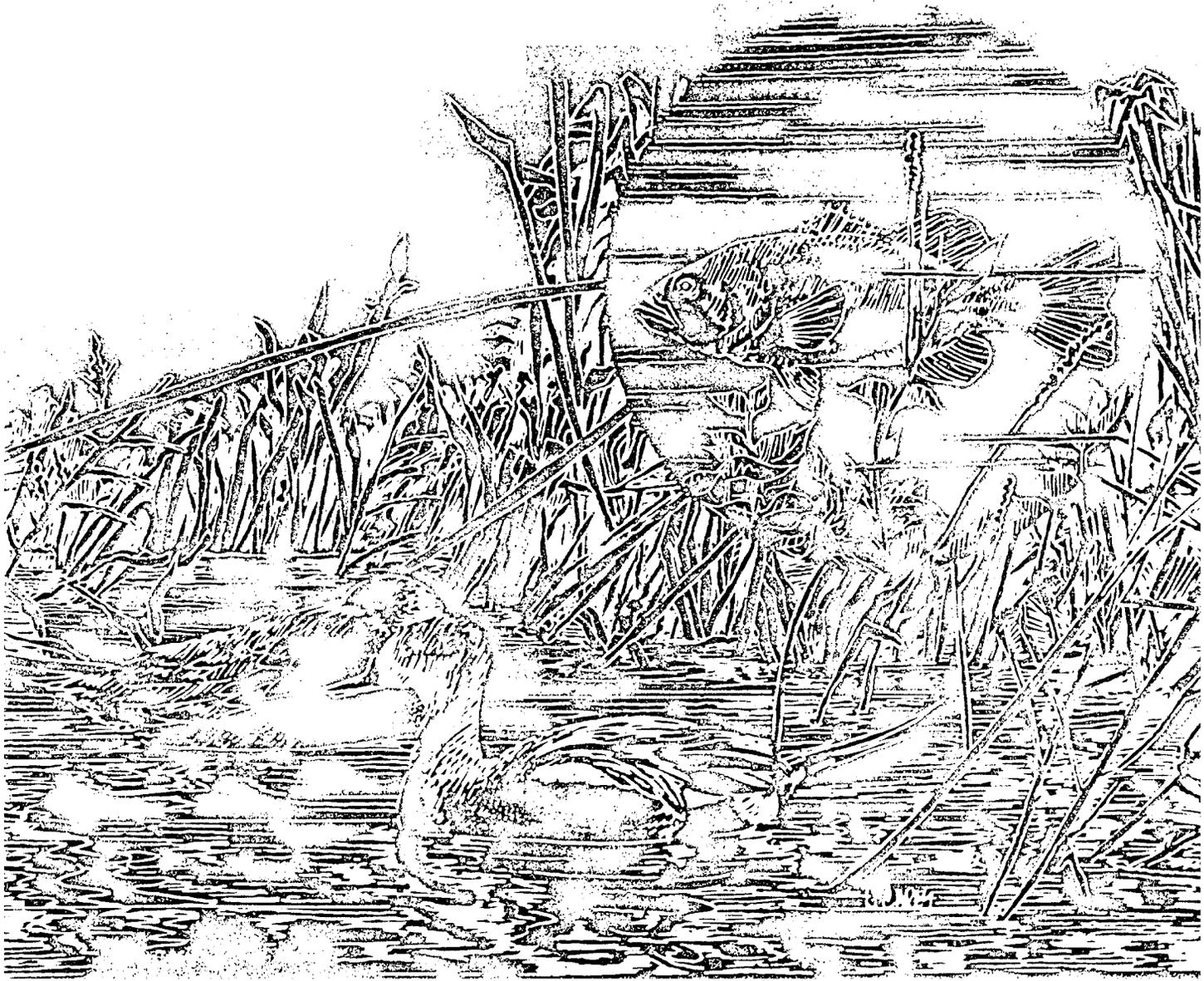


**UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT (R-4)
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT**

**ANDALUSIA REFUGE
REHABILITATION AND ENHANCEMENT**



NOVEMBER 1988



**US Army Corps
of Engineers
Rock Island District**

**Pool 16
UPPER MISSISSIPPI RIVER
ROCK ISLAND COUNTY, ILLINOIS**



REPLY TO
ATTENTION OF:

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

November 15, 1988

Planning Division

SEE REPORT DISTRIBUTION LIST

The Definite Project Report (DPR) with Integrated Environmental Assessment (EA) for the Andalusia Refuge EMP project is enclosed for your review and comment. The Andalusia Refuge project is one of several Habitat Rehabilitation and Enhancement Projects (HREP) in the Upper Mississippi River System - Environmental Management Program (UMRS-EMP).

Purposes of the project are to enhance migratory waterfowl habitat, retard the loss of fish and wildlife aquatic habitat, and increase fish habitat including deep water wintering habitat. Following are the project's major components:

- a. Construct a water level control levee approximately 5 feet high, 8,600 feet long, and up to 110 feet wide from toe to toe;
- b. Construct a pump station, two water control structures, and an armored lower levee section;
- c. Dredge a portion of Dead Slough to approximately 9 feet below flat pool;
- d. Dredge the interior of the moist soil management unit (MSMU) formed by the levee to create channels, drainage, and an island;
- e. Construct a new mouth for Dead Slough opening into Scisco Chute;
- f. Reroute the intermittent stream now emptying into the upper end of the MSMU into Scisco Chute; and
- g. Construct an access road to the water control structure and place electrical power supply.

As required by the Clean Water Act, the Section 404(b)(1) Evaluation also is included for comment. Please furnish comments no later than 30 days from the date of this letter. Any questions regarding the EA should be directed to Mr. Robert Clevestine of our Environmental Analysis Branch at 309/788-6361, Ext. 386. Written comments may be sent to the following address:

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

Sincerely,

A handwritten signature in black ink, appearing to read "Neil A. Smart". The signature is stylized with large, sweeping loops and a prominent initial "N".

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

Enclosures



REPLY TO
ATTENTION OF:

CENCR-PD-R

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

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

ANDALUSIA REFUGE
REHABILITATION AND ENHANCEMENT

POOL 16, MISSISSIPPI RIVER MILES 462 THROUGH 463

ROCK ISLAND COUNTY, ILLINOIS

NOVEMBER 1988

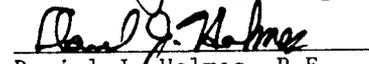
ACKNOWLEDGMENT

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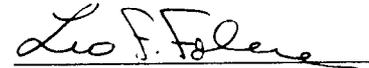
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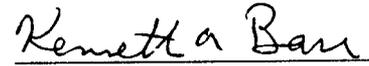
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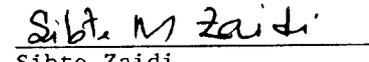
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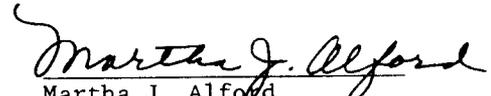
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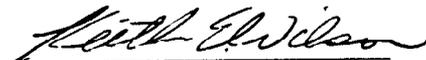
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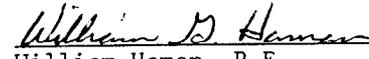
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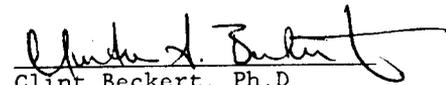
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**US Army Corps
of Engineers**

Rock Island District

**WE'RE PROUD
TO SIGN
OUR WORK**

EXECUTIVE SUMMARY

Andalusia Refuge and adjacent Dead Slough, located in Pool 16, are a 393-acre backwater complex approximately 1 mile north of Illinois City, Illinois. The proposed site is closed to hunting and located within the Upper Mississippi River Wildlife and Fish Refuge on General Plan lands made available to Illinois through cooperative agreements between the Corps of Engineers and the Department of Interior, and between the Department of Interior and the State. The refuge is managed by the Illinois Department of Conservation in accordance with an annual program submitted to the U.S. Fish and Wildlife Service as a National Wildlife Refuge within the meaning of Section 906(e) of the 1986 Water Resources Development Act.

Sedimentation from the Mississippi River and adjacent uplands has significantly impacted on the Andalusia Refuge and adjacent backwater fisheries. Migratory waterfowl already under stress due to drought conditions and loss of habitat in the Upper Midwest have been affected, and necessary deep water fish habitat off the main channel has been reduced. Duck counts by the Illinois Department of Conservation show that the duck use days at the Refuge, an important link for waterfowl using the Mississippi flyway, are exceedingly low. Food may be present in the Refuge, but there is often no available water. Present peak waterfowl use days are less than 2,000. This compares to conditions at the next nearest refuges, where water levels can be controlled, at Lake Odessa (River Mile 437) and Princeton Refuge (River Mile 507). Peak use days at these refuges are as much as 50 times higher than Andalusia Refuge. Additionally, fish are trapped in adjacent sloughs when water levels fall in the late spring and die from low levels of dissolved oxygen, and, in some years, from the high summer water temperatures or winter freeze-outs caused by the almost complete absence of water.

Alternative locations in the floodplain between Lake Odessa and Princeton Refuge were considered. Pool 17 has very little potential for sites in the upper pool due to flood control levees close to each shoreline. The first suitable location is already occupied by the Big Timber Division of the Mark Twain National Wildlife Refuge (River Mile 444). In Pool 16, Andalusia Island (River Mile 467) is not feasible because of the absence of land access and significantly higher construction costs necessitated by having to levee the entire perimeter. "Milan Bottoms" (River Mile 477) is not feasible since land dedicated to new uses would involve significant loss of present wood duck and terrestrial habitat benefits. There are no suitable locations in Pool 15 due to intense development, and none in Pool 14 below the existing refuge at Princeton, Iowa.

Project objectives are to: enhance migratory waterfowl habitat by providing adequate vegetation and reliable loafing and resting areas; retard the loss of fish and wildlife aquatic habitat by reducing sedimentation into the Refuge and Dead Slough; increase fish habitat in Dead Slough by channel excavation; and increase habitat available for wintering fish by providing deeper water areas.

The alternatives considered to accomplish the objectives included: variously sized moist soil management units (MSMU's); diversion of four adjacent watersheds supplying flow and sediment; river bank protection of the Refuge; various access channels and slough excavation configurations for Dead Slough; varying interior and side channel drainage excavation and associated island configurations within the MSMU; and various access road configurations to permit pump station and levee maintenance access. MSMU sizes considered ranged from a 130-acre area protected by a perimeter 2-year earthen levee approximately 6 feet high with a 12-foot crown to a 265-acre MSMU protected by levees corresponding to 5- and 10-year events with average heights of 9 and 11 feet, respectively. Watershed diversions considered all four watersheds and included diversion drainage lengths of 2,200 to 2,500 feet on private land which would require permanent easements or additional fee title. River bank protection would consist of crushed stone bedding with a riprap blanket to protect approximately 85 acres of emergent and submergent vegetation from possible Mississippi River erosion.

Dead Slough and access channel alternatives required locations where neither erosion nor deposition occurred and which were consistent with other project features, while allowing adequate material placement. Interior channels were necessary to facilitate drainage during drawdowns, hastening establishment of new vegetation, and to provide material for adjacent levee borrow. Interior material placement had to provide optimal island protection for waterfowl from foraging land animals. Access to the pump station alternatives required reliable all-year access, consideration of potential disruption of Refuge objectives due to unauthorized access, and clearing and ownership considerations.

The selected plan for the habitat project consists of constructing a 2-year event levee averaging approximately 6 feet high, 8,600 feet long with top widths of either 12 feet or 60 feet, providing water level control on 130 acres of Refuge land. Included are a pump station capable of pumping 3,500 gallons per minute into the Refuge and 5,000 gallons per minute from the Refuge, one gated water control structure, and an armored lower section of the levee to withstand overtopping of the levee without damage during floods. Mechanical excavation in Dead Slough to a depth approximately 9 feet below flat pool (about 110,000 cubic yards) and in the interior of the MSMU (about 75,000 cubic yards) will create approximately 3.1 miles of channel (10,900 feet within the MSMU and 5,600 feet within Dead Slough). Channel width within Dead Slough adjacent to the levee will be 60 feet at the base of the cut. The configuration of the dredged channel within the MSMU will create eight or more islands, totalling about 9 acres. These channels will enable fish to leave the MSMU through a water control structure into Dead Slough and then into the main channel. The new mouth of Dead Slough will empty into Scisco Chute. The intermittent stream now depositing sediment in Refuge backwaters will be redirected to Scisco Chute, decreasing the sedimentation rate in the Refuge and Dead Slough. The new channel will be 2,430 feet long and 3 feet deep with a 30-foot bottom width. It will be located on Government-owned land and will be capable of conveying a 2-year event within bank. The other three streams have no feasible rerouting alternatives and will be left unchanged. River bank erosion was determined to be insignificant, not threatening the stability of the bank or the interior portion of the Refuge. The recommended

access road consists of approximately 3,600 feet of a 12-foot-wide service road, which also will be used for placement of overhead poles for electric power supply. Illinois Department of Conservation personnel will control access to the road to minimize disturbance to the Refuge area.

Average annual operation and maintenance costs of the project are estimated to be \$11,400. The Illinois Department of Conservation has agreed to be responsible for the operation and maintenance of the project.

The habitat project will create a reliable food supply for migratory waterfowl in the fall, enabling water level manipulation on 130 acres of wetland to enhance food production. With the ability to manage water levels, water usually would be drawn down in June for the germination of natural or aerially seeded plants benefitting waterfowl, such as smartweed or Japanese millet. Water levels would be raised as the plants grow, allowing the seed heads to remain above the water level. The levee will prevent 2-year flood events (which have occurred only twice during the 22 years of record for the management period) from destroying the food crop, significantly increasing the Refuge's capacity to provide food and refuge. The channel configuration within the MSMU will create 9 acres of island suitable for the nesting of Canada geese. Improvements within Dead Slough and reopening the access will provide improved water circulation, increased levels of dissolved oxygen, and a decrease in the rapid water temperature fluctuations which now occur. The relocated drainage channel will improve water quality in Dead Slough and in the MSMU, with the decreased sediment influx prolonging project life.

It is proposed that the following information be collected to evaluate performance of the project: summer and winter measurement of dissolved oxygen in Dead Slough; soundings of Dead Slough and fish access channel excavations; sedimentation measurements within the MSMU; biennial waterfowl inventories during the fall migration; biennial vegetation inventories by water level and by time of year within the MSMU; and, biennial fishery inventories in Dead Slough.

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 for construction of the Andalusia Refuge habitat rehabilitation and enhancement project is recommended by the Rock Island District Engineer at a 100 percent Federal cost estimated to total \$1,870,000. The District Engineer further recommends that funds in the amount of \$24,000 be allocated as quickly as possible for the preparation of plans and specifications.

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

ANDALUSIA REFUGE
REHABILITATION AND ENHANCEMENT

POOL 16, MISSISSIPPI RIVER MILES 462 THROUGH 463

ROCK ISLAND COUNTY, ILLINOIS

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UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

ANDALUSIA REFUGE
REHABILITATION AND ENHANCEMENT

POOL 16, MISSISSIPPI RIVER MILES 462 THROUGH 463

ROCK ISLAND COUNTY, ILLINOIS

1. INTRODUCTION.

a. Purpose. The purpose of this report is to present a detailed proposal for the rehabilitation and enhancement of Andalusia Refuge. 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. Andalusia Refuge and adjacent Dead Slough is a 393-acre backwater complex located between Mississippi River miles 462 and 463 in Pool 16. The project, located in Rock Island County, Illinois, lies on the Illinois left bank of the Mississippi River across from Fairport, Iowa, and is also about 1 mile north of Illinois City, Illinois. The proposed project is located within the Upper Mississippi River Wildlife and Fish Refuge on General Plan lands owned by the U.S. Army Corps of Engineers. The site is managed by the Illinois Department of Conservation (IDOC) under authority of Cooperative Agreements with the U.S. Fish and Wildlife Service (USFWS) and the Corps of Engineers.

The IDOC manages the approximately 393-acre Refuge primarily as a feeding and resting area for waterfowl. At present, there is no water level control in the Refuge, which limits management capability in providing quality habitat for waterfowl. The portion of the Refuge south of Dead Slough is particularly shallow and frequently has little or no water during the fall waterfowl migration. Although waterfowl food, such as smartweed and arrowhead, is often present, the lack of water level control significantly decreases the Refuge's ability to support migratory waterfowl, which is its primary objective.

In addition, sediment originates from both the Mississippi River during flood events and adjacent watersheds. Sediment from the adjacent bluff-top watersheds enters the Refuge through several small streams that empty into the upper end of the Refuge. Sediments decrease the water volume in the Refuge. This sedimentation has caused a succession from a dominance of aquatic bed-palustrine wetlands to more emergent class plant species such as sedge, rice-cutgrass, and willow. Acquisition of water level control and channel dredging can compensate for this sedimentation and reserve the plant succession from terrestrial toward a more desirable aquatic and semi-aquatic (marsh) condition.

Measures to prevent sediment deposition from adjacent upland erosion include upland erosion control and/or diversion of adjacent watershed flows having heavy sediment loads from the project site. The principal measures to reduce river source sediment are diverting river flows or blocking flows through the area. Such measures would include use of natural tree buffers, construction of levee systems, or construction of deflection dikes.

The proposed project will fill an important gap in providing a reliable and much needed refuge for fall migratory waterfowl along the Upper Mississippi River. Between the Iowa Department of Natural Resources (DNR) Refuges at Princeton, Iowa (River Mile 507) and Lake Odessa, Iowa (River Mile 437), there are no other waterfowl refuges capable of water level control. Water level control is a necessary management tool for river refuges in order to provide a reliable food source for fall migrating waterfowl. Although natural waterfowl food sources (i.e., smartweed, arrowhead, wild celery, wild millet) are occasionally abundant when low summertime water levels occur, fall high water events frequently ruin their value to waterfowl. The construction of a Moist Soil Management Unit (MSMU) on the Andalusia Refuge (River Mile 462) will allow: (1) the reliable production of waterfowl food crops during summer months and (2) protection from loss due to fall flood events and optimization of water levels for waterfowl.

Construction of the levee required for the MSMU is also a unique opportunity to restore a backwater fishery habitat in Dead Slough that has been gradually lost due to sedimentation. The Andalusia Refuge overall has experienced sedimentation at an average rate of 0.5 inch/year since construction of the 9-foot channel. Dead Slough itself has experienced a rate closer to 0.8 inch/year due to pre-lock and dam deeper areas. Dead Slough is a backwater pond which is now isolated from the main river due to sedimentation at its mouth. Falling water levels regularly trap fish in the slough and cause frequent fish kills when dissolved oxygen is depleted. The reconnection of Dead Slough to the main river will restore and enhance the fishery resources of that portion of the Refuge.

c. Scope of Study. The geographical scope of the study area is shown on plates 1 and 2. Emphasis was placed on developing project features which were located on existing State or Federal lands. Although additional land could be purchased by non-Federal interests, alternatives with land acquisition were generally not pursued due to policy, scheduling, and funding purposes. Alternatives involving upland erosion control were not studied in detail. The U.S. Soil Conservation Service has primary jurisdiction for these programs.

Field surveys were performed in developing sedimentation estimates, assessing effects near project boundaries and Government property lines, and estimating excavation/dredge quantities. Surveyed sections will be used to evaluate post-construction performance.

Soil borings were taken to assess sediment types, to verify foundations of 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 were made by the IDOC. These observations 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 Andalusia Refuge 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. Sections 7 and 8 describe the selected plan. Section 9 is an assessment of environmental effects from the proposed plan. Section 10 provides a summary of project accomplishments or 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, 19, and 20 present the conclusions, recommendations, and Finding of No Significant Impact.

Drawings (plates) have been furnished to provide sufficient detail to allow review of the existing features and the proposed plan. Plates 1, 2, and 3 show the project location, the recommended plan, and alternative plans. Plate 4 shows adjacent watersheds which were studied to evaluate adjacent sedimentation effects. Plates 5 and 6 provide 22 years of hydrographic record of the Mississippi River at the proposed project site. These hydrographs provide the relationship between river flood events and proposed levee heights. Plate 7 provides soil borings which were used to evaluate foundation effects and excavation/fill methods. Plates 8, 9, 10, 11, 12, and 14 provide plan views of the selected alternative. Plate 13 was included to show existing ground surfaces relative to river erosion effects. This plate, with accompanying monitoring plates of 23, 24, and 25, provides a basis for future monitoring ranges. Plates 15, 16, 17, 18, and 19 provide profiles and section views for the selected plan. Plates 20, 21, and 22 provide concept plans and details for the pump station and the water control 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...

2. GENERAL PROJECT SELECTION PROCESS.

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

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

(1) First Annual Addendum. The Master Plan report... and the authorizing legislation do not pose explicit constraints on the kinds of projects to be implemented under the UMRS-EMP. For habitat projects, the main eligibility criteria should be that a direct relationship should exist between the project and the central problem as defined by the Master Plan, i.e., the sedimentation of backwaters and 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 openings/closures
- wing and closing dam modifications
- aeration and water control systems
- waterfowl nesting cover (as a complement to one of the other project types)
- acquisition of wildlife lands (for wetland restoration and protection.) Note: By letter of 5 February 1988, the Office of the Chief of Engineers directed that such projects not be pursued.

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

b. Selection Process. Projects are nominated for inclusion in the Rock Island District's habitat projects program by the respective State conservation agencies and the USFWS based on agency management objectives. To assist in the project formulation process, the Fish and Wildlife Interagency Committee (FWIC), a group composed of State and Federal biologists who work at projects along the Mississippi River and Illinois Waterway, convened a series of meetings in 1986 to consider critical habitat needs along the Mississippi River. At these meetings, the available habitat was evaluated on a pool-by-pool basis. This analysis revealed deficiencies (such as feeding, resting, and loafing areas for migratory waterfowl, absence of deep water off the main channel for diving ducks, fish, etc.) as well as types of habitat in abundant supply (e.g., mature bottomland hardwood). With this information, projects being considered can most accurately reflect broader regional needs in addition to representing the best site-specific choices.

Rock Island District assists the State and the USFWS agencies proposing habitat projects through use of an in-house task force with members from the design, hydraulics, channel maintenance, environmental, and waterways planning branches. As projects are being conceptualized, this groups meets on-site with State and USFWS personnel to examine as fully as possible what site-specific benefits would be both desirable and engineeringly feasible.

As input to the District to assist in the final selection of projects to be included in the program, projects are ranked according to the biological benefits that they could provide by the FWIC. Each project is considered, and

project alternatives to increase habitat benefits for fish, waterfowl, and other wildlife are suggested. Every project is ranked according to the benefits provided as high, medium, or low.

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

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

c. Specific Site Selection. Through the above selection process, Andalusia Refuge was recommended and supported as capable of providing high waterfowl and aquatic benefits if proposed project features were implemented. The site is located on existing federally owned lands, a significant aspect relative to project development. Andalusia Refuge is also locally known by the public as a closed refuge, minimizing land use changes and potential adverse public reactions.

Other floodplain and out-of-floodplain locations were evaluated within this reach of the river for potential waterfowl and aquatic enhancement benefits. Out-of-floodplain or upland (non-wetland) locations were considered not feasible for this project. The very nature of waterfowl and aquatic enhancement is wetland dependent and requires that it be constructed in a location with an abundant surface water supply immediately adjacent to the river.

Alternate locations to the Andalusia Refuge site (River Mile 462) within the floodplain were considered. In Pool 16, there are only two other locations where similar waterfowl water control measures could possibly be located: Andalusia Island and the "Milan Bottoms" near the mouth of the Rock River.

The Andalusia Island complex (River Mile 467) is very similar to the proposed project site. Its location being an island, however, would make management extremely difficult due to the lack of land access. Construction costs also would be significantly higher because a levee would be required on all four sides.

The "Milan Bottoms" area is a large, several-hundred-acre forest-wetland complex (River Mile 477) that State biologists in the past have considered as having potential for waterfowl habitat development. This area has some of the best existing habitat in Pools 15 and 16 because of its diverse complex of wetlands, backwaters, and forest. The area already is extremely important reproductive habitat for wood ducks. But it would be difficult to achieve

enough migratory habitat benefits to overcome the potential loss of reproductive habitat. Negative impacts to other wildlife increase the losses. The lack of a large, unforested expanse would require extensive clearing to achieve waterfowl benefits similar to those at the currently proposed location.

Pool 15 offers no possible locations due to its intensely developed nature, and Pool 14 offers no suitable locations until the existing refuge at Princeton, Iowa, (River Mile 507). Downstream, Pool 17 has very little potential for sites in the upper part because of flood control levees close to each shoreline. The first suitable location is already occupied by the Lake Odessa, Iowa, Refuge (River Mile 437). The lack of suitable alternative sites emphasizes the importance of developing the existing Andalusia Refuge.

3. ASSESSMENT OF EXISTING RESOURCES.

a. Resource History. The Refuge area was principally a wooded area prior to the completion of Lock and Dam 16 at Muscatine, Iowa, in 1937. The present Dead Slough area was considered a lake in 1936, but once Pool 16 was formed, the area became a series of backwater channels, ponds, and lakes.

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

b. Land Use. The Andalusia Waterfowl Refuge is managed by the IDOC. It is closed to all hunting from October 1 through December 31 every year in order to provide a feeding and resting area for migratory waterfowl. The Refuge (between River Miles 462-463) and surrounding habitat total approximately 393 acres. Based on aerial photographs taken in September 1984 and a 1982 IDOC vegetation survey, the composition of the Refuge as presented in table 3-1.

The upper end of the Refuge has the highest elevation. This area receives a significant amount of sediment deposition from the small creek which is proposed for realignment and is now completely dominated by wet soil species such as sedge and rice cutgrass. Proceeding westward (downstream), the vegetation gradually changes toward more aquatic species such as arrowhead and bulrush, and eventually to submerged species such as coontail, pondweed, and star grass in deeper areas. Dead Slough has no deep, open water and is 100 percent composed of submergents such as coontail, curlyleaf pondweed, duckweed, and potamogeton. The mouth of Dead Slough is a vegetated mudflat dominated by willow and giant smartweed.

In contrast to the existing conditions, 1964 aerial photographs showed a refuge consisting predominantly of open water and woodland. Sedimentation was evident at the mouth of Dead Slough, but a channel was still contiguous with the main river at low water. At present, Dead Slough has no water exchange

with the river except during floods. Several of the small, shallow backwater ponds and inlets within the Refuge have since succeeded to vegetated mudflats, willow thickets, or other persistent emergent wetland types.

