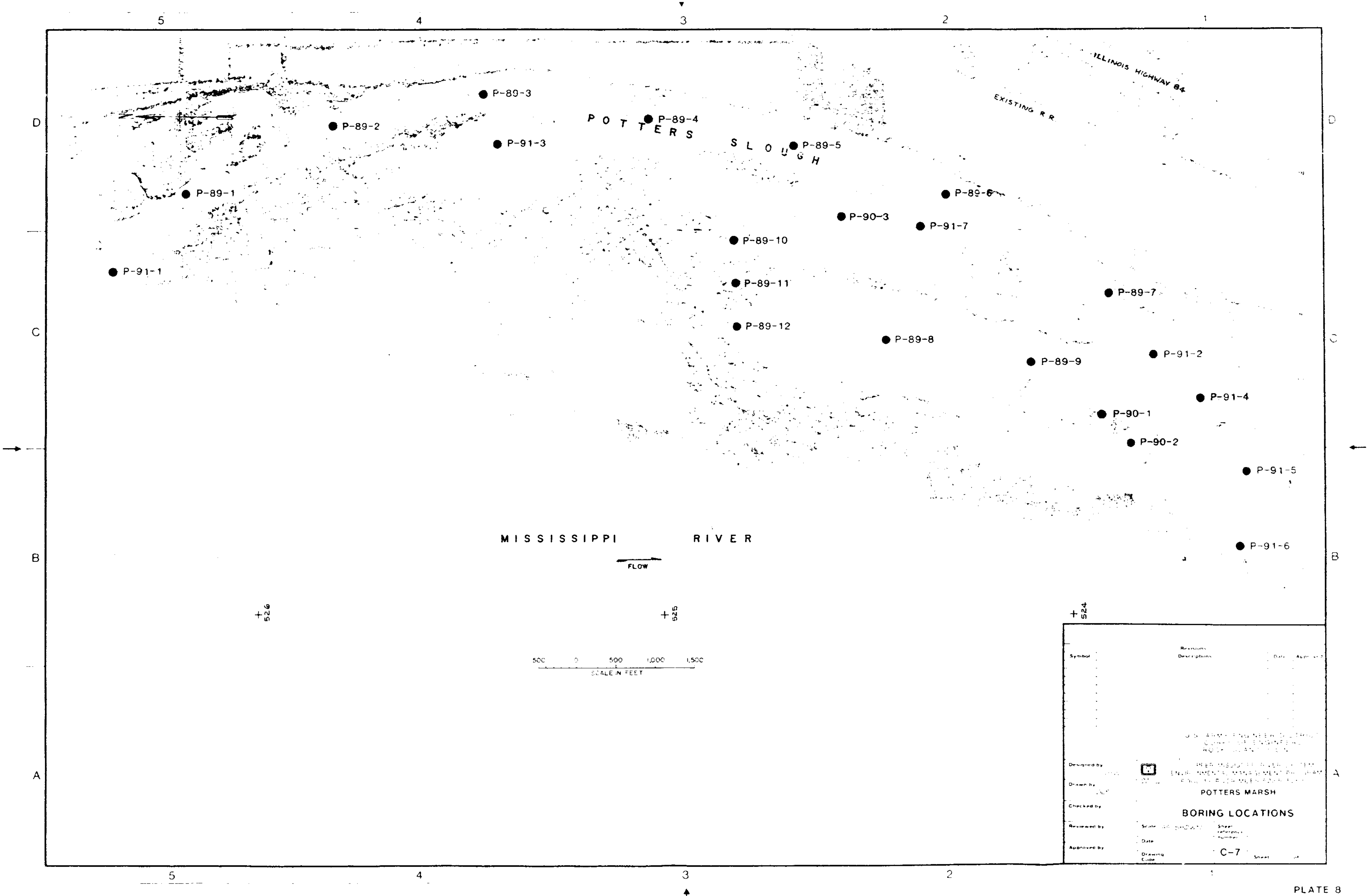
Designed by: JHW
Drawn by: BLV
Checked by:
Reviewed by:
Approved by:

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13, RIVER MILES 523.5-526.5
POTTERS MARSH

BORING LOGS II

Scale:
Date:
Drawing Code:
Sheet reference number: C-6
Solicitation Number:
Sheet of

PLATE 7



ILLINOIS HIGHWAY 84
EXISTING R.R.
POTTERS SLOUGH
P-89-1
P-89-2
P-89-3
P-89-4
P-89-5
P-89-6
P-89-7
P-89-8
P-89-9
P-89-10
P-89-11
P-89-12
P-90-1
P-90-2
P-90-3
P-91-1
P-91-2
P-91-3
P-91-4
P-91-5
P-91-6
P-91-7
MISSISSIPPI RIVER
FLOW
526
525
524
500 0 500 1,000 1,500
SCALE IN FEET
POTTERS MARSH
BORING LOCATIONS
C-7

