UPPER MISSISSIPPI RIVER SYSTEM-
ENVIRONMENTAL MANAGEMENT PROGRAM
(UMRS-EMP)

BATCHTOWN
HABITAT REHABILITATION AND ENHANCEMENT PROJECT (HREP)

POOL 25
MISSISSIPPI RIVER
CALHOUN COUNTY, ILLINOIS

FINAL
DEFINITE PROJECT REPORT (SL-8)
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

July 1996

**US Army Corps
of Engineers**
St. Louis District

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July 1996

BATCHTOWN HREP

EXECUTIVE SUMMARY

The Batchtown Habitat Rehabilitation and Enhancement Project is part of the Upper Mississippi River System-Environmental Management Program. The project is located on the Illinois side of the Mississippi River, in Pool 25, just upstream of Lock & Dam No. 25. The project area is contained within the Mark Twain National Wildlife Refuge, and is managed by both the U.S. Fish and Wildlife Service and the Illinois Department of Natural Resources (formerly the Illinois Department of Conservation). The 3,327-acre project consists of approximately 989 acres of forested wetland, 224 acres of cropland, 13 acres of moist soil, 1,172 acres of non-forested wetland and 929 acres of water.

The Batchtown area was once a prime habitat site for large numbers of migrating waterfowl. However, its habitat has been severely degraded due to siltation received from the Mississippi River and from runoff from a fairly large and steeply-sloped local upland watershed system. Additionally, necessary releases of water from Pool 25 cause harmful water level fluctuations in the project area.

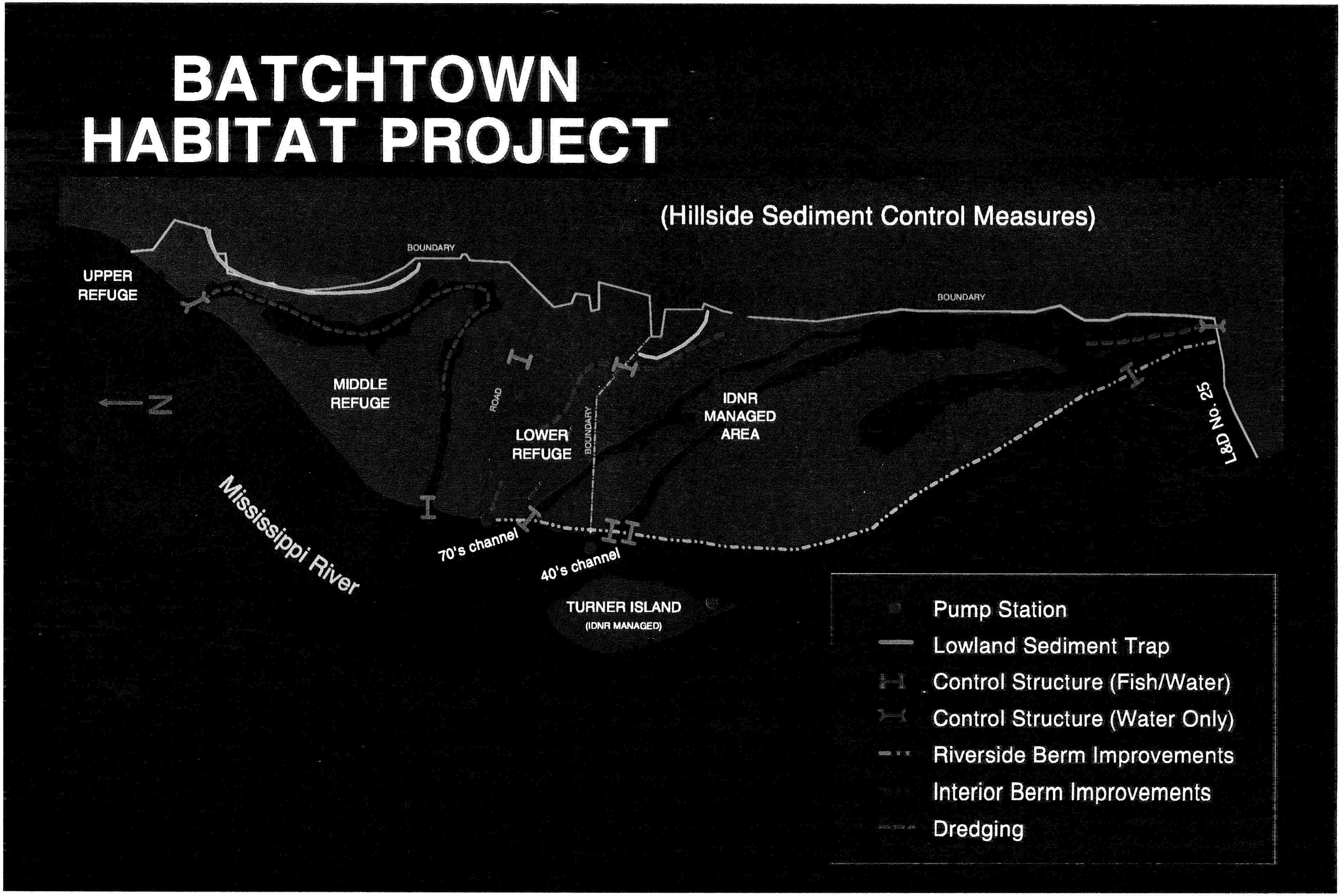
The project's management goal is to restore and maintain riverine habitat diversity to benefit fish, wildlife and freshwater mussels. Specific objectives of this project are to: increase diversity of wetland types within the project area, create a water-level management capability that is independent of water levels in Pool 25, reduce the rate of siltation throughout the project area, improve habitat quality and quantity of bottomland forest within the project area, improve spawning habitat for riverine fishes, improve overwintering habitat for fish in side channels and backwaters, improve side channel habitat by preventing river-borne sediment from filling the side channels, and ensure adequate long-term water flow over the freshwater mussel beds.

The measures idendified and evaluated to address the problems include: berms for interior water control and to prevent frequent flooding; gated water control structures; pump stations; fish-passage structures; dredging of side channels, lakes, and backwaters; dredge spoil for island construction; dike construction; bottomland forest habitat improvements; off-bankline revetment; upland sediment control measures; and the acquisition of wildlife lands for wetland restoration and protection.

This report documents the formulation of specific management measures and evaluates them as to their acceptability to the US Fish and Wildlife Service and the Illinois Department of Natural Resources, and evaluates the measures as to their engineering effectiveness, their ability to meet the project objectives, and as to their cost effectiveness.

The recommended plan consists of variations and improvements made to a Concept Plan C to more address ecosystem objectives. The attached schematic shows the general locations of recommended measures.

Habitat enhancements from the project are estimated to provide a net gain of 903 average annual habitat units (AAHUs) for wildlife and 746 AAHUs for fishes, and 56 AAHUs for mussels. Fully funded project costs including planning study costs, preparation of plans and specifications, construction costs, and construction management costs are estimated to be about $8,148,000, and annual operation, maintenance and rehabilitation costs are about $83,000.


BATCHTOWN
HABITAT PROJECT
(Hillside Sediment Control Measures)
UPPER REFUGE
MIDDLE REFUGE
LOWER REFUGE
IDNR MANAGED AREA
BOUNDARY
BOUNDARY
BOUNDARY
ROAD
N
Mississippi River
70's channel
40's channel
TURNER ISLAND
(IDNR MANAGED)
L&D No. 25
Pump Station
Lowland Sediment Trap
Control Structure (Fish/Water)
Control Structure (Water Only)
Riverside Berm Improvements
Interior Berm Improvements
Dredging

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BATCHTOWN HREP

1. INTRODUCTION

A. Purpose of Report. The purpose of this Definite Project Report (DPR) is to present a detailed proposal for the rehabilitation and enhancement of fish and wildlife habitat resources at the Batchtown project area. This report provides planning, engineering, and sufficient construction details of the Recommended Plan to allow final design and construction to proceed subsequent to approval of this document. The Environmental Assessment (EA) for the project is integrated with this DPR, including a section devoted to the Finding of No Significant Impact (FONSI).

B. Project Authority. The authority for this Definite Project 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. Excerpts from Section 1103 read as follows:

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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, it is hereby declared to be the intent
of the Congress to recognize that system as a nationally significant
ecosystem and a nationally significant commercial navigation system.
Congress further recognizes that the system provides a diversity of
opportunities and experiences.  The system shall be administered and
regulated in recognition of its several purposes.
. . .
(e)(1)  The Secretary, in consultation with the Secretary of the
Interior and the states of Illinois, Iowa, Minnesota, Missouri, and
Wisconsin, is authorized to undertake, as identified in the Master Plan
- . . .
   (A)  a program for the planning, construction, and evaluation of
measures for fish and wildlife habitat rehabilitation and enhancement;
. . .
```

C. Applicable Policy on Cost Sharing.

- Engineering and design (study costs and preparation of plans and specifications), supervision and administration, and construction costs are 100% Federal funded per WRDA 1986, Section 906 (e)(3) for the project on Federally-owned land.

- The Hillside Sediment Control Program costs are 75% Federal funded and 25% non-Federal funded, per WRDA '86 (See MOA, Appendix J-4)

- Operation, Maintenance, and Rehabilitation are borne 100% by the local sponsors (Illinois Department of Natural Resources and the US Fish and Wildlife Service), per Section 107(b) of the Water Resource Development Act of 1992.

D. History of UMRS-EMP.

The Upper Mississippi River System-Environmental Management Program (UMRS-EMP) had its origins in a controversy that developed in conjunction with the Corps of Engineer's proposal in the early 1970's to construct twin 1,200-foot locks at the Locks and Dam 26 replacement project. Some individuals and groups perceived a conflict between further development of the navigation system and maintenance of the environmental values of the Upper Mississippi River System. The GREAT (Great River Environmental Action Team) studies were implemented so that channel maintenance activities could be conducted with minimal negative environmental impacts, and positive impacts where possible.

In 1978 Public Law 95-502 authorized the Locks and Dam 26 Replacement Project (with one 1200-ft lock) and directed the Upper Mississippi River Basin Commission to prepare a Comprehensive Master Plan for the Management of the Upper Mississippi River System. The Master Plan was completed on January 1, 1982; it recommended a second lock, 600 ft in length at the new L&D 26, and an environmental management program with an initial 10-year timeframe. The environmental recommendations contained in the plan were tied to past, present, and future deterioration of fish and wildlife habitat of the river system, and were not to be considered as "mitigation" for any past or future lock construction.

According to the Master Plan report, the environmental recommendations were to be implemented by the U.S. Fish and Wildlife Service (USFWS) as the lead agency. However, the second lock and the EMP were authorized for implementation by the U.S. Army Corps of Engineers by P.L. 99-88, the Supplemental Appropriation Act of 1985, and P.L. 99-662, the Water Resources Development Act of 1986, Section 1103.

A General Plan for implementation of the EMP was completed by the North Central Division, U.S. Army Corps of Engineers (NCD), in January 1986. The U.S. Fish and

Wildlife Service, Region 3, and through the Upper Mississippi River Basin Association (UMRBA), the five affected states (Illinois, Iowa, Minnesota, Missouri, and Wisconsin) also participated in the development of the General Plan.

In October 1990, the Water Resources Development Act of 1990 was signed into law (P.L. 101-640). Section 405 of the Act amended Section 1103 of P.L. 99-662, and in essence, extended the authorization period an additional 5 years. Therefore, the EMP is authorized for a 15-year period, through FY 2002.

E. Purpose and Elements of EMP.

The purpose of the EMP is to ensure the coordinated development and enhancement of the Upper Mississippi River System, recognizing its several purposes. Thus, the EMP is a means for supporting "environmentally sustainable development" of the UMRS, i.e., development that meets the needs of the present without compromising the ability of future generations to meet their needs. More specifically, the EMP is the vehicle for implementing certain actions recommended in the Master Plan and specified in Section 1103 of P.L. 99-662.

Elements of the Upper Mississippi River System Environmental Management Program include:

- Habitat Rehabilitation and Enhancement Projects
- Long Term Resource Monitoring
- Computerized Inventory and Analysis System
- Recreation Projects
- Economic Impacts of Recreation Study
- Navigation Traffic Monitoring

F. Project Selection Process.

(1) Partnerships. A special partnership has been forged among the participants in the EMP. Congress placed Federal management responsibility for the program with the U.S. Army Corps of Engineers. In implementing the program, the Corps actively coordinates with the U.S. Department of the Interior; the Upper Mississippi River Basin Association (UMRBA); and the five states of Illinois, Iowa, Minnesota, Missouri, and Wisconsin.

The North Central Division of the Corps of Engineers manages the program and is guided in its policies by the Headquarters office of the U.S. Army Corps of Engineers. Three District offices, St. Paul (NCS), Rock Island (NCR), and St. Louis (LMS), manage the habitat projects within their boundaries and work directly with states and the USFWS on individual projects.

The U.S. Fish and Wildlife Service within the Department of Interior, in cooperation with the UMR basin states, executes the Long Term Resource Monitoring Program (LTRMP) element of the EMP. In addition, the Service participates in the planning of all projects on refuge lands and completes Coordination Act requirements for non-refuge habitat projects.

The five states and the Fish and Wildlife Service actively screen, make recommendations on, and participate in the development of habitat projects. Some projects involve state and local cost sharing with the Federal government, further emphasizing the partnership approach of the EMP. State personnel, primarily biologists, also staff six LTRMP field stations.

(2) Project Eligibility Criteria. Coordination with the States and the Fish and Wildlife Service during the preparation of the General Plan and several Annual Addenda led to an examination of the Comprehensive Master Plan for the Management of the Upper Mississippi River System. The Master Plan, completed by the Upper Mississippi River Basin Commission in 1981, was the basis of the recommendations subsequently 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 findings set forth in Annual Addenda:

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 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 . . ."

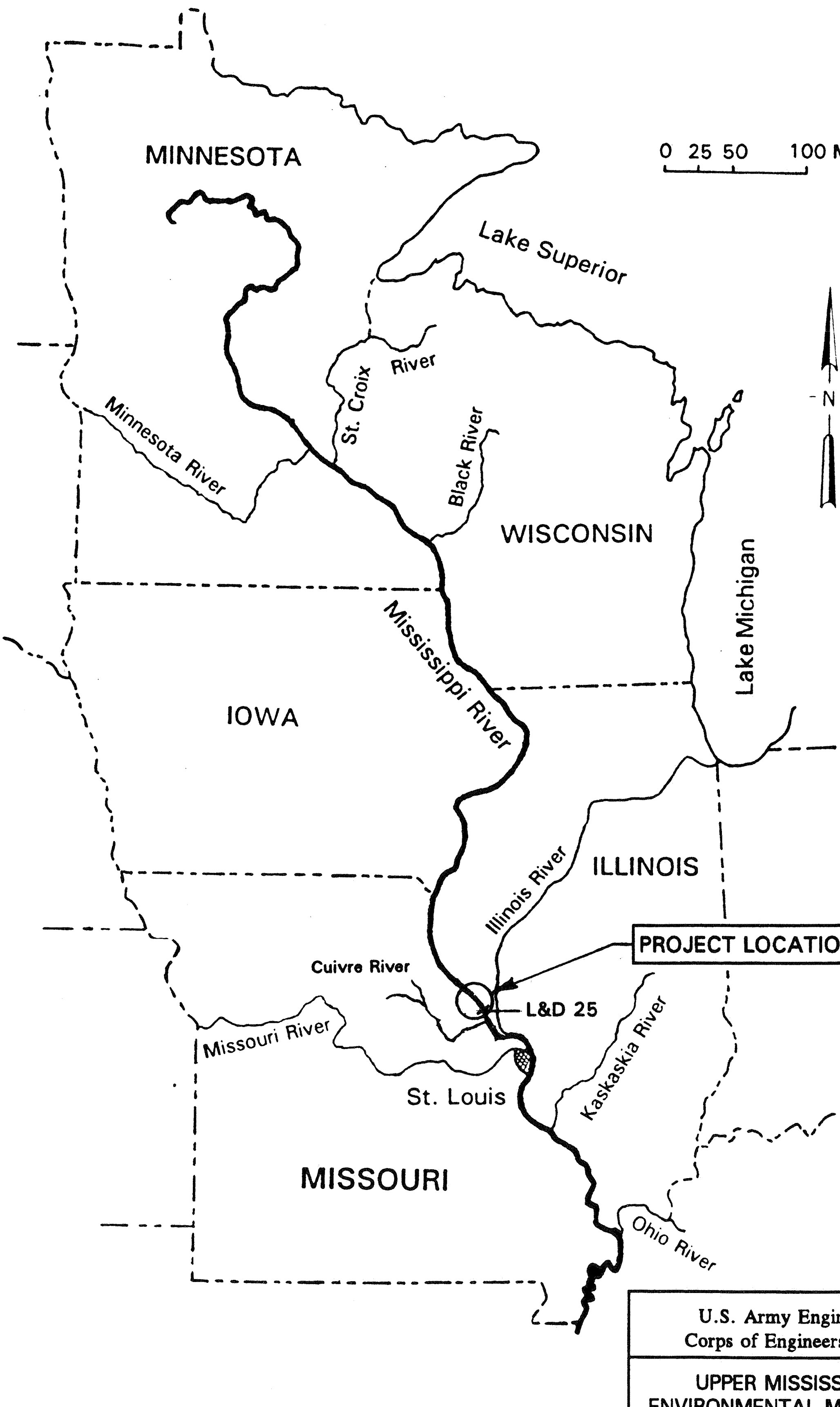
Second Annual Addendum. The types of projects that are definitely within the realm of Corps of Engineers implementation authorities include the following:

- 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)
- acquisitions of wildlife lands (for wetland restoration and protection) Initially not to be pursued, but by November 30, 1994, Headquarters, U.S. Army Corps of Engineers had granted approval for the acquisition of land for EMP projects under certain conditions.

A number of innovative structural and non-structural solutions that 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 the measures will be recommended only after consideration of system-wide effects.

(3) Project Selection. In the past, projects have been nominated and ranked for inclusion in the St. Louis District's habitat projects program by the Illinois Department of Natural Resources, the Missouri Department of Conservation, and the USFWS, based on a consensus of the agencies' management objectives.

G. Project Location. The project area consists of "General Plan" land on the Illinois side of the Mississippi River including the Batchtown State Fish and Waterfowl Management Area and portions of the Mark Twain National Wildlife Refuge. The project location is just upstream of Lock and Dam No. 25 [between Mississippi River Miles (MRM) 241.4 and 248.4] (see Figure 1). The northern portion--and about half of the project area--is managed by the US Fish & Wildlife Service, and the other half by the Illinois Department of Natural Resources. General Plan land is land that was acquired by the U.S. government through the Department of the Army for the improvement of navigation in the upper Mississippi River to provide a 9-foot channel, and is land that was incorporated into a general plan for fish and wildlife conservation and management. Adjacent to, and contributing runoff into the Federally-owned project land are eleven upland watersheds totalling 7,631 acres (12 square miles).



U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
BATCHTOWN
HABITAT REHABILITATION AND
ENHANCEMENT PROJECT
LOCATION MAP

FIGURE 1

2. EXISTING CONDITIONS.

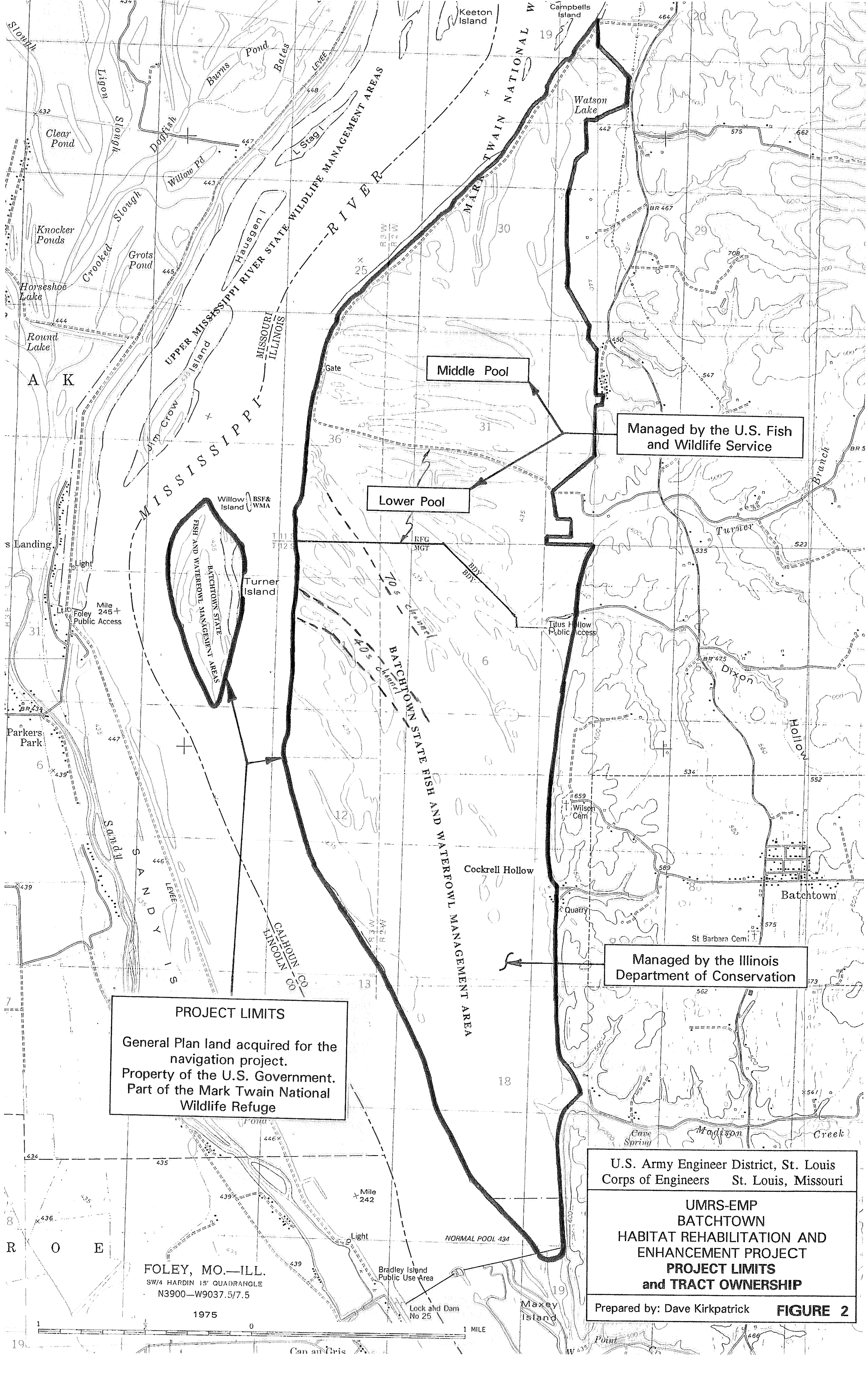
A. Physical Setting. The 3,327-acre project consists of approximately 989 acres of forested wetland, 224 acres of cropland, 13 acres of moist soil, 1,172 acres of non-forested wetland and 929 acres of water.

The project area is almost entirely owned by the federal government but is managed by two different agencies. The U.S. Fish and Wildlife Service manages 1,407 acres of the area as part of the Mark Twain National Wildlife Refuge. This area is known as the Batchtown Unit and is divided into two sections for management purposes, the middle unit or pool (1,007 acres), and the lower unit or pool (400 acres) (see Figure 2). This portion of the project area consists of approximately 613 acres of forested wetland (446 acres, middle unit and 167 acres, lower unit), 214 acres of cropland (134 acres, middle unit and 80 acres, lower unit), 13 acres of moist soil (middle unit), 233 acres of non-forested wetland (152 acres, middle unit and 81 acres, lower unit) and 334 acres of water (262 acres, middle unit and 72 acres, lower unit).

The Illinois Department of Natural Resources manages the remaining 1,920 acres as the Batchtown Unit of the Mississippi River Fish and Wildlife Area under a cooperative agreement with the USFWS and the Corps. This portion of the project area consists of 376 acres of forested wetlands, 10 acres of cropland, 939 acres of non-forested wetlands (22 acres is seasonally flooded) and 595 acres of water.

The acreage for the project area and its component habitat types were derived from planimetering of maps and may vary from some acreage obtained from legal descriptions.

Twelve square miles of upland watersheds direct precipitation runoff and soil erosion into the project area, and are also included into the study area. Earlier in the EMP, a policy had existed to limit EMP projects to federally-owned land, and not privately owned land adjacent or contiguous to the federally-owned land. In November, 1994 Headquarters, U.S. Army Corps of Engineers changed the policy to grant the acquisition of land as an acceptable habitat measure if well justified.



Middle Pool
Managed by the U.S. Fish and Wildlife Service
Lower Pool
PROJECT LIMITS
General Plan land acquired for the navigation project. Property of the U.S. Government. Part of the Mark Twain National Wildlife Refuge
Managed by the Illinois Department of Conservation
BATCHTOWN STATE FISH AND WATERFOWL MANAGEMENT AREA
BATCHTOWN STATE FISH AND WATERFOWL MANAGEMENT AREAS
UPPER MISSISSIPPI RIVER STATE WILDLIFE MANAGEMENT AREAS
MARK TWAIN NATIONAL W
MISSISSIPPI
RIVER
Turner Island
Willow Island
Titus Hollow Public Access
Cockrell Hollow
Batchtown
Foley Public Access
Bradley Island Public Use Area
Lock and Dam No 25
Maxey Island
Campbells Island
Watson Lake
Keeton Island
NORMAL POOL 434
FOLEY, MO.—ILL.
SW/4 HARDIN 15' QUADRANGLE
N3900—W9037.5/7.5
1975
1 MILE
U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri
UMRS-EMP
BATCHTOWN
HABITAT REHABILITATION AND
ENHANCEMENT PROJECT
PROJECT LIMITS
and TRACT OWNERSHIP
Prepared by: Dave Kirkpatrick
FIGURE 2

B. Water Resources. The minimum water surface elevation at the project area is approximately 429.0 feet National Geodetic Vertical Datum (NGVD). Generally, stages at the lower end of the project area are nearly the same as Lock and Dam 25 and are slightly higher at the upper end of the lower unit of the federal refuge. The middle unit of the refuge is generally higher than the pool elevation except when drawn down for management purposes. The normal pool elevation at Lock and Dam 25 is 434.0 NGVD. Water levels in the project area fluctuate frequently due to the water level management of Pool 25 and the proximity of the project area to the lock and dam. See an additional discussion of water level regulation under E. (3) Backwaters.

C. Geology and Soils.

(1) Geology. The Batchtown project area is part of the geologic area of Illinois known as the Upper Mississippi River and Illinois River Bottomlands Division. This division generally encompasses the Mississippi River and floodplain above its confluence with the Missouri River. The area immediately adjacent to the project area along the east side is part of the Middle Mississippi Border Division, a driftless area never covered by Pleistocene glaciation. Bedrock in the project area consists of limestone and sandstone associated with dolomite. Most of the bedrock in the project area is deeply covered by alluvial deposits.

(2) Soils. Information regarding the soils in the project area are taken from two sources: (Natural Resources Conservation Service (NRCS) - Soils Survey Calhoun County, Illinois and Soil Borings taken in June and July, 1991.

NRCS-Soil Survey. The Beaucoup-Tice Association consists of soils in the Mississippi River flood plain. This association is poorly drained to somewhat poorly drained, nearly level, silty soils formed in alluvium. This association covers the entire project area. The predominant soil types are: Beaucoup silty clay loam - wet, which is subject to annual flooding and ponding; Beaucoup silty clay loam, also subject to annual flooding and ponding but on slightly higher elevations; Sarpy sand, subject to frequent flooding and having little or no profile. All of these soils are listed as best used for management of wetland wildlife. These three soil types combined cover over 80 percent of the project area and are the primary soils in the lower, state-managed portion.

The Tice soils, which comprise the remainder of the project area, are somewhat poorly drained, located on slightly higher elevations, have high water tables, may be subject to flooding on an annual basis, but are suitable for cropland. Crops grown on these soils are generally soybeans or corn. The high water table generally precludes growing grasses or legumes unless internal drainage is improved. These soils are found in the northern part of the project area within the wildlife refuge.

Most of these soils are suitable for trees and much of the project area remains in woodlands. Cottonwood, black willow and silver maple are the predominant species in the project area. The wildlife refuge is protected to some degree by a low berm that allows for some water level fluctuation and management for moist soil plants in the middle management unit. The lower management unit and the state-managed area do not have levee protection and are difficult to manage for a specific purpose from one year to the next, depending upon the fluctuations of the river. Wetness is a severe limitation to the use of equipment, especially in the state-managed portion of the project area. An attempt is made each year that conditions are favorable to aerial seed some of the state-managed area with japanese millet as a food source for migratory birds, especially waterfowl. The results vary greatly, but good stands of millet have been established in some years.

The soils of the uplands adjacent to the project area and comprising the watershed, exclusive of the Mississippi River, are comprised of soils of the Seaton-Goss Association. These soils are well drained to moderately well drained, gently sloping to very steep, silty soils formed in loess or in loess over material weathered from limestone and occur on uplands. Slope ranges from 2 to 60 percent. Erosion is noted as a hazard in areas where these soils are used for corn, soybeans, or small grain. Conservation tillage that leaves crop residue upon the surface or one that incorporates the use of grasses and legumes is recommended as is the use of contour farming and terraces. The predominant soil types in this series are Seaton silt and Seaton silt loam and are characterized and differentiated by the percent of slope where they are located and by whether or not they are eroded. Depending upon the degree of slope these soils are suited for cultivated crops, pasture and hay. However, the greater the degree of slope, the greater the hazard of erosion. When slope exceeds 5 percent conservation tillage is recommended. Steeper slopes (greater than 18 percent) are well suited for use as woodland and habitat for woodland wildlife.

(3) Soil Borings. The foundation exploration program completed by the St. Louis District generally verifies the information presented by the NRCS soil surveys. The foundation stratigraphy consists of fine grained materials overlying a coarse-grained substratum. See Appendix F, Geotechnical Considerations, for additional details.

D. Water Quality. Sedimentation has the greatest impact of any water quality parameter on the Batchtown project area. Nearly all of the sloughs and backwater areas have become very shallow. Despite the decrease in depth, in most years, other water quality parameters such as dissolved oxygen remain at least at minimum levels to support aquatic life throughout the year. The nutrient enriched sediments can produce extensive aquatic vegetation beds in years when pool elevations remain fairly stable. When this occurs the area becomes even more important as a nursery area for fishes and a stopover for migratory birds. The shallow backwater areas frequently become ice and snow covered in winter and are important over-wintering areas for fish. However, oxygen depletion has caused fish kills in these areas in some winters with extended duration of ice cover. Water temperature and pH are generally conducive to the support of aquatic life. Water turbidity within the project area is comparable to other backwater areas in Pool 25 and is not felt to be a resource problem.

E. Habitat Types and Vegetation. The project area is in the alluvial floodplain of the Mississippi River, entirely within Illinois. The area in bounded on the east by limestone and sandstone bluffs, on the west by the Mississippi River, on the south by Lock and Dam No. 25, and on the north by the Mississippi River.

The project area was a mosaic of interspersed terrestrial and aquatic habitat types prior to settlement. Aquatic habitats were the main channel, side channels, islands, backwater lakes, sand and mud flats, chutes and backwaters. Bottomland forests were extensive and were the dominant vegetation, although wet prairies and marshes were present adjacent to the forests and wetlands. The Mississippi River flooded the area frequently, rejuvenating and creating wetlands and providing nutrients for terrestrial vegetation.

Prior to the construction of Lock and Dam No. 25 in the 1930's some of the land on the higher elevations had been cleared and was being farmed, and much of the area had been logged. Most of the project area was inundated upon completion of the lock and dam and the area became an important fishery, fish nursery area and mid-migration habitat for migratory birds and was important habitat for resident wildlife species. Post construction impacts have been severe, especially from sedimentation and water level fluctuations due to the operation of Lock and Dam No. 25. Nearly all of the project area has decreased in depth due to siltation, creating a flocculent bottom in areas unaffected by current for extended periods of time.

Frequent pool fluctuations due to the water level management of Pool 25 has inhibited the establishment of submerged aquatic vegetation beds in most years. The combined impact has severely degraded the fish and wildlife habitat quality of this important backwater area.

Currently, the project area consists of five major habitat types: 1) bottomland forest, 2) backwater lakes, 3) side channel, 4) backwater, and 5) cropland and moist soil management. Bottomland forest, backwaters, backwater lakes and moist soil habitats are considered wetlands because of the soils, plant species and hydrology that are present. All cropland within the project area has been classified as prior converted cropland by the NRCS, and is not considered wetland subject to Section 404 of the Clean Water Act. See Figure 3 for locations of land use and land cover.

(1) Bottomland Forest. This habitat type is defined as floodplain forest regularly inundated with floodwater resulting in unique species composition. Depending upon hydrology, species composition varies, and may include mast producing trees. Bottomland forest covers 989 acres of the project area and is present in all of the various management units (See Figure 3). Ground elevations within the forested area range from a high of approximately 440 feet NGVD at the upper (north) end of the project within the USFWS refuge to a low of approximately 435 feet NGVD toward the lower (south) end of the project area within the IDNR managed portion.

Silver maple and cottonwood are the dominant tree species in the bottomland forest.

Willow, green ash and sycamore are also common. Oaks and pecans occur on some of the higher elevations of the site. Natural regeneration within the forest is occurring at a low level overall, which allows for relatively weak subcanopy and understory components. Groundcover is comprised of a variety of herbaceous plants and grasses. Narrow bands of willow and silver maple surround the backwaters and side channels within the project area.

Logging and clearing had occurred in the Batchtown project area prior to the construction of Lock and Dam No. 25. Some of the cleared land was being farmed and several residences were present. The majority of the project area was inundated upon completion of the lock and dam, thus preventing the regeneration of much of the bottomland forest and the demise of many remaining trees. Consequently, the forest within the project area is relatively young, having grown upon the higher ground elevations since inundation and upon areas where siltation has provided suitable substrate. The larger trees are found on the northern end of the project area and immediately adjacent to the river and are predominantly silver maple and cottonwood. Preliminary field surveys conducted during the summer indicate that the flood of 1993 has had a major impact on the forest. Approximately 10 to 20 percent of the trees in the project area are estimated to have died as a result of the flood. Mortality is lowest near the river and higher inland. Tree species especially susceptible to the flood were hackberry, sugarberry, box elder and elm. The least affected species include silver maple, cottonwood, green ash, pecan and bur oak. Additional mortality may become apparent over the next several years, all related to the flood of 1993.

(2) Backwater Lakes. These lakes are water bodies that are only connected to the main channel during flood stage. Depth may vary but is generally equal to or greater than one meter at the deepest part of the basin. The Middle Pool of the Batchtown Unit of the USFWS refuge contains several sloughs which are not connected with the river at normal pool levels. There are approximately one-half dozen separate water bodies linked together by shallow water depressions or man-made ditches totaling approximately 425 acres, 13 acres of which is a moist soil management unit. Turner Island is within the state-managed portion of the project area, and has one backwater lake of approximately 22 acres that normally goes dry each summer. This lake is leveed-off at the downstream end, and in the fall, portable pumps are used to flood the lake for waterfowl management purposes. This generally occurs when portable pumps are needed elsewhere on the site due to a high pumping demand and insufficient pumping equipment. The normal water surface elevation in these lakes is about 435 feet NGVD with average water depths varying from one to three feet. The water elevation in these lakes decreases as summer progresses exposing mud flats. These backwater lakes are not directly connected to the river unless Pool 25 reaches an elevation of about 436 feet NGVD or higher. When this level is reached water backs into the lakes from the south across the middle refuge access road leading to the boat launch ramp at the river bank. The backwater lake on Turner Island is inundated at approximately the same elevation.

A variety of vegetative types occur in these backwater lakes during the warmer months. Species such as duckweed and watermeal are common as are creeping water primrose, cattail, arrowhead and lotus. Woody vegetation includes buttonbush and willow and silver maple that invade on the exposed mud flats. Pondweeds, such as curly-leaf pondweed, may also be present some years. However, the flood of 1993 had a dramatic affect on the occurrence of some species of aquatic vegetation and it may be several years before they are again present in abundance.

(3) Side Channels. These include all departures from the main channel in which there is inflow and outflow during normal river state. The 40's and the 70's side channels and their combined channel comprise the side channel habitat in the project area. These channels are so named because of the numbering of the duck blinds in or adjacent to these channels are in the 40's or 70's, respectively. The 70's channel is the smaller of the two, averaging about 60 feet wide and traversing the project area for about two miles before joining with the 40's channel to form one larger side channel (see Figure 2, Figure 15, and other figures). The 70's channel provides approximately 15 acres of side channel habitat. The 40's channel averages 100 feet wide and is about one and a half miles long, providing around 18 acres of side channel habitat. The two channels combine to form one larger channel that flows past Cockrell Hollow (See Figure 2) toward the dam. The larger channel is approximately 250 feet wide and nearly two miles long, providing around 61 acres of side channel habitat for a grand total of 93 acres of side channel habitat in the project area. The 40's and 70's channels are connected with the Mississippi River on their upper end. The lower end of the larger channel formed by the confluence of the two smaller channels is also connected to the river in the vicinity of the dam. The side channels vary in depth from two feet to a maximum of eight feet when the pool is at 434.0 feet NGVD. Although mostly devoid of aquatic vegetation, some habitat structure is provided by fallen trees and drift logs. All three of the channels support freshwater mussels from their upstream connection with the river to the downstream end near the dam. A moderate density bed is found beginning just west of Cockrell Hollow (See Figure 2) and extending downstream, nearly to the dam. A variety of other benthic organisms have also been found throughout this area. Flow velocity in these channels varies from 0 ft./sec. to over 2.5 ft./sec. when the pool is at maximum tilt.

(4) Backwaters. This habitat is considered as any area of water beyond the banks of the main channel that are typically connected during normal or high flows. There is a morass of interconnected ponds, old channels, herbaceous wetlands and bays present in the lower pool and the state fish and wildlife area totaling approximately 1600 acres. All are connected in some manner to the Mississippi River either directly or through one of the two side channels. These water areas provide excellent fish and wildlife habitat when water levels in Pool 25 are stable at or near pool level. The area is subject to a high degree of water level fluctuation because of the proximity to Lock and Dam No. 25 and the water management regime for the pool (known as hinge-point control).

The pool is regulated within the limits of 429.7 feet and 434.0 feet NGVD at Lock and Dam No. 25 (located at MRM 241.4), and within 434.0 and 435.75 feet NGVD at Mosier Landing (MRM 260.3, also known as the "hinge-point"). Plates 13 and 14 depict river stage information at Lock and Dam No. 25. A statistical mean of the pool elevation of every day from 1939 to 1992 is 433.05 feet NGVD.

When the flow rate of the Mississippi River exceeds 135,000 c.f.s., a nine foot channel--suitable for navigation--exists without the need for the dam, so at those flows the gates of the dam are lifted clear of the water and open river conditions prevail. The gates of the dam are lowered into the water at flow rates of less than 135,000 c.f.s. at the hinge-point, impeding flow and forming a pool that maintains the nine foot navigation channel. When flows are less than 70,000 c.f.s., the gates are maintained in their lowest position allowing maximum pooling and attempting to maintain a pool level of 434.0 feet NGVD at the dam. However, when the flow at Mosier Landing exceeds 70,000 c.f.s. the dam gates are raised to allow the pool to recede to accommodate the increased flow without exceeding the authorized limit at the hinge-point, thus allowing the water level at the dam to fall below 434.0 feet NGVD. When this occurs the pool is said to be in a "tilted" condition. When the flow rate reaches 95,000 c.f.s. at the hinge-point, the gates are raised to a higher level which still impedes flow, but allows the pool level at the dam to decrease to 429.7 feet NGVD. This would be a maximum tilted condition for the pool.

Minor pool fluctuations as a result of tilting pose little problem for fish and wildlife or recreational users of the backwaters. Maximum or near maximum tilted pool conditions, however, may pose significantly greater problems for fish and recreational users of these backwaters. When the pool is drawn down rapidly, recreational boaters may have difficulty returning to their launch area, the boat launch area is completely dry, side channel flows are greatly constricted, water is drawn out of aquatic vegetation and the backwaters are partially or completely drained. Hydrology data for the fifty year period from 1939 through 1988 indicates that there has been an average of 2.7 drawdown events each spring when water levels at the dam have been below 430.0 feet NGVD, or approximately four feet below normal pool.

These frequent and dramatic changes in water levels may have a detrimental effect on some fish species, especially when the drawdowns occur during the spawning and rearing life stages. Fish eggs and fry may be subjected to increased predation when protective vegetative cover is unavailable, are stranded or exposed when water levels decrease rapidly and may be drawn into the current and flushed down river when the pool is tilted in preparation for increased flow events. They also may be detrimental to other aquatic species both plant and animal throughout their life cycle.

Water level fluctuations may be a factor limiting the development of submerged aquatic vegetation in most years within the project area. Substantial beds of vegetation have developed in the backwaters in some years when water levels have been relatively stable during spring and early summer. Development of these beds and of extensive areas of emergent vegetation are beneficial for fish spawning, larval fish survival, survival of aquatic invertebrates and as food sources for birds and mammals. These water level fluctuations also occur during the late fall and winter in some years causing survival problems for wintering fishes and aquatic invertebrates and survival and foraging problems for aquatic mammals and migratory birds.

(5) <u>Cropland and Moist Soil Management Units</u>. There are a total of 224 acres of cropland in the project area (134 acres FWS Middle Unit, 80 acres FWS Lower Unit, 10 acres IDNR). The wildlife refuge is protected to some degree by a low berm that allows for some water level fluctuation and management for moist soil plants in the middle management unit.

Batchtown Area

1989 Land Cover/ Land Use

- Open water
- Submergents
- Sub/Rooted Floating
- Sub/Rooted/Emerg
- Rooted Floating
- Rooted Floating/Emerg
- Emergents
- Emerg/Grass/Forbs
- Grass & Forbs
- Trees & Shrubs
- Agriculture
- Urban/Developed
- Sand/Mud

Acreage Report

Agriculture	466
Emergents	252
Emerg/Grass/Forbs	34
Grass & Forbs	21
Open Water	1,320
Rooted Floating	11
Rooted Floating/Emerg	43
Sand/Mud	8
Sub/Rooted Floating	85
Submergents	719
Urban/Developed	7
Trees & Shrubs	1,261
Total	4,226

Data Source:

The 1989 land cover/land use coverage was created from 1:15,000 color infrared aerial photography using a genus-level classification scheme and minumum mapping unit of <1 acre, 10% vegetation cover.

Cartographer: Kristen McDaniel

Nov. 1994

U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
BATCHTOWN
HABITAT REHABILITATION AND
ENHANCEMENT PROJECT
1989 LAND COVER / LAND USE

FIGURE 3

F. Management. Current USFWS and IDNR management operations at the project area are targeted primarily at the production of food plants beneficial to migratory birds, especially waterfowl.

The USFWS Middle Pool is the only area with sufficient existing water level management capability to produce moist soil plants by water level manipulation on an annual basis. Such management strives for stable water levels during the fall and winter. This condition benefits fish, and with a slight drawdown during spring migration, and a gradual drawdown beginning in mid-June and continuing through July stimulates the establishment of moist soil plants. Once the plants are established water levels are raised gradually over a period of weeks until they return to normal pool level, having inundated the plants produced and making the seed available to migratory birds.

The USFWS Lower Pool and the state-managed areas of Batchtown do not have a perimeter berm nor water control structures to allow for water manipulation. Consequently, they are affected by the water level management for Pool 25 which is frequently inconsistent with water level regimes for moist soil plant production. Millet is aerially sown on the Batchtown and Turner Island portions of the project area when conditions for plant establishment are present. Annual attempts to establish millet is only marginally successful.

G. Animals. Terpening et al. (1975) reported the occurrence or suspected occurrence of 416 species of birds, mammals and amphibians and reptiles in floodplain habitats of Pools 24, 25 and 26 of the upper Mississippi and lower Illinois Rivers.

(1) Birds. About 285 species of birds are known to use or probably use floodplain habitats of Pools 24-26 (Terpening et al. 1975). The most diverse orders are the perching or song birds, shorebirds and gulls, waterfowl, herons and egrets, and vultures and hawks. The Mississippi River and floodplain is the center of one of the major flight corridors in North America for migrating waterfowl. This mid-migration habitat is recognized in the North American Waterfowl Management Plan as a habitat of major concern. About 20 species of ducks and geese stop during fall and spring migrations to rest, feed and seek sanctuary in wetlands and deepwater habitats of Pools 25 and 26 and adjacent floodplain (Havera 1985). The mallard is the most abundant duck, with the wood duck a close second. The project area is important for wood duck nesting and brooding. Several large heron and egret rookeries are located within a short distance from the project area, and it provides important foraging habitat for these species. The most common game birds, in addition to waterfowl, are the wild turkey, mourning dove, bobwhite quail, American woodcock and crow.

(2) Mammals. Approximately 50 species of mammals inhabit or are expected to inhabit the project area (Terpening et al. 1975). Common species include opossum, raccoon, muskrat, mink, fox, beaver, squirrel, cottontail, white-tailed deer and a variety of bats and mice.

(3) Amphibians and Reptiles. Approximately 75 species of amphibians and reptiles have distribution that currently or historically include the project area (Terpening et al. 1975). The Batchtown project area and vicinity is used by a variety of turtles, snakes, skinks, frogs and toads.

(4) Fish. A diverse fish fauna comprised of 107 species in 28 families is found in Pools 24, 25 and 26 of the Upper Mississippi and lower Illinois Rivers (Colbert et al. 1975; Sheehan et al. 1990). The five most diverse families are minnows (30 species), suckers (16 species), sunfishes (13 species), perches and darters (11 species) and catfishes and bullhead (9 species). Many of these fishes prefer to spawn in backwater or side channel habitats where the current is slow and bottom is muddy or silty. Sunfishes generally prefer to spawn in the backwaters and to use these areas as general habitat. Batchtown has an abundance of backwaters and two side channels and, consequently, is regarded as good spawning habitat when water levels are at or near pool elevation. However, when the pool is "tilted" during the spawning season, spawning may be delayed or interrupted and may not be possible in much of the area if the drawdown is of long duration. The interior backwaters within the project area also serve as spawning habitat as does the adjacent main channel, main channel border.

Some species of fish, such as channel catfish and largemouth bass, are unable to tolerate the cold water temperatures and currents of channel habitats. This is especially true of young-of-the-year fish of these species and is true to some degree for young-of-the-year fishes of nearly all species that inhabit the river (Sheehan et al. 1990). Backwaters provide a refuge from harsh winter conditions for wintering fishes because they generally have warmer water and little or no current. The project area is well known as a winter fish refuge, especially the areas known as "Big Hole" and "Little Hole" (Sheehan et al. 1990). Both of these areas are found within the lower unit of the wildlife refuge, with access from the IDNR managed portion of the project area when the pool is at or near normal pool level. The remaining backwater areas of the project are also thought to be important fish wintering areas. Wintering conditions for fish can deteriorate rapidly if the pool is tilted, which occasionally occurs, or if ice and snow cover is of long duration. Oxygen depletion fish mortality has occurred in these backwaters in some years.

The most important commercial fish species of Pools 24, 25 and 26 are carp, buffalo, freshwater drum and catfish (St. Louis District 1988; UMRCC 1989,1990,1991). Commercial fishing occurs in the main channel border area and throughout the backwaters and side channels of the project area, except for the middle unit of the wildlife refuge. Important sport fishes of the Upper Mississippi River include all members of the sunfish family as well as white bass, freshwater drum, sauger, channel catfish, yellow perch, walleye and bullhead (St. Louis District 1988). The Batchtown project area is a popular area for sport fishing because of the presence of sought after species such as largemouth bass, crappie and channel catfish. Access may be restricted if the pool elevation is lowered under the existing water level management plan.

(5) Freshwater Mussels. A mussel bed is located within the project area from a point just west of Cockrell Hollow (See Figure 2) downstream, nearly to Lock and Dam 25 in the larger side channel formed by the 40's and 70's side channels. Sampling by brail and SCUBA in 1991 yielded eleven species, predominantly threeridge (Amblema plicata), threehorn (Obliquaria reflexa) and mapleleaf (Quadrula quadrula). No threatened or endangered species were collected during the sampling effort (Atwood 1991, unpublished data). The bed had been heavily harvested by commercial mussel fisherman until 1991 when it was declared a mussel sanctuary by the Illinois Department of Natural Resources. Mussels were also found upstream of the bed in the 40's and 70's side channels, although densities were not as high and locations of the collections were not precise (Atwood 1991, unpublished data). The zebra mussel, a non-native species from Europe, has been unintentionally introduced into Pools 24-26. There is concern that the zebra mussel, a species that attaches itself to any hard substrate, could have a devastating impact on native mussel populations. Studies are currently underway to determine impacts on native species and their habitats. Another non-native mussel, the Asian clam, has been present for several years.

(6) Other Animals. Insects and other invertebrates are common and comprise an important component in the diet of fish and wildlife that use the project area.

H. Threatened and Endangered Species. One endangered and two threatened species are known to inhabit the project area. The endangered species is the Indiana Bat (Myotis sodalis). Threatened species are the Bald Eagle (Haliaeetus leucocephalus) and the Decurrent False Aster (Boltonia decurrens). These Federally threatened and endangered species are addressed in Appendix H. It is the St. Louis District's perspective that the habitat enhancement of Batchtown site would have no effect on Federally endangered species or their critical habitat.

The Illinois Endangered Species Protection Board has listed several species at the state level as either threatened or endangered with recent (Since 1980) or historical (Before 1980) distributions that may include the project area (Herkert 1992). Those that may currently inhabit the project vicinity include the spectaclecase mussel (Cumberlandia monodonta), which prefers sand or gravel substrates in medium to large rivers having fairly good current; the lake sturgeon (Acipenser fulvescens), which prefers lake or large river bottoms 4-9 meters deep over sand, gravel or mud substrates; the western sand darter (Ammocrypta clara), is restricted to sandy runs of medium to large rivers and is intolerant of excessive siltation and turbidity; the river otter (Lutra canadensis), which prefers waterways isolated from large river channels, riparian habitat with extensive woodlands, open water in winter and good water quality; the bobcat (Lynx rufus), which can inhabit a variety of habitats, such as heavily wooded areas, brushy hollows and timbered swamps; and the great egret (Casmerodius albus), which prefers rookeries often shared with great blue or other herons and forages in floodplain lagoons of large rivers. State listed species having historic occurrence in the vicinity of the project area include: the elephant ear (Elliptio crassidens), Higgin's Eye (Lampsilis higginsi), fat pocketbook (Potamilus capay) and pondhorn (Uniomerus tetralasmus) mussels; and the little blue (Egretta caerulea) and black-crowned night herons (Nycticorax nycticorax).

I. Recreation / Aesthetic Resources. Recreational uses of the Batchtown project area include sport fishing, hunting, recreational boating, bird watching and picnicking. The present facilities include two boat ramps and parking lots and a wildlife viewing platform. No facilities exist for camping.

The project area is surrounded by agricultural lands and wooded, limestone bluffs. Bottomland forest exists on the higher elevation land that has not been cleared. Most of the area is open water or non-forested wetlands. The area is attractive for fishing and is heavily hunted for waterfowl in the fall, except for the refuge.

State hunting and fishing regulations generally apply and there are regulations regarding the building and hunting of the approximately 90 duck blinds on the state-managed portion of the area. A three year blind allocation period is currently allowed with staked blind sites distributed by a drawing. Blind builders and their partners must build, brush and maintain the blind and boat hide for a period of three years or forfeit their right to that blind. Blind occupancy is regulated through a check station with unclaimed blinds being offered to the hunting public if the blind builders or partners do not check in by the specified time.

J. Socioeconomic Resources. The project area is approximately two miles west of Batchtown, Illinois (population 254 in 1990 census), and about ten miles southwest of Hardin, Illinois (population 5189 in the 1990 census), the county seat of Calhoun County, Illinois. The closest major metropolitan area is St. Louis, Missouri, which is approximately 40 miles southeast of the project area. The immediate surrounding area is woodlands, cultivated fields and pasture with a few homesteads.

The local economy is based upon agricultural activities such as row crops, livestock and orchards. There are not any residences within the project area, but some are present adjacent to the east boundary on private property. There are also a few cottages and travel trailers used primarily in summer and on weekends along the road to Cockrell Hollow Access Area.

K. Cultural Resources. Little systematic archaeological work had been conducted within the project area prior to this HREP study. Only three small scale investigations, including a literature search for the entire project area, had been carried out. Only one prehistoric site, now inundated, had been formally recorded, although the presence of several historic sites had been noted. More archaeological sites have been recorded from the valleys near the bluff line to the east, including the well known Middle Woodland Snyders Mound and Village site.

A Phase I archaeological and geomorphological investigation of the 121 terrestrial acres to be impacted by the project construction, as then envisioned, was conducted in June, 1994 by American Resources Group, Ltd., Carbondale, Illinois (Titus et al. 1995). The geomorphological investigation indicated that the northwestern and southwestern portions of the HREP were relatively recent landforms which were judged to have little or no potential for containing cultural deposits. Also, the geomorphological investigation indicated that much of the HREP was covered by thick (about 3 feet) of historic alluvium, which is deeper than most construction impacts. However, the central portion of the project area had older landforms with shallow historic alluvium where several surface archaeological sites were found during the survey. The older land forms also have the potential to contain buried sites.

Seven archaeological sites were recorded during the field survey, including three prehistoric sites (11-C-206, 11-C-208, 11-C-209), three historic sites (11-C-205, 11-C-207, 11-C-211) and one site containing both prehistoric and historic components (11-C-210). Four sites (11-C-207, 11-C-208, 11-C-209, 11-C-210) were evaluated as potentially eligible for listing on the National Register of Historic Places. The Illinois State Historic Preservation Officer (ISHPO) concurred with this determination in their letter dated July 19, 1995. Present plans will avoid all four potentially eligible sites. However, should plans change so that any of the eligible sites will be impacted, Phase II testing to determine eligibility will be conducted.

Since the field survey was conducted, some project elements have been added or deleted. The new elements, including the lowland sediment traps, disposal area, and new borrow areas, will require Phase I survey if they are on landforms where sites may occur.

L. Air Quality and Noise. There are no major sources of pollutant emissions or noise in the vicinity of the project area. Because of its low pollution potential, this area is not actively monitored. Most of the air pollutants in the area consist of suspended particles from agricultural activities and navigation operations. Noise levels in the project area would stem from these same two sources. The existing air quality and noise conditions are expected to continue into the future if the project is not implemented.

3. FUTURE WITHOUT PROJECT CONDITIONS.

A number of assumptions were made as to what the project area and vicinity would be like 50 years in the future without a habitat rehabilitation and enhancement project. The primary assumption was that Pool 25 would continue to be managed much as it is now for fish, wildlife and navigation, and that there would be little or no change in the normal pool elevations or their frequency of fluctuations. These assumptions were discussed by both the wildlife habitat appraisal guide (WHAG) and aquatic habitat appraisal guide (AHAG) teams during the WHAG and AHAG analyses and there was consensus that there would be little, if any, change in management, unless ongoing efforts to change the water level management scheme for Pool 25 are successful. Both teams also agreed that surrounding land use was unlikely to change, remaining predominantly agricultural with perhaps some increase in tourism because of some of the unique aspects of Calhoun County, such as the presence of peach and apple orchards and the season markets for these and other kinds of produce. Little change in the floodplain use was anticipated. The following additional assumptions were made that relate directly to site habitat conditions.