TABLE 3-1

Andalusia Refuge Existing Features

<u>Aquatic Conditions</u>	<u>Area, Acres</u>
Main Channel	-
Main Channel Border	-
Side Channel	-
Sloughs	-
River Lake, Floating Submergent (lotus, coontail, duckweed)	87.0
Open Water (Occasional)	<u>7.5</u>
Total Aquatic	94.5
 <u>Terrestrial/Wetland Conditions</u>	
Forest (silver maple, cottonwood, willow)	236.0
Brush	-
Meadow	-
Sand	-
Mudflat, Emergent Persistent and Non-Persistent (rice cutgrass, arrowhead, smartweed, bulrush, cattail)	62.0
Agriculture	-
Developed	<u>-</u>
Total Terrestrial	298.0
<u>Total Aquatic and Terrestrial</u>	392.5

c. Existing Fisheries Use. Dead Slough is an extremely shallow backwater slough of the Mississippi River. Maximum depth at an adjusted flat pool stage of 545.0 MSL (Fairport gauge) was approximately 1.5 feet in May of 1988 compared to the Plane Table survey of 1936 which showed mean depths of 6 feet from the same reference stage. The slough is virtually 100 percent vegetated during summer growing periods, with coontail, curlyleaf pondweed, and duckweed dominating the vegetation.

Fish populations in the slough are sporadic and stage-dependent. Severe summer and winter kills have been reported by both local residents and IDOC district wildlife biologists. These kills have been attributed to dissolved oxygen crashes brought on by high sediment oxygen demands and biological oxygen demands coupled with thermal stresses. The slough undoubtedly acts

as an important fish refuge area during flood events and provides sport fishing opportunities during these periods. The slough also provides spawning and/or nursery habitat for fish species including carp, largemouth bass, black crappie, bluegill, smallmouth buffalo, and golden shiners. Other species collected in the area during a May 1988 sampling were shortnose gar, bowfin, gizzard shad, and central mudminnow. Fish trapped in the area by receding water are subjected to extreme dissolved oxygen and temperature stress, often leading to the fish kills already discussed. Because of these conditions, the net fisheries value of this area is near zero or is negative. During spring and fall floods, the area has value, but this value is largely negated by subsequent fish kills.

d. Existing Waterfowl Use. Migratory waterfowl use of Andalusia Refuge is low, primarily due to its erratic food production for migratory waterfowl. The Refuge's present primary benefit is in providing a resting area (no hunting). Available food, such as duck potato, wild millet, and smartweed, varies annually according to water level fluctuations. Summer floods often prevent germination or growth of food plants, or late fall flood events often inundate good food crops under several feet of water. Active management of the Refuge is minimal since there is very little that can be done to significantly affect habitat quality for waterfowl. Censuses of waterfowl use in the Refuge indicate very low use compared to other waterfowl refuges in nearby pools that have water level management capability.

The aerial census information available for the Andalusia Refuge indicates that peak waterfowl use days probably has never exceeded 2,000. This is no better than other unmanaged locations in Pool 16. In comparison, the 348-acre refuge at Princeton, Iowa (Pool 14) had 100,000 duck use days for the 1987 fall migration and a peak day use of 15,000. Figures for other years are comparable.

e. Water Quality. The water quality of Dead Slough is poor. The shallow depth (maximum of 1.5 feet at flat pool) and lack of contiguity with the main river cause frequent oxygen depletion and increased temperature in summer and fall. Total fish kills are common following high water periods that leave fish stranded in the slough without any exit.

There is very little to no water in the refuge area proposed for levee protection. Most of the area consists of moist soil vegetation (reed canary grass, sedge, cattail, etc.) with water present only during spring and fall flooding.

Elutriate analyses showed only ammonia-nitrogen exceeding surface water quality standards. The effects of ammonia-nitrogen can be minimized by selecting appropriate construction methods and/or excavation/dredging during low temperature and pH seasons of the year.

f. Endangered Species. The following federally endangered species are listed as being historically or currently present in Rock Island County:

Indiana bat	<u>Myotis sodalis</u>
Bald eagle	<u>Haliaeetus leucocephalus</u>
Higgins' eye pearly mussel	<u>Lampsilis higginsii</u>
Fat pocketbook	<u>Potamilus capax</u>

None of these species has been observed or documented on the project, except for periodic use by bald eagles during late fall and early winter.

g. Cultural Resources. The proposed project levee alignment will impact a natural levee. Both the proposed stream diversion channel and access road crosscut alluvial fans. Previous investigations in the Mississippi River floodplain indicate that natural levees have a moderate potential for containing archeological deposits, while alluvial fans have been found to have much higher potential for containing intact buried archeological deposits. Previous archeological surveys conducted in the Mississippi River Pool 16 area have documented archeological sites dating from the Archaic period, 8,000 years ago, to the Woodland period, 900 years ago. None of the proposed project area had been previously examined for historic properties.

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

i. Sedimentation. A sedimentation study was conducted to evaluate sedimentation in Dead Slough and in the Refuge area during the period 1936 through 1987. The average sedimentation rate for the entire area has been 0.5 inch/year. The average rate for Dead Slough has been approximately 0.8 inch/year.

The two predominant sedimentation sources are the Mississippi River and adjacent upland erosion. A comparison of river versus upland erosion is presented in table 3-2, along with potential sediment reductions due to the proposed project.

4. PROJECT OBJECTIVES. The objectives of the project are to:

a. Enhance migratory waterfowl habitat by providing adequate vegetation in reliable resting and loafing areas.

b. Retard the loss of fish and wildlife aquatic habitat by reducing sedimentation into the Refuge and Dead Slough.

c. Increase fish habitat in Dead Slough by access and channel excavation.

d. Increase habitat available for wintering fish by providing deeper water areas.

TABLE 3-2

Comparison of River Versus Upland Erosion Sedimentation

<u>Sedimentation Source</u>	<u>Existing Conditions</u>		<u>Sedimentation Reduction Due to Proposed Project</u>	
	<u>Ac-Ft/Yr</u>	<u>%</u>	<u>Ac-Ft/Yr</u>	<u>%</u>
Adjacent Watershed	11.0	39.3	4.2	15.0 <u>a/</u>
River	<u>17.0</u>	<u>60.7</u>	<u>0.0</u>	<u>0.0</u>
Net	28.0	100.0	4.2	15.0

a/ $(28.0 - 4.2) \div 28.0 = .15$

5. ALTERNATIVES.

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

b. Alternative B - 130-Acre MSMU Protected by 2-Year Levee. This plan consists of the construction of an approximate 130-acre MSMU protected by a perimeter 2-year earthen levee. The unit would consist of a perimeter levee approximately 8,600 feet in length tying into adjacent high ground on the south, as shown on plate 2. The MSMU area would be supported by a permanent pump station and water control structure. The pump station would have the capability of pumping from the MSMU during dewatering to the Mississippi River and also would be able to pump from the Mississippi River to the MSMU for additional inundation during migratory periods.

The general operating scenario for this alternative would consist of dewatering the unit commencing in June of each year (or as soon as possible following spring floods) and maintaining a dewatered condition through July and August. During this dewatered time, natural vegetation would emerge and/or seeds would be planted which would best support migrating waterfowl. Once either planted seeds or natural vegetation occurs, water levels would be allowed to increase within the unit by gravity flow. After water levels and vegetation within the unit reach adjacent river levels, additional water would be pumped from the river into the unit during September and October. The pumping of additional water would utilize the full capacity of the MSMU for migratory waterfowl.

The 2-year event levee would be approximately 6 feet high with a minimum 12-foot crown and typical sections as shown on plates 18 and 19. Because this is only a 2-year event levee, provisions are necessary to allow overflow to occur without significant annual maintenance.

Overflow of the levee would occur by means of a riprap-protected section, as shown on plate 12, and by use of the gates on both the water control structure and the pump station.

c. Alternative C - Other MSMU Sizes. Additional sizes of MSMU's within the study area also were considered, as shown on plate 3. An additional 90 acres of unit could be achieved by extending the levee system down river by about 3,000 feet, as shown.

Approximately 65 additional acres also could be added by extending the perimeter system around Dead Slough, as shown on plate 3. Water levels within Dead Slough and the Refuge would be controlled by a similar pump station and water control structure, as discussed in Alternative B.

d. Alternative D - MSMU Protected by Higher Levees. Higher levees to protect the MSMU also were studied, and levee heights corresponding to 5- and 10-year event frequencies were evaluated. These levees would consist of the same features as described in Alternative B, but would have approximate average levee heights of 9 feet and 11 feet for the 5- and 10-year events, respectively.

e. Alternative E - Adjacent Watershed Flow and Sediment Diversion. Adjacent watersheds with corresponding tributary drainage areas are shown on plate 4. Sediment from watersheds A, B, and C enters the project site with no practical alternative for diversion. Sediment from watershed D enters the project site and may be diverted.

Proposed diversion of sediment from watershed D consists of the construction of a diversion drainage ditch, as shown on plate 3. The diversion ditch is located on Government property and adequately intercepts all flows from this watershed and diverts them directly to Scisco Chute. The diversion ditch consists of a trapezoidal-shaped excavated channel approximately 30 feet wide at the bottom and approximately 2,430 feet long.

An alternative location for the diversion drainage ditch would consist of a ditch located as shown on plate 3. This ditch would require a permanent easement or fee title to lands off Government property. This alternative location would consist of the same typical section and would be approximately 2,200 feet long.

f. Alternative F - Refuge Bank Protection. River bank protection from Mississippi River flood events also was studied, as shown on plate 3. This protection would consist of 6 inches of crushed stone bedding with an 18-inch riprap blanket approximately 2,600 feet long. The intended purpose of this bank stabilization is to protect approximately 85 acres of emergent and submergent vegetation, as shown, from possible Mississippi River erosion.

g. Alternative G - Dead Slough Aquatic Improvement. This alternative consists of excavating an access channel to Dead Slough and adjacent channel excavation to the levee for improved habitat volume and quality. The improved areas should be deep enough to allow fish to winter and also to allow for future Dead Slough sedimentation. Various configurations of access and slough

excavation were considered, as shown on plate 3. The mouth of the new access channel should be located in a zone which neither erodes nor exhibits sedimentation. Excavation within Dead Slough should be compatible with other project features to allow adequate material placement. The estimated length of the Dead Slough aquatic improvement is 5,600 feet.

h. Alternative H - Refuge Drainage/Island Construction. This alternative consists of the construction of interior and side channel drainage channels with associated islands, as shown on plate 2. Interior drainage channels approximately 8,600 feet long and 50 feet wide would facilitate drainage during pump station drawdowns and hasten establishment of new vegetation. Material excavated from the interior drainage channels would be placed to construct about 9 acres of islands which would serve as island refuge to waterfowl from land-based foraging animals.

The interior side channel would be constructed for adjacent levee borrow purposes, would assist in interior drainage during drawdown, and would provide a pool for aquatic habitat during the drawdown period. The total length of this channel would be approximately 2,300 feet, with a 20-foot bottom width. A portion of this channel, 600 feet in length, would be about 6 feet deep during drawdown.

6. EVALUATION OF ALTERNATIVES.

Alternative A, No Federal Action, would not meet project objectives of enhancing migratory waterfowl by providing resting/food support areas or improving or stabilizing aquatic habitat from further sedimentation degradation. Fish kills would continue to occur in Dead Slough when water levels fall, trapping fish without egress to the river. Benefits to waterfowl would continue to fluctuate erratically, depending upon the season and frequency of flood events. Even this marginal waterfowl habitat would gradually decrease as aquatic habitat succeeds toward a more terrestrial cover type. Up to 14 acres of bottomland hardwood would be saved directly if the levee and relocated drainage channel were not constructed. Approximately 18 acres of emergent/submergent wetland would not be converted to deep aquatic habitat. The leveed area would remain contiguous to the main river with no levee to affect fish movement into flooded vegetation.

Alternative B, 130-Acre MSMU Protected by a 2-Year Levee, is compatible with existing Government lands and provides other aquatic improvement opportunities within Dead Slough. The inclusion of the additional 90 acres, as shown on plate 3, by extending the levee system downriver approximately 3,000 feet was not selected due to negative impacts on existing aquatic conditions. This area is recognized as a valuable submergent/emergent vegetative zone and is a desirable backwater feature.

In Alternative C, different MSMU sizes were evaluated. Enlarging the size of the leveed area would increase the number of waterfowl the area could support. Waterfowl gains, however, must be weighed against fishery losses. The levee boundary was determined to be the best location to provide the maximum benefit to waterfowl and fishery resources. Extending the levee north of Dead Slough would negate any fishery benefits that would result from the dredging of Dead

Slough. It also could conceivably cause a significant increase in cost, since the levee would be adjacent to the main river channel and hence would require more protection from erosion. Extending the levee westward would place the levee in more open water and would necessitate a much longer tie-back to higher ground. In addition to the loss of fishery habitat, there would likely be a significantly higher cost to maintain the levee section in open water.

An alternative alignment which placed the levee on the north side of Dead Slough also was considered. This alternative would increase the MSMU by approximately 65 acres, but would greatly diminish fishery benefits from the dredging of Dead Slough.

In Alternative D, higher levee heights were considered. River events exceeding a 2-year frequency level during the months of June through December were studied. Out of 22 years of record, only 2 events exceeded a 2-year elevation during these months of MSMU operation. One of these events occurred in June following a long spring flood. This overtopping rate is acceptable, given the nature of the project and management objectives. Easements or property from abutting private landowners also would be required since the Corps has flood easements up to only the 2-year event. A 5-year levee could be used to keep floodwaters out, but water levels inside the levee could not be raised higher than elevation 550.8 without acquiring additional flood easements.

In Alternative E, diversion of flows and sediment was evaluated for all adjacent watersheds. Diversion of flows with associated sediment from watershed D was the only practical alternative. Flows from watersheds A, B, and C empty directly into the project site and would require miles of drainage ditches and channel relocations. However, areas where watersheds A, B, and C empty into the project site have natural alluvial fans with established semi-mature timber stands and low-level brush. These areas effectively settle and entrap much of the sediment from upland erosion before they reach Andalusia backwater areas. Should monitoring efforts after construction of the proposed project reveal substantial sediment inflow due to adjacent watersheds A, B, or C, coordination with appropriate soil conservation agencies should be effected to initiate upland erosion control programs.

In Alternative F, refuge bank protection was studied. During efforts to ensure that the downstream portion of the Refuge area would remain protected from Mississippi River flows, bank stabilization was proposed, as shown on plate 3. Field survey sections were taken and compared with 1936 topographic maps to determine relative movement of the bank line in protecting this area. These sections are shown on plates 24 and 25. It was concluded that this entire reach is not subject to river channel erosion. Shallow water depths of approximately 2 to 3 feet at flat pool are present throughout the entire reach. However, towboat propeller wash and wind-generated waves have contributed to tree line erosion with minor bank effects.

Comparison of the present survey sections with the 1936 elevations indicated that the substantial initial investment and recurring maintenance costs were not justified by providing bank stabilization in this reach. Furthermore, a

closure dam located down river at approximately river mile 461.2 effectively blocks Drury Slough from direct flows and indirectly provides additional stability to the left bank within the project site.

Alternative G consists of the improvement of the Dead Slough area for fishery purposes. One of the critical features of the improvement consists of a channel for fish access into the Dead Slough area that would be open all year. The opening of the channel required location in a sediment-free and erosion-free zone. Areas on plate 3 were studied as possible alternatives to the new channel. One location consisted of a natural flow area as shown. However, there is only about 2 to 3 feet of water in the river adjacent to this site for about 300 feet. Additionally, the bottom of this zone consists of several feet of soft sediments, indicating sediment deposition and questionable side slope stability during excavation and subsequent maintenance.

An additional mouth location also was studied, as shown on plate 3. The location of this proposed mouth could possibly increase sedimentation to the backwater refuge area by allowing uncontrolled entry of river flows into the upper end of the backwater area where such flows presently do not exist. The construction of the associated access channel from this point to the levee itself also could clear a desired natural buffer zone of mature trees which lies adjacent to the river. Clearing of this natural buffer would segment this portion of the refuge and possibly allow increased sedimentation in the backwater refuge area. These additional flows would create maintenance considerations by causing possible erosional scour against the new levee system, as well. Approximately 400 feet lies between the existing bank and main river channel, with only 3 feet of water clearance over a firm sand bottom. This condition would become a blockage to aquatic habitat during low flow, ice conditions. Excavation of a deeper channel in this vicinity also would encourage accelerated sedimentation in the mouth of the channel itself during Mississippi River high water events.

The location for the mouth of the access channel was selected as shown on plate 2. This location lies at the lower end of Scisco Chute and consists of an overland cut of about 400 feet. The entire Scisco Chute is a stable channel relative to sedimentation and scour and maintains minimum water depths from flat pool of 6 to 8 feet throughout the entire reach. Other evidence of erosion, such as downed bank trees, or sedimentation, such as sand or mud bars, is not present. Loss of the timber habitat is considered acceptable relative to the other negatives of considered alternatives. This access channel would provide deep water and reliable year-round fish access to the Dead Slough area.

Additional aquatic improvement also is proposed by means of excavation adjacent to the proposed levee, as shown on plate 2. This excavation would improve fish access to the Dead Slough area and provide additional deep water. Material from this excavation can be placed, as shown on plate 18, at the slough's edge to increase the section of the perimeter levee in this reach.

In Alternative H, interior improvements to the proposed MSMU were evaluated. Construction of drainage channels within the refuge itself was considered necessary to ensure adequate drainage to the pump station during drawdown periods. Without such drainage channels, water from the refuge would not reach the station in a timely manner, thus precluding efficient vegetation establishment during drawdowns. Material excavated from these ditches would be placed adjacent to the excavation zones and would create island habitat for additional refuge protection from land-based animals. These islands would be constructed as shown on plate 2. Construction of islands was considered a management objective to provide island-based refuge for migratory waterfowl.

Additional excavation within the MSMU, as shown on plate 2, would both provide a source of levee borrow and function as a low-water pool for survival of aquatic life.

7. SELECTED PLAN WITH DETAILED DESCRIPTION.

a. General Description. Alternatives B, E, G, and H were selected to be recommended for project construction. The construction of the 130-acre MSMU protected by a 2-year levee (Alternative B), selection of adjacent watershed flow and sediment diversion (Alternative E), Dead Slough aquatic improvement (Alternative G), and refuge drainage/island construction (Alternative H) all meet program objectives and are cost effective. This plan further provides balanced waterfowl habitat improvement and aquatic fishery habitat improvement.

The proposed project consists primarily of the construction of a 2-year event levee (elevation 550.8 MSL), 8,600 feet long and up to 110 feet wide from toe to toe, which will provide water level control on 130 acres of Refuge land, and a pump station capable of pumping 3,500 gallons per minute into the Refuge and 5,000 gallons per minute from the Refuge. Fill material for the levee will be excavated from Dead Slough, from the interior of the newly leveed Refuge, and from the diversion drainage ditch. This construction will create approximately 3.1 miles of channel (10,900 feet within the Refuge and 5,600 feet within Dead Slough). (See plates 9-12.) The Dead Slough channel adjacent to the levee will have a 60-foot bottom width. The configuration of the excavated channels within the leveed area will create islands totalling approximately 9 acres. These channels will allow fish to exit the leveed Refuge through a new water control structure into Dead Slough, and eventually the main river. The new mouth of Dead Slough will now empty into Scisco Chute. These channels also will facilitate the drawdown of water levels in the Refuge. The water control structure will be placed in the upstream portion of the levee to provide improved water level management, as well as permit fish egress and ingress to the levee interior.

The intermittent stream which now deposits sediment in the refuge backwaters will be rerouted directly to the main river (Scisco Chute). This will significantly decrease the sedimentation rate in the refuge and Dead Slough and will prolong the habitat life of the newly dredged channels and leveed area. The

new channel will be 2,430 feet long and 3 feet deep, with a 30-foot bottom width. This action will require clearing 3.7 acres of timber and excavating 11,700 cubic yards of material.

The levee has only been designed for the 2-year event. This level of protection will be sufficient to provide water level control for approximately 21 years out of 22, which is considered good for an MSMU. The levee elevation has been designed to withstand frequent overtopping without extensive damage. The lower portion of the levee will be armored to protect it from overflow during floods.

Dredging will be accomplished by mechanical means (i.e., backhoe or clamshell). In order for the mechanical equipment to operate, some trees along the immediate shoreline must be cleared. Approximately 7.4 acres of woodland and 2.5 acres of submergent/emergent wetland will be lost in a 40- to 100-foot-wide path along the Refuge's perimeter levee. The equipment for dredging Dead Slough also will operate along the levee alignment or from floating barges in Dead Slough.

A new access road approximately 3,600 feet long and an electrical transmission line also will be constructed, as shown on plate 14. These will follow the government property line from the pump station to a county road which abuts Corps land just outside the project site. About 2 acres of timber will be cleared for this access.

b. Perimeter Levee. The entire perimeter levee is designed to prevent a Mississippi River 2-year flood event from entering the Refuge. The 2-year flood elevation for the project site is elevation 550.8 feet MSL, which represents the elevation of the overflow reach of the levee as shown on plate 12 from station 24+17CE to station 30+17CE (600 feet). From station 24+17CE to station 9+40 (see profile on plate 15), the profile of the levee is approximately five times steeper than the natural flood profiles of the Mississippi River. The profile of the levee in this manner will ensure that the leveed system will be filled from the lower end by river events that exceed 2-year events. This profile should provide minimal maintenance to the levee in this reach. A detailed description of the operational features of the levee system is presented in Section 11.

(1) Station 12+21C to Station 11+00. This reach of levee, as shown on plate 8, consists of a 12-foot-wide crown with an approximate height of 4 feet. Typical section is shown on plate 18. Borrow for this approximately 1,300 feet of levee will come from excavation of the nearby diversion drainage ditch and from Dead Slough excavation.

(2) Station 11+00 to Station 8+00CE. This reach of levee of about 4,100 feet consists of an approximate 60-foot-wide levee crown with 4:1 (Horizontal:Vertical) side slopes, as shown in plan on plates 9, 10, and 11 and with typical section on plate 18.

Through detailed on-site meetings and investigations, this reach of the levee has been located adjacent to Dead Slough such that approximately 40 feet of the levee section lies on existing ground above flat pool (elevation 545.0)

with the remainder of the levee section lying within Dead Slough on land below flat pool (average elevation 544.0). This reach of the levee system has a substantially thicker section due to the placement requirement of adjacent Dead Slough excavation. The average height of this levee is 6 feet.

After construction, about half of the levee on the slough side will not require maintenance. The other half of this levee section will become the integral core of the levee and will require annual inspection and maintenance.

(3) Station 9+00CE to Station 24+17CE. This reach of the levee consists of approximately 1,600 lineal feet and has an average height of about 6 feet with 4:1 side slopes. This reach would be constructed using adjacent borrow sources, as shown on plates 12 and 13, with typical section on plate 18. The width of the levee crown of this reach will be 12 feet.

(4) Station 24+17CE to Station 30+17CE. This reach of the levee consists of approximately 600 feet crossing the most downstream area of the MSMU. Average height of this levee will be about 7 feet, with a 12-foot clay core and a 2-foot bedding and riprap blanket on the exterior for overflow and wave protection. This reach is shown on plate 12, with typical section on plate 18.

Borrow for this section of levee will be obtained from adjacent in-water excavation. Typical side slopes will be 4:1 due to construction considerations of the adjacent borrow.

(5) Station 30+17CE to Station 34+50CE. This 450-foot reach of the levee is shown on plate 12, with typical section on plate 19. This section of levee will tie into high ground and will be connected to the access road. Average height in this reach will be approximately 2 feet. Borrow will be obtained from areas adjacent to the access road.

c. Diversion Drainage Ditch. The plan view of the diversion ditch is shown on plate 8, with section shown on plate 18. The bottom width of the excavated ditch will be approximately 30 feet, with average depth of excavation of 3 feet. The drainage ditch has been sized to pass a 2-year precipitation event within bank.

The outlet of the diversion drainage ditch has been placed near flat pool in Scisco Chute which closely approximates the existing outlet and which should provide a maintenance-free outlet area.

The entire drainage diversion ditch is located on existing Government lands, so no additional easements/fee taking will be required. As shown on the typical section, an additional 10-foot-wide unsurfaced maintenance access service road also will be built during construction and used for maintenance after construction.

d. Dead Slough Excavation. As shown on plates 9, 10, and 11, with typical sections on plate 18, it is proposed to excavate approximately 110,000 cubic yards for Dead Slough aquatic improvement. The average bottom width of this excavation will be about 60 feet to elevation 536 MSL adjacent to the

levee. The average cut for this excavation will be approximately 7 feet. This material will be placed in the levee section adjacent to Dead Slough, as described in the above perimeter levee from station 11+00 to station 8+00CE.

An additional river access channel also will be constructed from Scisco Chute to the Dead Slough area. The approximately 1,100 feet of excavation will consist of a 30-foot-wide cut with an approximate 9-foot depth to elevation 536 MSL, with excavated material placed on adjacent land between stations 8E to 13E, as shown in section on plate 19.

e. Refuge Drainage/Islands. Interior Refuge drainage will be provided by the construction of excavated channels, as shown on plates 9, 10, 11, and 12. Two types of typical sections will be constructed as shown on plate 19.

Type I will consist of drainage channels constructed on both sides of an island. The excavated material would produce an approximate 45-foot-wide island at elevation 551 feet MSL.

Type II refuge excavation will consist of the drainage channel constructed on one side of the excavation with excavated material producing an approximate 10-foot-wide island with an elevation of 551 feet MSL. The overall length of the refuge drainage excavation will be about 8,600 feet. The profile of the refuge drainage excavation is shown on plate 17.

f. Pump Station. The pump station has been sized to evacuate the MSMU in approximately 14 days. Plan views and typical sections of the proposed station are shown on plate 20.

The pump station will be furnished with two pumps which will provide the capability to dewater the MSMU during drawdown times and to pump water from the Mississippi River into the MSMU. The sizes of these pumps will be 5,000 gpm and 3,500 gpm, respectively. The pump station will be manually energized when required and will operate automatically until de-energized. Overhead electrical power will be furnished adjacent to the proposed access road.