PLATE 8

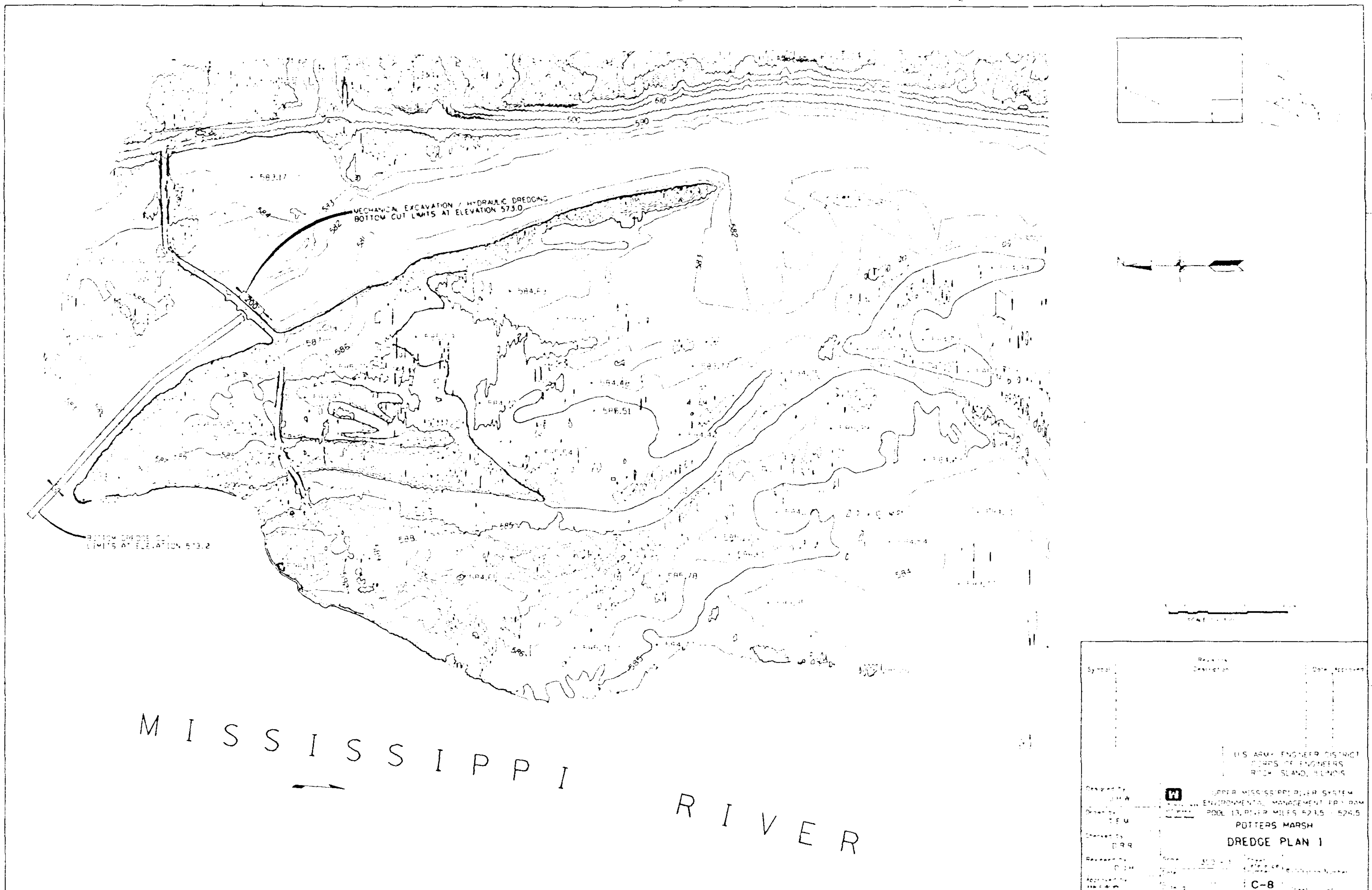

MECHANICAL EXCAVATION / HYDRAULIC DREDGING
BOTTOM CUT LIMITS AT ELEVATION 573.0
MISSISSIPPI RIVER
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13, RIVER MILES 523.5 - 526.5
POTTERS MARSH
DREDGE PLAN 1
C-8

PLATE 9

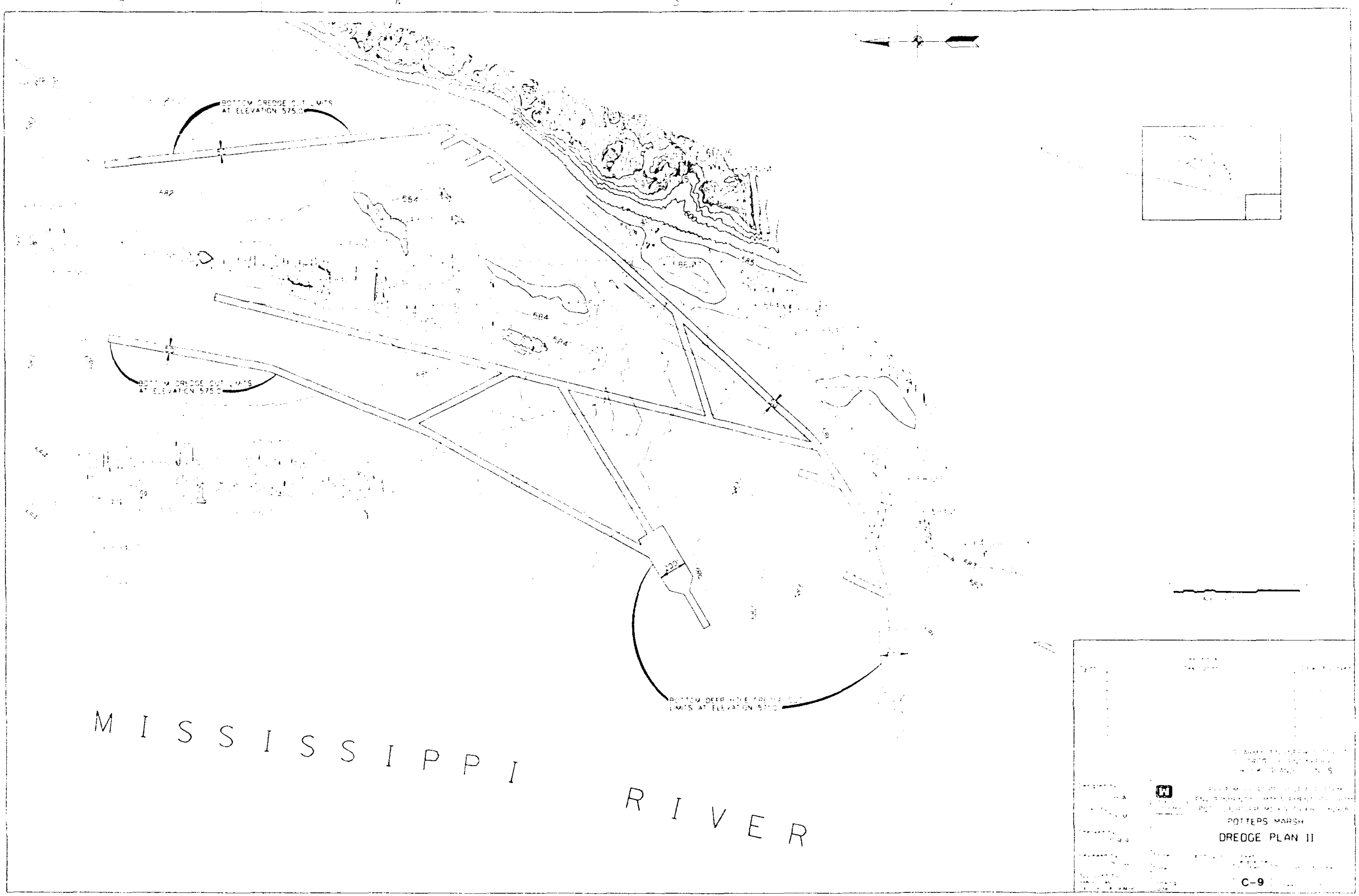
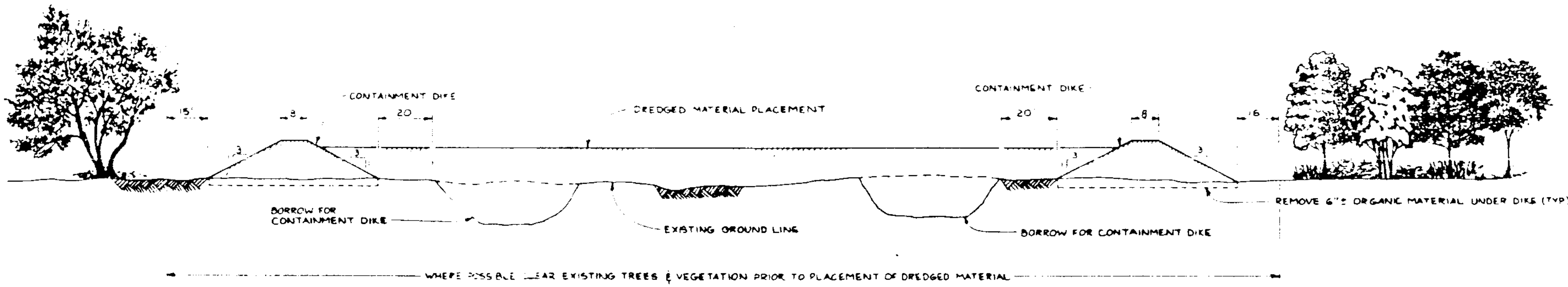