- Wetland habitat in the project area is rapidly being degraded due to siltation. There will be a 50% loss of water surface area and depth in the USFWS Middle Pool over the next 50 years without the project. A 65% decrease in surface area and water depth will occur in the IDNR managed area and the USFWS Lower Pool. The difference in siltation rates is due primarily to the existing low berm around the USFWS Middle Pool and the lack of a similar structure around the remainder of the project area and is based upon flooding frequency. The result will be a transitional habitat situation that is changing from wetlands to bottomland forest, the initial phase of which will be a softwood monoculture of predominantly willow and soft maple having minimal wildlife habitat value.

- Bottomland forest habitat in the project area will be an ever increasing habitat type without the project. The existing habitat will age and provide greater benefits to wildlife than at the present time. There will be conversion of wetlands to bottomland forest as a result of the continuing siltation. Initially this will be predominantly willow and silver maple of little wildlife habitat value, but as these stands age their wildlife habitat value will increase for forest dwelling species. Species such as oak and pecan will began to establish themselves on the higher ridges, although it may take nearly a century before hardwoods become the climax vegetation. The flood of 1993 resulted in the loss of approximately 15-20 percent of the bottomland forest within the project area. Primary species affected were hackberry and sugarberry. Some loss of silver maple occurred as a result of their being overtopped by the flood. These impacts will be seen immediately in the loss of tree species diversity and over the short term as invading species such as willow and silver maple occupy the now unshaded area. As much as 50 to 100 years may be required before the forest recovers totally from the flood impacts.

- The 40's and 70's side channels will both close, beginning at the upper ends, thus ending the flow of water through the project area. This closure will likely be the result of drift material blocking the shallow entrances of these channels allowing siltation to occur. This will have a dramatic impact on the side channel adjacent to Cockrell Hollow, allowing for increased siltation and likely causing the demise of the state mussel sanctuary. Siltation throughout the project area will increase when these channels close causing the loss of fish access to deep water wintering areas. There will be a concurrent loss of habitat diversity as the siltation becomes more prevalent. The impact will be greatest in the upper end of the project area because water level fluctuations as a result of pool management are not as severe and water velocities are generally much lower.

- Backwater and backwater lake habitat within the project area will continue to degrade, primarily as a result of siltation, and habitat quantity and quality for aquatic species will decrease. The flocculent substrate that is already present in some of the backwater habitat will become more prevalent and throughout the area, and that coupled with the unstable water levels will not be conducive to the rooting of aquatic plants. Consequently, aquatic plants will continue to be absent within the project area except for isolated spots or during years of unusually stable water levels. The water will be warmer in summer and more prone to freezing or oxygen depletion in winter as the backwaters become shallower. The likelihood of winter and/or summer fish kills will increase.

Overall, water and wetland depth and surface area are expected to decrease by 50 to 65 percent in the future without condition. These changes will have a substantial impact on all fish and wildlife species that use the area resulting in decreased habitat quality and species diversity. Recreational use of the area will decline as access to the project area becomes restricted and fish and wildlife use decreases.

4. RESOURCE PROBLEMS AND OPPORTUNITIES.

Existing problems, and problems that will occur in the future-without-project condition in the project area have been documented in the literature and have been further defined by the interagency planning team. The problems are summarized below in terms of specific physical effects on the local biological resources.

A. High Rates of Sedimentation. Lee (1978) concluded that the Batchtown Wildlife Management Area, that portion of the project area that is managed by IDNR, has been subjected to a net average annual silt deposition of 133 acre feet or 0.8 inches. Some parts of the area had accumulated nearly seven feet of silt during the period from 1932 to 1973. Deposition of silt in the project area has continued at a high rate and has further degraded the quality of the fish and wildlife habitat.

The detrimental effects of high sedimentation rates on backwater and side channel habitats are of major concern to resource managers. Water depths decrease as bottom elevations are raised by sedimentation. These aquatic areas, over time, may become filled with sediment and undergo a gradual conversion to forested terrestrial habitat. There is a net loss in area of these types of habitats in the absence of new side channels and backwaters being created simultaneously.

Further declines in the quality of aquatic habitat may occur as a result of a variety of secondary effects. Areas that become too shallow under no flow conditions may experience winter and/or summer fish mortality due to oxygen depletion. Increased turbidity levels frequently accompany sedimentation and may block the passage of sunlight for photosynthesis, thus limiting or eliminating aquatic plant communities. Bottom materials may also be too soft for aquatic plants to produce successful root systems. Loss or severe restriction of the aquatic plant community results in a decline in aquatic invertebrates, a decline in fish spawning habitat and protective cover for fry and a loss in food sources for aquatic vertebrates such as waterfowl and wading birds. Sediment can also smother the eggs of fish species that spawn on silty or muddy substrates, further inhibiting reproduction.

Reductions in surface area and depth of aquatic habitats in the Batchtown project area due to siltation have been severe since construction of Lock and Dam 25 in the late 1930's. The source of the sediment is primarily from the river (approximately 85%), although adjacent agricultural land has been found to be a significant contributor (approximately 15%). Further degradation of this habitat has occurred in some parts of the area because of proximity to the dam and the impact of Pool 25 water management regimes causing frequent, rapid and severe (greater than three feet) water level fluctuations.

(1) Sedimentation in Side Channels. The lower portion of the Batchtown project area has two side channels that connect to the river, flow in a southeasterly direction, and combine to form one larger side channel that flows south toward the dam (Figure 2). The biggest threat to these channels is at the upper ends where they connect to the river.

The 70's channel (northern most channel) is extremely narrow near the river connection and also very shallow due to the deposition of silt and sand by the river. One medium sized tree perpendicular across this channel would be sufficient to reduce flows to a level that would allow silt deposition to block this channel, interrupting the flow of water except at higher river levels. This channel has been reduced in width and depth over time due to siltation, but still has depths of four to seven feet at normal pool. This is two to five greater depth than what is found at the entrance of this sidechannel where it connects with the main channel of the river. The bottom of the channel is firm and comprised predominantly of sand.

The 40's channel (the southernmost channel) is at least twice the width of the 70's channel but similar in depth and substrate. Near the connection with the main channel the water depth is less than three feet and an island has formed in the middle of the channel due to deposition of river-borne material. Silt deposition has caused this channel to narrow and become more shallow, although it still carries a significant flow. Flows through both channels are much greater when the pool is "on tilt" which allows the channels to cleanse themselves, somewhat, of silt that may have been deposited during lower flows.

The larger side channel formed by the confluence of the 40's and 70's channels is much wider than either of the feeder channels and has a depth of five to seven feet in the area where the flow is concentrated when Pool 25 is "on tilt". The bottom in this area is firm and comprised of silt, sand, clay and some rubble near the stream mouths from the adjacent bluff area. A variety of benthic organisms have been found on these substrates, including a mussel bed of moderate size and density. Silt deposition has occurred along the margin of this channel and in other areas not affected by the current when the pool is lowered for upcoming flood events. Some of these areas have become terrestrial and support stands of grass and invading willow and soft maple. The increase in size of these terrestrial areas has reduced the width and overall depth of this channel over time due to the deposition of silt.

The effects of future sedimentation on the quantity and quality of side channel habitat will be severe. Both the 40's and 70's channels are expected to close at the upper end within the next 50 years, eliminating the flow of water through the larger channel and over the mussel bed. The total effect of a lack of water flow and continued siltation will eliminate this habitat type from the project area during normal and near normal water stages.

(2) Sedimentation in Backwaters and Backwater Lakes. The majority of aquatic habitat within the project area is slough or backwater that is directly affected by the water levels at Lock and Dam 25. All of the aquatic habitat in the state-managed portion of the project, and in the USFWS lower management unit fluctuates with the navigation pool water levels. The backwater lake in the USFWS middle management unit is not contiguous with the river at normal pool levels (at least since the 1970's) and, consequently, is manageable. To a varying extent, all of these areas have been severely impacted by siltation since construction of the lock and dam.

Within the USFWS middle management unit the maximum depth of the aquatic habitat is just over three feet. This depth occurs at the water control structure at the upper end of the slough. The majority of this unit cannot be dewatered resulting in an unconsolidated, flocculent substrate that is not conducive to the growth of aquatic vegetation. The perimeter of the backwater lake has a consolidated substrate due to annual water level fluctuations to stimulate the development of moist soil plants for migratory birds. The predominant vegetation in the perimeter area is creeping waterprimrose (Jussiaea repens), a species that provides little benefit to fish and wildlife. The predominance of this species may be changed in areas where the shoreline is deepened and in areas where water control is improved.

The state-managed portion of the project and the lower unit of the USFWS refuge have been the most severely impacted by sedimentation because they are directly connected with the river and have no berm protection. Evidence of sedimentation impacts on the backwaters can be found at virtually any location an observer wishes to look. The most frequently observed problem is the raising of the substrate throughout the project area and the accumulation of sediments above the water level that have been rapidly occupied by grasses and invading willow and silver maple trees. Most of the substrate is comprised of soft sediments that have not been conducive to the growth of emergent or submergent vegetation or the proliferation of benthic organisms. These soft substrates are frequently flocculent and of little use for fish spawning. Light penetration for photosynthesis may be impacted because of suspended particles in the water. The quality of the habitat for fish and wildlife has declined as a result of the annual sediment load and the cumulative effects. Backwater habitats are expected to decline 65 percent in surface area and depth over the next 50 years with a concurrent decline in surface area of somewhat lesser magnitude.

B. Fluctuating Water Levels. Water level fluctuations for pool water management are a frequent occurrence in the portion of the project area not protected by a berm. One effect is a rapid dewatering of approximately 50 percent of the aquatic habitat not protected by berm and the subsequent displacement of the aquatic organisms. Benthic organisms are generally not found in the area affected by the pool drawdown because the water level may be down for days allowing the substrate to become dry. Vegetation, usually does not occur in this same area for the same reason. However, in years when the pool has been relatively stable dense beds of submergent vegetation have been present.

The effect of these rapid drawdowns on fish spawning and rearing may be severe depending upon when the events occur. Hydrologic records for Pool 25 indicate that most of these events occur in the spring and early summer when flooding is most prevalent. Spring and early summer is also the time when many fish species spawn. When the two events coincide, eggs may be stranded, fry displaced from protective vegetation and made vulnerable to increased predation and eggs, fry and fingerlings may be drawn into the current and flushed down the river.

C. Insufficient Deep Water During Winter. One impact of the deposition of sediments into the Batchtown project area has been a decline in the amount of deep water habitat available to overwintering fish. There are only a few areas where the water depth would meet the seven feet minimum depth that IDNR feels is necessary to safely overwinter fish without a danger of oxygen depletion and the subsequent loss of fish life. The area known as "Big Hole" within the USFWS lower management area has been documented as an important wintering area for fish in Pool 25 (Sheehan, 1990). The area having a depth of seven feet is very small, probably less than 0.1 acres, and is continually being reduced in size due to sedimentation. The other areas are found in the 70's and 40's channels where current is present throughout the winter. Adult and sub-adult fish may winter here, but flowing water is not considered good habitat for overwintering fingerlings (Sheehan, 1990). The remainder of the project area has become to shallow to ensure that fish can overwinter without the danger of oxygen depletion. Fish kills have occurred in past years when the duration of ice and snow cover was prolonged.

D. Limited Water Control Capability Throughout the Project Area. The potential for optimum habitat management for fish and wildlife is limited by the inability of managers to control water levels. The area is mostly unprotected from flooding and/or loss of water due to pool management, there is an inability to dewater when the river is high in the USFWS middle management unit, there is also a sediment choked water distribution system in this unit as well as insufficient depth to overwinter fish, there is no dedicated pumping equipment for Turner Island, fish access to overwintering areas is becoming limited or is non-existent under certain water levels and there are an insufficient number of water control structures.

The fluctuation of water levels in all of the project area except the USFWS middle management unit is a detriment to the production of moist soil plants and submergent vegetation in most years. Germination and growth of moist soil plants requires a gradual drawdown during the late spring or summer with the capability to keep water off until the plants are large enough to stand flooding. Submersed aquatic vegetation requires stable water levels and a consolidated substrate for plants to germinate and take root and most must remain covered with water to survive. The fluctuating water levels either dry plant production areas too much, or flood them when plants are immature and prone to drowning. A drawdown to consolidate flocculent substrates and encourage submergent vegetation growth is not possible.

(1) Inability to Dewater when the River is High. At the present time the USFWS middle management unit is drained by gravity flow. When Pool 25 has an elevation at or above that of the middle unit, drainage is not possible. This problem is further compounded by the unit being sediment choked and without a positive drainage system.

(2) Lack of Dedicated Pumping Equipment. Portable pumping equipment is used to fill the waterfowl management area on Turner Island. This equipment must be shared with other IDNR sites and may not always be available or availability may be untimely. Inefficient management results in many years, limiting food plant production for waterfowl and reflooding capability later in the summer to allow waterfowl use of the food

produced. Hunter access may also be impaired due to insufficient water depth.

(3) Insufficient Water Depth to Overwinter Fish. Water depth in the USFWS middle management unit barely exceeds three feet and as such is insufficient to overwinter fish most years.

(4) Access to Areas Where Fish Can Overwinter is Impaired. Fish access to the "Big Hole" area has been impaired by the deposition of sediment in the sloughs leading to the overwintering area. Access is currently through a narrow channel at normal pool that is maintained by waterfowl hunters and fisherman that use the area. Once boat access is no longer possible the channel is expected to rapidly fill with silt.

(5) Insufficient Number of Water Control Structures. There is only one water control structure in the USFWS middle management unit and one in the lower unit. Water level in the navigation pool must be at or below normal before these structures are fully functional in allowing both water inflow and outflow.

E. Loss of Wetlands. There has been a dramatic decline in wetland areas over the last century both nationally and at the local level. When Illinois was first settled there were 8.2 million acres of wetlands or 23 percent of the total area of the state. Today, wetlands comprise only 3 percent of the state. Many of these remaining wetlands are associated with the Upper Mississippi River and have declined in quality due to the deposition of sediments carried by this large river system. Marsh habitats, such as those found in the Batchtown project area, have been impacted the most. Many of these marsh habitats are undergoing a change from non-forested wetlands to forested wetlands due to accretion of sediments and the invasion by species such as willow, silver maple and cottonwood.

F. Decline in Quality of the Bottomland Forest in the Project Area. The flood of 1993 had a significant impact on the quality of the bottomland forest in the project area. Estimates of tree mortality run as high as 30 percent in some parts of the project area and certain species, such as hackberry, may have been nearly eliminated. Recovery of the forest will be slow without a forest management plan.

5. PROJECT GOAL AND OBJECTIVES.

The management goal for this HREP study is to rehabilitate the area's riverine habitat diversity to benefit fish, wildlife and freshwater mussels. The project goal and objectives were reached through participation of an interagency planning team comprised of the Illinois Department of Natural Resources, the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, the Illinois Natural History Survey and the Fisheries and Wildlife Laboratories at Southern Illinois University-Carbondale. These participants identified the following project objectives to address the problems in the study area:

Table 1. Project Objectives.

Project Objectives
Increase diversity of wetland types within the project area.
Create a water-level management capability that is independent of water levels in Pool 25.
Reduce the rate of siltation throughout the project area.
Improve habitat quality and quantity of bottomland forest within the project area.
Improve spawning habitat for riverine fishes.
Improve overwintering habitat for fish in side channels and backwaters.
Improve side channel habitat by preventing river-borne sediment from filling the side channels.
Ensure adequate long-term water flow over the freshwater mussel beds.

6. PLANNING CONSTRAINTS.

There are constraints that limit the type of potential solutions that can be developed for study, or that direct the study toward certain recommendations.

An overall constraint is that to some extent recommendations must be made without having all of the scientific data that might optimally be desired. EMP funding is not sufficient to fund an exhausting analysis of all HREP sites. The EMP is experimental in nature, and therefore allowances are made for recommending and implementing measures that may be promising but as yet unproven in their effectiveness.

This report--specifically the plan formulation process and its recommendations--must be reviewed and approved by appropriate elements within the St. Louis District, the Lower Mississippi Valley Division, the North Central Division, and Headquarters, U.S. Army Corps of Engineers. The recommendations must also be acceptable to the local sponsors: the Illinois Department of Natural Resources and the U.S. Fish and Wildlife Service.

Due to government-wide budget constraints, the study has an overall bias towards measures that have low initial costs, that are simple to construct, and that have low operation, maintenance, and rehabilitation costs.

A long-standing Army policy toward the EMP was to not acquire additional non-Federal land for recommended HREP projects. This policy was reassessed by Headquarters, U.S. Army Corps of Engineers, and in November 1994 authority was granted to acquire property when certain conditions were met. With respect to Batchtown, it was a working assumption by the team planners and formulators that habitat measures would be located using primarily existing Federally-owned land, and that for the most part it was unnecessary to acquire property. The only exceptions being that one of the two proposed lowland sediment traps would require the acquisition of a sliver of adjoining property.

An Army policy toward the EMP has been to not recommend upland or hillside sediment control measures to be funded by the Corps when they are found to be in the purview of the mission of another agency. However, language included in the Energy and Water Development Appropriations Bill of 1996 expects the U.S. Army Corps of Engineers--within available funds--to implement a hillside erosion component as part of this project.

The report recommendations must be compatible with navigational and operational requirements on the Mississippi River, and specifically must not interfere with or endanger the stability or the operation of Lock and Dam No. 25.

7. ALTERNATIVE FORMULATION AND EVALUATION.

The approach to the formulation and evaluation of a recommended plan was as follows:

First, project objectives and plan formulation and evaluation criteria were established. The project objectives are discussed in Chapter 5. The formulation and evaluation criteria are acceptability, engineering effectiveness, completeness, and cost effectiveness. These criteria are discussed in Table 3, Chapter 8.

Second, various habitat restoration measures were identified. Table 2 shows how the available measures address the specific project objectives.

Third, concept plans were developed by utilizing various combinations of the more viable measures to offer different alternative plans to address all of the project objectives. The concept plans were evaluated using the criteria listed in Table 3.

Fourth, the most favorable concept plan was further evaluated by a cost effectiveness and incremental cost analyses process termed the: "Nine easy steps."

Throughout the development of measures or concept plans, the planning constraints were observed.

The principal purpose of plan formulation is to develop a plan that would provide the best use, or combination of uses, of water and land resources to meet the project objectives. Much discussion by the project participants and design effort centered on achieving the desired project objectives with the lowest first costs and with minimal operation and maintenance requirements. Efforts were made to find the best compromises to the sometimes conflicting objectives or perspectives of the interagency planning team members.

A. Measures Available. Measures considered available as components of concept plans to meet the objectives were:

No Action: This measure would consist of no Federal funds being provided to meet the project purposes.

Dredging: Dredging can either be mechanical or hydraulic and can entail large scale excavations or more selective, smaller scale excavations. Dredging can be used to deepen project area wetlands damaged by siltation. Channels clogged by siltation can be cleared by dredging thereby increasing their flow capacity. Backwater areas can be deepened by dredging to provide sufficient depth for over-winter fish habitat.

Dikes: A dike is a rock structure used to control or influence water flows, such as for deflecting highly sediment-laden waters. Rock dikes are typically constructed of A-stone (1000# topsize) and can be capped with smaller stone to provide safer pedestrian and vehicle accessibility. A rock dike would be placed in open water at the head of the island, in an alignment and at such a height, to deflect the sediment laden waters from the project area. At the same time, the rock dike would provide an important sheltered off-channel water habitat for use by slackwater fishes.

Off-bankline revetment: These structures are built of grade "A" stone and placed about 50 to 100 feet out from, and parallel to, the natural bankline. The top of these structures are about 0.5 meters above normal pool elevation. They would be tied in to the bank and closed off at the upstream end. At selected locations 50 to 100 feet gaps would be left to allow fish passage and the exchange of water. The quiet backwater created behind these structures can create fish nursery and spawning areas, and overwintering habitat. Off-bankline revetment is a highly-rated "avoid and minimize" measure recommended by the approved St. Louis District design memorandum published on October 1992 entitled "Design Memorandum No. 24, Avoid and Minimize Measures, Melvin Price Locks and Dam, Mississippi River - Missouri and Illinois."

Berms: This measure entails the use of low earthen levees or berms to achieve water and sediment intrusion protection from the more frequent floods (less than 2 year low stage flood events). See Appendix A, Plate 17--Percent Reduction of River-borne Sediment by Berm Height--for a relationship between berm height and recurrence interval and sediment reduction. See Appendix A, Plate 12 for typical berm sections.

Lowland sediment traps: These are low earthen levees or berms designed to intercept sediment-laden runoff from upland watersheds. The intention is to locate these sediment traps within the Federally-owned property, and contain most if not all of the ponding area and trapped sediment within the Federally-owned property while keeping the sediment out of aquatic habitat. Additionally, the alignment and height of these sediment traps is highly dependent upon the location and presence of property lines, stands of timber, and channels or sloughs.

Upland or hillside sediment control measures and structures: This measure is actually a comprehensive plan or amalgamation of cultural and structural practices to effectively address sheet, rill, ephemeral, and gully and streambank erosion. The NRCS routinely employs combinations of cultural and structural practices as the result of recommendations made in their Resource Plans developed for problem areas. See Appendix O for a draft sediment control plan and for a listing of cultural practices and methods commonly used.

Water control structures: From experience with other habitat rehabilitation projects, the recommended structure is a corrugated metal pipe (CMP) with flared-end sections, and a vertical sluice gate located near the crown of the berm. See Appendix A, Plate 8.

Fish passage and water control structures: An effective measure to allow both fish passage and water passage through a berm has been stop-log structures. These structures allow for water level management of compartmented areas, and provide for flowing water through the areas. Stop-log structures would be constructed similar to open-topped concrete box culverts. They would be constructed in one or multiple standard 8-ft. widths, and would possess wooden, plastic, or aluminum stop-logs that would stack up in a groove in the "box culvert" walls (however, aluminum is cost prohibitive). These structures would be also useful for allowing boat passage through the berm. The St. Louis District has commissioned a contractor to review the composition of these structures and explore cheaper alternatives to concrete. The results of this review are not available yet.

Bottomland Forest Habitat Improvements: One to two acre clearings or spot clearings with subsequent planting (two year old potted seedlings) of hard mast trees (such as pin oak).

Pumps: For the project conditions, a suitable pump of about 6 c.f.s. would be a portable, trailer mounted, submersible pump with a diesel engine drive unit mounted directly on the pump frame. The pump would be similar to a Gator pump or a Crisafulli pump. A pump in the size of 15 c.f.s. would also be a portable, trailer mounted submersible pump, but with a portable diesel engine drive unit mounted on an independent trailer frame. The pump would be similar to a Gator pump or a Crisafulli pump. A suitable pump for a large pumping station requiring 90 c.f.s. capacity would be a permanently mounted 45° angle propeller pump as manufactured by the Couch Pump Company. The pump would be driven by a portable diesel engine.

Table 2 associates available measures with the project objectives.

Table 2. Measures Available.

general . . . . **Objective** . . . . specific		**Measure**
Improve side channel habitat by preventing river-borne sediment from filling the side channels	Remove localized accumulations of sediment in interior of side channel	Dredge
	Prevent additional sediment from entering side channels	Construct low riverside berms with water control and fish passage structures
Improve overwintering habitat for fish in side channels and backwaters	Provide areas of deep water (> 8 ft deep) accessible to fish	Dredge Construct low riverside berms with water control and fish passage structures
Create a water-level management capability that is independent of water levels in Pool 25		Enclose State-managed Area with riverside berm Enclose USFWS lower pool with riverside and interior berm Add water pumping capability Add water control structures
Increase diversity of wetland types within the project area	Re-establish submergent vegetation Manage for moist soil plants	Dredge Excavate Construct low riverside and interior berms with water control and fish passage structures
Improve habitat quality and quantity of bottomland forest within the project area	Initiate management program for bottomland forest	Reforestation Implement Bottomland Forest Habitat Improvements
Ensure adequate long-term water flow over the freshwater mussel beds	Maintain or increase flow through channels in the State-managed Area	Don't completely close off channels with berms If crossing channels with berm, install structures to allow passage of water and fish
Reduce the rate of siltation throughout the project area	Reduce sediment coming into the project area from the uplands	Cultural and structural measures Lowland sediment traps or berms
	Reduce sediment coming into the project area from the river	Construct low riverside berms
Improve spawning habitat for riverine fishes	Stabilize water levels in spawning areas	Off-bankline revetment Construct riverside berms with fish passage structures

B. Formulation of Concept Plans.

One or more of the measures available for addressing habitat problems and meeting the project objectives were combined into concept plans by the interagency planning team.

Plan 0. No action. With this plan, no project would be implemented using Federal funds. Specific details of future conditions with no action have been described in previous sections.

Plan A1. Enclose the State-managed Area and a portion of the Cockrell Hollow mussel bed with a riverside berm that would tie in immediately upstream of L&D No. 25. Existing berms on the USFWS managed areas would be rehabilitated as necessary. See Figure 4.

Plan A2. This plan is similar to Plan A1, would also enclose the State-managed Area, but the proposed berm would tie in upstream of the Cockrell Hollow mussel. In this way, the mussel bed would not be within the bermed area. Existing berms on the USFWS managed areas would be rehabilitated as necessary. See Figure 4.

Plan B1. This plan would call for the construction of two separate berms enclosing the State-managed Area--leaving the 40's channel open to flow between the two bermed areas. The 70's channel would be closed off. This plan calls for pumps and gravity drains to achieve desired interior water levels. Existing berms on the USFWS managed areas would be rehabilitated. See Figure 5.

Plan B2. Similar to Plan B1, this plan calls for the construction of two separate berms enclosing the State-managed Area--leaving the 40's channel open to flow between the two bermed areas. The 70's channel would be closed off. Plan B2 differs from Plan B1 in that it recognizes the potential for water seepage from the river through a somewhat sandy bottom substrate into the two interior compartments. Accordingly, this plan relies on a drain to connect the upper enclosed area of the State-managed Area with the lower area, and a drain at the downstream end of the lower area to drain through the dam and spillway. Existing berms on the USFWS managed areas would be rehabilitated. See Figure 6.

Plan C (renamed C1). This plan is similar to Plan A1, except that the proposed berm to enclose the State-managed Area (and the Cockrell Hollow mussel bed) would tie directly into the eastern end of the dam and spillway of L&D No. 25. A water control structure through the dam would take advantage of the considerable head differential between the pool and tailwater at L&D No. 25, and would assist in greater water flow through, and draining ability of the State area. In particular, during the period from mid-July to mid-August when establishment of moist-soil plants is desirable, a water control structure through the dam will greatly facilitate holding a water level in the State-managed area a necessary one to two feet below normal pool. Existing berms on the USFWS managed areas would be rehabilitated as necessary. See Figures 7 and 8.

Issues were raised by IDNR concerning the viability of mussel beds within the project area, overall ecosystem approaches, and the need for increasing aquatic habitat. This led to an attempt to improve Plan C primarily by efforts to increase water flow through the state area. Through brainstorming techniques a myriad of potential measures--under certain constraints--were developed and evaluated using certain agreed upon criteria (See Table 6).

Three alternatives or modifications of Plan C surfaced as most promising, and these were compared on the basis of an average annual dollar cost per average annual habitat unit (AAHU) (See Appendix B for a discussion on habitat units). Plan C was renamed C1, and the three modifications were Plans C2, C3, and C4. Modifications C2, C3, and C4 of Plan C included the re-alignment of the proposed interior berm--originally following the boundary between the USFWS and the State-managed Area and crossing over the 70's channel. The proposed berm was re-aligned such that it would not follow the boundary, but would veer further north so that it would not cross nor close off the 70's channel.

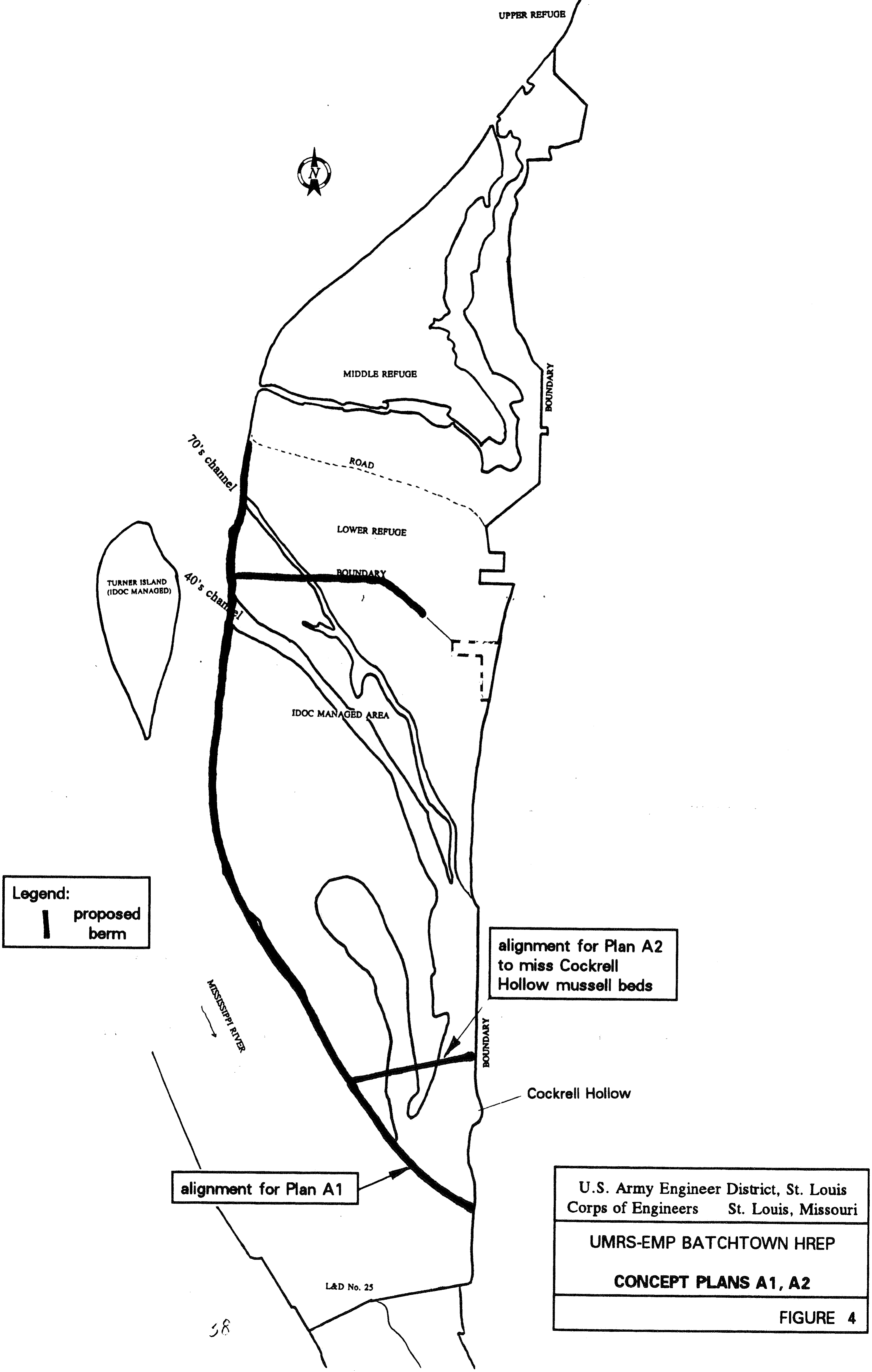
Of these three modifications, Plan C2 appeared the most cost-effective and reasonable to improve the aquatic habitat and the viability of the mussels within the project area. This led to the recommendation of Plan C2 on April 19, 1992.

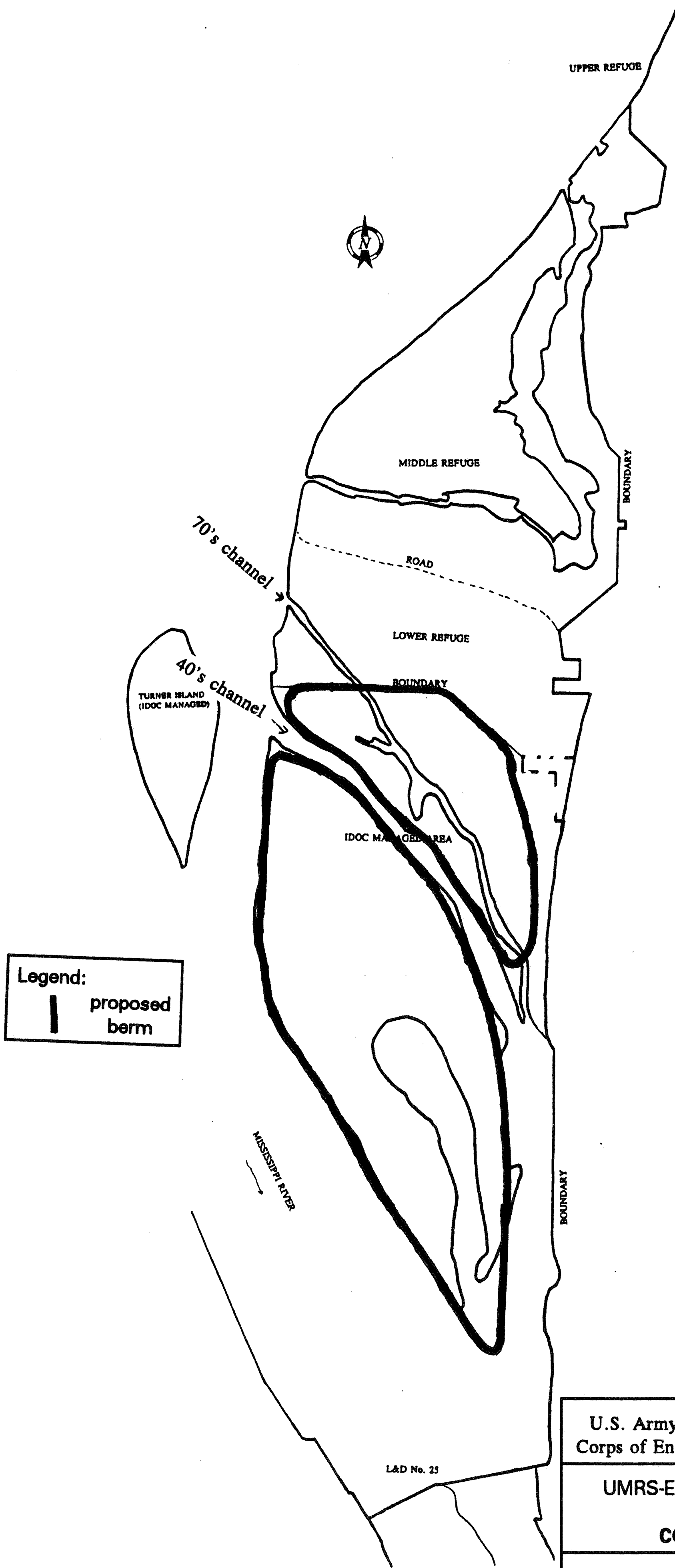
Further meetings ensued whereby specific implementation of Plan C2 through the seasonal water control objectives were discussed, following water level and management objectives as contained in correspondence in Appendix D, enclosures D-3 and D-4. Figures 18 and 19 graphically depict the water management plans for the project area. Written agreement from IDNR was reached on December 7, 1993. All variations of Plan C included the same proposals to rehabilitate existing berms on the USFWS managed areas as had Plans A and B.

Plan C2. This modification of Plan C1 calls for four additional concrete stop-log water control/fish passage structures in the exterior berm of the State-managed Area. One of these additional stop-log structures would be placed at the entrance to the 70's channel, one at the entrance to the 40's channel, and two additional stop-log structures would be placed near the lower end of the proposed berm. This would double the volume of flow--as compared with Plan C1--during times of open flow through the State-managed Area. See Figure 9.

Plan C3. This modification of Plan C1 proposes a siphon system to provide a very large flow over the dam and spillway of L&D No. 25. In turn, to allow a greater flow of water through the State-managed Area, 5 additional stop-log structures would be placed at the entrance to the 40's and 70's channels. [Information and plans from the U.S. Army Corps of Engineers, Memphis District regarding a siphon project were referred to help formulate the siphon component for Plan C3.]

Plan C4. This modification of Plan C1 proposes a large concrete box culvert structure placed in the dam and spillway to allow a greater flow of water through the State-managed Area. This structure would be composed of six 6 ft. x 7 ft. gated box culverts.


UPPER REFUGE
MIDDLE REFUGE
BOUNDARY
ROAD
70's channel
LOWER REFUGE
BOUNDARY
TURNER ISLAND
(IDOC MANAGED)
40's channel
IDOC MANAGED AREA
Legend:
proposed berm
alignment for Plan A2 to miss Cockrell Hollow mussell beds
MISSISSIPPI RIVER
BOUNDARY
Cockrell Hollow
alignment for Plan A1
L&D No. 25
U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri
UMRS-EMP BATCHTOWN HREP
CONCEPT PLANS A1, A2
FIGURE 4

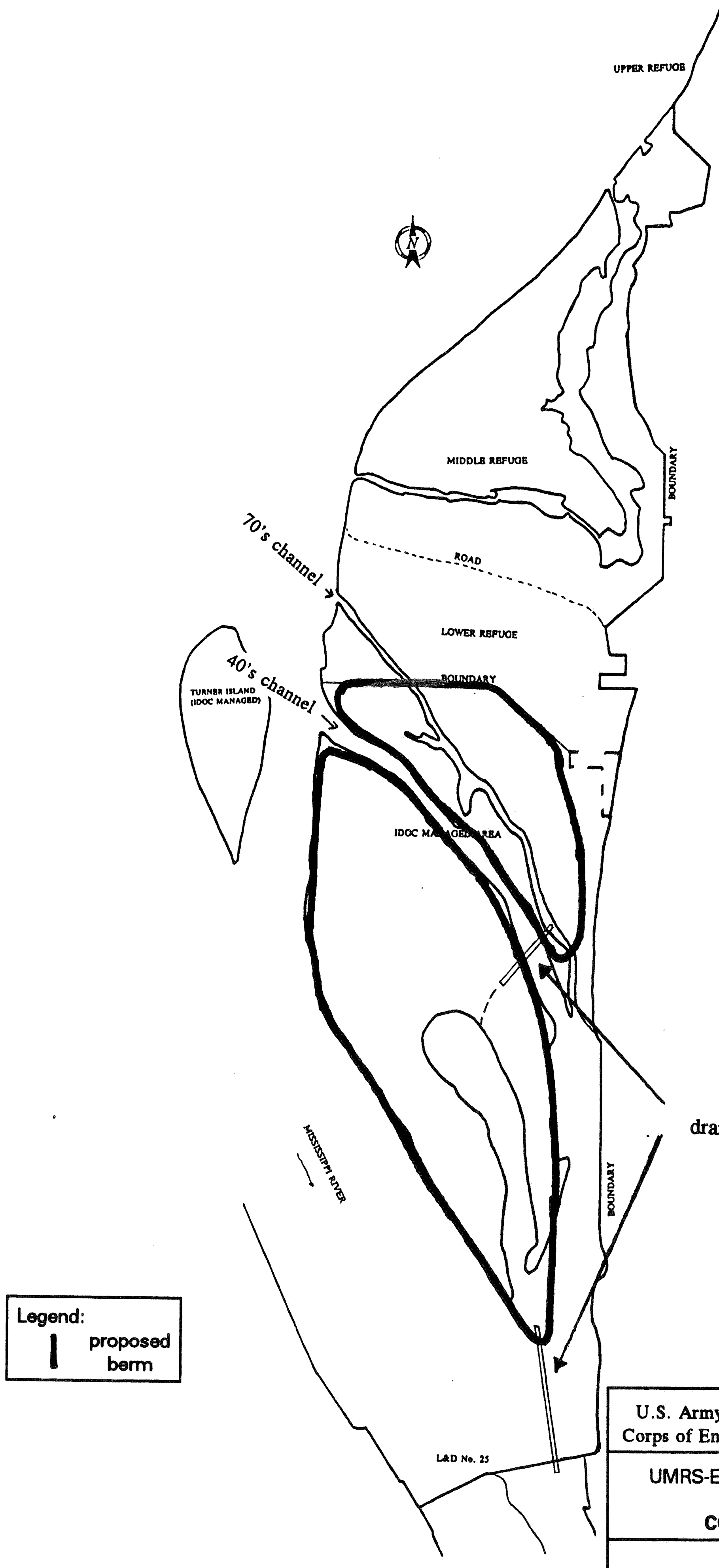


U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UMRS-EMP BATCHTOWN HREP

CONCEPT PLAN B1

FIGURE 5



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Corps of Engineers St. Louis, Missouri

UMRS-EMP BATCHTOWN HREP

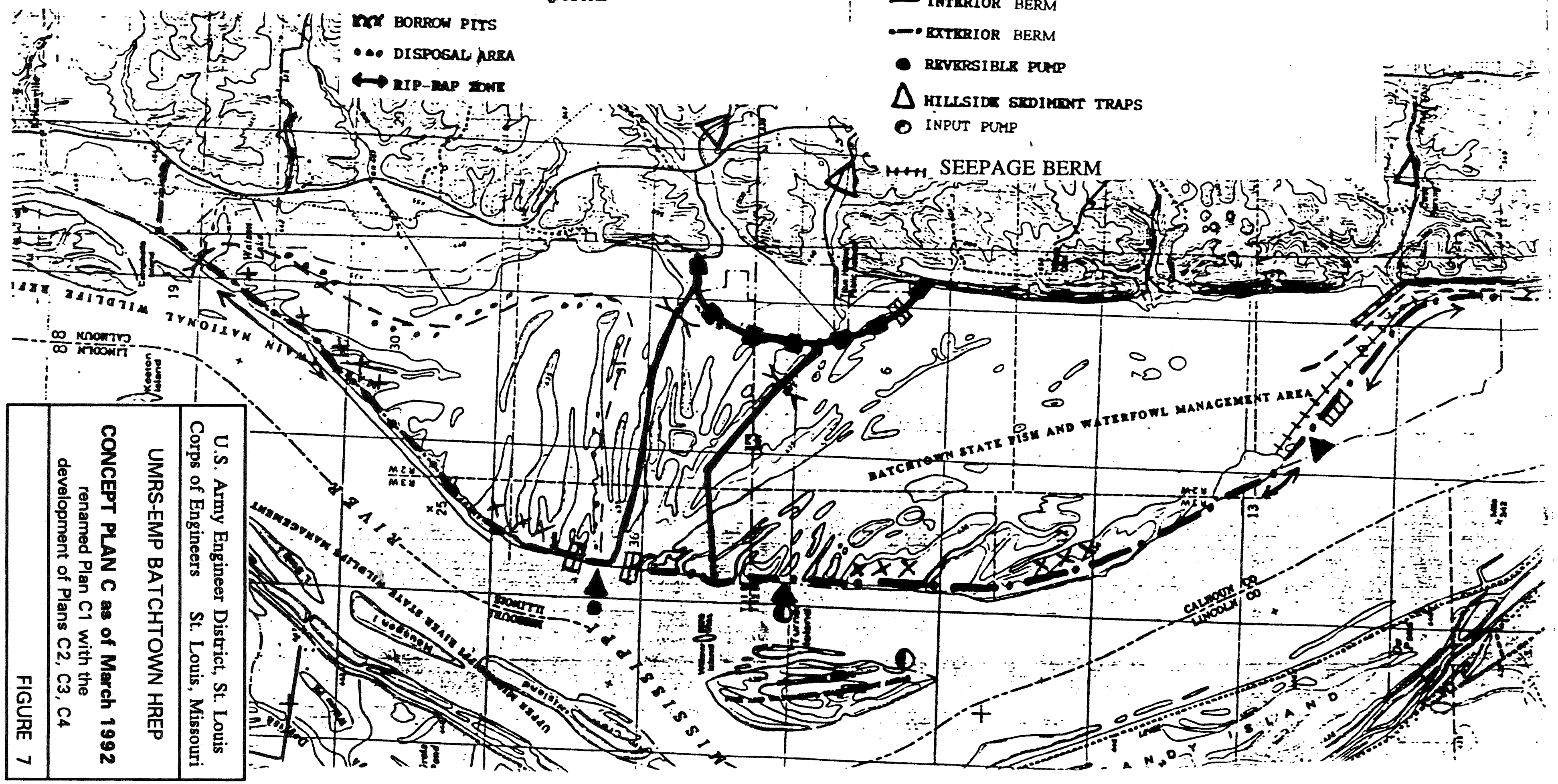
CONCEPT PLAN B2

FIGURE 6

PLAN C

Legend:
proposed berm

- OVERFLOWS
- COMBINATION SLUICE GATE/STOP-LOG STRUCTURES
- GATED CULVERT STRUCTURE
- BORROW PITS
- DISPOSAL AREA
- RIP-RAP ZONE
- DEEPWATER FISHERIES HABITAT (CLAMSHELL DREDGING)
- LOWLAND SEDIMENT TRAP
- INTERIOR BERM
- EXTERIOR BERM
- REVERSIBLE PUMP
- HILLSIDE SEDIMENT TRAPS
- INPUT PUMP
- SEEPAGE BERM

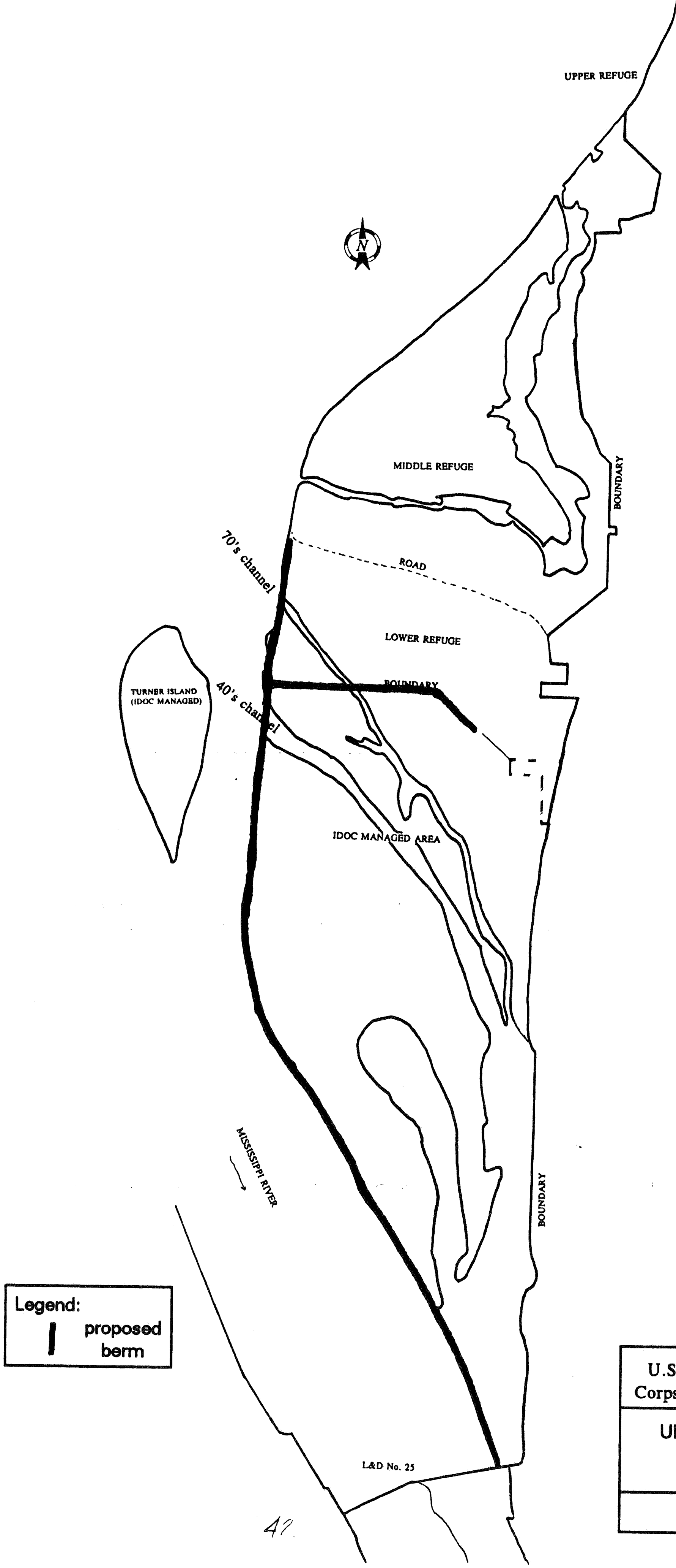


U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UMRS-EMP BATCHTOWN HREP

CONCEPT PLAN C as of March 1992
renamed Plan C1 with the
development of Plans C2, C3, C4

FIGURE 7



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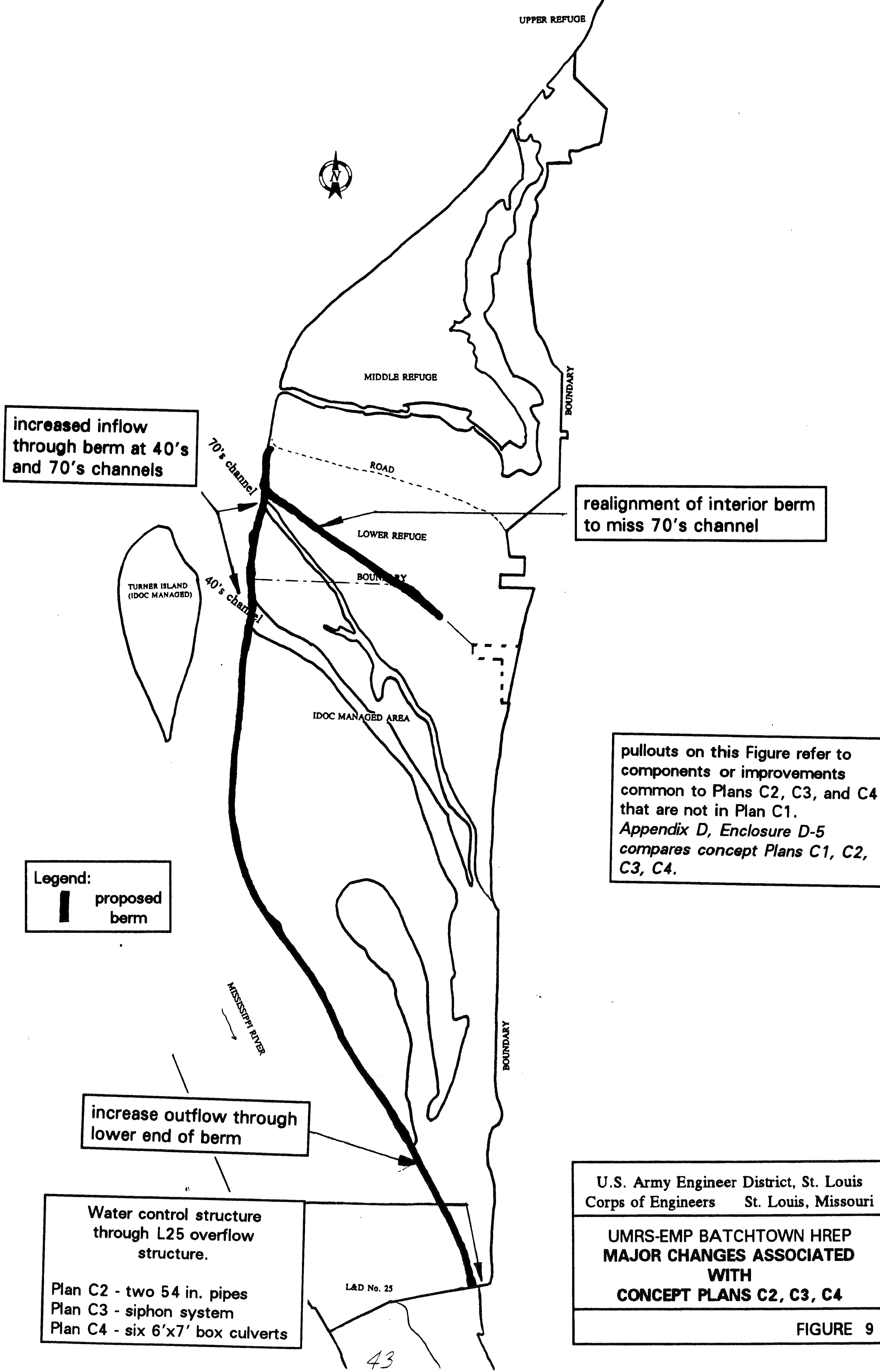
UMRS-EMP BATCHTOWN HREP

CONCEPT PLAN C1

FIGURE 8



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Corps of Engineers St. Louis, Missouri

UMRS-EMP BATCHTOWN HREP
MAJOR CHANGES ASSOCIATED WITH CONCEPT PLANS C2, C3, C4

FIGURE 9

8. EVALUATION OF CONCEPT PLANS.

The concept plans identified in the previous section were evaluated according to the four criteria in Table 3.

Table 3. Evaluation Criteria for Concept Plans.

Acceptability	:	The extent to which a plan is acceptable to the sponsoring agencies in meeting their operational and management goals and priorities, and is compatible with existing laws, regulations, and public policies.
Engineering Effectiveness	:	The extent to which a plan is "engineeringly" feasible and workable.
Completeness	:	The extent to which a plan addresses the intended project objectives.
Cost Effectiveness	:	The extent to which a plan is cost effective (average annual cost per Average Annual Habitat Units). Concept plans were evaluated at a gross level of detail for cost effectiveness. The best concept plan was then further evaluated according to a Corps of Engineers procedure as described in a report entitled "Cost Effectiveness Analysis and Incremental Cost Analysis for Corps Fish and Wildlife Habitat Planning - Nine Easy Steps."

Table 4. Evaluation of Concept Plans as to Acceptability, Engineering Effectiveness, and Completeness.

Concept Plan	Initial Evaluation or Recommendation		
	Acceptability	**Engineering Effectiveness**	**Completeness**
0	Unacceptable to U.S. Army Corps of Engineers and Illinois Department of Natural Resources.	Not applicable	This plan does not address problems nor does it meet the planning objectives.
A1	Addresses resource problems, and meets the objectives of providing the ability to control and maintain water levels in interior of the State-managed Area for waterfowl. Unacceptable to the extent that the proposed berm encompasses a mussel bed at Cockrell Hollow.	The potential for underseepage at the berms in the State-managed area, and the potential inability (or high operating cost) to hold the interior water level down brings the feasibility of this plan into serious question. This plan calls for the unnecessary crossing of the 70's channel, but for less berm construction than Plans B1 or B2.	Encompasses Cockrell Hollow and the mussel beds and does not maintain high enough water velocities across the mussel beds, therefore this plan does not adequately meet the mussel and aquatic-resource objectives.
A2	Addresses resource problems, and meets objectives of providing ability to control and maintain water level in interior of State-managed Area for waterfowl. Does not contain as much interior area for waterfowl as Plan A1. Is more acceptable than Plan A1 because this plan proposes a berm that attempts to avoid the mussel bed at Cockrell Hollow.	The potential for underseepage at the berms in the State-managed area, and the potential inability (or high operating cost) to hold the interior water level down brings the feasibility of this plan into serious question. This plan calls for unnecessary crossing of the 70's channel, but for less berm construction than Plans B1 or B2.	Avoids encompassing Cockrell Hollow and the mussel beds with a berm. Water velocities across the mussel beds may be diminished because the side channel is crossed by a berm. Otherwise, meets all project objectives.

Table 4. Evaluation of Concept Plans as to Acceptability, Engineering Effectiveness, and Completeness.

Concept Plan	Initial Evaluation or Recommendation		
	Acceptability	**Engineering Effectiveness**	**Completeness**
B1	As compared to Plan A1 and A2, this plan increases the water control ability in the State-managed area as it divides it into two separate bermed areas. As compared to Plan A1 and A2, this plan increases the flow through the 40's channel and the main side channel by Cockrell Hollow. This plan does not contain as much interior ponding area for wildlife management as would the A or C concept plans. This plan shifts more emphasis towards managing for fish and aquatic resources than Plans A1 and A2, and puts less emphasis on waterfowl management. This plan would have higher OM&R costs than Plans A1 or A2 because of additional lengths of berms causing more seepage and therefore more pumping.	This plan is basically feasible and workable. However, more berm construction is required than for Plans A or C. This plan would have more seepage problems through the berms and therefore more operating costs than plans A, C and B2. This plan avoids closing off the 40's channel.	Meets all project objectives. Meets objectives for aquatic habitat more strongly than Plans A or C.
B2	As compared to Plan A1 and A2, this plan increases the water control ability in the State-managed area as it divides it into two separate bermed areas. As compared to Plan A1 and A2, this plan increases the flow through the 40's channel and the main side channel by Cockrell Hollow. This plan does not contain as much interior ponding area for wildlife management as would the A or C concept plans. This plan shifts more emphasis towards managing for fish and aquatic resources than Plans A1 and A2, and puts less emphasis on waterfowl management. This plan would have higher operating costs than Plans A1 or A2 because of additional lengths of berms causing more seepage and therefore more pumping. However, the pipe connecting the bermed areas in the State-managed area, and the pipe leading to the L25 overflow structure would reduce operating costs as compared to Plan B1. More acceptable than Plans A1 and A2 to the extent that this Plan would retain some of the flow from the 40's and 70's channels and across the mussel beds. Retains diversity of aquatic habitat and refuge from high velocity water in back channels.	This plan is basically feasible and workable. However, more berm construction is required than for Plans A or C. The seepage problems through the berms would be offset by the interconnecting drainage pipe and the pipe through the L25 overflow structure. This plan avoids closing off the 40's channel.	Meets all project objectives. Meets project objectives for aquatic habitat more strongly than Plans A1, A2, B1, or C.

Table 4. Evaluation of Concept Plans as to Acceptability, Engineering Effectiveness, and Completeness.

Concept Plan	Initial Evaluation or Recommendation		
	Acceptability	Engineering Effectiveness	Completeness
C or C1	This plan is an attempt to combine some of the best aspects of Plans A1 and B by: • encompassing as large an area as possible for wildlife management; • reducing OM&R by minimizing the amount of berm construction (as compared to Plan B1 and B2); • increasing the viability of mussel beds (as compared to Plan A1), improving aquatic ecosystem (as compared to Plans A1 and A2), and by reducing pump operating costs by allowing a large volume of interior seepage water to pass through the State-managed area and discharge through the dam/spillway. Without a project the mussel beds will continue to diminish as the project area converts from aquatic to terrestrial habitat.	This plan is feasible and workable. This plan calls for unnecessary crossing of the 70's channel. This plan entails less berm construction than Plans B1 or B2, and would require proportionally less pump operation costs per unit area than the other concept plans due to draining interior seepage through a structure through the L25 overflow structure.	Meets project objectives. However, it does not meet the mussel and aquatic-resource objectives as strongly as Plans B1 and B2.

Table 5. Evaluation of Concept Plans as to Cost Effectiveness.

Concept Plan	Initial Cost[1] ($)	Annualized Initial Cost[2] ($)	Annual OM&R Cost ($)	Annualized Initial + OM&R Cost ($)	AAHU (All Species)	Efficiency (Annual Cost divided by AAHU)
A1	3,350,000	265,993	110,000	375,993	1243	302
A2	3,350,000	265,993	110,000	375,993	not determined	not determined
B1	6,000,000	476,405	120,000	596,405	1366	437
B2	8,000,000	635,207	130,000	765,207	not determined	not determined
C or C1	4,000,000	317,604	100,000	417,604	1626	257

Notes:
1. These are rough initial costs used for relative comparison of concept plans. Costs for Plans B1, B2, and C1 were estimated and compared in the October 23, 1991 letter to IDNR. For a rough-cost comparison, Plans A1 and A2 will be considered similar in costs to Plan C1 but with a $650,000 structure through the spillway removed.
2. Annualized where i=.0775/year, 50 years.

Tabulation of AAHUs for input into Table 5:

Concept Plan	Mussel	Wildlife	Aquatic	Total
A1	6	612	625	1,243
B1	55	672	639	1,366
C1	5	969	652	1,626

During the early period of plan formulation, while Plan A was the primary concept plan, the Illinois Department of Natural Resources (IDNR) became aware of a commercially-harvested mussel bed within the Batchtown project area (May 1991) by a commercial sheller who had worked the Batchtown area. A field inspection by IDNR staff that same month confirmed that a bed was present, although of undetermined size and density. Ten hauls with a five-foot crowfoot bar yielded 61 mussels representing nine species. The predominant species collected was the threeridge, Amblema plicata. IDNR staff concluded that further investigation of the mussel bed was warranted based upon their initial sampling and that additional information was needed regarding the hydrology of the area and its short and long-term effects on the existing mussel bed.

IDNR requested that the District obtain additional velocity measurements through the side channels to determine if scouring was occurring and thus protecting the mussel bed from siltation. IDNR also requested a second opinion regarding conclusions related to the new plan proposed specifically to accommodate the mussel bed (Plan B) and approved by the project sponsors. IDNR requested information on the siltation rate in the backwater, the effects of scouring as a result of the proximity to L & D 25 and the effects that the construction of berms adjacent to the future project side channel might have on the mussel bed.