This station is being furnished with a trash rack on both the MSMU side and the river side due to flow reversals as described. The inverts of the station have been set consistent with refuge ditching and adjacent natural ground elevations. A sedimentation zone has been provided on the MSMU side with an overflow weir protecting the entrance to the station to minimize sediment entering the pump station during drawdown periods.

The station also will contain a 3-foot by 3-foot sluice gate to allow passage of gravity flows. The gate will be operated by an electrically driven motor.

Both pumps and the gate will be located within a cast-in-place concrete building structure. A vandal-resistant and durable structure will be provided.

g. Water Control Structure. A water control structure is proposed as shown in plan view on plate 21. The water control structure will consist of a 36-inch-diameter concrete conduit located within the proposed levee section. The conduit will be controlled by a 3-foot by 3-foot sluice gate which will be fitted with portable power source wrench fittings.

h. Access Road. Access to the pump station and levee system must be constructed as part of the project. Three general alternatives were considered in providing access, which are presented in table 7-1.

TABLE 7-1

Evaluation of Access Road Alternatives

<u>Alternative Description</u>	<u>Pros</u>	<u>Cons</u>	<u>Estimated Initial Construction Cost</u>	<u>Remarks</u>
Access on top of new levee from existing county highway (see plate 3).	Access from county highway provides year-round access reliability; provides good surveillance of refuge activities; provides good maintenance inspection of perimeter levee.	Need right-of-way from county highway for entrance; unauthorized public use could disturb refuge objectives; requires 7,600 feet crushed stone surface on top of the levee to build and maintain; requires 3,600 feet in length of clearing for electric service line.	\$52,000	Not feasible due to cost, disturbance of refuge activities, and inaccessibility to pump station across overflow section once overflow commences.

TABLE 7-1 (Cont'd)

<u>Alternative Description</u>	<u>Pros</u>	<u>Cons</u>	<u>Estimated Initial Construction Cost</u>	<u>Remarks</u>
Access across private lands (see plate 3).	Access is remote from public view.	Requires approximately 3,700 feet of access road in addition to an overhead electric service road for electrical supply purposes; existing road to beginning of new access road not maintained by county.	\$48,000	Not feasible due to no county maintenance of connecting road to road prior to new access road.
Access from downstream existing cottages.	Located entirely on Government lands and shortest distance, about 3,600 feet of electric supply would follow same route.	Access road would require filling and bank stabilization in vicinity of station 6+30F, as shown on plate 14; access must be coordinated with existing cottage leases and boat docks.	\$65,000	Recommended access route.

The recommended access road consists of the construction of approximately 3,600 lineal feet of a 12-foot-wide service road, with typical sections shown on plate 19. The service road access also will be used by the local utility company for placement of overhead poles for electric power supply. IDOC personnel will control egress to the access road to prevent and minimize public access to the refuge area and consequent disturbance.

8. DESIGN AND CONSTRUCTION CONSIDERATIONS.

a. Existing Site Elevations. Construction of the levee and excavation equipment types is dependent upon existing water elevations during the construction period. During normal dry seasons of the year (June through December), conventional excavation equipment can be used for the majority of the levee, diversion drainage ditch excavation, Dead Slough excavation, and associated access road and drainage facilities.

b. Foundations of Structures. Prior to completion of the final plans and specifications, two deep borings will be required to confirm the presence of dense sand below the proposed pump station.

In the areas of the pump station and the water control structure, the levee shall be built 2 feet higher than final grade and consolidated for at least 3 months before excavation of the structure commences.

c. Borrow Sites/Construction Materials.

(1) Borrow Sites. Levee embankment sections with corresponding borrow sites are presented in table 8-1.

TABLE 8-1

Borrow Sources

<u>Levee Embankment Station</u>	<u>Borrow Source</u>	<u>Remarks</u>
Station 12+21C to 11+00	From diversion drainage ditch excavation.	Use Dead Slough excavation as additional borrow if quantity from diversion ditch is insufficient.
Station 11+00 to 8+00CE	From adjacent Dead Slough excavation.	Place uncompacted levee sec- tion. Construction activities for the embankment must allow passage of other construction equipment on a 10-foot-wide temporary access road without clear cutting mature timber. Based on further evaluation of soils data, consideration during final design consid- eration should be given to steepening side slopes and raising the levee profile higher than required (for disposal of excess Dead Slough

TABLE 8-1 (Cont'd)

<u>Levee Embankment Station</u>	<u>Borrow Source</u>	<u>Remarks</u>
		material). These actions would reduce the levee base width and impacts on the area.
Station 9+00CE to 24+17CE	Adjacent borrow creating permanent pool during drawdown using land-based equipment.	Place uncompacted levee fill.
Station 24+17CE to 30+17CE	Adjacent submergent borrow creating permanent pool during drawdown using floating plant equipment.	Possible alternative embankment material based on most economic section.
Station 30+17CE to 34+50CE	Adjacent to proposed access road.	Additional borrow is available in vicinity of station 23E.

(2) Construction Materials. Only common construction materials are required for this project. Construction of the access road will allow access to the proposed pump station and water control structure.

Riprap and bedding sources are available from nearby river terminals and probably would be transported by floating barge to the project site.

After construction of the access road, construction materials, including concrete, can be transported on the access road to the pump station and the water control structure using conventional equipment.

Because of the significant quantity of bedding and riprap, riprap sources were investigated and are readily available within several miles of the project site. These materials could be transported to the project site by floating barge.

d. Excavation Depths and Equipment. The basis for the proposed Dead Slough access channel and slough excavation is shown in table 8-2.

TABLE 8-2

Basis of Dead Slough Excavation

<u>Elevation</u>	<u>Description</u>
545.0	Flat Pool
-1.0	Low Flow Regulation
-6.0	Maintain Water Depth
<u>-2.0</u>	<u>25[±] Years Sediment Storage a/</u>
536.0	Selected Excavation Bottom

a/ An average rate of 1.0 inch per year was used as the average sedimentation rate for areas normally covered by water (below flat pool).

All excavation for the selected plan was presented and costs were estimated based on common excavation equipment such as draglines, backhoes, or clamshell (as opposed to hydraulic dredging). This equipment must be placed on floating plant for excavating the Dead Slough access channel, portions of the Dead Slough channel excavation, and adjacent to the riprapped weir overflow section. Adjacent disposal reaches have been based on use of typical equipment of this type with normal throw/placement distances.

An alternative to excavating the access channel and Dead Slough by floating plant will be further evaluated. Consideration will be given to using hydraulic dredging with placement in containment areas located on adjacent private property. Further coordination with adjacent agricultural property owners will proceed to effect possible alternate methods of dredged material placement. Construction easements will be required.

e. Erosion Control. Riprap is proposed on both sides of the weir overflow section of the perimeter levee to protect against both Mississippi River current during overflow and also against wave erosion during high flow events. The governing riprap design is based on wind-generated wave erosion at this location.

Riprap is also proposed in the area of the pump station for protection of pump embankment slopes and at the entrance of the new Dead Slough Access channel.

An estimated width of approximately 200 feet of existing mature timber will remain in most reaches between the new levee and the Mississippi River to provide a natural buffer from Mississippi River high flood events. This natural undisturbed zone should adequately protect the new levee in Dead Slough.

Seeding will be required immediately following the diversion drainage ditch excavation and also on the proposed levee sections to ensure face stability from erosion forces.

f. Permits. The requirements of Section 404 of the Clean Water Act will be completed prior to submission of this report for final approval, including Section 401 Water Quality Certification. An additional Construction-in-the-Flood Plain permit from the Illinois Division of Water Resources also will be required and completed prior to final submission.

9. ENVIRONMENTAL EFFECTS.

a. Summary of Effects. The effects of the Selected Plan are summarized in table 9-1.

b. Economic and Social Impacts.

(1) Community and Regional Growth. No significant impacts to the growth of the community or region will result from the project.

(2) Community Cohesion. No adverse impacts to community cohesion will be noticed, due to the nature of the project and its limited area of influence. Since the site is managed as a fish and wildlife refuge by the IDOC and is located in a rural surrounding with limited recreational opportunities, it will result in only a slight increase in recreation visitation to the area.

(3) Displacement of People. No residential relocations will be necessitated by the project.

(4) Property Values and Tax Revenues. The potential value of property at the project site could increase slightly following completion of the project. Since the affected property is in Federal ownership, an increase in its value will not increase local tax revenues.

(5) Public Facilities and Services. The project site is federally owned and zoned for low density recreation. The project will positively impact public facilities by enhancing fish and wildlife habitat and by improving conditions for recreational boating. If no action is taken, recreational opportunities at the Refuge will be reduced and a once important fishery, migratory waterfowl, and furbearer area will be transformed into lowland brush habitat.

(6) Life, Health, and Safety. Currently, the Andalusia Wildlife Refuge poses no threats to life, health, or safety of recreationists or others in the area. The project will not affect current conditions regarding these areas of concern.

TABLE 9-1

Effects of the Preferred Plan on Natural and Cultural Resources

<u>Resource</u>	<u>Effect</u>
Air Quality	No effect
Endangered/Threatened Species	No effect
<u>Habitat Type</u>	
Bottomland Hardwoods	Potential negative impacts on 50-60 acres of bottomland within leveed Refuge due to inundation from water level management; 7.4 acres lost due to levee construction (5.3 acres of which is forested wetland), 3.7 acres lost due to drainage channel relocation; .78 acre at the mouth of Dead Slough; 2 acres from new access road.
Emergent/Submergent Wetlands	2.5 acres filled due to levee construction; 7.2 acres in Dead Slough converted to deep water aquatic from dredging; 9 acres within Refuge converted to nesting islands. 10 acres within Refuge MSMU converted to deep aquatic from channel dredging.
Fisheries	Dredging of Dead Slough will replace 7.2 acres of submergent/emergent with 7.2 acres of new deepwater/backwater habitat and reconnect the now isolated slough with the main river.
Waterfowl	Greatly improved habitat for migratory waterfowl on 130 acres of wetland through improved water level control.
Floodplain	No measurable increase in flood heights.
Historic & Cultural Properties	No effect
Prime & Unique Farmlands	No effect
Water Quality	Temporary increase in turbidity during construction of levee and channel dredging. Significantly improved water quality in Dead Slough after construction (i.e., improved DO and water circulation).

(7) Employment and Labor Force. Project construction would slightly impact short-term employment in the project area. Rock Island County has a labor pool of large enough size to absorb project needs without noticeable impact. No impacts to long-term employment will result from the project.

(8) Business and Industrial Development. Changes in business and industrial activity during the after-project construction will not be noticed. The project will require no business relocations.

(9) Farm Displacement. No farms will be affected by the environmental enhancement project, as the project site is located entirely on federally owned land.

(10) Noise Levels. No significant long-term noise impacts will result from the project. Heavy machinery will generate an increase in noise during construction. This increase would disturb recreationists in the immediate project vicinity. However, the project site is located in an area with limited residential or other types of development.

c. Natural Resource Impacts.

(1) Man-Made Resources. The proposed new levee will be a man-made resource that will be managed and maintained to provide improved resting and feeding habitat for migratory waterfowl. There are no existing man-made resources in the immediate project area, other than the 9-foot navigation channel project which will be unaffected.

(2) Natural Resources.

(a) Bottomland Forest. The most significant impact from project construction will be the clearing of bottomland forest for the levee right-of-way. Approximately 7.4 acres of hardwoods along the levee alignment must be cleared which consists of mixed-age oak, hickory, silver maple, hackberry, cottonwood, and elm. The timber through which the levee passes is the only stand in the project area containing mast trees (i.e., oak and hickory). In order to minimize the loss of these trees, the levee will be placed as close to the shoreline of Dead Slough as possible. This shoreline alignment is also necessary to allow mechanical excavation of borrow material from Dead Slough. Approximately 4.5 acres along the relocated drainage ditch and the new Dead Slough entrance also will be cleared. Overall, these trees consist of less mature silver maple and cottonwood. Another 2 acres of mostly bottomland hardwoods will be cleared for the access road and power transmission line. An additional 50 to 60 acres of silver maple/cottonwood within the levee interior may be affected by artificial water level management within the Refuge. These tree species, however, are adapted to long periods of inundation during spring and fall. The severity of impact will depend primarily on the length of time that trees are artificially inundated during the summer growing season and the depth of water.

(b) Fisheries Resources. The proposed project will reduce the almost annual fish kills that now occur in Dead Slough. The new deepwater habitat will allow ingress and egress from Dead Slough to both the Mississippi

River main channel and the Refuge interior for spawning and nursery habitat. The creation of the deepwater channels adjacent to shallow vegetated areas will create ideal conditions for both forage and sport fishes. This is important for spawning, cover, and allowing egress when refuge water levels are drawn down in early summer. The creation of deepwater aquatic habitat in a backwater area will provide a critically needed wintering habitat for several fish species (Bodensteiner and Sheehan, 1988).¹ The net project result will be increased fish populations both inside and outside the project.

(c) Waterfowl Resources. The proposed project will create a reliable food supply for fall migratory waterfowl. The new levee and pump station will allow waterfowl biologists to manipulate water levels on 130 acres of wetland to enhance waterfowl food production. The levee also will prevent 2-year flood events from destroying the food crop, significantly improving the Refuge's capacity to provide food and refuge.

The configuration of the channel dredging within the leveed area will create several low elevation islands that will promote nesting of Canada geese. However, the anticipated number of geese using these islands is probably less than a dozen nesting pairs.

(d) Other Wildlife. The increased deep and shallow water habitat will make the area more attractive to semi-aquatic mammals (i.e., muskrat, beaver, and possibly river otter), amphibians and reptiles (i.e., turtles, water snakes), and shorebirds. The loss of mast-producing trees along the levee alignment will decrease available food for some species (i.e., squirrel, deer, wood duck).

(3) Water Quality. The water quality of Dead Slough will improve as a result of the project. The increased depth and reconnection of the slough with the main river channel will improve water circulation, dissolved oxygen, and decrease the rapid fluctuation of water temperature that now occurs. The dredging of Dead Slough will increase turbidity levels during construction. This will have negligible adverse effects since the existing water quality is poor. The relocated drainage channel will improve water quality in Dead Slough and the leveed area. The decrease in sediment input from this stream will improve water quality and prolong the project's life. A more detailed discussion of water quality and prolonged impacts can be found in appendix B.

(4) Air Quality. No effect.

(5) Endangered Species. The only observed endangered species known to occur in the immediate project vicinity is the bald eagle. During late fall and early winter, migratory eagles are frequently sighted along the

¹ Bodensteiner, Leo and Robert Sheehan, 1988. Implications of Backwater Habitat Management Strategies to Fish Populations. 43rd Annual Upper Mississippi River Conservation Committee Meeting, Peoria, Illinois, March 8-10, 1988.

entire river in the Rock Island District. As ice cover forms on the river in December, the eagles concentrate in critical wintering locations near the open tailwaters of the locks and dams.

Project construction may discourage use of the area by eagles during fall, but will have no effect on wintering eagles which utilize other wintertime habitats. Based on this evaluation, the project will have no effect on bald eagles or any other State or federally endangered species.

(6) Wetlands. Under Corps wetland determination guidelines, any area below 547.0 feet MSL is wetland regulated by the Corps. Using this criterion, approximately 18 acres of palustrine forested, scrub-shrub, emergent, and aquatic bed wetland classes are common in Pool 16. This loss of wetland will have no significant impact on local wetland functions. Operation of the new levee will be filled or cleared as a result of the project. Although these wetlands are valuable from several perspectives, these palustrine wetland classes are common in Pool 16. This loss of wetland will have no significant impact on local wetland functions. Operation of the new levee will impose a more regular hydrologic regime upon the wetlands within the levee. Regular and consistent water level control may lead to a decrease in the diversity of wetland types that now exist within the levee. The extent to which this decreased diversity may occur will depend upon water level management and the variability of the substrate elevation (for example, the more uniform the water depth, the more likely that one wetland class will tend to dominate).

(7) Cultural Resources. An archeological survey and geomorphological evaluation of the proposed project area was conducted under the direction of archeologist David Stanley and geomorphologist Jeffery Anderson of Bear Creek Archeology and Donohue and Associates, respectively, from July 23, 1988, to August 1, 1988. A detailed archeological and geomorphological evaluation of the proposed levee alignment, diversion drainage ditch, dead slough access channel, and access road failed to locate any significant historic properties. Isolated chert flakes were present in an area where the proposed access road crosses an alluvial fan. However, these were thought to be relocated from a higher elevation outside the project area. No intact cultural deposits or features were encountered. Based on these field results, it is the conclusion that the proposed Andalusia EMP project will not impact any significant historic properties. By letter dated September 7, 1988, the Illinois State Historic Preservation Officer concurred with this finding.

(8) Relationship of the Proposed Project to Land-Use Plans. The present land use of the entire project area is the management of fish and wildlife resources. This project is compatible with this land use and is designated to enhance and promote these land-use plans. The USFWS also has determined that the proposed project is compatible with existing refuge goals and objectives. (See Appendix A.)

d. Adverse Effects Which Cannot Be Avoided. The clearing of approximately 13 acres of bottomland hardwoods during construction is unavoidable. The possible indirect loss of 50 to 60 acres of additional trees within the leveed area from periodic flooding may be unavoidable if the project is managed as intended.

e. Short-Term Use Versus Long-Term Productivity. The proposed project will improve both the short- and long-term productivity in terms of fishery and waterfowl habitat. The newly leveed area will provide a reliable long-term feeding and resting refuge for waterfowl. Productive deepwater fish habitat will be constructed at the expense of locally abundant emergent wetland occasionally used as fish spawning habitat by some species.

f. Irreversible or Irretrievable Resource Commitments. Aside from the commitment of funds, labor, and construction materials, there will be no permanent loss of natural resources except for the loss of forest and wetland replaced by the project.

g. Compliance with Environmental Quality Statutes. The proposed project complies with all applicable laws and regulations listed in table 9-2.

10. SUMMARY OF PROJECT ACCOMPLISHMENTS.

The proposed project will benefit three major areas: improve water quality by reducing sedimentation in the project area; increase the quantity and quality of reliable waterfowl habitat; and increase fishery habitat.

Construction of the diversion ditch will reduce the present sediment load into the area by approximately 15 percent. This reduction will increase the water quality in the Dead Slough area by reducing suspended solids and agricultural runoff chemicals.

Construction of the moist soil unit with accompanying water level control will provide a reliable resting and feeding area for migrating waterfowl. The MSMU will not only provide a readily available food source in existing open areas, but also an additional food source within the inundated "green tree" portion of the unit. Without implementation of the proposed project, migrating waterfowl will not have reliable resting and feeding areas along this reach of the river for approximately 70 miles. The present usage of approximately 2,000 waterfowl use days should significantly increase due to the project.

The proposed levee construction will prevent most fall floods from entering the MSMU. With the provision of the pump station and the levee system, waterfowl biologists will have the capability to manipulate water levels for optimum waterfowl support on approximately 130 acres of prime Refuge lands.

Aquatic habitat will be improved by providing year-round access to Dead Slough. Dead Slough experienced increasing numbers of fish kills due to low dissolved oxygen. The proposed project should eliminate these conditions by connection to the main river and by providing deeper channel areas. The construction of the deep water channels adjacent to the shallow vegetated areas of Dead Slough will provide ideal conditions for both forage and sport fishes. The construction of deeper channels in the backwater area of the river will provide critically needed wintering habitat for several fish species.

TABLE 9-2

Compliance of the Selected Plan with WRC-
Designated Environmental Statutes

<u>Federal Policies</u>	<u>Compliance</u>
Archaeological and Historic Preservation Act, 16 U.S.C. 469, et seq.	Full compliance
Clean Air Act, as amended, 42 U.S.C. 1857h-7, et seq.	Full compliance
Clean Water Act (Federal Water Pollution Control Act) 33 U.S.C. 1251, et seq.	Full compliance
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 Act, 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. 1401, 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
Rivers and Harbors Act, 33 U.S.C. 403, 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
National Farmland Protection Policy Act, 7 U.S.C. 4201, et seq.	Full compliance

11. OPERATION, MAINTENANCE, REPAIR, AND REHABILITATION CONSIDERATIONS.

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

b. Operation. The estimated costs for operation, maintenance, repair, and rehabilitation of the selected plan are presented in table 13-2.

The gate of the pump station and the water control structure should be operated in an open position, except during periods of MSMU management by IDOC personnel. During desired drawdown periods, the gate of the water control structure and the pump station should be closed and the pump station activated for drawdown purposes. The pump station must be manually activated but will automatically turn off at a low water level of 542.0 MSL. During drawdown periods, the pump station will automatically turn on at elevation 542.5 MSL to maintain the 542.0 drawdown elevation.

After drawdown has occurred and once vegetation has been established in the MSMU, either adjacent tributary inflow, seepage, or opening of the water control structure gate or the pump station gate will allow water into the MSMU area. Use of gates should be controlled to achieve desired water levels consistent with vegetative growth.

When it is desired to pump from the river into the MSMU, the station must be manually activated and will continue pumping automatically until elevation 547.0 MSL (which can be adjustable to elevation 550.8, the elevation of the levee overflow). It is anticipated that ponding levels higher than elevation 547.0 will cause damage to adjacent agricultural fields during crop growing seasons. Coordination between the IDOC and adjacent property owners during non-crop season may be effected to realize higher MSMU elevations than 547.0. The highest MSMU elevation of 550.8 MSL will occur when water reaches the elevation of the overflow weir.

During periods of drawdown and when river events reach elevation 550.0 MSL with predicted stage to increase, the gates of the water control structure and the station should be opened in efforts to fill the interior of the levee without overtopping. Should the river stage exceed 550.8 MSL prior to filling using the existing water control structure and pump station conduits, the remainder of overflow will occur by means of a riprapped overflow weir station.

The Rock Island District will prepare an operation and maintenance manual for the IDOC during the design phase.

TABLE 11-1

Andalusia Refuge Project Data Summary of Proposed FeaturesPerimeter Levee

Embankment fill	122,000	Cubic Yards
Length	8,600	Feet
Crown elevation	552.8	Station 12+21C to Station 11+00
	552.8 to 551.8	Varies from Station 11+00 to Station 24+17CE
	550.8	From Station 25+17CE to Station 29+17CE
	551.8	From Station 30+17CE to Station 34+50CE
Side slopes	4:1	Horizontal to vertical from Station 12+21C to 8+00CE. Slopes flattened for over- flow and soft material placement purposes
	4:1	From Station 9+00CE to Station 34+50CE
Armored overflow levee section		
Length	600	Feet
Overflow elevation	550.8	MSL
Riprap	3,370	Tons

Diversion Drainage Ditch

Approximate length	2,430	Feet
Average width	30	Feet
Average depth	3	Feet
Bottom slope	.0025	Foot per foot
Watershed area	1,152	Acres
Capacity of channel	340	CFS (2-year precipitation event)

TABLE 11-1 (Cont'd)

Dead Slough Channel Excavation

Adjacent to Levee		
Approximate length	4,500	Feet
Width at bottom	60	Feet
Bottom elevation	536.0	MSL
Volume of excavation	87,000	CY

River Access Excavation

Approximate length	1,100	Feet
Width at bottom	30	Feet
Bottom elevation	536	MSL
Volume of excavation	23,000	CY

Refuge Drainage/Island ConstructionInterior drainage
with islands

Length	8,600	Feet
Width	40	Feet
Bottom elevation	542.0±	MSL
No. of islands	8	Each
Area of an island above elevation 545.0	9.0	Acres

Interior drainage for
adjacent levee
borrow

Length	2,300	Feet
Width at bottom	20	Feet
Bottom elevation	536.0	MSL

Pump Station

Submersible pumps		
Emptying pump	1	Each: 5,000 gpm at 14.3 TDH
Filling pump	1	Each: 3,500 gpm at 7.8 TDH
Sluice gate	1	Each: 3 feet x 3 feet
Operating elevations		
Refuge max. elevation	550.8	MSL (overflow elevation)
Refuge min. elevation	542.0	MSL
Sump floor elevation	539.5	MSL
Equipment floor elevation	560.0	MSL (100-year Mississippi River event)

TABLE 11-1 (Cont'd)

Electric power source		
Primary supply	7,620	Volts, 1 phase
Secondary station supply	480/277	Volts, 1 phase
Transformer size	37.5	KVA, 1 phase
Power converter	37.5	KVA, 3 phase
Trash racks		
upper and lower ends	2	Each
<u>Water Control Structure</u>		
Sluice gate	1	Each: 3 feet x 3 feet
Invert	542.0	MSL
<u>Access Road</u>		
Approximate length	3,600	Feet
Width	12	Feet, with crushed stone surface

c. Maintenance, Repair and Rehabilitation. The proposed features have been designed to ensure low annual maintenance requirements with the estimated annual maintenance, repair, and rehabilitation costs presented in table 13-2. These quantities and costs may change during final design. The principal maintenance features consist of levee inspection, mowing, diversion ditch cleanout, levee repair as needed, riprap replacement, and pump station maintenance.

12. POST-CONSTRUCTION PERFORMANCE MONITORING.

Post-construction performance evaluation/monitoring by the IDOC will be described in detail in the Operation and Maintenance Manual. A summary of post-construction performance is presented in table 12-1. This qualitative evaluation will be completed and submitted by the IDOC annually. Physical, chemical, and biological monitoring parameters are presented in table 12-2, with entries completed and submitted by the IDOC as shown. Measurement intervals shown are minimums and may be performed more often by the IDOC as necessary to reflect appropriate changes. Established sedimentation ranges which are defined and reproducible traverses are shown on plates 23, 24, and 25.