BOTTOM DREDGE CUT LIMITS AT ELEVATION 575.0
BOTTOM DREDGE CUT LIMITS AT ELEVATION 575.0
584
584
584
585
MISSISSIPPI RIVER
POTTERS MARSH
DREDGE PLAN II
C-9

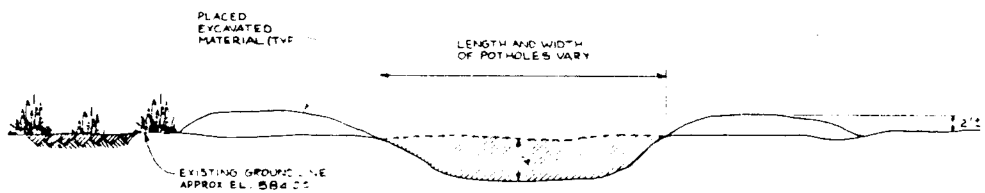
PLATE 10

PROPOSED ROAD
EXISTING ROAD
CONFINED PLACEMENT SITE
DIKE SURFACE AREA
MISSISSIPPI RIVER
LEGEND
CONFINED PLACEMENT SITE
EXISTING ROAD
PROPOSED ROAD
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13, RIVER MILES 523.5-526.5
POTTERS MARSH
TOPOGRAPHIC & CPS PLAN
C-10



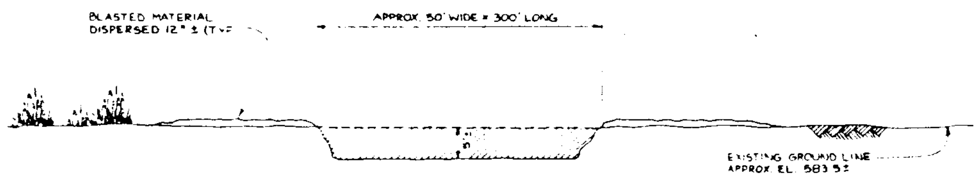
TERRESTRIAL DREDGED MATERIAL PLACEMENT

TYPICAL SECTION



MECHANICALLY CONSTRUCTED POTHOLE

TYPICAL SECTION



BLASTED POTHOLE

TYPICAL SECTION

Symbol	Revisions Descriptions	Date	Approved

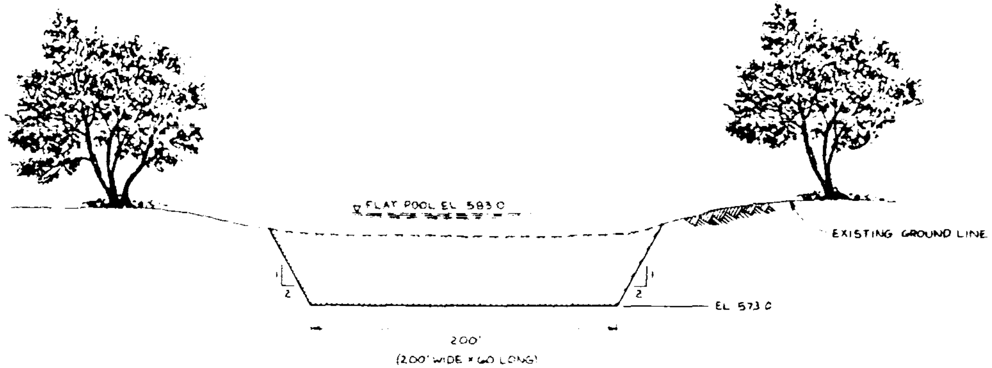
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13, RIVER MILES 523.5-526.5