The St. Louis District responded with a WOTS request to the Waterways Experiment Station (WES) for assistance in assessing the hydraulic and biological issues regarding a comparison of the proposed Plans A & B for the project and their effect upon the future welfare of the mussel bed. The District also obtained water velocity measurements in the project area on June 18, 1991. Velocities ranged from 0.3 to 2.9 feet per second with Dam 25 at "open river" and the pool on "tilt." Scouring velocities greater than 4 feet per second were not observed during the field investigations.

A meeting with WES staff was convened in St. Louis on August 14, 1991 to discuss the mussel issue, first with in-house personnel and later with the project sponsors. All in attendance agreed that Batchtown is a depositional area due to its location at the inside of a bend, thus jeopardizing the future of the mussel bed without a project.

Comparisons of Plans A and B showed that the essential difference is that Plan A sequesters more of a complex mix of aquatic and terrestrial habitats into bermed areas for moist soil management and does not make provision for flow over the mussel bed. Plan B represents a compromise by providing bermed management areas while maintaining some flow over the mussel bed. Plans A1 and A2 met the primary objectives of managing for waterfowl. Plan B shifted emphasis to aquatic and mussel habitat. Although Plan A2 attempts to avoid constructing a berm across a mussel bed, it will impede much of the flow through the side channel presumed necessary for the survival of that mussel bed.

Plan B is considered inferior to Plan A in that it possesses a higher initial cost, and requires more OM&R costs due to pumping because of seepage under a greater length of berms. Also, Plan B reduces the overall interior State-managed pool area available for wildlife management and waterfowl habitat.

Even Plan B was felt to place the mussel bed at increased risk due to the elimination of the storage volume and the subsequent loss of water flow along the bluff line that eroded depositional materials off the mussel bed. No estimate was made as to the length of time the life of the mussel bed might be shortened. There was agreement that a shortened bed life would occur given that the fate of the mussel bed is already sealed due to the existing sediment deposition pattern. There was agreement that Plan B was preferable to Plan A since it would maintain off-channel habitat while making a reasonable attempt to prolong the life of the mussel bed. IDNR expressed concern that underseepage could be a serious problem with Plan B, making operating costs prohibitive and that perhaps a Plan C should be considered.

A field trip to the project area (August 15, 1991) led WES staff to the conclusion that the mussel bed was not of large size or high density when compared to other UMRS mussel beds. It was suggested that a more rigorous survey of the mussel bed be conducted to determine density of individuals and bed size as a measure of bed quality to allow a comparison of this bed to others on the upper river and to use this evaluation to assist in establishing project priorities.

IDNR had attempted to survey the mussel bed prior to the meeting with personnel from WES but were only partially successful. Five stations were sampled on July 3, 1991 using SCUBA. Four 0.25 meter quadrates were cleared at each station and the data combined to provide density information reported as the number of live mussels per square meter. No further sampling was attempted on this date due to extremely low water levels (so low that boat launching was not possible).

Subsequent to the meeting with WES and District staff, IDNR again attempted to survey the mussel bed. A total of 74 three minute crowfoot bar (five foot) hauls were made on August 28, 1991 throughout the project area, but primarily in the area of the mussel bed and through the so-called "40's" channel. This effort resulted in the collection of 122 live mussels representing eleven species. A total of 49 square meters of quantitative sampling resulted in the collection of 239 individual mussels representing eleven species. Quantitative sampling was conducted again on August 29 and 30, 1991 resulting in the collection of 192 live mussels of ten species. The range of densities found was from 0 to 17 mussels per square meter. IDNR concluded that while the bed within the project area did not appear as dense or contain as many species as others found on the upper river, a viable mussel community existed that was worthy of preservation. Additional sampling would be conducted to further define the extent and density of the mussel bed.

Plan A was in disfavor because it did not provide for mussels, and Plan B was recognized as having either excessive pumping costs (Plan B1) and/or because of high construction costs per unit area (Plan B2) due to more berm and drainage pipe construction.

Consequently a new concept plan--Plan C--was developed. A meeting was convened by the District with the project sponsors on October 7, 1991 to discuss the new plan proposal.

Plan C called for a perimeter berm, similar to Plan A, but extending to the L&D No. 25 overflow structure to allow the venting of water via culverts placed in the L&D 25 overflow structure. Gravity filling and draining would also be possible, greatly reducing operating costs. The primary goal of the initial concept Plan C was food production for wildlife, especially migratory waterfowl. Secondary goals--to the extent compatible with the primary objectives--included: providing for mussels, providing for wintering fish, and providing for fish spawning.

While Plan C did not totally meet the needs of all resource interests, it was felt to be the best overall approach available given the shortcomings of Plans A and B. For the above mentioned reasons--and as roughly assessed in the dollar cost per habitat unit comparison--concept Plan C was essentially agreed upon by the Corps, IDNR, and the USFWS as preferable over Plans A and B. However, IDNR stated in a March 19, 1992 letter their desire that a recommended project plan address the entire ecosystem within the project and that certain aquatic and mussel habitat enhancements be provided above what Plan C was presently achieving.

In an attempt to enhance aquatic and mussel habitat, discussions and meetings were conducted to determine the minimum water velocity needed to maintain the survival of mussel beds within the project. Initial investigations indicated that additional or larger water control structures could be placed through the proposed berm around the State-managed area to provide a velocity of 0.2 feet/second over the mussel beds at Cockrell Hollow.

An interagency meeting was held on April 10, 1992 with District personnel and sponsors to address issues raised by IDNR in their qualified letter of support for Plan C. The key issue needing resolution was the question of water flow and velocity over the mussel bed, with an objective to obtain a flow of 0.2-1.5 feet per second (fps). IDNR indicated their support for Plan C was contingent upon the District being able to insure a flow of 0.45 fps over the mussel bed. The District did not guarantee a flow of 0.45 fps over the mussel bed--only that an attempt would be made to generate this level of flow.

Concern within the District about economically achieving the target velocity of 0.45 fps, and any possible measures calling for structures through the L&D No. 25 overflow structure led to a decision to "brainstorm" the mussel issue. A brainstorming session was held to produce ideas that could be evaluated to produce solutions (see Table 6 for more details). The required velocity constraint, and additional constraints and criteria were incorporated into the session. Some twenty-six ideas were identified during the brainstorming session, most were evaluated and ranked. Of the top ten, five met the constraints. One idea (to enhance and/or mitigate mussel beds outside of the project area) was discarded as not being a serious option at the time. The other four ideas were evaluated further, and as a result, the ideas were incorporated into variations of Plan C1. Then, Plans

C1, C2, C2, and C4 were examined in terms of a seasonal water management plan, and pumping and water-control structure requirements.

The collection of environmental data continued during the time that discussions were ongoing over the issue of providing a flow of 0.45 fps over the mussel bed. WHAG and AHAG field exercises were conducted involving District and sponsor staff. The WHAG and AHAG teams re-aligned the interior proposed berm between the USFWS lower pool and the State-managed area so as not to close off the opening to the 70's channel. During these exercises IDNR staff continued to express concern over the future of the mussel bed. A second WOTS request to WES was generated requesting assistance in determining habitat suitability indexes (HSI) for the mussels found in the project area.

Dr. Barry Payne of WES conducted a field investigation of the mussel bed on July 9, 1992 in conjunction with District, IDNR and LTRM staff. He reported his conclusions--based upon his field investigations--in a memorandum to the District on August 6, 1994. He modified an existing HSI model for freshwater mussels (that he had helped develop) specifically for the habitat conditions at the site of the mussel bed within the Batchtown project area. He concluded that the HSI for mussels for existing conditions at Batchtown was 0.64, for future conditions (fifty years) without a project 0.24, and 0.49 for future conditions (fifty years) with a project based upon the Plan C design.

Plans C1, C2, C3, and C4 generated an estimated 58 average annual mussel habitat units because of similarities in the amount of mussel habitat, water velocities and HSI's.

Dr. Barry Payne of WES was asked on January 28, 1993, to comment on the potential for mussel survival during periods of no or very low flow over the mussel bed. His opinion was that the mussels would have a good chance for survival because of the tolerance to impounding that was exhibited by the mussel species present. He was also of the opinion that the biggest impact of restricted flow during the drawdown period, usually from late June to late August, might be to inhibit mussel reproduction. He did not feel that this was particularly important because the species present were common species found throughout the area and were successfully reproducing elsewhere in sufficient numbers that the loss of reproduction in this bed would not affect the overall mussel population in the river. Consequently, if habitat were present the area would be repopulated. More important than the mussel bed is the habitat type that the mussel bed is inhabiting. This habitat type is limited and important within the Batchtown project area and outside of the project area. This habitat is worthy of preservation not only because of the mussels present, but also for benefits to other invertebrates. Bottom samples taken throughout the area of the mussel bed showed an abundance of aquatic life in addition to the mussels. All are important to the aquatic ecosystem.

Table 6. Summary and Final Results of Mussel Brainstorming Meeting, Held May 14, '92.

Twenty-six alternatives were developed by the attendees of the brainstorming session in order to meet the following constraints:

- Must produce a minimum velocity of 0.2 ft/sec. to help ensure mussel bed survival
- Must satisfy IDNR's ecosystem objective (i.e., habitat restoration that includes wildlife, fish, and mussel components)
- Must be acceptable to all appropriate elements in the District (e.g., Planning Division, Engineering Division, Construction-Operation Division)
- Must be acceptable to the sponsors (IDNR, USFWS)
- Must be compatible with navigation needs (e.g., must not interfere with navigation nor require changes in L&D 25 operations)
- Corps is not to routinely operate the proposed mussel features or HREP project
- Leave the spillway cells alone (to ensure the structural integrity of the dam and so as not to lose pool)

Each alternative was judged Yes or No (met or did not meet all constraints)

The alternatives were rated on the following criteria:

Criterion no.	
1	Alternative is cost effective in terms of dollars per Average Annual Habitat Units.
2	Alternative meets the objectives (to provide effective water control for waterfowl management while avoiding adverse impacts to fisheries/mussels).
3	Alternative should incur only moderate to low O&M costs.

Each alternative was rated on the three criteria to whether the criterion was met, where the ratings were:

rating of 1 = criterion not met
rating of 2 = criterion met to a minor degree
rating of 3 = criterion met to a moderate degree
rating of 4 = criterion largely met
rating of 5 = criterion fully met

The ratings from the Brainstorming participants were added up and averaged so that there was one rating for each alternative (giving equal weight to each criterion and "vote").

Table 6. Summary and Final Results of Mussel Brainstorming Meeting, Held May 14, '92.

Evaluation and Ranking of Alternatives
by How Alternatives Met the Criteria
(see Notes on next page)

Alternative	Criteria 1	2	3	average	Meets Constraints Y/N	Description
1	4.7	4.9	4.1	4.6	N	
20	4.6	3.7	4.6	4.3	Y	Enhance / mitigate mussel beds elsewhere.
9	3.7	3.1	4.9	3.9	N	
17	4.0	4.1	3.6	3.9	Y	Siphon pipes in combination with small or moderately-sized gated culverts through the spillway.
18	3.1	4.6	3.9	3.9	Y	Open-top concrete box against bluff and through spillway.
22	3.0	4.3	3.9	3.7	Y	Box culvert(s) through the spillway.
10	5.0	1.1	4.7	3.6	N	
13	4.6	1.6	4.7	3.6	N	
24	4.7	3.3	2.2	3.4	N	
3	2.7	4.3	2.9	3.3	Y	Side channel training dikes to concentrate flows across existing mussel beds (with 54" pipe through spillway).
The top 10 alternatives are above this line, highlighted alternatives meet the constraints						
12	4.3	1.3	4.1	3.2	N	
15	3.8	1.2	4.2	3.1	N	
5	2.9	3.9	2.4	3.0	Y	
14	1.1	4.0	3.4	2.9	N	
2	2.0	1.7	4.8	2.8	N	
4	3.6	1.1	3.7	2.8	N	
7	1.3	3.9	2.9	2.7	N	
8	2.3	3.7	1.9	2.6	N	
26	2.9	3.6	1.1	2.5	N	
21	2.8	1.0	3.2	2.3	N	
23	2.8	2.7	1.3	2.3	N	
6 (deferred)						
11 (deleted)						
16 (deferred)						
19 (deleted)						
25 (deleted)						

(continued)

Table 6. Summary and Final Results of Mussel Brainstorming Meeting, Held May 14, '92.

Surviving Alternatives[1] from the Brainstorming's Top Ten:		
Description of Alternate.	Estimated Cost.	Remarks
Enhance / mitigate mussel beds elsewhere.	not determined	This alternative could be pursued in conjunction with keeping the proposed two 54 in. pipes through the L&D No. 25 overflow structure as in Plan C1.
Siphon pipes over the spillway.	$1,200,000	Four 9 ft. dia. steel pipes with vacuum pump. No culverts would be placed beneath the siphons because they would interfere with each others water intake. **This became a major component of Plan C3.**
Concrete box culvert through the spillway.	$5,680,000	This alternative would require six 6 x 7 ft. boxes w/ sluice gates. **This became a major component of Plan C4.**
Training dike to concentrate flows across existing mussel beds.	$429,000	This training dike would be constructed of grade "C" stone, 3,000 feet long. The dike would have to be close to the mussel bed to be effective, and that would overlay and eliminate some mussel habitat.
2 - 54 in. pipes through spillway	$647,000	This was a main component of Plan C1, and its purpose was primarily to manage water level, but not to provide a water velocity of 0.45 fps over the mussel bed. **This became a major component of Plan C2.**

Notes:

1. These surviving Brainstorming alternatives were carried into the formulation of Plans C2, C3, and C4, except that the training dike alternative was subsequently deleted because of doubts about its engineering effectiveness and because its "footprint" would overlay and eliminate some mussel habitat.

Table 7. Initial Evaluation of Concept Plans C1, C2, C3, C4 .

Concept Plan	Description	Initial Evaluation or Recommendation as to Acceptability / Effectiveness / Completeness
C1	This concept plan is essentially as shown in Figure 7, and drawn in a more simplified manner in Figure 8. This plan relies upon two 54-inch gated concrete pipes through the L&D No. 25 overflow structure. This plan is termed Alternate 1 in Appendix D, Enclosure D-5. With the displayed water control structures in the berm enclosing the State-managed area, the maximum water velocity over the mussel bed would be during periods of open flow between pool 25 and the interior of the bermed area, and would be about 0.2 fps.	Not acceptable to IDNR--did not sufficiently address aquatic habitat and mussel viability.
C2	**Concept Plans C2, C3, and C4 share common features as shown in pull-out in Figure 9: any berm to be proposed between the USFWS Lower Pool and the State-managed area would be realigned to miss the 70's channel, and inflow would be increased through structures at the openings to the 70's and 40's channels as necessary to work with outflow structures at the lower end of the berm encompassing the State-managed area.** This plan is termed Alternate 2 in Appendix D, Enclosure D-5, and it, as well as Plan C1, relies upon <u>two 54-inch concrete pipes</u> through the L&D No. 25 overflow structure. With additional water control structures (as compared to Plan C1) in the berm enclosing the State-managed area, the maximum water velocity over the mussel bed for this plan would be during periods of open flow between pool 25 and the interior of the bermed area, and would be about 0.3 fps.	This was considered to be an acceptable compromise for IDNR. Following a meeting that clarified the water level management scheme for Plan C2, IDNR transmitted their acceptance of Plan C2 in a letter dated December 7, 1993 (Appendix D, Enclosure D-7). The width of construction necessary to place the two 54-inch concrete pipes through the L&D No. 25 overflow structure was considered to be close to the maximum width that could be tolerated without encroaching on the last and eastern-most sheet-pile coffercell. Any further encroachment on the coffercell would raise concerns of affecting the structural integrity of the overflow structure.

Table 7. Initial Evaluation of Concept Plans C1, C2, C3, C4 .

Concept Plan	Description	Initial Evaluation or Recommendation as to Acceptability / Effectiveness / Completeness
C3	Using a <u>siphon</u> over the L&D No. 25 overflow structure, and with the water control structures in the berm enclosing the State-managed area (displayed in Alternate 3, Encl. D-5), a water velocity over the mussel bed of 0.45 fps can be achieved for the desired water level management scheme.	Unacceptable. This plan is very effective at moving water through the State-managed area and providing a good velocity over the mussel bed, but it has high initial and OM&R costs (See Table 8), would aesthetically stand out because it projects above the overflow structure, and would be especially subject to flood and ice-flow damage.
C4	This plan is termed Alternate 4 in Appendix D, Enclosure D-5, and it relies upon a large <u>concrete box culvert</u> to be constructed through the L&D No. 25 overflow structure. With the box culvert and the displayed water control structures in the berm enclosing the State-managed area, a water velocity over the mussel bed of 0.45 fps can be achieved for the desired water level management scheme. This plan is termed Alternate 4 in Appendix D, Enclosure D-5.	Unacceptable. The width of the structure became an overriding constraint with the Corps. Six 6 ft. x 7 ft. box structures necessary to achieve the desired flow would encroach on the last and east-most sheet-pile coffercell. At most, two or three box culverts of this size would fit, in which case pre-cast pipe would clearly be less expensive, which pointed in favor of using the 54-inch concrete pipes as in Plan C2.

Table 8. Additional Costs of Plans C2, C3, and C4 over Plan C1.

The purpose of this table (extracted from Enclosure D-5) is to estimate the costs (and costs per habitat units) of Plans C2, C3, and C4 that are additional to Plan C1.

Plan	Primary Features	Initial Cost ($)	Annualized Initial Cost ($)	Annual Operating, Maintenance, and Replacement Cost ($)	Total Annual Costs ($)	Average Annual Mussel Habitat Units (AAHU)	Annual Cost per Average Annual Habitat Units ($/AAHU)
C2[1]	Four 8-ft. wide concrete stop-log structures additional to Plan C1	581,000	50,235	13,000†	63,235	58	1,090
C3	Siphon system	1,200,000	103,756	23,303	127,059		
	7 additional 8' wide concrete stop-log structures	1,016,750	87,912	22,750†	110,662		
	increased pumping for certain periods[4]	10,000,000	864,633	93,212†	957,845		
	protection for siphon and pumphouse	20,000†	1,729†	112†	1,841		
	(subtract 2-54 inch gated pipes)[2]	-647,000	-55,942	-12,956	-68,898		
	subtotal	11,589,750	1,002,088	126,421	1,128,509	58	19,457
C4	6-6' x 7' gated box culvert	5,680,000	491,112	40,313	531,425		
	9 additional 8' wide concrete stop-log structures	1,307,250	113,029	27,220	140,249		
	increased pumping for certain periods[4]	10,000,000	864,633	93,212†	957,845		
	(subtract 2-54 inch gated pipes)[3]	-647,000	-55,942	-12,956	-68,898		
	subtotal	16,340,250	1,412,832	147,789	1,560,621	58	26,907

Notes:

1. Because both Plan C1 and Plan C2 included two 54-inch pipes through the overflow structure, the major additional cost for Plan C2 involved additional stop-log structures.

2. Because Plan C3 substitutes a siphon system for Plan C1's two 54-inch pipes, the cost of the two 54-inch pipes should be deducted.

3. Because Plan C4 substitutes six 6x7-ft. box culverts for Plan C1's two 54-inch pipes, the cost of the two 54-inch pipes should be deducted.

4. If Plans C3 and C4 were to be able to provide 0.45 fps flow over the mussel bed for any period when the Pool 25 water level was below the desired water level of the interior of the State-managed area, then a tremendous pumping capacity of 1,735 cfs would be required (shown at the entrance to the 70's channel, schematics for Alternate 3 and 4, Encl. D-5). The $10,000,000 initial cost for pumping was roughly estimated by ED-C and was considered accurate for comparison purposes.

† Some costs were not estimated by the Engineering Division, Cost Engineering Branch (ED-C).

(There could be additional inflow into the State-managed Area from hillside runoff, and from the USFWS lower pool. This would increase water velocities over the mussel bed.)

The brainstorming session culminated with the Corps recommending Plan C2 with two 54 inch concrete pipes with gates through the Lock and Dam 25 spillway as being the best alternative to meet the objectives, constraints and criteria. Concurrence to proceed with recommending Plan C2 was requested in a letter from the Corps to IDNR dated April 16, 1993, Enclosure D-5.

IDNR responded in a letter dated August 18, 1993 that they still had some concerns about the mussel issue related to water flow. They felt that more data would be helpful. They concurred that Plan C2 was likely the best approach to continue working with.

The District convened a meeting of the project sponsors, District staff and the Ecological Services of the Fish and Wildlife Service on October 5, 1993 to further discuss the mussel topic. The District indicated that there was a limit to the amount of information that could be provided given that this was essentially an EMP project with experimental intent and not a research and development project. Ultimately it was agreed, after much discussion, that the District would provide some additional information in the hope that a final decision could be made. The District agreed to provide hydrographic data for low flow, normal pool and flood conditions in a with-project scenario for IDNR to review and discuss points of agreement on water levels and flows for fisheries and waterfowl benefits.

The information was provided to IDNR in a series of fax's (including Plate 14) to their staff in mid to late October. Plate 14 shows stage elevations at Pool 25 for a flood year (1973), a drought year (1988), and mean data for the years 1939 through 1992. WES, Dr. Barry Payne, was contacted once again for his opinions on mussel survival given the Plan C2 design. He reiterated again, in a memorandum to the District dated November 9, 1993 (Enclosure D-9) that it was not at all certain that reduced water velocity in the area of the mussel bed would lead to its demise. He further stated that if berms and other project features prevent excessive sedimentation in the area of the mussel bed, there may not be negative effects of the project on mussels.

IDNR wrote in letter dated December 7, 1993 (see Appendix D, Enclosure D-7): "We believe that the Plan C-2 project can provide the necessary water levels and flows needed for us to manage for fish and wildlife with some possible design modifications identified during the Definite Project Report (DPR) process." Specific items mentioned for potential further consideration were water control structure location, berm alignment, vanes, pump sizes and flows through the refuge area.

An attempt was made to place the minimum number of water control and fish-passage structures in concept Plan C2 sufficient to accommodate the desired water control regimes for the USFWS and IDNR managed areas, with the exception that additional structures are being recommended to increase water flow over the mussel bed.

9. EVALUATION OF HILLSIDE AND LOWLAND SEDIMENT CONTROL MEASURES.

As described in the chapter on Resource Problems and Opportunities, sediment deposition is recognized as one of the most significant habitat degradation problems in the project area. An estimated 15% of the sediment deposition in the project area is soil erosion from the local upland watersheds. To address this problem two overall methods were considered: hillside sediment control, and lowland sediment control.

A hillside sediment control plan was drafted for this study area by the Natural Resource Conservation Service (NRCS, formerly the Soil Conservation Service), see Appendix O. Figure O-1 shows the watersheds contributing to the project area (watershed #1, #2, and #7 are do not contribute to the project area and were excluded from further analyses).

The NRCS routinely addresses upland soil erosion problems, and has developed a myriad of "cultural" and structural practices to effectively address sheet, rill, and ephemeral erosion, and for areas subjected to concentrated flow (see Figures O-2 and O-3). For lowland sediment control, only lowland sediment trap berms were considered as a practical measure.

The benefits of upland sediment control are that it:

- ✓ reduces habitat-degrading sediment from being input into the non-forested wetlands
- ✓ increases infiltration of rainfall into the soil
- ✓ slows the loss of agricultural topsoil
- ✓ increases crop yields and production
- ✓ reduces the need for crop inputs (e.g., chemicals, fertilizers)
- ✓ produces habitat unit gains for the project's non-target species in the upland areas through improved ground cover and habitat diversity
- ✓ improves water quality in the upland and lowland areas
- ✓ provides livestock watering and recreational ponds
- ✓ helps prevent erosion from archeological or cultural sites
- ✓ reduces silt and mud deposits on roadways that would otherwise be road hazards and incur maintenance costs
- ✓ improves aesthetics
- ✓ does not require project lands to be used for sediment containment
- ✓ is watershed-wide and more comprehensive than when compared to only one or two possible lowland sediment trap locations

Lowland sediment traps can be more efficient than some upland practices in physically trapping sediment. However, lowland traps do nothing for the upland areas: they don't slow the loss of topsoil from the uplands nor the transport of sediment into the tributaries, nor do they improve the habitat in the uplands. Additionally, lowland traps physically occupy project land, may change the type of habitat within the lowland trap, and may require the need for additional land acquisition.

The comparison in Table 9 shows that the lowland sediment trap at Titus and Dixon Hollow, as estimated, is more effective (cost per AAHU) than the alternative upland sediment control measures. The lowland sediment trap for the USFWS Middle Pool is slightly less cost effective, and would require the acquisition of some privately-owned property. However, these comparisons do not capture many of the benefits for upland sediment control checked in the list above. Also, a hillside sediment control program can reduce 26% of the total hillside sediment entering the project, whereas the trap proposed at the USFWS Middle pool will reduce 7.8% of the total hillside sediment, and at the State-managed Titus Hollow, the trap will reduce 6.6% of the total hillside sediment.

For the foregoing reasons, both the upland and lowland sediment control measures were carried into the cost effectiveness and incremental cost analyses, and evaluated as separate measures that could be included in a selected plan.

Within the Conclusion and Recommendation section of the USFWS's draft Fish and Wildlife Coordination Act Report of February 2, 1995, upland and lowland sediment control measures are considered critical to the success of the project. Strong support for upland sediment control measures has been received from the Migratory Waterfowl Hunters, Inc. and the Illinois Waterfowlers Alliance, Inc.

Because of strong recommendations from constituents favoring the inclusion of a hillside sediment control program, U.S. Representative Richard J. Durbin offered an amendment into the FY 1996 [House] Energy and Water Appropriations bill--expecting or directing the Corps to fund a hillside erosion component. The passed Energy and Water Development Appropriations Bill of 1996 includes the following language: "A major threat to this area is sedimentation due to hillside erosion. Control of hillside erosion is essential to the long-term success of this project. Within available funds, the Committee expects the Corps to fund a hillside erosion component in the Batchtown Habitat Rehabilitation and Enhancement Project."

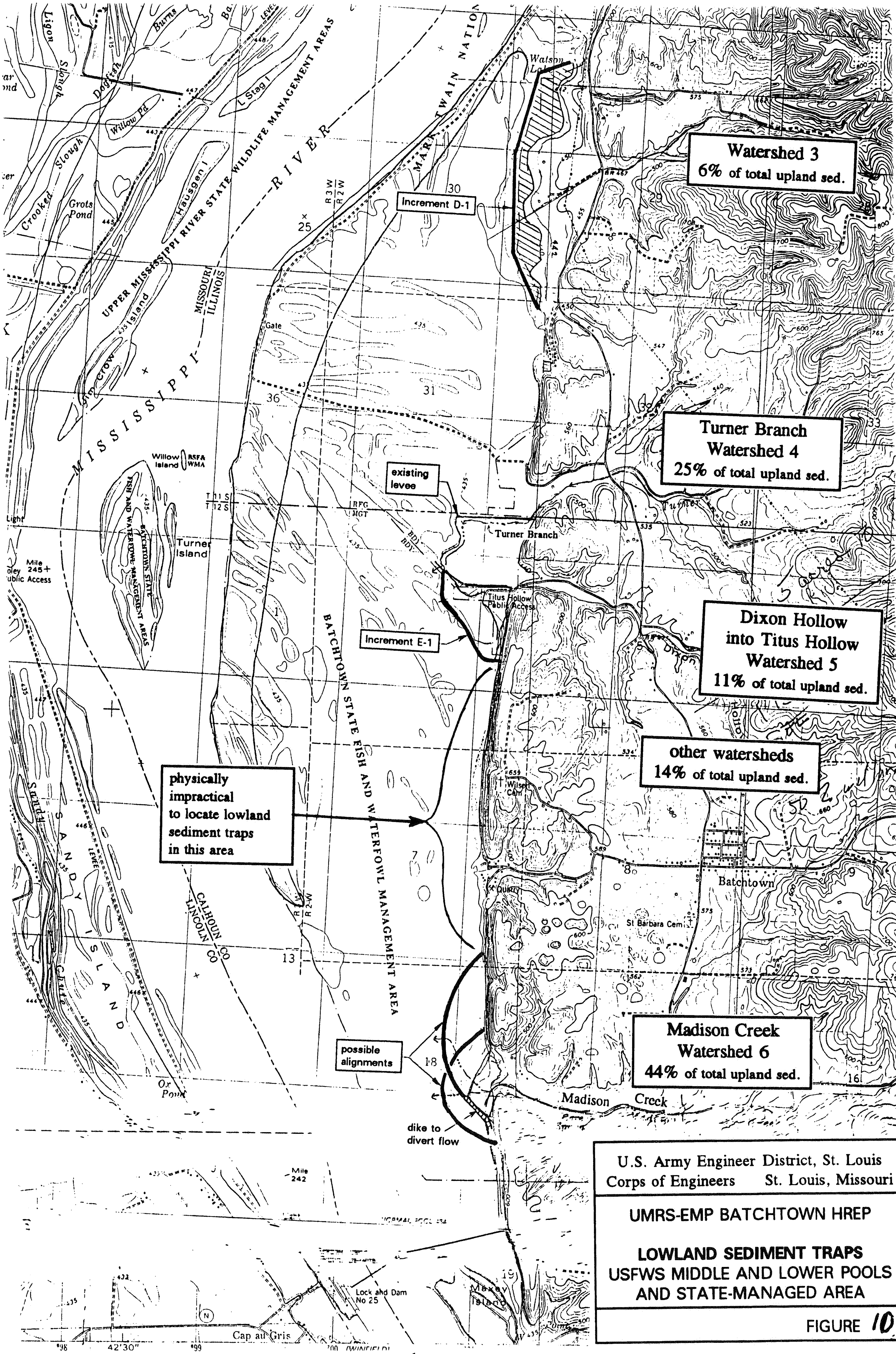
Table 9A displays alternative programs available for funding soil and water conservation activities. Many of these programs have severely declined in funding availability within the last several years. The USFWS and the NRCS explored with limited success the applicability of these programs to a potential hillside sediment control program for the Batchtown HREP prior to the introduction of the language in the appropriations bill mentioned in the previous paragraph. It appears unlikely that any non-EMP funding sources could be located to accomplish the magnitude of sediment reduction as proposed by the NRCS hillside sediment control plan for this project.

Notes that apply to Table 9 on the following page:

1. Construction costs for the lowland sediment traps include 25% for contingencies and 32% for E&D and S&A. The base cost estimate for the upland sediment control program includes E&D by the NRCS.
2. Does not include the non-Federal cost of OM&R. When annualized, i=0.0775/year, N=50 years.
3. Habitat units at the site of the lowland sediment trap have been assumed to remain unchanged. Losses in habitat and HUs for certain species will be offset by gains for other species.
4. 34 units in the State-managed area, 8 units for reducing sediment backing into the USFWS Lower Pool.
5. In the Federally-owned project area only. Additional, but uncalculated HU gains would also occur in the privately-owned upland areas.

Table 9. Comparison of Upland Sediment Control Measures with Lowland Sediment Control Measures.

Description (See Figure 10 for possible locations of lowland sediment traps)	Sediment Reduced	Constr. Costs[1]	Ave. Annual Cost[2]	AAHU	Costs/ AAHU
Lowland sediment trap (USFWS Middle Pool). Build approx. 7,200 linear feet of berm to elev. 439.0 on the eastern edge of the project limits to retain sediment from watersheds 8, 12, 9, 3 and 10. This sediment trap would be positioned to intercept about 2% of the runoff from watershed 8, 100% from watersheds 12, 9, and 3, and 60% from watershed 10, accounting for about 194,597 tons per acre per year of sediment or about 13% of the net 50 year sediment delivery from the hillside area into the project boundary. The sediment trap is estimated to eliminate from 50% to 75% of the sediment input. It is estimated that this would pond water on approximately 41 acres of private farmland outside of the boundary of the Federally-owned land. At $900 per acre, land acquisition cost would be at least $36,900. (This measure was redesigned in July 1996 to eliminate need for any easements). The Turner Branch (watershed 4) accounts for about 25% of the total hillside sediment being delivered into the project boundary. This creek is already routed into an existing bermed area of farmland within the project boundary. No modification to this berm is necessary, although the existing CMP interior drainage structure at the berm's most western was recently replaced.	middle pool, 60% of 13% = 7.8% of total hillside sediment	135,589 + 36,900 = 172,489	13,696	50[3]	274
Lowland sediment trap (Dixon Hollow/Titus Hollow, State-managed Area). Build approximately 2,600 linear feet of berm to elev. 440.5 on the eastern edge of the project limits to retain sediment from Dixon Hollow (watershed 5). Dixon Hollow accounts for about 11% of the total hillside sediment being delivered into the project boundary. The sediment trap is estimated to eliminate from 50% to 75% of this sediment input. A lowland sediment trap was also initially considered at Madison Creek (watershed 6) which contributes 44% of the total hillside sediment being delivered into the project boundary. Such a trap would require at least 2,300 linear feet of berm, built to an elev. of 438.5. It was determined that an area to impound sediment would have to be at least as large as the existing area impounding sediment from Turner Branch. Such a large sediment trap would require the berm to be constructed too far out into the channel of open flow through the state area. This would excessively restrict the channel, remove aquatic habitat acreage, and the berm itself would likely be overlaid on mussel beds. For watersheds 11, 13, and 14 there are similar constraints in that any lowland sediment traps would threaten the viability of the channel through the State-managed area.	Dixon Hollow, 60% of 11% = 6.6% of total hillside sediment	75,657 (No real estate acquisition necessary)	6,007	42[4]	143
Upland sediment control measures. A plan has been drafted by Martha Sheppard, NRCS, to employ cultural and structural measures to address all 11 watersheds that contribute to the project area.	26% of total hillside sediment	504,385	40,049	166[5]	241



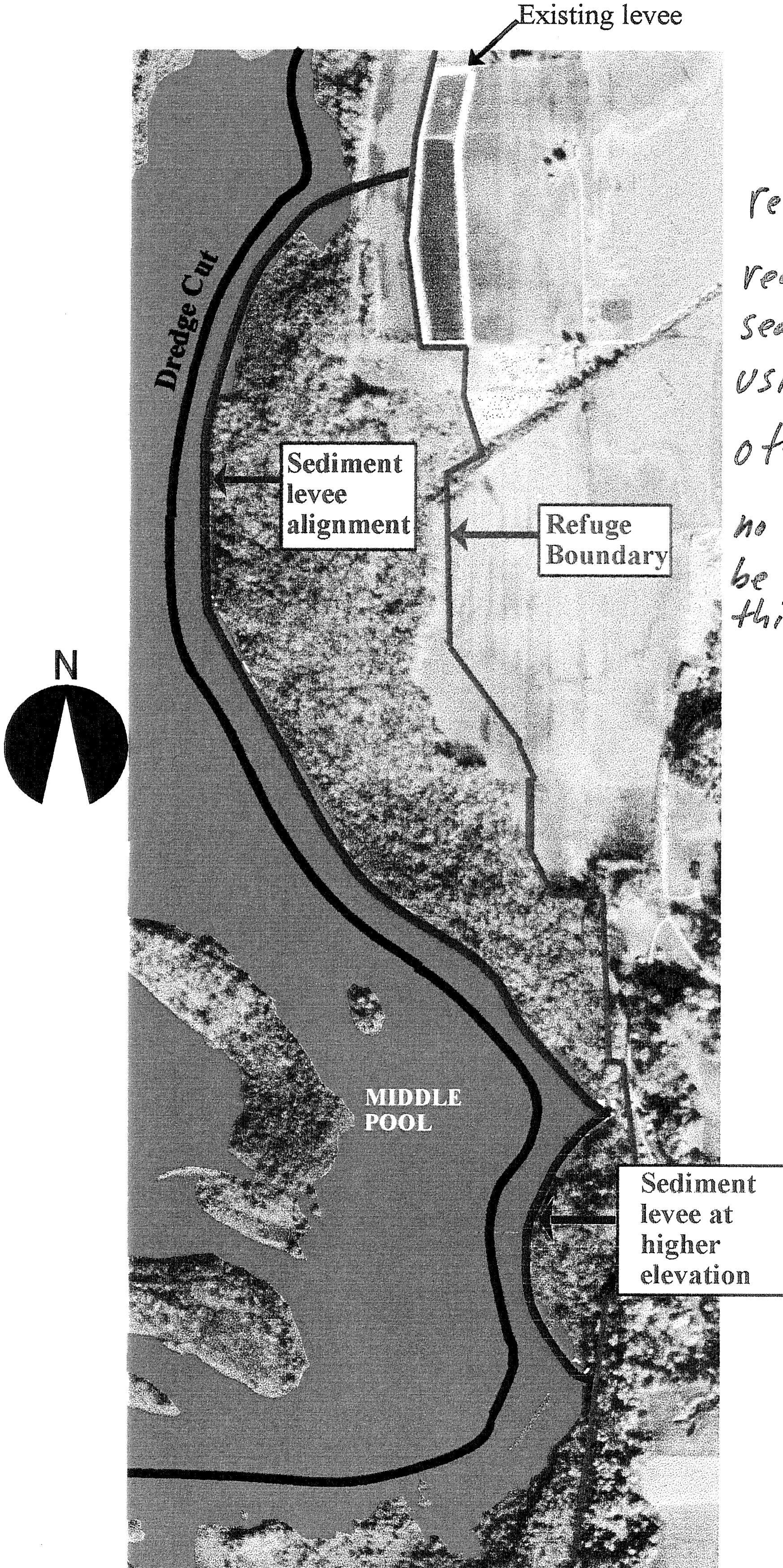
U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UMRS-EMP BATCHTOWN HREP

LOWLAND SEDIMENT TRAPS
USFWS MIDDLE AND LOWER POOLS
AND STATE-MANAGED AREA

FIGURE 10

Mark Twain National Wildlife Refuge
Brussels District
Batchtown Division
Batchtown HREP



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redesigned lowland sediment trap, USFWS Middle Pool, other designs void, no easements to be required for this design

Fig. 10A

page 64A

Table 9A. Alternative Funding Sources for Soil and Water Conservation.

Alternative Programs	Description of Objectives	Future Funding Potential	Remarks
Federal			
P.L. 566 Watershed Land Treatment	Projects, establish conservation measures on public and private lands. Runoff control measures reduce erosion, siltation, and flooding.	Very Low	Currently slow progress - 10 years, application backlog, $2 mil appropriated in FY91 with $15 mil in project requests.
Agricultural Conservation Program (ACP)	Annual program, cost-sharing the application of soil and water conservation practices.	Low	County allocation fully utilized - used to accomplish annual program goals.
Water Quality Special Projects (WQSP)	One-year projects, designed to improve water quality and help solve problems caused by agricultural non-point source pollution.	Low	One project funded in IL in 1990, none in 1991. Extremely competitive at Washington level.
Hydrologic Unit Areas (HUA)	Five-year projects, designed to accelerate improvement of water quality in identified agricultural areas.	Low	54 projects funded nationally, 2 in IL. No appropriation for for FY92. Uncertain future.
Demonstration Projects (DEMO)	Five-year projects, designed to accelerate adoption of water quality technology in DEMO areas and to gain experience to extend program activities into other areas.	Low	16 projects approved to date, none in IL. No appropriation FY92, uncertain future.
Conservation Reserve Program (CRP)	Multi-year program, converts highly erodible and other cropland to perennial vegetation.	Low	County allocation fully utilized to support program initiative.
Non-Point Source Program Grants Section 319(h)	Activities that result in demonstrated progress in achieving Congress' goal of controlling and abating non-point source pollution.	High	Wetlands and water quality high priority. Recommended to support state cost share program (CPP) and project hillside feature.
State			
Watershed Land Treatment Program (WLTP)	Multi-year project, provides financial assistance to landusers in highly erosive land areas of selected watersheds, to install erosion control practices.	Very Low	Funding discontinued pending additional appropriation future highly uncertain.
Conservation Practices Program (CPP)	Annual program, provides financial assistance to landusers to install erosion control practices.	High	Recommended to address water quality as priority issue - proposed to support Section 319 and project hillside feature.

Table 9. Alternative Funding Sources for Soil and Water Conservation (Continued).

Alternative Programs	Description of Objectives	Future Funding Potential	Remarks
<u>Local</u>			
Landowner Contribution	Provides cost-share for technical assistance and construction, also provides lands and assumes O&M responsibility through successive agreements with the Conservation District, Soil Conservation Service and Corps of Engineers.	High	Landowner surveys demonstrate high degree of support.
<u>Private</u>			
Ducks Unlimited Matching Aid to Restore States Habitat (M.A.R.S.H.)	Provides for permanent protection and/or restoration of important waterfowl habitat through funding for selected projects/ proposals.	Low	Highly supportive of hillside feature concept. Requests proposal for project.

10. COST EFFECTIVENESS AND INCREMENTAL COST ANALYSES.

A. Introduction. Over the last several years, the Corps of Engineers has been developing and standardizing analytical procedures for conducting cost effectiveness analysis and incremental cost analyses (CEICA) in planning for environmental restoration and mitigation. In October 1994 a publication was prepared by the Corps' Institute for Water Resources entitled: "Cost Effectiveness for Environmental Planning: Nine EASY Steps."

CEICA will tell decision makers about the relative relationships among solutions--that one solution will likely produce greater output than another, or that one solution is likely to be more costly than another. While these analyses may not lead, and are not intended to lead, to a single best solution (as in economic cost-benefit analysis), they will improve the quality of decision making.

CEICA was performed on the measures, or increments of measures available to or included in concept Plan C2. The berm alignments and structures or features peculiar to concept Plan A and B (including their variations) were not specifically included in this cost effectiveness analysis. There are four reasons for the decision to perform the analysis only on Plan C2, and not on a greater body of measures from which any variation of Plans A, B, or C could have emerged. These reasons are:

(1) Plans A, B, C1, C3, and C4 are fundamentally flawed when compared on the acceptability, engineering effectiveness, and completeness criteria;

(2) A great deal of conceptual planning and coordination had been accomplished, and planning input received by other agencies, with agreements reached before the Corps' guidance on this CEICA process had become instated and before participants had become trained and familiar with the process;

(3) There are various ways of formulating a recommended plan, and the method of first developing concept plans that would involve markedly different berm alignments or different habitat and water management regimes is still valid;

(4) The actual process of conducting the cost effectiveness and incremental cost analyses can become excessively computer and time-intensive due to the shear number of combinations of measures, therefore encouraging the elimination of flawed or ineffective measures from consideration.

Some of the generic information that the CEICA provide is shown graphically and hypothetically in Figure 11. The data points on the curve represent an "envelope" of many individual plans, all efficient in that they provide a fairly high level of habitat output for the cost. There would be a scattering of inefficient plans above this curve or envelope. All of the plans (efficient ones shown on the curve, and the inefficient plans) are composed of the measures and increments of measures available to the preferred concept plan. Assuming that the preferred concept plan had a given cost per habitat unit (value on the y-axis) and level of output (value on the x-axis) that placed it in the shown position above the curve, then there would be more efficient plans in a region on the curve below the preferred plan that would provide roughly the same outputs for less cost. Similarly, there would be more effective plans that would provide more output for the same cost or less cost. The adoption of some measures from plans more efficient than the preferred concept plan in order to form a recommended plan might produce a level of input and output shown with a data-point that places the recommended plan closer to the envelope of the most efficient plans.

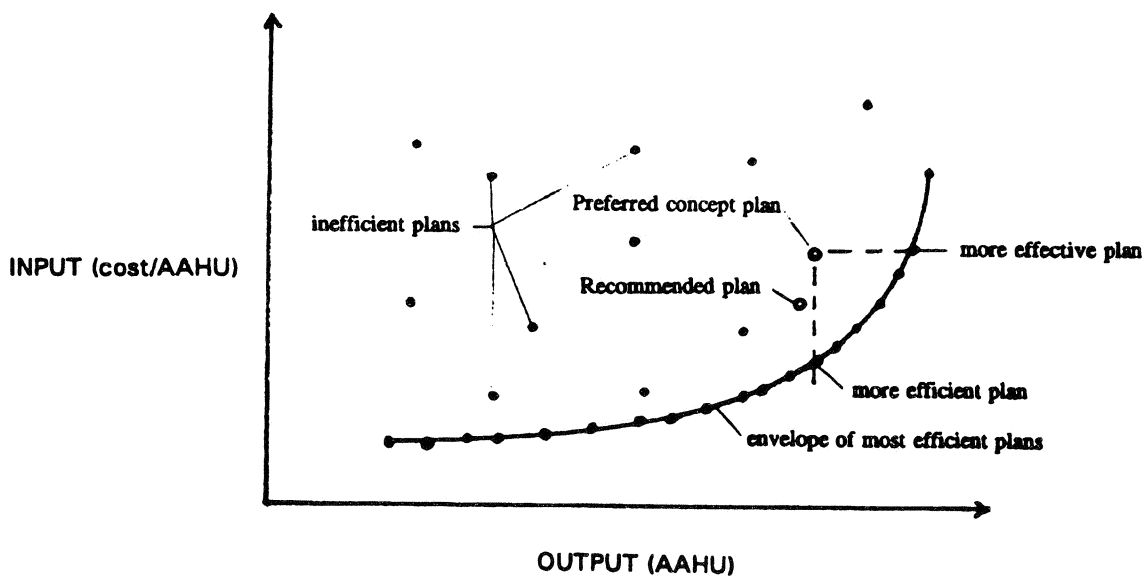

Figure 11. Hypothetical Representation of Information Produced by Cost Effectiveness and Incremental Cost Analyses.

B. Management Measures Considered. The discrete components or measures that could form Plan C2 are listed in Table 10. An attempt was made to include a fair distribution of increments (quantity or size) for each measure when possible. Through judgement, costs and benefits were attributed or assigned to each measure. Costs (see Appendix L) and benefits (see Appendix B) were annualized over the 50-year life of the project.

The costs include initial construction costs, engineering and design, construction management, and OM&R costs.

The benefits are an output of each measure, and are rated in average annual habitat units. Almost all measures in Plan C2 have wildlife, aquatic, and mussel habitat unit benefits. Measures associated with Turner Island have only wildlife benefits.

A habitat benefit or output, and a cost is associated with each measure and is displayed in Table 10.

The term "interior" or "exterior" as applied to management measures refers to interior or exterior (facing the Mississippi River) berms; i.e., an "interior" water control structure would be situated on an interior berm.

All water control pipes were initially 48 inch CMPs, but were re-designed to 42 inch CMPs because standard pre-fabricated sluice gates were not available for the 48 inch diameter pipes.

Table 10. Management Measures with Outputs and Costs.
(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

	Measure	Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
A	Riverside berm (USFWS Middle Pool)	A-1	Fill low spots to 436.5	32	29	0	174,875	13,681	1,000	14,681
		A-2	Raise berm to 437.5	94	48	0	200,000	15,647	3,000	18,647
		A-3	Raise berm to 439.0	116	54	0	235,351	18,413	5,000	23,413
B	Riverside berm (USFWS Lower Pool)	B-1	Build berm to 434.0	2	3	0	12,133	949	200	1,149
		B-2	Build berm to 435.5	11	4	0	34,676	2,713	300	3,013
		B-3	Build berm to 437.0	13	5	0	33,097	2,589	300	2,889
C	Riverside berm (State-managed Area)	C-1	Build berm to 434.0	186	82	7	454,458	35,555	5,000	40,555
		C-2	Build berm to 435.5	289	134	34	345,685	27,045	5,500	32,545
		C-3	Build berm to 437.0	343	144	34	577,533	45,183	6,000	51,183
D	Lowland sediment trap (USFWS Middle Pool)	D-1	Please see Table 9 for a description of this measure.	96	39	0	135,589	10,608	1,000	11,608
E	Lowland sediment trap (State-managed Area, Dixon Hollow to Titus Hollow)	E-1	Please see Table 9 for a description of this measure.	32	13	1	75,657	5,919	500	6,419
F	Dredging (fisheries) (USFWS Middle Pool)	F-1	Deepening of existing shallow water areas to facilitate dewatering, water flow, and to provide refuge for fish during winter stress periods.	40	19	0	685,080	53,597	5,174	58,771

Table 10. Management Measures with Outputs and Costs.
(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

	Measure	Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
FC	Dredging (fisheries) (USFWS Lower Pool)	FC-1	Deepening of existing shallow water areas to facilitate dewatering, water flow, and to provide refuge for fish during winter stress periods.	0	15	0	85,635	6,700	623	7,323
FB	Dredging (fisheries) (State-managed Area)	FB-1	Deepening of existing shallow water areas to facilitate dewatering, water flow, and to provide refuge for fish during winter stress periods.	0	15	0	85,635	6,700	623	7,323
G	Dredging to L&D No. 25 overflow structure (State-managed Area)	G-1	Dredging to facilitate flow into a drainage structure (measure W) at the L&D No. 25 overflow structure.	0	117	0	247,157	19,336	1,869	21,205
H	Pump (USFWS Middle Pool)	H-1	Use existing 44 cfs pump.	40	0	0	0	0	12,000	12,000
		H-2	Replace/rehabilitate existing pump station.	40	0	0	30,000	2,347	10,000	12,347
		H-3	Increase pumping capacity by adding 9 cfs pump.	40	0	0	99,000	7,745	18,000	25,745
I	Pump (USFWS Lower Pool)	I-1	Add pad for, and provide portable 7 cfs pump, and cut ditch to interior lake.	14	0	0	99,000	7,745	6,000	13,745

Table 10. Management Measures with Outputs and Costs.
(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

Measure		Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
		I-2	Add pad for, and provide portable 15 cfs pump, and cut ditch to interior lake.	28	0	0	107,250	8,391	6,500	14,891
		I-3	Add pad for, and provide portable 30 cfs pump, and cut ditch to interior lake.	28	0	0	115,500	9,036	7,000	16,036
J	Pump (State-managed Area)	J-1	45 cfs	43	0	0	412,500	32,272	20,000	52,272
		J-2	90 cfs	86	0	0	449,000	35,127	27,000	62,127
		J-3	135 cfs	86	0	0	495,000	38,726	33,000	71,726
K	Hillside sediment control (USFWS Middle Pool)	K-1	Cultural and structural measures in watersheds #3, 8, 9, 10, 12 (see Figure O-1)	15	12	0	100,877	7,892	600	8,492
KB	Hillside sediment control (State-managed Area)	KB-1	Cultural and structural measures in watersheds #5, 6, 11, 13, 14 (see Figure O-1)	38	29	3	252,193	19,730	1,500	21,230
KC	Hillside sediment control (USFWS Lower Pool)	KC-1	Cultural and structural measures in watersheds #4 (see Figure O-1)	23	17	0	151,316	11,838	930	12,768
L	Interior berm (between USFWS Lower Pool and State-managed Area)	L-1	Build berm to 434.0	4	7	0	64,596	5,054	1,000	6,054
		L-2	Build berm to 435.5	21	8	0	16,054	1,256	1,100	2,356
		L-3	Build berm to 437.0	27	10	0	51,101	3,998	1,200	5,198

Table 10. Management Measures with Outputs and Costs.
(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

	Measure	Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
M	Exterior CMPs - or - Stop-log structures (upper end of USFWS Middle Pool)	M-1	1-42 in. CMP with gate	26	0	0	107,250	8,391	500	8,891
		M-2	2-42 in. CMPs with gates	26	0	0	214,500	16,781	700	17,481
		M-3	1-8 ft.-wide conc. stop-log structure	26	25	0	93,844	7,342	500	7,842
		M-4	2-8 ft.-wide conc. stop-log structures	26	25	0	187,688	14,684	700	15,384
N	Exterior water control (USFWS Lower Pool)	N-1	1-42 in. CMP with gate plus 1-8 ft.-wide concrete stop-log structure	10	0	0	201,094	15,732	1,000	16,732
		N-2	1-8 ft.-wide concrete stop-log structure	10	0	0	93,844	7,342	500	7,842
O	Exterior water control (State-managed Area)	O-1	2-42 in. CMPs w/ gates plus 2-8 ft.-wide conc. stop-log structures	100	0	0	363,000	28,399	2,000	30,399
		O-2	3-42 in. CMPs w/ gates plus 4-8 ft.-wide conc. stop-log structures	100	245	6	412,500	32,272	3,500	35,772
		O-3	5-42 in. CMPs w/ gates plus 10-8 ft.-wide conc. stop-log structures	100	245	6	1,474,688	115,372	7,500	122,872
		O-4	2-8 ft.-wide conc. stop-log structures	100	245	6	187,688	14,684	1,000	15,684

Table 10. Management Measures with Outputs and Costs.
(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

	Measure	Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
		O-5	4 ft.-wide conc. stop-log structures	100	245	6	375,375	29,367	2,000	31,367
		O-6	10-8 ft.-wide conc. stop-log structures	100	245	6	938,438	73,419	5,000	78,419
P	Interior water control (between USFWS Middle Pool and USFWS Lower Pool) **(This measure eliminated after USFWS conducted post-flood of 1993 repairs)**	-	-	-	-	-	-	-	-	0
Q	Interior water control (between USFWS Lower Pool and State-managed Area)	Q-1	1-42 in. CMP with gate plus 1-8 ft.-wide concrete stop-log structure	10	0	0	201,094	15,732	1,000	16,732
		Q-2	1-8 ft.-wide concrete stop-log structure	10	14	0	93,844	7,342	500	7,842
R	Exterior CMPs - or - Stop-log structures on exterior berm (lower end of USFWS Middle Pool)	R-1	1-42 in. CMP with gate	0	40	0	107,250	8,391	500	8,891
		R-2	2-42 in. CMPs with gates	0	40	0	214,500	16,781	1,000	17,781
		R-3	1-8 ft.-wide conc. stop-log structure	0	40	0	93,844	7,342	500	7,842

Table 10. Management Measures with Outputs and Costs.
(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

	Measure	Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
		R-4	2-8 ft.-wide conc. stop-log structures	0	40	0	187,688	14,684	1,000	15,684