TABLE 12-1

Post-Construction Performance Monitoring

<u>Project Objectives</u>	<u>Standard</u>	<u>Rating/Evaluation</u>
Enhance migratory waterfowl habitat	Increase migratory waterfowl vegetation.	-
	Increase waterfowl resting and loafing area.	-
	Increase waterfowl usage.	-
Enhance aquatic habitat	Increase volume of aquatic habitat.	-
	Ensure year-round aquatic habitat access to river/deep water.	-
	Increase water quality within project.	-
	Increase fish usage.	-
Decrease/retard Refuge sedimentation	Decrease adjacent tributary sediment load into project area.	-

TABLE 12-2

Suggested Physical, Chemical, and Biological Monitoring Plan

<u>Project Objectives</u>	<u>Monitoring Plan</u>	<u>Measurement Interval (Years)</u>
Enhance migratory waterfowl habitat	Perform waterfowl inventories during migration to assess effects of the MSMU	2
	Perform vegetation inventories by elevation by time of year within the MSMU to assess effects of the pump station and to optimize MSMU management.	2
	Perform other monitoring as needed.	-
Enhance aquatic habitat	Identify dissolved oxygen concentrations during critical seasons at fixed stations to verify Dead Slough excavation effectiveness.	1
	Perform soundings of excavated Dead Slough access and channel excavation to provide estimates of channel sloughing.	5
	Perform fishery inventories to assess effects from excavation of Dead Slough.	2
	Perform other monitoring as needed.	-
Decrease/retard Refuge sedimentation	Establish base sedimentation ranges in the project area and perform sedimentation measurements at same ranges to assess effects of the proposed project.	5
	Perform other monitoring as needed.	-

13. COST ESTIMATES.

A detailed estimate of initial construction costs is presented in table 13-1. A detailed estimate of operation, maintenance, repair, and rehabilitation costs is presented in table 13-2. Quantities may vary during final design and construction.

TABLE 13-1

Andalusia Refuge Initial Construction Detailed Estimate of Cost
(July 1988 Price Levels)

<u>Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost (\$)</u>	<u>Total Cost (\$)</u>
Perimeter Levee				
Clearing/grubbing	10	AC	3,175.00	31,750
Embankment fill	122,000	CY	2.50	305,000
Bedding	1,120	TN	22.00	24,640
Riprap	3,370	TN	24.0	80,880
Seeding	10	AC	1,650.00	<u>16,500</u>
				458,770
Existing Ditch Relocation				
Clearing/grubbing	4	AC	3,175.00	12,700
Excavation	11,700	CY	3.00	35,100
Seeding	4	AC	1,650.00	<u>6,600</u>
				54,400
Dead Slough Improvement				
Clearing/grubbing	1	AC	3,175.00	3,175
Excavation for adjacent levee	87,000	CY	3.00	261,000
Excavation for river access	23,000	CY	5.00	115,000
Seeding	0.5	AC	1,650.00	<u>825</u>
				380,000
Refuge Improvement				
Excavation with side cast Placement for islands	48,000	CY	3.00	144,000
Excavation for adjacent levee	27,000	CY	3.00	<u>81,000</u>
				225,000
Pump Station				
Civil/site work	1	JOB	SUM	195,000
Pumps, motor, control, gates	1	JOB	SUM	45,000
Overhead power supply	1	JOB	SUM	<u>15,000</u>
				255,000
Water Control Structure Between Dead Slough and Refuge				
	1	JOB	SUM	45,000
Access Road				
Clearing/grubbing	2	AC	3,175.00	6,350
Excavation	3,000	CY	3.00	9,000
Embankment fill	4,100	CY	3.00	12,300
Crushed stone surface	1,240	TN	14.00	17,360
Riprap	825	TN	24.00	<u>19,800</u>
				64,810
Subtotal				1,482,980
Contingencies				<u>274,020</u>
				1,757,000
Engineering and Design				217,000
Supervision and Administration				<u>121,000</u>
TOTAL PROJECT				\$2,095,000

TABLE 13-2

Andalusia Refuge Estimate of Annual Operation,
Maintenance, Repair, and Rehabilitation Costs
(July 1988 Price Levels)

<u>Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost (\$)</u>	<u>Total Cost (\$)</u>
Operation <u>a/</u>				
Pump station energy	12,000	kWh	.10	1,200
Gate operation	20	Hr	17.00	340
Performance monitoring	40	Hr	30.00	<u>1,200</u>
Subtotal-Operation				2,740
Maintenance, Repair, and Rehabilitation				
Levee inspection	40	Hr	17.00	680
Levee mowing (4 mowings per year)	32	AC	30.00	960
Diversion ditch cleanout	267	CY	3.00	801
Levee repair and rehabilitation	130	CY	6.00	780
Riprap replacement	33	TN	24.00	792
Access road crushed stone	10	TN	20.00	200
Pump station maintenance (debris and sediment removal, mechanical/electrical)	80	Hr	30.00	<u>2,400</u>
Subtotal-Maintenance, Repair, and Rehabilitation				6,613
Subtotal				9,353
Contingencies				<u>2,047</u>
Total per year				\$11,400

a/ Natural seeding for plant establishment assumed.

14. REAL ESTATE REQUIREMENTS.

a. General. All project features are located on Corps of Engineers-owned General Plan lands. These lands are managed under a Cooperative Agreement between the Department of Interior, USFWS, and the Corps of Engineers dated February 14, 1963. Management of these project lands is administered by the IDOC under a third party Cooperative Agreement between the USFWS and IDOC.

b. Local Cooperation Agreements/Cost-Sharing. Funds for the initial construction of the proposed project are proposed for 100 percent Federal funding. The Andalusia Refuge project is part of the Mark Twain National Wildlife and Fish Refuge system. The Water Resources Development Act of 1986 (Public Law 99-662) is the basis for the 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 - such activities are located on lands managed as a national wildlife refuge.

A local cooperation agreement is required with the IDOC for operation, maintenance, repair, and rehabilitation of the project features. A draft local cooperation agreement has been included in this report as Appendix C. Estimated operation, maintenance, repair, and rehabilitation costs are presented in table 13-2.

c. Construction Easements. Minor easements may be required for construction from the existing county highway or local privately owned farm accesses to facilitate access to the construction site. Additional construction easements may be required if adjacent agricultural landowners agree to accept dredged material on their lands. Construction easements with such parties will be obtained for construction prior to contract advertisement.

15. SCHEDULE FOR DESIGN AND CONSTRUCTION.

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

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 IDOC, and other affected agencies. The Rock Island District will prepare and submit the subject DPR; program funds; finalize plans and specifications; complete all National Environmental Policy Act requirements; advertise and award a construction contract; and perform construction contract supervision and administration.

TABLE 15-1

Project Implementation Schedule

<u>Requirements</u>	<u>Scheduled Date</u>
Submission of Draft Definite Project Report (DPR) to Corps of Engineers, North Central Division and participating agencies for Review	Sep 88
Formal Distribution of DPR for public and agency review	Nov 88
Submit final and public reviewed DPR to North Central Division	Jan 89
Receive plan and specification funds	Feb 89
Obtain construction approval and approval of draft local cooperation agreement for execution by Assistant Secretary of the Army (Civil Works)	Mar 89
Initiate acquisition of real estate permits and execution with State of Illinois of local cooperation agreement	Apr 89
Submit local cooperation agreement signed by the non-Federal sponsor to the Office of the Chief of Engineers for execution by the Assistant Secretary of the Army (Civil Works)	May 89
Submit final plans and specifications to North Central Division for review and approval and to participating agencies for review	May 89
Obtain real estate permits	Jun 89
Obtain approval of the local cooperation agreement by Assistant Secretary of the Army (Civil Works)	Jun 89
Obtain approval of the plans and specifications	Jun 89
Advertise contract	Jul 89
Complete construction	Dec 90

b. U.S. Fish and Wildlife Service. The USFWS should ensure that all proposed features are compatible with Refuge objectives and management strategies.

c. Illinois Department of Conservation. The IDOC is responsible for 100 percent operation, maintenance, repair, and rehabilitation costs as estimated in table 13-2. A local cooperation agreement must be executed between the Government and the IDOC prior to initiation of construction contract advertisement proceedings. The IDOC has volunteered to assume 100 percent of the annual OMRR costs.

17. COORDINATION, PUBLIC VIEWS, AND COMMENTS.

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

(1) November 29, 1986 - Onsite meeting to discuss project objectives and scope.

(2) March 4, 1987 - Meeting at Rock Island District, Corps of Engineers, to further scope project and define objectives.

(3) February 4, 1988 - Meeting at Rock Island District, Corps of Engineers, to discuss/coordinate preliminary DPR.

(4) June 29, 1988 - Meeting at Rock Island District, Corps of Engineers, an onsite review of proposed project features and proposed timber clearing practices.

b. 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 this report, and Finding of No Significant Impact.

18. CONCLUSIONS.

Andalusia Refuge has been recommended to the Corps of Engineers, Rock Island District, by various inter-agency coordination committees for priority inclusion into the Environmental Management Program. With proposed project features in place, the Refuge will enhance migratory waterfowl habitat by providing an increased food source within a reliable water-control unit and will improve aquatic fisheries. The Refuge is ideally sited in Pool 16 as a resting area for Mississippi River flyway waterfowl.

Sedimentation from both adjacent watersheds and the river has been the principal cause of the general waterfowl and fishery habitat degradation. Sedimentation has converted a former backwater fishery in Dead Slough into a shallow, land-locked area with no present fishery.

Alternative B (130-acre MSMU protected by 2-year levee), Alternative E (adjacent watershed flow and sediment diversion), Alternative 6 (Dead Slough aquatic improvement), and Alternative H (Refuge drainage/island construction) all meet project objectives and are compatible with Refuge management objectives.

19. RECOMMENDATIONS.

I have weighed the accomplishments to be obtained from this environmental enhancement project against its cost and have considered the alternatives, size, and scope of the proposed project. In my judgement, the proposed project is a justified expenditure of Federal funds. I recommend that the Secretary of the Army approve construction of a 130-acre Moist Soil Management Unit, protected by a 2-year levee, adjacent watershed flow and sediment diversion, Dead Slough aquatic improvement, and Refuge drainage/island construction for habitat rehabilitation and enhancement of Andalusia Refuge in Rock Island County, Illinois. The total estimated Federal construction cost of the habitat project is \$1,870,000, which amount would be a 100 percent Federal cost according to Section 906(e)(3) of Public Law 99-662. I further recommend that funds in the amount of \$24,000 be allocated as quickly as possible for the preparation of plans and specifications.

20. FINDING OF NO SIGNIFICANT IMPACT.

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

a. The project will significantly improve the quality of fish and wildlife habitat.

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

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

Date

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

CORRESPONDENCE

A

P

P

E

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D

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X

A

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

ANDALUSIA REFUGE
REHABILITATION AND ENHANCEMENT

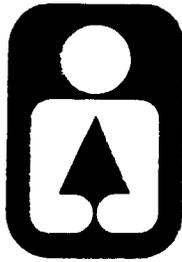
POOL 16, MISSISSIPPI RIVER MILES 462 THROUGH 463
ROCK ISLAND COUNTY, ILLINOIS

APPENDIX A
CORRESPONDENCE

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<u>Letter</u>	<u>Page</u>
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Letter from Illinois Department of Conservation, dated December 15, 1986, enclosing revised engineering and design appendix	A-6
Letter from Rock Island District to Office of Planning and Development, Illinois Department of Conservation, dated September 10, 1987	A-12
Letter of Intent from Illinois Department of Conservation, dated October 8, 1987	A-14
Letter from U.S. Fish and Wildlife Service, dated August 4, 1988, providing the Coordination Act Report	A-15
Letter from Illinois State Historic Preservation Officer, dated September 7, 1988, concurring with no significant effect of proposed project	A-19

Illinois



Department of Conservation

life and land together

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CHICAGO OFFICE • ROOM 4-300 • 100 WEST RANDOLPH 60601
Michael B. Witte, Director • James C. Helfrich, Assistant Director

April 17, 1986

District Engineer
U.S. Army Engineer District, Rock Island
ATTN: Planning Division, PD-R
Clock Tower Building - P.O. Box 2004
Rock Island, IL 61204-2004

Dear Sirs:

Enclosed is the appendix for the engineering and design of the proposed project at Andalusia Refuge to be part of the Upper Mississippi River System-Environmental Management Program.

If you have any questions or require further information, please contact me.

Sincerely,

William R. Donels
Landscape Architect
Division of Planning

WRD:sm
Encl.

cc: Gary McCandless
Bill Bertrand
Bob Thornberry

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
GENERAL PLAN APPENDIX
FOR ENGINEERING AND DESIGN

Andalusia Refuge
Pool 16, Upper Mississippi River
Rock Island County, Illinois

INTRODUCTION

Project Authority

The 1985 Supplemental Appropriations Act (Public Law 99-88) provides authorization and appropriations for an environmental management program for the Upper Mississippi River system that includes fish and wildlife habitat rehabilitation and enhancement. The proposed project would be funded under this authorization.

Project Location

Within the Upper Mississippi Wildlife and Fish Refuge between river mile 462 and 463, immediately south of Dead Slough and north of Illinois City are 256 acres managed by the State of Illinois, Department of Conservation (see attachment).

Resource Problems and Opportunities

Presently, there are no low water control systems located in Pool 16. The construction of a low water control structure system would greatly enhance habitat and its management. The lack of shallow water habitat with submergent/emergent aquatic plants has adversely affected waterfowl, furbearer and fisheries resources within this pool of the Mississippi River.

Proposed Solution

The proposed project would involve repair of an existing levee and construction of two additional low water leveed about 7,200' which would tie into high ground along the south edge of the impoundment to provide 130 acres of refuge area. It would include two 12" water control structures and some associated ditching that would accommodate portable pumps.

PROJECT REQUIREMENTS

Estimated Engineering and Design Cost

Estimated engineering and design costs for this project are \$43,000 broken down as follows:

1. Dike condition, topographic and soils surveys	\$ 8,000
2. Design of structures	17,000
3. Coordination, environmental documentation & review	18,000
4. Total	<u>\$43,000</u>

The engineering and design costs would be 100 percent Federal because the project is on the Upper Mississippi Wildlife and Fish Refuge and

because the project's primary purpose is habitat improvement for migratory waterfowl.

The Illinois Department of Conservation has estimated project implementation costs to be \$185,000. This cost estimate would be refined during the engineering and design phase.

Compliance with the National Environmental Policy Act of 1969 and other environmental laws and regulations would be documented during the engineering and design phase.

Project Participants

The primary project participants would be the Illinois Department of Conservation, U.S. Fish and Wildlife Service and the Corps of Engineers.

Project Schedule

It is estimated that the engineering and design phase of this project could be completed within 6 months following receipt of funds.

RECOMMENDATION

I recommend that the Secretary of the Army provide \$43,000 for engineering and design for the Guttenberg Fish Pond project under the Upper Mississippi River System Environmental Management Program.

William C. Burns
Colonel, Corps of Engineers
District Engineer

LEGEND

PRINCIPAL THROUGH HIGHWAYS

- MULTILANE DIVIDED ACCESS FULLY CONTROLLED
- MULTILANE DIVIDED ACCESS FULLY CONTROLLED UNDER CONSTRUCTION
- MULTILANE DIVIDED ACCESS PARTIALLY CONTROLLED
- MULTILANE TOLL ROAD
- MULTILANE DIVIDED
- MULTILANE UNDIVIDED
- 2 LANE ACCESS FULLY CONTROLLED
- 2 LANE PAVED
- UNDER CONSTRUCTION

OTHER THROUGH HIGHWAYS

- MULTILANE DIVIDED
- MULTILANE UNDIVIDED
- 2 LANE PAVED
- DUSTLESS
- UNDER CONSTRUCTION

OTHER HIGHWAYS

- PAVED
- DUSTLESS
- OTHER ALL WEATHER

ROUTE MARKERS

- INTERSTATE
- UNITED STATES
- STATE

ACCESS POINTS

- FULL TRAFFIC INTERCHANGE
- INTERCHANGE EXIT NUMBER
- PARTIAL TRAFFIC INTERCHANGE
- ACCESS DENIED

- MILEAGE BETWEEN TOWNS AND MARKED ROUTE JUNCTIONS
- MILEAGE ALONG ACCESS CONTROLLED HIGHWAY

SPEEDOMETER CHECK SECTION

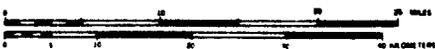
- GREAT RIVER ROAD
- COVERED BRIDGE
- LINCOLN HERITAGE TRAIL
- STATE PARK HISTORIC RECREATION AREA, CONSERVATION AREA, OR FOREST
- STATE INSTITUTION
- COLLEGE OR UNIVERSITY
- COMMERCIAL AIRPORT WITH SCHEDULED SERVICE
- MILITARY AIRPORT
- OTHER AIRPORT
- ILLINOIS STATE POLICE HOOPS
- OTHER POINT OF INTEREST
- REST AREA - FULL FACILITIES
- REST AREA - LIMITED FACILITIES
- ROADSIDE TABLE

In congested areas these symbols will generally appear only on the reverse side

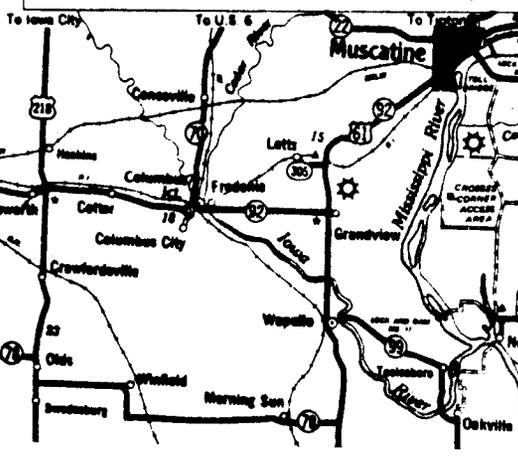
POPULATION OF CITIES AND VILLAGES

- State Capital
- Under 1,000
- 1,000 to 2,500
- 2,500 to 5,000
- 5,000 to 10,000
- 10,000 to 25,000
- 25,000 to 50,000
- 50,000 to 100,000
- 100,000 and over

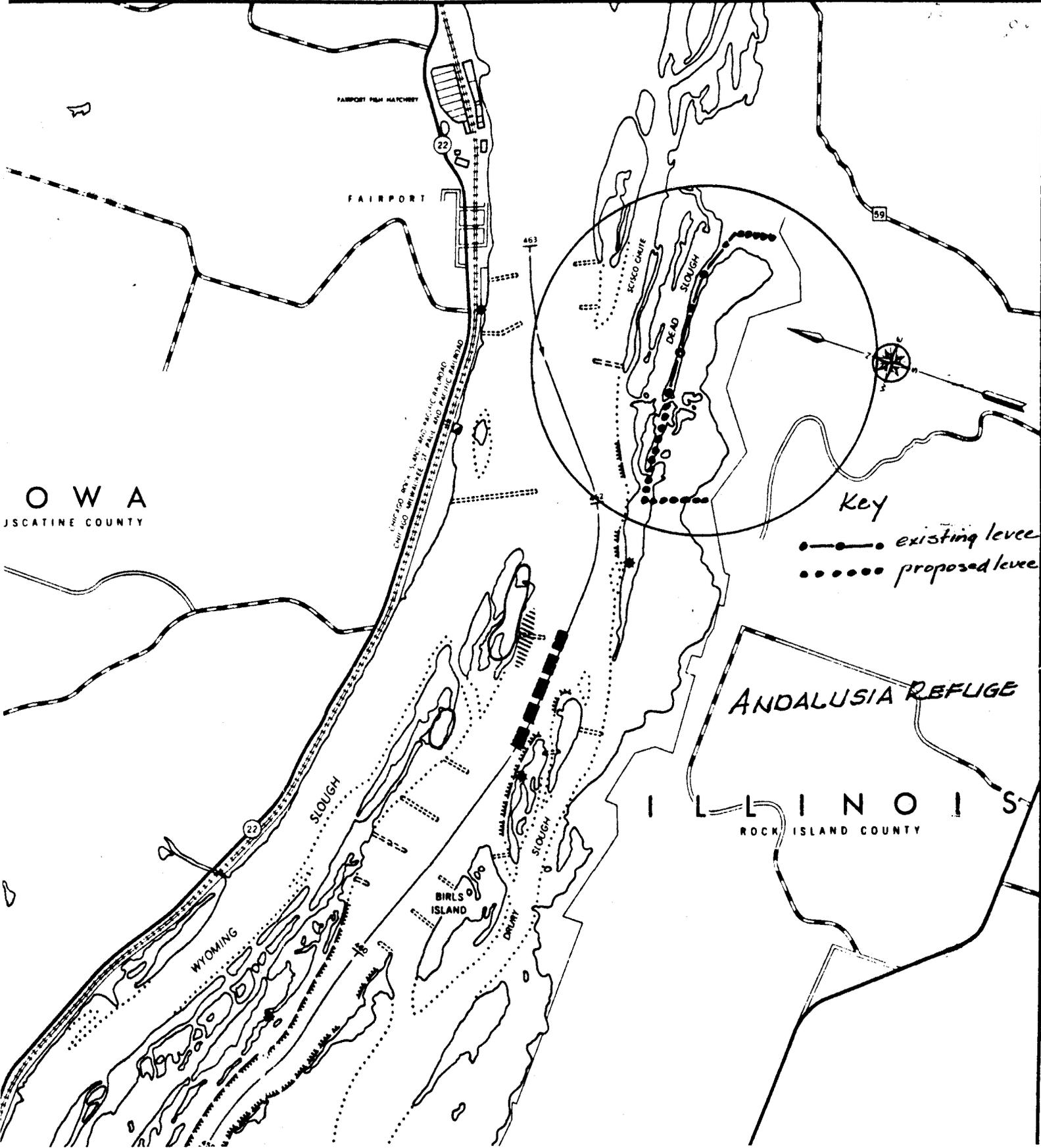
County Seats Population not shown by symbols
In congested areas some municipalities appear only on the reverse side



SCALE ONE INCH EQUALS APPROXIMATELY 17 MILES
ONE CENTIMETER EQUALS APPROXIMATELY 7.5 KILOMETERS
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Attachment 1 - Andalusia Refuge
Mississippi River, Illinois Department of Conservation
Proposed habitat enhancement project.



O W A
JSCATINE COUNTY

ANDALUSIA REFUGE

ILLINOIS
ROCK ISLAND COUNTY

WYOMING

BIRLS ISLAND

SLOUGH

SLOUGH

DRURY

SCISCO CHUTE

DEAD SLOUGH

FAIRPORT FISH HATCHERY

FAIRPORT

Key

- existing levee
- proposed levee

Attachment 2 - Andalusia Refuge
Proposed low levee extensions for shallow water habitat.

Illinois



Department of Conservation

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CHICAGO OFFICE • ROOM 4-300 • 100 WEST RANDOLPH 60601
Michael B. Witte, Director • James C. Helfrich, Assistant Director

December 15, 1986

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

Dear Sirs:

Enclosed for your information is our revised Andalusia Refuge Project Scope for the Environmental Management Program. The changes made in this scope reflect the discussions our field staff had with your staff and the U.S. Fish & Wildlife Service staff about what we hope to accomplish at the refuge.

I have also included an estimated project requirement list we utilized to aid us in the development of this scope. Should you have any questions do not hesitate to call us.

Sincerely,

A handwritten signature in cursive script that reads "William R. Donels".

William R. Donels
Landscape Architect
Division of Planning

BD:mib

cc: Gary McCandless
Bob Thornberry

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
GENERAL PLAN APPENDIX
FOR ENGINEERING AND DESIGN

Andalusia Refuge
Pool 16, Upper Mississippi River
Rock Island County, Illinois

INTRODUCTION

Project Authority

The 1985 Supplemental Appropriations Act (Public Law 99-88) provides authorization and appropriations for an environmental management program for the Upper Mississippi River system that includes fish and wildlife habitat rehabilitation and enhancement. The proposed project would be funded under this authorization.

Project Location

Within the Upper Mississippi Wildlife and Fish Refuge between river mile 462 and 463, immediately south of Dead Slough and north of Illinois City are 256 acres managed by the State of Illinois, Department of Conservation (see attachments 1 and 2).

Resource Problems and Opportunities

Presently, there are no low water control systems located in Pool 16. The construction of a low water control structure system would greatly enhance habitat and its management. The lack of shallow water habitat with submergent/emergent aquatic plants has adversely affected waterfowl, furbearer, and fisheries resources within this pool of the Mississippi River.

Proposed Solution

The proposed project would involve repair of an existing levee and construction of two additional low water levees about 7,200 feet long which would tie into high ground along the south edge of the impoundment to provide 130 acres of refuge area. It would include two 30-inch water control structures and some associated ditching that would accommodate portable pumps.

PROJECT REQUIREMENTS

Estimated Engineering and Design Cost

The estimated costs for the engineering and design project are:

Hydraulic Analysis	\$ 2,500
Surveying	8,000
Engineering and Design	17,000
Procurement	2,500
Environmental Assessment	2,000
Coordination/Project Preparation	<u>7,500</u>
Total	\$39,500

The engineering and design costs would be 100-percent Federal because the project is on the Upper Mississippi Wildlife and Fish Refuge and because the project's primary purpose is habitat improvement for migratory waterfowl.

The Illinois Department of Conservation has estimated project implementation costs to be \$280,000. This cost estimate would be refined during the engineering and design phase.

Compliance with the National Environmental Policy Act of 1969 and other environmental laws and regulations would be documented during the engineering and design phase.

Project Participants

The primary project participants would be the Illinois Department of Conservation, U.S. Fish and Wildlife Service, and the Corps of Engineers.

Project Schedule

It is estimated that the engineering and design phase of this project could be completed within 6 months following receipt of funds.

RECOMMENDATION

I recommend that the Secretary of the Army provide \$39,500 for engineering and design for the Andalusia Refuge project under the Upper Mississippi River System Environmental Management Program.