POTTERS MARSH

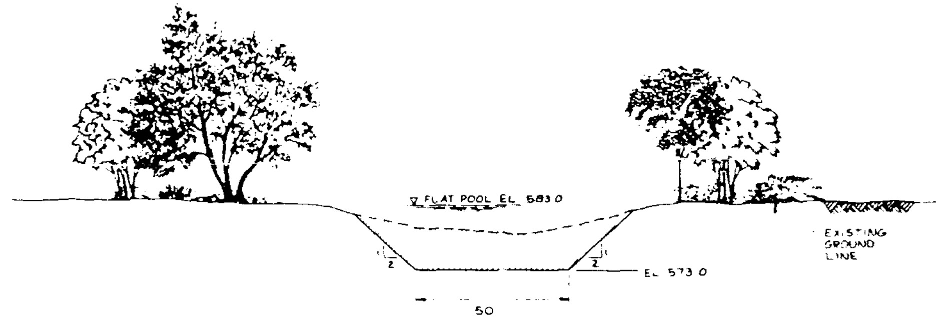
TYPICAL SECTIONS I

Designed by: JHA
Drawn by: DJS
Checked by:
Reviewed by:
Approved by:
Scale: NONE
Date:
Sheet reference number:
Drawing Code: C-11
Sheet of



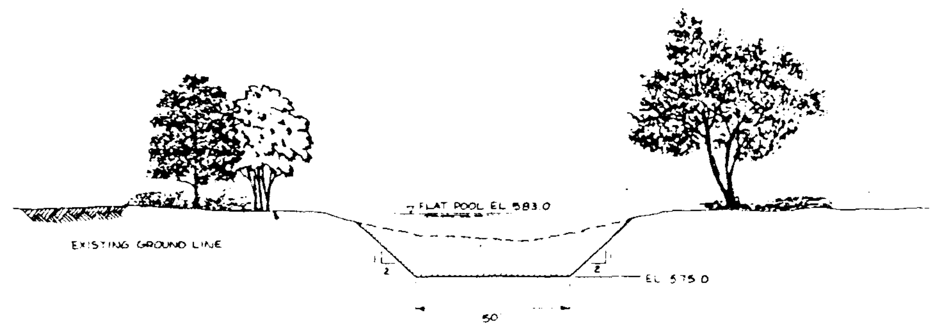
MECHANICAL EXCAVATION

TYPICAL SECTION



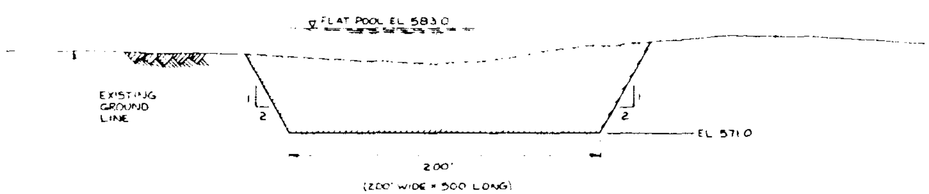
HYDRAULIC DREDGING SEGMENT 1

TYPICAL SECTION



HYDRAULIC DREDGING SEGMENTS 2 & 3

TYPICAL SECTION



HYDRAULIC DREDGING

TYPICAL DEEP HOLE SECTION

Symbol	Revisions Descriptions	Date	Approved

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

Designed by JMW
Drawn by DJS
Checked by
Reviewed by
Approved by
Scale
Date
Drawing Code

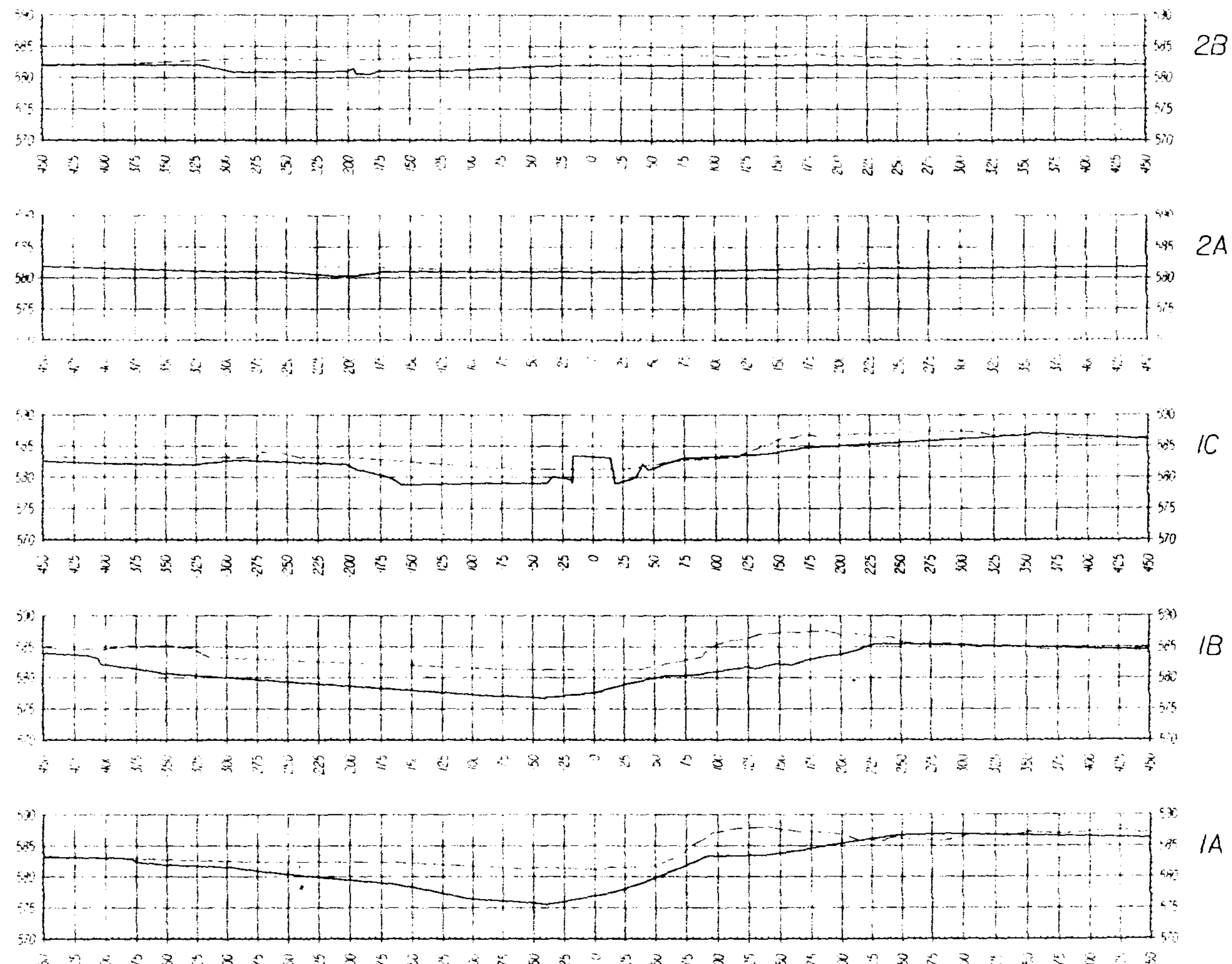
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13, RIVER MILES 523.5-526.5