S	Stop-log structure on exterior berm (USFWS Lower Pool) **(This measure has been combined with measure N)**	-	-	-	-	-	-	-	-	0
T	Stop-log structure on exterior berm (State-managed Area) **(this measure has been combined with measure O)**	-	-	-	-	-	-	-	-	0
U	Stop-log structure (between USFWS Middle Pool and USFWS Lower Pool) **(This measure has been combined with measure P)**	-	-	-	-	-	-	-	-	0

Table 10. Management Measures with Outputs and Costs.
(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

Measure		Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
V	Stop-log structure (between USFWS Lower Pool and State-managed Area) (This measure has been combined with measure Q)	-	-	-	-	-	-	-	-	0
W	Flow through L&D No.25 overflow structure (from State-managed Area)	W-1	Siphon system (major component from concept plan C3)	48	0	6	1,200,000	93,882	23,303	117,185
		W-2	2-54 inch concrete pipes (major component from concept plan C1 and C2)	48	0	6	647,000	50,618	12,956	63,574
		W-3	6-6 ft. x 7 ft. gated concrete box culverts (major component from concept plan C4)	48	0	6	5,680,000	444,374	4,480	448,854
X	Pump (on Turner Island)	X-1	3 cfs	14	0	0	82,500	6,454	4,000	10,454
		X-2	6 cfs	29	0	0	94,562	7,398	6,000	13,398
		X-3	9 cfs	29	0	0	99,000	7,745	8,000	15,745
Y	Off-bankline revetment (State-managed Area)	Y-1	Approx. 12,400 linear feet along lower portion of proposed berm on the State-managed area.	0	0	0	1,022,258	79,976	100	80,076

Table 10. Management Measures with Outputs and Costs.
(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

Measure		Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
		Y-2	Approx. 3,300 additional linear feet along upper portion of proposed berm on the State-managed area, plus the length for measure Y-1, giving a total of 17,700 linear feet.	0	0	0	1,461,323	114,326	200	114,526
Z	Off-bankline revetment (USFWS Middle and Lower Pools)	Z-1	Rehabilitate approx. 6,800 linear feet of existing off-bankline revetment along upper portion of USFWS Middle Pool.	0	0	0	56,166	4,394	0	4,394
		Z-2	Rehabilitate approx. 6,800 linear feet of existing off-bankline revetment along upper portion of USFWS Middle Pool, and construct approx. 1,900 linear feet of revetment continuing to entrance of 70's channel.	0	0	0	213,411	16,696	50	16,746

Table 10. Management Measures with Outputs and Costs.
(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

Measure		Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
		Z-3	Rehabilitate approx. 6,800 linear feet of existing off-bankline revetment along upper portion of USFWS Middle Pool, construct 1,900 linear feet of revetment continuing approx. to entrance of 70's channel, and construct approx. 3,000 linear feet of revetment continuing to entrance of 40's channel.	0	0	0	460,499	36,027	100	36,127
AA	Bottomland Forest Improvement (USFWS Middle Pool)	AA-1	One to two acre clearings, or spot clearings, with subsequent planting of hard mast trees for a total of 75 acres.	0	0	0	65,850	5,152	555	5,707
AC	Bottomland Forest Improvement (USFWS Lower Pool)	AC-1	One to two acre clearings, or spot clearings, with subsequent planting of hard mast trees for a total of 25 acres.	0	0	0	21,950	1,717	185	1,902
AB	Bottomland Forest Improvement (State-managed Area)	AB-1	One to two acre clearings, or spot clearings, with subsequent planting of hard mast trees for a total of 100 acres.	0	0	0	87,800	6,869	740	7,609

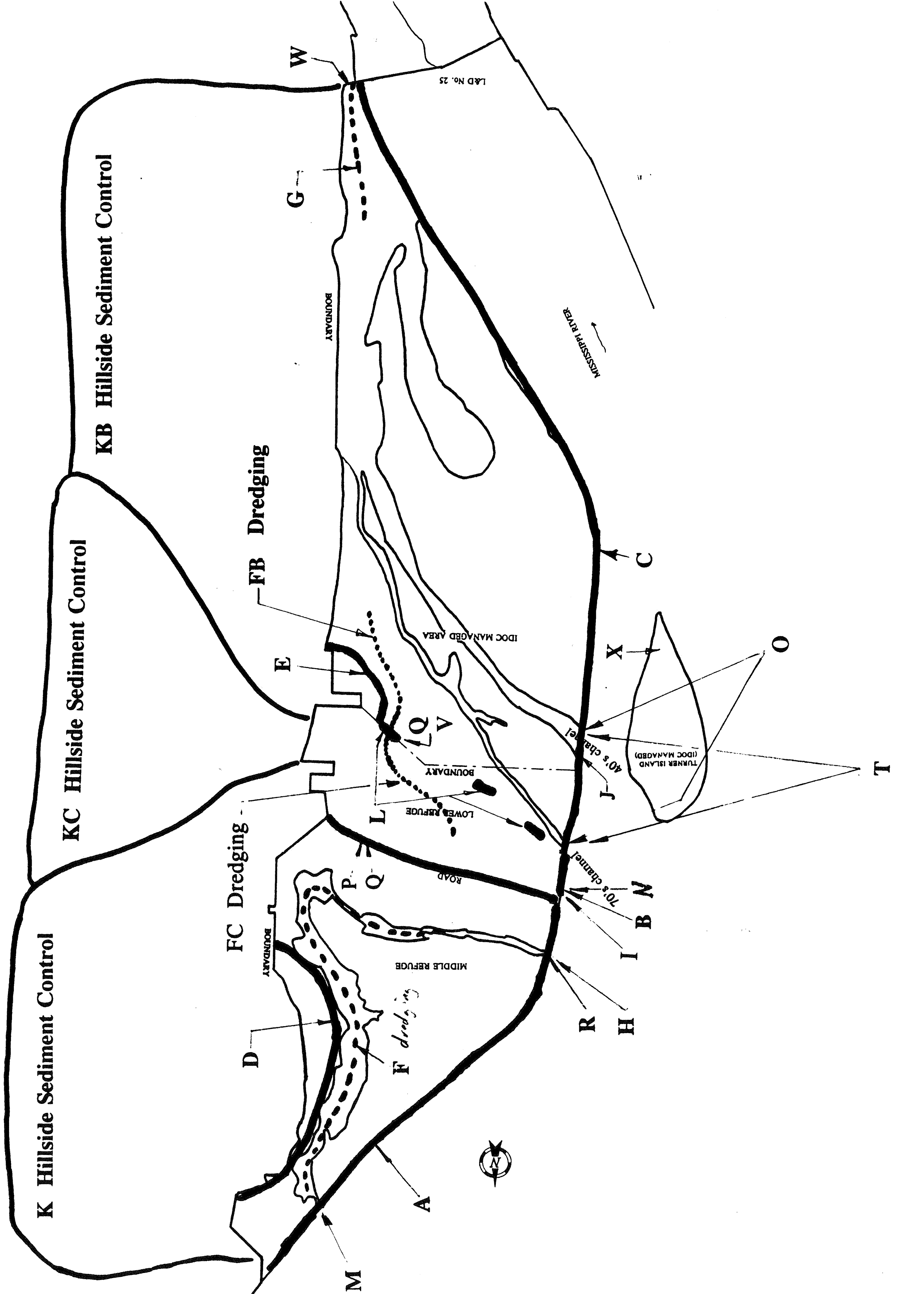

Figure 12. Locations of Management Measures.

Figure 13. Dependencies of Measures for Cost Effectiveness Analysis.

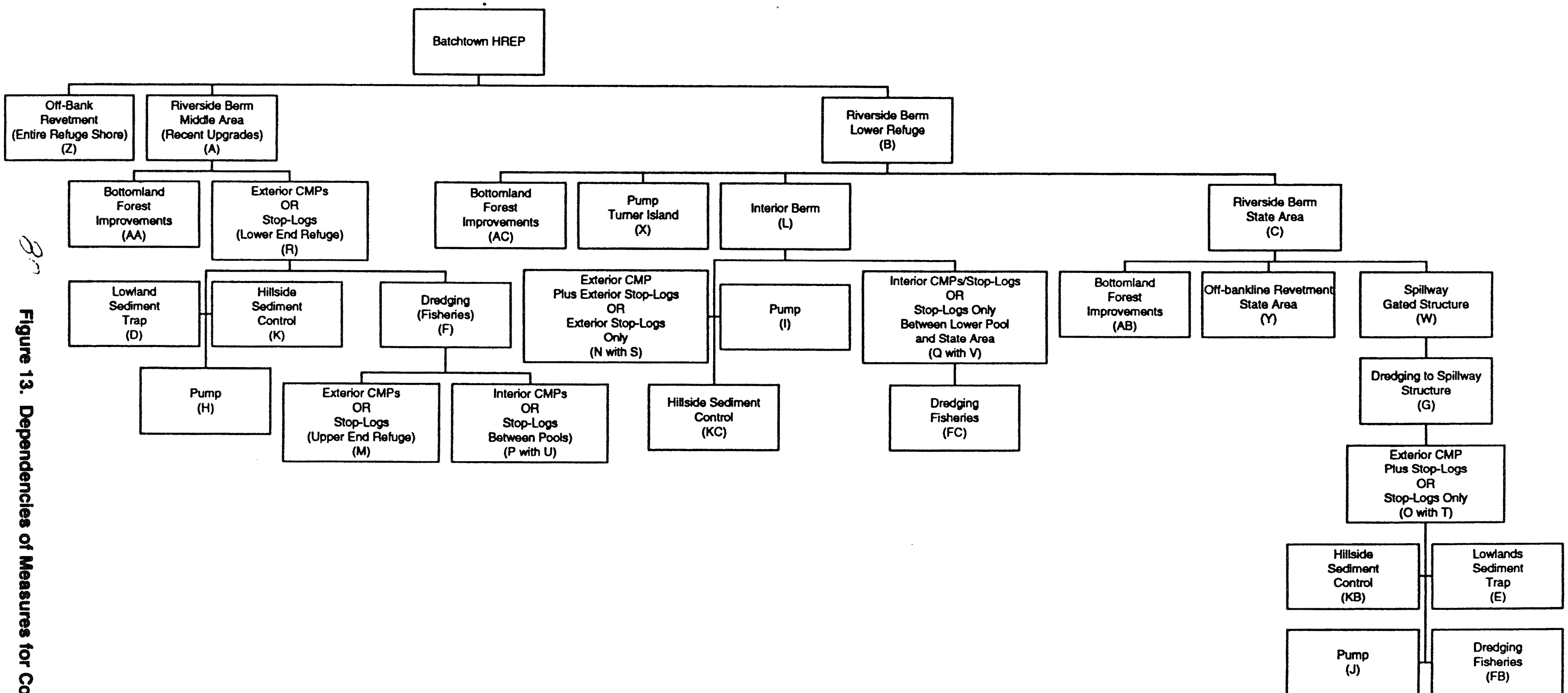

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Figure 13. Dependencies of Measures for Cost Effectiveness Analysis.

Notes to Figure 13.

Assumptions:

1. Off-bankline revetment is totally separable (although there must be a bankline to be set off from), providing fish habitat benefits independent of all other features.

2. For the Middle Pool, while some separation from the river and some water control (without fish access) exists, one would not go to the expense of implementing a lowland trap, a hillside sediment control program, bottomland forest improvements, a replacement pump or dredging for fisheries unless a basic viable water control system first existed. Thus, initially a berm and exterior water control structures are needed.

3. For the Middle Pool, once dredging is included, an upstream exterior water control structure and an interior water control structure between the refuge pools is a possibility.

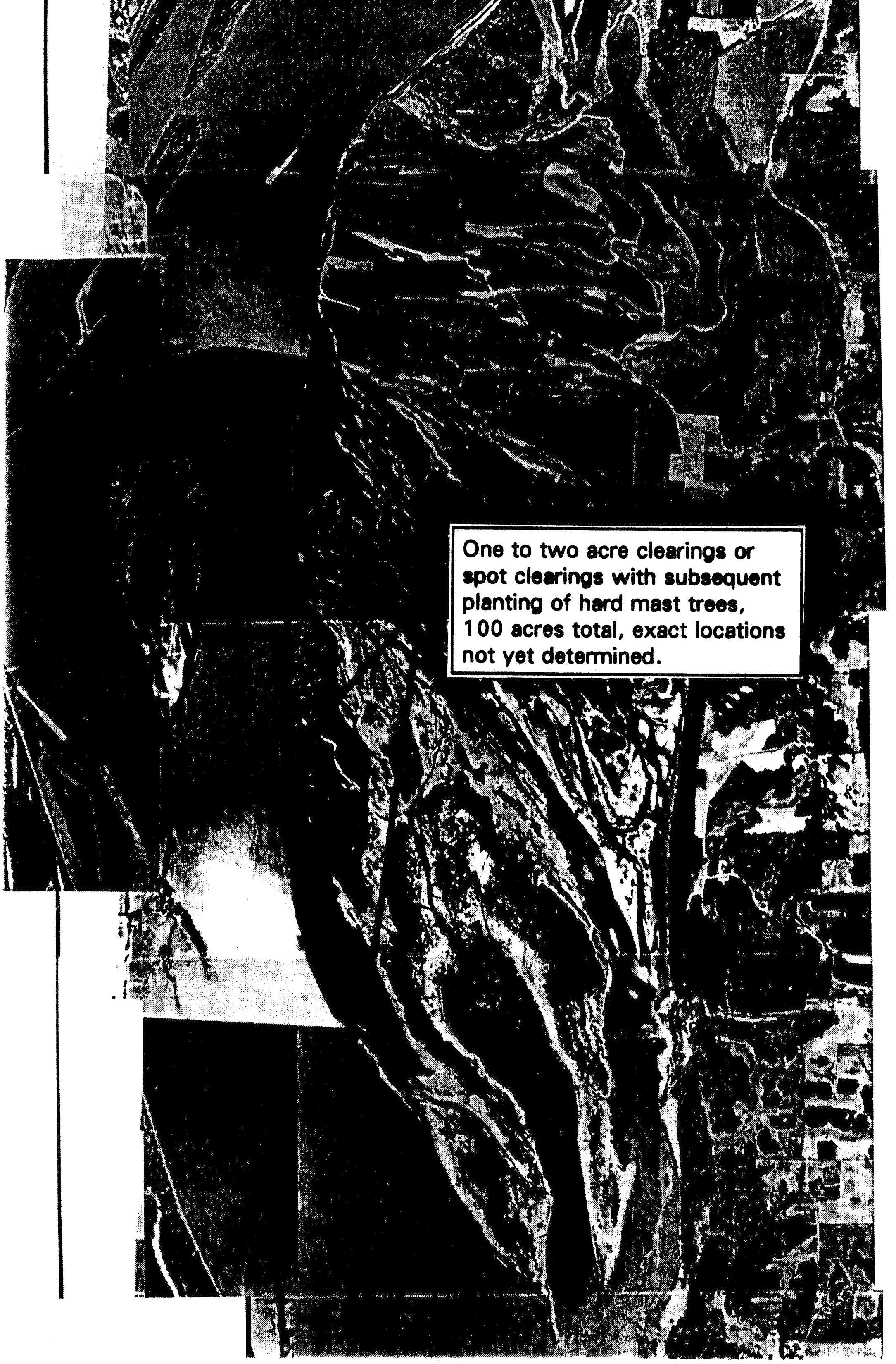
4. For the Lower Pool and State-managed Area, the assumptions are similar as for the Middle Pool, but there is no existing water control system present.

U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UMRS-EMP BATCHTOWN HREP

OFF-BANKLINE REVETMENT
INCREMENTS FOR USFWS MIDDLE AND LOWER POOLS AND STATE-MANAGED AREA

FIGURE 14



U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UMRS-EMP BATCHTOWN HREP

BOTTOMLAND FOREST HABITAT IMPROVEMENT
STATE-MANAGED AREA

FIGURE 15

U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UMRS-EMP BATCHTOWN HREP

BOTTOMLAND FOREST HABITAT IMPROVEMENT
USFWS MIDDLE AND LOWER POOLS

FIGURE 16

11. RECOMMENDED PLAN.

A. Summary of Recommended Plan. Section 8 of this report described how the concept plans were evaluated (based on acceptability, engineering effectiveness, completeness, and in some cases cost effectiveness) leading to a preferred concept plan. Section 10 described how a CEICA was performed on the preferred concept plan.

The wildlife AAHUs of the preferred concept plan totalled 923, with an average annual cost of $469,566. There were several identified plans that were more efficient (see Appendix N, Exhibit N-7) and which included different measures and increments of measures as compared to the preferred concept plan. However, at this stage, these more efficient plans were optimized only for wildlife benefits, and did not contribute more than marginally to aquatic or mussel habitat. A more efficient plan for wildlife habitat that did not meet ecosystem objectives could not reasonably be recommended.

Continuing on with the CEICA, plans were identified whereby a wildlife habitat benefit output of 923 units was held constant, and efficient plans were identified that optimized for aquatic habitat units. These efficient plans are listed in Appendix N, Exhibit N-10. The preferred concept plan was compared to these efficient plans, and a decision was made whether to modify the preferred concept plan measure by measure.

Table 11 describes each measure of the recommended plan, and the reasons why each measure is included. The reasons for including each measure in the recommended plan are explained individually, but fall into the following categories:

Reason 1. The measure was considered a necessary component of the preferred concept plan to achieve project objectives and ecosystem management schemes, and a deliberate attempt was made to minimize the size and cost of the measure. Additionally, all, or the majority of plans displayed by the CEICA that had similar AAHUs also included this measure or increment of measure, indicating that this is a cost efficient measure.

Reason 2. The recommended measure was not included in all or the majority of plans displayed by the CEICA that had similar AAHUs, but there were overriding and compelling reasons for recommending the measure.

Reason 3. The measure was a necessary appurtenance to the project or some other recommended measure, e.g. the measure is necessary to provide user access or maintenance access, or was necessary to protect and prolong the life of other measures.

Table 11. Description of Recommended Plan.

(Measures re-ordered by category and management area (Middle Pool, Lower Pool, State-managed Area)

Measure		Description of Measure	Reasons for Recommending
Riverside or exterior berms			
A-2	~~Riverside berm (USFWS Middle Pool)~~	~~The riverside or exterior berm along the USFWS Middle Pool will be brought up to elevation 436.5. The Stationing of this measure is from 0+00 to 126+00. Only a few locations will actually require the placement of fill: about two feet of fill around Sta. 10+00, about two feet of fill around Sta. 99+00 to 103+00, about 3 feet of fill from Sta. 115+00 to 118+00.~~	Reason 1: this measure was included in all of the CEICA plans, and is a cost efficient measure. <u>However, during 1995, in conjunction with post-1993 flood repair work, the USFWS independently rehabilitated this berm and the ditches on either side, replaced rock for the road surface, and built several rock overflow areas. The USFWS is satisfied with the condition of this berm, and this measure is excluded from the recommended plan, and is not included in the successive table of costs for the recommended plan</u>.
B-2	Riverside berm (USFWS Lower Pool)	The berm will cross the USFWS Lower Pool from approximately Station 126+00 to 135+00. The elevation of the proposed berm will be 435.5, and will require fill when crossing the a northern and smaller entrance to the 70's channel at Sta. 131+50, and again beginning at about Sta. 133+30.	This Measure B-2 was not forwarded as the most cost efficient increment of Measure B by the CEICA, and was not included in any CEICA plans in Exhibit N-10. Rather, the CEICA Measure B-3 forwarded by CEICA. This is explained by the fact that the cost estimate for Measure B-2 was revised upward, but it was neglected to revise upward the cost estimates for B-1 and B-3. Nevertheless, there is little variation between the costs or output for these three relatively close increments. B-2 will be less costly than B-3, and B-2 has an acceptable cost per output of $201/AAHU.
C-2	Riverside berm (State-managed Area)	Build berm to 435.5, tapering to 434.5, with overflow at 434.0, beginning at Sta. 135+00 (the larger entrance to the 70's channel), ending at Sta. 343+00 at L&D No. 25.	This Measure C-2 was not forwarded as the most cost efficient increment of Measure C by the CEICA, and was not included in any CEICA plans in Exhibit N-10. Rather, the CEICA Measure C-3 forwarded by CEICA. Although Measure C-3 garners more wildlife benefits, Measure C-2 is recommended because it is less costly that C-3, and because it was determined that the elevation of the berm was best determined by the existing elevation of L&D No. 25 overflow structure, and the desired water level within the State-managed area. Measure C-3 was proposed primarily for comparative reasons. Of the three C Measures, Measure C-2 has the lowest cost per habitat units (at $71/AAHU). C-1 calculates at $147/AAHU, C-3 at $98/AAHU.

Table 11. Description of Recommended Plan.

(Measures re-ordered by category and management area (Middle Pool, Lower Pool, State-managed Area)

Measure		Description of Measure	Reasons for Recommending
Interior berms			
-	~~Interior berm between the USFWS Middle Pool and the Lower Pool~~	~~Raise low spots in berm to approximately 436.5.~~	<u>During 1995, in conjunction with post-1993 flood repair work, the USFWS independently rehabilitated this berm and the ditches on either side, replaced rock for the road surface, and built several rock overflow areas. The USFWS is satisfied with the condition of this berm, and this measure is excluded from the recommended plan, and is not included in the successive table of costs for the recommended plan</u>.
L-2	Interior berm (between USFWS Lower Pool and State-managed Area)	Build berm to 435.5. Almost all of the existing ground along this interior berm's alignment is at or above this elevation. Where this is the case, no berm construction nor the disturbance of the ground will be required. Only three locations along this berm will require earthwork: where the CMP water control structure is to be placed, a ditch that is to be crossed and closed off, and a swale that is crossed near the west end of the "berm." In addition, the only portion of this "berm" that will require a roadway will be the eastern-most 800 feet, from the concrete stop-log structure to the existing berm.	This Measure L-2 was not forwarded as the most cost efficient increment of Measure L by the CEICA, and was not included in any CEICA plans in Exhibit N-10. Rather, the CEICA Measure L-3 forwarded by CEICA. Although Measure L-3 garners more wildlife benefits, Measure L-2 is recommended because it is less costly that L-3, and because it was determined that the elevation of the berm was best determined by the proposed elevation of the exterior berm for the State-managed area, and the desired water level within the USFWS Lower Pool and the State-managed area. Measure L-3 was proposed primarily for comparative reasons. This measure is necessary to provide separate water management capability for the USFWS Lower Pool. This capability allows the two units to be managed separately with different water level regimes if desired. The Lower Pool unit could be used for wood duck brooding or as a fish nursery while the state managed unit is being managed for moist soil plants. This measure provides additional management flexibility to the project. Measure L-2 had the lowest cost per habitat units of the L Measures (at $81/AAHU), with L-1 at $550/AAHU, and L-3 at $140/AAHU.

Table 11. Description of Recommended Plan.

(Measures re-ordered by category and management area (Middle Pool, Lower Pool, State-managed Area)

Measure		Description of Measure	Reasons for Recommending
Lowland sediment traps			
D-1	Lowland sediment trap (USFWS Middle Pool)	Build approx. 7,200 linear feet of berm to elev. 439.0 on the eastern edge of the project limits to retain sediment from watersheds 8, 12, 9, 3 and 10. See Figure 10. This sediment trap would be positioned to intercept about 2% of the runoff from watershed 8, 100% from watersheds 12, 9, and 3, and 60% from watershed 10, accounting for about 194,597 tons per acre per year of sediment or about 13% of the net 50 year sediment delivery from the hillside area into the project boundary. The sediment trap is estimated to eliminate from 50 to 75% of this sediment input. It is estimated that this would pond water on approximately 83 acres of private farmland outside of the Federally-owned project boundary.	Reason 1: this measure was included in all of the CEICA plans, and is a cost efficient measure. Approximately 15 percent of the total sediment load entering the project area results from hillside erosion. This measure further reduces the amount of sediment entering the Middle Pool thus prolonging project benefits and project life. The cost per output of Measure D-1 is $86/AAHU.
E-1	Lowland sediment trap (Dixon Hollow to Titus Hollow, State-managed Area)	At Titus Hollow, build approximately 2,600 linear feet of berm to elev. 440.5 on the eastern edge of the project limits to retain sediment from Dixon Hollow (watershed 5). Dixon Hollow accounts for about 11% of the total hillside sediment being delivered into the project boundary. The sediment trap is estimated to eliminate from 50 to 75% of this sediment input. See Figure 10.	Reason 1: this measure was included in all of the CEICA plans, and is a cost efficient measure. Approximately 15 percent of the total sediment load entering the project area results from hillside erosion. This measure further reduces the amount of sediment entering the state managed area, but will greatly reduce sediment impacts on the mussel bed which is located immediately downstream. The cost per output of Measure E-1 is $140/AAHU.

Table 11. Description of Recommended Plan.

(Measures re-ordered by category and management area (Middle Pool, Lower Pool, State-managed Area)

Measure		Description of Measure	Reasons for Recommending
Dredging			
F-1	Dredging (fisheries) (USFWS Middle Pool)	Deepening of existing shallow water areas to facilitate dewatering, water flow, and to provide refuge for fish during winter stress periods. This dredging will reach from the proposed concrete stop-log water control structure at "Watson lake," run through the Middle Pool, and terminate at the location of the existing 44 cfs pump station and the proposed 8 ft. wide concrete stop-log structure.	Reason 1: this measure was included in all of the CEICA plans, and is a cost efficient measure. This measure will restore overwintering habitat for fish in the Middle Pool. Existing water depths are insufficient to winter fish without oxygen depletion fish kills most years. The cost per output of this Measure is \$996/AAHU.
FC-1	Dredging (fisheries) (USFWS Lower Pool)	Deepening of existing shallow water areas to facilitate dewatering, water flow, and to provide refuge for fish during winter stress periods, and to connect "Big Hole" with the fish passage and water control structure between the USFWS Lower Pool and the State-managed Area.	Reason 1: this measure was included in all of the CEICA plans, and is a cost efficient measure. This measure is considered crucial to maintaining drainage through the lower pool, and to maintain fish access to Big Hole. Current water depths are insufficient to allow fish access to this overwintering area when pool levels are below 434.0. The access is so shallow and constricted that within a few years, flood events will be necessary for fish to utilize this backwater. The cost per output of this Measure is \$488/AAHU.
FB-1	Dredging (fisheries) (State-managed Area)	Deepening of existing shallow water areas to facilitate dewatering, water flow, and to provide access for fish prior to winter stress periods, and to connect the channel from "Big Hole" to the Lower Pool boundary (measure FC-1) with the deeper channels in the State-managed Area.	Reason 1: this measure was included in all of the CEICA plans, and is a cost efficient measure. This measure is considered crucial for fish access from the four concrete stop-log structures in the berm, through the state managed area, to off-current overwintering areas. The cost per output of this Measure is \$488/AAHU.
G-1	Dredging to the L&D No. 25 overflow structure (State-managed Area)	Deepening of existing shallow water areas to facilitate dewatering, water flow to the proposed water control structure through the L&D No. 25 overflow structure. The cost per output of this Measure is \$181/AAHU.	Reason 1: this measure was included in all of the CEICA plans, and is a cost efficient measure.

Table 11. Description of Recommended Plan.

(Measures re-ordered by category and management area (Middle Pool, Lower Pool, State-managed Area)

Measure		Description of Measure	Reasons for Recommending
Pumps			
H-2	Pump (USFWS Middle Pool)	Replace existing 44 cfs pump.	Assuming that the existing pump can be used, it appears that it is more cost effective to use the existing pump than to rehabilitate the pump or than by adding pumping capacity. However, the existing pump has been determined to need replacement. No additional habitat units would be gained by increasing pumping capacity. The cost per output of Measure H-1 is $300/AAHU. Measure H-2, rehabilitating the pump is $309/AAHU. Increasing pumping capacity, Measure H-3, is $644/AAHU.
I-2	Pump (USFWS Lower Pool)	Provide a 15 cfs portable, trailer mounted submersible pump with a portable diesel engine drive unit mounted on an independent trailer frame. The pump will be similar to a Gator pump or a Crisafulli pump. Initially, all increments of this measure called for a concrete pad for the pump, and for a ditch to be cut to the interior lake. For cost savings, the pad and the ditch can be eliminated.	This measure was included in most of the CEICA plans, and is a cost efficient measure. This measure is necessary to allow independent management capability of this unit from the USFWS Middle Pool and the state managed unit. This Measure, I-2, has the lowest cost per output of the I Measures at $532/AAHU, with I-1 generating fewer AAHU for about the same cost ($982/AAHU), and with I-3, adding additional pumping for no AAHU gains ($573/AAHU).
J-2	Pump (State-managed Area)	The 90 cfs pump will be a permanently mounted 45° angle propeller pump as manufactured by the Couch Pump Company. The pump will be driven by a portable diesel engine.	This measure was included in most of the CEICA plans, and is a cost efficient measure. This pump allows water level management in the state unit if gravity flow is not available due to the pool being drawdown. This Measure, J-2, has the lowest cost per output of the J Measures at $722/AAHU, with J-1 generating fewer AAHU for about the same cost ($1,216/AAHU), and with J-3, adding additional pumping for no AAHU gains ($834/AAHU).

Table 11. Description of Recommended Plan.

(Measures re-ordered by category and management area (Middle Pool, Lower Pool, State-managed Area)

Measure		Description of Measure	Reasons for Recommending
X-2	~~Pump (on Turner Island)~~	~~The 6 cfs pump will be a portable, trailer mounted, submersible pump with a diesel engine drive unit mounted directly on the pump frame. The pump will be similar to a Gator pump or a Crisafulli pump.~~	This measure is not recommended in order to cut costs. However, this measure was included in most of the CEICA plans, and would ber a cost efficient measure. This pump would allow the Turner Island unit to be managed independently from the other state managed areas at Batchtown and on other GP lands where portable pumps are used to manage water levels. This Measure, X-2, has the lowest cost per output of the X Measures at $462/AAHU, with X-1 determined inadequate in pumping capacity and generating fewer AAHU for about the same cost ($747/AAHU), and with X-3, adding additional pumping for no AAHU gains ($543/AAHU).
Hillside sediment control program			
K-1 KB-1 KC-1	Hillside sediment control	A hillside sediment control program to include all three measures (K-1, KB-1, and KC-1) totalling all 11 watersheds contributing to the project area. See Appendix O for a detailed description.	Reason 1: this measure was included in all of the CEICA plans, and is a cost efficient measure. The passed Energy and Water Development Appropriations Bill of 1986 includes the following language: "A major threat to this area is sedimentation due to hillside erosion. Control of hillside erosion is essential to the long-term success of this project. Within available funds, the Committee expects the Corps to fund a hillside erosion component in the Batchtown Habitat Rehabilitation and Enhancement Project." The cost per output for K-1 (Middle Pool) is $315/AAHU, for KB-1 (State-managed Area) is $303/AAHU, and for KC-1 (Lower Pool) is $319/AAHU.
Exterior berm water control features			

Table 11. Description of Recommended Plan.

(Measures re-ordered by category and management area (Middle Pool, Lower Pool, State-managed Area)

Measure		Description of Measure	Reasons for Recommending
M-3	Exterior CMPs or Stop-log structures on exterior berm (upper end of USFWS Middle Pool)	1-8 ft. wide concrete stop-log structure	Reason 1: this measure was included in all of the CEICA plans, and is a cost efficient measure. This Measure is recommended because it is necessary, as a minimum, to have fish passage and water control at this location to provide water into the main channel through the Middle Pool. This structure will allow gravity flow capability into this unit at most normal river levels. This Measure, M-3, has the lowest cost per output of the M Measures at $154/AAHU, M-1 at $342/AAHU, M-2 at $343/AAHU, and M-4 at $301/AAHU.
R-3	Exterior CMPs or Stop-log structures on exterior berm (lower end of USFWS Middle Pool)	1-8 foot-wide concrete stop-log structure	Reason 1: this measure was included in all of the CEICA plans, and is a cost efficient measure. This structure will allow fish access to the overwintering habitat provided by the dredging and will allow water levels in the middle pool unit to be lowered for moist soil plant management. This Measure, R-3, has the lowest cost per output of the four R Measures at $196/AAHU, with R-1 at $222/AAHU, R-2 at $445/AAHU, and R-4 at $392/AAHU.
N	None is recommended for exterior berm of USFWS Lower Pool	-	Fish passage access can be through the 8-ft. stop-log structure (Q-1 or Q-2) leading to the State-managed area.

Table 11. Description of Recommended Plan.

(Measures re-ordered by category and management area (Middle Pool, Lower Pool, State-managed Area)

Measure		Description of Measure	Reasons for Recommending
O-6	Exterior water control (State-managed Area)	10-8 ft.-wide concrete stop-log structures [2 at the entrance to the 70's channel (pts. 5 and 6 on Plate 1), 4 at the entrance to the 40's channel (pts. 8, 9, and 10 on Plate 1), and 4 at the lower end of the berm (pt. 11 on Plate 1)]	Although the CEICA forwarded Measure O-4 as being the most cost effective, Measure O-6 contains the number and locations of stop-log structures to provide additional water flow into and through the State-managed area that was analyzed when comparing various alternates of Plan C to more adequately meet aquatic and mussel habitat flow objectives. IDNR agreed to accept, as a minimum, the volume of water that 8-8 feet-wide stop-logs plus 5-42 inch CMPs would provide through the exterior berm, but it was determined that in order to reduce costs and to provide additional fish passage that only stop-log structures would be used. Therefore, the 5 CMPs were replaced with 2 additional stop-log structures. Assuming all fish passage could be conducted with only two 8-ft. stop-log structures, and additional habitat units could be shown by increasing the number of stop-log structures, Measure O-4 (two 8-ft. stop-log structures) has the lowest cost per output at $45/AAHU. Measure O-1 has $304/AAHU, O-2 has $103/AAHU, O-3 has $350/AAHU, O-5 has $89/AAHU.
W-2	Flow through L25 spillway (from State-managed Area)	2-54 inch concrete pipes with gates.	Reason 1: this measure was included in all of the CEICA plans, and is a cost efficient measure. Of the three W Measures, this Measure W-2 had the lowest cost per output at $1,177/AAHU, with W-1 (siphon system) at $2,170/AAHU, and W-3 (six concrete box culverts) at $8,312/AAHU.

Table 11. Description of Recommended Plan.

(Measures re-ordered by category and management area (Middle Pool, Lower Pool, State-managed Area)

Measure		Description of Measure	Reasons for Recommending
Interior berm water control features			
P-1	~~Interior water control (between USFWS Middle Pool and USFWS Lower Pool)~~	~~1-42 inch CMP with gates~~	Reason 1: this measure was included in all of the CEICA plans, and is a cost efficient measure. However, during 1995, in conjunction with post-1993 flood repair work, the USFWS independently rehabilitated this berm and the ditches on either side, replaced rock for the road surface, and built several rock overflow areas. The USFWS is satisfied with the condition of this berm, and this measure is excluded from the recommended plan, and is not included in the successive table of costs for the recommended plan.
Q-2	Interior water control (between USFWS Lower Pool and State-managed Area)	1-8 foot-wide concrete stop-log structure	Reason 1: this measure was included in all of the CEICA plans, and is a cost efficient measure. Fish passage at this location is considered crucial and was specifically called for by the USFWS and will connect a channel from "Big Hole" in the USFWS Lower Pool to the State-managed Area. Of the two Q Measures, Q-2 clearly gave the more output for less cost at $377/AAHU, with Q-1 (CMP plus stop-log structure) at $1,673/AAHU.

Table 11. Description of Recommended Plan.

(Measures re-ordered by category and management area (Middle Pool, Lower Pool, State-managed Area)

Measure		Description of Measure	Reasons for Recommending
U-1	~~Stop log structure (between USFWS Middle Pool and USFWS Lower Pool)~~	~~1 8 foot wide concrete stop log structure (requires road bridge over 8 foot wide channel through road/berm)~~	Fish passage at this location was considered important and was specifically called for by the USFWS. However, during 1995, in conjunction with post-1993 flood repair work, the USFWS independently rehabilitated this berm and the ditches on either side, replaced rock for the road surface, and built several rock overflow areas. The condition of this berm is improved, and because of efforts to reduce EMP costs and the construction costs of this project, the USFWS agrees that this measure can be excluded from the recommended plan, and is not included in the successive table of costs for the recommended plan.

Table 11. Description of Recommended Plan.

(Measures re-ordered by category and management area (Middle Pool, Lower Pool, State-managed Area)

Measure		Description of Measure	Reasons for Recommending
Bottomland Forest Habitat Improvements			
AA-1	~~Bottomland Forest Habitat Improvements (USFWS Middle Pool)~~	~~One to two acre clearings, or spot clearings, with subsequent planting of hard mast trees for a total of 75 acres.~~	During 1995, in conjunction with post-1993 flood repair work, the USFWS independently conducted some Bottomland Forest Habitat Improvements, therefore this measure is excluded from the recommended plan, and is not included in the successive table of costs for the recommended plan.
AC-1	~~Bottomland Forest Habitat Improvements (USFWS Lower Pool)~~	~~One to two acre clearings, or spot clearings, with subsequent planting of hard mast trees for a total of 75 acres.~~	During 1995, in conjunction with post-1993 flood repair work, the USFWS independently conducted some Bottomland Forest Habitat Improvements, therefore this measure is excluded from the recommended plan, and is not included in the successive table of costs for the recommended plan.
AB-1	Bottomland Forest Improvements (State-managed Area)	One to two acre clearings, or spot clearings, with subsequent planting of hard mast trees on a total of 100 acres.	Necessary to offset for bottomland forest loss due to the Flood of 1993. Approximately 20-30 percent of the trees in the unit died as a direct result of the flood of 1993. AAHUs were not calculated for the Bottomland Forest Habitat Improvement Measures.

Table 11. Description of Recommended Plan.

(Measures re-ordered by category and management area (Middle Pool, Lower Pool, State-managed Area)

Measure		Description of Measure	Reasons for Recommending
Miscellaneous Features			
Z-1 Z-2 Z-3	Off-bankline revetment	None recommended.	Although initially thought to be a good idea as it was a highly-rated "avoid and minimize" measure (see 7. A, Measures Available), these measures had high costs for almost no quantifiable habitat unit outputs in this situation.
-	~~Overflow structure, USFWS Middle Pool, Sta. 117+00 to 124+00, elev. 436.0~~	~~Portion of the berm lowered 0.5 ft., stone capped with grade "C" stone 2 ft. thick.~~	<u>During 1995, in conjunction with post-1993 flood repair work, the USFWS independently rehabilitated this berm and the ditches on either side, replaced rock for the road surface, and built several rock overflow areas. The USFWS is satisfied with the condition of this berm, and this measure is excluded from the recommended plan, and is not included in the successive table of costs for the recommended plan.</u>
-	Overflow structure, State-managed Area, Sta. 313+00 to 328+00, elev. 434.0	Portion of the berm lowered 0.5 ft., stone capped with grade "C" stone 2 ft. thick.	Reason 3: The measure was a necessary appurtenance to the project and is necessary to protect and prolong the life of other measures. This measure allows water levels to equalize as the river rises, thus minimizing damage to the berm.
-	Boat ramps.	None recommended.	Additional boat ramps are not recommended. There is an existing ramp and parking lot at the southwest corner of the USFWS Middle Pool giving access to the Mississippi River (when the USFWS entrance and road through to Batchtown is open). There is an existing boat ramp at Cockrell Hollow giving access to the State-managed area and the Mississippi River. An additional boat ramp would be unnecessary along the proposed riverside berm at the State-managed area, and the roadway on the berm would be inadequate for two-way travel. Also, an additional ramp would require the construction of a parking lot. Not included in incremental cost analysis (because it does not have a habitat unit output).

Table 11. Description of Recommended Plan.

(Measures re-ordered by category and management area (Middle Pool, Lower Pool, State-managed Area)

Measure		Description of Measure	Reasons for Recommending
-	Boat pullovers	Recommended at lower portion of proposed berm adjacent to state area and on Turner Island to facilitate access by boaters and hunters. Incline will be at a 12% slope, or 8.3 to 1 slope. The pullover is not proposed to have any winch or mechanical means to assist in pulling the boat up the incline. Not included in incremental cost analysis (because they do not have a habitat unit output).	Reason 3: The measure was a necessary appurtenance to the project to provide user access. The state unit contains approximately 90 waterfowl hunting blinds. Traffic to these blinds overloads the capacity of the Cockrell boat ramp so additional access is needed from the river and to allow access through the unit to blinds outside of the managed unit.

U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UMRS-EMP BATCHTOWN HREP

AERIAL MOSAIC WITH RECOMMENDED PLAN

FIGURE 17

Table 12. Costs and Outputs of Recommended Plan.

(Initial Costs are preliminary, not detailed MCACES costs, and include contingencies, Engineering & Design, and Construction Management. For Annualized Initial Costs, i=0.07625/year, n=50 years. n.a.= not available. Hillside sediment control measures do not include contingencies.)

		Outputs (AAHUs)			Costs			
Measure		Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
B-2	Riverside berm (USFWS Lower Pool)	11	4	0	34,676	2713	300	3,013
C-2	Riverside berm (State-managed Area)	289	134	34	345,685	27,045	5,500	32,545
D-1	Lowland sediment trap (USFWS Middle Pool)	96	39	0	135,5890	10,608	1,000	11,608
E-1	Lowland sediment trap (State-managed Area, Dixon Hollow)	32	13	1	75,657	5,919	500	6,419
F-1	Dredging (fisheries) (USFWS Middle Pool)	40	19	0	685,080	54,597	5,174	59,771
FC-1	Dredging (fisheries) (USFWS Lower Pool)	0	15	0	85,635	6,700	623	7,323
FB-1	Dredging (fisheries) (State-managed Area)	0	15	0	85,635	6,700	623	7,323
G-1	Dredging (State-managed Area)	0	117	0	247,157	19,336	1,842	21,178
H-2	Pump (USFWS Middle Pool)	40	0	0	30,000	2,347	10,000	12,347
I-2	Pump (USFWS Lower Pool)	28	0	0	107,250	8,391	6,500	14,891
J-2	Pump (State-managed Area)	86	0	0	449,000	35,127	27,000	62,127

Table 12. Costs and Outputs of Recommended Plan.
(Initial Costs are preliminary, not detailed MCACES costs, and include contingencies, Engineering & Design, and Construction Management. For Annualized Initial Costs, i=0.07625/year, n=50 years. n.a.= not available. Hillside sediment control measures do not include contingencies.)

Measure		Outputs (AAHUs) Wildlife	Outputs (AAHUs) Aquatic	Outputs (AAHUs) Mussel	Costs: Initial Costs $	Costs: Annualized Initial Costs $	Costs: Annual OM&R $	Costs: Costs (average annual $)
K-1	Hillside sediment control (USFWS Middle Pool)	15	12	0	100,877	7,892	600	8,492
KB-1	Hillside sediment control (State-managed Area)	38	29	3	252,193	19,730	1,500	21,230
KC-1	Hillside sediment control (USFWS Lower Pool)	23	17	0	151,316	11,838	930	12,768
L-2	Interior berm (between USFWS Lower Pool and State-managed Area)	21	8	0	16,054	1,256	1,100	2,356
M-3	Exterior water control, 1-8 ft. wide conc. stop-log (USFWS Middle Pool)	26	25	0	93,844	7,342	500	7,842
O-6	Exterior water control, 10-8 ft. wide conc. stop-logs (State-managed Area)	100	245	6	938,438	73,415	5,000	78,415
Q-2	Interior water control, 1-8 ft. wide conc. stop-log (between USFWS Lower Pool and State-managed Area)	10	14	6	93,844	7,342	500	7,842
R-3	Stop-log structure on exterior berm, 1-8 ft. conc. stop-log (USFWS Middle Pool)	0	40	0	93,844	7,342	500	7,842

Table 12. Costs and Outputs of Recommended Plan.
(Initial Costs are preliminary, not detailed MCACES costs, and include contingencies, Engineering & Design, and Construction Management. For Annualized Initial Costs, i=0.07625/year, n=50 years. n.a.= not available. Hillside sediment control measures do not include contingencies.)

Measure		Outputs (AAHUs) Wildlife	Aquatic	Mussel	Costs: Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
W-2	Flow through L25 spillway, 2-54 in. conc. pipes (from State-managed Area)	48	0	6	647,000	50,618	12,956	63,574
AB-1	Bottomland Forest Habitat Improvements (State-managed Area)	n.a.	n.a.	0	87,800	6,869	740	7,609
	Totals	903	746	56	5,976,875	373,127	83,388	456,515

Habitat enhancements from the recommended measures (when including the Hillside sediment control measure) are estimated to provide a net gain within the project area of 903 average annual habitat units (AAHUs) for wildlife and 746 AAHUs for fishes, and 56 AAHUs for mussels.

The hillside sediment control measure will also provide net gains of AAHUs in the upland watersheds on non-project land for non-target species. These gains have been calculated to be 697 AAHUs for bobwhite quail, and 500 AAHUs for fox squirrel. See Appendix O, Enclosure O-3.

B. Construction Methods.

(1) Foundation Considerations. Foundation Considerations: The Geotechnical Exploration and Testing program (detailed in Appendix F) indicates that the foundation is capable of supporting the various berms, embankments and water control structures. Final design work detailing construction dewatering, bearing capacity and settlement potential for these structures will be completed during the plans and specifications phase. Additional exploration, testing and design (as outlined in Appendix F) will be needed for the detailed design (plans and specifications) of the structure which passes through the Lock and Dam No. 25 overflow section.

(2) Site Access. Access to the part of the project controlled by the U.S. Fish and Wildlife Service can be done by conventional land based equipment. Access to that part of the project controlled by the Illinois Department of Natural Resources will be more difficult. Access by boat may be the only way to access some of the areas. As the exterior berm embankment progresses, access will become easier. Access to the structure which passes through the Lock and Dam No. 25 overflow section is only possible by boat. Therefore, construction equipment associated with this construction will have to be barged to the site from one of the existing boat ramps on the Illinois Shore.

(3) Construction Materials. Only common construction materials will be required for this project.

(4) Threatened and Endangered Species Considerations.

Wintering Bald Eagles. Most construction activities would likely take place outside of the winter months. In addition, consideration (in coordination with the USFWS) will be given during the preparation of Plans and Specifications to sequencing construction activities in a manner that minimizes impacts to eagles. Specific restrictions relative to any sequencing will be included as part of the contract specifications. The contracting officer will ensure appropriate compliance.

Indiana Bat. Special conditions on the contracted work will require that tree clearing activities be scheduled outside the period May 1 - August 31 when Indiana bats are known to inhabit summer habitat. If for any reason tree clearing activities have to be carried out during the period May 1 - August 31, a site visit will be conducted first by a team of biologists to determine if any roost trees are among those proposed to be removed. If none are found, tree clearing activities could resume. If removal of a roost tree is proposed during the period May 1 - August 31, then the District must enter into section 7 consultation with the U. S. Fish and Wildlife Service to determine if the proposed action is likely to jeopardize the continued existence of the Indiana bat.

(5) Waterfowl Considerations. Consideration will be given during the preparation of Plans and Specifications to sequencing construction activities in a way that

minimizes the disruption of resting and feeding waterfowl during the fall and early winter period.

C. Real Estate Requirements. With the exception of the Hillside Sediment Control Measures, this project is designed to be completely contained within Federally-owned property. The U. S. Army Corps of Engineers originally acquired this property and it is currently managed by the U. S. Fish and Wildlife Service and the Illinois Department of Natural Resources.

Project features include two lowland sediment traps. The most northerly trap lies within Federal land managed by the U. S. Fish and Wildlife Service, the southerly trap is within the land managed by the Illinois Department of Natural Resources. Both sediment traps have been designed to have no impact on adjacent private property.

The features of the hillside sediment control program will remain on privately-owned land. There is a non-cost easement granted to the soil and water conservation district (SWCD) and the NRCS established in a cooperative agreement between the landowners and the SWCD for the inspection of these features. No additional realty rights are necessary to acquire for the construction, operation and maintenance of this project.

12. FUTURE WITH PROJECT CONDITIONS.

A. Physical Setting. There will be minor alterations to topography due to berm construction and dredging to improve drainage and to provide deep water for fish overwintering.

B. Water Resources. The surface waters within the FWS lower management unit and the IDNR managed area will be stabilized when pool levels are at or below normal operating level except for partial summer drawdowns to facilitate the development of moist soil plants. Water level stabilization will insure adequate water is present to foster the growth of submergent aquatic vegetation and provide improved fish spawning and over wintering habitat. There may be a seasonal increase in the amount of surface water due to water level management schemes for the various management units. The quantity of deep water habitat will increase in and adjacent to the project as a result of dredging and excavation for berm construction.

C. Geology and Soils. The project will not affect the geology, but will significantly reduce the amount of sediment that is being deposited within the lower end of the project area.

D. Water Quality with Project. The overall reduction in the sedimentation rate is itself a significant water quality enhancement. Stabilizing the water levels in the lower portion of the project area will insure that deeper water will be present even when the pool is "on tilt". The result should enhance the aquatic biota and insure that deep water habitats will have sufficient oxygen during normal winters to minimize or prevent fish mortality.

The predominant land use in the area is agricultural, consequently, sediment samples from within the project area were analyzed for pesticides and heavy metals. Evaluation of the results indicates the sediments do not contain any known contaminants. The disturbance of these sediments during construction should not have a significant impact.

Water quality certification under Section 401 of the Clean Water Act will be needed for mechanized land clearing, land excavation, dredging in the FWS middle management unit and IDNR unit, construction of disposal areas, water control structures, pump stations and stone dikes. The certification would allow for the open water placement of mechanically dredged material. However, geotextile curtains would be used around all the areas where dredged material is to be placed. These curtains would remain in place until all settling is complete.

E. Habitat Types and Vegetation.

(1) Bottomland Forest. The impact of construction activities to the bottomland forest will be minimal. Berm alignment on the FWS middle and lower management units will be atop an existing berm or in open fields, except where some spot

tree removal may be necessary. The berm between the state-managed portion of the project area and the river will be excavated from the river bottom and placed outside of the existing tree line. Elevations may be high enough on some portions of the state area to preclude the need for berm construction or necessitating filling only in lower areas, thus little forest disturbance will occur. Selective tree removal or spot clearing may be needed to accommodate the service and management access road along the berm.

The loss of forest due to construction activities will be much less than that which occurred as a result of the flood of 1993. A tree planting/seeding and bottomland forest improvement measure will offset the minor losses due to construction and aid with the reestablishment of the forest lost due to the flood of 1993. Direct seeding of mast species such as pecans and oaks may occur in some areas, whereas the use of seedlings may be more desirable in others. Replacement of trees will occur predominantly on FWS managed land, while on IDNR managed land the interest will be in bottomland forest improvement to upgrade the forest quality and change the species composition toward more hard mast producing species. Approximately 25% (150 acres) of the bottomland forest on the FWS will be targeted for tree replacement and/or bottomland forest improvement. Approximately one half (100 acres) of the state-managed portion of the project area will be targeted for bottomland forest improvement. Upon completion of the perimeter berm the hydrology of the entire project should be such that less water tolerant species such as pecans and oaks, should thrive and be able to regenerate on higher areas.

(2) Backwater Lakes. The interior sloughs in the project area will be altered only as needed to construct berms or to provide deep water habitat for fish. Dredging in the FWS Middle Unit will consist of a 50-60 foot wide channel approximately 2.5 miles long and connecting the water control structures at the north end and on the southwest corner. Dredging in the FWS Lower Unit will be as needed to construct berms or project features and as needed to insure fish access to the "Big Hole" area for over wintering. The IDNR managed portion of the project will be dredged for the purpose of constructing berms and/or project features, to insure fish access to the "Big Hole" area for over wintering and dredging upstream of the gated concrete culverts through the L&D No. 25 overflow structure to insure adequate water flow over the mussel bed and for water level management purposes. Another anticipated impact to the slough areas will be a drawdown to consolidate the flocculent substrate, thus decreasing turbidity and enhancing the rooting capabilities of aquatic and emergent vegetation. Similar drawdowns may periodically be necessary as silt continues to accumulate in the project area over time.

(3) Cropland. There are a total of 224 acres of cropland in the project area (134 acres FWS Middle Unit, 80 acres FWS Lower Unit, 10 acres IDNR unit). The quality of this habitat for wildlife will increase with the increased water management capability. The amount of available cropland may decrease somewhat due to reforestation measures on the two FWS units. However, this should not have a significant adverse impact upon the species using this habitat. The project will not affect any prime, unique, statewide or locally important farmland, and is in compliance with Illinois' Farmland Preservation Act (See

Appendix I).

(4) Side Channel Habitat. One of the more important features of the project is the preservation of the side channel habitat in the IDNR managed portion of the project area. These channels are necessary as a source of flow for water going over the mussel bed, which is located in the largest side channel. Water control structures will be placed at the upper end of these channels, where they connect with the main channel. The 70"s channel will have two 48-inch CMP's and one eight foot stop-log structure, while the larger 40's channel will have four 48-inch CMP's and two eight foot stop-log structures. These structures have been sized to insure that existing flows can be maintained in these channels after the project is completed. The outflow from these channels will be released either through the two 54-inch concrete pipes through the L&D No. 25 overflow structure, or through the water control structures located in the perimeter berm approximately three/quarters of the way southward in the IDNR managed portion of the project. The existing amount of side channel habitat is expected to be maintained throughout the life of the project.

F. Management. Enhanced management of the project area by the FWS and IDNR will be possible upon completion of the project. All three management units will have the capability to reduce water levels to consolidate flocculent substrate material and to encourage the development of moist-soil plants on an annual basis. Total water reductions will not be utilized in most years in order to protect the development of any submerged aquatic vegetation beds that are expected to developed.

Water levels in the FWS Middle Unit and the IDNR Unit will be managed at or near pool levels after moist-soil plants are flooded, except when the pool is on "tilt", when the water levels in the management units will be higher than the pool.

The FWS Lower Unit will be held slightly higher than the other two units, primarily to benefit the brooding of wood ducks. When the three management units and the pool are at the same level, ingress and egress by fish and recreational boaters will be possible through the eight foot stop-log structures. This will be especially important during the fall for hunting and for fish access to the sloughs to over winter, and during the spring and early summer for fish access to the sloughs and side channels for spawning. Water level fluctuations in the management units will not be so severe most years that the rearing of fry and fingerlings fish produced within the project will be impeded (See Figures 18 and 19 for water level management plans). Use of the area by the general public is expected to be higher than at present because of the more stable water levels, with opportunities for fishing, hunting and recreational boating being enhanced.