William C. Burns
Colonel, Corps of Engineers
District Engineer

ATTACHMENTS

1. General Area Map
2. Project Area Map

LEGEND

PRINCIPAL THROUGH HIGHWAYS

- MULTILANE DIVIDED ACCESS FULLY CONTROLLED
- MULTILANE DIVIDED ACCESS FULLY CONTROLLED UNDER CONSTRUCTION
- MULTILANE DIVIDED ACCESS PARTIALLY CONTROLLED
- MULTILANE TOLL ROAD
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- MULTILANE UNDIVIDED
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- 2 LANE PAVED
- UNDER CONSTRUCTION

OTHER THROUGH HIGHWAYS

- MULTILANE DIVIDED
- MULTILANE UNDIVIDED
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- DUSTLESS
- UNDER CONSTRUCTION

OTHER HIGHWAYS

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- DUSTLESS
- OTHER ALL WEATHER

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- STATE PARK HISTORIC RECREATION AREA, CONSERVATION AREA, OR FOREST
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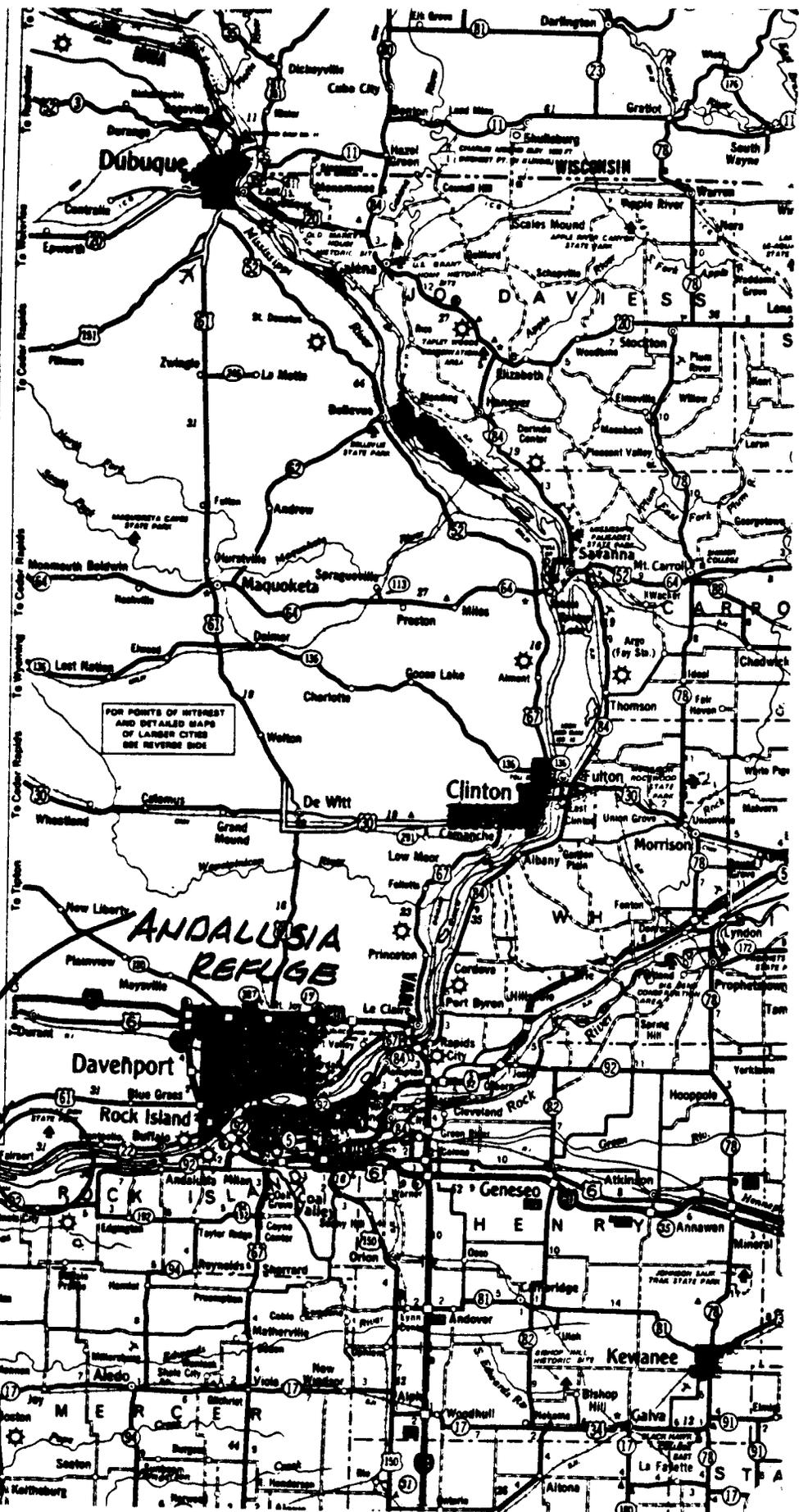
POPULATION OF CITIES AND VILLAGES

- State Capital
- 2,500 to 5,000
- 25,000 to 50,000
- Under 1,000
- 5,000 to 10,000
- 50,000 to 100,000
- 1,000 to 2,500
- 10,000 to 25,000
- 100,000 and over

County Seats Population not shown by symbols
In congested areas some municipalities appear only on the reverse side



SCALE ONE INCH EQUALS APPROXIMATELY 20 MILES
ONE CENTIMETER EQUALS APPROXIMATELY 13 KILOMETERS
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Attachment 1 - Andalusia Refuge
Mississippi River, Illinois Department of Conservation
Proposed habitat enhancement project.



REPLY TO
ATTENTION OF

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

September 16, 1987

Planning Division

Mr. John W. Comerio
Director
Office of Planning and Development
Illinois Department of Conservation
Lincoln Tower Plaza
524 South Second Street
Springfield, Illinois 62701-1787

Dear Mr. Comerio:

As you are aware, the Rock Island District is proceeding with design of the Upper Mississippi River System - Environmental Management Program (UMRS - EMP) project for habitat rehabilitation and enhancement at Andalusia Refuge, Illinois. At the time of the November 24, 1986, site visit, Mr. William Donels of your office noted that the State would have to seriously consider whether the operation and maintenance costs related to water level management for waterfowl would be supported by Illinois.

The major elements of the Andalusia Refuge project were set at a coordination meeting held at the District offices on March 4, 1987, with Illinois Department of Conservation, U.S. Fish and Wildlife Service, and Rock Island District personnel. At that time it was explicitly noted that an expression of the State's interest was critical for the District to proceed with design work and that such a statement would be forthcoming. This has been reiterated in subsequent telephone conversations between Mr. Donels and Mr. Andrew Bruzewicz of my staff, the District's EMP program manager.

It is essential that the District receive written notice of the State's intentions before funds are expended on additional design work. As noted in the General Plan, dated January 1986, which describes the criteria for EMP projects, your support is a prerequisite for a viable project.

We would also appreciate written notification of the State's willingness to cost-share on the project at Rice Lake, Illinois. Unlike Andalusia Refuge, but like the

project for Peoria Lake for which we have received a letter of your intent, this project does not qualify for 100-percent Federal funding of design or construction.

Should you have any questions about this matter, please telephone Mr. Bruzewicz at 309/798-6361, Ext. 203, or you may write to the following address:

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

Sincerely,

ORIGINAL SIGNED BY

Cudley M. Hanson, P.E.
Chief, Planning Division

Copies Furnished:

Mr. Karl Frech
Director
Illinois Department of Conservation
Lincoln Tower Plaza
524 South Second Street
Springfield, Illinois 62701-1787

Mr. Donald Vennahme
Illinois Department of Transportation
Division of Water Resources
2300 South Dirksen Parkway
Springfield, Illinois 62764

Illinois



Department of Conservation

life and land together

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

October 8, 1987

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

Attention: Dudley M. Hanson

Dear Colonel Smart:

With this letter of intent, I wish to commit the Department to operation and management of the Andalusia Refuge project, currently programmed in the Environmental Management Program for the Upper Mississippi River System and identified in the Second Annual Addendum and located on Upper Mississippi River Fish and Wildlife Refuge/General Plan land between river miles 462 and 463 of Pool 16, south of Dead Slough and north of Illinois City, in accordance with Section 906(e) of the 1986 WRDA.

The federal project includes upgrading a natural levee and constructing two additional low water levees, totaling about 7,200 feet in length, which tie into high ground along the south edge of the proposed impoundment. It also includes two 30-inch water control structures, a pump and associated ditching, dredging portions of Dead Slough for deep water fish habitat and rerouting a small tributary.

Upon final acceptance, the Department of Conservation will assume operation and management of the moist soil management area to provide submergent and emergent vegetation habitat for nesting, resting and shallow water feeding by migrating waterfowl. Departmental operation and management will include operation and maintenance of the pumps and water control structures, maintenance of the levee system, and general site management typical of a wildlife refuge.

My staff looks forward to working with your office in completing the project at a reasonable cost.

Sincerely,

A handwritten signature in black ink that reads "Mark Frech". The signature is written in a cursive, slightly slanted style.

Mark Frech
Director

BD:mib

A-14

cc: Don Vonnahme
John Comerio



United States Department of the Interior

FISH AND WILDLIFE SERVICE

IN REPLY REFER TO:

ROCK ISLAND FIELD OFFICE (ES)

COM: 309/793-5800

1830 Second Avenue, Second Floor

FTS: 386-5800

Rock Island, Illinois 61201

August 4, 1988

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

Dear Colonel Smart:

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

PROJECT DESCRIPTION

The proposed project consists of construction of a levee approximately 8,600 feet in length and up to 110 feet in base width. The structure would provide protection from a 2-year flood event to 130 acres of the refuge, and would provide water level control to the protected area. A pump station with a capacity of 10 cubic feet per second would provide capability to increase or decrease water levels on the area in conjunction with a management plan. Approximately 110,000 cubic yards of material for the levee would be dredged from Dead Slough on the riverward side of the alignment. An additional 48,000 acres of material will also be obtained for the structure from the area to be protected. The dredging will result in 5,400 feet of channel in Dead Slough and 5,100 feet of channel in the protected portion of the refuge. The configuration of channel in the protected area will be designed to provide approximately nine acres of habitat divided among six or more islands, and to facilitate drawdown of water levels. Control structures in the levee would provide egress for fish trapped in the leveed area by flood events. The Dead Slough channel will be opened to Scisco Chute (thence to the main river) in order to provide ingress and egress for fish. The design of the above features is shown on plates 9 through 12 of the Corps' main report.

Andalusia Refuge is located on lands acquired by the Corps of Engineers (Corps) in the 1930's for the Mississippi River Navigation Project. By 1958 management of approximately 67,000 acres of the project between Muscatine, Iowa, and St. Louis, Missouri, had been transferred to the U. S. Fish and Wildlife Service (Service) by general plan and cooperative agreement. About 17,000 acres of these lands have been designated as the Mark Twain National Wildlife Refuge. The remaining 50,000 acres, including the Andalusia Refuge site, have been made available to the adjacent States for wildlife purposes.

The 320-acre Andalusia Refuge is located at approximate River Mile 462 in Pool 16, and is managed by the Illinois Department of Conservation under cooperative agreements with the Service and the Corps. The primary objective of the refuge is to provide feeding and resting habitat for waterfowl and other migratory birds. In that regard, the site is currently the only wildlife management area between the Princeton Wildlife Area at River Mile 507 (managed by the Iowa Department of Natural Resources), and the Louisa Unit of the Mark Twain National Wildlife Refuge at River Mile 410.

FISH AND WILDLIFE RESOURCES

The fisheries resources at Andalusia Refuge consist largely of catfish, carp and buffalo in Dead Slough. High water conditions in Pool 16 temporarily produces conditions that attract bass and other important species to the area. However, sedimentation over the years has reduced normal water depths in the slough to the point that the habitat is choked with duck weed, coontail and similar species. Summer low water levels often result in reduced dissolved oxygen content that can result in fish kills. The slough no longer has an opening to the river except during high water periods, resulting in fish being trapped in the backwater. Boat access for fishermen is also limited to high water periods.

The terrestrial resources on the refuge consist of 236 acres of cottonwoods, silver maple and willow surrounding approximately 150 acres of marsh landward of Dead Slough. The habitat values of the marsh have been greatly reduced over time by sediments accumulating from the uplands adjacent to the refuge. The value of the area to migratory waterfowl, particularly in the fall, is dependant upon the water levels in the Mississippi River. It is not uncommon for fall flood events to inundate a good crop of important food plants to depths that render the area unattractive to most waterfowl species. The excessively shallow summer water depths usually results in less than optimum nesting conditions for wood ducks, mallard and teal. Shallow water also contributes to nest predation during the breeding season, because predator access to nest sites is easier.

The timber on the refuge does not contain a large percentage of mast producers. However, there are areas consisting of older stands of cottonwood, maple and associated species that provide important nesting and feeding habitat for a variety of migratory birds. This type of habitat requires a long period of time to develop, and therefore protection of older timber stands is an important component of the Mark Twain National Wildlife Refuge Master Plan.

Bald eagles are the only federally listed threatened or endangered species that is known to utilize the refuge. The proposed project features should not affect that species.

PROBLEMS AND NEEDS

The current habitat values of Andalusia Refuge are limited by a lack of shallow water, an overabundance of emergent aquatic plant growth, and a lack of water control capability. The proposed project is an attempt to address those deficiencies and provide management flexibility. Sedimentation in Dead Slough has resulted in a greatly reduced fishery, and conditions that invite significant fish kills. The deepening of the slough and creation of an opening to Scisco Chute would address those problems.

Construction of the proposed levee could impact some of the older trees between Dead Slough and the marsh area landward of the levee alignment. Identification of this concern has resulted in the alignment presented in this draft, which minimizes the timber impact.

DISCUSSION

One of the major goals of the North American Waterfowl Plan is to maintain the habitat value of designated areas of international significance to waterfowl. The plan identifies the Upper Mississippi River as one of these specific areas of concern. The proposed project would provide water level management capability for Andalusia Refuge, and thus aid in restoration of the waterfowl values reduced by long-term sedimentation.

The current midcontinent drought conditions also illuminate the critical importance of the Upper Mississippi River to migratory birds when isolated wetland habitats are desiccated. The river pools will serve as a haven to the fall migration flights, and could provide the only significant resting habitat in the region for north bound birds in the spring if the drought persists for several years.

Although operated and maintained by the State, Andalusia Refuge is a component of the National Wildlife Refuge System. Actions that affect habitat on the refuge are subject to the compatibility requirements of the National Wildlife Refuge System Administration Act. Therefore, a compatibility statement will be prepared for inclusion in the Corps' final project report.

CONCLUSIONS AND RECOMMENDATIONS

The Andalusia Refuge Habitat Rehabilitation and Enhancement Project, as currently proposed, should restore and enhance fish and wildlife values on the refuge. The levee and pump station would provide management potential that is currently lacking at the site.

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

1. that the final design, in particular the alinement of the levee, be closely coordinated with the Mark Twain National Wildlife Refuge staff to insure compatibility with the refuge master plan;
2. that a draft monitoring plan be developed prior to final project design, and;
3. that preconstruction monitoring of water quality and aquatic biota at the project site be initiated immediately;

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

Sincerely,



Charles P. Davis
Assistant Field Supervisor

cc: Mark Twain NWR
R.O. AE
R.O. AWR
IL DOC
IA DNR



**Illinois Historic
Preservation Agency**

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

217/785-4512

ROCK ISLAND COUNTY
Andalusia EMP Levee Alignment and Stream Realignment
Mississippi River
Andalusia Slough

September 7, 1988

James H. Blanchar, P.E.
Acting Chief, Operations Division
District Engineer, US Corps of Engineers
Rock Island District
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".

Our staff has reviewed the Archaeological Survey Short Report submitted by David G. Stanley, President, Bear Creek Archaeology, Inc. of Highlandville, Iowa for the proposed project referenced above.

The Phase I survey and assessment of the archaeological resources appear to be adequate. No archaeological material was recorded within the boundaries of the proposed Andalusia EMP Levee Alignment project area. 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.

If you have any further questions, please contact Ms. Paula G. Cross, Staff Archaeologist, Illinois Historic Preservation Agency, Old State Capitol, Springfield, Illinois 62701, 217/785-4997.

Sincerely,

Theodore W. Hild
Deputy State Historic
Preservation Officer

TWH:PGC:bv

cc: Julia A. Hertenstein
Dudley Hanson, CoE, Planning Division
David Stanley

A-19

SECTION 404(B)(1) EVALUATION

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REPLY TO
ATTENTION OF:

CENCR-PD-E

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

CLEAN WATER ACT
SECTION 404(b)(1) EVALUATION
ANDALUSIA REFUGE HABITAT REHABILITATION AND ENHANCEMENT
POOL 16, UPPER MISSISSIPPI RIVER
ROCK ISLAND COUNTY, ILLINOIS

NOVEMBER 1988

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

ANDALUSIA REFUGE HABITAT REHABILITATION AND ENHANCEMENT
POOL 16, UPPER MISSISSIPPI RIVER
ROCK ISLAND COUNTY, ILLINOIS

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

ANDALUSIA REFUGE HABITAT REHABILITATION AND ENHANCEMENT
POOL 16, UPPER MISSISSIPPI RIVER
ROCK ISLAND COUNTY, ILLINOIS

SECTION I - PROJECT DESCRIPTION

A. Location. The project is located in Rock Island County approximately 1 mile north of Illinois City on the Mississippi River, Pool 16, River Mile 462-463.

B. General Description. (See plate 2 and pages 16 through 21 of main report for details.) The proposed project calls for the construction of a 2-year event levee (elevation 550.8 MSL), 8,600 feet long, surrounding approximately 130 acres of Illinois Department of Conservation (IDOC) refuge land. Water levels within the leveed area will be controlled by pumping. Borrow material for the levee will be mechanically dredged from Dead Slough (approximately 110,000 cubic yards) and from the interior of the newly leveed Refuge (approximately 75,000 cubic yards).

An intermittent stream that now deposits sediment in the Refuge and Dead Slough will be rerouted to Scisco Chute. Approximately 11,700 cubic yards of mostly silt will be excavated to form a new channel 2,430 feet long, 3 feet deep, and 30 feet wide (bottom width). Material will be placed along the left bank of the channel and(or) placed in existing row crop land adjacent to the new channel. The mouth of Dead Slough also will be relocated approximately 1,800 feet upstream in Scisco Chute. Material will be placed on the levee alignment or possibly in nearby agricultural fields. A new access road to the proposed pump station will require filling of approximately 5,000 cubic yards into adjacent river areas.

Alternative out-of-floodplain (upland) fill sites are not feasible for this project. The intent of this project, which is waterfowl and fisheries habitat improvement, requires that it be located in aquatic and wetland habitats. The proposed levee alignment (fill site) minimizes the amount of fill to be placed in these environments.

C. Authority and Purpose. The 1985 Supplemental Appropriations Act (P.L. 99-88) and Section 1103 of the Water Resources Development Act of 1986 (P.L. 99-662) provide authorization and appropriations for an environmental management program on the Upper Mississippi River.

D. General Description of Fill Material. Test borings of the dredged material show it to be predominantly silts and clays.

E. Description of the Proposed Discharge Sites. The proposed discharge site, which is the new levee, occupies approximately 10 total acres. About 7.4 acres of the levee will replace existing bottomland forest. Material

excavated from the relocated channel will be placed on existing agricultural row crop land and(or) spread in adjacent bottomland forest. Plate 2 of the main report shows the location of the proposed discharge site. All material will be mechanically excavated (i.e., backhoe or clamshell).

SECTION II - FACTUAL DETERMINATIONS

A. Physical Substrate Determination.

1. Substrate Elevation and Slope. The proposed levee will raise the existing surface elevation along the alignment from 0 to 7 feet. The east-west levee segment will replace bottomland hardwood forest with an earthen levee. Although the substrate composition will remain much the same, the increased elevation and lack of canopy trees will promote growth of more upland plant types on the levee. The north-south levee tie-off will fill scrub/shrub and emergent/submergent wetland. Substrate composition will be similar, but the elevation will be increased to about 550.8 MSL. This tie-off section also will be armored with rock to prevent levee erosion when flooding occurs. Material excavated from the relocated drainage channel will be placed on adjacent woodland and cropland of similar substrate composition.

2. Sediment Type. The disposal site substrates consist primarily of bottomland soils composed predominantly of silts, clays, and organic soils.

3. Dredged/Fill Material Movement. All material will be placed by physical and mechanical methods that will ensure that it will not be displaced.

4. Physical Effects on Benthos. The composition of the dredged material is very similar to the disposal site substrate.

5. Action Taken to Minimize Impacts. The size and location of the levee minimize the loss of aquatic habitat. The north-south levee tie-off crosses the emergent-submergent wetland at its narrowest location. The levee right-of-way will be approximately 40 to 110 feet wide, minimizing the loss of bottomland forest.

B. Water Circulation, Fluctuation, and Salinity Determination.

1. Water.

a. Salinity - Not applicable.

b. Water Chemistry - The dredged material should not cause any direct change in water chemistry (i.e., pH). Indirectly, as a result of dredging, water quality in Dead Slough should improve.

c. Clarity - Water clarity within the leveed area will improve during flood events as long as the levee is not overtopped. The new levee will keep out sediment-laden floodwaters that previously flowed through the Refuge.

- d. Color - No effect.
- e. Odor - No effect.
- f. Taste - No effect.
- g. Dissolved Gas Levels - The amount of dissolved oxygen in Dead Slough should increase, particularly in fall and winter months.
- h. Nutrients - The dredged material itself will not affect aquatic nutrients. The project will alter nutrient cycles in the Refuge (leveed area). The new levee will reduce nutrient exchange (import and export) to waters contiguous with the Mississippi River. This effect should be negligible.
- i. Eutrophication - Indirectly the project should reverse eutrophication in Dead Slough.

2. Current Patterns and Circulation.

a. Current Patterns and Flow - The levee will prevent floodwaters up to the 2-year event (elevation 550.8) from entering the Refuge. The natural flow of water into and out of the Refuge from the downstream end will be blocked. A water control structure in the levee will now permit the flow of water between Dead Slough and the Refuge. The fill material will not affect current patterns and flows outside the Refuge and Dead Slough.

b. Velocity - The new levee may cause some minor increases in velocities since floodwaters that previously flowed through the Refuge will now be diverted.

c. Stratification - No effect anticipated.

d. Hydrologic Regime - The levee will divert flood flows, up to the 2-year event, from entering the Refuge.

3. Normal Water Level Fluctuation. The fill material will have a negligible effect on river stages.

C. Suspended Particulate/Turbidity Determinations.

1. Suspended particulates and turbidity will increase in Dead Slough and the Refuge during dredging and disposal. Some temporary elevation of these parameters also will occur in the Mississippi River main channel when the mouth of Dead Slough is dredged. These suspended particulates and increased turbidity will be predominantly clays and silts.

2. Effects on Chemical and Physical Properties of the Water Column.

a. Light Penetration - Temporary reduction during dredging, but no permanent adverse effects will result.

b. Dissolved Oxygen - The increased turbidity during dredging may cause temporary and localized reductions in D.O.

c. Toxic Metals and Organics - Results of bulk sediment analyses indicate that all organic contaminants were present in concentrations less than their respective detection limits. Toxic metals did exhibit measurable levels for several parameters, however, only nickel and zinc fell in the "moderately polluted" category as established by U.S. EPA Region V draft sediment criteria. Elutriate test results indicate that toxic metal and organic contaminants were quite low and, in most cases, less than their respective detection limits.

d. Pathogens - No effect.

e. Aesthetics - No effect.

3. Effects on Biota.

a. Primary Production - Some primary production from bottomland forest and wetland will be lost due to levee construction. Overall, however, primary productivity within the leveed refuge will increase.

b. Suspension/Filter Feeders - No effect.

c. Sight Feeders - Temporary and localized increases in turbidity may cause some sight-feeding fishes to move to adjacent areas. Effects will be negligible.

D. Contaminant Determinations. Results of ambient water and elutriate tests were compared to Illinois State Water Quality General Use standards. The concentration of ammonia nitrogen in two elutriate samples exceeded the standard of 1.5 mg/l. Also, the concentrations of copper in one elutriate sample and lead in the ambient water exceeded their respective standards of 0.05 and 0.10 mg/l. Results of bulk sediment analyses indicate that ammonia is the only pollutant to occur in concentrations in excess of nonpolluted category based on Interim Guidelines for the Pollutational Classification of Great Lakes Harbor Sediments.

E. Aquatic Ecosystem and Organism Determinations.

1. Effects on Plankton - No effect.

2. Effects on Nekton - There will be little or no direct adverse impacts from fill placement on nektonic organisms such as fish. Indirectly the fisheries of Dead Slough will be greatly improved due to the dredging. Please refer to the Environmental Assessment for a detailed discussion.

3. Effects on Benthos - Adverse impacts on benthos will be negligible. The deepening of Dead Slough and leveeing of the Refuge could cause changes in benthic species diversity locally.

4. Effects on Aquatic Food Web - The proposed fill will inhibit the upper end of the Refuge wetland from freely exchanging nutrients, water, etc. with the main river. Nutrients that otherwise would be transported to other downstream locations during floods will most likely stay within the leveed area. Any effects beyond the Refuge will be negligible.

5. Effects on Special Aquatic Sites.

a. Sanctuaries and Refuges - The proposed discharge will occur in a State-managed waterfowl refuge. At present, the Refuge has no water level management capability. The project will allow biologists to manipulate water levels, thus greatly improving waterfowl food production in the Refuge. The excavation of levee borrow material from Dead Slough will rejuvenate its fishery habitat, which at present acts as more of a detriment. (At low water stages, fish become trapped in the slough with no way of escape.)

b. Wetlands - The entire project area consists of a wetland complex comprised of several classes and subclasses of Palustrine wetlands, such as aquatic bed (rooted vascular, floating vascular, unconsolidated bottom (mud), emergent (persistent), and forested (broadleaf deciduous).

Several of these wetland types will be affected directly and indirectly by the fill. Approximately 18 acres of forested, aquatic bed, and emergent wetland will be filled or cleared. The seasonal water regime of 130 acres of emergent and aquatic bed wetland will become artificially controlled. This artificial water level control will likely cause vegetation diversity to decrease. Annual species such as smartweed (Polygonum spp.) are likely to increase in abundance. Scrub/shrub species around the levee perimeter, such as willow, could decrease in abundance depending upon future water level management practices. The possible decrease in plant diversity and loss of the natural water regime will be exchanged for improved waterfowl feeding and resting habitat.

c. Mudflats - Vegetated mudflats may increase within the leveed Refuge on account of manipulated water levels.

d. Vegetated Shallows - See discussion on wetlands.

e. Coral Reefs - Not applicable.

f. Riffle and Pool Complexes - No effect.

6. Threatened and Endangered Species. The American bald eagle is the only federally endangered or threatened species known to use the project area. Migrating eagles occasionally use the Refuge area during late fall and early winter when ice is not present. During the colder winter months of January

and February, eagle use is minimal or nonexistent. The project area does not provide any critical life requirements for wintering eagles. The proposed fill will have no effect on eagles.

There are no known State-listed endangered or threatened species present on the project site.

7. Other Wildlife - The loss of mast trees along the upland portion of levee alignment will reduce the amount of food available to such wildlife as wood ducks, deer, and squirrel. The levee alignment has been moved riverward into Dead Slough in order to reduce the loss of trees.