POTTERS MARSH

TYPICAL SECTIONS II

Sheet reference number C-12 Sheet of

PLATE 13



LEGEND

- - - - 1989, FIELD BOOK FC-89-44.
1990-1991, FIELD BOOK FC-90-1.

——— 1938 PLANE TABLE, SHEETS
111 THROUGH 114, 31.1, 34.1, AND 35.1.

FLAT POOL ELEVATION 583.0

ELEVATIONS ARE EXPRESSED IN FEET AND REFERENCE TO MSL 1912 DATUM

2A SEDIMENTATION CROSS SECTION REFERENCE NUMBER

Revisions			
Symbol	Description	Date	Approved

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

Designed by:

Drawn by: T.E.M.

Checked by: D.R.R.

Reviewed by: D.J.H.

Approved by:

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13, RIVER MILES 523.5-526.5

POTTERS MARSH

COMPOSITE SEDIMENTATION CROSS SECTIONS I

Scale:

Date:

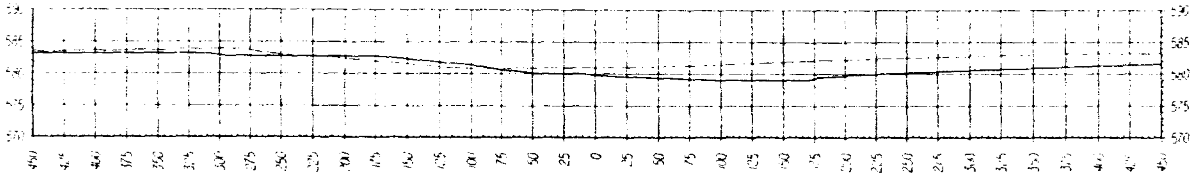
Drawing Code:

Sheet reference number: C-13

Solicitation Number:

Sheet of

PLATE 14



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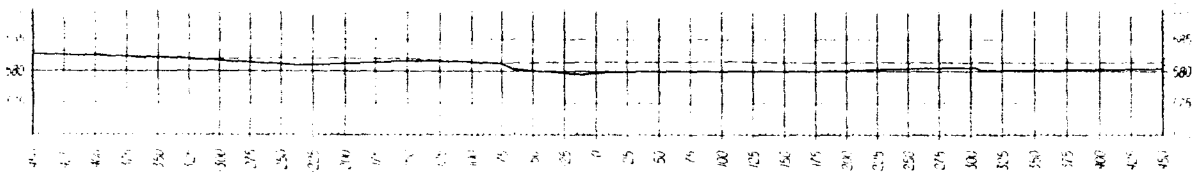

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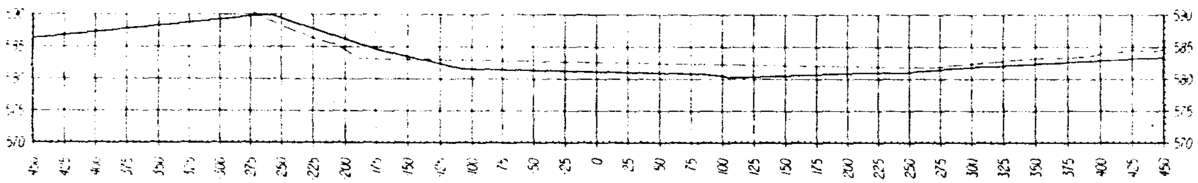

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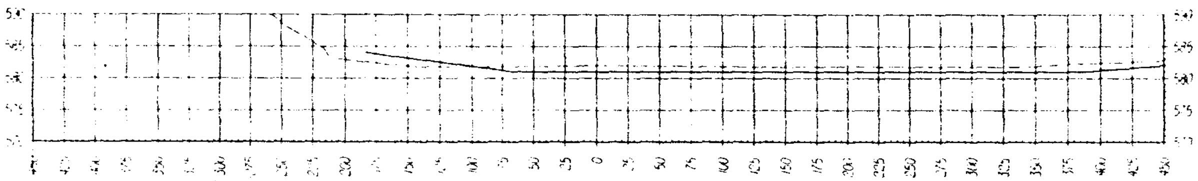
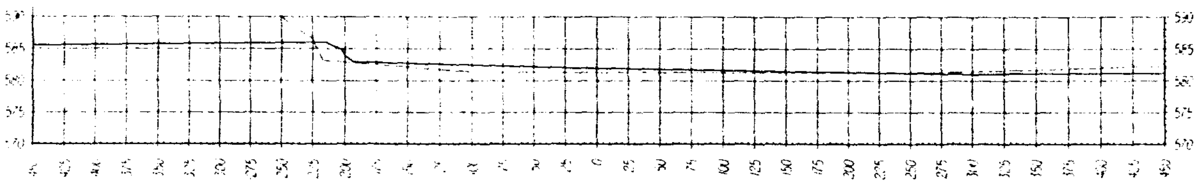


3A



4A

LEGEND

1989, FIELD BOOK FC-89-44.
1990-1991, FIELD BOOK FC-90-1.

1938 PLANE TABLE, SHEETS
111 THROUGH 114, 31.1, 34.1, AND 35.1.

FLAT POOL ELEVATION 583.0

ELEVATIONS ARE EXPRESSED IN FEET
AND REFERENCE TO MSL 1912 DATUM

3A SEDIMENTATION CROSS SECTION
REFERENCE NUMBER

Symbol	Revisions Description	Date	Approved

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

Designed by:

Drawn by: T.E.M.

Checked by: D.R.R.