G. Animals. Habitat benefits for all management measures were quantified using three methods, one for wildlife, one for fish and one for freshwater mussels and are described in detail in Appendix B. The evaluation for wildlife habitat conditions was made for four target and five non-target species (all birds). HSI's were computed for certain other species including mammals and birds. Habitat conditions for fish were assessed in terms of two target and two non-target species. Habitat conditions for freshwater mussels were assessed in terms of mussels in general (i.e., not species specific). The effect of the recommended plan on the evaluation species is summarized below:

(1) Birds. Target species evaluated were mallard, diving ducks, wood duck and Canada goose, all of which represent the waterfowl bird group. Non-target species were lesser yellowlegs (shorebirds group); king rail (cranes and allies group); green-backed heron (herons and egrets group); and northern parula and prothonotary warbler (songbirds group, more specifically Neotropical migrants).

The mallard, diving ducks and Canada goose are expected to benefit substantially from the moist-soil management capability--an effect of the project's stable water levels and the growth of submergent aquatic vegetation. The wood duck will also benefit, but not at the same extent as the other three species. The lesser yellowlegs, king rail, green-backed heron and prothonotary warbler should receive significant habitat benefits as well. The only evaluation species showing a net loss in habitat value is the northern parula, and this is due to a reduction in the conversion of aquatic habitat to terrestrial habitat. The same phenomenon also lessens the benefits shown for the wood duck. A variety of other resident and migratory species should also benefit from the improved management capability at the site.

Reforestation on the FWS units and bottomland forest improvements on the IDNR managed unit (providing a better mix of mast tree species) are expected to benefit such migratory species as the mallard, wood duck, green-backed heron, prothonotary warbler and northern parula as well as resident species such as the wild turkey.

(2) Mammals. See Appendix B, Tables B-2 and B-3 for species.

(3) Amphibians and Reptiles. The evaluation methods did not assess habitat conditions for amphibians or reptiles, nor are these groups the focus of any specific management objective. However, the stabilization of water levels in the management units and the presence of submergent and emergent aquatic vegetation should be beneficial to the life cycles of many species from these two animal groups. Hopefully, a habitat suitability model for species representing these groups will be developed for use in the evaluation of future projects.

(4) Fish. The target species--smallmouth buffalo and flathead catfish--represent the large slackwater fishes guild--the primary guild targeted for management in the project area. Non-target species are the emerald shiner (a member of guild 2) and the largemouth bass (a member of the guild 5). The habitat evaluation focused upon the sloughs and side channels present within the project area.

Substantial habitat benefits are expected to accrue to all of the target and non-target species and to species within the fish guilds that they represent. All species of fish that use the side channels and sloughs in the project area will benefit from the proposed measures, as these measures are expected to reduce sediment, stabilize water levels and allow for the growth of submergent and emergent aquatic vegetation that will be beneficial for food production and escape cover. Because access to these waters are not expected to be impeded by the perimeter berms (due to the stop-log structures) the area will continue to be important for over wintering fish.

(5) Freshwater Mussels. The habitat evaluation did not target any specific mussel species as an indicator. Instead, it utilized habitat parameters felt to be important for all species of freshwater mussels. The habitat evaluation did not indicate that habitat conditions for freshwater mussels would improve (as compared to existing conditions) because of the project, but rather shows that the decline of the habitat with the project would be less than that expected without a project.

(6) Other Animals. Aquatic conditions within the project area are expected to improve as a result of the project due to stabilized water levels and an expanded food base. A variety of aquatic invertebrates including insects, crayfish and fingernail clams should benefit.

H. Threatened and Endangered Species. Threatened and endangered species are not expected to be impacted by the project. One endangered species--the Indiana Bat (Myotis sodalis)--is listed for the area along with two threatened species--the Bald Eagle (Haliaeetus leucocephalus and the Decurrent False Aster (Boltonia decurrens). See Appendix H for the St. Louis District's Biological Assessment describing the project's effect on Federally threatened and endangered species.

Species listed as threatened or endangered at the state level should benefit from the same project features that benefit the non-listed species. Some species such as the king rail should realize substantial habitat benefits, but no species are expected to lose habitat benefits as a result of the project.

I. Recreation / Aesthetic Resources. Stabilization of the water levels due to project features will directly benefit recreational use of the area. Hunters, fisherman and boaters will no longer have access problems due to shallow water should the pool be "tilted" to prepare for an incoming high water event. Also, anglers and waterfowl hunters should benefit from the increased numbers of fish and waterfowl that will use the area due to the improved habitat conditions. Hunting within the FWS refuge will continue to be prohibited but bird watching will improve as more migratory birds, especially waterfowl, use the refuge. Short-term opportunities for fishing, hunting and boating may be affected during project construction.

Construction activities will have minor adverse impacts on the aesthetic quality of the project area during the duration of the work. The most visible activities will occur during the construction of the perimeter berm and water control structures, and the dredging for drainage and deep water fish habitat. The aesthetic quality of the area is expected to improve over the long term due to more stable water levels, submergent and emergent aquatic vegetation growth, and improvements to the bottomland forest.

J. Socioeconomic Resources. The project is not expected to affect development in Calhoun County. Locally, residents may benefit from the improved hunting, fishing and boating in the area, but a large scale increase in any of these activities is not expected.

The proposed project would have minimal or no impact on the following Section 122 (Rivers and Harbors Act) socioeconomic categories: aesthetic values, transportation, public health and safety, community cohesion, community growth and development, business or business activity, food supply, navigation, flooding effects, or energy sources.

K. Cultural Resources. As indicated in the EXISTING CONDITIONS, section 2.K, seven archaeological sites were found during the Phase I archaeological survey of the construction zone. Four sites (11-C-207, 11-C-208, 11-C-209, 11-C-210) were evaluated as potentially eligible for listing on the National Register of Historic Places and the ISHPO concurred. As the project is presently planned, neither construction nor project operation will impact any of the potentially eligible sites. The four potentially eligible archaeological sites are within the wildlife refuge and will be managed by the U. S. Fish and Wildlife Service. Should any future activities be planned at any of the potentially eligible sites which might impact them, Phase II testing for eligibility should be conducted. If determined eligible, then the sites should be avoided or mitigated if avoidance is not feasible. The three ineligible sites (11-C-205, 11-C-206, 11-C-211) will not require avoidance or management.

Additional eligible or potentially eligible sites may be located by Phase I archaeological survey of project elements added since the June 1994 survey was conducted. Such sites will require further testing and/or avoidance or mitigation.

The geomorphological investigation demonstrated that land forms in the center of the Batchtown HREP have a high potential for both surface and buried archaeological sites to occur. The central landforms are ridges which are several thousand years old. Their surfaces are covered by relatively thin (less than 45 cm) recent deposits. These central ridges area easily identified: they run almost due east and west, and on the map they appear perpendicular to the bluff line.

The geomorphological investigation also demonstrated that landforms in the southwestern and northwestern portions of the HREP are unlikely to contain archaeological sites now. However, sites may have been present on these landforms previously since a site about a thousand years old was recorded from the southwestern HREP (that site is usually inundated). These landforms are poorly drained and relatively recent; they are covered by a thick (up to about 3 feet) modern flood sediments. These landforms are ridges and swales oriented southeast to northwest.

A letter dated July 19, 1995 from the Illinois Historic Preservation Agency concurred with an archeological phase I reconnaissance that the project (as then defined) would have no effect upon Historic Properties. Since that archeological reconnaissance was performed there have been changes and additions to the project. These changes consist of: the addition of a hillside sediment control program with as-of-yet unlocated sediment traps, the addition of a lowland sediment trap and accompanying borrow area for the USFWS Middle Pool, the addition of a lowland sediment trap and borrow area at Titus Hollow in the State-managed Area, the addition of a borrow area in the agricultural field behind the existing berm for Turner Branch in the USFWS Lower Pool, and a disposal area near the intersection of the interior berm/road and the existing exterior berm for the USFWS Middle Pool, approximately Station 123+00. Other changes to the project involved: the elimination of all proposed earthwork and construction of an overflow structure on the USFWS Middle Pool's berm, the elimination of a stop-log and CMP structure on the berm/road between the USFWS Middle and Lower Pools, and the changing in place of proposed CMP structures to stop-log structures, and the elimination of a CMP at the berm between the USFWS Lower Pool and the State-managed area. Also, the proposed exterior berm for the State-managed area was tapered down from elev. 435.5 to 434.5 at Station 260+50.

L. Air Quality. Fumes and dust will be generated by heavy equipment during the construction process. The pumps to be used to assist in water level management in the three management units will be diesel, consequently, air quality will be affected for a short time by diesel fumes when pumping is occurring. The project is not expected to have any long-term adverse affect on the air quality of Calhoun County.

M. Compliance with Environmental Laws and Regulations. The degree of compliance of the proposed project with environmental laws and regulations is presented in Table 14.

N. Adverse Environmental Effects Which Cannot be Avoided. Adverse impacts which cannot be avoided include spot clearing and/or tree removal for the construction of berms, water control structures and service roads, the placement of dredged material (sediment) into slough habitat adjacent to areas excavated, loss of cropland due to conversion to bottomland forest, loss of side channel habitat due to construction of berms and water control structures and the loss of cropland and bottomland hardwoods due to the construction of the lowland sediment trap.

O. Short-term Uses of Environment Versus Long-term Productivity. Local short-term uses of the environment are limited to disturbances created during the construction process and during pumping activities. Such things as soil disturbance, tree removal, disposal of dredged material, construction of berms and water control structures, staging for construction equipment and pumping to assist with water level management are all short-term uses of the environment. Maintenance and enhancement of long-term biological productivity is the basic goal of this project. Productivity of all three management units will be enhanced once improvements to water control are implemented and the production of submergent and emergent aquatic vegetation is possible. Aquatic productivity in the side channels is expected to be to be maintained because measures are proposed to maintain side channel flows. The short-term uses of the project area are minor in comparison to the expected increase in biological productivity.

P. Irreversible or Irretrievable Resource Commitments. Should the proposed project be implemented, there will be irreversible or irretrievable resource commitments. These would include initial construction costs (mostly Federal), and operation, maintenance and rehabilitation costs by the U.S. Fish and Wildlife Service and the Illinois Department of Natural Resources.

Q. Cumulative Impact Assessment. In terms of cumulative impacts, the HREPs are limited in scope. The EMP is working only a fraction of the total habitat area of the UMRS (See Cumulative Impact Assessment Appendix R). If all planned program activities turn out to be a failure (and most evidence is to the contrary), it would not represent an irreversible, catastrophic adverse impact on the river's ecosystem.

Table 13. Magnitude of Probable Environmental Impacts Associated with Implementation of Preferred Management Measure.

PARAMETER	INCREASING BENEFICIAL IMPACT <------------------			NO APPRECIABLE EFFECT	INCREASING ADVERSE IMPACT ------------------>		
	SIGNIFICANT	MODERATE	MINOR		MINOR	MODERATE	SIGNIFICANT
SOCIAL EFFECTS							
Noise Levels					X		
Aesthetic Values					X		
Recreational Opportunities			X				
Public Health and Safety				X			
Transportation				X			
Community Cohesion				X			
Community Growth and Development				X			
Business and Home Relocations				X			
Existing/Potential Land Use				X			
Controversy				X			
ECONOMIC EFFECTS							
Property Values				X			
Tax Revenues				X			
Public Facilities and Services				X			
Regional Growth				X			
Employment				X			
Business Activity				X			
Farmland/Food Supply				X			
Commercial Navigation				X			
Energy Needs and Resources				X			
Flooding				X			
NATURAL RESOURCE EFFECTS							
Air Quality					X		
Terrestrial Habitat		X					
Wetlands	X						
Aquatic Habitat	X						
Habitat Diversity and Interspersion		X					
Biological Productivity		X					
Quality of Surface Water				X			
Water Supply				X			
Groundwater				X			
Soils				X			
Threatened or Endangered Species				X			
CULTURAL RESOURCE EFFECTS							
Prehistoric/Historic Architectural/Archaeological Values				X			

Table 14. Degree of Compliance of Selected Plan with Environmental Statutes and Requirements.

Federal Laws, Executive Orders, and Policies	Degree of Compliance [1]
Analysis of Impacts on Prime and Unique Farmland (CEQ Memorandum, 11 Aug 80)	full compliance
Archaeological and Historic Preservation Act, 16 U.S.C. 469, et seq.	full compliance
Clean Air Act, as amended, 42 U.S.C. 7401, et seq.	full compliance
Clean Water Act (Federal Water Pollution Control Act), as amended, 33 U.S.C. 1251, et seq.	full compliance[2]
Coastal Zone Management Act, 16 U.S.C. 1451, et seq.	not applicable
Endangered Species Act, as amended, 16 U.S.C. 1531, et seq.	full compliance
Environmental Effects Abroad of Major Federal Actions (Executive Order 12114)	not applicable
Estuary Protection Act, 16 U.S.C. 1221, et seq.	not applicable
Farmland Protection Policy Act, 7 U.S.C. 4201, et seq.	full compliance
Federal Water Project Recreation Act, 16 U.S.C. 460*l*-12, et seq.	not applicable
Fish and Wildlife Coordination Act, 16 U.S.C. 661, et seq.	full compliance
Floodplain Management (Executive Order 11988)	full compliance
Land and Water Conservation Fund Act, 16 U.S.C. 460*l*-4, et seq.	not applicable
Marine Protection, Research, and Sanctuaries Act, 16 U.S.C. 1401, et seq.	not applicable
National Environmental Policy Act, as amended, 42 U.S.C. 4321, et seq.	full compliance
National Historic Preservation Act, as amended, 16 U.S.C. 470, et seq.	full compliance
Protection of Wetlands (Executive Order 11990)	full compliance
Rivers and Harbors Act, (Permits) 33 U.S.C. 403, et seq.	full compliance[2]
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq.	not applicable
Wild and Scenic Rivers Act, 16 U.S.C. 1271, et seq.	not applicable

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[1] The degree of compliance falls into one of two categories:

Full compliance - the project meets all the requirements of the statute at the present time.

Not applicable - the statute does not apply to the project.

[2] Full compliance will be achieved when permits are issued under provisions of Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act, and when Illinois State certification in given in accordance with Section 401 of the Clean Water Act.

13. FINDING OF NO SIGNIFICANT IMPACT (FONSI).

BATCHTOWN
HABITAT REHABILITATION AND ENHANCEMENT PROJECT
POOL 25, MISSISSIPPI RIVER
CALHOUN COUNTY, ILLINOIS

1. I have reviewed and evaluated the documents concerning the proposed rehabilitation and enhancement of the Batchtown project area.

The purpose of the project is to restore and maintain habitat diversity to benefit fish, mussels and wildlife species by: maintaining and improving side channel habitat by maintaining flow and preventing river-borne sediment from filling side channels, providing overwintering and summer habitat for fish in side channels and sloughs, increasing habitat quality and quantity of natural and artificially flooded habitats for wetland-dependent wildlife, and maintaining and improving habitat quality and quantity of bottomland forest within the project area.

2. Prior to my decision, I evaluated pertinent data and information which led to the development of various potential Management Measures. I have reviewed the steps in the evaluation process that produced the recommended plan.

3. All Management Measures have been studied, and major findings of this investigation include the following:

a. The "No Action" measure was evaluated but subsequently rejected. This measure would do nothing to address study objectives;

b. The recommended project is a viable, acceptable and effective combination of measures to address study objectives.

4. The possible consequences of the recommended plan have been studied for physical, environmental, cultural, social, and economic effects. Major conclusions of this study are as follows:

a. It is expected that substantial habitat benefits will accrue to wetland wildlife and river fishes of the project area;

b. The sloughs within the project area will improve in habitat quantity and quality because of improved water management capabilities;

c. Habitat quality of bottomland forest on IDNR managed areas will improve after the implementation of bottomland forest improvements to change the mix of species present

14. PROJECT REQUIREMENTS.

A. Cost Sharing. Under Public Law 99-662, the Water Resources Development Act of 1986, Section 906 (e) (3), the project first costs shall be a Federal cost when the project is located on lands managed as a national wildlife refuge. First costs are defined as the costs of preparing the Draft and Final Definite Project Report planning documents, Plans and Specifications, and the construction and construction management costs.

The hillside sediment control measures are entirely on non-Federal lands, and are subject to 75% Federal, 25% non-Federal cost sharing, per the Water Resources Development Act of 1986 (See Appendix J-4). The hillside sediment control measures are the only non-Federal cost-shared items of this recommended project, and the costs are displayed in Table 15.

B. Project Cooperation Agreement (PCA). A PCA is not required between the Corps and IDNR because there is no project cost sharing with IDNR. Neither will the project require the acquisition of lands, easements, real estate, right-of-way, or disposal areas (LERRDS) for any features associated with the IDNR-managed portion of the project.

A letter of intent has been received from the NRCS to sign a memorandum of agreement to participate in the hillside sediment control measures as recommended in this DPR (See Appendix J).

C. Initial Construction Costs. Initial costs for the Management Measures of the recommended plan for the Draft DPR are in Table 12. A Microcomputer-Aided Cost Engineering System (MCACES) cost estimate (a more detailed and standard estimate required for Corps projects) of the recommended plan was performed for the Final DPR and is summarized in Table 15, below.

Table 15. Summary of Initial Costs for the Recommended Plan.
(using MCACES[1] cost estimates)

Account / Item	MCACES Cost Estimate (Not fully funded)	MCACES Cost Estimate (Fully funded[2])
06 Total[3]	$5,372,814	5,641,455
Federal share	5,234,108	5,495,813
non-Federal share[4]	138,706	145,641
30 Planning, Engineering and Design (including the preparation of plans and specifications [construction contract documents], and Value Engineering Study)	746,000	783,300
31 Construction Management	860,000	903,000
Total Project Implementation Costs	6,978,814	7,327,754
Preparation of Draft and Final Definite Project Reports	820,000	820,000
Total Study and Fully Funded Project Implementation Costs	7,798,814	8,147,754

Notes:

1. Microcomputer-Aided Cost Engineering System (MCACES). MCACES cost estimates apply contingencies per line item. The Draft DPR did not have MCACES cost estimates available for measure evaluation and the CEICA process. The MCACES cost estimate is included in Appendix L.

2. Increased by 5% to reflect anticipated cost inflation.

3. Account 06, Fish and Wildlife Facilities. This includes the costs for the Hillside Sediment Control Measures. The estimated total cost (not fully funded, but including contingencies) for the Hillside Sediment Control Measures is $554,825 (non-Federal 25% cost-share: $138,706, Federal cost-share: $416,119). The estimated total fully-funded cost for the Hillside Sediment Control Measures is $582,566 (non-Federal 25% cost-share: $145,641, Federal cost-share: $436,925).

4. The Hillside Sediment Control Measures are the only non-Federal cost-shared items of this recommended project.

D. <u>Operation, Maintenance and Rehabilitation</u>. After construction of the project, annual operation, maintenance and rehabilitation (OM&R) of the project will be the responsibility of, and funded 100% by the Illinois Department of Natural Resources (IDNR) (per Section 107(b) of the Water Resource Development Act of 1992) for the portion of the project area that it presently manages. The USFWS will have the OM&R responsibility and funding for the Middle and Lower Refuge Pools. OM&R will be conducted for the project life of 50 years.

An O&M manual detailing the operations and maintenance requirements will be prepared by the Corps during the plans and specifications phase. Development of the manual will be coordinated with IDNR and the USFWS.

PROJECT	Page __ of __	COMPUTED BY	DATE
SUBJECT		CHECKED BY	DATE

Figure 18. Water Management Plan for USFWS Middle and Lower Pools.

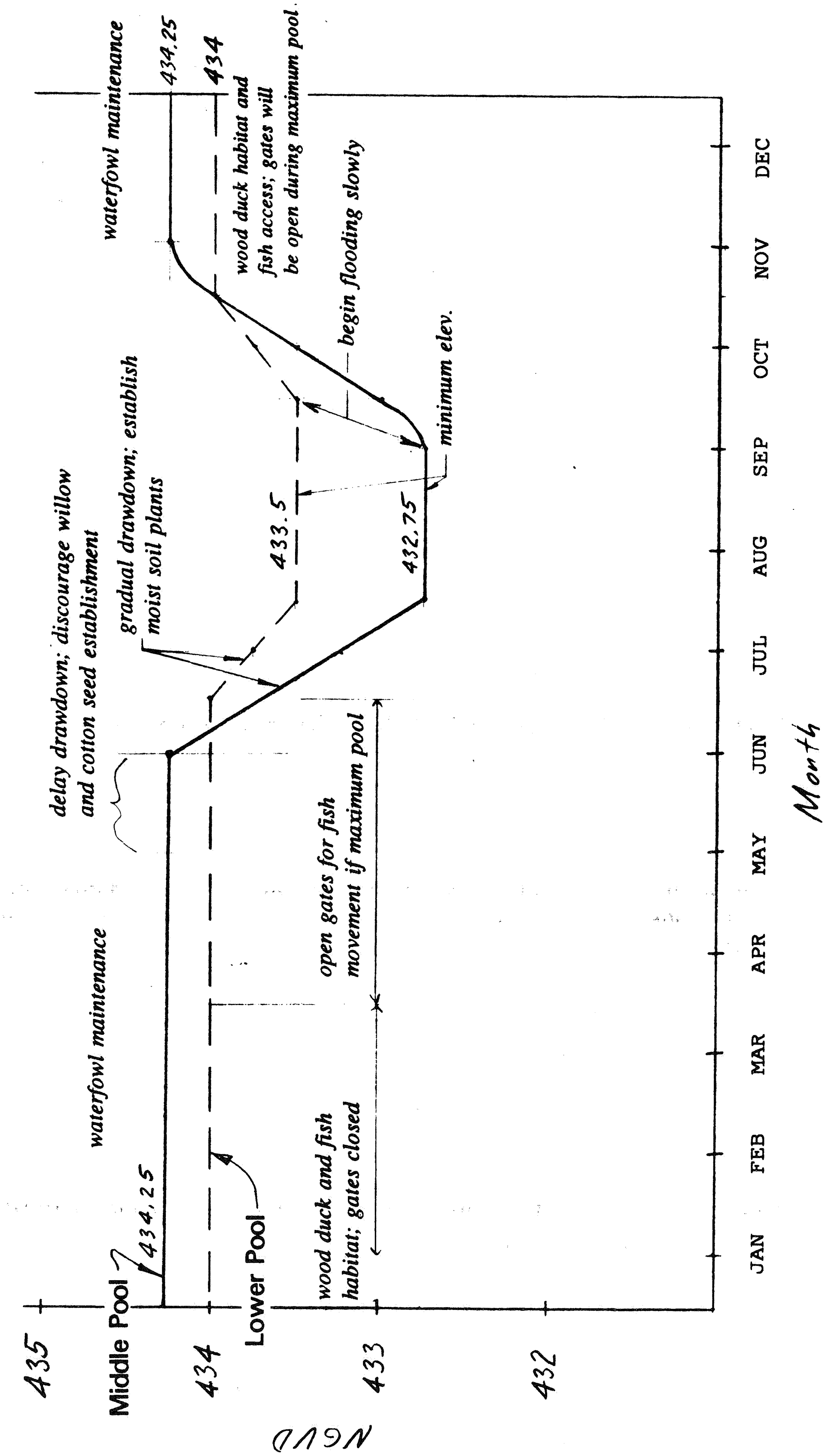


Figure 18.

PROJECT	Page __ of __	COMPUTED BY	DATE
SUBJECT		CHECKED BY	DATE

Figure 19. Water Management Plan for State-Managed Area.

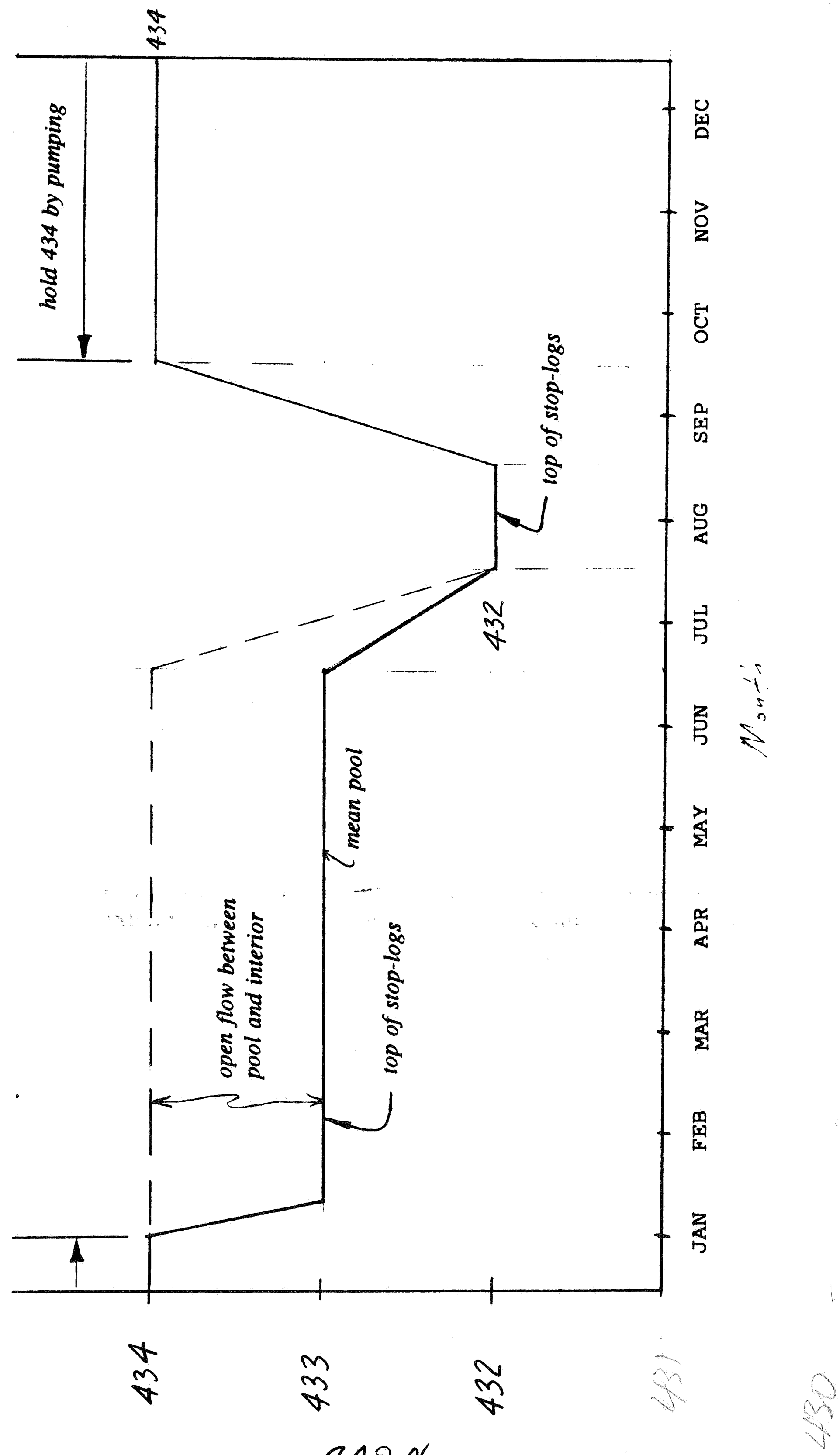


Figure 19.

E. Performance Evaluation. Table 16 lists the general types, purposes, and responsibilities of project evaluation. Plans to monitor this project for performance evaluation purposes were designed to measure the degree of attainment of project objectives. Therefore, for each objective, an appropriate monitoring parameter was specified. The specific parameter to be measured for each objective is shown in Table 17.

It is unlikely that performance evaluation will be conducted on this project because construction of the project is not scheduled to be complete before the year 2001, and because the Environmental Management Program is only authorized through the year 2002. However, should funding become available, post-construction monitoring and performance evaluation could take place. Field observations could be conducted. The habitat evaluation methods described in Appendix B (WHAG for terrestrial, FHAG for aquatic) would be reapplied at the project site during target years 1, 5, and 10 to determine how habitat quality as assessed by these methods has changed after construction is completed. Likewise, actual numbers of waterfowl using the project site in the fall would be estimated by aerial census and ground counts. Interviews with sport fishermen would be conducted to determine if fishing has improved. Assuming that Batchtown would require approximately the same amount of performance monitoring and evaluation as for the Swan Lake HREP, the estimated average annual cost for this at Batchtown would be about $10,000.

Table 16. Monitoring and Performance Evaluation Matrix.

Type of Activity	Purpose	Responsible Agency	Implementing Agency	Funding Source	Remarks
Sedimentation Problem Analysis	System-wide problem definition. Evaluates planning assumptions.	USFWS	USFWS (EMTC)	LTRM	Leads into pre-project monitoring; defines desired conditions for plan formulation.
Pre-project Monitoring	Identifies and defines problems at HREP site. Established need for proposed project features.	Sponsor	Sponsor	Sponsor	Attempts to begin defining baseline.
Baseline Monitoring	Establishes baselines for performance evaluation.	Corps	Field station or sponsor thru Cooperative Agreements or Corps.	LTRM	See Plate 20 and Plate 23.
Data Collection for Design	Includes identification of project objectives, design of project, and development of performance evaluation plan.	Corps	Corps	HREP	Comes after the fact sheet. This data aids in defining the baseline.
Construction Monitoring	Assesses construction impacts; assures permit conditions are met.	Corps	Corps	HREP	Environmental protection specifications to be included in construction contract documents. Inter-agency field inspections will be accomplished during project construction phase.
Performance Evaluation Monitoring	Determines success of project as related to objectives.	Corps (physical), sponsor (biological).	Field station or sponsor thru Cooperative Agreement, sponsor thru O&M, or Corps.	LTRM	Comes after construction phase of project.
Analysis of Biological Responses to Projects	Determine critical impact levels, cause-effect relationships, and effect on long-term losses of significant habitat.	USFWS	USFWS (EMTC)	LTRM	Problem Analysis and Trend Analysis studies of habitat projects.
	Demonstrates success or failure of habitat	Corps	Corps/USFWS/(EMTC)/Others	LTRM	Biological Response Study tasks beyond scope of Performance Evaluation, Problem Analysis, and Trend Analysis.

Table 17. Post-Construction Monitoring For Project Performance Evaluation.

Goals	Objectives	Monitoring Plan		
		Unit of Measure	Method	Target years for Data Collection (50-year project life, construction completed at 0) [1]
To rehabilitate the area's riverine habitat diversity to benefit fish, wildlife and freshwater mussels.	Improve side channel habitat by preventing river-borne sediment from filling the side channels	Depth (tenths of a foot) of sediment deposition	Corps conducts hydrographic survey, determines depth of sediment deposition.	-1, 0, 1 . . .
	Improve overwintering habitat for fish in side channels and backwaters	catch per unit of effort	electrofishing in wintering areas	-1, 0, 1 . . .
	Create a water-level management capability that is independent of water levels in Pool 25	annual hydrograph for each mananagement unit	monitor hydrographs for each management unit	-1, 0, 1 . . .
	Increase diversity of wetland types within the project area	numbers of, and species of aquatic macrophytes	annual point samples	0, 1 . . .
	Improve habitat quality and quantity of bottomland forest within the project area	numbers of, ans sizes of tree species	forest survey taken at 10 year intervals	0, 10 . . .
	Ensure adequate long-term water flow over the freshwater mussel beds	bed survival size and density	monitor mussels at 5 year intervals, monitor flow in side channels	0, 5 . . .
	Reduce the rate of siltation throughout the project area	area of project lost to siltation	review aerial photographs at 5 year intervals	0, 5 . . .
	Improve spawning habitat for riverine fishes	species diversity and numbers	larval fish samplers and minnow seine hauls	0, 1 . . .

[1] As presently funded, the Environmental Management Program will terminate in the year 2002. If the program were to be extended beyond this date, monitoring would be expanded into the future for all measures.

F. Steps Prior to Project Construction. The Draft Definite Project Report (DPR) is reviewed internally within the St. Louis District by a technical review team. This internal review replaces technical review by the U.S. Army Engineer Division, Lower Mississippi Valley. The Draft DPR is then reviewed by the sponsors (the Illinois Department of Natural Resources and the U.S. Fish and Wildlife Service). Also, the Draft DPR is reviewed by the U.S. Army Corps of Engineers, North Central Division (NCD) for policy compliance. Concurrent with this review, the Draft DPR is submitted for other agency and public review. The incorporation of review comments, corrections, and other improvements leads to the completion of the Final DPR.

Two measures of the recommended plan are the construction of lowland sediment traps, one in the USFWS Middle Pool, the other at Dixon Hollow in the state-managed area. Some additional planning, coordination, and possible land surveying is required for these measures prior to completion of the Final DPR.

As identified in Appendix F, Geotechnical Considerations, additional engineering, testing, and exploration must be completed in the early stages of the preparation of plans and specifications for the measure that recommends a water control structure passing through the L&D No. 25 overflow structure.

The Final DPR follows the review procedures as for the Draft DPR. After submittal of the Final DPR through the North Central Division for review, approval can be granted by the Assistant Secretary of the Army for Civil Works. North Central Division would request funds for plans and specifications from Headquarters, U.S. Army Corps of Engineers. The current schedule is to complete plans and specifications in fiscal year 1998. A construction contract would be advertised by the competitive bid process and would likely be awarded in fiscal year 1998. Construction would be completed in fiscal year 2000.

15. PARTICIPANTS, COORDINATION, PUBLIC VIEWS AND COMMENTS.

Participants in project planning included the Illinois Department of Natural resources, the U.S. Fish and Wildlife Service, and the St. Louis District, Corps of Engineers. The U.S. Fish and Wildlife Service participates in all EMP habitat projects because of the National Environmental Policy Act, the Fish and Wildlife Coordination Act, and the Endangered Species Act. The U.S. Fish and Wildlife Service is also a local sponsor for this project.

The study participants and ad hoc WHAG and AHAG teams met at the project site and other locations to discuss the project objectives and designs, and correspondence was initiated between the agencies to coordinate the development of the project. Drafts of this report were sent to the USFWS and the State of Illinois for review and comment. The comments received and the results of meetings with these agencies were used to formulate the selected plan and prepare this report. Separate meetings were held in 1991, 1992, and 1993 to discuss and resolve the issues associated with the viability of the mussel beds and the aquatic habitat, and the water management plans. A public workshop was held in Alton, Illinois in April 1991.

On Saturday, May 20, 1995, the Study Manager gave a presentation on the proposed project to a meeting of the Migratory Waterfowl Hunters, Inc. in the Village of Batchtown.

The Draft DPR was compiled and a brief internal review was conducted in September 1995. Also in September 1995 an in-house technical review team (TRT) was formed. See Chapter 19 for a short discussion and the sign-off list. On September 26, 1995 an "advance" copy of the Draft DPR was distributed to points of contact in the USFWS and IDNR for review and comments. On December 18, 1995 in-house technical review began. Comments received from the TRT were consolidated by the TRT team leader, and revisions were made to the report.

On December 11, 1995 a meeting was held at the Pere Marquette State Park to discuss and agree upon potential cost-saving measures for several EMP projects, including Batchtown.

In February 1996 a meeting was held with the NRCS to finalize most aspects regarding the MOA for the Hillside Sediment Control Program.

The Draft Definite Project Report/Environmental Documentation was sent to the agencies and interests listed in Appendix P in March 1996. A public notice was widely distributed in April 1996 describing the proposed project and announcing the joint application for 404 and 401 permits and a public workshop that was held on April 23, 1996. Comments received from the public distribution of the Draft DPR and from the workshop are included in Appendix T (along with responses).

In July 1996 a separate meeting was held on-site to redesign the lowland sediment trap at the USFWS Middle Pool.

16. COMPARISON OF RECOMMENDED PLAN WITH ORIGINAL FACT SHEET CONCEPT.

a. Location. The original fact sheet defined the project area as including 2,069 acres. The acreage has been corrected to 2,327 acres (not counting 7,631 acres contained in the hillside area).

b. Resource Problem. The original fact sheet is fairly accurate; however, the problems have been more accurately defined, and more recognition has been given to the problems caused by the fluctuating water level associated with Pool 25.

c. Proposed Project. The fact sheet very generally described the recommended plan.

d. Proposed Outputs. Better identification of the resource problems and an expansion of the project objectives enabled the project to more strongly rehabilitate aquatic and mussel habitat.

e. Financial Data. The costs in the original fact sheet were estimated by the Illinois Department of Natural Resources in 1988, and for inflation alone would increase in 1996 by at least 50%. The general design (planning) costs were estimated at $315,000. Planning costs have now approached $820,000. Much of this is attributed to the originally-unplanned-for efforts of addressing the mussel resources, a new cost-effectiveness analysis, and in-house technical review. The construction costs were estimated at $2,350,000. This estimate did not include a hillside sediment control program, additional water control and fish passage structures for aquatic and mussel habitat, and likely did not include a 25% contingency, an additional 10% increase for plans and specifications (meeting Corps CADD standards), a 14% increase for construction management costs, nor a 5% increase for "fully funding" as the current estimate does. The estimate for the Draft DPR included 25% for contingencies, $461,000 for engineering and design, $646,000 for construction management, and $504,000 for a hillside sediment control program. The estimate for the Draft DPR is fully funded at $6,537,000. With planning costs, this figure totals $7,357,000 for the Draft DPR, and is now $8,147,754 from the MCACES estimate for the Final DPR. The Draft DPR's estimate does not vary much with an estimate made in 1992 for concept plan C. The Final DPR cost estimate increased some $800,000 over the Draft DPR due to having more detailed cost estimates from the Microcomputer-Aided Cost Engineering System, and includes some increases in initial construction costs, plans and specifications, construction management, and the inclusion of a planned value engineering study. OM&R costs were previously estimated at $8,000--a factor of 10 times smaller than the current estimate of $83,000. The original OM&R estimate likely did not include hired labor costs, nor the operation, repair and replacement costs for the pump stations nor the many additional recommended stop-logs structures. The original fact sheet stated that OM&R cost sharing would be 75% Federal and 25% local. A policy with EMP has since shifted all OM&R costs to the project sponsor.

17. DPR / ENVIRONMENTAL ASSESSMENT PREPARERS.

Name	Study Role	Expertise/Discipline Experience
T. Miller	Biologist	15 yrs Fisheries Biologist, 15 yrs Wildlife Biologist
Dennis Stephens	Hydrologic and Hydraulic Engineer	22 yrs Hydraulic Engineer
Pat Conroy	Geotechnical Engineer	18 yrs Geotechnical Design, SLD
Suzanne Harris	Archeologist	25 yrs Archaeologist, 11 yrs SLD
John Poullain	Civil Engineer	35 yrs Civil Engineering, SLD
Mike Hamm	Civil Engineer	22 years Civil Engineering, SLD
Tom Ruf	Structural Engineer	15 yrs Structural Engineering, SLD
Steele Beller	Real Estate Requirements	Real Estate Specialist 10 yrs Real Estate, Private 7 yrs Real Estate, State of Mo. 8 yrs Real Estate, SLD
John Cannon	Preliminary Planning	Natural Resources Ranger 2 yrs Resource Management, Tulsa District 16 yrs Resource Management, SLD
Cathy Mueller	MCACES Cost Estimate	6 yrs SLD
Roger Myhre	Water Quality	20 yrs Water Quality and Environment Quality Analysis, SLD
Mike Ricketts	Regultory Requirements	2 yrs NRCS 6 yrs Defense Mapping Agency 2 yrs Regulatory, SLD
Sharon Cotner	Project Management	9 yrs Study Management, SLD 8 yrs Project Management, SLD
Dave Kirkpatrick	Study Management	2 yrs Civil Engineering, State of Mo. 1 yr Civil Engineering, private 10 yrs Civil Engineering, SLD
Dave Gates	Preliminary Study Management	10 yrs Wildlife Biology, SLD 8 trs Study Management, SLD

18. DPR AGENCY CONTRIBUTORS.

Name	Agency	Role
Butch Atwood	IDNR, Greenville, IL	Fisheries Biologist
Neil Booth	IDNR, MRF&WMA, Grafton, IL	Site Superintendent
Chris Borden	USNRCS--SCD, Hardin, IL	District Conservationist
Martha Sheppard	USNRCS, Hardin, IL	District Conservationist
Mike Andreas	USNRCS, Belleville, Il	Agricultural Engineer
Michael Bornstein	USFWS, MTNWR	Refuge EMP Coordinator
Ross Adams	USFWS, MTNWR	Refuge EMP Coordinator
Joyce Collins	USFWS, Marion, IL	Ecological Services
Fred Cronin	INHS, LTRMP Fld. Sta., Mel Price	Biologist
Bill Donels	IDNR, Springfield, IL	State EMP Coordinator
K. L. Drews	USFWS, MTNWR, Brussels District	District Manager
Dave Harper	IDNR-Region IV, Alton, IL	District Wildlife Biologist
Marvin Hubble	IDNR, Springfield, IL	State EMP Coordinator
Tom Groutage	USFWS, Marion, IL	Ecological Services
Barry Payne	WES, Vicksburg, MS	Research Biologist
Doug Johnson	USFWS, Twin Cities, MN	Engineering Technician
Murray Laubahn	U of Mo--Gaylord Lab., Puxico, MO	Senior Research Technician
Deck Major	IDNR-Region IV, Alton, IL	Regional Wildlife Administrator
Rob Maher	INHS, LTRMP Fld. Sta., Mel Price	Biologist
Jim Mattsson	USFWS, MTNWR	Assist Regional Refuge Biologist
Rick Messinger	IDNR-Region IV, Alton, IL	Resource Manager
Patti Meyers	USFWS, MTNWR, Brussels District	District Manager
Jerry Olmsted	USFWS, MTNWR, Brussels District	Fisheries Biologist
Mark Phipps	IDNR, Pittsfield, IL	Natural Heritage Biologist
Kim Postlewait	IDNR, MRF&WMA, Grafton, IL	Site Assistant Superintendent
Bob Stratton	USFWS, MTNWR, Quincy, IL	Refuge Management
Chuck Surprenant	USFWS, Carterville, IL	Fisheries Assistance
Chuck Theiling	INHS, LTRMP Field Sta, Mel Price	Team Leader
Tom Wilson	IDNR, Carrollton, IL	Forester
Bruce Yurdin	IEPA, Springfield, IL	State EMP Coordinator

19. QUALITY CONTROL AND TECHNICAL REVIEW.

Recently, the Corps discontinued technical review of reports at the Division level, and transferred this function to the authors of the reports at the District level. Review for policy compliance remains with Headquarters, U.S. Army Corps of Engineers. Additionally, a more formal (yet evolving) quality control / quality assurance process was developed and initiated. The quality control process involves a separate and independent technical review team conducting concurrent review of the reports. Quality assurance implies that the quality control process is reviewed and approved by the Division office. This DPR is the first planning document from the St. Louis District for which in-house technical review was performed. Table 18 is a summary of tasks conducted and issues addressed in the quality control process for this DPR.

Table 18. Quality Control Procedure Checklist.

Task / issue	Completed, or comment
GENERAL	
Authority	
a. Conformity with study authority?	YES
Scope of Investigation	
a. Problems adequately addressed?	YES
Objective of Investigation	
a. Planning objectives clearly stated?	YES
Risk-based Analysis	N/A
Cost Effectiveness and Incremental Cost Analyses	YES
Project Cost Sharing	
a. Is the apportionment of cost to local interests in conformance with present policy and evaluation procedure?	YES
b. If recreation or fish and wildlife enhancement are included in multiple-purpose projects, is a letter of intent from non-Federal interests included?	YES
Coordination	

a. State/local/Federal coordination adequate, views considered? YES

b. Conforms with laws, orders, and agency agreements? YES

c. Preservation/conservation/historical/ scientific interests consulted, views considered? YES

Public Involvement

a. Was adequate public involvement conducted during the planning process to fully inform interested parties and to ascertain their views? YES

b. Have implications associated with the recommended plan been properly addressed? YES

c. Has there been adequate response to public concerns? YES

d. Has the public involvement process been documented, and a discussion of the process prepared? YES

Policy Aspects

a. Conforms with applicable policies? YES

b. Consideration of Administration policies/ decisions? YES

Legal/Institutional

a. Does the draft project memorandums of agreement reflect applicable cost sharing and financing policies; policies regarding evaluation of in-kind non-Federal contributions; and other provisions required by law and policy for new start construction projects? YES

b. Has the sponsor either demonstrated that it possesses all authorities necessary to implement its responsibilities under the PCA or submitted a plan to obtain those authorities? YES

PLAN FORMULATION

Scoping

a. Have all reasonable alternatives, including non-structural and no-action plans, been adequately addressed? YES

b. Has recent guidance been incorporated in the study? YES

c. Has full consideration been given to inclusion of recreation as a project purpose? YES

Existing Conditions/Plan Development

a. Have the assumptions and rationale for the without-project conditions been explicitly stated and are they reasonable? YES

b. Have innovative alternatives been fully considered? YES

Alternative Screening

a. Have both beneficial and adverse effects been adequately evaluated for the selected plan and alternatives? YES

b. Has acquisition of necessary land for future project elements been adequately considered? YES

c. Has a reasonable justification been provided for eliminating alternatives? YES

Plan Selection YES

a. Are the reasons for selection of major elements of the recommended plan sound and adequate? YES

b. Does the selected plan conform with existing policy? If not, have the reasons for departure been adequately documented? YES

c. Is the selected plan consistent with applicable comprehensive plans for the area? YES

Report Review

a. Consistency with recent guidance? YES

b. Major tech review issues/resolutions documented? YES

c. Tech review certification signature page included? YES

ECONOMIC AND SOCIAL ANALYSIS

a. Are the assumptions regarding future alternative conditions clearly stated and justified, and are these assumptions reasonable? YES

b. Have methodologies and assumptions been explained in sufficient detail? YES

c. Is the without-project condition reasonable and does it actually reflect how non-Federal interests will act if the resource under study is not developed? YES

ENVIRONMENTAL ANALYSIS

General

a. Adequate coordination conducted between Envir., Engineering, and Real Estate? YES

NEPA and Related Documents

a. Future benefits assessed by habitat evaluation methodology? YES

b. Coordination conducted with USFWS? YES

c. Appropriate envir. appendices included? YES

d. Monitoring plan prepared? YES

e. Draft document submitted for LMS review, and revisions made? YES

HTRW N/A

Mitigation N/A

Cultural Resources	YES
a. Have significant cultural resources been identified and evaluated?	YES
b. Have the necessary cultural resource studies been conducted in accordance with the National Historic Preservation Act and other applicable cultural resources laws and regulations?	YES
Recreation/Aesthetic	N/A

ENGINEERING DIVISION

General

a. Adequate field investigations were conducted?	YES
b. Is project operable?	YES
c. Are annual OM&R costs reasonable?	YES
d. Adequate coordination conducted between Envir., Engineering, and Real Estate?	YES

CHECKLIST CERTIFICATION SHEET

I certify that the Final DPR for the Batchtown Habitat Rehabilitation and Enhancement Project has been reviewed and that sound technical practices and procedures have been followed.

Dave Gates, Tech. Review Team Leader
CELMS-PD-F

Ronald Frerker, Chemist
CELMS-ED-HQ

Janice Hitchcock, Mechanical Engineer
CELMS-ED-DM

Joseph Schwenk, Geotechnical Engineer
CELMS-ED-GF

James Lynch, Natural Resources Specialist
CELMS-CO-N

Robert Wasitis, Civil Engineer
CELMS-CO-CQ

Terry Norris, Archaeologist
CELMS-PD-A

Harry Hamell, Real Estate Specialist
CELMS-RE

Tamara Atchley, Structural Engineer
CELMS-ED-DA

Ronald Dieckmann, Hydraulic Engineer
CELMS-ED-HE

Michael Hamm, Civil Engineer
CELMS-ED-DC

for Ronald E. Paul

Dawayne Sanders, Civil Engineer
CELMS-ED-C

Dan Erickson, Assist. Riverlands Area
CELMS-CO-NM

Mike Ricketts, Regulatory Specialist
CELMS-CO-F

Brian Johnson, Fishery Biologist
CELMS-PD-A

Sharon Cotner, Project Manager
CELMS-PM-M

Larry Kilgo, Economist
CELMV-ET-PE

Table 19. Major Issues or Comments from the In-house Technical Review.

Issue/Comment	Response
GENERAL COMMENTS	
Need reconsideration of inclusion of and funding for Hillside Sediment Control Plan in recommended plan.	Initial recommendation was to include as part of the recommended plan, but that funding was to be by other. Legislation by U.S. Rep. Durbin expected the Corps to fund the measure. DPR's recommendation was changed to reflect this. MOA was developed with NRCS, and LOI to sign MOA was received and included in Final DPR.
The plan formulation process needs clarification to show how the concept plans led to the selection of a recommended plan.	The plan formulation process was clarified to show how the concept plans led to the selection of one favorable concept plan. Then, all of the measures available for that concept plan were evaluated using the Cost Effectiveness and Incremental Cost Analysis (CEICA) process.
The real estate issues need resolution.	All locations possibly requiring land acquisition or easements were determined, and initially only one location was necessary. This location was for the lowland sediment trap, USFWS Middle Pool. Because of USFWS review comments for the Draft DPR, this lowland sediment trap was re-designed to eliminate the need for an easement, and the Final DPR contains no needs for land acquisition or easements.
A need was identified for preparation of Federal, state and local permits.	A public notice was distributed for joint application for permits, a public workshop was held, and a joint application was coordinated with the Corps' Regulatory Branch, and made with the Illinois Department of Natural Resources, Technical Analysis & Permit Unit, Office of Water Resources, for permitting and review pursuant to the Rivers, Lakes and Streams Act, provisions of the Fish and Wildlife Coordination Act, Section 401 of the Clean Water Act, and other authorities, and with the Illinois Environmental Protection Agency (IEPA) for the water quality certification pursuant to Section 401 of the Clean Water Act on June 10, 1996.
PLAN FORMULATION	
Plan formulation summary needs to better discuss the development and forwarding of Plan C.	See response to GENERAL COMMENT for plan formulation. Additional explanations were included in the Evaluation of Concept Plans chapter for clarification and continuity.
Need appendices for cumulative impacts assessment and real estate requirements.	Appendices developed and included.
The proposed berm to be constructed over open water appears to need a design that includes an impervious inner core.	The integrity of the berm was re-looked at by the Geotechnical Branch. If this has not been addressed in the

Table 19. Major Issues or Comments from the In-house Technical Review.

Issue/Comment	Response
Discussion of off-shore revetment is difficult to follow.	Location along the proposed berm that required revetment were identified and indicated on the design plates. No off-bankline revetment measures were selected because of not being incrementally justified.
Need expanded discussion of lowland sediment traps.	A separate chapter was devoted to evaluating lowland sediment traps and the hillside sediment control measures. Feasible measures and increments were included in the CEICA process.