F. Proposed Disposal Site Determinations.

1. Mixing Zone Determination - Negligible effects.

2. Determination of Compliance with Applicable Water Quality Standards - Water quality standards for Illinois are discussed in Section II, C.2.c. Test results indicate that ammonia nitrogen is the most likely water quality standard which may be violated by the project activity. However, the proposed dredging and disposal methods for material containing all contaminants are expected to minimize contaminant reintroduction to the water column.

3. Potential Effects on Human Use Characteristics.

a. Municipal and Private Water Supply - No effect.

b. Recreational and Commercial Fisheries - Although there will be 130 acres of wetland (used by fish during high water) isolated due to levee construction, the excavation of Dead Slough will create an excellent backwater fish habitat valuable to both recreational and commercial fishermen.

c. Water Related Recreation - The project will create recreational fishing opportunities in Dead Slough where none currently exist. The improved ability of the Refuge to provide quality migratory waterfowl habitat may improve waterfowl hunting opportunities adjacent to the Refuge.

d. Aesthetics - Construction and maintenance of the levee will detract from the natural undisturbed setting that now exists. Increased waterfowl use of the Refuge may improve aesthetics relating to wildlife viewing.

e. Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves - No effect.

G. Determination of Cumulative Effects on the Aquatic Ecosystem. No cumulative effects are anticipated, since there will be no future disposal actions (exclusive of project maintenance and repair) after project completion.

H. Determination of Secondary Effects on the Aquatic Ecosystem. No adverse secondary effects will occur to the aquatic ecosystem.

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

A. Adaptation of the Section 404(b)(1) Guidelines to this Evaluation. No significant adaptation of the 404(b)(1) guidelines was made in this evaluation.

B. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem. Several alternative levee alignments were studied. The selected alignment minimizes the amount of fill in aquatic and wetland sites. Alternative, out-of-floodplain project locations are not practicable by the very nature of this project. Projects designed to manipulate natural water level fluctuations for the benefit of wildlife must be located in aquatic/wetland environments. There are no practicable alternatives.

C. Compliance With Applicable State Water Quality Standards. Permits, certification, or waiver of certification under Section 401 of the Clean Water Act will be obtained before construction begins. The project will thus be in compliance with water quality requirements of the State of Illinois.

D. Compliance With Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act. The disposal will not violate any toxic effluent standards.

E. Compliance With Endangered Species Act, as Amended. The project will have no effect on any federally endangered or threatened species.

F. Evaluation of Extent of Degradation of the Waters of the United States. The proposed project will not affect any municipal or private water supplies. Recreational and commercial fisheries will benefit from the project by the creation of fish habitat in Dead Slough. The project will have no adverse effects on plankton, shellfish, or special aquatic sites. Some wildlife species will suffer minor adverse effects from the loss of some mast-producing trees along the levee alignment. There will be no significant adverse effects to aquatic-dependent wildlife, ecosystem diversity, productivity, and stability. The habitat improvement from this project should benefit recreational opportunities in Pool 16, as well as economics. There will be some loss of aesthetic values due to the construction of the levee.

G. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem. The selected levee alignment will minimize the amount of aquatic and wetland habitat filled.

H. On the basis of the guidelines, the proposed disposal site for the discharge of dredged material is specified as complying with the requirements of these guidelines with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the affected aquatic ecosystem.

Date

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

DRAFT LOCAL COOPERATION AGREEMENT

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LOCAL COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE ILLINOIS DEPARTMENT OF CONSERVATION
FOR CONSTRUCTION OF THE
ANDALUSIA REFUGE HABITAT ENHANCEMENT PROJECT
ON THE MISSISSIPPI RIVER
AT ANDALUSIA, ILLINOIS

THIS AGREEMENT, entered into this _____ day of _____, 1988, by and between the DEPARTMENT OF THE ARMY (hereinafter referred to as the "Government"), acting by and through the Assistant Secretary of the Army (Civil Works), and the STATE OF ILLINOIS (hereinafter referred to as the "State"), acting by and through the Illinois Department of Conservation,

WITNESSETH, that

WHEREAS, the Andalusia Refuge Habitat Enhancement Project (hereinafter referred to as the "Project") was approved under the terms of the Upper Mississippi River System Environmental Management Program, as authorized by the Water Resources Development Act of 1986 (Public Law 99-662); and

WHEREAS, the Water Resources Development Act of 1986, Public Law 99-662, specifies the cost-sharing requirements applicable to the Project; and

WHEREAS, title to all of the lands required for the Project is vested in the United States and is under the Control of the U.S. Army Corps of Engineers; and

WHEREAS, said land is managed by the Illinois Department of Conservation as a national wildlife refuge within the meaning of Section 906(e)(3) of Public Law 99-662; and

WHEREAS, the Illinois Department of Conservation has the authority and capability to furnish the cooperation hereinafter set forth under Section 6361 of Ch. 27, Ill. Rev. Stat. 1987, and is willing to participate in accordance with the terms of this Agreement;

NOW, THEREFORE, the parties agree as follows:

ARTICLE 1 - DEFINITIONS

For purposes of this Agreement:

a. The term "Project" shall mean construction of a low levee approximately seven to nine feet high, with a riprapped overflow weir section, along the riverside edge of the Refuge and tying into higher ground upstream and downstream; a pump station with two submersible pumps, trash racks, and a water control structure with a 36-inch diameter concrete conduit and a sluice gate; access roads to the pump station and levee system; provision of a source of overhead electrical power; excavation in Dead Slough and of a water access from Scisco Chute to Dead Slough; excavation of drainage channels within the Refuge, including excavation to create an island; excavation of a diversion drainage ditch to reroute the creek emptying into the upper end of the Refuge into Scisco Chute; and an unsurfaced maintenance road for the diversion ditch.

b. The term "total project costs" shall mean all costs incurred by the Government directly related to construction of the Project. Such costs shall include, but not necessarily be limited to, actual construction costs, costs of applicable engineering and design, continuing planning and engineering costs incurred after October 1,

1985, supervision and administration costs, costs of project construction contract dispute settlements or awards, and any costs associated with providing for the use of Government-owned lands, but shall not include any costs for operation, maintenance, rehabilitation, replacement, or betterments.

c. The term "period of construction" shall mean the time from the advertisement of the first Government construction contract to the time of acceptance of the Project by the Contracting Officer.

d. The term "Contracting Officer" shall mean the Commander of the U.S. Army Engineer District, Rock Island, or his designee.

ARTICLE II - OBLIGATIONS OF THE PARTIES

a. The Government, subject to and using funds appropriated by the Congress, shall expeditiously construct the Project applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The State shall be afforded the opportunity to review and comment on all contracts, including relevant plans and specifications, prior to the issuance of invitations for bids. The State also shall 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. The Government will consider the views of the State, but award of the contracts and performance of the work thereunder shall be exclusively within the control of the Government.

b. When the Government determines that the Project, or functional element thereof, is complete, the Government shall turn the Project or element over to the State, which shall accept the Project or element and be solely responsible, subject to the provisions of Article

XIII of this Agreement for operating, maintaining, replacing, and rehabilitating the Project or element in accordance with ARTICLE VIII hereof.

c. No Federal funds may be used for the non-Federal share of project costs unless specifically authorized for that purpose.

ARTICLE III - CONSTRUCTION PHASING AND MANAGEMENT

a. To provide for consistent and effective communication between the State and the Government during the term of construction, the State and the Government shall appoint representatives to coordinate on scheduling, plans, specifications, modifications, contract costs, and other matters relating to construction of the Project.

b. The representatives appointed as provided above shall meet as necessary during the term of Project construction and shall make such recommendations as they deem warranted to the Contracting Officer.

c. The Contracting Officer shall consider the recommendations of the representatives in all matters relating to the Project, but the Contracting Officer, having ultimate responsibility for construction of the Project, has complete discretion to accept, reject, or modify the recommendations.

ARTICLE IV - DISPUTES

Before any party to this Agreement may bring suit in any court concerning an issue relating to this Agreement, such party must first seek in good faith to resolve the issue through negotiation or other forms of nonbinding alternative dispute resolution mutually acceptable to the parties.

ARTICLE V - OPERATION, MAINTENANCE, AND REHABILITATION

a. After the Project is turned over by the Government, the State, subject to the provisions of Article XIII of this Agreement,

shall operate, maintain, replace, and rehabilitate the Project, or functional element thereof, in accordance with regulations or directions prescribed by the Government.

b. The State currently has a right to enter upon the lands for wildlife conservation and management, in accordance with the General Plan for Use of the Project Land and Water Areas for Wildlife Conservation and Management, Mississippi River Between the Missouri River and Minneapolis, Minnesota, State of Illinois, executed by the Department of the Army on 19 January 1961; and in accordance with the Cooperative Agreement between the Department of the Army and the Department of Interior, Bureau of Sport Fisheries and Wildlife, dated 14 February 1963. This Agreement shall be interpreted in conjunction with said prior agreements and is not considered to be violative of the terms of said agreements.

c. If inspection shows that the State for any reason is failing to fulfill its obligations under this Agreement without receiving prior written approval from the Government, the Government shall send a written notice to the State. If the State persists in such failure for 30 calendar days after receipt of this notice, then the Government shall have a right to enter, at reasonable times and in a reasonable manner, upon Project lands for the purpose of completing, operating, repairing, maintaining, replacing, or rehabilitating the Project. No completion, operation, repair, maintenance, replacement, or rehabilitation by the Government shall operate to relieve the State of responsibility to meet its obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at

law or equity to assure faithful performance pursuant to this Agreement.

ARTICLE VI - RELEASE OF CLAIMS

The State shall hold and save the Government free from all damages arising from the construction, operation, maintenance, replacement, and rehabilitation of the Project, except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE VII - MAINTENANCE OF RECORDS

The Government and the State shall keep books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement to the extent and in such detail as shall properly reflect total project costs. The Government and the State shall maintain such books, records, documents, and other evidence for a minimum of three years after completion of construction of the Project and resolution of all claims arising therefrom, and shall make available at their offices at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the parties to this Agreement.

ARTICLE VIII - FEDERAL AND STATE LAWS

In acting under its rights and obligations hereunder, the State agrees to comply with all applicable Federal and State laws and regulations, including Section 601 of Title VI of the Civil Rights Act of 1964 (Public Law 88-352) and Department of Defense Directive 5500.11 issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

ARTICLE IX - RELATIONSHIP OF PARTIES

The parties to this Agreement act in an independent capacity in the performance of their respective functions under this Agreement, and neither party is to be considered the officer, agent or employee of the other.

ARTICLE X - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, or Resident Commissioner of the United States, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XI - COVENANT AGAINST CONTINGENT FEES

The State warrants that no person or selling agency has been employed or retained to solicit or secure this Agreement upon agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees of bona fide established commercial or selling agencies maintained by the State for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this Agreement without liability, or, in its discretion, to add to this Agreement or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE XII - TERMINATION OR SUSPENSION

If the Government fails to receive annual appropriations in amounts sufficient to meet Project expenditures for the then-current or upcoming fiscal year, the Government shall so notify the State. After 60 days either party may elect without penalty to terminate this Agreement or to suspend performance thereunder, and the parties shall conclude their activities relating to the Project.

ARTICLE XIII - OBLIGATION OF FUTURE APPROPRIATIONS

Nothing in this Agreement shall constitute or be deemed to constitute an obligation of future appropriations by the legislature of the State of Illinois, and all obligations of the State shall cease if the legislature fails to appropriate the funds necessary to meet the State's obligation pursuant to this obligation.

ARTICLE XIV - NOTICES

a. All notices, requests, demands, and other communications required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and delivered personally, given by prepaid telegram, or mailed by first-class (postage prepaid), registered, or certified mail, as follows:

If to the State:

Director
Illinois Department of Conservation
Lincoln Tower Plaza
524 South 2nd Street
Springfield, Illinois 62701-1787

If to the Government:

District Engineer
U.S. Army Engineer District, Rock Island
Clock Tower Building, PO Box 2004
Rock Island, Illinois 61204-2004

b. A party may change the address to which such communications are to be directed by giving written notice to the other in the manner provided in this section.

c. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at such time as it is personally delivered or on the third business day after it is mailed, as the case may be.

ARTICLE XV - CONFIDENTIALITY

To the extent permitted by the law governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the day and year first above written.

THE DEPARTMENT OF THE ARMY

STATE OF ILLINOIS
DEPARTMENT OF CONSERVATION

By: _____
ROBERT W. PAGE
Assistant Secretary of
the Army (Civil Works)

By: _____
Title: _____

DATE: _____

DATE: _____

CERTIFICATE OF AUTHORITY

I, _____, do hereby certify that I am the Attorney General of the State of Illinois, that the State is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the Illinois Department of Conservation for local cooperation in connection with a project for the enhancement of habitat at the Andalusia Refuge, and to pay damages, if necessary, in the event of its failure to perform, in accordance with Section 221 of Public Law 91-611, as amended, and that the person who has executed the Agreement on behalf of the Illinois Department of Conservation has acted within his statutory authority.

IN WITNESS WHEREOF, I have made and executed this Certificate this _____ day of _____, 198_____.

Attorney General for the State of Illinois

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DISTRIBUTION LIST FOR
UPPER MISSISSIPPI RIVER SYSTEM
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DEFINITE PROJECT REPORT
ANDALUSIA REFUGE
REHABILITATION AND ENHANCEMENT

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HONORABLE PAUL SIMON, UNITED STATES SENATOR
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CHICAGO IL 60604

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328 CANNON HOUSE OFFICE BLDG, WASHINGTON DC 20515

HONORABLE LANE EVANS, REPRESENTATIVE IN CONGRESS
3919 16TH ST, MOLINE IL 61265-7217

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WASHINGTON DC 20004

DOT COORDINATOR, US DEPT OF TRANSPORTATION
(6-WS/TP 11), 2100 SECOND STREET SW
WASHINGTON, DC 20593

FEDERAL EMERGENCY MANAGEMENT ADMIN, 500 C STREET SW
ROOM 713, WASHINGTON DC 20472

OFFICE OF ENVIRONMENTAL PROJ REVIEW, DEPARTMENT OF INTERIOR
MS 4239-MIB, 18TH & C STREETS NW - ROOM 4241
WASHINGTON DC 20240

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DIRECTOR, OFFICE OF HABITAT PROTECTION
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WASHINGTON DC 20235

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STATE DIRECTOR, US DEPT OF AGRICULTURE
STATE FAIRGROUNDS, SPRINGFIELD, IL 62706

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WILLIAM C FUCIK - DIRECTOR, FEDERAL EMERGENCY MANAGEMENT AGENCY
REGION V, 175 W JACKSON BLVD - 4TH FLOOR
CHICAGO IL 60604

REGIONAL ENGINEER, FERC REGIONAL OFFICE
FEDERAL BLDG - 31ST FLOOR, 230 S DEARBORN ST
CHICAGO IL 60604

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311 NORTH 4TH ST, SUITE 100
QUINCY IL 62301

MR RICHARD NELSON - FIELD SUPRVR, U.S.FISH & WILDLIFE SERVICE
1831 SECOND AVE. - 2ND FLOOR, ROCK ISLAND, IL 61201

US FISH & WILDLIFE SERVICE, ATTN CHUCK DAVIS/LEROY SOWL
1831 SECOND AVENUE, ROCK ISLAND IL 61201

STATE CONSERVATIONIST, SOIL CONSERVATION SVC USDA 2
301 N RANDOLPH, CHAMPAIGN IL 61820

US FISH & WILDLIFE SERVICE, NORTH CENTRAL REGL OFFICE
ATTN CHUCK GIBBONS, FEDERAL BLDG-FORT SNELLING
TWIN CITIES MN 55111

MR JAMES C GRITMAN-REGIONAL DIRECTOR, U.S.FISH AND WILDLIFE SERVICE
FEDERAL BLDG FORT SNELLING, TWIN CITIES MN 55111

MR JERRY RASMUSSEN, ENVIRONMENTAL MANAGEMENT
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MILWAUKEE WI 53203

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ATTN CENSD-PD/D POWELL, 1421 USPO & CUSTOMHOUSE
ST PAUL MN 55101-1479

DISTRICT ENGINEER, US ARMY ENGINEER DISTRICT ST LOUIS
ATTN FLANNING DIV/EMMETT HAHN, 210 TUCKER BLVD NORTH
ST LOUIS MO 63101-1986

OFFICE OF THE GOVERNOR, ATTN: TOM BERKSHIRE
STATE OF ILLINOIS, SPRINGFIELD, IL 62706

HONORABLE JAMES R THOMPSON, GOVERNOR OF ILLINOIS
STATE CAPITOL, SPRINGFIELD IL 62706

DIRECTOR, BUREAU OF SOIL & WATER CONS
IL DEPT OF AGRICULTURE, EMERSON BLDG-IL ST FAIRGROUNDS
SPRINGFIELD IL 62706

ILLINOIS DEPT OF CONSERVATION, ATTN: TERRY MOYER
DEARBORN HALL, 205 EAST SEMINARY
MOUNT CARROLL IL 61053

MR MARK FRECH - DIRECTOR, ILLINOIS DEPT OF CONSERVATION
LINCOLN TOWER PLAZA, 524 SOUTH 2ND STREET
SPRINGFIELD IL 62701-1787

2

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NORTHERN STREAMS PROJECT OFFICE, BOX 147
ALEDO IL 61231

MR BILL DONELIS, ILLINOIS DEPT OF CONSERVATION
LINCOLN TOWER PLAZA, 524 SOUTH 2ND STREET
SPRINGFIELD IL 62706

MR DONALD VONNAHME - DIRECTOR, DIVISION OF WATER RESOURCES
IL DEPARTMENT OF TRANSPORTATION, 2300 SOUTH DIRKSEA PARKWAY
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NORMAN STUCKY, MISSOURI DEPT OF CONSERVATION
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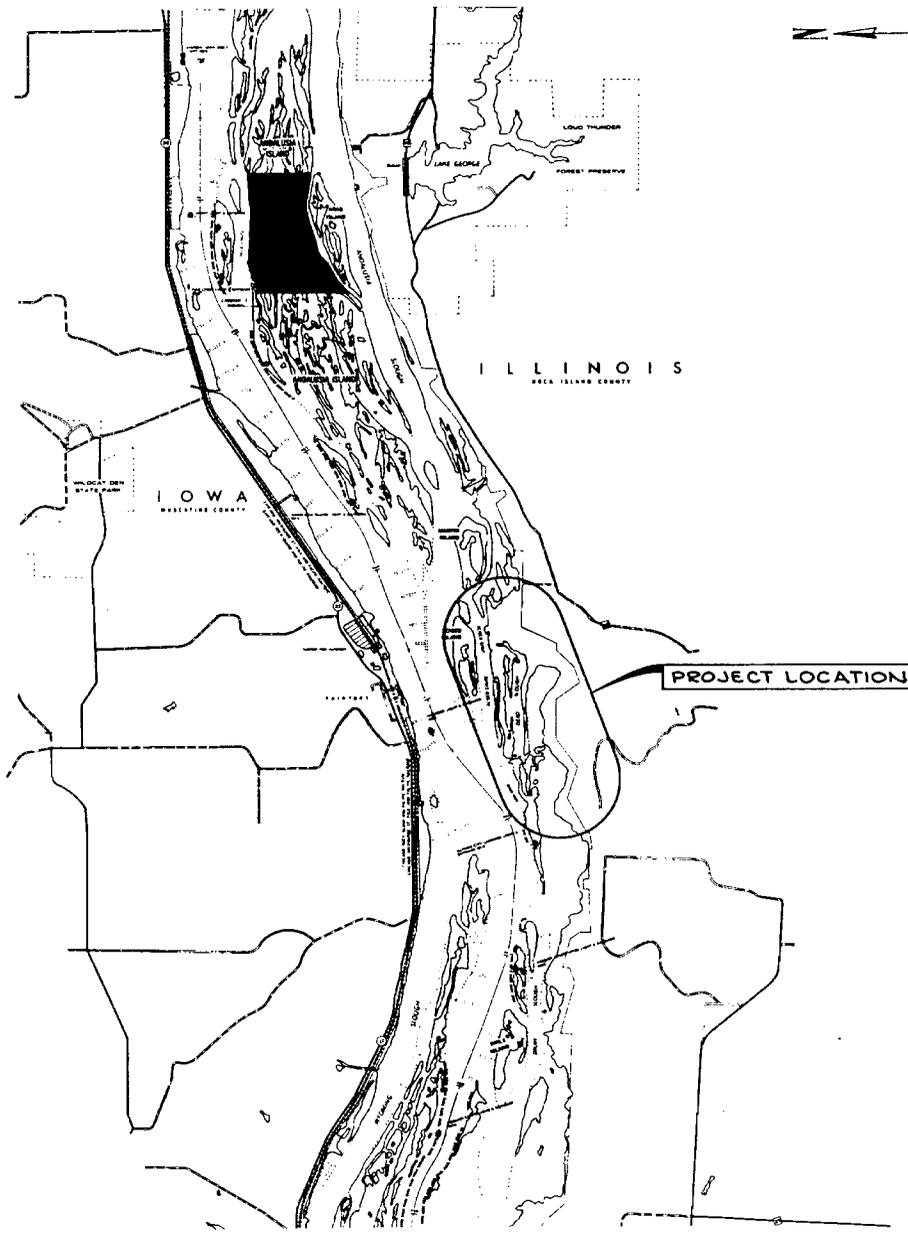
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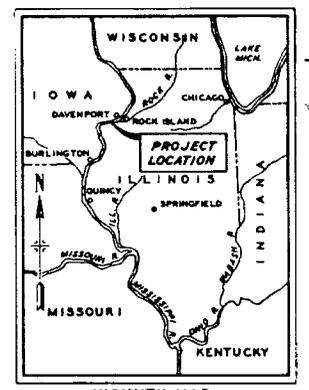
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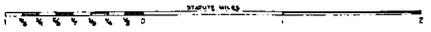


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VICINITY MAP
 25 0 25 50 75
 SCALE IN MILES

LOCATION MAP



SIGNATURES AFFIXED BELOW INDICATE OFFICIAL RECOMMENDATION AND APPROVAL OF ALL DRAWINGS IN THIS SET AS INDICATED ON EACH INDIVIDUAL TITLE BLOCK

Prepared by: U.S. ARMY ENGINEER DISTRICT, ROCK ISLAND
 Submitted by: CHIEF, DESIGN BR.
 CHIEF, HYDRAULICS BR.
 CHIEF, GEOTECHNICAL BR.
 CHIEF, ENGINEERING DIV.
 Approved by: COL, CORPS OF ENGINEERS

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

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

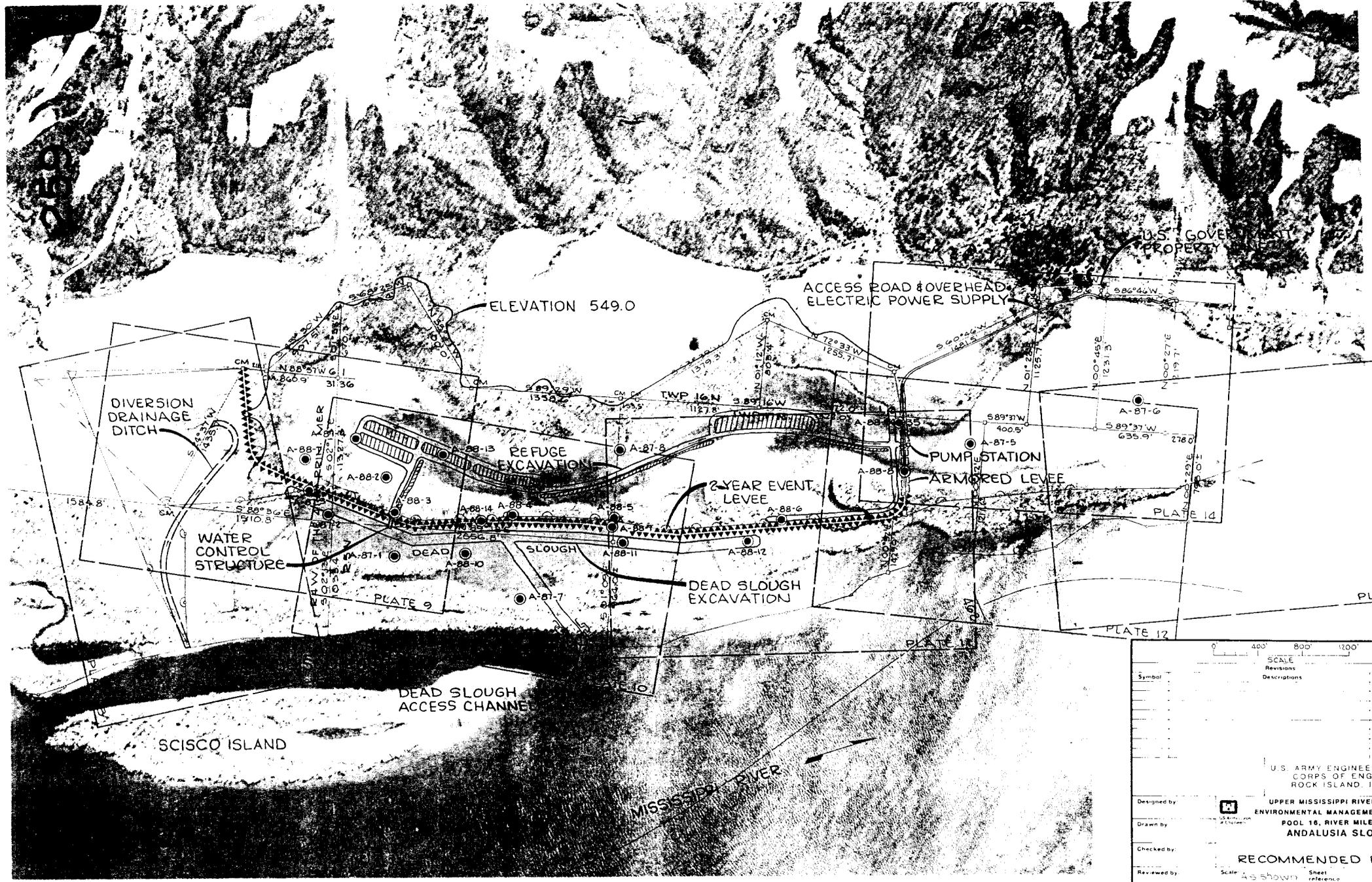
UPPER MISSISSIPPI RIVER SYSTEM
 ENVIRONMENTAL MANAGEMENT PROGRAM
 PODL 16, RIVER MILE 482.7
 ANDALUSIA SLOUGH