Reviewed by: D.J.H.

Approved by:

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13, RIVER MILES 523.5-526.5

POTTERS MARSH

COMPOSITE SEDIMENTATION
CROSS SECTIONS II

Scale:

Date:

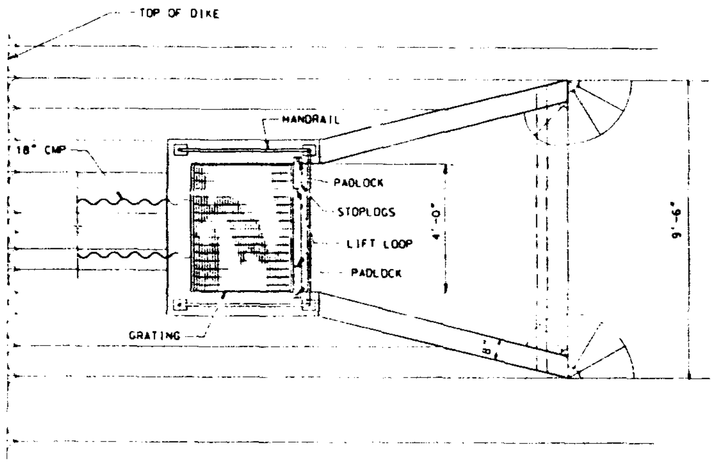
Drawing Code:

Sheet reference number: C-14

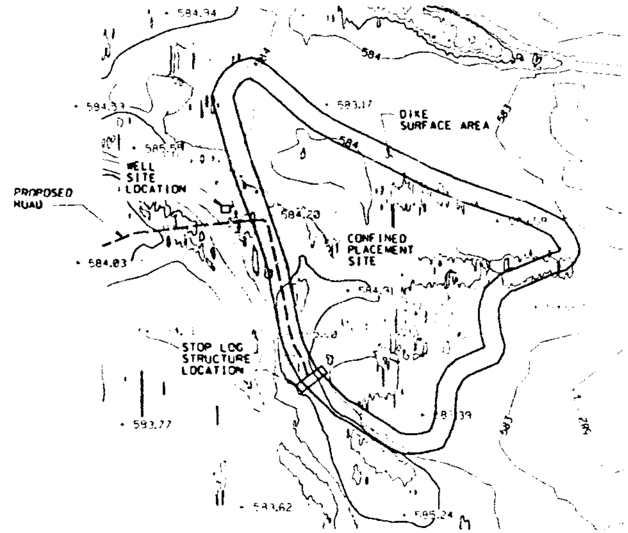
Solicitation Number:

Sheet of

PLATE 15

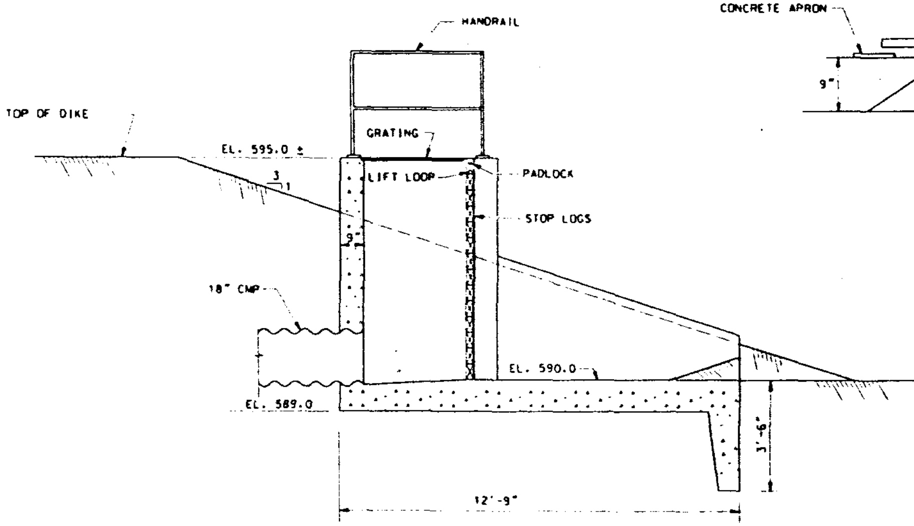


OUTLET PLAN



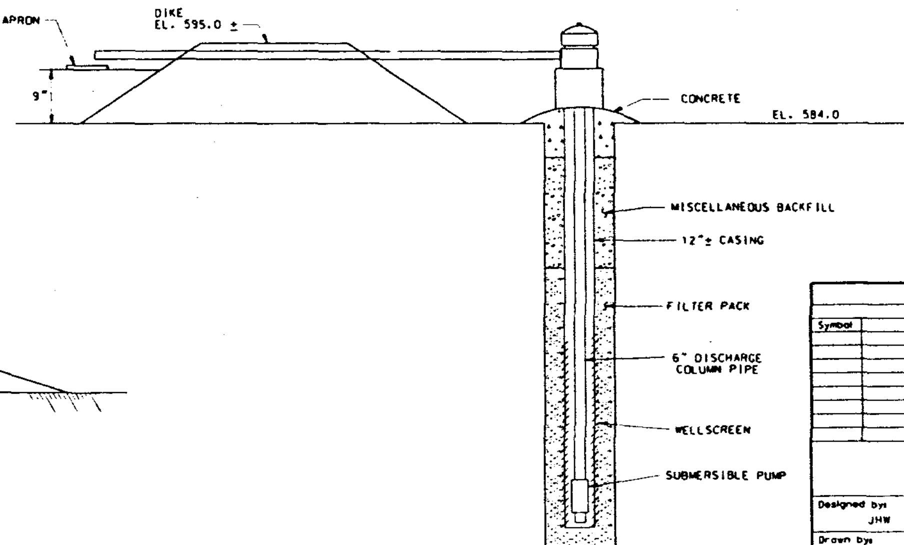
SITE PLAN

NO SCALE



SECTION AT ℄

1FT 0 1FT 2FT



WELL SECTION

NO SCALE

Symbol	Revisions Description	Date	Approved

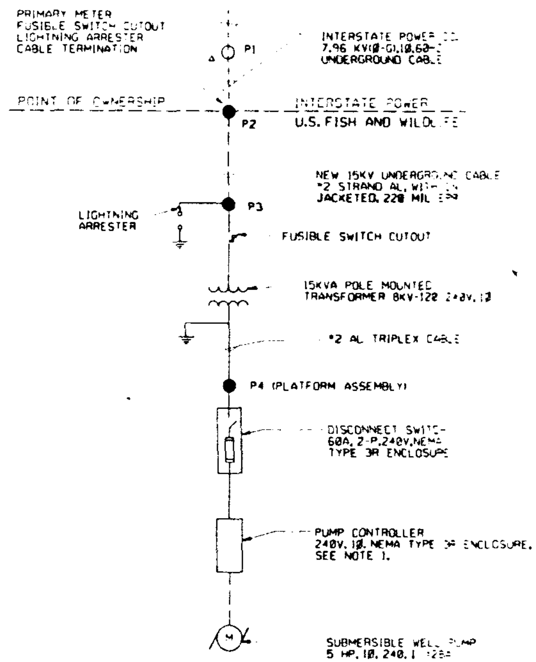
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

Designed by: JHW
Drawn by: DJS
Checked by:
Reviewed by:
Approved by:

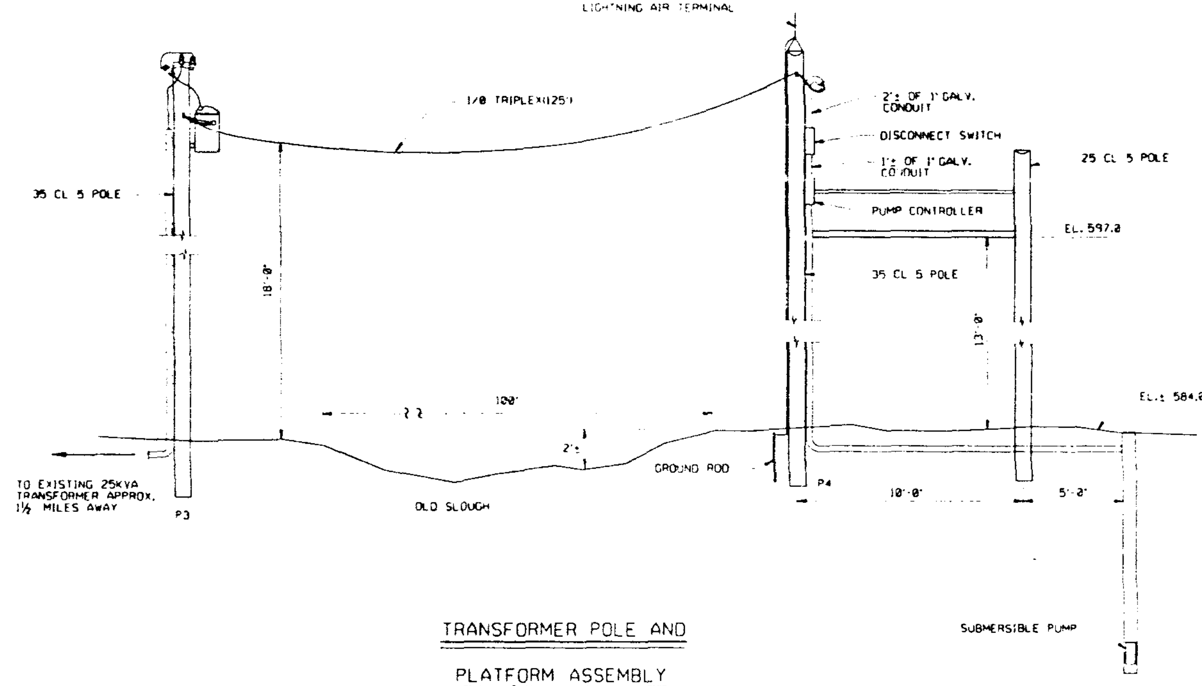
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13 RIVER MILES 523.5-526.5
POTTERS MARSH

STOPLOG STRUCTURE & WELL
SITE PLAN & DETAILS

Scale: AS SHOWN
Date:
Drawing Code:
Sheet reference number: S-1
Solicitation Number:
Sheet of



ONE-LINE DIAGRAM OF WELL POWER SERVICE



TRANSFORMER POLE AND PLATFORM ASSEMBLY

NOTES:

1. PUMP MANUFACTURER TO FURNISH PUMP CONTROLLER AND CABLE BETWEEN PUMP CONTROLLER AND PUMP MOTOR.
2. LIGHTNING PROTECTION SYSTEM FOR PLATFORM ASSEMBLY SHALL BE A CLASS 1 INSTALLATION PER NFPA 78.
3. FOR PUMP STATION SITE PLAN, SEE SHEET M-1.

LEGEND

○	EXISTING WOOD POWER POLE
△	EXISTING POLE MOUNTED TRANSFORMER WITH KVA RATING
●	NEW WOOD POWER POLE
— — —	NEW UNDERGROUND CABLE
———	NEW OVERHEAD CABLE
(M)	SUBMERSIBLE PUMP
P#	DENOTES POWER POLE NUMBER

CONTRACTOR TO FURNISH AND INSTALL THE FOLLOWING IN ACCORDANCE WITH INTERSTATE POWER CO. STANDARDS:

1. TRANSFORMER POLE(P3) 35-CL 5
2. ELEVATED WOOD PLATFORM ASSEMBLY
3. PRIMARY CABLE BETWEEN P2 AND P3
4. ALL TRENCHING
5. WEATHERHEAD
6. TRANSFORMER
7. LIGHTNING ARRESTER
8. PRIMARY FUSED CUTOUT SWITCH
9. STAND OFF BRACKET
10. GROUND RODS AND CONNECTION
11. TRIPLEX CABLE
12. LIGHTNING AIR TERMINAL
13. DISCONNECT SWITCH
14. PUMP CONTROLLER
15. GALV. STEEL CONDUIT AND APPURTENANCES
16. POWER CABLE TO PUMP
17. PRIMARY CABLE TERMINATION

INTERSTATE POWER CO. TO FURNISH AND INSTALL THE FOLLOWING:

1. UTILITY POLE (REPLACE P2)
2. PRIMARY CABLE TERMINATION
3. PRIMARY METERING
4. LIGHTNING ARRESTER
5. PRIMARY FUSED CUTOUT SWITCH

Revisions			
Symbol	Description	Date	Approved

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

Designed by: CJA
Drawn by: DJS
Checked by:
Reviewed by:
Approved by:

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13 RIVER MILES 523.5-526.5

POTTERS MARSH

ELECTRICAL

Scale:
Date:
Drawing Code:
Sheet reference number: E-1
Solicitation Number:
Sheet of

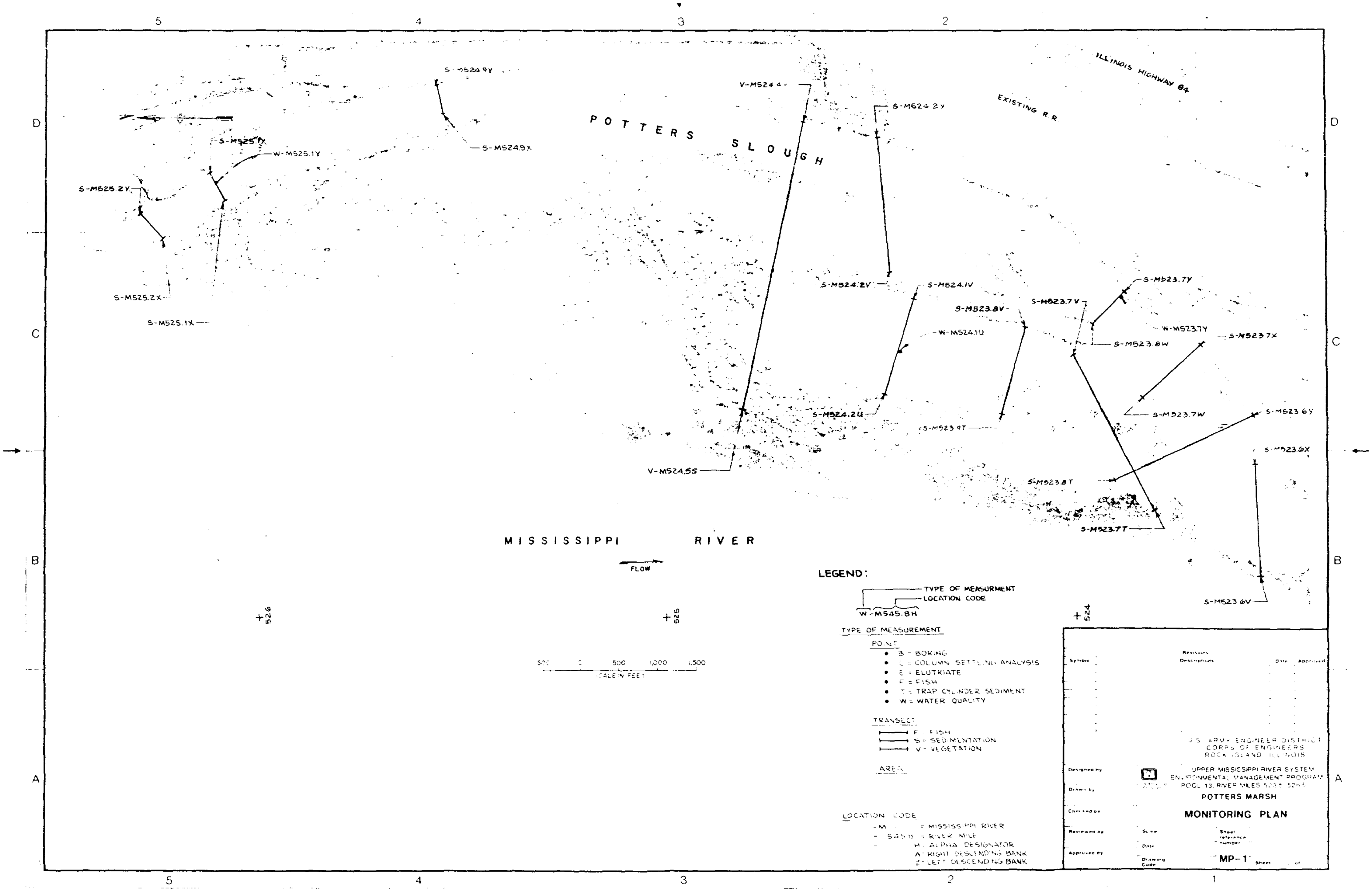

ILLINOIS HIGHWAY 84
EXISTING R.R.
POTTERS SLOUGH
MISSISSIPPI RIVER
FLOW
S-M524.9Y
S-M524.9X
V-M524.4V
S-M524.2Y
S-M525.1Y
W-M525.1Y
S-M525.2Y
S-M525.2X
S-M525.1X
S-M524.2V
S-M524.1V
W-M524.1U
S-M524.2U
V-M524.5S
S-M523.8V
S-M523.9T
S-M523.7V
S-M523.7Y
W-M523.7Y
S-M523.7X
S-M523.8W
S-M523.7W
S-M523.6Y
S-M523.6X
S-M523.8T
S-M523.7T
S-M523.6V
526
525
524
500 0 500 1,000 1,500
SCALE IN FEET
LEGEND:
TYPE OF MEASURMENT
LOCATION CODE
W-M545.8H
TYPE OF MEASUREMENT
POINT
B = BORING
C = COLUMN SETTLING ANALYSIS
E = ELUTRIATE
F = FISH
T = TRAP CYLINDER SEDIMENT
W = WATER QUALITY
TRANSECT
F = FISH
S = SEDIMENTATION
V = VEGETATION
AREA
LOCATION CODE
-M = MISSISSIPPI RIVER
- 545.8 = RIVER MILE
- H = ALPHA DESIGNATOR
A = RIGHT DESCENDING BANK
Z = LEFT DESCENDING BANK
Revisions
Symbol
Descriptions
Date
Approved
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 13, RIVER MILES 523.5-526.5
POTTERS MARSH
MONITORING PLAN
Designed by
Drawn by
Checked by
Reviewed by
Approved by
Scale
Date
Drawing Code
Sheet reference number
MP-1
Sheet
of

PLATE 18