Need a table to establish that no non-EMP viable funding options exist for the hillside sediment control measures.	That was added as Table 9A.
Need to explain and clarify the figure showing the dependencies of measures for the cost effectiveness analysis.	This became Figure 13, and explanatory notes were added.
Need information on status of or need for boundary survey as it relates to project real estate matters.	A boundary survey was conducted during the spring of 1996 by the Bureau of Land Management. A "preliminary, subject to change" boundary has been described and is marked in the field. Care was taken in the plan formulation to see that any recommended construction features were well away from the boundary of the Federal property.
Need to close off coordination with the SHPO.	The NRCS has developed a program to preserve cultural resources, and will conduct the program for the hillside sediment control measures (see Appendix M, Final DPR). For the project on Federal land, features were displayed on a USGS quad map and furnished to a contractor that prepared the archeological Phase I reconnaissance report. The SHPO concurred that the project will have no effect upon historic properties. No major realignments, relocation of borrow areas, or feature modifications have occurred since the archeological survey.
Main report should include a summary of cumulative effects.	Summary and appendix was added.
Percentages used to estimate the E&D and S&A costs seemed too low.	The percentages were increased, and the Final DPR now reflects estimates that were more accurately itemized and estimated.
Need to reflect a "fully funded" cost estimated.	Added.
ENVIRONMENTAL PLANNING	
Need to clarify Table 6. Summary and Final Results of Mussel Brainstorming Meeting.	Done.

Table 19. Major Issues or Comments from the In-house Technical Review.

Issue/Comment	Response
Need to better explain the role and importance of the mussel beds in the plan formulation and evaluation.	Text was included in Chapter 8 to make the decision process more understandable.
Nine additional laws needed to be included in the table that displays the degree of compliance with environmental statutes and requirements.	Done.
Need to accommodate potential impacts on the plan formulation due to possible replacement of L&D No. 25 as a result of the on-going upper Mississippi River navigation study.	This issue was addressed, see responses (Appendix T) to comments received from Butch Atwood, IDNR, dated 15 May 96.
Need to consider implications of potential water level management change from hinge-point to dam-point.	Relocation of the water control point in the pool will not impact the proposed water control plan for the management of Batchtown. The plan would remain essentially as depicted in Figures 18 and 19 for the USFWS pools and the state managed area, respectively.
Cultural resources need to be expanded to include project elements added after June 1994.	No major realignments, relocation of borrow areas, or feature modifications have occurred since the archeological survey.
ENGINEERING/DESIGN COMMENTS	
Need to check invert elevation on discharge pipe, and possible need for flap gate on inlet pipe at 90 cfs pump station.	Civil designer believes that this is a design detail to be finalized during P&S.
Numerous corrections and changes need to be made to the design drawing plates.	Corrections and changes made.
Gated CMPs in conjunction with stop-log structures seems redundant.	Agreed, and all CMPs were eliminated from the recommended plan. Additional stop-log structures were required in some locations.
The fish-passage (stop-log) structures that will allow boat passage my need to be designed significantly different from what is shown.	This was discussed, and it is believed that the current design will allow boat passage, and do not need redesign.

Table 19. Major Issues or Comments from the In-house Technical Review.

Issue/Comment	Response
Final DPR needs a detailed MCACES estimate to include line-item contingencies, PE&D costs, and CM costs.	Included in Appendix L.
REAL ESTATE COMMENTS	
RE write-up needs expansion.	Estimated Real Estate Requirements appendix added.
CONSTRUCTION-OPERATIONS COMMENTS	
Need to expand and discuss measures available for hillside sediment control.	Although a description is included in Appendix O, it was expanded upon in chapter 9.
Need more detailed geotechnical study at the location of the two 54-in. pipe structure through the L&D No. 25 overflow structure.	Agreed, but current design is sufficient for concept planning, and more detailed study is to be completed during the P&S phase.
Gated CMPs in conjunction with stop-log structures seems redundant.	Agreed, and all CMPs were eliminated from the recommended plan. Additional stop-log structures were required in some locations.
Dredging should be held to a minimum to save costs.	This was reexamined, but the amount of dredging has not been reduced, although dredging has been identified as a likely item for future reduction as necessary. Dredging will be examined in a planned Value Engineering study.
Bottomland Forest Habitat Improvement measures should be eliminated.	For cost savings, Bottomland Forest Habitat Improvement measures were reduced but not eliminated.
Do we have adequate borrow material?	Yes, this was reviewed.
PROJECT MANAGEMENT	
Description of Air Quality is weak.	Description enhanced using reviewer's comments.
Future Without Project Conditions need to be rewritten.	The IPT biologist reviewed this section and improved it as necessary.
Real Estate issues in conjunction with lowland sediment traps have to be resolved.	All locations possibly requiring land acquisition or easements were determined, and initially only one location was necessary. This location was for the lowland sediment trap, USFWS Middle Pool. Because of USFWS review comments for the Draft DPR, this lowland sediment trap was re-designed to eliminate the need for an easement, and the Final DPR contains no needs for land acquisition or easements.

Table 19. Major Issues or Comments from the In-house Technical Review.

Issue/Comment	Response
MCACES cost estimate is needed.	It had been agreed that MCACES cost estimates would not be performed for the Draft DPR, but would be done for the Final DPR. It is contained in Appendix L.
ECONOMICS	
CIECA process should not apply to Plan C2, but should apply to the full spectrum of potential project possibilities.	The CEICA process was developed and its use became required well after much concept planning had been performed, and many agreements had been reached with the local sponsors. It was determined that it was a valid idea to develop and evaluate concept plans prior to performing the CEICA process. The plan formulation was extensively modified to accommodate the CEICA process, and all available measures were included in the CEICA process for the preferred concept plan. The CEICA process produced information by which to compare combinations of measures or increments of measures to reach a recommended plan.
Descriptions of what information the CEICA process was producing needs clarification.	Text was added and re-worded.
GEOTECHNICAL	
Sheet pile cofferdam may need to be designed and constructed rather than an earthen cofferdam for the structures through the spillway.	Although additional geotechnical investigations will need to be done for the design of the structure through the overflow structure, further field examination of the site did validate that an earthen cofferdam will be adequate.

20. RECOMMENDATIONS.

I have weighed the accomplishments to be obtained from this habitat rehabilitation project against its cost and have considered its alternatives, impacts, and scope. In my judgment, the proposed project is a justified expenditure of Federal funds.

I recommend that the Assistant Secretary of the Army for Civil Works approve the Batchtown Habitat Rehabilitation and Enhancement Project.

The fully-funded total estimated first cost of this project (not including study costs) is $7,327,754. The Federal cost-share is $7,182,113 in accordance with section 906(e) of the Water Resource Development Act of 1986. The 25% non-Federal cost-share is $145,641 for the recommended Hillside Sediment Control Program.

The total estimated average annual operation, maintenance and rehabilitation cost is $83,000, and are to be borne the U.S. Fish and Wildlife Service and the Illinois Department of Natural Resources for those portions of the project that each agency manages respectively.

I further recommend that funds be allocated as soon as possible for preparation of plans and specifications and subsequent project construction.

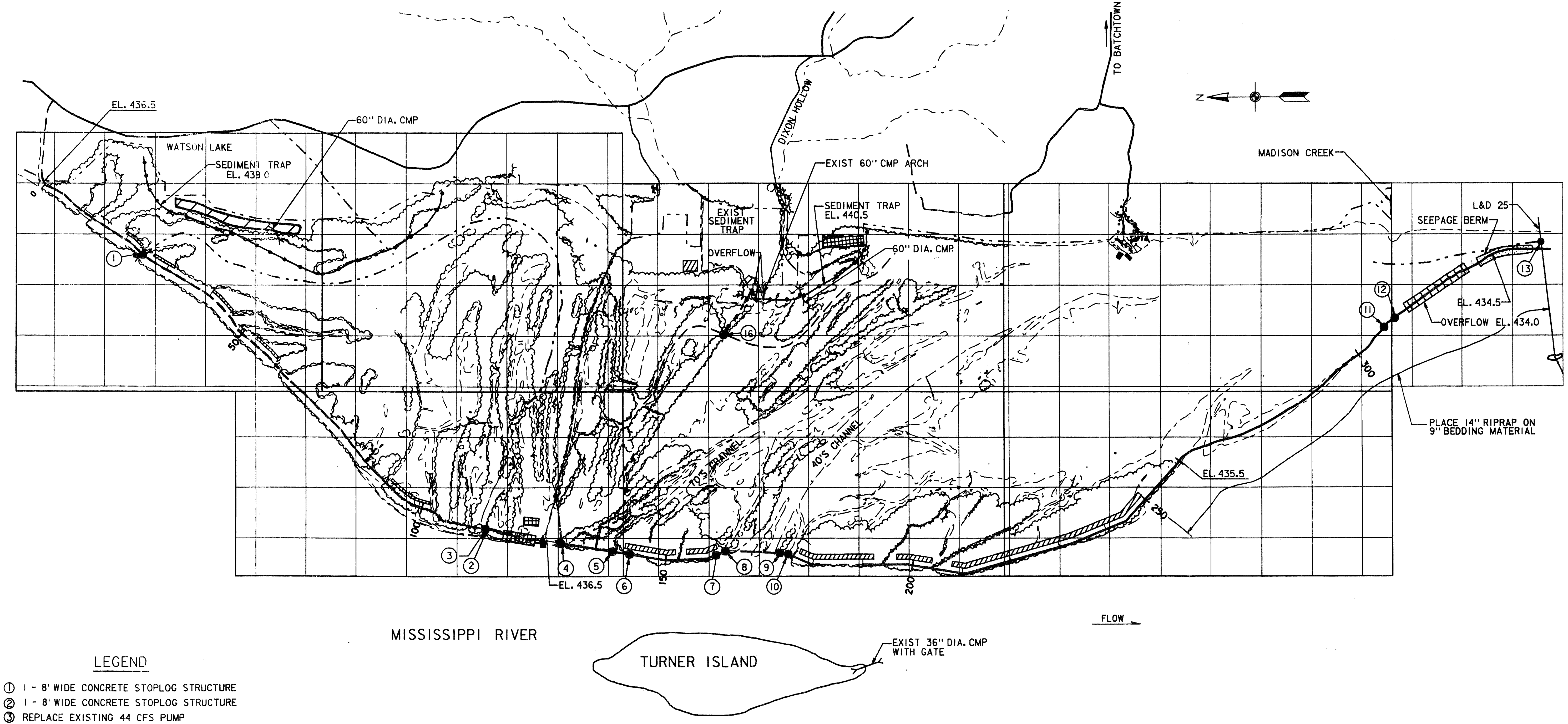
Thomas J. Hodgini

THOMAS J. HODGINI
Colonel, U.S. Army
District Engineer

Appendix A - Plates

PLATES 1-12, CADD DESIGN DRAWINGS FOR RECOMMENDED PLAN:

MISCELLANEOUS PLATES:



LEGEND

1. 1 - 8' WIDE CONCRETE STOPLOG STRUCTURE
2. 1 - 8' WIDE CONCRETE STOPLOG STRUCTURE
3. REPLACE EXISTING 44 CFS PUMP
4. 15 CFS PUMP, PORTABLE PUMP AND PORTABLE DRIVE UNIT
5. 1 - 8' WIDE CONCRETE STOPLOG STRUCTURE
6. 1 - 8' WIDE CONCRETE STOPLOG STRUCTURE
7. 90 CFS PERMANENTLY MOUNTED PUMP WITH PORTABLE DRIVE UNIT
8. 2 - 8' WIDE CONCRETE STOPLOG STRUCTURES
9. 1 - 8' WIDE CONCRETE STOPLOG STRUCTURE
10. 1 - 8' WIDE CONCRETE STOPLOG STRUCTURE
11. 4 - 8' WIDE CONCRETE STOPLOG STRUCTURES
12. BOAT PULLOVER
13. 2 - 54" DIA. PIPES WITH CONCRETE GATEWELL STRUCTURE
16. 1 - 8' WIDE CONCRETE STOPLOG STRUCTURE

LEGEND

- NEW RIVERSIDE BERM/DIKE
- EXISTING RIVERSIDE BERM RAISE
- NEW INTERIOR WATER CONTROL BERMS
- EXIST INTERIOR WATER CONTROL LEVEE RAISE
- CHANNEL EXCAVATION
- OVERFLOW STRUCTURE
- BORROW AREA
- DISPOSAL AREA
- PUBLIC ACCESS (BOAT RAMP)
- SEDIMENT TRAP
- SEEPAGE BERM

PLAN

SCALE: 1"=1000'

1000' 0 1000'

DRAWING INDEX

PLATE NO.	SHEET	TITLE
1	1 OF 1	GENERAL SITE PLAN INDEX
2	1 OF 6	EXTERIOR LEVEE PROFILE STA. 0+00 TO 109+00
3	2 OF 6	EXTERIOR LEVEE PROFILE STA. 109+00 TO 218+00
4	3 OF 6	EXTERIOR LEVEE PROFILE STA. 218+00 TO 325+00
5	4 OF 6	EXTERIOR LEVEE PROFILE STA. 325+00 TO 345+00
6	5 OF 6	EXTERIOR LEVEE PROFILE STA. 0+00 TO 67+00
7	6 OF 6	EXTERIOR LEVEE PROFILE STA. 0+00 TO 58+00
8	1 OF 4	DETAILS HAVE BEEN ELIMINATED FOR FINAL DPR
9	2 OF 4	PLANS AND SECTIONS SITES 1, 2, 5, 6, 8, 9, 10, 11, AND 16
10	3 OF 4	PLAN, SECTION AND PROFILE SITE 7
11	4 OF 4	PLAN, SECTION AND PROFILE 2-54" DIA. GATED PIPES
12	1 OF 1	MISCELLANEOUS SECTIONS AND DETAILS

SYMBOL	DESCRIPTION	DATE	APPROVED

REVISIONS

U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

DESIGNED BY: J.W. POULLAIN
DRAWN BY: A. BIENKOWSKI
CHECKED BY: J.W. POULLAIN

DATE: AUGUST, 1995

UPPER MISSISSIPPI RIVER BASIN
DEFINITE PROJECT REPORT
POOL 25, CALHOUN COUNTY, ILLINOIS
ENVIRONMENTAL MANAGEMENT PROGRAM
BATCHTOWN
HABITAT REHABILITATION PROJECT

GENERAL SITE PLAN AND INDEX

SUBMITTED: JOHN W. POULLAIN, DESIGN ENGINEER

SUBMITTED: MICHAEL R. RECTOR, CHIEF, CIVIL ENGINEERING SECTION

APPROVED: BOBBY R. HUGHEY, CHIEF, DESIGN BRANCH

SIZE: D | DWG. CODE: DACW 43 | DRAWING NO.: PLATE 1

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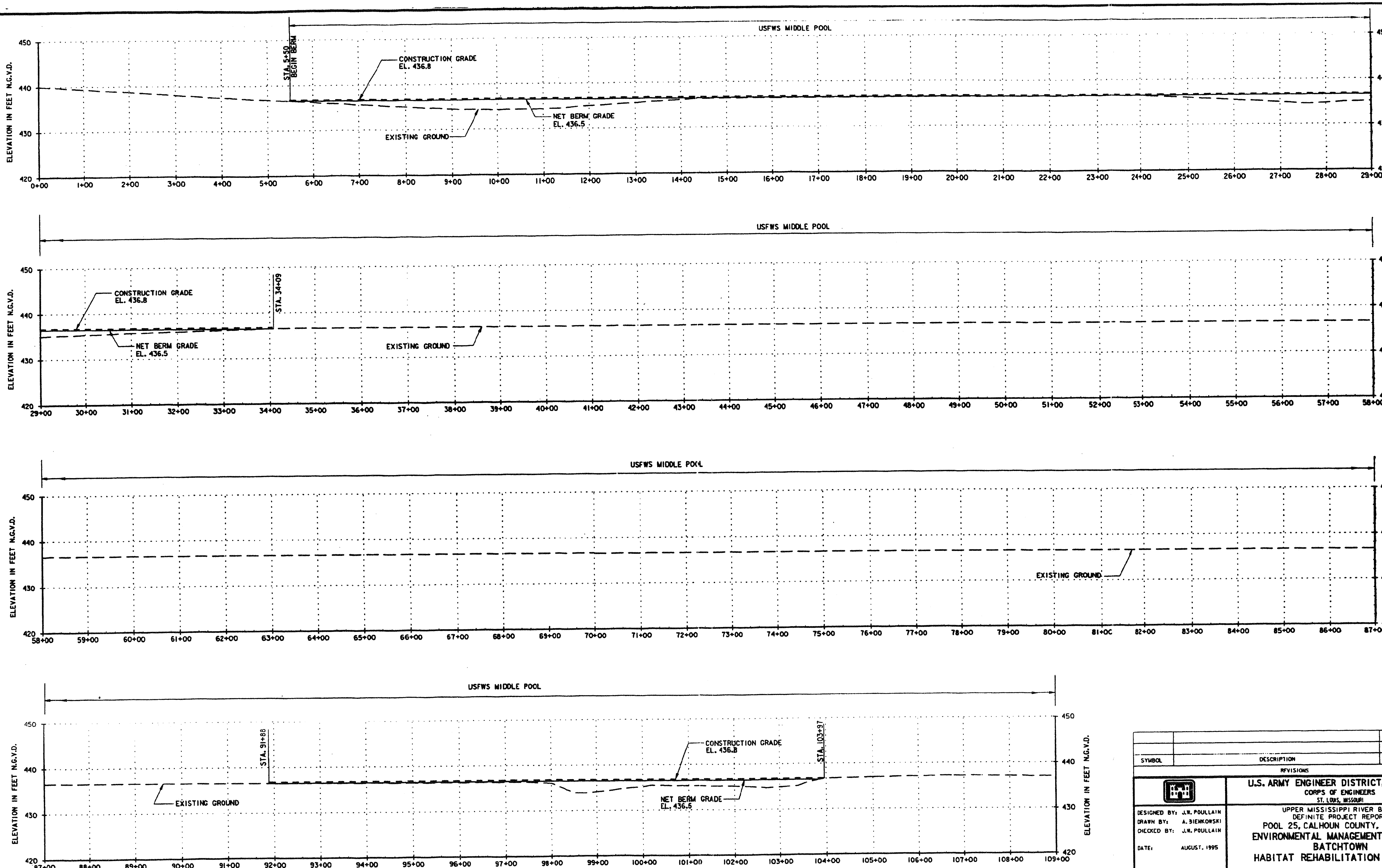

BERM PROFILE

SCALE: 1"=100'

HORIZ. 100' 0 100'

SCALE: 1"=10'

VERT. 10' 0 10'

SYMBOL	DESCRIPTION	DATE	APPROVED

REVISIONS

U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

DESIGNED BY: J.W. POULLAIN
DRAWN BY: A. BIENKOWSKI
CHECKED BY: J.W. POULLAIN
DATE: AUGUST, 1995

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ENVIRONMENTAL MANAGEMENT PROGRAM
BATCHTOWN
HABITAT REHABILITATION PROJECT

EXTERIOR BERM PROFILE
STA. 0+00 TO 109+00

SUBMITTED: JOHN W. POULLAIN, DESIGN ENGINEER
SUBM ITEM: MICHAEL R. RECTOR, CHIEF, CIVIL ENGINEERING SECTION
APPROVED: BOBBY R. HUGHEY, CHIEF, DESIGN BRANCH

SIZE D | DWG. CODE DACW 43 | DRAWING NO. PLATE 2

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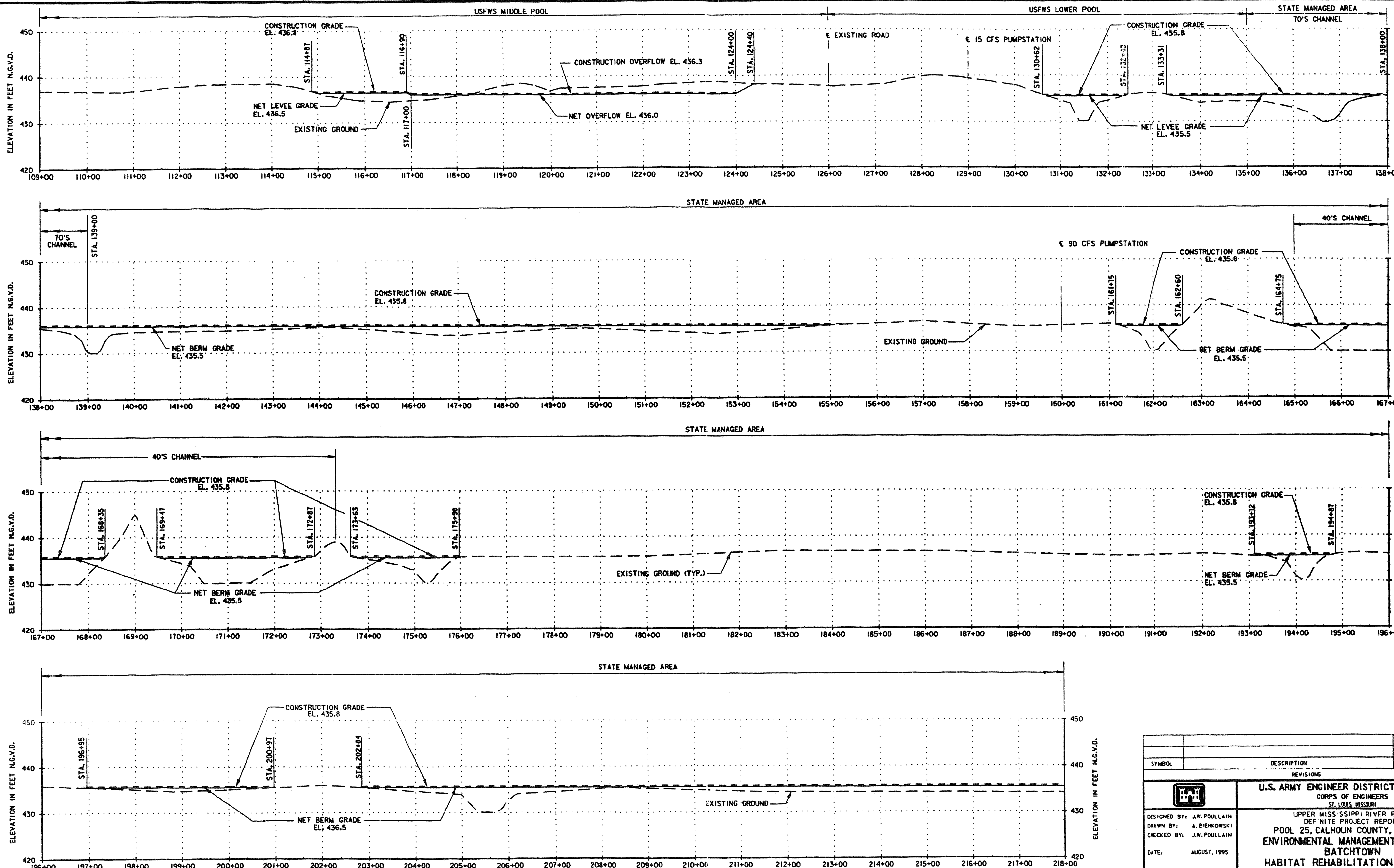

BERM PROFILE

SCALE: 1"=100'

HORIZ. 100' 0 100'

SCALE: 1"=10'

VERT. 10' 0 10'

SYMBOL	DESCRIPTION	DATE	APPROVED
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BATCHTOWN
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SUBMITTED: JOHN R. POULLAIN, DESIGN ENGINEER
SUBMITTED: MICHAEL R. RECTOR, CHIEF, CIVIL ENGINEERING SECTION
APPROVED: BOBBY R. HUGHEY, CHIEF, DESIGN BRANCH

EXTERIOR BERM PROFILE
STA. 109+00 TO 218+00

SIZE	DWG. CODE	DRAWING NO.	
D	DACW 43		PLATE 3

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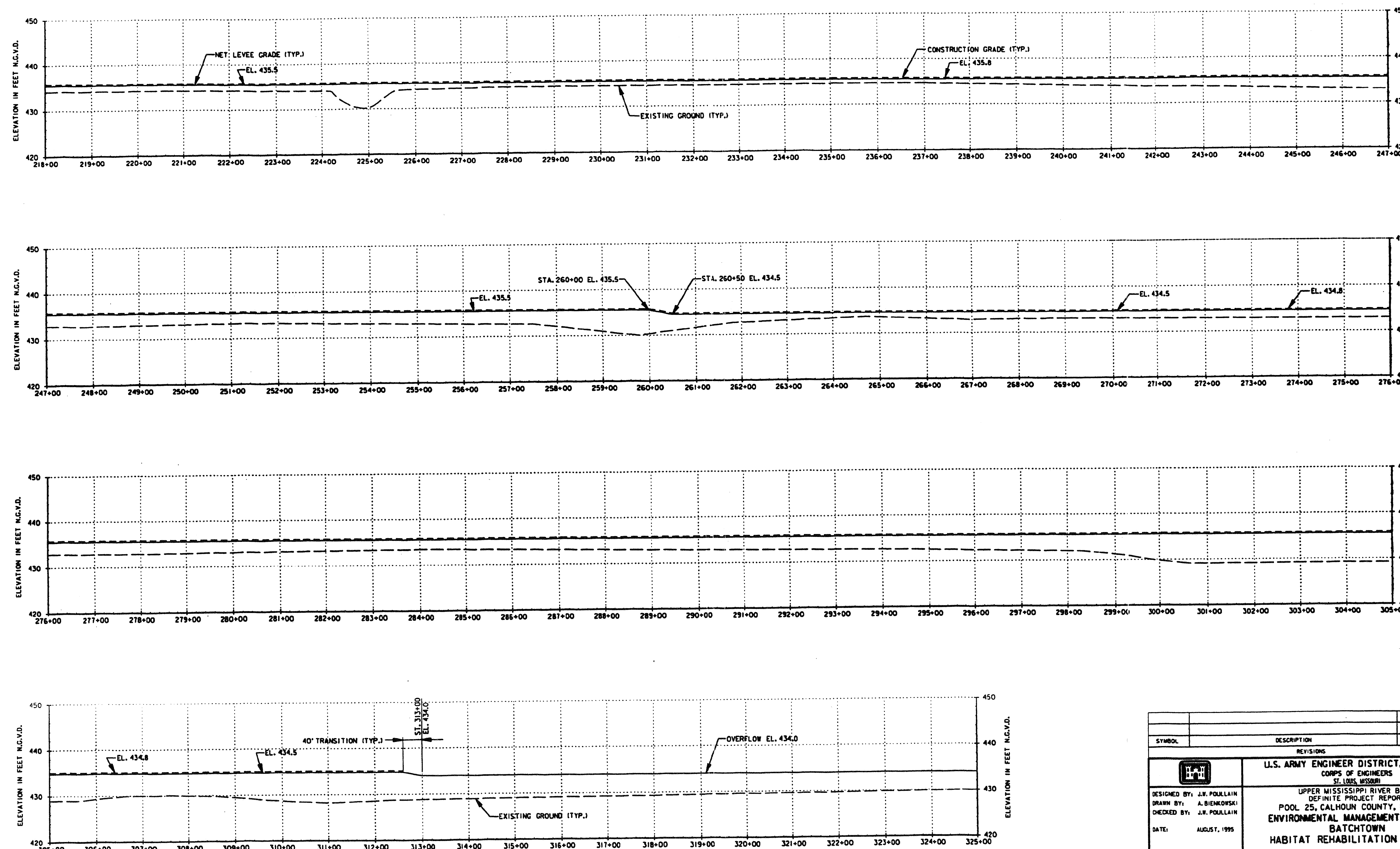

LEVEE PROFILE

HORIZ. SCALE: 1"=100'

VERT. SCALE: 1"=10'

SYMBOL	DESCRIPTION	DATE	APPROVED
	REVISIONS		

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DRAWN BY: A. BIENKOWSKI
CHECKED BY: J.W. POULLAIN
DATE: AUGUST, 1995

SUBMITTED: JOHN W. POULLAIN, DESIGN ENGINEER
SUBMITTED: MICHAEL A. RECTOR, CHIEF, CIVIL ENGINEERING SECTION
APPROVED: BOBBY A. HUCKEY, CHIEF, DESIGN BRANCH

EXTERIOR BERM PROFILE
STA. 218+00 TO 325+00

SIZE: D | DWG. CODE: DACW 43 | DRAWING NO. | PLATE 4

DESIGN FILE: ***DESIGN*FILE*SPECIFICATION*** | PLOT DATE: ***DATE-TIME***
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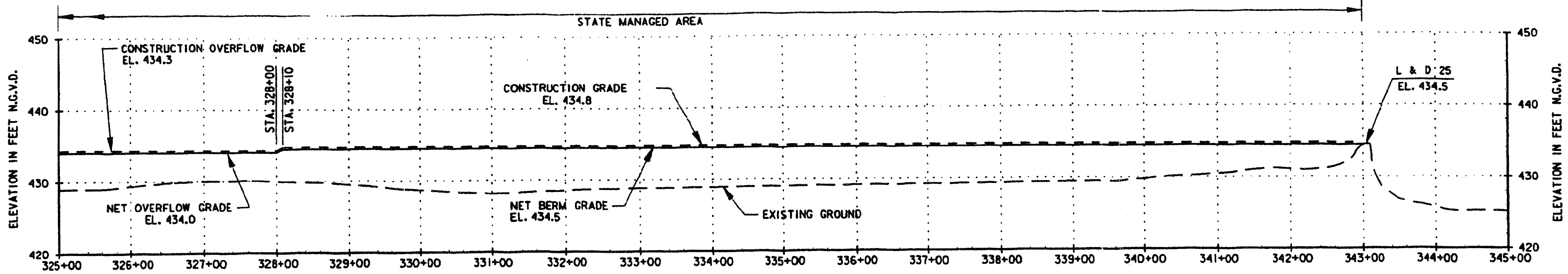

BERM PROFILE

HORIZ. SCALE: 1"=100' (100' 0 100')

VERT. SCALE: 1"=10' (10' 0 10')

SYMBOL	DESCRIPTION	DATE	APPROVED
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
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ST. LOUIS, MISSOURI

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DRAWN BY: A. BIENKOWSKI
CHECKED BY: J.W. POULLAIN
DATE: AUGUST, 1995

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EXTERIOR BERM PROFILE
STA. 325+00 TO 345+00

SUBMITTED: JOHN R. POULLAIN, DESIGN ENGINEER
SUBMITTED: MICHAEL R. RECTOR, CHIEF, CIVIL ENGINEERING SECTION
APPROVED: BOBBY R. HUCKEY, CHIEF, DESIGN BRANCH

SIZE: D | DWG. CODE: DACW 43 | DRAWING NO.: PLATE 5

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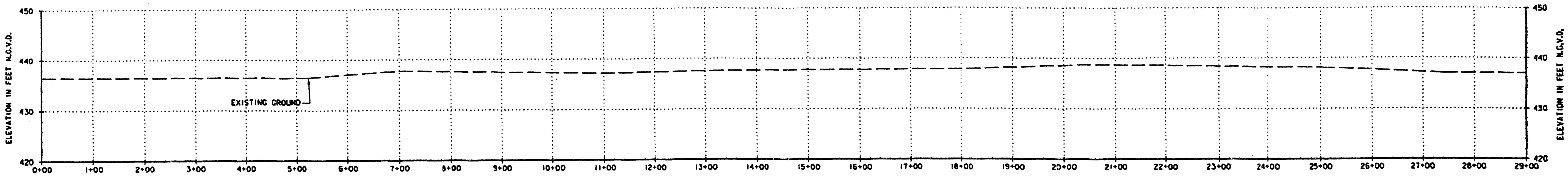

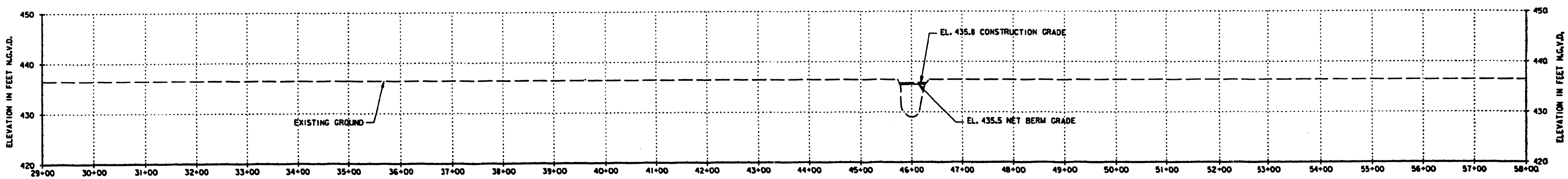

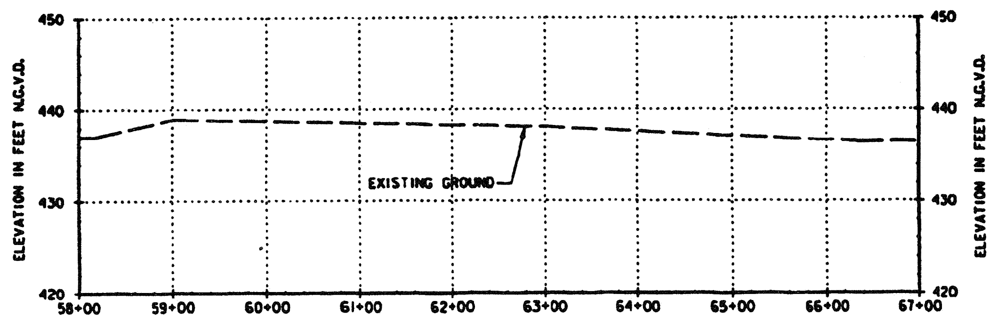

INTERIOR BERM (BETWEEN USFWS MIDDLE & LOWER POOLS) PROFILE

HORIZ. SCALE: 1"=100' 100' 0 100'

VERT. SCALE: 1"=10' 10' 0 10'

SYMBOL	DESCRIPTION	DATE	APPROVED

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U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
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SUBMITTED: JOHN W. POULLAIN, DESIGN ENGINEER

SUBMITTED: MICHAEL R. RECTOR, CHIEF, CIVIL ENGINEERING SECTION

APPROVED: BOBBY R. HUCKEY, CHIEF, DESIGN BRANCH

INTERIOR BERM PROFILE
STA. 0+00 TO 67+00

SIZE D | DOC. CODE DACW 43 | DRAWING NO. | PLATE 6

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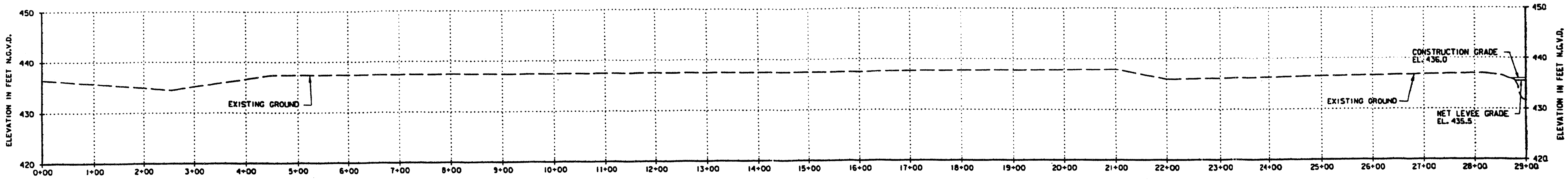
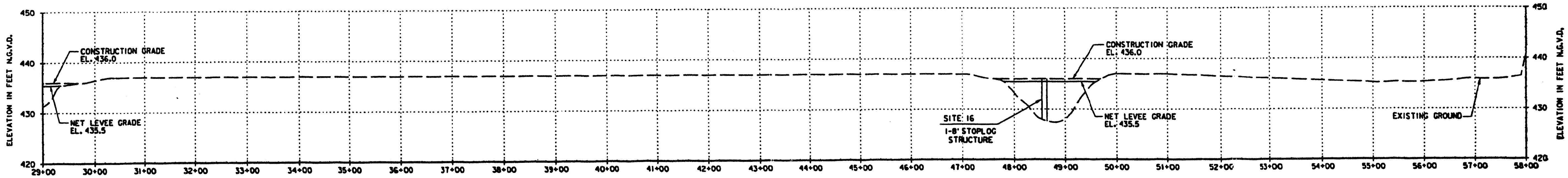
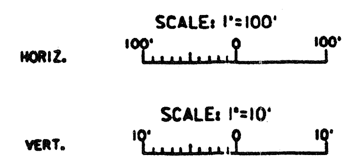




INTERIOR BERM (BETWEEN USFWS AND IDOC POOLS) PROFILE



NOTE:
CRUSHED STONE ACCESS ROAD, STA. 47+00 TO 56+00

SYMBOL	DESCRIPTION	DATE	APPROVED

REVISIONS

U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
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UPPER MISSISSIPPI RIVER BASIN
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SUBMITTED: JOHN W. POULLAIN, DESIGN ENGINEER
SUBMITTED: MICHAEL A. RECTOR, CHIEF, CIVIL ENGINEERING SECTION
APPROVED: BOBBY R. HUGHEY, CHIEF, DESIGN BRANCH

INTERIOR BERM PROFILE
STA. 0+00 TO 58+00

SIZE	DOC. CODE	DRAWING NO.
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DESIGN FILE: ###DESIGNFILE@SPECIFICATION### | PLOT DATE: ###DATE-TIME###
PLOT SCALE: 100 | SOL. NO. DACW43-94-B-X | FILE NO. | SHEET 6 OF 6

DETAILS HAVE BEEN ELIMINATED FOR FINAL DPR

SYMBOL	DESCRIPTION	DATE	APPROVED
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

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DATE: AUGUST, 1995

UPPER MISSISSIPPI RIVER BASIN
DEFINITE PROJECT REPORT
POOL 25, CALHOUN COUNTY, ILLINOIS
ENVIRONMENTAL MANAGEMENT PROGRAM
BATCHTOWN
HABITAT REHABILITATION PROJECT
PLANS AND SECTIONS

SUBMITTED: JOHN W. POULLAIN, DESIGN ENGINEER
SUBMITTED: MICHAEL R. RECTOR, CHIEF, CIVIL ENGINEERING SECTION
APPROVED: BOBBY R. HUGHEY, CHIEF, DESIGN BRANCH

SIZE: D | DWG. CODE: DACW 43 | DRAWING NO.: PLATE 8
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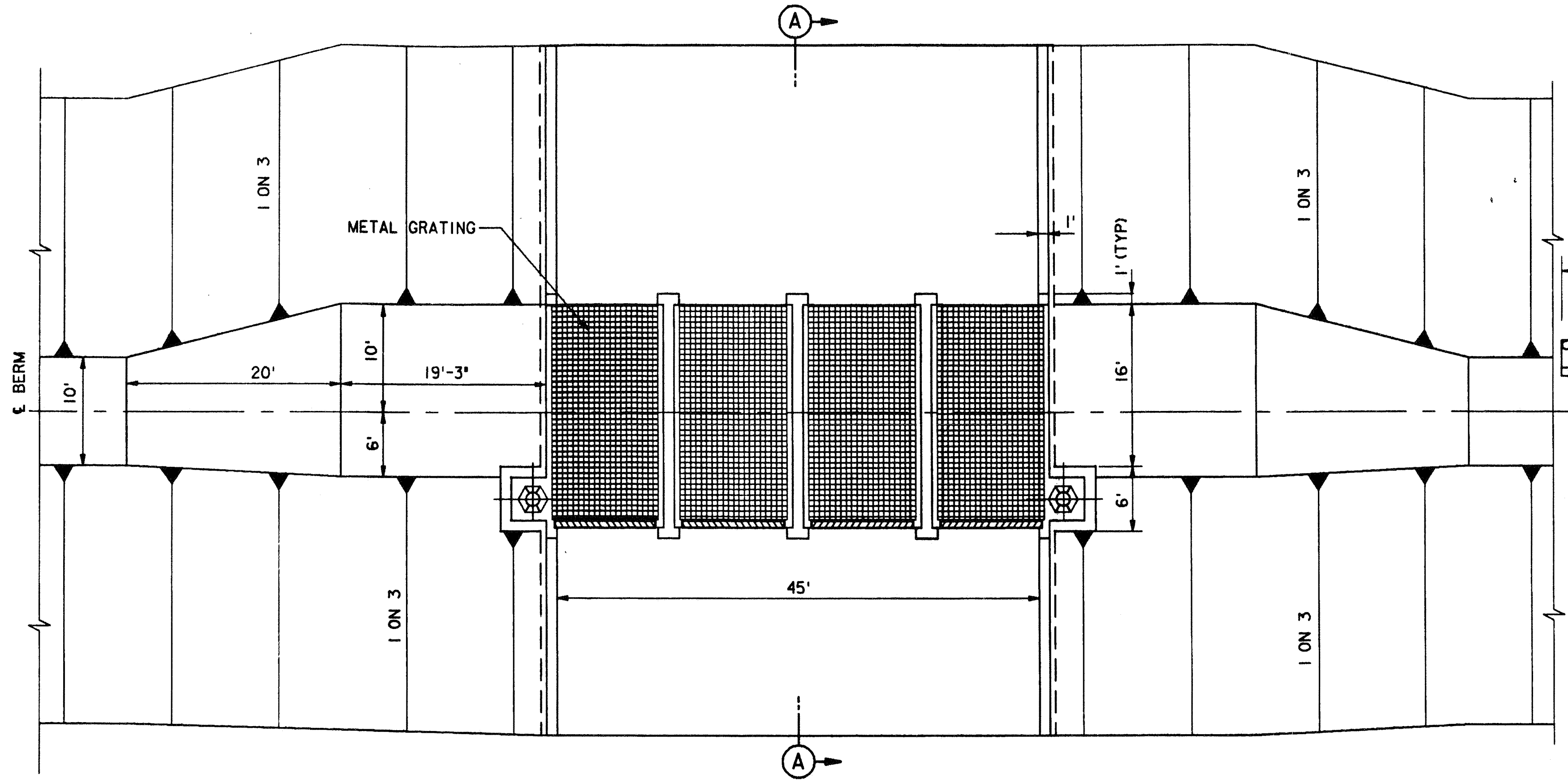
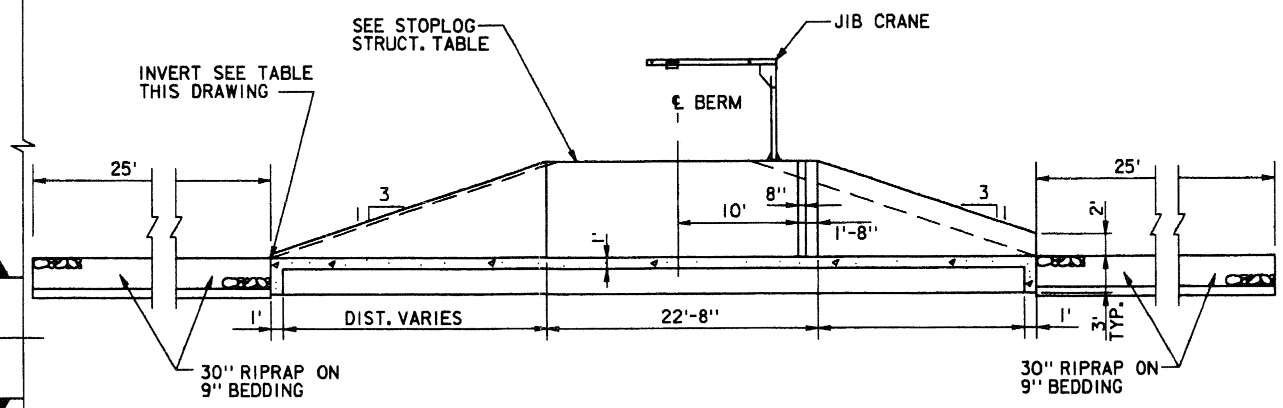


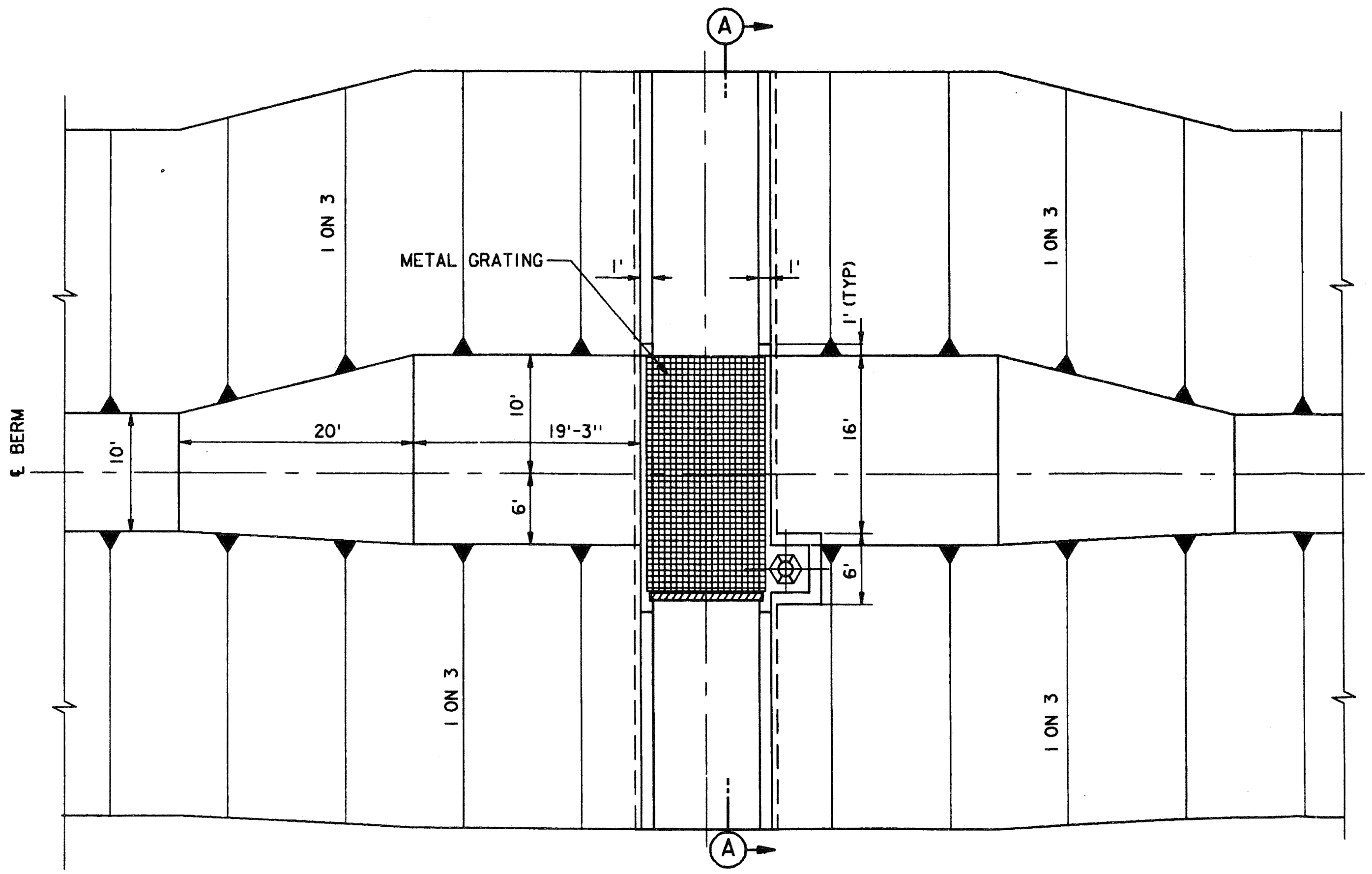
PLAN - SITE 11

SCALE: 1/8" = 1'-0"



SECTION A-A

SCALE: 1/8" = 1'-0"



PLAN - SITES 1, 2, 5, 6. 9, 10, AND 16

SCALE: 1/8" = 1'-0"

STOPLOG STRUCT. TABLE

SITE LOCATION	INVERT EL.	BERM EL. AT PIPE	TOP OF RISER EL.
USFWS EXTERIOR BERM			
(1) 1-8' STOPLOG STRUCT.	430.0	-----	-----
(2) 1-8' STOPLOG STRUCT.	429.5	-----	-----
INTERIOR BERM			
(16) 1-8' STOPLOG STRUCT.	429.0	-----	-----
STATE			
(5) 1-8' STOPLOG STRUCT.	429.0	-----	-----
(6) 1-8' STOPLOG STRUCT.	429.0	-----	-----
(8) 2-8' STOPLOG STRUCT.	429.0	-----	-----
(9) 1-8' STOPLOG STRUCT.	429.0	-----	-----
(10) 1-8' STOPLOG STRUCT.	429.0	-----	-----
(11) 4-8' STOPLOG STRUCT.	429.0	-----	-----

NOTE:
SITE 8, 2-8' WIDE CONCRETE STOPLOG STRUCTURES IS SIMILAR TO SITE 11, WITH HALF THE WIDTH.

SYMBOL	DESCRIPTION	DATE	APPROVED
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

DESIGNED BY: J.W. POULLAIN
DRAWN BY: A. BIENKOWSKI
CHECKED BY: J.W. POULLAIN
DATE: AUGUST, 1995

UPPER MISSISSIPPI RIVER BASIN
DEFINITE PROJECT REPORT
POOL 25, CALHOUN COUNTY, ILLINOIS
ENVIRONMENTAL MANAGEMENT PROGRAM
BATCHTOWN
HABITAT REHABILITATION PROJECT
PLANS AND SECTIONS
SITES 1, 2, 5, 6, 8, 9, 10, 11, AND 16

SUBMITTED: JOHN W. POULLAIN, DESIGN ENGINEER
SUBMITTED: MICHAEL R. RECTOR, CHIEF, CIVIL ENGINEERING SECTION
APPROVED: BOBBY R. HUGHEY, CHIEF, DESIGN BRANCH

SIZE: D | DWG. CODE: DACW 43 | DRAWING NO. PLATE 9

DESIGN FILE: rs\upermiss\batchtwn\revised\ba | PLOT DATE: 01-JUL-1996 07:14
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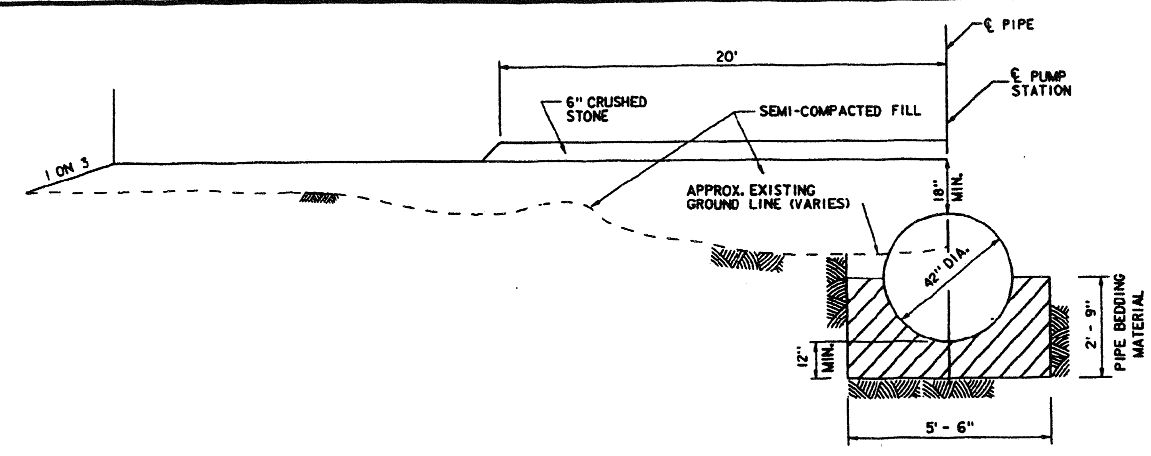

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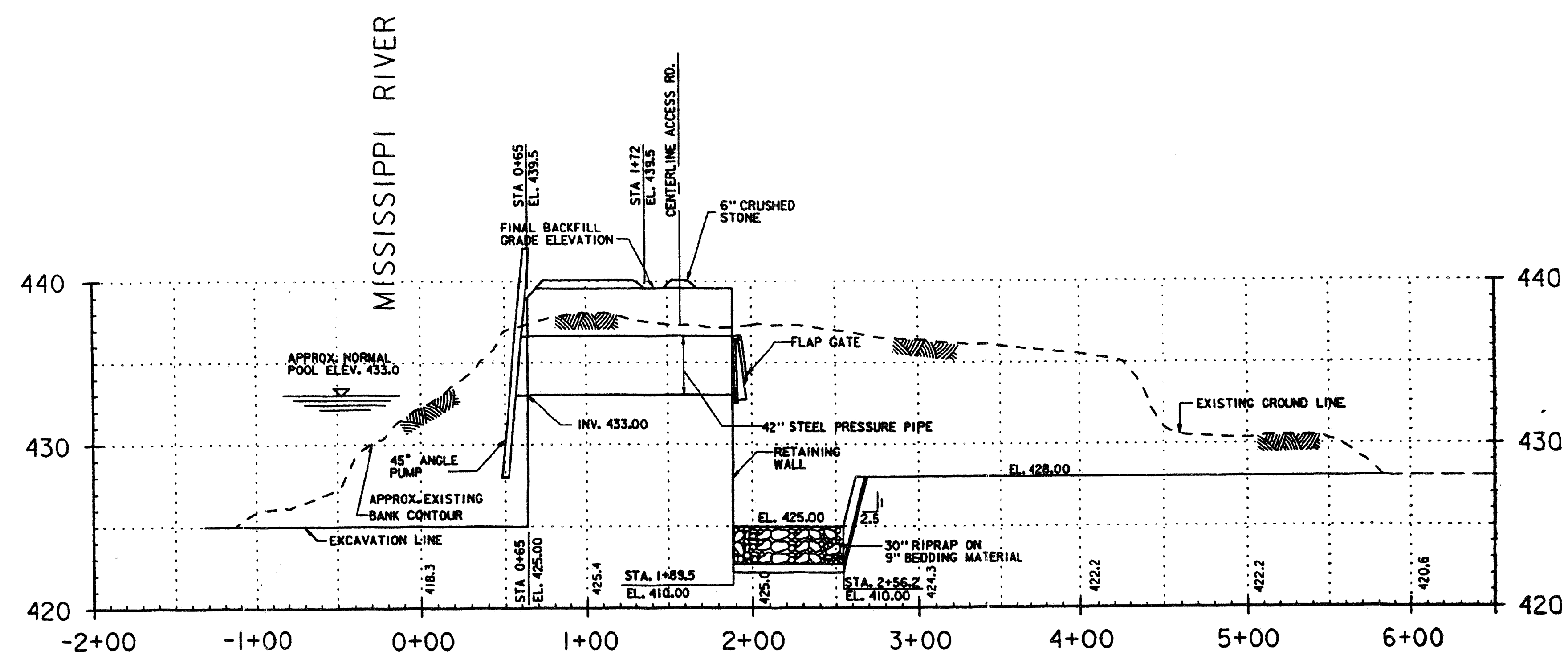
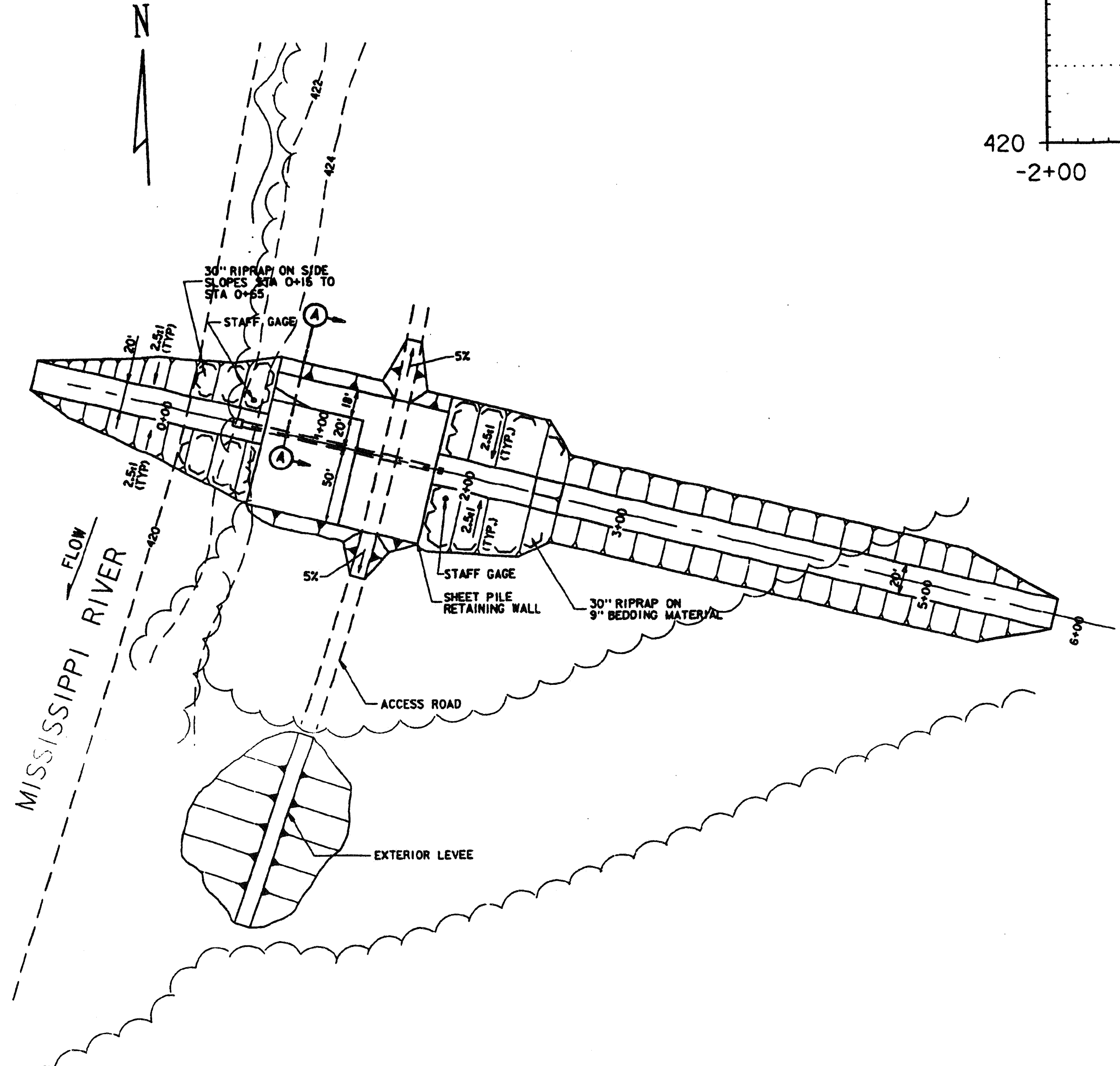


PUMP STATION PROFILE

SCALE: VERTICAL: 1" = 5'
HORIZONTAL: 1" = 50'



PUMP STATION PLAN

SCALE: 1" = 50'

50' 0 50'

SYMBOL	DESCRIPTION	DATE	APPROVED

REVISIONS

U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

DESIGNED BY: J.W. POULLAIN
DRAWN BY: A. BIENKOWSKI
CHECKED BY: J.W. POULLAIN
DATE: AUGUST, 1995

UPPER MISSISSIPPI RIVER BASIN
DEFINITE PROJECT REPORT
POOL 25, CALHOUN COUNTY, ILLINOIS
ENVIRONMENTAL MANAGEMENT PROGRAM
BATCHTOWN
HABITAT REHABILITATION PROJECT
PLAN, SECTION AND
PROFILE SITE 7

SUBMITTED: JOHN R. POULLAIN, DESIGN ENGINEER
SUBMITTED: MICHAEL R. RECTOR, CHIEF, CIVIL ENGINEERING SECTION
APPROVED: BOBBY R. HUDKEY, CHIEF, DESIGN BRANCH

SIZE	DWG. CODE	DRAWING NO.	
D	DACW 43		PLATE 10

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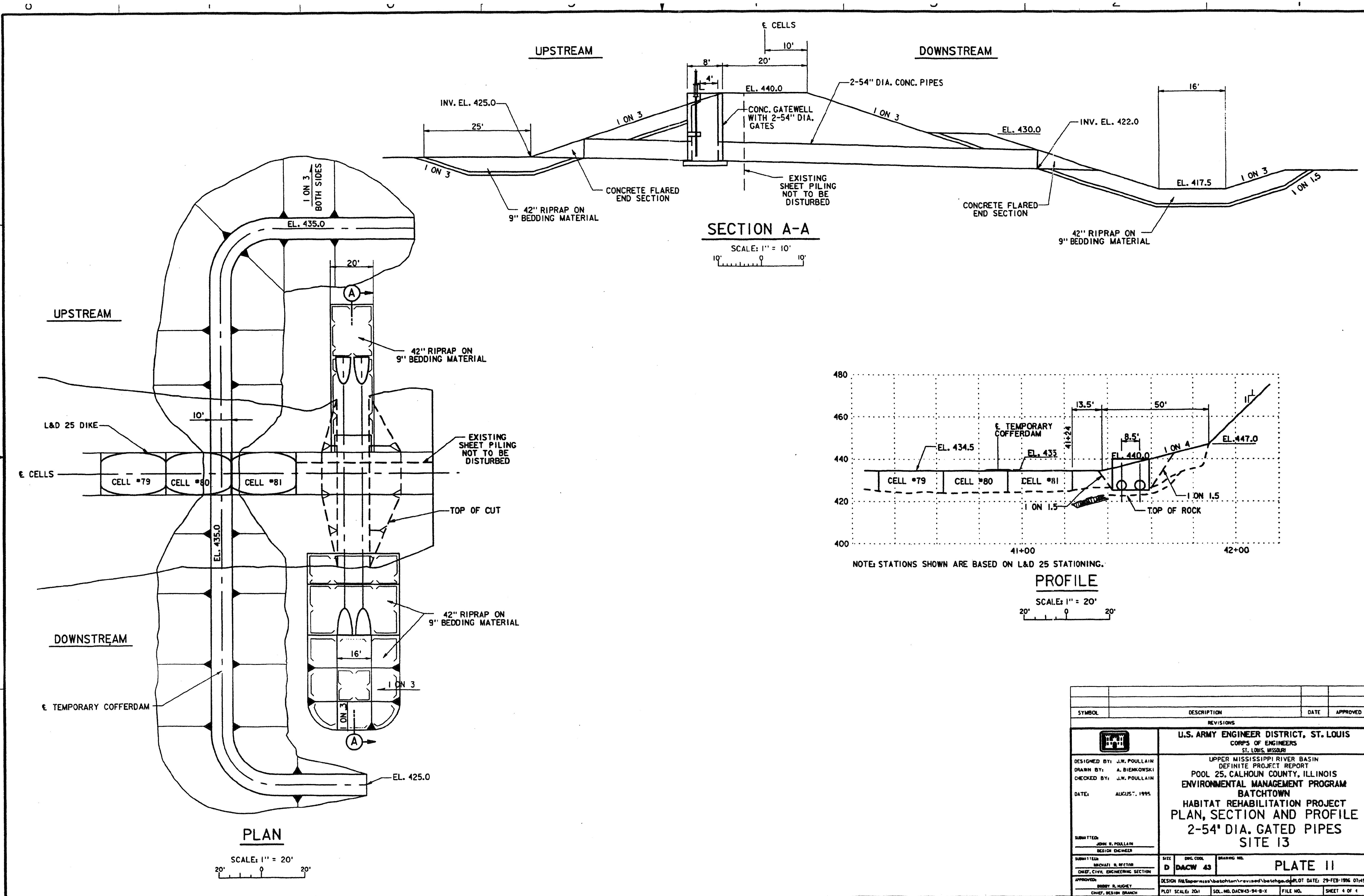
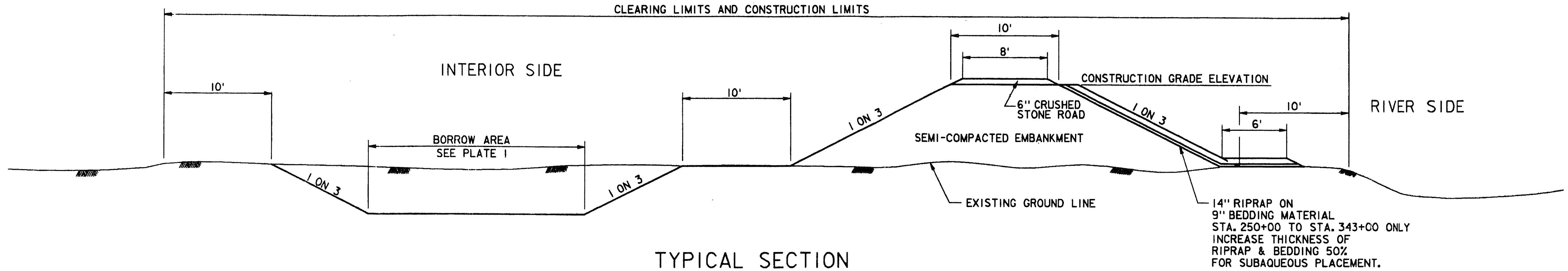
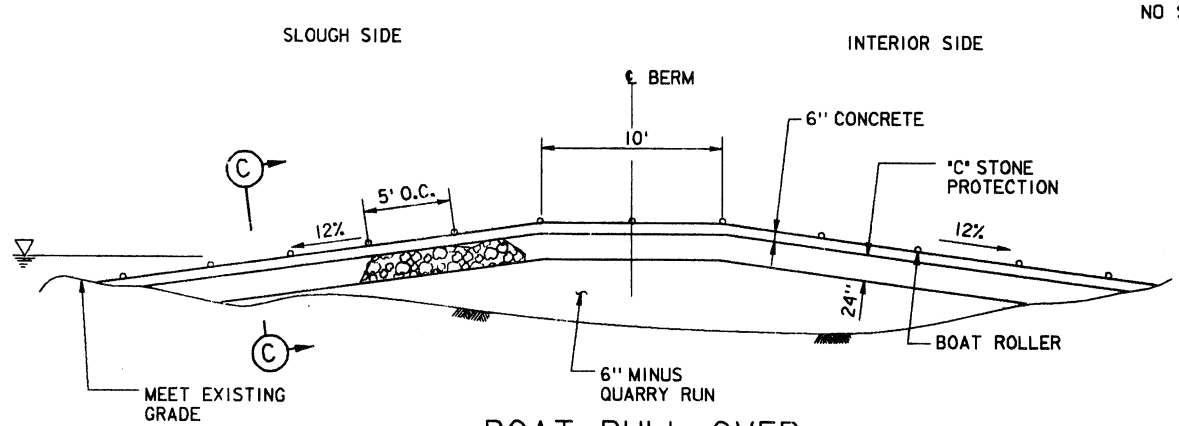


SECTION A-A
SCALE: 1" = 10'
UPSTREAM
DOWNSTREAM
℄ CELLS
10'
20'
8'
4'
EL. 440.0
2-54" DIA. CONC. PIPES
INV. EL. 425.0
25'
1 ON 3
CONC. GATEWELL WITH 2-54" DIA. GATES
CONCRETE FLARED END SECTION
42" RIPRAP ON 9" BEDDING MATERIAL
EXISTING SHEET PILING NOT TO BE DISTURBED
EL. 430.0
INV. EL. 422.0
16'
EL. 417.5
1 ON 1.5
PLAN
SCALE: 1" = 20'
1 ON 3 BOTH SIDES
EL. 435.0
L&D 25 DIKE
℄ CELLS
CELL #79
CELL #80
CELL #81
TOP OF CUT
℄ TEMPORARY COFFERDAM
EL. 425.0
PROFILE
SCALE: 1" = 20'
480
460
440
420
400
41+00
42+00
41+24
13.5'
50'
8.5'
EL. 434.5
℄ TEMPORARY COFFERDAM
EL. 435
EL. 440.0
EL. 447.0
1 ON 4
1 ON 1.5
TOP OF ROCK
NOTE: STATIONS SHOWN ARE BASED ON L&D 25 STATIONING.
SYMBOL
DESCRIPTION
DATE
APPROVED
REVISIONS
U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI
DESIGNED BY: J.W. POULLAIN
DRAWN BY: A. BIENKOWSKI
CHECKED BY: J.W. POULLAIN
DATE: AUGUST, 1995
UPPER MISSISSIPPI RIVER BASIN
DEFINITE PROJECT REPORT
POOL 25, CALHOUN COUNTY, ILLINOIS
ENVIRONMENTAL MANAGEMENT PROGRAM
BATCHTOWN
HABITAT REHABILITATION PROJECT
PLAN, SECTION AND PROFILE
2-54" DIA. GATED PIPES
SITE 13
SUBMITTED: JOHN R. POULLAIN DESIGN ENGINEER
SUBMITTED: MICHAEL R. RECTOR CHIEF, CIVIL ENGINEERING SECTION
APPROVED: BOBBY R. HUGHEY CHIEF, DESIGN BRANCH
SIZE D
DWG. CODE DACW 43
DRAWING NO.
PLATE 11
PLOT DATE: 29-FEB-1996
PLOT SCALE: 20:1
SOL. NO. DACW43-94-B-X
FILE NO.
SHEET 4 OF 4



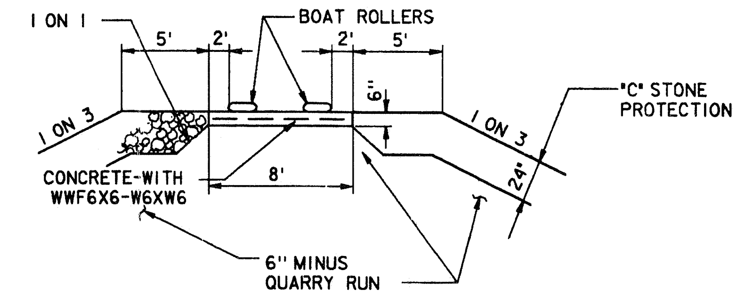
TYPICAL SECTION
EARTHEN LEVEE

NO SCALE



BOAT PULL OVER

NO SCALE



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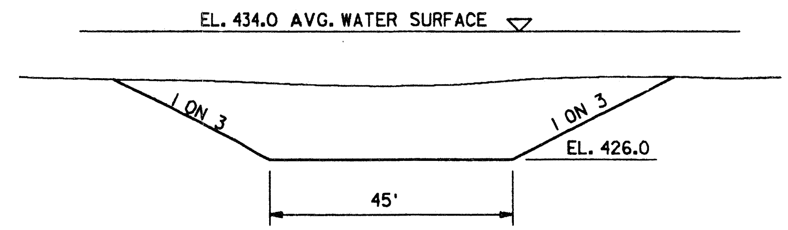
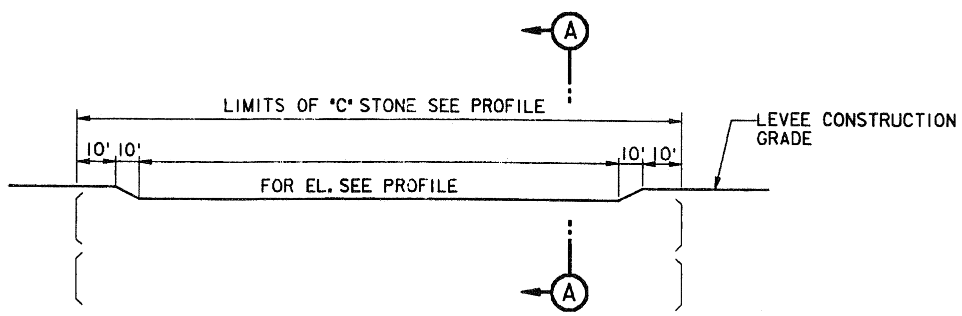


TYPICAL SECTION
CHANNEL EXCAVATION

NO SCALE



TYPICAL SECTION
OVERFLOW

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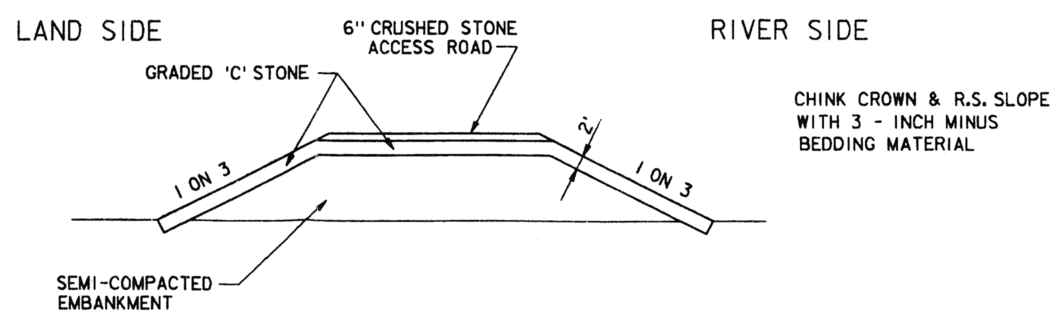


SECTION A-A

NO SCALE

NOTE:
CRUSHED STONE ACCESS ROADS TO BE CONSTRUCTED ON THE EXTERIOR BERM AND ON THE INTERIOR BERM AS SHOWN.

SYMBOL	DESCRIPTION	DATE	APPROVED
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

DESIGNED BY: J.W. POULLAIN
DRAWN BY: A. BIENKOWSKI
CHECKED BY: J.W. POULLAIN
DATE: AUGUST, 1995

UPPER MISSISSIPPI RIVER BASIN
DEFINITE PROJECT REPORT
POOL 25, CALHOUN COUNTY, ILLINOIS
ENVIRONMENTAL MANAGEMENT PROGRAM
BATCHTOWN
HABITAT REHABILITATION PROJECT
MISCELLANEOUS SECTIONS
AND DETAILS

SUBMITTED: JOHN W. POULLAIN, DESIGN ENGINEER
SUBMITTED: MICHAEL R. RECTOR, CHIEF, CIVIL ENGINEERING SECTION
APPROVED: BOBBY R. HUGHEY, CHIEF, DESIGN BRANCH

SIZE D | DWG. CODE DACW 43 | DRAWING NO. PLATE 12

DESIGN FILE: n:\upermiss\batchtwn\revised\ba | PLOT DATE: 01-JUL-1996 07:15
PLOT SCALE: 20:1 | SOL. NO. DACW43-94-B-X | FILE NO. | SHEET 1 OF 1

DAILY MEAN
DAILY STAGE FOR 1992
COMPUTED FOR DATA BETWEEN 1939 - 1992 (0 YEARS)

0241A MISSISSIPPI RIVER AT L+D 25 (UPPER) WINFIELD, MO.

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	432.91	432.59	432.37	432.34	433.04	432.38	432.28	432.57	433.29	433.22	433.47	433.48
2	432.97	432.52	432.44	432.31	433.09	432.41	432.29	432.56	433.25	433.18	433.42	433.46
3	432.98	432.51	432.44	432.32	432.84	432.35	432.41	432.70	433.30	433.17	433.43	433.51
4	432.96	432.53	432.43	432.46	432.78	432.34	432.34	432.74	433.38	433.20	433.36	433.65
5	432.99	432.57	432.32	432.53	432.58	432.27	432.40	432.72	433.37	433.35	433.26	433.70
6	432.95	432.57	432.26	432.56	432.54	432.19	432.35	432.75	433.36	433.37	433.19	433.63
7	432.91	432.52	432.24	432.51	432.50	432.15	432.35	432.83	433.39	433.37	433.20	433.64
8	432.93	432.57	432.22	432.52	432.48	432.20	432.39	432.84	433.40	433.42	433.27	433.71
9	432.95	432.57	432.21	432.44	432.54	432.19	432.38	432.85	433.45	433.34	433.31	433.71
10	432.99	432.52	432.21	432.39	432.48	432.26	432.34	432.83	433.45	433.43	433.29	433.71
11	433.05	432.46	432.23	432.34	432.43	432.32	432.40	432.82	433.37	433.34	433.25	433.75
12	433.12	432.57	432.28	432.38	432.31	432.32	432.34	432.92	433.34	433.21	433.23	433.75
13	433.08	432.63	432.20	432.39	432.24	432.35	432.25	432.92	433.37	433.21	433.26	433.70
14	433.05	432.68	432.08	432.36	432.14	432.33	432.20	433.07	433.38	433.21	433.27	433.70
15	433.05	432.83	432.10	432.34	432.20	432.24	432.18	433.12	433.38	433.27	433.45	433.72
16	433.02	432.61	431.96	432.35	432.31	432.09	432.13	433.14	433.41	433.29	433.50	433.59
17	433.03	432.60	431.90	432.26	432.42	432.08	432.06	433.06	433.35	433.31	433.53	433.58
18	432.98	432.59	431.87	432.31	432.47	432.09	432.01	433.06	433.34	433.34	433.35	433.49
19	432.98	432.63	431.84	432.38	432.62	432.19	432.06	433.06	433.25	433.33	433.38	433.45
20	432.65	432.64	431.96	432.46	432.62	432.26	432.12	433.14	433.22	433.38	433.39	433.36
21	432.51	432.53	432.15	432.52	432.46	432.36	432.09	433.20	433.20	433.37	433.39	433.28
22	432.48	432.48	432.19	432.62	432.48	432.40	432.15	433.22	433.19	433.39	433.35	433.28
23	432.37	432.48	432.22	432.78	432.06	432.46	432.23	433.21	433.25	433.45	433.31	433.29
24	432.40	432.52	432.32	432.85	432.01	432.65	432.31	433.27	433.35	433.43	433.23	433.26
25	432.45	432.39	432.42	432.94	431.96	432.43	432.42	433.27	433.37	433.42	433.22	433.20
26	432.55	432.43	432.35	433.09	431.98	432.34	432.50	433.30	433.33	433.34	433.34	433.19
27	432.38	432.45	432.32	433.17	432.04	432.24	432.66	433.35	433.33	433.36	433.37	433.20
28	432.45	432.46	432.31	433.19	432.18	432.21	432.74	433.34	433.37	433.38	433.38	433.08
29	432.58	433.11	432.51	433.12	432.26	432.26	432.67	433.31	433.27	433.40	433.46	433.01
30	432.62	-------	432.34	433.03	432.34	432.28	432.64	433.32	433.18	433.37	433.45	432.93
31	432.55	-------	432.35	-------	432.34	-------	432.62	433.35	-------	433.48	-------	432.84
SUM VALUES	13416.88	12544.56	13399.03	12977.28	13404.75	12968.64	13402.28	13423.83	12999.90	13433.35	13000.29	13436.86
MEAN VALUE	432.80	432.57	432.23	432.58	432.41	432.29	432.33	433.03	433.33	433.33	433.34	433.45
MAX VALUE	433.12	433.11	432.51	433.19	433.09	432.65	432.74	433.35	433.45	433.48	433.53	433.75
MIN VALUE	432.37	432.39	431.84	432.26	431.96	432.08	432.01	432.56	433.18	433.17	433.19	432.84
SUM DAYS	31	29	31	30	31	30	31	31	30	31	30	31
P.R. DAYS	1643	1498	1643	1588	1668	1620	1674	1670	1620	1674	1620	1674

STATISTICS FOR 1992 BASED ON THE RECORD 1939 - 1992

	CURRENT YEAR		PERIOD OF RECORD
SUM OF VALUES	158497.31		8479586.95
SUM OF DAYS	366		19592
MEAN VALUE	433.05		432.81
		MAX VALUE	433.75
		ON	DEC 12, 1992
		MIN VALUE	431.84
		ON	MAR 19, 1992

U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UMRS-EMP BATCHTOWN HREP

LOCK & DAM 25 POOL
STAGE DATA

PLATE 13

STAGE ELEVS. AT L25 POOL

MAX OR MIN FOR EACH MONTH OF YEAR SHOWN
MEAN FOR 1939 - 1992 (54 YEARS)

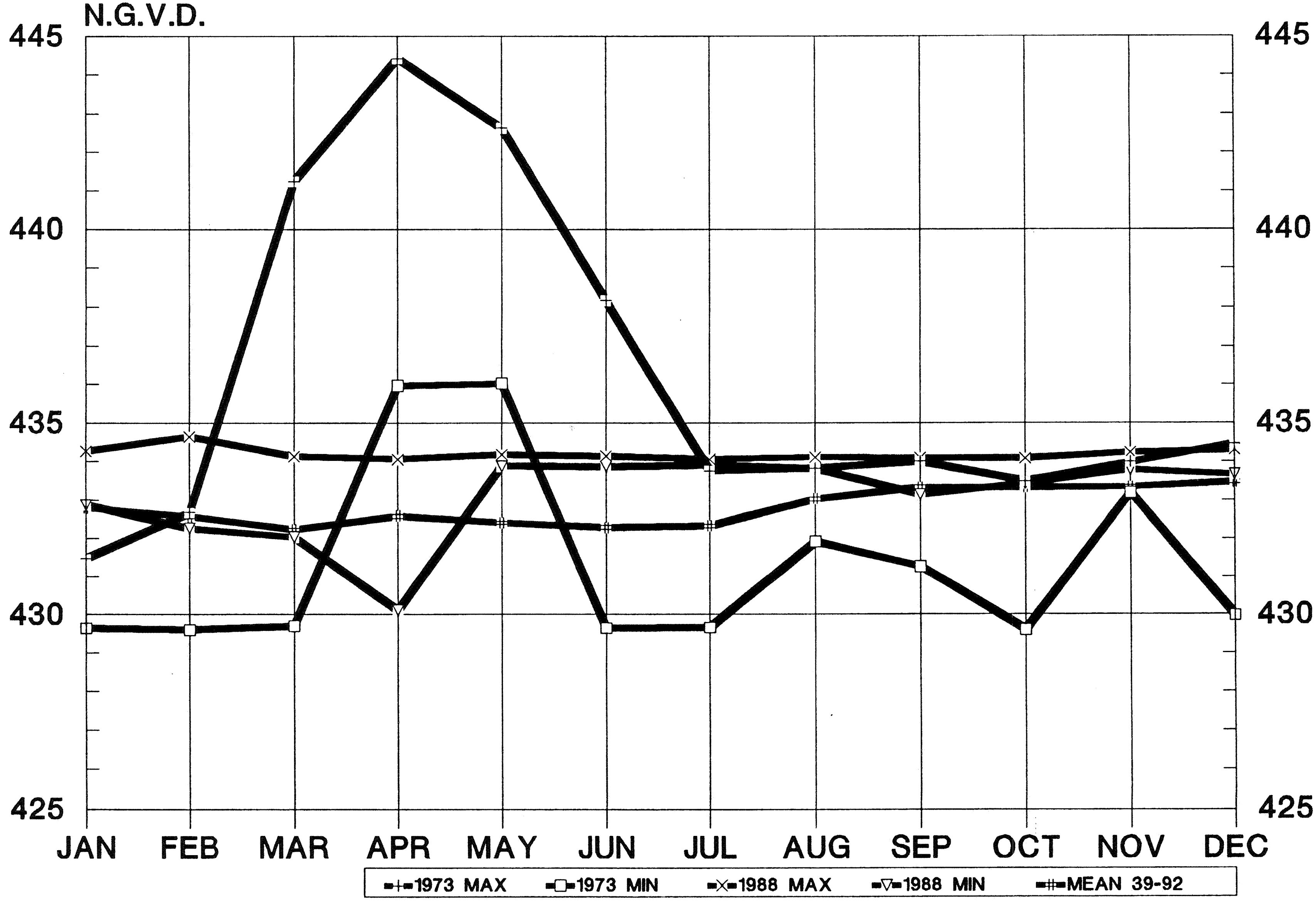
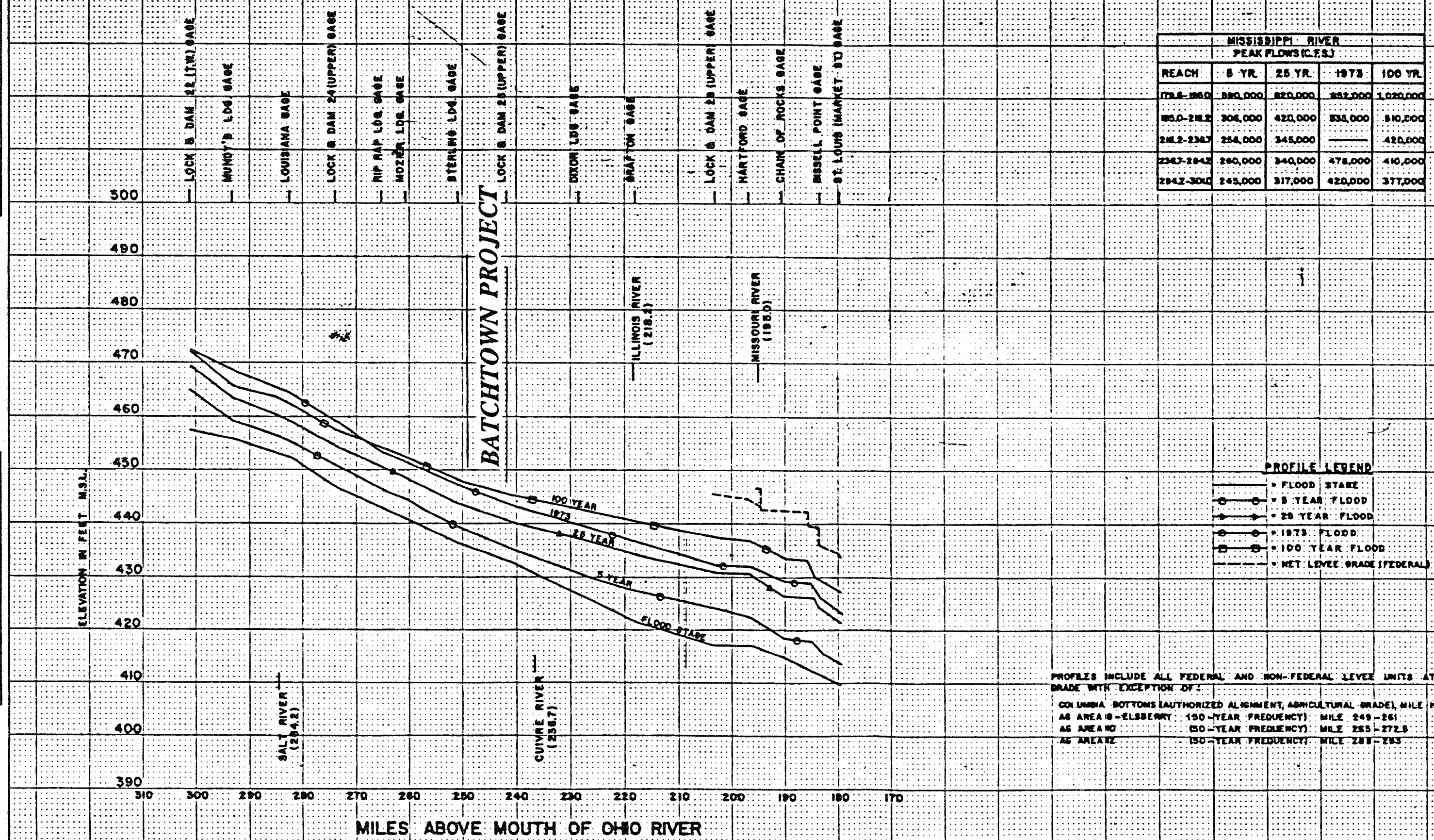


PLATE 14



MISSISSIPPI RIVER PEAK FLOWS (C.F.S.)				
REACH	5 YR.	25 YR.	1973	100 YR.
179.6-195.0	580,000	820,000	852,000	1,020,000
195.0-218.2	306,000	420,000	535,000	510,000
218.2-236.7	254,000	345,000	—	420,000
236.7-284.2	260,000	340,000	478,000	410,000
284.2-301.0	245,000	317,000	420,000	377,000

PROFILES INCLUDE ALL FEDERAL AND NON-FEDERAL LEVEE UNITS AT 1973 GRADE WITH EXCEPTION OF:

COLUMBIA BOTTOMS (AUTHORIZED ALIGNMENT, AGRICULTURAL GRADE), MILE 193-195
AS AREA 18-ELSBERRY (50-YEAR FREQUENCY) MILE 249-261
AS AREA 10 (50-YEAR FREQUENCY) MILE 255-272.5
AS AREA 12 (50-YEAR FREQUENCY) MILE 288-283

MISSISSIPPI RIVER PROFILE
ST. LOUIS, MO TO LOCK & DAM 22
DATA FROM 1975 MISSISSIPPI RIVER MODEL TESTS OCTOBER 1975

PREPARED BY ______
REVIEWED BY ______

SUPERSEDES ALL PREVIOUS FLOOD PROFILE DATA

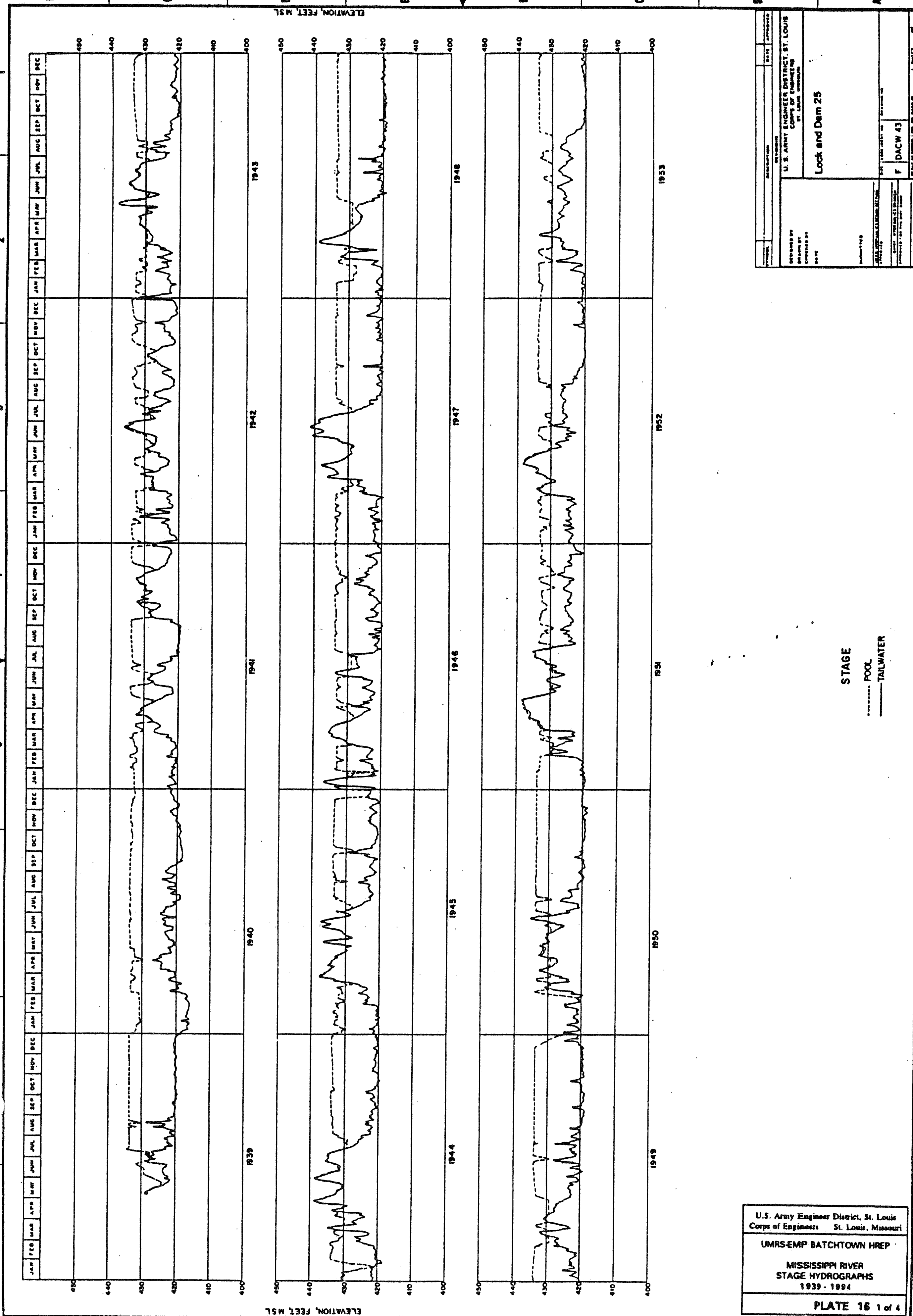
5YR, 25YR, & 100YR FLOWS FROM MILE 284.2 TO 301.0 WERE REVISED

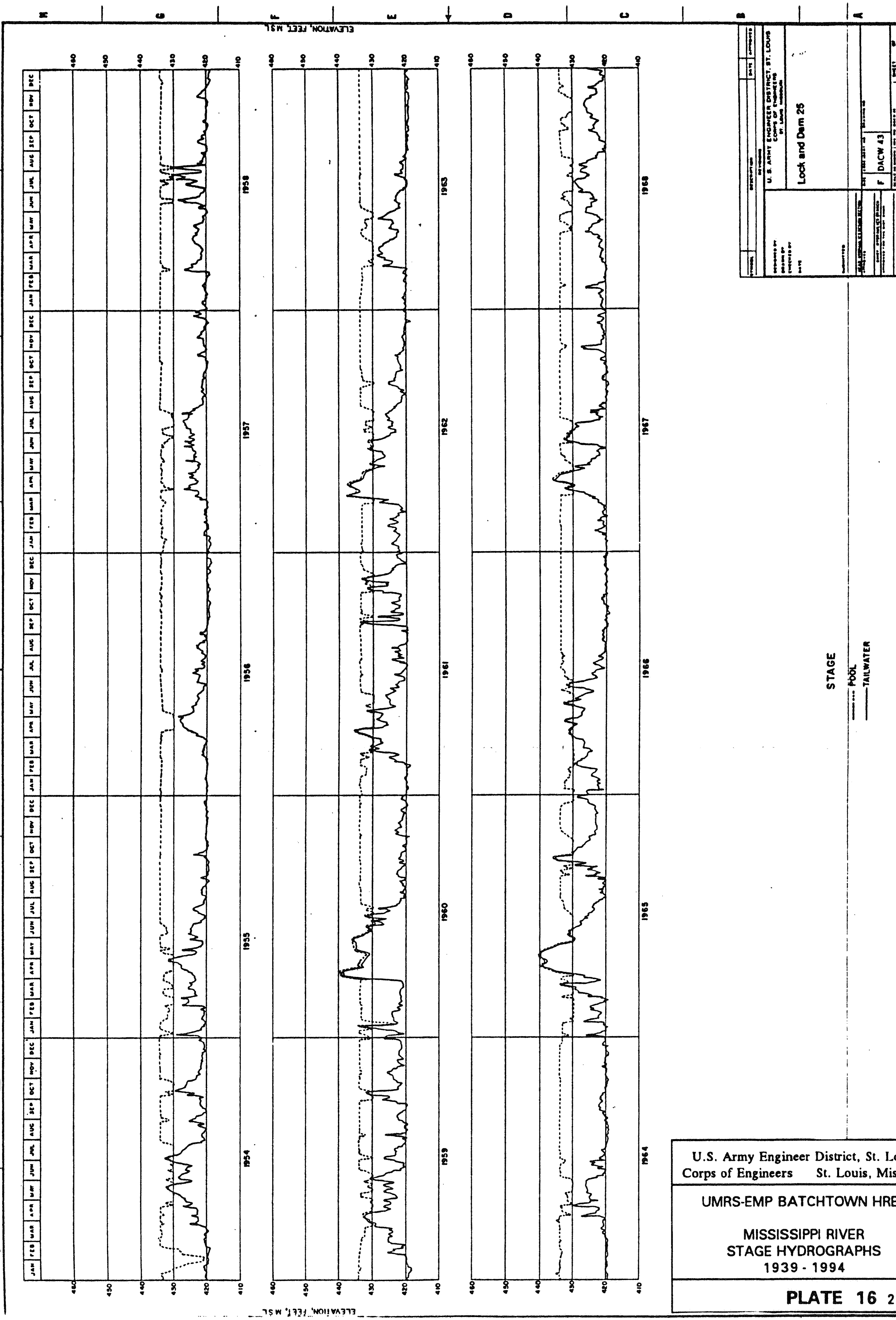
U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UMRS-EMP BATCHTOWN HREP

MISSISSIPPI RIVER PROFILE

PLATE 15


ELEVATION, FEET, MSL
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
STAGE
POOL
TAILWATER
U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
Lock and Dam 25
DACW 43
U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri
UMRS-EMP BATCHTOWN HREP
MISSISSIPPI RIVER
STAGE HYDROGRAPHS
1939 - 1994
PLATE 16 1 of 4

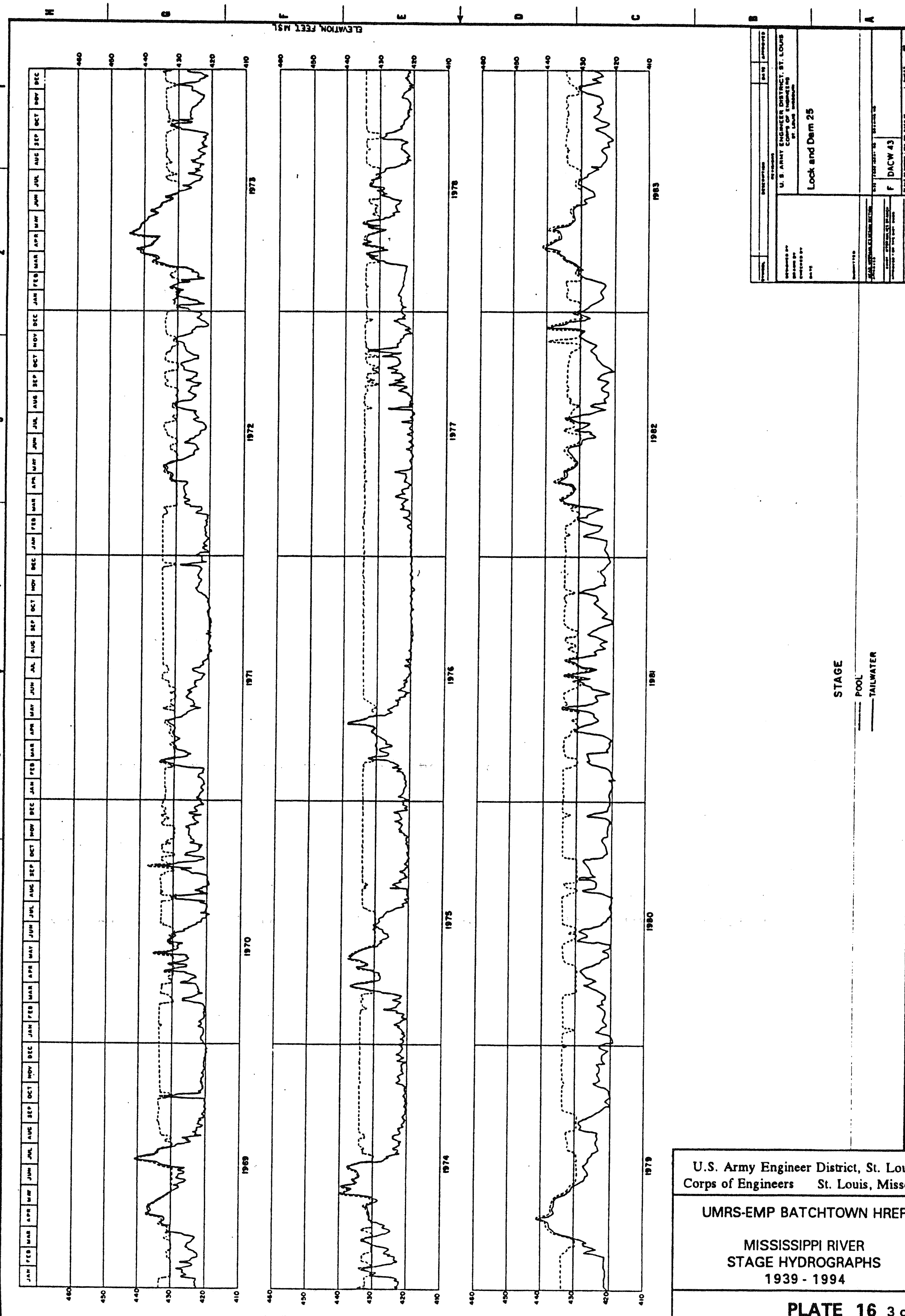


U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UMRS-EMP BATCHTOWN HREP

MISSISSIPPI RIVER
STAGE HYDROGRAPHS
1939 - 1994

PLATE 16 2 of 4

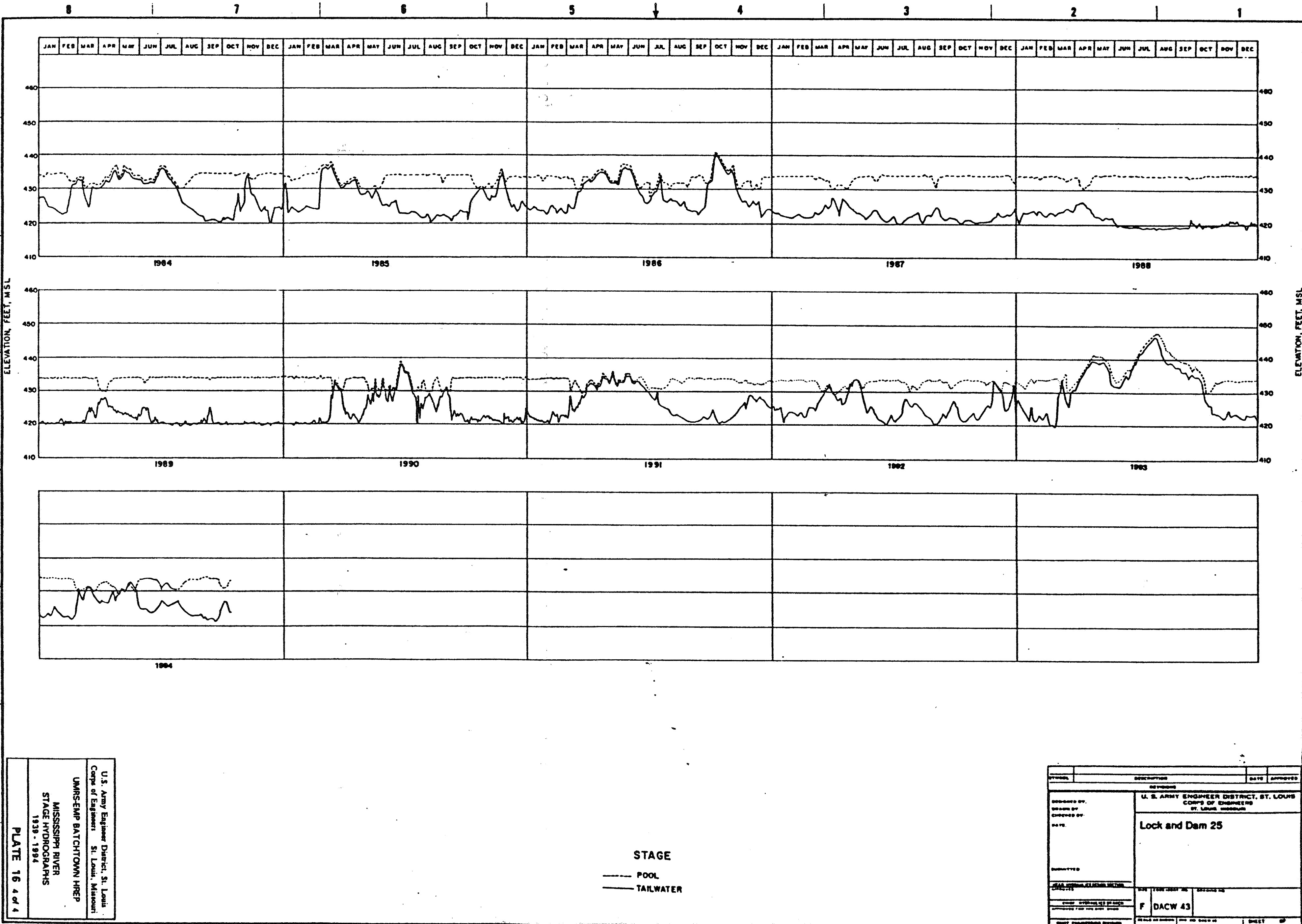


U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UMRS-EMP BATCHTOWN HREP

MISSISSIPPI RIVER
STAGE HYDROGRAPHS
1939 - 1994

PLATE 16 3 of 4



U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UMRS-EMP BATCHTOWN HREP

MISSISSIPPI RIVER
STAGE HYDROGRAPHS
1939 - 1994

PLATE 16 4 of 4

Percent Reduction of River-borne Sediment by Levee Height.

Elev. at MRM 241.5	% of Time Innundated	Recurrence Interval	Corresponding Elev. at MRM 243.5 +/-	No. of Days/Year Innundated	No. of Days/Year Not Innundated	Approx. % Reduction of Sedimentation
441.1	.2	500	442	0	365	100
440.1	.4	250	441	1	364	100
439.1	.7	143	440	2	363	99
438.1	1.3	77	439	5	360	99
437.1	2.0	50	438	7	358	98
436.1	3.0	33	437	11	354	97
435.1	4.2	24	436	15	340	93
434.1	10.8	9	435	39	326	89
433.1	64.0	2	434	233	132	36
432.1	72.4	1	433	264	101	27
431.1	79.1	1	432	289	76	20
430.1	84.7	1	431	309	56	15
429.1	100.0	1	430	365	0	0

U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UMRS-EMP BATCHTOWN HREP

PERCENT REDUCTION OF
RIVER-BORNE SEDIMENT
BY LEVEE HEIGHT

PLATE 17

Appendix B - Habitat Quantification

This appendix provides a quantification of habitat conditions for the project, and consists of three sections:

Section I--dealing with the project planning analysis for wildlife
Section II--dealing with the project planning analysis for fish
Section III--dealing with the project planning analysis for freshwater mussels.

A quantification of habitat conditions for the hillside area, or upland watersheds, is contained in Appendix O, Enclosure O-3.

BATCHTOWN HREP
APPENDIX B - HABITAT QUANTIFICATION

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BATCHTOWN HREP
APPENDIX B - HABITAT QUANTIFICATION

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LIST OF TABLES

LIST OF FIGURES

BATCHTOWN HREP
APPENDIX B - HABITAT QUANTIFICATION

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BATCHTOWN HREP

INTRODUCTION.

This appendix provides a quantification of habitat conditions for project planning. Quantification is needed to evaluate project features where traditional benefit/cost evaluation procedures are not applicable. Currently, the unit of measure that has gained the widest acceptance among technical and policy elements--both within and outside the Corps--is the habitat unit (HU). Habitat units have been used to evaluate the Batchtown HREP. A habitat unit is the product of an estimated acreage for a given habitat type times a habitat suitability index (HSI) value for that habitat type. HSIs result from the numeric ranking of site characteristics at sample sites for a habitat throughout a given project area. HUs can be annualized (Average Annual Habitat Unit, or AAHU) for specific target years to project changes in habitat values over time. The effects of various plans or plan features can then be compared by applying the HSIs to the acreages of habitat for each alternative considered.

There is a need for fisheries, wildlife and freshwater mussel based HU accounting methodologies for the Batchtown HREP. A number of such methodologies are available, but the Habitat Evaluation Procedure (HEP) developed by the U. S. Fish and Wildlife Service is the most familiar to all participants in the UMRS-EMP. The Missouri Department of Conservation (MDOC) and the Natural Resource Conservation Service (NRCS) developed an appraisal system based upon HEP. The system, known as the Wildlife Habitat Appraisal Guide (WHAG), represents a regional fine tuning of HEP and is structured to more efficiently input field data. The WHAG is accepted by UMRS agencies as the method of choice for EMP wildlife habitat analysis, consequently, it was chosen for application to the Batchtown project.

HU methodologies for wildlife evaluation have been used for some time resulting in greater support and acceptance among biologists than the more recently developed fisheries evaluation methods. Two fisheries evaluation methods have been used on EMP projects on the UMRS, these are the Aquatic Habitat Appraisal Guide (AHAG) developed by the Waterways Experiment Station (WES) and the Corps' Rock Island District, and the Fisheries Habitat Appraisal Guide (FHAG) developed by the Missouri Department of Conservation.

Both methods follow the format of the Missouri WHAG. The AHAG was selected for application to the Batchtown HREP because of the flexibility to evaluate fisheries habitat suitability during different seasons of the year.

A habitat suitability index model for riverine freshwater mussel communities was developed by WES based upon studies of prominent mussel beds having commercial and ecological value in sandy gravel or gravelly sand shoals of four major rivers. Modification of this model by WES was necessary because of the location of the mussel bed at Batchtown in a back channel with a silt/clay substrate and subject to the impact of sediment deposition. The modified version of this model was used for application to the Batchtown HREP.

Habitat quantification was based upon desired water level management activities for all management units. Water level management is generally the same for all management units, that is, maintenance of normal pool throughout winter, spring and fall, with drawdown in the summer for moist soit plant establishment. Summer drawdown levels in the state backwater area may be dictated by the performance of the system determined in the early years of management rather than by the water levels proposed. The exception to water level management at pool in the fall of the year is IDNR-Turner Island which will be held one foot above pool in the fall to facilitate hunter access. All other units, when operating at maximum pool level, will operate with stop-log structures open to facilitate fish passage. Consequently, the management emphasis during most of the year will be aimed at both fish and wildlife, the exception being the summer drawdown period. None of the management units will have such severe summer drawdowns that fish populations will be adversely affected to a large degree. Both the federal and state managers plan to establish aquatic vegetation beds to benefit both fish and wildlife, so severe drawdowns would not be advantageous. The notable exception may be years when water levels are reduced to solidify the substrate for the express purpose of establishing aquatic vegetation. Such drawdowns will occur only occasionally, perhaps once every eight to ten years, depending upon the rate of silt deposition. Before final operational plans have been determined for each unit, it is likely that several alternative water plans will be explored.

The WHAG and AHAG analysis have assumed an equal management emphasis for waterfowl and fish. The freshwater mussel bed is not expected to be adversely affected by the water management regime because of the management flexibility built into the proposed system and the ability of freshwater mussels to survive for extended periods without flowing water. There is likely to be some flowing water in the system at all times due to seepage and the need to discharge seepage water for management purposes.

SUBSECTION I. WILDLIFE HABITAT APPRAISAL GUIDE (WHAG) METHOD.

1. BACKGROUND.

The WHAG is a field evaluation procedure designed to measure the quality of a habitat for particular species of wildlife, and also account for land management practices. The method provides HSI values for areas classified into broad land-use types such as forested wetland and non-forested wetland. WHAG is based on the assumption that habitat can be numerically described by HSIs calculated from species-habitat models.

WHAG utilizes checklist-type appraisal guides for each habitat type. The guide breaks habitat into the most important characteristics which are rated on a 1-to-5 or 1-to-10 scale, depending on their importance. Field data values are entered into a computer program that rates habitat types based on life requisite requirements for a variety of species. The resulting index ranges from a low habitat suitability value of 0.1 to a high of 1.0.

Computer results are provided for estimated total HUs and HSIs. The results can be used to assess the value of various proposed habitat improvements on habitat quality. HUs are annualized for target years in order to evaluate changes in project features over time. Sediment control, water control and maintenance of flow and aquatic access are habitat improvement measures considered in the Batchtown project. A number of target years were selected over the life of the project because habitat units can change over time. These target years were year 0 (or existing conditions), year 2 (or early post-construction) and year 50 of the project life.

Habitat can potentially be improved by: (1) protecting habitat types considered critical, (2) altering a habitat limiting factor, such as unstable water levels, (3) altering a management strategy, such as food crop composition, or (4) a combination of the above.

The primary wildlife goal for the management of Batchtown is to enhance wetland values for migratory waterfowl, while providing or maintaining suitable habitats for non-target species. Consequently, appraisal guides for wetland habitats and cropland were selected. Nine questions that addressed habitat use by upland species known to exist in the project were also used to evaluate species from the upland species matrix. The indicators for waterfowl were mallard, wood duck, diving ducks and Canada goose. The WHAG team included representation from the USFWS, IDNR and the Corps.

2. ASSUMPTIONS.

Certain assumptions were developed regarding existing conditions and future conditions during the WHAG analysis. These assumptions are listed below.

a. Existing Conditions.

(1) Water levels fluctuate during the year, but especially during the growing season and during waterfowl migration periods resulting in food production that is unreliable or unavailable to waterfowl.

(2) Available wetland habitat at the site is rapidly being degraded due to siltation.

FWS - There will be a 50% loss of surface area and water depth in the Middle Pool over the next 50 years without the project.

IDNR - There will be a 65% loss of surface area and water depth over the nest 50 years without the project, resulting in the closure of both side channels, loss of access to Big Hole and the loss of overall habitat diversity.

b. Future Conditions.

(1) General. The following four general assumptions were applied to the analysis of all future changes in habitat during the 50-year project life.

(a) Target years of 0, 2 and 50 are sufficient to annualize HUs and to characterize habitat changes over the life of the project.

(b) Dabbling and diving ducks and Canada geese should be given equal emphasis during project analysis.

(c) HSIs for the mallard, wood duck, diving ducks and Canada goose were accumulated for individually as an appropriate way to compute HUs for the purposes of the incremental analysis of this project.

(d) Fifteen species of wildlife as listed in Table B-2 can be used for comparative evaluation of habitat value changes.

(2) Specific. Specific assumptions employed in evaluating alternative plans F, A, B and C are given below.

(a) <u>Alternative Plan F, No Action Plan</u> (also represents future without project conditions).

(1) Severe water level fluctuations will continue to limit aquatic food production capabilities for waterfowl in all management units.

(2) Approximately 50-65 percent of the non-forested wetlands in the project area will be lost over the next 50 years.

(3) The existing HSI values developed from the field data are a fair representation of the habitat quality of unprotected habitat in all target years and for all future conditions with or without a project.

(b) Alternative Plan A, Partial Wetlands Protection

(1) This plan would address many of the concerns of the wetland associated wildlife species but would not address fish management concerns nor the survival of the freshwater mussels.

(2) The size of the project area is somewhat smaller under this alternative as shown on the original concept plan, hence the differance in HUs computed for plans A and C.

(c) Alternative Plan B, Partial Backwater Protection

(1) This plan would address some wildlife and fisheries management concerns and may provide for the survival of the freshwater mussels.

(2) Operation and maintenance costs under this alternative were felt to be excessive due to seepage and the longer lengths of levee to be maintained in the state backwater part of the project.

(3) The size of the project area used for waterfowl management in the state backwater is substantially smaller under this alternative, hence the differance in HUs computed for plans B and C.

(d) Alternative Plan C, Wetlands Protection

(1) Water levels would be predictable and controlled (via levee, water control structures and pumps). This will greatly increase the reliability of moist soil and aquatic plant production and will ensure that the food produced is available to waterfowl during migration.

(2) Sedimentation should be reduced by 60 percent from its existing rate in the state backwater area and by 70 percent in the FWS part of the project.

Wetland losses would continue to occur but at a much slower rate than at present and was estimated at 25 percent over the life of the project.

(3) Operation and maintenance costs in the state backwater part of the project would be very low in most years due to the gravity flow capability to drain and fill the levee protected area.

3. RESULTS.

Site Locations. The WHAG analysis locations were selected by the WHAG team as shown in Figure B-1. The number and location of these sites were judged by the team to be representative of the prevailing habitat conditions.

Appraisal Items/Ratings. Figure B-2 (WHAG Matrix) provides a listing of the appraisal guide items and potential ratings utilized in the WHAG for wetlands, bottomland hardwood, and cropland evaluation.

Table B-1 (4 pages) lists the particular appraisal item numbers used in evaluating the projects habitats and provides the team's assigned ratings for each appraisal item for each project condition.

Table B-2 provides the HSI values resulting from the application of the WHAG software to the Table B-1 ratings.

Table B-3 shows the overall waterfowl HSIs used for subsequent habitat unit determination. Table B-4 provides a tabulated prediction for waterfowl of HSI and habitat acerage changes expected for the project area over the next 50 years for various alternative plan and plan feature options. The rate of existing sedimentation was determined from available literature describing this site. The determination of the future sedimentation rate with a project took sedimentation rate half-life and levee entrapment effects into consideration. Future sedimentation with a project took applicable hydraulic engineering estimates of percent reduction in sediment input into account.

Tables B-5 and B-6 provide the HU value changes resulting from the aplication of the Corps' HES software to the Table B-4 values. The HUs are tabulated for waterfowl for each project alternative and individual habitat type.

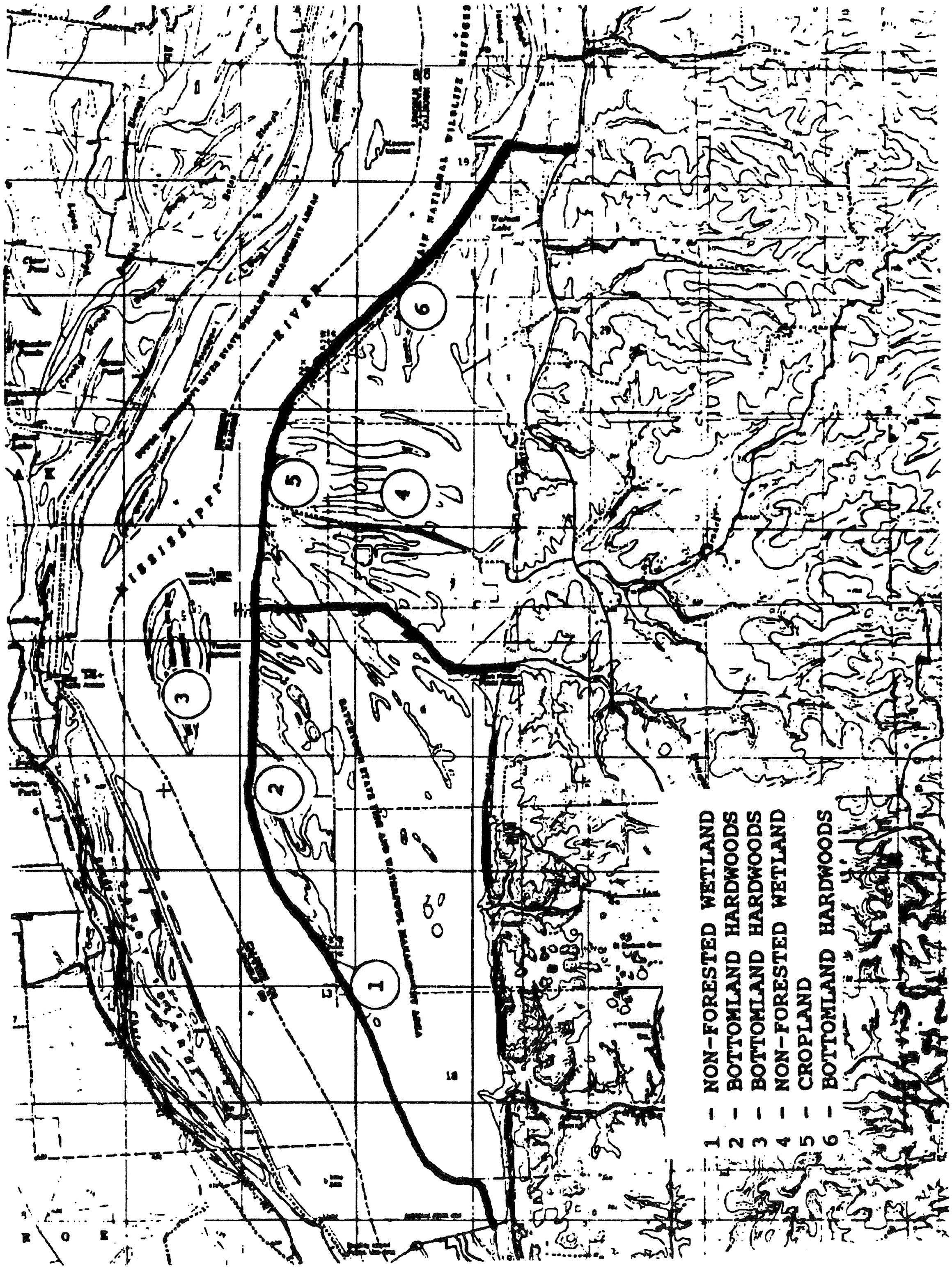

Figure B-1. Wildlife Habitat Appraisal Guide Sample Site Locations.

Wetland Species Characteristic Matrix

Wildlife Area: ______________

Date: ______________

Habitat Type: ______________

CHARACTERISTIC	Habitat Type	Mallard	Canada Goose	Least Bittern	Lesser Yellowlegs	Muskrat	King Rail	Green-backed Heron	Wood Duck	Beaver	American Coot	Northern Parula	Prothonotary Warbler
1. Percent Nonforest Wetlands in 2 Mile Wide Circle	N												
1. >75%				10	10	10	10				10		
2. 50 - 75%				8	8	8	8				8		
3. 25 - 50%				6	6	6	6				6		
4. 10 - 25%				4	4	4	4				4		
5. <10%				1	1	1	1				1		
2. Percent Nonforest Wetlands and Lakes or Reservoirs in 2 Mile Wide Circle	N,C,G												
1. >75%			10										
2. 50 - 75%			8										
3. 25 - 50%			6										
4. 10 - 25%			4										
5. <10%			1F										
3. Percent Bottomland Hardwoods and Nonforest Wetlands in 2 Mile Wide Circle	N,B,C												
1. >75%		10						10	10	10			
2. 50 - 75%		8						8	8	8			
3. 25 - 50%		6						6	6	6			
4. 10 - 25%		4						4	4	4			
5. <10%		1F						1	1	1			
4. Fall Winter Water Conditions	N,B,C												
1. Water present annually (predictable & water levels controlled		10	10										
2. Water present most years with occasional lapse & water levels controlled		7	7										
3. Water present 1 out of 3 years (opportunistic) & water levels controlled		4	4										
4. Water unpredictable; dry during fall and winter; or no control when present		1F	1F										
5. Fall-Winter Flood Conditions (food plant availability)	N,B	M	M										
1. Food plants unaffected		10	10										
2. Reduced 1 - 25% (Multiply index by .75)		8	8										
3. Reduced 25 - 50% (Multiply index by .50)		6	6										
4. Reduced 50 - 75% (Multiply index by .25)		4	4										
5. Reduced >75% (Multiply index by .25)		1	1										
6. Water Depth 4" - 18" Fall - Winter	N,B,C												
1. >90%		10	10										
2. 75 - 90%		8	8										
3. 50-75%		6	6										
4. 25 - 50%		4	4										
5. <25%		1	1										
7. Water Depth <4" During May	N												
1. >90%					10						1F		
2. 75 - 90%					8						2		
3. 25 - 75%					6						4		
4. 1 - 25%					4						7		
5. ZERO or all >4" Deep					1						10		
8. Water Depth 4 - 18" By August	N												
1. >75%				1		10	1	10			10		
2. 50 - 75%				7		7	7	7			7		
3. 25 - 50%				10		4	10	4			4		
4. <25%				4		1	4	1			1		
9. Permanent Water Entire Year	N					M							
1. >90%						10							
2. 75 - 90% (Multiply index by .90)						8							
3. 50 - 75% (Multiply index by .75)						6							
4. 25 - 50% (Multiply index by .50)						4							
5. <25% (Multiply index by .25)						1							
10. Percent Emergent Vegetation Within 2 yds. of Water	N												
1. >75% of emer. veg. within 2 yd. of water				10							10		
2. 50-75% of emer. veg. within 2 yd. of water				7							7		
3. 25-50% of emer. veg. within 2 yd. of water				4							4		
4. <25% of emer. veg. within 2 yd. of water				1							1		

Figure B-2. WHAG Matrix. Page 1 of 7.

Wetland Species Characteristic Matrix

	CHARACTERISTIC	Habitat Type	Mallard	Canada Goose	Least Bittern	Lesser Yellowlegs	Muskrat	King Rail	Green-backed Heron	Wood Duck	Beaver	American Coot	Northern Parula	Prothonotary Warbler
11.	**Woody Invasion**	N												
	1. <10%				10		5	6	1					
	2. 10 - 25%				8		4	8	6					
	3. 25 - 50%				6		3	10	8					
	4. 50 - 75%				4		2	4	10					
	5. >75%				1		1	1	4					
12.	**Emergent Vegetation Coverage**	N,B												
	1. >90%				6	LF			1					
	2. 75 - 90%				10	2			2					
	3. 50 - 75%				8	4			4					
	4. 25 - 50%				4	6			10					
	5. 10 - 25%				2	8			7					
	6. <10%				LF	10			1					
13.	**Cattail and Bulrush Coverage**	N												
	1. >75%						10	LF				8		
	2. 50 - 75%						8	2				10		
	3. 25 - 50%						6	4				6		
	4. 10 - 25%						4	7				4		
	5. <10%						1	10				LF		
14.	**Wetland Size**	N,B												
	1. >200 acres				10	10	10	10	10			10		
	2. 100 - 200 acres				10	8	8	8	10			10		
	3. 50 - 100 acres				8	6	6	6	10			8		
	4. 25 - 50 acres				6	4	4	4	10			6		
	5. 5 - 25 acres				4	1	2	2	5			4		
	6. <5 acres				LF	LF	1	1	LF			LF		
15.	**Wetland Edge**	N,B												
	1. >75% Bottomland H. - % adj. to water								10					
	2. 50-75% Nonforest w.-% woody or adj. to								8					
	3. 25 - 50% bottomland hardwoods								6					
	4. 10 - 25%								4					
	5. <10%								1					
16.	**Water Regime**	N												
	1. Gradual drying with >75% water remaining by Aug. 1				4	4	8	2	10			8		
	2. Gradual drying with 50 - 75% water remaining by Aug. 1				6	6	6	6	6			6		
	3. Gradual drying with 25 - 50% water remaining by Aug. 1				10	10	4	10	4			4		
	4. Gradual drying with <25% water remaining by Aug. 1				8	8	2	8	2			2		
	5. Stable water				2	4	10	4	10			10		
	6. Rapid drying; or no water after June 1				LF	LF	LF	LF	LF			LF		
17.	**Important Food Plant Coverage**	N,B	M	M										
	1. >75%		10	10										
	2. 50 - 75% (Multiply index by .75)		8	8										
	3. 25 - 50% (Multiply index by .50)		6	6										
	4. 10 - 25% (Multiply index by .25)		4	4										
	5. <10% (Multiply index by .25)		1	1										
18.	**Plant Diversity**	N,B												
	1. >7		5	5										
	2. 4 - 7		3	3										
	3. <4		1	1										
19.	**Persistent Emergent and Woody Vegetation Coverage**	N												
	1. 5 - 15%		5	5										
	2. 15 - 25%		4	4										
	3. 25 - 50%		2	2										
	4. <5% or >50%		1	1										

Figure B-2. WHAG Matrix (Page 2 of 7).

Wetland Species Characteristic Matrix

	CHARACTERISTIC	Habitat Type	Mallard	Canada Goose	Least Bittern	Lesser Yellowlegs	Muskrat	King Rail	Green-backed Heron	Wood Duck	Beaver	American Coot	Northern Parula	Prothonotary Warbler
20.	Substrate - Surface Water Interspersion	N												
	1. Substrate interspersed with shallow water					10								
	2. Shallow water occurring as one or few pools					1								
21.	Percent Open Water	N												
	1. <10%		5	5			10					6		
	2. 10 - 25%		3	3			8					10		
	3. 25 - 50%		1	1			6					8		
	4. 50 - 90%		1	1			4					4		
	5. >90%		1	1			1					1		
22.	Winter Water Depth (Oct. - March)	N												
	1. 15 - 24"						10							
	2. 10 - 15" or 24 - 30"						7							
	3. 6 - 10" or 30 - 36"						4							
	4. <6" or >36"						1							
23.	Sedge Canopy Coverage	N												
	1. >90%							8						
	2. 75 - 90%							10						
	3. 50 - 75%							6						
	4. 25 - 50%							4						
	5. 1 - 25%							2						
	6. Zero							LF						
24.	Wetland Substrate	N												
	1. Mucky					5								
	2. Sandy					3								
	3. Gravel					1								
25.	Percent Soil Waterlogged Substrate During May	N												
	1. >90% of substrate waterlogged					10								
	2. 75 - 90% of substrate waterlogged					8								
	3. 50 - 75% of substrate waterlogged					6								
	4. 25 - 50% of substrate waterlogged					4								
	5. <25% of substrate waterlogged					1								
26.	Percent Exposed Wetland Substrate and 1-4" Shallow Water Covered by Vegetation May-June	N												
	1. <10%					10								
	2. 10 - 25%					8								
	3. 25 - 50%					6								
	4. 50 - 75%					4								
	5. 75 - 90%					2								
	6. >90%					LF								
27.	Percent Channel with Aquatic Vegetation	B												
	1. >10%									10	10			
	2. 5 - 10%									7	7			
	3. 1 - 5%									4	4			
	4. None; or 1/4 mi. from center stand									1	1			
28.	Average Water Fluctuation in Channel	B												
	1. Bank full <3 times per year										10			
	2. Bank full 3-5 times per year										7			
	3. Bank full 5-7 times per year										4			
	4. Bank full >7 times per year; or >1/4 mile from channel										1			
29.	Cropfield Management	C												
	1. No fall tillage		10	10										
	2. Winter wheat		2	10										
	3. Chisel plowing		8	8										
	4. Chopped, baled, grazed		6	6										
	5. Fall disc		4	4										
	6. Fall moldboard		1	1										

Figure B-2. WHAG Matrix (Page 3 of 7).