LOCATION MAP

Scale: As shown
 Date:
 Drawing Code:

Sheet reference number:
 Sheet ___ of ___

Revisions			
Symbol	Description	Date	Approved



0' 400' 800' 1200'

SCALE

Symbol	Revisions	Date	Approved
	Descriptions		

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

DESIGNED BY: [Signature]

DRAWN BY: [Signature]

CHECKED BY: [Signature]

REVIEWED BY: [Signature]

APPROVED BY: [Signature]

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ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 16, RIVER MILE 482.7
ANDALUSIA SLOUGH

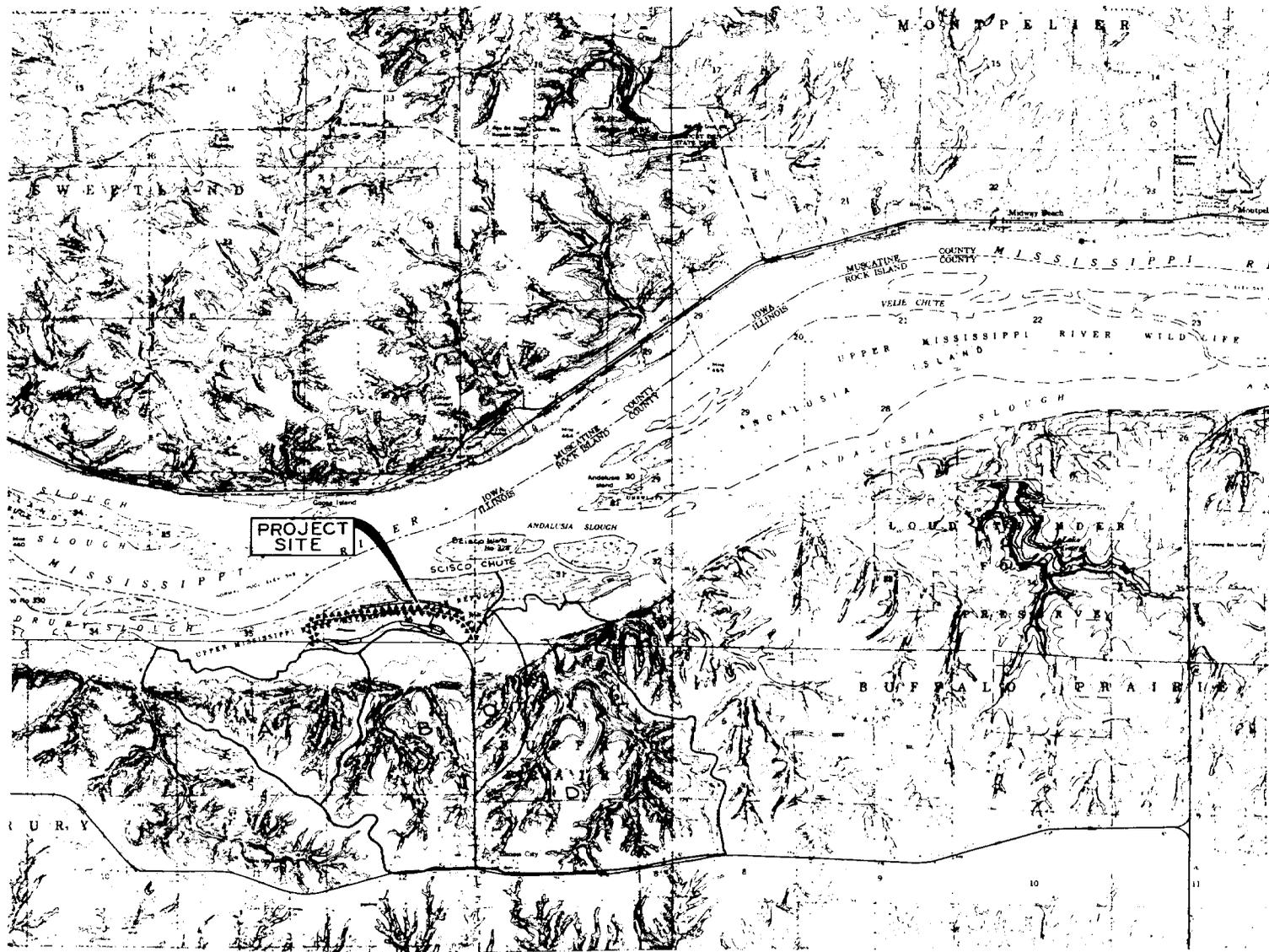
RECOMMENDED PLAN

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Sheet reference number: [] of []

Drawing Code: []

Sheet [] of []



ADJACENT WATERSHEDS

ADJACENT WATERSHED CHARACTERISTICS

Watershed	Area, acres	Sediment Yield, AC-FT/Year
A	519	2.2
B	774	3.8
C	208	0.8
D	1152	4.2

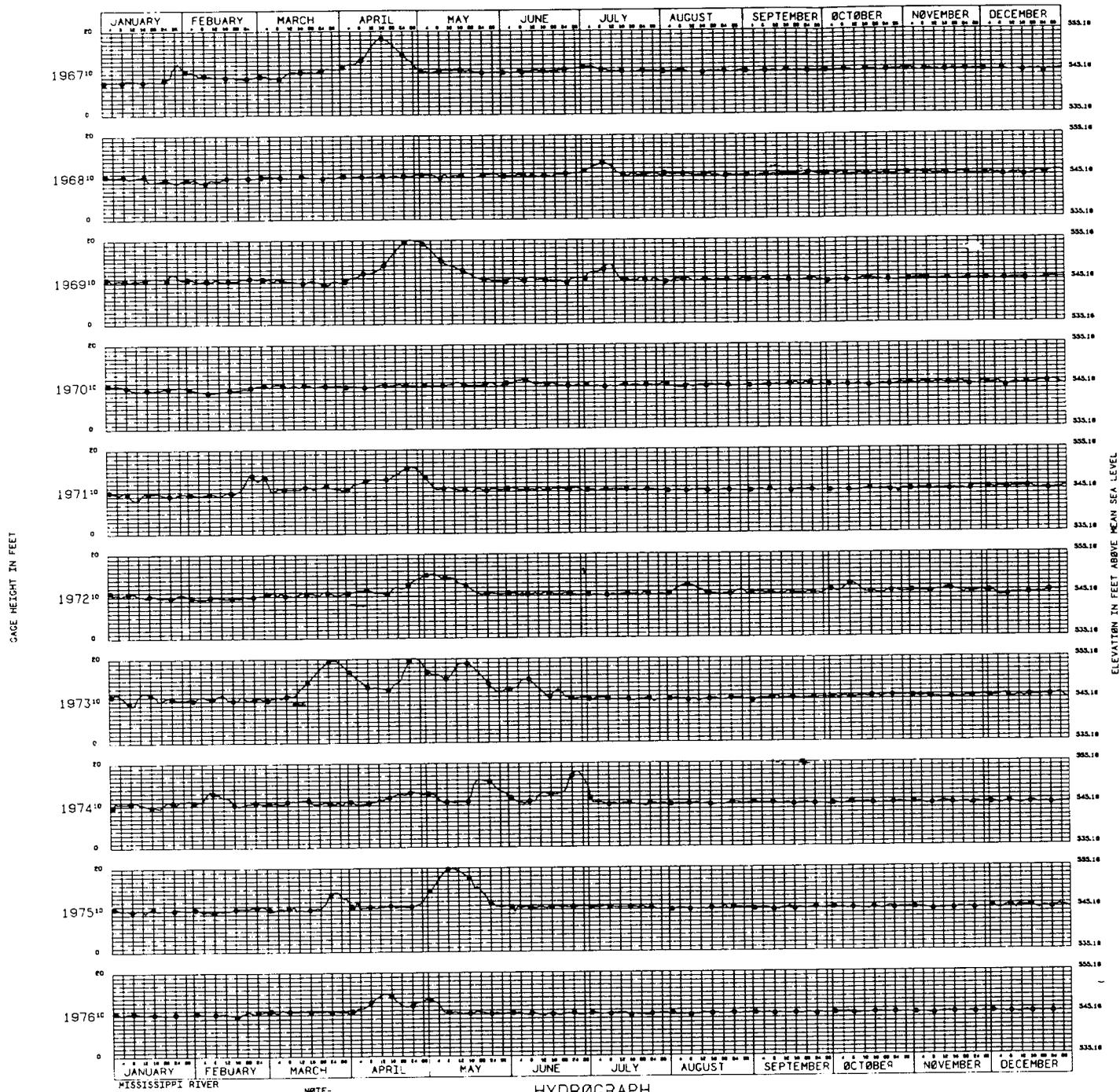


CONTOUR INTERVAL 10 FEET
 NATIONAL GEODETIC VERTICAL DATUM OF 1989

Symbol	Revisions Descriptions	Date	Approved

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

Designed by:		UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM	
Drawn by:		POOL 18, RIVER MILE 482.7 ANDALUSIA SLOUGH	
Checked by:	ADJACENT WATERSHEDS		
Reviewed by:	Scale: As shown	Sheet reference number:	
Approved by:	Drawing Code:	Sheet:	



MISSISSIPPI RIVER NOTE- HYDROGRAPH - FAIRPORT, IOWA

FLOOD PROFILES AT FAIRPORT, IOWA
River Mile 463.5

Event	Elevation
1.5	549.0
2	550.8
5	553.0
10	554.8
50	558.7
100	559.8

Revisions		Date	Approved
Symbol	Description		

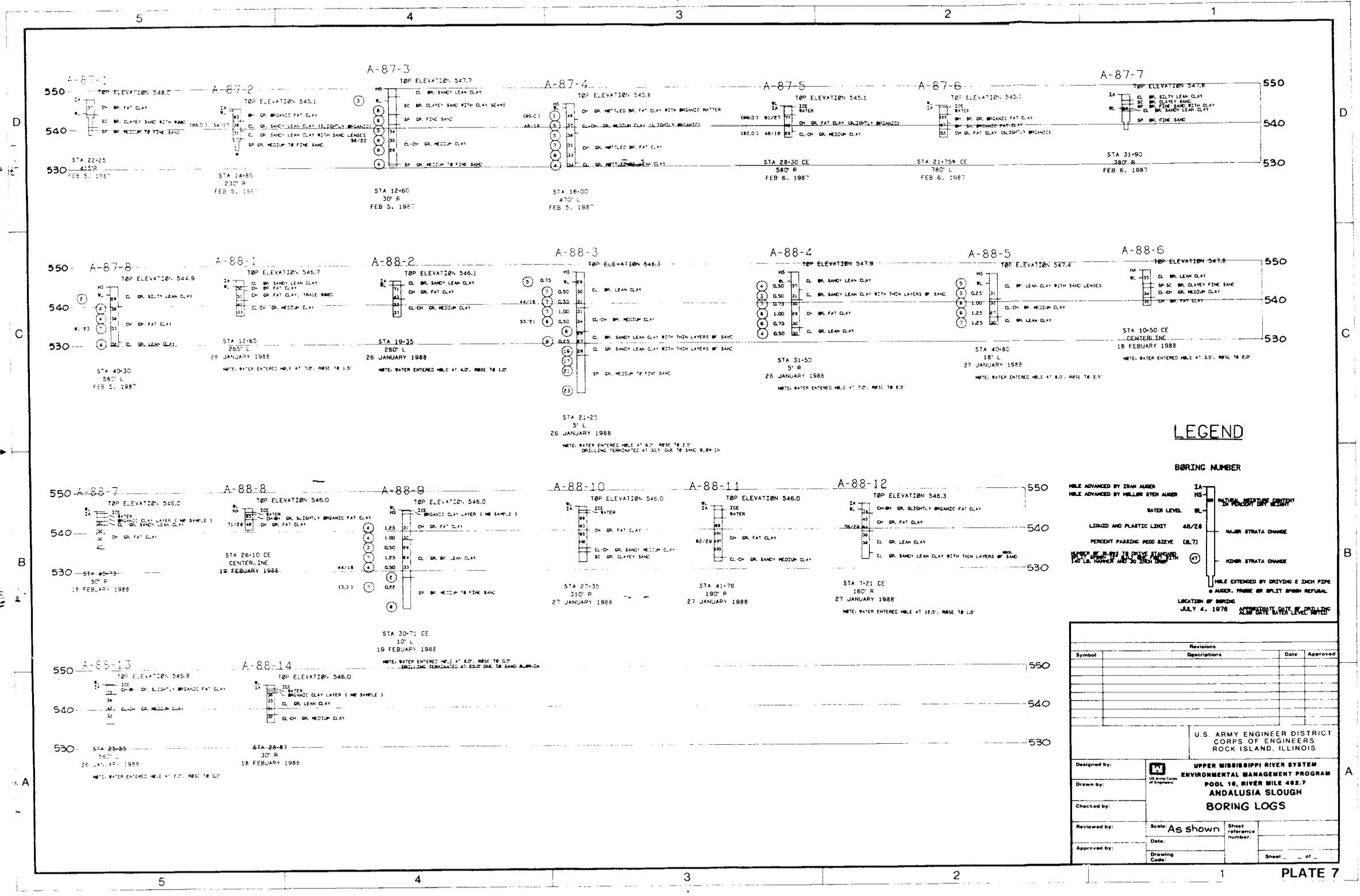
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CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

Designed by: UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 10, RIVER MILE 463.7
ANDALUSIA SLOUGH

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

HYDRAULIC DATA I

Scale: As shown Sheet reference number: _____
Sheet _____ of _____



LEGEND

BORING NUMBER

- IA HOLE ADVANCED BY JOHN AUGER
- HS HOLE ADVANCED BY HULLUM STEIN AUGER
- WL WATER LEVEL
- LI LIQUID AND PLASTIC LIMIT 48/28
- PP PERCENT PASSING #200 SIEVE (0.75)
- MA MAJOR STRATA CHANGE
- MI MINOR STRATA CHANGE
- EA HOLE EXTENDED BY DRIVING 2 INCH PIPE
- EA AUGER, PUSHE OR SPLIT SPURR REFUSAL

LOCATION OF BORING
JULY 4, 1978

APPROPRIATE DATE OF DRILLING
ALSO DATE WATER LEVEL NOTED

Revisions			
Symbol	Descriptions	Date	Approved

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

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

**UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14, RIVER MILE 482.7
ANDALUSIA SLOUGH
BORING LOGS**

Scale: As shown Sheet reference number: _____
 Date: _____
 Drawing Code: _____ Sheet _____ of _____

Sta. 12+21.59 C+
 Mon 32.3 El. 553.53
 End of Levee - El. 552.8

MATCH LINE STA. 11+00

PI STA. 3+51.0C
 $\Delta = 67^{\circ}30'00''$
 $D = 23^{\circ}10'43''$
 $R = 247.192'$
 $T = 150'$
 $L = 269.645'$
 $E = 41.951'$
 PC STA. 3+01.0C
 PT STA. 9+62.1

PI STA. 1+50.00B
 $\Delta = 90^{\circ}00'00''$
 $D = 38^{\circ}11'50''$
 $R = 150.00'$
 $T = 150.00'$
 $L = 235.62'$
 $E = 62.13'$
 PC STA. 0+00.00B
 PT STA. 2+35.62B

PI STA. 3+55.62B
 $\Delta = 67^{\circ}22'48''$
 $D = 38^{\circ}11'50''$
 $R = 150.00'$
 $T = 100.00'$
 $L = 176.40'$
 $E = 30.28'$
 PC STA. 2+35.62B
 PT STA. 4+12.02B

PI STA. 11+82.00B
 $\Delta = 12^{\circ}44'50''$
 $D = 4^{\circ}00'00''$
 $R = 1432.40'$
 $T = 160.00'$
 $L = 318.68'$
 $E = 8.91'$
 PC STA. 10+22.00B
 PT STA. 13+40.68B

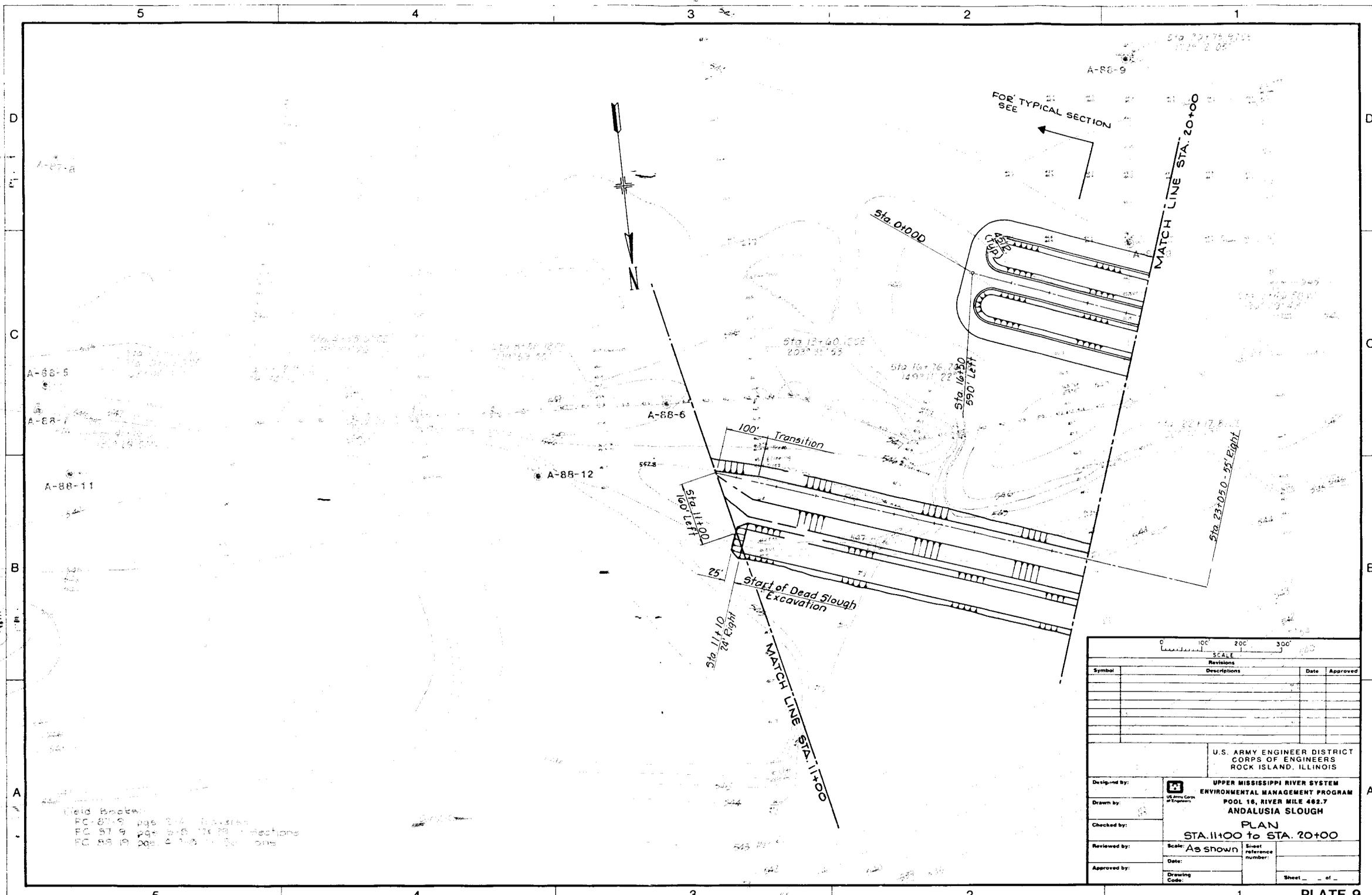
PI STA. 16+70.68B
 $\Delta = 45^{\circ}27'20''$
 $D = 8^{\circ}00'00''$
 $R = 716.20'$
 $T = 300'$
 $L = 568.20'$
 $E = 60.29'$
 PC STA. 13+70.68B
 PT STA. 19+38.80B

GOVERNMENT PROPERTY

SUSCO CHUTE

Field Station
 PO Box 100
 PO Box 100
 PO Box 100
 PO Box 100
 PO Box 100

Revisions			
Symbol	Descriptions	Date	Approved
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS			
Designed by:		UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 18, RIVER MILE 482.7 ANDALUSIA SLOUGH	
Drawn by:		PLAN STA. 12+21.59 C to STA. 11+00	
Checked by:	Scale:	As shown	Sheet reference number:
Reviewed by:	Date:		
Approved by:	Drawing Code:		Sheet ___ of ___



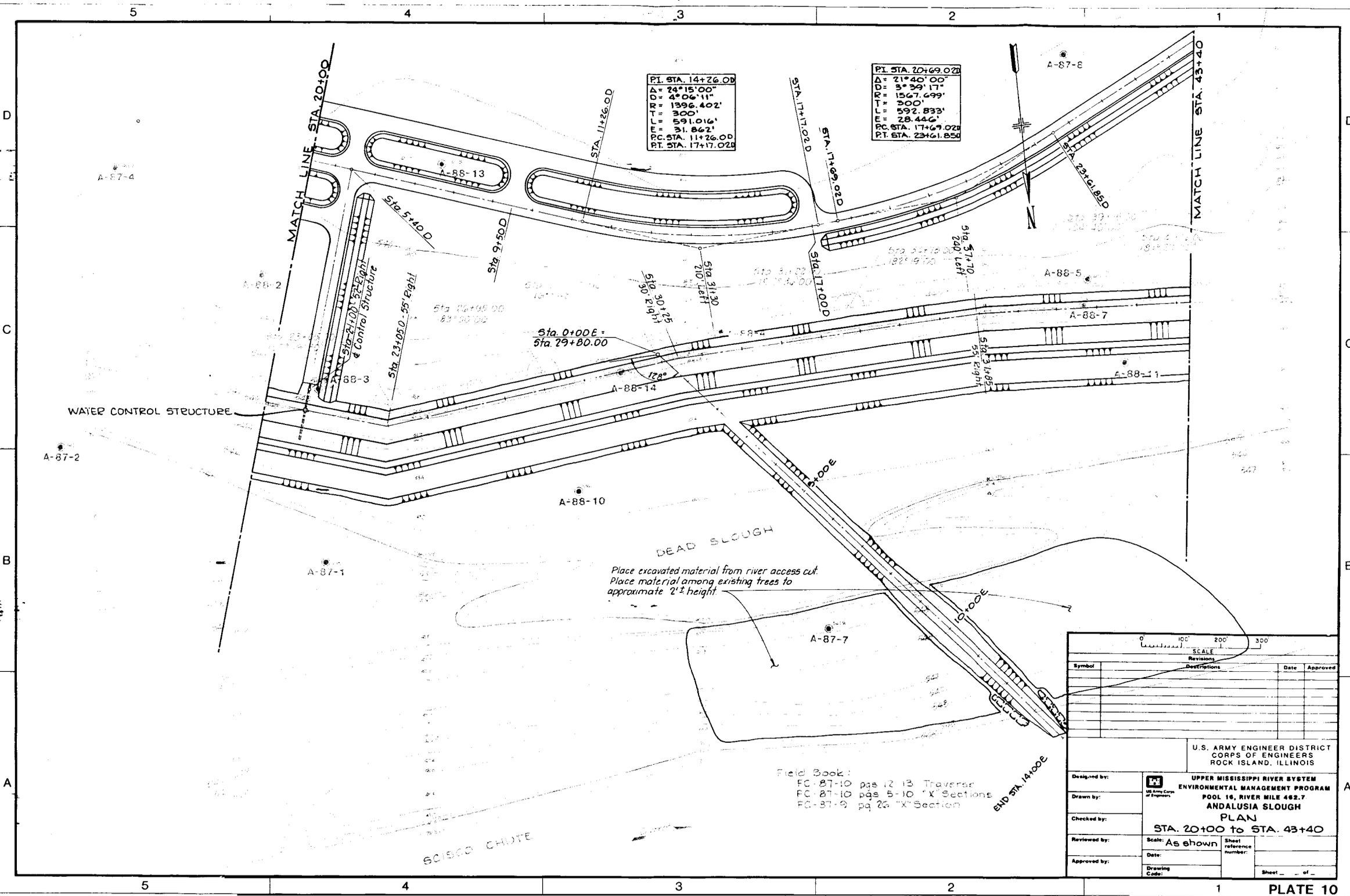
Cold Spoken
 FC 87-9 pgs 2-4 covers
 FC 87-9 pgs 5-6 74 75 76
 FC 88-10 pgs 5-7 74 75 76

0 100' 200' 300'
 SCALE

Symbol	Revisions Descriptions	Date	Approved

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

Designed by:		 UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM	
Drawn by:		POOL 16, RIVER MILE 482.7 ANDALUSIA SLOUGH	
Checked by:		PLAN STA. 11+00 to STA. 20+00	
Reviewed by:	Scale: As shown	Sheet reference number:	
Approved by:	Date:		
	Drawing Code:		Sheet ___ of ___



PI STA. 14+26.00

A	= 24°15'00"
D	= 47°06'11"
R	= 1396.402'
T	= 300'
L	= 591.016'
E	= 31.862'
PC STA.	11+26.00
PT STA.	17+17.028

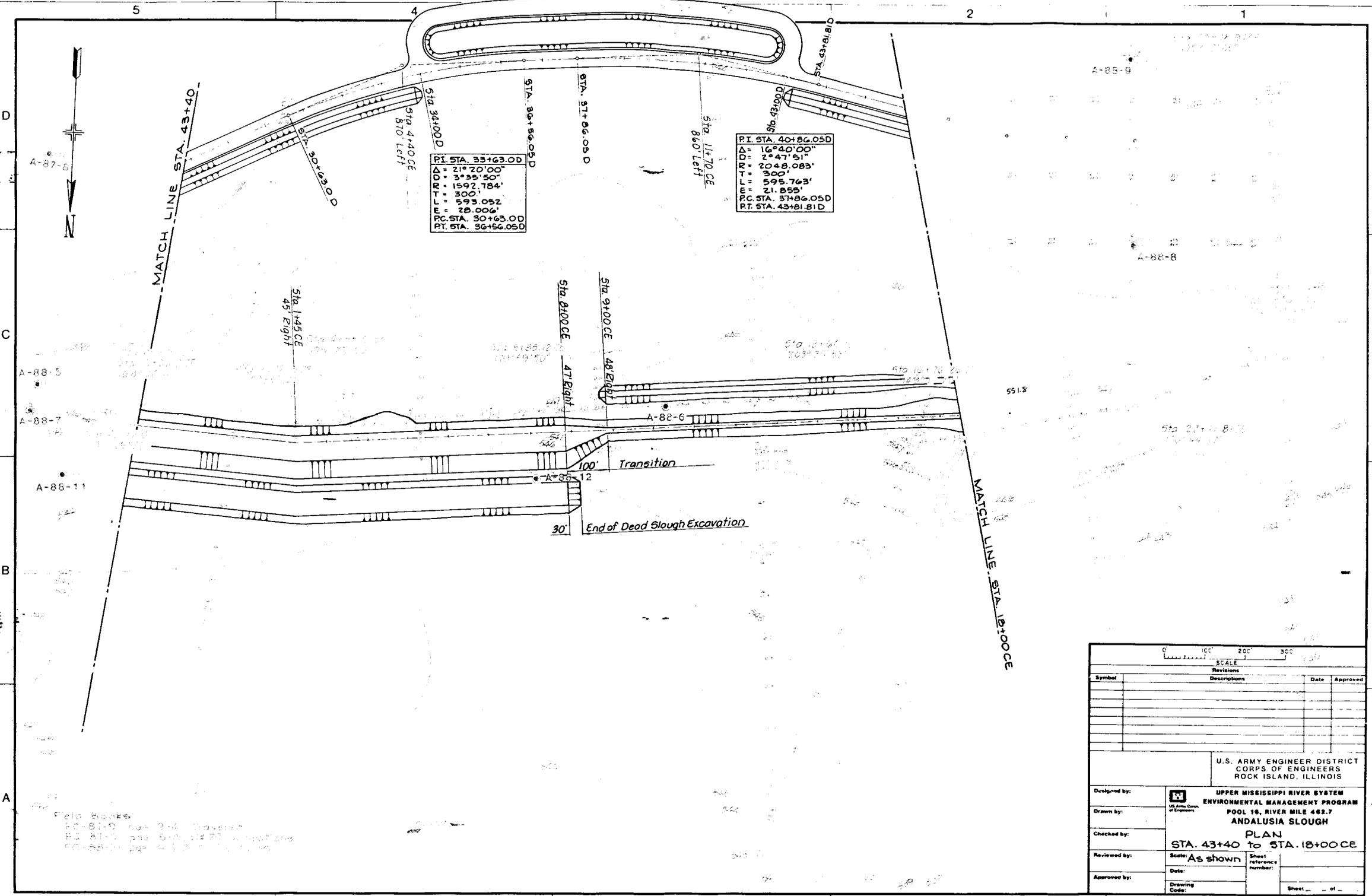
PI STA. 20+69.02

D	= 21°40'00"
R	= 1567.699'
T	= 300'
L	= 592.833'
E	= 28.446'
PC STA.	17+69.028
PT STA.	23+61.850

Place excavated material from river access cut.
Place material among existing trees to
approximate 2' height

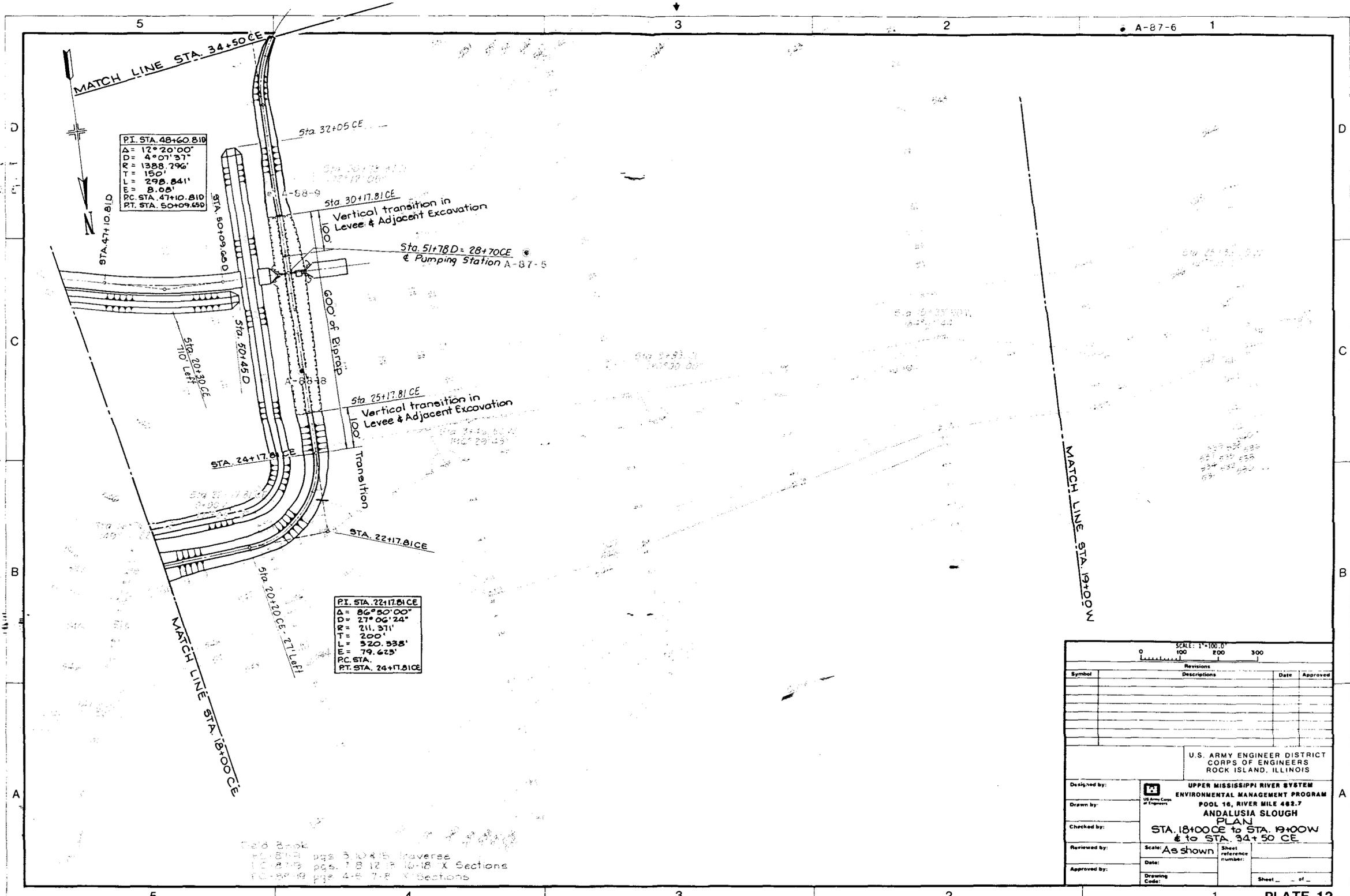
Field Book:
FC-87-10 pgs 12-13 Traverser
FC-87-10 pgs 5-10 "X" Sections
FC-87-9 pg 26 "X" Section

0 100' 200' 300'		SCALE	
Symbol	Revisions	Date	Approved
	Descriptions		
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS			
Designed by:	UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 16, RIVER MILE 482.7 ANDALUSIA SLOUGH PLAN STA. 20+00 TO STA. 43+40		
Drawn by:			
Checked by:			
Reviewed by:			
Approved by:	Scale: As shown	Sheet reference number:	
	Date:		
	Drawing Code:		Sheet ___ of ___



Field Books
 PC-81-9 pgs 3-4
 PC-81-9 pgs 5-14
 PC-88-10 pgs 4-12

Revisions <table border="1"> <thead> <tr> <th>Symbol</th> <th>Descriptions</th> <th>Date</th> <th>Approved</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>				Symbol	Descriptions	Date	Approved																																								
Symbol	Descriptions	Date	Approved																																												
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS																																															
Designed by: Drawn by: Checked by: Reviewed by: Approved by:	UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 16, RIVER MILE 462.7 ANDALUSIA SLOUGH PLAN STA. 43+40 to STA. 18+00 CE																																														
Scale: As shown Date: Drawing Code:	Sheet reference number: Drawing Code:	Sheet ____ of ____	Sheet ____ of ____																																												



P.I. STA. 48+60.81 D
 $\Delta = 12^\circ 20' 00''$
 $D = 4^\circ 01' 37''$
 $R = 1388.796'$
 $T = 150'$
 $L = 298.841'$
 $E = 8.05'$
 P.C. STA. 47+10.81 D
 P.T. STA. 50+09.65 D

P.I. STA. 22+17.81 CE
 $\Delta = 86^\circ 50' 00''$
 $D = 27^\circ 06' 24''$
 $R = 211.371'$
 $T = 200'$
 $L = 320.535'$
 $E = 79.625'$
 P.C. STA. 20+17.81 CE
 P.T. STA. 24+17.81 CE

10-20-80
 10-20-80 pgs. 5-10 4-15 Traverses
 10-20-80 pgs. 7-8 12-13 10-18 X Sections
 10-20-80 pgs. 4-6 7-8 X Sections

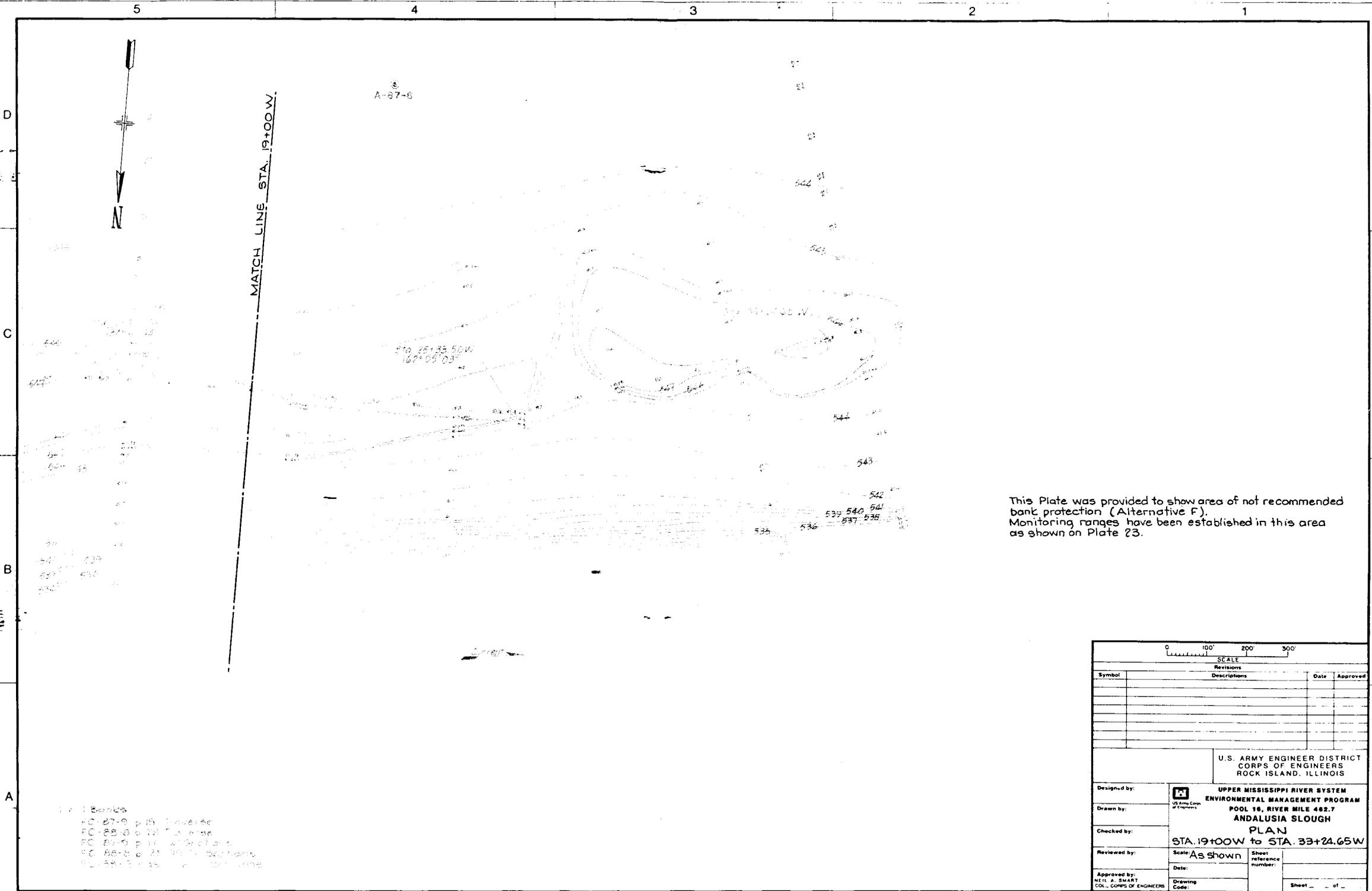
SCALE: 1"=100.0'

0 100 200 300

Symbol	Descriptions	Date	Approved

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

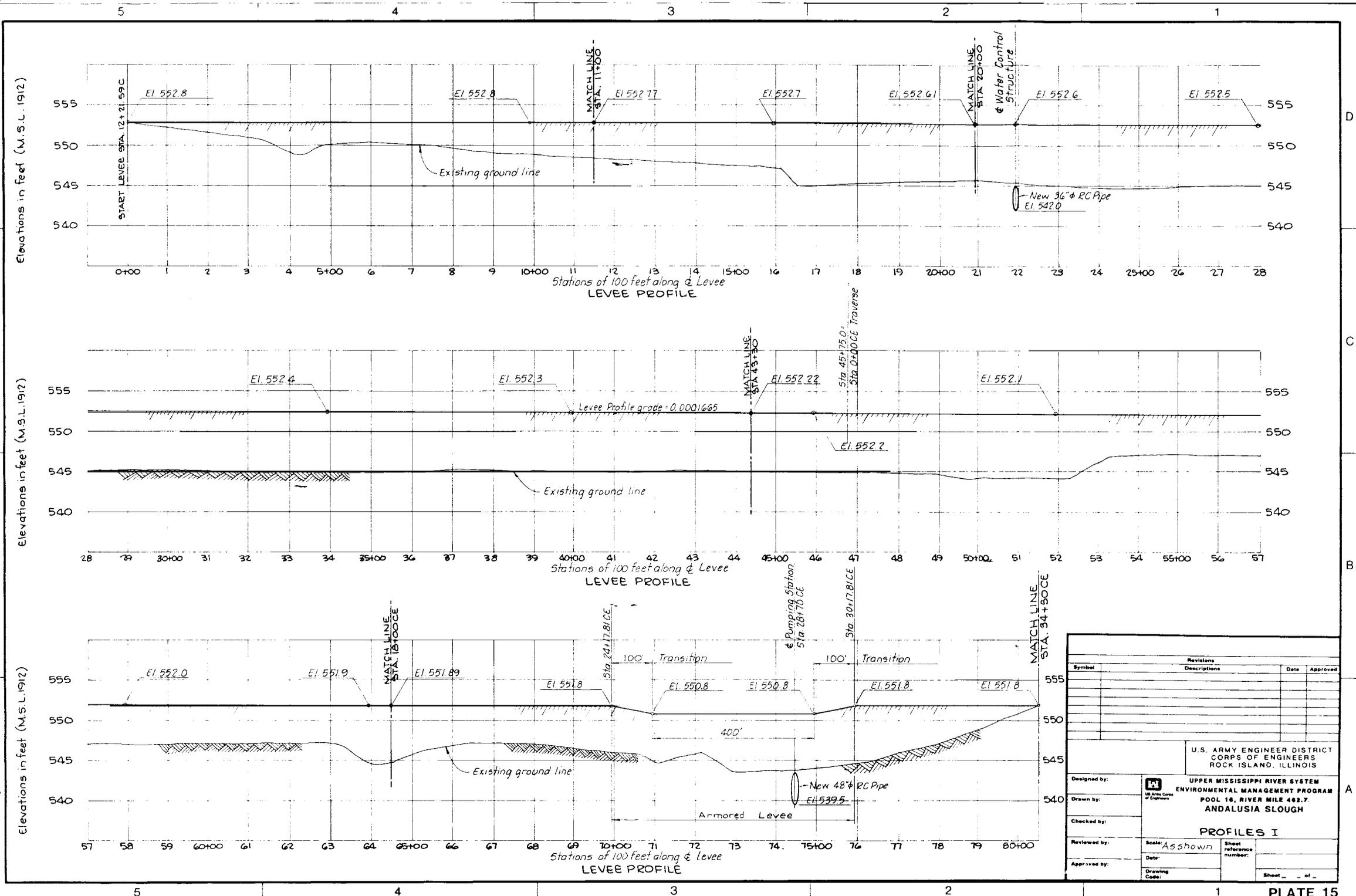
Designed by: UPPER MISSISSIPPI RIVER SYSTEM
 ENVIRONMENTAL MANAGEMENT PROGRAM
 Drawn by: POOL 16, RIVER MILE 482.7
 ANDALUSIA SLOUGH
 PLAN
 Checked by: STA. 18+00 CE to STA. 19+00 W
 & to STA. 34+50 CE
 Reviewed by: Scale: As shown Sheet reference number:
 Date: _____
 Approved by: _____ Drawing Code: _____ Sheet _____ of _____



171 Banks
 FC 87-0 p 15 Proposed
 FC 88-0 p 12 Final
 FC 88-9 p 17 1st draft
 FC 88-8 p 21 2nd draft
 FC 88-3 p 25 3rd draft

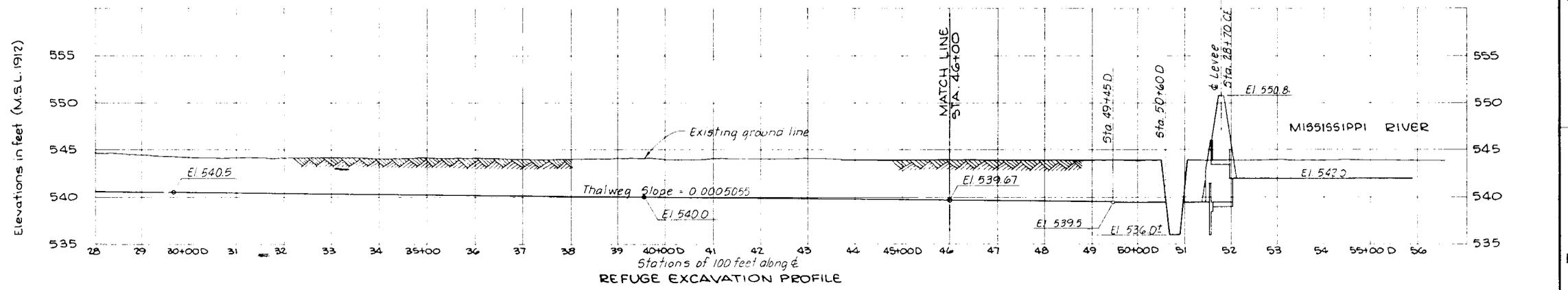
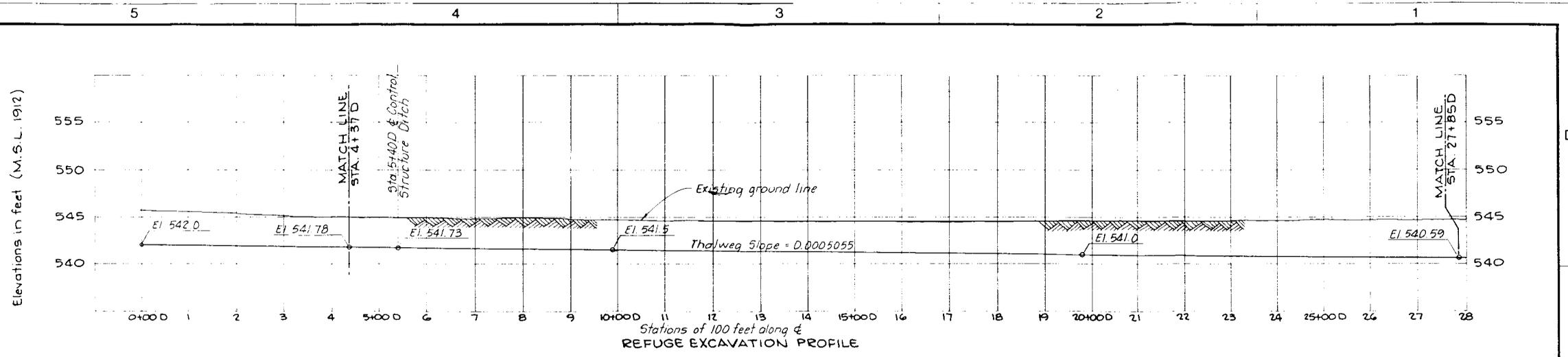
This Plate was provided to show area of not recommended
 bank protection (Alternative F).
 Monitoring ranges have been established in this area
 as shown on Plate 23.

0 100' 200' 300' SCALE			
Revisions			
Symbol	Descriptions	Date	Approved
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS			
Designed by:	UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 18, RIVER MILE 482.7 ANDALUSIA SLOUGH PLAN STA. 19+00W to STA. 33+24.65W		
Drawn by:	Scale: As shown Sheet reference number:		
Checked by:	Date:		
Reviewed by:	Drawing Code:		
Approved by:	Sheet _____ of _____ NEL A. SMART COL., CORPS OF ENGINEERS		



Revisions			
Symbol	Descriptions	Date	Approved

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS			
Designed by:	 UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 18, RIVER MILE 482.7 ANDALUSIA SLOUGH	PROFILES I	
Drawn by:		Scale: <i>As shown</i>	Sheet reference number:
Checked by:		Date:	Drawing Code:
Reviewed by:			
Approved by:			Sheet <i> </i> of <i> </i>



Revisions			
Symbol	Descriptions	Date	Approved

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

Designed by: _____

Drawn by: _____

Checked by: _____

Reviewed by: _____

Approved by: _____

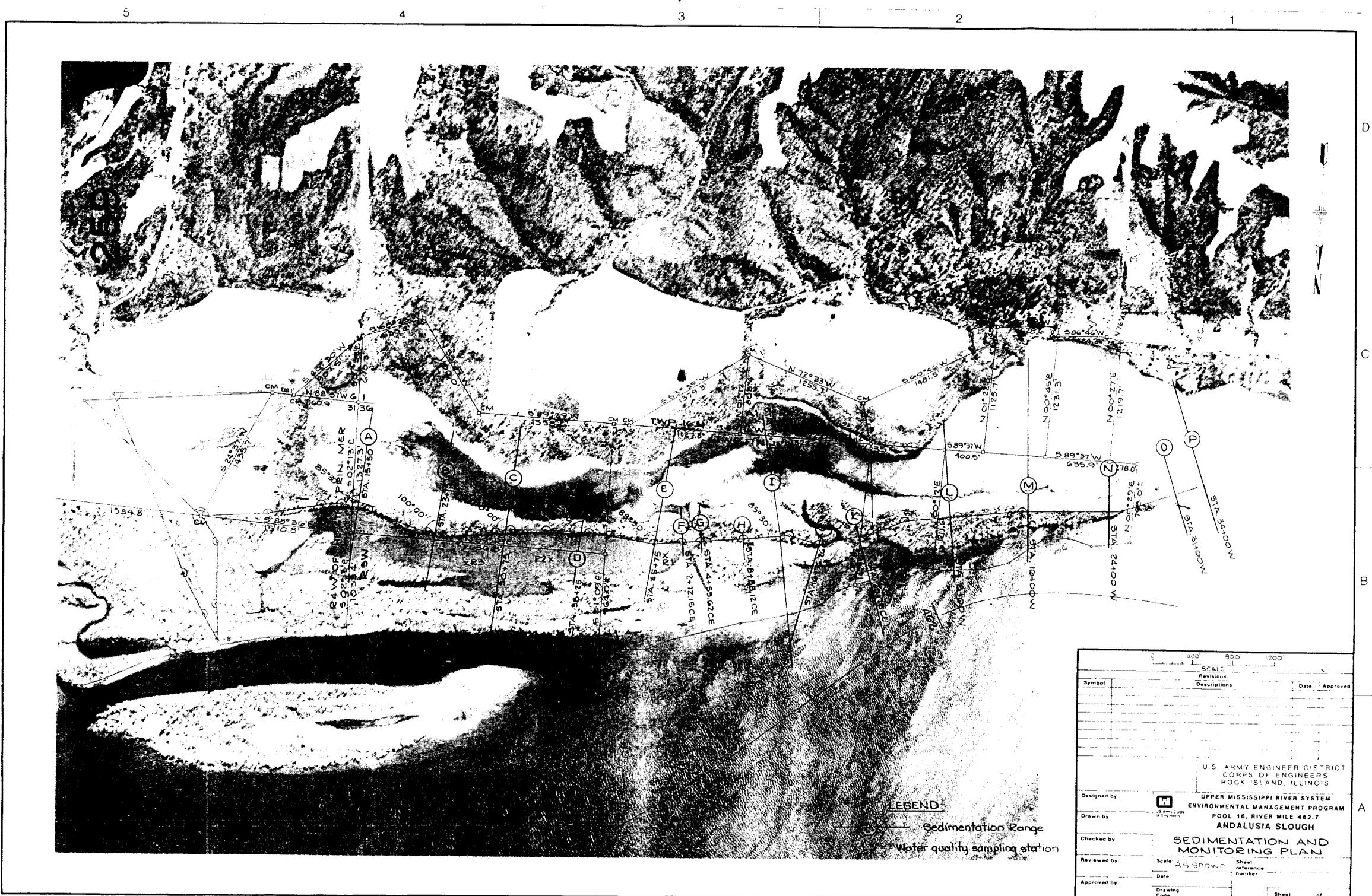
Scale: As shown

Date: _____

Drawing Code: _____

Sheet reference number: _____

Sheet _____ of _____



D
C
B
A

D
C
B
A

5

4

3

2

1

5

4

3

2

1

LEGEND
 Sedimentation Range
 Water quality sampling station

<p>Scale: 1" = 400'</p>			
Symbol	Revisions	Date	Approved
	Descriptions		
<p>U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS</p>			
Designed by:	<p>UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 16, RIVER MILE 482.7 ANDALUSIA SLOUGH</p>		
Drawn by:			
Checked by:	<p>SEDIMENTATION AND MONITORING PLAN</p>		
Reviewed by:	Scale: As shown	Sheet reference number:	
Approved by:	Date:		
Drawing Code:			Sheet ___ of ___