Wetland Species Characteristic Matrix

	CHARACTERISTIC	Habitat Type	Mallard	Canada Goose	Least Bittern	Lesser Yellowlegs	Muskrat	King Rail	Green-backed Heron	Wood Duck	Beaver	American Coot	Northern Parula	Prothonotary Warbler
30.	Cropping Practice	C												
	1. >50 unharvested		10	10										
	2. 25-50% harvested		7	7										
	3. 10 - 25% unharvested		4	4										
	4. <10% unharvested		1	1										
31.	Crop Rotation	C												
	1. SG - RC - L			5										
	2. SG - RC; or idle some years			3										
	3. Continuous SG or RC			1										
32.	Field Size (% w/in 660' Woodland or Treeline)	C,G												
	1. <25%			10										
	2. 25 - 50%			6										
	3. 50 - 75%			3										
	4. >75%			1										
33.	Grassland Composition	G												
	1. Bluegrass, clover, alfalfa			10										
	2. Timothy, orchardgrass or mixed CSG			5										
	3. Fescue or WSG			1										
34.	Average Height Herbaceous Vegetation (Fall)	G												
	1. <6"			10										
	2. >6"			1										
35.	Woodland Tree Species	B												
	1. >50% trees as elm, walnut, cottonwood, sycamore, willow, maple, ash		1							8	10			
	2. 25 - 50% trees as elm, walnut, cottonwood, sycamore, willow, maple, ash		4							10	8			
	3. <25% trees as elm, walnut, cottonwood, sycamore, willow, maple, ash; or <25% pin oak (or other small acorns)		6							1	6			
	4. 25 - 50% pin oak (or other small acorns)		8							4	4			
	5. >50% pin oak (or other small acorns)		10							6	1			
36.	Permanent Water Within Woodland	B												
	1. >25%		1						10	10				10
	2. 10 - 25%		3						7	7				7
	3. 5 - 10%		5						4	4				4
	4. 1 - 5%		3						2	2				2
	5. Zero		2						1	1				1
37.	Forest Openings (<2 ac. in size)	B												
	1. 15 - 30% scattered		1						10	10	5			
	2. 15 - 30% one or few		3						7	7	4			
	3. 5 - 15%		5						4	4	3			
	4. <5% or >30%		1						1	1	1			
38.	Woodland Size Class	B												
	1. Sawtimber - open canopy		10						4	10	4		10	10
	2. Sawtimber - close canopy		8						1	8	1		10	10
	3. Pole with 25-50% sawtimber		6						10	6	6		7	7
	4. Regeneration with 25-50% sawtimber		4						8	4	8		2	2
	5. Regeneration		1						8	LF	10		LF	LF
	6. Pole		1						6	2	6		4	4
39.	Percent Canopy From Old Growth (>16" dbh)	B												
	1. >25%									10	1			
	2. 10 - 25%									8	4			
	3. 5 - 10%									6	6			
	4. 1 - 5%									4	8			
	5. Zero									1	10			

Figure B-2. WHAG Matrix (Page 4 of 7).

Wetland Species Characteristic Matrix

CHARACTERISTIC	Habitat Type	Mallard	Canada Goose	Least Bittern	Lesser Yellowlegs	Muskrat	King Rail	Green-backed Heron	Wood Duck	Beaver	American Coot	Northern Parula	Prothonotary Warbler
40. Woodland Overstory Canopy Height (feet)	B												
1. >80'												10	10
2. 65-80'												7	7
3. 40-65'												4	4
4. <40'												1	1
41. Percent Subcanopy Closure	B												
1. >75%												10	1
2. 50-75%												7	4
3. 25-50%												4	10
4. <25%												1	7
42. Woodland (Stand) Size													
1. <25%												10	10
2. 25-50%												7	7
3. 50-75%												4	4
4. >75%												1	1
43. Percent Forest Canopy Adjacent to or Over Permanent Water	B												M
1. >25%													10
2. 10-25%													7
3. 5-10%													4
4. <5%													1
44. Number of Snags Trees per Acre	B												
1. >4									5				10
2. 3-4									5				7
3. 1-2									3				4
4. <1									1				1
45. Number of Cavity Trees Per Acre	B												
1. >9									10				10
2. 3 - 9									7				7
3. 1 - 3									4				4
4. None									LF				1
46. Stems per Square Yard of Shrub and Tree Regeneration >3 Feet Tall													
1. >3									1	10		10	1
2. 1-3									3	7		7	4
3. .5-1									5	4		4	10
4. <.5									2	1		1	7
47. Percent Woodland Within 660' of Permanent Water	B							M	R	M			
1. >75%								10	10	10		10	10
2. 50 - 75% (Multiply Index by .75)								7	7	7		7	7
3. 25 - 50% (Multiply Index by .50)								4	4	4		4	4
4. <25% (Multiply Index by .25)								1	1	1		1	1
48. Distance to Nonforest Wetland, Oxbow or Slough	B,C,G												
1. <250' water predictable		10	10					10	10	10			
2. 250'-1/8 mi. water predictable		10	10					10	10	5			
3. 1/8-1 mi. water predictable		10	10					1	1	1			
4. <250' water predictable 1 of 3 years		5	5					5	5	3			
5. 250'-1/8 mi. water predictable 1 of 3 yrs.		5	5					5	5	2			
6. 1/8-1 mi. water predictable 1 of 3 yrs.		5	5					1	1	1			
7. >1 mi.; or <1 mi. water unpredictable		1	1					1	1	1			
49. Distance to Bottomland Hardwoods	M,C												
1. <1/4 mi. water predictable		10						5					
2. 1/4-1/2 mi. water predictable		10						3					
3. 1/2-1 mi. water predictable		8						1					
4. <1/4 mi. water predictable 1 of 3 yrs.		6						5					
5. 1/4-1/2 mi. water predictable 1 of 3 yrs.		6						3					
6. 1/2-1 mi. water predictable 1 of 3 yrs.		4						1					
7. >1 mi.; or <1 mi. water unpredictable		1						1					

Figure B-2. WHAG Matrix (Page 5 of 7).

Wetland Species Characteristic Matrix

	CHARACTERISTIC	Habitat Type	Mallard	Canada Goose	Least Bittern	Lesser Yellowlegs	Muskrat	King Rail	Green-backed Heron	Wood Duck	Beaver	American Coot	Northern Parula	Prothonotary Warbler
50.	**Distance to Cropland**	N,B,G												
	1. <1/4 mi., unharvested or partially unharvested and water predictable		10	10										
	2. 1/4-1/2 mi. unharvested or partially unharvested and water predictable		8	8										
	3. 1/2-1 mi. unharvested or partially unharvested and water predictable		6	6										
	4. <1/4 mi., unharvested or partially unharvested and water predictable 1 of 3 years; or adjacent, unflooded with residues undisturbed		5	5										
	5. 1/4-1/2 mi. unharvested or partially unharvested and water predictable 1 of 3 years; or 1/4-1/2 mi. unflooded with residues and undisturbed		4	4										
	6. 1/2-1 mi. unharvested or partially unharvested and water predictable 1 of 3 yrs; or 1/2-1 mi. unflooded with residues undisturbed; or winter wheat		2	2										
	7. >1 mi. to any cropfield; or <1 mi. unflooded cropfield with residues disced or plowed		1	1										
51.	**Distance to Grassland**	N,C												
	1. <1/2 mi. with winter height <6" and field size >40 acres			10										
	2. 1/2-1 mi. with winter height <6" and field size >40 acres			7										
	3. <1 mi. with winter height <6" and field size <40 acres			4										
	4. >1 mi. to any grassland with winter height <6"; or grassland with winter height>6"			1										
52.	**Distance to Stream or River (permanent flow or pools)**	N,B												
	1. <1/4 mi.								10					
	2. 1/4 - 1/2 mi.								5					
	3. >1/2 mi.								1					
53.	**Distance to Major River, Lake or Reservoir >100 Acres**	N,C,G												
	1. <1 miles — Missouri, Mississippi,			10										
	2. 1 - 5 miles — Grand, St. Francis			7										
	3. 5 - 10 miles			4										
	4. >10 miles			1										
54.	**Distance to FALL Canada Goose Concentration Area**	N,C,G		M										
	1. <4 miles			10										
	2. 4 - 10 miles (Multiply Index by .75)			7										
	3. 10 - 25 miles (Multiply Index by .50)			4										
	4. >25 miles (Multiply Index by .25)			1										

Figure B-2. WHAG Matrix (Page 6 of 7).

Wetland Species Characteristic Matrix

	Mallard	Canada Goose	Least Bittern	Lesser Yellowlegs	Muskrat	King Rail	Green-backed Heron	Wood Duck	Beaver	American Coot	Northern Parula	Prothonotary Warbler
Total												
Maximum Possible												
HTSI												
Multiplier												
Revised HTSI												
N	85	105	70	85	85	70	85			80		
B	105						100	110	95		60	100
C	70	105										
P		80										

Abbreviations

C = cropfield, G = grassland, N = nonforest wetland, B = bottomland hardwoods,
LF - limiting factor, score Habitat Type Suitability Index (HTSI) as .1 if characteristic scores .1.
M = multiplier. Multiply HTSI by the appropriate value to calculate revised HTSI. Use lowest value if 2 multiplier values apply.

Limiting Factors

	Character Number
Mallard - If Percent in Bottomland Hardwood and Nonforest Wetland or Fall Winter Water Conditions score 1, HTSI = .1.	3,4
Canada goose - If Percent in Nonforest Wetland or Fall Winter Water Conditions score 1, HTSI = .1.	2,4
Lesser yellowlegs - If Wetland Size, Water Regime or Percent Wetland Substrate score 1, HTSI = .1.	14,16,26
Green-backed heron - If Wetland Size Water or Regime HTSI = .1.	14,66
Wood duck - If Woodland Size Class or Number of Tree Cavities score 1, HTSI = .1.	38,45
Least bittern - If Emergent Vegetation Coverage, Wetland Size, or Water Regime Score 1, HTSI = .1.	12,14,16
American Coot - If Cattail and Bulrush Coverage, Wetland Size or Water Regime Score 1, HTSI = .1.	13,14,16
King Rail - If Sedge Canopy Coverage or Water Regime Score 1, HTSI = .1 Score 1, HTSI = .1.	23,16
Northern Parula - If Woodland Size Class	40
Prothonotary Warbler - If Woodland Size Class	40

Multiplier

Mallard - Important Food Plant Coverage (Nonforest wetland)	17
Fall-Winter Flood Conditions	5
Canada goose - Distance to Major Canada Goose Winter Area	54
Important Food Plant Coverage (Nonforest wetland)	17
Fall-Winter Flood Conditions	5
Muskrat - Percent Permanent Water Entire Year	9
Wood duck - Percent Woodland Within 660' of Permanent Water	47
Beaver - Percent Woodland Within 660' of Permanent Water	47
Green-backed Heron - Percent Woodland Within 660' of Permanent Water	47
Prothonotary Warbler - Percent Forest Canopy Adjacent to or Over Permanent Water	43

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Figure B-2..WHAG Matrix (Page 7 of 7).

Table B-1. Wildlife Habitat Appraisal Guide Ratings.

Site 1
Non-forested Wetlands

Appraisal	Existing	Future Without	Future With
1	4	5	4
2	1	2	1
3	4	3	4
4	4	4	1
5	3	3	1
6	4	5	2
7	5	5	2
8	3	2	2
9	5	5	2
10	4	3	1
11	1	3	1
12	6	5	4
13	5	5	4
14	1	1	1
15	5	4	5
16	1	2	3
17	2	2	1
18	2	2	1
19	1	2	1
20	2	2	2
21	1	1	3
22	1	3	1
23	5	5	5
24	1	1	1
25	1	1	1
26	1	1	2
49	7	7	7
50	7	7	7
51	3	3	3
52	1	1	1
53	1	1	1
54	2	2	2
----------- Supplemental Items (Diving Ducks) -----------			
55	4	4	2
56	3	3	3
57	3	3	3
58	4	4	3
59	3	3	3
60	3	3	1

Table B-1. Wildlife Habitat Appraisal Guide Ratings (Continued).

Site 2
Bottomland Forest

Appraisal	Existing	Future Without	Future With
3	2	2	2
4	4	4	1
5	1	1	1
6	5	5	5
12	6	6	6
14	2	1	2
15	2	2	2
17	5	5	3
18	3	3	3
27	4	4	4
35*	1	1	4
36	5	5	5
37*	4	4	3
38*	4	3	4
39*	2	2	2
40*	2	2	2
41*	2	3	2
42*	4	4	4
43	1	1	1
44*	1	1	1
45*	1	1	1
46*	1	2	1
47	1	1	1
48	7	7	1
50	7	7	7
52	1	1	1

* Same questions as Upland Species Matrix and the basis for computing HSIs for Fox Squirrel and Pileated Woodpecker

Table B-1. Wildlife Habitat Appraisal Guide Ratings (Continued).

Site 3.
Bottomland Forest

Appraisal	Existing	Future Without	Future With
3	2	2	2
4	4	4	1
5	2	2	1
6	5	5	3
12	6	6	5
14	3	3	3
15	5	5	5
17	5	5	4
18	3	3	3
27	4	4	4
35*	1	1	2
36	3	4	3
37*	3	4	4
38*	5	3	3
39*	4	2	3
40*	3	2	2
41*	3	4	3
42*	4	4	4
43	1	2	1
44*	2	1	1
45*	2	2	2
46*	2	2	2
47	1	1	1
48	7	7	1
50	6	7	6
52	1	1	1

* Same questions as Upland Species Matrix and the basis for computing HSIs for Fox Squirrel and Pileated Woodpecker

Table B-1. Wildlife Habitat Appraisal Guide Ratings (Continued).

Site 4.
Non-Forested Wetlands

Appraisal	Existing	Future Without	Future With
1	3	4	3
2	3	3	3
3	2	2	2
4	2	2	1
5	2	2	1
6	3	4	3
7	5	4	5
8	1	1	1
9	2	3	1
10	4	4	4
11	1	2	1
12	6	5	6
13	5	4	5
14	5	5	5
15	1	1	1
16	1	1	2
17	5	5	3
18	3	3	1
19	1	2	1
20	2	2	2
21	5	4	4
22	1	1	1
23	5	5	5
24	1	1	1
25	1	1	1
26	1	1	2
49	7	7	1
50	5	5	5
51	2	2	2
52	1	1	3
53	1	1	1
54	2	2	2
-----------	Supplemental Items	(Diving Ducks)	-----------
55	4	4	3
56	3	2	2
57	3	3	3
58	3	4	2
59	1	1	1
60	2	2	1

Table B-1. Wildlife Habitat Appraisal Guide Ratings (Continued).

Site 5.
Cropland

Appraisal	Existing	Future Without	Future With
2	1	1	1
3	3	3	3
4	4	4	1
6	5	5	5
29	2	2	1
30	3	3	3
31	3	3	3
32	3	3	3
48	7	7	1
49	7	7	1
51	4	4	4
53	1	1	1
54	2	2	2

Table B-1. Wildlife Habitat Appraisal Guide Ratings (Continued).

Site 6.
Bottomland Forest

Appraisal	Existing	Future Without	Future With
3	3	3	3
4	4	4	1
5	5	1	1
6	5	5	5
12	6	6	6
14	4	3	4
15	3	4	3
17	5	5	4
18	3	3	3
27	3	3	3
35*	1	1	2
36	5	5	5
37*	4	4	4
38*	3	1	4
39*	2	1	1
40*	2	1	2
41*	4	4	4
42*	4	3	4
43	2	2	3
44*	3	2	1
45*	3	2	2
46*	4	4	3
47	1	1	1
48	7	7	1
50	6	6	6
52	1	1	1

* Same questions as Upland Species Matrix and the basis for computing HSIs for Fox Squirrel and Pileated Woodpecker.

Table B-2. Wildlife Habitat Suitability Indexes.

SPECIES	EXISTING						FUTURE WITHOUT						FUTURE WITH					
Site #	1N	2B	3B	4N	5C	6B	1N	2B	3B	4N	5C	6B	1N	2B	3B	4N	5C	6B
Mallard	LF	.1	.1	.1	.22	.1	LF	LF	.1	.11	.22	.1	.64	.63	.16	.38	.73	.13
Divers	.11	--	--	.38	--	--	.11	--	--	.42	--	--	.40	--	--	.62	--	--
Least Bittern	.1	--	--	.1	--	--	.51	--	--	.34	--	--	.79	--	--	LF	--	--
Lesser Yellowlegs	.65	--	--	.1	--	--	.61	--	--	.1	--	--	.73	--	--	.56	--	--
Muskrat	.1	--	--	.1	--	--	.1	--	--	.31	--	--	.68	--	--	.64	--	--
King Rail	.63	--	--	.41	--	--	.66	--	--	.37	--	--	.66	--	--	.47	--	--
Green-backed Heron	.49	.58	.43	.55	--	.28	.69	.60	.41	.79	--	.36	.55	.62	.76	.55	--	.70
Wood Duck	--	.57	.1	--	--	.27	--	.60	.41	--	--	.47	--	.53	.60	--	--	.64
Beaver	--	.62	.68	--	--	.51	--	.56	.56	--	--	.45	--	.59	.60	--	--	.45
Coot	.1	--	--	.1	--	--	.1	--	--	.52	--	--	.61	--	--	LF	--	--
Northern Parula	--	.65	LF	--	--	.45	--	.65	.65	--	--	.60	--	.58	.60	--	--	.42
Prothonatary Warbler	--	.42	.1	--	--	.55	--	.35	.16	--	--	.18	--	.54	.70	--	--	.66
Pileated Woodpecker	--	.43	LF	--	--	.35	--	.47	.44	--	--	.51	--	.56	.41	--	--	.48
Fox Squirrel	--	.34	--	--	--	.32	--	.38	--	--	--	.40	--	.48	--	--	--	.33
Canada Goose	LF	--	--	.14	LF	--	LF	--	--	.14	LF	--	.58	--	--	.37	.48	--

Notes:
1N-Illinois Department of Natural Resources-Backwater: Non-forested Wetland
2B-Illinois Department of Natural Resources-Backwater: Bottomland Forest
3B-Illinois Department of Natural Resources-Turner Island: Bottomland Forest
4N-Fish and Wildlife Service-Middle Unit: Non-forested Wetland
5C-Fish and Wildlife Service-Middle Unit: Cropland
6B-Fish and Wildlife Service-Middle Unit: Bottomland Forest

Limiting Factor (LF) is shown on the table when indicated by the WHAG characteristics. LF has a value of .1 when computing HSIs. HSIs shown as .1 do not have an associated limiting factor (LF).

Table B-3. Waterfowl HSIs.

Species	Existing				Future Without				Future With			
Site	DNR-B	DNR-T	FWS-M	FWS-L	DNR-B	DNR-T	FWS-M	FWS-	DNR-B	DNR-T	FWS-M	FWS-L
Non-forested Wetland												
Mallard	LF(.1)	LF(.1)	.1	.1	LF(.1)	LF(.1)	.11	.11	.64	.64	.38	.38
Divers	.11	.11	.38	.38	.11	.11	.42	.42	.40	.40	.62	.62
Canada Geese	LF(.1)	LF(.1)	.14	.14	LF(.1)	LF(.1)	.14	.14	.58	.58	.37	.37
Bottomland Forest												
Mallard	.1	.1	.1	.1	LF(.1)	.1	.1	.1	.63	.16	.13	.13
Wood Duck	.57	.1	.27	.27	.60	.41	.47	.47	.53	.60	.64	.64
*Average	.34	.1	.19	.19	.35	.26	.29	.29	.58	.38	.39	.39
Cropland												
Mallard	.22	--	.22	.22	.22	--	.22	.22	.73	--	.73	.73
Canada	LF(.1	--	LF(.1	LF(.1)	LF(.1)	--	LF(.1	LF(.1	.48	--	.48	.48

Notes:
* Values used as a basis for HSIs aplied to acres in "Other" habitat category [minimum HSI=0.1, maximum HSI=1/2(HSI-0.1)].

Waterfowl management in the entire project area is directed at dabblers, divers and Canada geese.
DNR-B - Illinois Department of Natural Resources - Backwater
DNR-T - Illinois Department of Natural Resources - Turner Island
FWS-M - Fish and Wildlife Service - Middle Management Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit

4. DISCUSSION.

The improvement of the Batchtown project area for migratory waterfowl is a primary purpose of the proposed project. Both dabbling ducks and diving ducks along with Canada geese were given consideration in the evaluation of all management units.

While the movement of dabblers through the project area during migration far exceeds that of divers, there is a need for management emphasis on divers. The use of the Mississippi River by diving ducks over the past decade has shown a dramatic decline due in part to food availability. Canada goose populations remain near all-time highs, thus the management of mid-migration habitat for this species is appropriate. The management emphasis within the project area would emphasize moist soil plant production and allow for the reestablishment of aquatic vegetation.

Table B-6 shows the general effects of each project plan for all habitat types. Plans A and B show modest gains in habitat improvement (557 and 622 AAHUs, respectively) compared to the more substantial waterfowl benefits of Plan C (969 AAHUs).

Table B-5 shows that the major contributor to this habitat gain is the dike/levee (providing both sediment and water control) followed by the water control structures, pumps, hillside sediment control, dredging and lowland sediment control. A more detailed explanation of the incremental AAHU changes reflected in Table B-5 is provided in the Evaluation of Concept Plans section of the DPR.

5. CONCLUSION. Plan C provides significant benefits to migratory waterfowl.

Table B-4. Wildlife Habitat Acreages and HSI Values.

PLAN F (FUTURE WITHOUT)						
Year	1992		1994		2042	
Management Unit	Acres	HSI	Acres	HSI	Acres	HSI
CROPLAND						
DNR-B	10	(.16)	10	(.16)	10	(.16)
DNR-T	----	----	----	----	----	----
FWS-M	134	(.16)	134	(.16)	134	(.16)
FWS-L	80	(.16)	80	(.16)	80	(.16)
TOTAL	224		224		224	
BOTTOMLAND FOREST						
DNR-B	275	(.34)	275	(.34)	275	(.35)
DNR-T	101	(.1)	101	(.11)	101	(.26)
FWS-M	446	(.19)	446	(.19)	446	(.29)
FWS-L	167	(.19)	167	(.19)	167	(.29)
TOTAL	989		989		989	
OTHER*						
DNR-B	0	0	39	(.10)	983	(.23)
DNR-T	0	0	1	(.10)	14	(.18)
FWS-M	0	0	3	(.10)	207	(.20)
FWS-L	0	0	3	(.10)	76	(.20)
TOTAL	0		46		1280	
NON-FORESTED WETLANDS						
DNR-B	1512	(.1)	1473	(.1)	529	(.1)
DNR-T	22	(.1)	21	(.1)	8	(.1)
FWS-M	427	(.21)	418	(.21)	207	(.22)
FWS-L	153	(.21)	150	(.21)	77	(.22)
TOTAL	2114		2062		821	
GRAND TOTAL	3327		3327		3327	

Notes:
DNR-B - Illinois Department of Natural Resources - Backwater
DNR-T - Illinois Department of Natural Resources - Turner Island
FWS-M - Fish and Wildlife Service - Middle Management Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit

OTHER* - Wetlands converting to bottomland forest due to siltation and succession.

Table B-4. Wildlife Habitat Acreages and HSI Values (Continued).

PLAN A (Partial Wetlands Protection)						
Year	1992		1994		2042	
Management Unit	Acres	HSI	Acres	HSI	Acres	HSI
CROPLAND						
DNR-B	10	(.16)	10	(.61)	10	(.61)
DNR-T	----	----	----	----	----	----
FWS-M	134	(.16)	134	(.61)	134	(.61)
FWS-L	80	(.16)	80	(.61)	80	(.61)
TOTAL	224		224		224	
BOTTOMLAND FOREST						
DNR-B	275	(.34)	275	(.31)	275	(.29)
DNR-T	101	(.1)	101	(.38)	101	(.38)
FWS-M	446	(.19)	446	(.39)	446	(.39)
FWS-L	167	(.19)	167	(.39)	167	(.39)
TOTAL	989		989		989	
OTHER*						
DNR-B	0	0	31	(.10)	747	(.20)
DNR-T	0	0	0	0	5	(.24)
FWS-M	0	0	3	(.10)	62	(.25)
FWS-L	0	0	1	(.10)	76	(.25)
TOTAL	0		35		885	
NON-FORESTED WETLANDS						
DNR-B	1512	(.1)	1493	(.27)	769	(.54)
DNR-T	22	(.1)	22	(.54)	17	(.54)
FWS-M	427	(.21)	412	(.46)	365	(.46)
FWS-L	153	(.21)	152	(.46)	138	(.46)
TOTAL	2101		2079		1289	
GRAND TOTAL	3327		3327		3327	

Notes:
DNR-B - Illinois Department of Natural Resources - Backwater
DNR-T - Illinois Department of Natural Resources - Turner Island
FWS-M - Fish and Wildlife Service - Middle Management Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit

OTHER* - Wetlands converting to bottomland forest due to siltation and succession.

Table B-4. Wildlife Habitat Acreages and HSI Values (Continued).

PLAN B (Backwater Protection)						
Year	1992		1994		2042	
Management Unit	Acres	HSI	Acres	HSI	Acres	HSI
CROPLAND						
DNR-B	10	(.16)	10	(.61)	10	(.61)
DNR-T	----	----	----	----	----	----
FWS-M	134	(.16)	134	(.61)	134	(.61)
FWS-L	80	(.16)	80	(.61)	80	(.61)
TOTAL	224		224		224	
BOTTOMLAND FOREST						
DNR-B	275	(.34)	275	(.35)	275	(.35)
DNR-T	101	(.1)	101	(.38)	101	(.38)
FWS-M	446	(.19)	446	(.39)	446	(.39)
FWS-L	167	(.19)	167	(.39)	167	(.39)
TOTAL	989		989		989	
OTHER*						
DNR-B	0	0	30	(.1)	645	(.23)
DNR-T	0	0	0	0	5	(.24)
FWS-M	0	0	3	(.1)	62	(.25)
FWS-L	0	0	1	(.1)	76	(.25)
TOTAL	0		34		788	
NON-FORESTED WETLANDS						
DNR-B	1512	(.1)	1494	(.32)	806	(.54)
DNR-T	22	(.1)	22	(.54)	17	(.54)
FWS-M	427	(.21)	412	(.46)	365	(.46)
FWS-L	153	(.21)	152	(.46)	138	(.46)
TOTAL	2101		2080		1326	
GRAND TOTAL	3327		3327		3327	

Notes:
DNR-B - Illinois Department of Natural Resources - Backwater
DNR-T - Illinois Department of Natural Resources - Turner Island
FWS-M - Fish and Wildlife Service - Middle Management Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit

Table B-4. Wildlife Habitat Acreages and HSI Values (Continued).

Plan C (Wetlands Protection - Dike/Levee 434.0+ NGVD)						
Year	1992		1994		2042	
Management Unit	Acres	HSI	Acres	HSI	Acres	HSI
CROPLAND						
DNR-B	10	(.16)	10	(.30)	10	(.30)
FWS-M	134	(.16)	134	(.34)	134	(.34)
FWS-L	80	(.16)	80	(.30)	80	(.30)
TOTAL	224		224		224	
BOTTOMLAND FOREST						
DNR-B	275	(.34)	275	(.29)	275	(.29)
FWS-M	446	(.19)	446	(.22)	446	(.22)
FWS-L	167	(.19)	167	(.20)	167	(.20)
TOTAL	888		888		888	
OTHER*						
DNR-B	0	0	27	(.1)	765	(.2)
FWS-M	0	0	6	(.1)	142	(.16)
FWS-L	0	0	2	(.1)	46	(.15)
TOTAL	0		35		953	
NON-FORESTED WETLAND						
DNR-B	1512	(.1)	1485	(.27)	747	(.27)
FWS-M	427	(.21)	421	(.25)	285	(.25)
FWS-L	153	(.21)	151	(.23)	107	(.23)
TOTAL	2092		2057		1139	
GRAND TOTAL	3204		3204		3204	
Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD)						
CROPLAND						
DNR-B	10	(.16)	10	(.40)	10	(.40)
FWS-M	134	(.16)	134	(.43)	134	(.43)
FWS-L	80	(.16)	80	(.40)	80	(.40)
TOTAL	224		224		224	
Continued on Next Page						

Notes:
OTHER* - Wetlands converting to bottomland forest due to siltation and succession.

Table B-4. Wildlife Habitat Acreages and HSI Values (Continued).

Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD)						
Year	1992		1994		2042	
Management Unit	Acres	HSI	Acres	HSI	Acres	HSI
BOTTOMLAND FOREST						
DNR-B	275	(.34)	275	(.38)	275	(.38)
FWS-M	446	(.19)	446	(.27)	446	(.27)
FWS-L	167	(.19)	167	(.25)	167	(.25)
TOTAL	888		888		888	
OTHER*						
DNR-B	0	0	10	(.1)	548	(.24)
FWS-M	0	0	3	(.1)	62	(.19)
FWS-L	0	0	1	(.1)	36	(.18)
TOTAL	0		14		646	
NON-FORESTED WETLAND						
DNR-B	1512	(.1)	1502	(.35)	964	(.35)
FWS-M	427	(.21)	424	(.32)	365	(.32)
FWS-L	153	(.21)	152	(.30)	117	(.30)
TOTAL	2092		2055		1446	
GRAND TOTAL	3204		3204		3204	
Plan C (Wetlands Protection - Dike/Levee 437.0+ NGVD)						
CROPLAND						
DNR-B	10	(.16)	10	(.43)	10	(.43)
FWS-M	134	(.16)	134	(.46)	134	(.46)
FWS-L	80	(.16)	80	(.43)	80	(.43)
TOTAL	224		224		224	
BOTTOMLAND FOREST						
DNR-B	275	(.34)	275	(.41)	275	(.41)
FWS-M	446	(.19)	446	(.29)	446	(.29)
FWS-L	167	(.19)	167	(.27)	167	(.27)
TOTAL	888		888		888	
Continued on Next Page						

Notes:
OTHER* - Wetlands converting to bottomland forest due to siltation and succession.

Table B-4. Wildlife Habitat Acreages and HSI Values (Continued).

Plan C (Wetlands Protection - Dike/Levee 437.0+ NGVD)						
Year	1992		1994		2042	
Management Unit	Acres	HSI	Acres	HSI	Acres	HSI
OTHER*						
DNR-B	0	0	10	(.1)	507	(.26)
FWS-M	0	0	2	(.1)	37	(.20)
FWS-L	0	0	1	(.1)	26	(.19)
TOTAL	0		13		570	
NON-FORESTED WETLANDS						
DNR-B	1512	(.1)	1502	(.38)	1005	(.38)
FWS-M	427	(.21)	425	(.34)	390	(.34)
FWS-L	153	(.21)	152	(.32)	127	(.32)
TOTAL	2092		2079		1522	
GRAND TOTAL	3204		3204		3204	
Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD + 30% Hillside Sediment Control)						
CROPLAND						
DNR-B	10	(.16)	10	(.43)	10	(.43)
FWS-M	134	(.16)	134	(.43)	134	(.43)
FWS-L	80	(.16)	80	(.43)	80	(.43)
TOTAL	224		224		224	
BOTTOMLAND FOREST						
DNR-B	275	(.34)	275	(.41)	275	(.41)
FWS-M	446	(.19)	446	(.27)	446	(.27)
FWS-L	167	(.19)	167	(.28)	167	(.28)
TOTAL	888		888		888	
Continued on Next Page						

Notes:
DNR-B - Illinois Department of Natural Resources - Backwater
DNR-T - Illinois Department of Natural Resources - Turner Island
FWS-M - Fish and Wildlife Service - Middle Management Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit
OTHER* - Wetlands converting to bottomland forest due to siltation and succession.

Table B-4. Wildlife Habitat Acreages and HSI Values (Continued).

Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD + 30% Hillside Sediment Control)						
Year	1992		1994		2042	
Management Unit	Acres	HSI	Acres	HSI	Acres	HSI
OTHER*						
DNR-B	0	0	16	(.1)	359	(.26)
FWS-M	0	0	3	(.1)	62	(.19)
FWS-L	0	0	1	(.1)	14	(.19)
TOTAL	0		30		435	
NON-FORESTED WETLANDS						
DNR-B	1512	(.1)	1497	(.38)	1163	(.38)
FWS-M	427	(.21)	424	(.32)	365	(.32)
FWS-L	153	(.21)	152	(.33)	139	(.33)
TOTAL	2092		2073		1667	
GRAND TOTAL	3204		3204		3204	
Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD + 30% Hillside Sediment Control + Lowland Sediment Control)						
CROPLAND						
DNR-B	10	(.16)	10	(.46)	10	(.46)
FWS-M	134	(.16)	134	(.43)	134	(.43)
FWS-L	80	(.16)	80	(.46)	80	(.46)
TOTAL	224		224		224	
BOTTOMLAND FOREST						
DNR-B	275	(.34)	275	(.43)	275	(.43)
FWS-M	446	(.19)	446	(.27)	446	(.27)
FWS-L	167	(.19)	167	(.29)	167	(.29)
TOTAL	888		888		888	
OTHER*						
DNR-B	0	0	15	(.1)	378	(.27)
FWS-M	0	0	3	(.1)	62	(.19)
FWS-L	0	0	1	(.1)	15	(.2)
TOTAL	0		19		455	

Continued On Next Page

Notes:
OTHER* - Wetlands converting to bottomland forest due to siltation and succession.

Table B-4. Wildlife Habitat Acreages and HSI Values (Continued).

Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD + 30% Hillside Sediment Control + Lowland Sediment Control)						
Year	1992		1994		2042	
Management Unit	Acres	HSI	Acres	HSI	Acres	HSI
NON-FORESTED WETLAND						
DNR-B	1512	(.1)	1497	(.40)	1134	(.40)
FWS-M	427	(.21)	424	(.32)	365	(.32)
FWS-L	153	(.21)	152	(.34)	138	(.34)
TOTAL	2092		2073		1637	
GRAND TOTAL	3204		3204		3204	
Plan C (Wetland Protection - Dike/Levee 435.5+ NGVD + 30% Hillside Sediment Control + Lowland Sediment Control + Water Control Structures)						
CROPLAND						
DNR-B	10	(.16)	10	(.55)	10	(.55)
FWS-M	134	(.16)	134	(.49)	134	(.49)
FWS-L	80	(.16)	80	(.52)	80	(.52)
TOTAL	224		224		224	
BOTTOMLAND FOREST						
DNR-B	275	(.34)	275	(.52)	275	(.52)
FWS-M	446	(.19)	446	(.31)	446	(.31)
FWS-L	167	(.19)	167	(.33)	167	(.33)
TOTAL	888		888		888	
OTHER*						
DNR-B	0	0	15	(.1)	378	(.31)
FWS-M	0	0	3	(.1)	62	(.21)
FWS-L	0	0	1	(.1)	15	(.22)
TOTAL	0		19		455	
NON-FORESTED WETLANDS						
DNR-B	1512	(.1)	1497	(.49)	1134	(.49)
FWS-M	427	(.21)	424	(.39)	365	(.39)
FWS-L	153	(.21)	152	(.39)	138	(.39)
TOTAL	2092		2073		1637	
GRAND TOTAL	3204		3204		3204	
Continued On Next Page						

Table B-4. Wildlife Habitat Acreages and HSI Values (Continued).

Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD + 30% Hillside Sediment Control + Lowland Sediment Control + Water Control Structures + Pumps)						
Year	1992		1994		2042	
Management Unit	Acres	HSI	Acres	HSI	Acres	HSI
CROPLAND						
DNR-B	10	(.16)	10	(.61)	10	(.61)
DNR-T	----	----	----	----	----	----
FWS-M	134	(.16)	134	(.55)	134	(.55)
FWS-L	80	(.16)	80	(.61)	80	(.61)
TOTAL	224		224		224	
BOTTOMLAND FOREST						
DNR-B	275	(.34)	275	(.58)	275	(.58)
DNR-T	101	(.1)	101	(.38)	101	(.38)
FWS-M	446	(.19)	446	(.35)	446	(.35)
FWS-L	167	(.19)	167	(.39)	167	(.39)
TOTAL	989		989		989	
OTHER*						
DNR-B	0	0	15	(.1)	378	(.34)
DNR-T	0	0	0	0	5	(.24)
FWS-M	0	0	3	(.1)	62	(.28)
FWS-L	0	0	1	(.1)	15	(.25)
TOTAL	0		19		460	
NON-FORESTED WETLANDS						
DNR-B	1512	(.1)	1497	(.54)	1134	(.54)
DNR-T	22	(.1)	22	(.54)	17	(.54)
FWS-M	427	(.21)	424	(.41)	365	(.41)
FWS-L	153	(.21)	152	(.46)	138	(.46)
TOTAL	2114		2095		1654	
GRAND TOTAL	3327		3327		3327	
Continued On Next Page						

Notes:
DNR-B - Illinois Department of Natural Resources - Backwater
DNR-T - Illinois Department of Natural Resources - Turner Island
FWS-M - Fish and Wildlife Service - Middle Managemant Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit

OTHER* - Wetlands converting to bottomland forest due to siltation and succession.

Table B-4. Wildlife Habitat Acreages and HSI Values (Continued).

Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD + 30% Hillside Sediment Control + Lowland Sediment Control + Water Control Structures + Pumps + Dredge Cuts)						
Year	1992		1994		2042	
Management Unit	Acres	HSI	Acres	HSI	Acres	HSI
CROPLAND						
DNR-B	10	(.16)	10	(.61)	10	(.61)
DNR-T	----	----	----	----	----	----
FWS-M	134	(.16)	134	(.61)	134	(.61)
FWS-L	80	(.16)	80	(.61)	80	(.61)
TOTAL	224		224		224	
BOTTOMLAND FOREST						
DNR-B	275	(.34)	275	(.58)	275	(.58)
DNR-T	101	(.1)	101	(.38)	101	(.38)
FWS-M	446	(.19)	446	(.39)	446	(.39)
FWS-L	167	(.19)	167	(.39)	167	(.39)
TOTAL	989		989		989	
OTHER*						
DNR-B	0	0	15	(.1)	378	(.34) 359
DNR-T	0	0	0	0	5	(.24)
FWS-M	0	0	3	(.1)	62	(.25)
FWS-L	0	0	1	(.1)	15	(.25)
TOTAL	0		19		441	
NON-FORESTED WETLANDS						
DNR-B	1512	(.1)	1497	(.54)	1134	(.54)
DNR-T	22	(.1)	22	(.54)	17	(.54)
FWS-M	427	(.21)	424	(.46)	365	(.46)
FWS-L	153	(.21)	152	(.46)	138	(.46)
TOTAL	2114		2095		1654	
GRAND TOTAL	3327		3327		3327	

Notes:
DNR-B - Illinois Department of Natural Resources - Backwater
DNR-T - Illinois Department of Natural Resources - Turner Island
FWS-M - Fish and Wildlife Service - Middle Management Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit
OTHER* - Wetlands converting to bottomland forest due to siltation and succession.

TABLE B-5. Annualized Waterfowl Habitat Units for Plan C.

INCREMENTAL COMPONENTS

	CROPLAND															
	DNR-B			DNR-T			FWS-M			FWS-L			TOTAL			Potential AAHU Contribution
Alternative	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	
Dike/Levee																
434.0 NGVD	3	2	1	--	--	--	45	21	24	24	13	11	72	36	36	+36
435.5 NGVD	4	2	2	--	--	--	57	21	36	32	13	19	93	36	57	+57
437.0 NGVD	4	2	2	--	--	--	61	21	40	34	13	21	99	36	63	+63
30% Hillside Sediment Control (+ D/L 435.5 NGVD)																
435.5 NGVD	4	2	2	--	--	--	57	21	36	34	13	21	95	36	59	+ 2
Lowland Sediment Control (+ D/L 435.5 NGVD + H. S. C.)																
435.5 NGVD	5	2	3	--	--	--	57	21	36	36	13	23	98	36	62	+ 3
Water Control Structures (+ D/L 435.5 NGVD + H. S. C. + L. S. C.)																
435.5 NGVD	6	2	4	--	--	--	65	21	44	41	13	28	112	36	76	+14
Pumps (+ D/L 435.5 NGVD + H. S. C. + L. S. C. + W. C. S.)																
435.5 NGVD	6	2	4	--	--	--	78	21	57	48	13	35	132	36	96	+20
Dredging (+ D/L 435.5 NGVD + H. S. C. + L. S. C. + W. C. S. + Pumps)																
435.5 NGVD	6	2	4	--	--	--	81	21	60	48	13	35	135	36	99	+ 3

Notes:
DNR-B - Illinois Department of Natural Resources - Backwater
DNR-T - Illinois Department of Natural Resources - Turner Island
FWS-M - Fish and Wildlife Service - Middle Management Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit

Table B-5. Annualized Waterfowl Habitat Units for Plan C (Continued).

INCREMENTAL COMPONENTS

BOTTOMLAND FOREST																
	DNR-B			DNR-T			FWS-M			FWS-L			TOTAL			Potential AAHU Contribution
Alternative	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	
Dike/Levee																
434.0 NGVD	80	95	-15	--	--	--	98	106	- 8	33	40	- 7	211	241	- 30	- 30
435.5 NGVD	104	95	9	--	--	--	120	106	14	42	40	2	266	241	+ 25	+ 25
437.0 NGVD	112	95	17	--	--	--	128	106	22	45	40	5	285	241	+ 44	+ 44
30% Hillside Sediment Control (+ D/L 435.5 NGVD)																
435.5 NGVD	112	95	17	--	--	--	120	106	14	47	40	7	279	241	38	+ 13
Lowland Sediment Control (+ D/L 435.5 NGVD + H. S. C.)																
435.5 NGVD	118	95	23	--	--	--	120	106	14	47	40	7	285	241	44	+ 6
Water Control Structures (+ D/L 435.5 NGVD + H. S. C. + L. S. C.)																
435.5 NGVD	142	95	47	--	--	--	137	106	31	55	40	15	334	241	93	+ 49
Pumps (+ D/L 435.5 NGVD + H. S. C. + L. S. C. + W. C. S.)																
435.5 NGVD	158	95	63	38	18	20	155	106	49	65	40	25	416	259	151	+ 64
Dredging (+ D/L 435.5 NGVD + H. S. C. + L. S. C. + W. C. S. + Pumps)																
435.5 NGVD	158	95	63	38	18	20	172	106	66	65	40	25	433	259	174	+ 17

Notes:
DNR-B - Illinois Department of Natural Resources - Backwater
DNR-T - Illinois Department of Natural Resources - Turner Island
FWS-M - Fish and Wildlife Service - Middle Management Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit

Table B-5. Annualized Waterfowl Habitat Units for Plan C (Continued).

INCREMENTAL COMPONENTS

	OTHER*															
	DNR-B			DNR-T			FWS-M			FWS-L			TOTAL			Potential AAHU Contribution
Alternative	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	
Dike/Levee																
434.0 NGVD	75	110	-35	--	--	--	11	20	- 9	3	7	- 4	89	137	- 48	- 48
435.5 NGVD	64	110	-46	--	--	--	6	20	-14	3	7	- 4	73	137	- 64	- 64
437.0 NGVD	64	110	-46	--	--	--	4	20	-16	2	7	- 5	70	137	- 67	- 67
30% Hillside Sediment Control (+ D/L 435.5 NGVD)																
435.5 NGVD	46	110	-64	--	--	--	6	20	-14	1	7	- 6	53	137	- 84	- 20
Lowland Sediment Control (+ D/L 435.5 NGVD + H. S. C.)																
435.5 NGVD	50	110	-60	--	--	--	6	20	-14	1	7	- 6	57	137	- 80	+ 4
Water Control Structures (+ D/L 435.5 NGVD + H. S. C. + L. S. C.)																
435.5 NGVD	57	110	-53	--	--	--	6	20	-14	1	7	- 6	64	137	- 73	+ 7
Pumps (+ D/L 435.5 NGVD + H. S. C. + L. S. C. + W. C. S.)																
435.5 NGVD	62	110	-48	1	1	0	7	20	-13	2	7	- 5	72	138	- 66	+ 7
Dredging (+ D/L 435.5 NGVD + H. S. C. + L. S. C. + W. C. S. + Pumps)																
435.5 NGVD	62	110	-48	1	1	0	8	20	-12	2	7	- 5	73	138	- 65	+ 1

Notes:
DNR-B - Illinois Department of Natural Resources - Backwater
DNR-T - Illinois Department of Natural Resources - Turner Island
FWS-M - Fish and Wildlife Service - Middle Management Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit
OTHER* - Wetlands converting to bottomland forest due to siltation and succession.

Table B-5. Annualized Waterfowl Habitat Units for Plan C (Continued).

INCREMENTAL COMPONENTS

NON-FORESTED WETLANDS															
	DNR-B			DNR-T			FWS-M			FWS-L			TOTAL		
Alternative	FW	FW0	NET	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	Potential AAHU Contribution
Dike/Levee																
434.0 NGVD	337	102	235	--	--	--	93	68	25	31	25	6	419	195	224	+224
435.5 NGVD	426	102	324	--	--	--	126	68	58	40	25	15	593	195	398	+398
437.0 NGVD	472	102	370	--	--	--	138	68	70	44	25	19	654	195	459	+459
Hillside Sediment Control (+ D/L 435.5 NGVD)																
435.5 NGVD	499	102	397	--	--	--	126	68	58	48	25	23	673	195	478	+ 80
Lowland Sediment Control (+ D/L 435.5 NGVD + H. S. C.)																
435.5 NGVD	520	102	418	--	--	--	126	68	58	49	25	24	695	195	500	+ 22
Water Control Structures (+ D/L 435.5 NGVD + H. S. C. + L. S. C.)																
435.5 NGVD	636	102	534	--	--	--	153	68	85	56	25	31	845	195	650	+150
Pumps (+ D/L 435.5 NGVD + H. S. C. + L. S. C. + W. C. S.)																
435.5 NGVD	701	102	599	10	1	9	161	68	93	66	25	41	938	195	742	+ 92
Dredging (+ D/L 435.5 NGVD + H. S. C. + L. S. C. + W. C. S. + Pumps)																
435.5 NGVD	701	102	599	10	1	9	180	68	112	66	25	41	957	195	761	+ 19

Notes:
DNR-B - Illinois Department of Natural Resources - Backwater
DNR-T - Illinois Department of Natural Resources - Turner Island
FWS-M - Fish and Wildlife Service - Middle Management Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit

Table B-5. Annualized Waterfowl Habitat Units for Plan C (Continued).

INCREMENTAL COMPONENTS

SUMMARY OF ALL HABITAT TYPES																
	DNR-B			DNR-T			FWS-M			FWS-L			TOTAL			Potential AAHU Contribution
Alternative	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	
Dike/Levee																
434.0 NGVD	495	309	186	--	--	--	247	215	32	91	85	6	833	609	224	+224
435.5 NGVD	598	309	289	--	--	--	309	215	94	117	85	32	1024	609	445	+415
437.0 NGVD	652	309	343	--	--	--	331	215	116	125	85	40	1108	609	499	+499
Hillside Sediment Control (+ D/L 435.5 NGVD)																
435.5 NGVD	661	309	352	--	--	--	309	215	94	130	85	45	1100	609	491	+ 76
Lowland Sediment Control (+ D/L 435.5 NGVD + H. S. C.)																
435.5 NGVD	693	309	384	--	--	--	309	215	94	133	85	48	1135	609	526	+ 35
Water Control Structures (+ D/L 435.5 NGVD + H. S. C. + L. S. C.)																
435.5 NGVD	841	309	532	--	--	--	361	215	146	153	85	68	1355	608	746	+220
Pumps (+ D/L 435.5 NGVD + H. S. C. + L. S. C. + W. C. S.)																
435.5 NGVD	927	309	618	49	20	29	401	215	186	181	85	96	1558	629	929	+183
Dredging (+ D/L 435.5 NGVD + H. S. C. + L. S. C. + W. C. S. + Pumps)																
435.5 NGVD	927	309	618	49	20	29	441	215	226	181	85	96	1598	629	969	+ 40

Notes:
DNR-B - Illinois Department of Natural Resources - Backwater
DNR-T - Illinois Department of Natural Resources - Turner Island
FWS-M - Fish and Wildlife Service - Middle Management Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit

Table B-6. Annualized Waterfowl Habitat Units - Plan Comparisons.

	DNR-B			DNR-T			FWS-M			FWS-L			TOTAL		
Plan	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET
CROPLAND															
A	6	2	4	---	---	---	81	21	60	48	13	35	135	36	99
B	6	2	4	---	---	---	81	21	60	48	13	35	135	36	99
C	6	2	4	---	---	---	81	21	60	48	13	35	135	36	99
BOTTOMLAND FOREST															
A	83	95	-12	38	18	20	172	106	66	65	40	25	358	259	99
B	96	95	1	38	18	20	172	106	66	65	40	25	371	259	112
C	158	95	63	38	18	20	172	106	66	65	40	25	433	259	174
NON-FORESTED WETLANDS															
A	73	102	-37	10	1	9	177	68	109	66	25	41	657	196	461
B	451	102	349	10	1	9	177	68	109	66	25	41	704	196	508
C	701	102	599	10	1	9	180	68	112	66	25	41	957	196	761
OTHER															
A	73	110	-37	1	1	0	8	20	-12	9	7	2	91	138	-47
B	73	110	-37	1	1	0	8	20	-12	9	7	2	91	138	-47
C	62	110	-48	1	1	0	8	20	-12	2	7	-5	73	138	-65
SUMMARY OF ALL HABITAT TYPES															
A	235	309	-74	49	20	29	438	215	223	188	85	103	1241	629	612
B	626	309	311	49	20	29	438	215	223	188	85	103	1301	629	672
C	927	309	618	49	20	29	441	215	226	181	85	92	1598	629	969

SUBSECTION II. AQUATIC HABITAT APPRAISAL GUIDE (AHAG) METHOD.

1. BACKGROUND.

The major fisheries goal of the project is to enhance aquatic habitat conditions for slackwater fish, particularly larger slackwater fish. Many of the fish comprising the slackwater fish guild are important commercial fish (e.g., buffalo and catfish) and recreational fish (e.g., bullhead, catfish, bass and crappie). Thus, AHAG guild three was targeted for emphasis by the AHAG team. The AHAG team included representation from the USFWS, IDNR, INHS, SIU-C and the St. Louis District.

The team met prior to the field evaluation and discussed and/or agreed to the following:

* appraisal of aquatic habitat and comparison of results using both the Missouri Fisheries Habitat Appraisal Guide and the Waterways Experiment Station Aquatic Habitat Appraisal Guide (WES-AHAG). One method to be agreed upon by the committee for final data analysis.

* alignment of the levee separating FWS and IDNR managed properties should be moved north at the west end to protect the integrity of the 70's channel.

* a structure should be included in the project design to allow the flow of water through the 70's channel similar similar to what is proposed for the 40's channel.

* there is a need for the management of L & D 25 "on the curve" as the COE agreed to do in 1979 to accommodate waterfowl hunting.

* the need to provide/protect/enhance habitat diversity should be reflected in the goals and objectives for the project.

* eight aquatic sample sites were selected (See Figure B-3): four slackwater and four chutes/channels with flow. The slackwater sampling sites selected were:
  - FWS Middle Refuge (Site #8)
  - Big Hole (Site #1)
  - North of Cockrell Hollow (Site #2)
  - Big Bay (Site #5).

  Sampling sites with flowing water were selected as follows:
  - 70's Channel (Site #3)
  - 40's Channel (Site #4)
  - Gravel Bar (Site #6)
  - Cockrell Hollow (Site #7)

  All sites were to be evaluated using both appraisal methods.

The AHAG team ultimately selected the WES-AHAG as the habitat appraisal method to be used for computing HSI'S and habitat units for the Batchtown project. The team felt that the Missouri aquatic habitat appraisal system did not correctly reflect the quality of the aquatic habitat in the Batchtown project area. Also, the WES-AHAG provided the added flexibility to evaluate seasons and life stages for the indicator species. The team agreed to use an HSI of .25 for the spawning and rearing life stages of the indicator species due to the extreme and frequent fluctuation of the water level in the project area. Eggs and fry are undoubtedly subjected to increased predation when protective vegetative cover is unavailable, are stranded or exposed when water levels decrease rapidly and are drawn into the current and flushed down river when the pool is tilted in preparation for higher flow events. Thus, the WES-AHAG was modified in the manner indicated above for computing the average annual HSI for each indicator species.

2. ASSUMPTIONS.

Certain assumptions were developed regarding existing and future conditions during the AHAG analysis. These assumptions are listed below.

a. Existing Conditions

(1) Water levels fluctuate during the year, but especially during the spawning and rearing life stages of the fish species utilizing the project area, resulting in unreliable reproduction and missing year classes of important commercial and recreational species.

(2) Wetland habitat at the site is rapidly being degraded due to siltation.

FWS - There will be a 50% loss of surface area and water depth over the next 50 years without the project.

IDNR - There will be a 65% loss of surface area and water depth over the next 50 years without the project, resulting in the closure of both side channels, loss of access to Big Hole and the loss of overall habitat diversity.

b. Future Conditions

(1) General. The following general assumptions were applied to the analysis for all future changes in habitat during the 50-year project life.

(a) Target years of 0, 2 and 50 are sufficient to annualize HUs and to characterize habitat changes over the life of the project.

(b) Slackwater fish guild 3 is a suitable guild for management emphasis and the life requirements of the slackwater fish group are adequately characterized for the purpose of the incremental analysis of this project.

(c) No comparative evaluation of project-related changes in habitat values was developed for other fish guilds. The swiftwater fishes were not considered because there is a limited amount of swiftwater habitat in the project area. The small slackwater fishes were not addressed because many of them are not commercially or recreationally significant.

(2) Specific. Specific assumptions employed in evaluating alternative plans F, A, B and C are given below.

(a) <u>Alternative Plan F, No Action Plan</u> (also represents future without project conditions).

(1) Severe water level fluctuations will continue to impact spawning and rearing life stages for all fish species in the area in all management units.

(2) Approximately 50-65 percent of the existing wetlands in the project area will be lost over the next 50 years.

(3) The existing HSI values developed from the field data are a fair representation of the habitat quality of unprotected habitat in all target years and for all future conditions with or without a project.

(b) <u>Alternative Plan A, Partial Wetlands Protection</u>
This plan would address many of the concerns of the wetland associated wildlife species but would not address fish management concerns nor the survival of the freshwater mussels.

(c) <u>Alternative Plan B, Partial Backwater Protection</u>

(1) This plan would address some wildlife and fisheries management concerns and may provide for the survival of the freshwater mussels.

(2) Operation and maintenance costs under this alternative were felt to be excessive due to seepage and the longer lengths of levee to be maintained in the state backwater part of the project.

(d) <u>Alternative Plan C, Wetlands Protection</u>

(1) Water levels would be predictable and controlled, greatly enhancing fish spawning and rearing and the production of aquatic vegetation for spawning and feeding.

(2) Sediment should be reduced by 60 percent from the existing rate in the state backwater area and by 70 percent in the FWS part of the project. Wetland losses would continue to occur but at a much slower rate than at present and was estimated at 25 percent over the life of the project.

(3) Water control structures will provide a source of flow and fish access during most of the year, but will be most important during spring and fall movement periods. Operation and maintenance costs in the state backwater part of the project would be very low in most years due to the gravity flow capability to drain and fill the levee protected area.

(4) The clam shell dredging will result in deep water habitat and access to deep water habitat potentially critical to the survival of overwintering fish.

(5) The AHAG does not take into account the exchange of fish between the river and backwaters but it is assumed that the access provided by the stop log structures is sufficient for normal fish movement during all of the year, except when the management units are drawn down for moist soil plant production.

3. RESULTS.

Site Locations. The AHAG analysis locations were selected by the AHAG team as shown in Figure B-3. The number and location of these sites were judged by the team to be representative of the prevailing habitat conditions.

Appraisal Items/Ratings. Table B-7 provides a listing of the appraisal guide ratings for each habitat situation for both existing and future conditions. Tables B-8 and B-9 provide the HSI values for each fish life stage and season of the year for both existing and future conditions. Table B-10 provides a tabulated prediction of the habitat acreage and HSI changes expected for the project area over the next 50 years for various alternative plans and component plan measure options. The rate of existing sedimentation was determined from available literature describing the site. The determination of the future sedimentation rate with a project took sedimentation rate half-life and levee entrapment effects into consideration. Future sedimentation with a project took applicable hydraulic engineering estimates of percent reduction in sediment input into account.

Tables B-11 and B-12 provide the HU value changes resulting from the application of the Corps' HES software to the Table B-10 values. The HUs are tabulated for slackwater fishes for each alternative project plan and component measures.

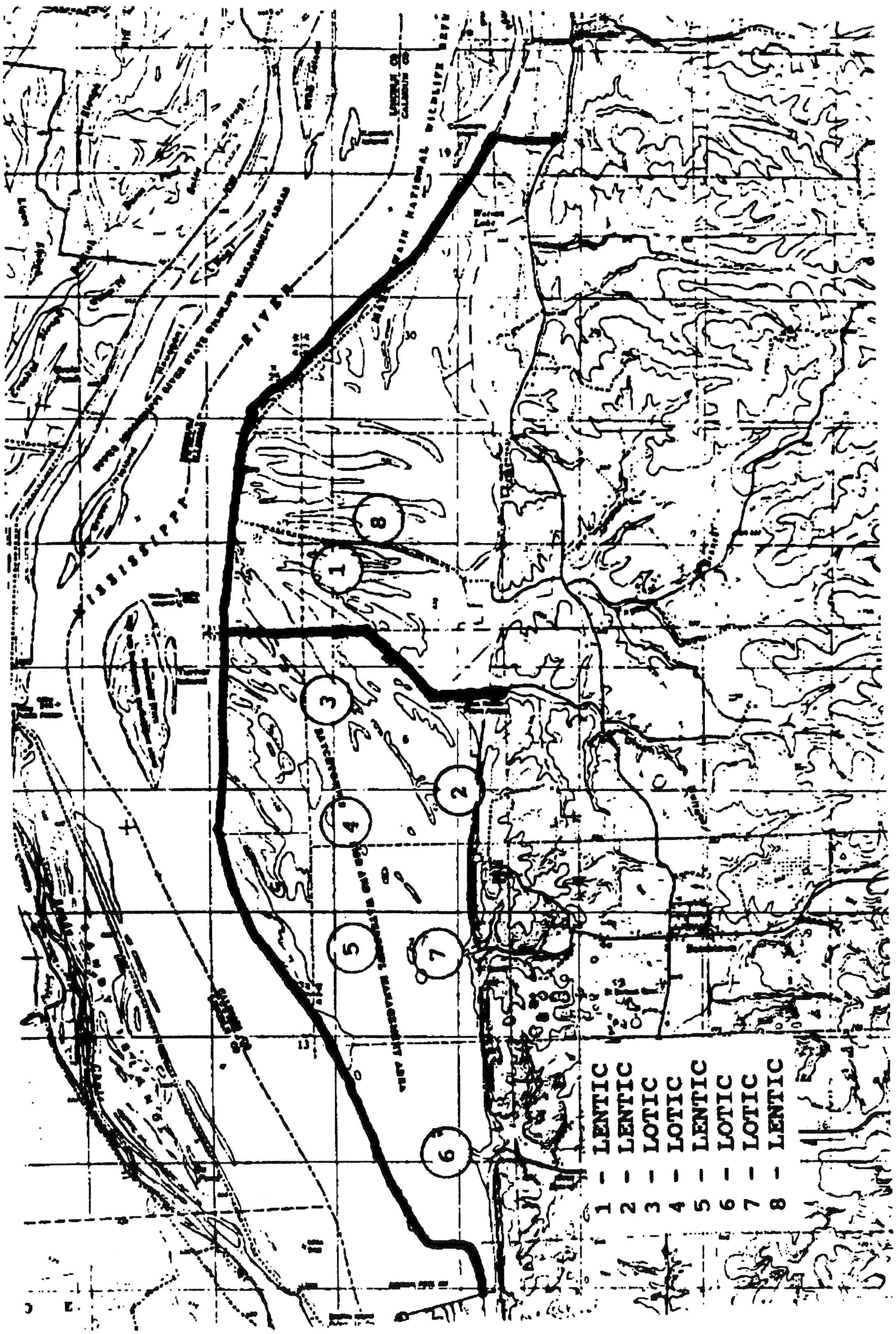

Figure B-3. Aquatic Habitat Appraisal Guide Sample Site Locations.

Table 5. Aquatic Habitat Appraisal Guide

AQUATIC HABITAT APPRAISAL GUIDE-UPPER MISSISSIPPI RIVER SYSTEM

Sample Site:______________________ Habitat: Lentic Lotic Date:______ Season: Winter Spring Summer Fall

Suitability Index Scoring Criteria: Excellent = 1 Good = 0.75 Fair = 0.5 Poor = 0.25 Unusable = 0.0

Habitat Variable	Suitability Index (SI) Score by Species and Life Stage																							
	WHITE BASS			EMERALD SHINER			RIVER DARTER			NORTHERN PIKE			SMALLMOUTH BUFFALO			WALLEYE			LARGEMOUTH BASS			BLUEGILL		
	S	R	J/A	S	R	J/A	S	R	J/A	S	R	J/A	S	R	J/A	S	R	J/A	S	R	J/A	S	R	J/A
1. Average water temperature, °C																								
1. >30	0	0	.5	0	.25	.5	0	.5	.75	0	0	0	0	.25	.5	0	0	0	0	0	.5	0	.25	.75
2. 25-30	0	.5	1	.5	.75	.75	.75	1	1	0	0	.75	.5	1	1	0	.25	.25	.25	.5	1	.5	1	1
3. 20-25	.75	.75	1	1	1	1	1	1	1	0	0	1	1	1	1	0	.5	1	1	1	1	1	1	1
4. 15-20	1	1	1	.75	1	1	.75	.75	1	0	.25	1	1	.5	1	.25	1	1	1	1	1	1	1	1
5. 10-15	.25	.5	1	.5	.75	1	.5	.5	1	0	.5	.75	.5	.25	.75	.75	.75	.75	.25	.25	.75	.5	.5	.75
6. 4-10	0	0	.75	0	.25	.75	0	.25	.75	.5	1	.5	0	.25	.5	1	.25	.5	0	.25	.5	0	.25	.5
7. 2-4	0	0	.5	0	0	.25	0	0	.25	1	.25	.25	0	0	.25	0	0	.25	0	0	.25	0	0	.25
8. 0-2	0	0	.25	0	0	0	0	0	.25	.5	0	.25	0	0	0	0	0	0	0	0	0	0	0	0
2. Average turbidity, NTU																								
1. 0-10	.75	.75	1	1	1	1	.5	.5	.5	1	1	1	.75	.75	1	.25	.5	.5	1	1	1	1	1	1
2. 10-50	1	1	1	1	1	1	.75	1	.75	1	1	1	1	1	1	.75	1	1	1	1	1	1	1	1
3. 50-100	1	1	1	.75	.75	1	1	1	1	1	1	.75	1	1	1	1	1	1	1	.75	1	1	1	1
4. 100-150	.5	.75	1	.5	.75	.75	.75	.75	1	.5	.5	.5	.75	.5	1	.75	.5	.75	.5	.5	.75	.75	.75	1
4. 150-200	.25	.5	.75	.25	.5	.5	.5	.5	.75	.25	.25	.25	.5	.25	.75	.25	.25	.25	.25	.25	.5	.5	.5	.75
4. >200	.25	.25	.5	0	.25	.25	.25	.25	.5	0	0	.25	0	.25	.5	0	0	.25	0	0	.25	.25	.25	.5
3. Minimum daily dissolved oxygen, mg/l																								
1. 0-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. 1-3	.0	.25	.25	.25	.25	.5	.25	.25	.5	0	.25	.25	.25	.25	.25	.25	.25	.25	0	.25	.25	.0	.25	.25
3. 3-5	.5	.5	.5	.5	.75	.75	.5	.75	.75	.5	.5	.5	.5	.75	.75	.5	.75	.75	.5	.5	.5	.5	.5	.75
4. >5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4. Percent of shoreline rip-rapped																								
1. 0	.25	.5	.75	1	.5	.75	.5	.5	.75	1	1	1	1	.5	.5	.25	.25	.25	1	.5	.25	.5	.25	.5
2. 1-10	.25	.75	1	1	.75	1	.75	1	1	.75	.75	1	1	.75	.75	.25	.5	.5	1	.75	.5	.75	.5	.75
3. 10-25	.75	1	1	1	1	1	1	1	1	.25	.5	1	.5	1	1	.5	.75	.75	.75	1	.75	1	.75	1
4. 25-50	1	1	1	1	1	1	1	1	1	0	.25	.75	.5	1	1	.75	1	.75	.5	1	1	1	1	1
5. >50	1	1	1	1	1	1	1	1	1	0	.25	.5	.25	1	1	1	1	1	.5	1	1	1	1	1
5. Dominant substrate type																								
1. Plants/detritus	.5	.5	.25	.25	.75	.5	0	.25	.25	1	1	1	1	1	1	1	1	.75	.5	1	1	1	1	1
2. Clay/Silt (<1.0 mm)	.5	.25	.5	.25	.5	.5	0	.25	.25	0	.25	.25	.25	.5	.75	.5	.25	.25	.25	.25	.5	.5	.75	.5
3. Sand (1-2 mm)	.75	1	1	1	1	1	.5	1	1	.25	.5	.5	.25	1	1	.25	.5	.75	1	1	1	1	1	1
4. Gravel (2-64 mm)	1	1	1	1	1	1	1	1	1	0	.25	.25	0	1	1	1	1	1	1	1	1	1	1	1
5. Rocks (>64 mm)	1	.75	1	1	1	1	1	1	1	0	.25	.25	0	.75	1	1	1	1	.25	1	1	1	1	1

Figure B-4. AHAG Matrix (Page 1 of 4).

Table 5. Continued

Habitat Variable	Suitability Index (SI) Score by Species and Life Stage																							
	WHITE BASS			EMERALD SHINER			RIVER DARTER			NORTHERN PIKE			SMALLMOUTH BUFFALO			WALLEYE			LARGEMOUTH BASS			BLUEGILL		
	S	R	J/A	S	R	J/A	S	R	J/A	S	R	J/A	S	R	J/A	S	R	J/A	S	R	J/A	S	R	J/A
6. Percent of surface area with visible logs, inundated timber, undercut banks, and/or brush																								
1. 0-5	1	1	1	1	1	1	1	1	1	0	.25	.25	.25	.5	1	1	1	1	.25	.25	.25	.25	.25	.5
2. 5-10	1	1	.75	.75	.5	.5	.75	1	.75	.25	.5	.5	.75	.75	1	1	1	1	.5	.25	.5	.25	.25	.75
3. 10-25	.5	.75	.25	.5	.5	.25	.25	.75	.5	.75	.75	.75	1	1	.75	.75	1	1	.75	.5	.75	.5	.5	1
4. 25-50	.25	.5	.25	.25	.25	.25	0	.25	.25	1	1	1	1	.5	.5	.5	.5	.75	1	.75	1	.75	.75	1
5. >50	0	.25	0	.25	.25	.25	0	.25	.25	1	1	1	.75	.5	.25	.25	.25	.25	1	1	1	1	1	1
7. Percent of surface area with aquatic vegetation lentic habitats only)																								
1. 0-10	1	1	1	1	1	1	1	1	1	0	.25	.25	.25	.75	1	1	1	1	.5	.25	.25	.25	.25	.25
2. 10-25	.75	.25	.75	.75	.75	.5	.5	.75	.5	.5	.5	.75	.5	1	1	.75	1	1	.75	.5	.5	.75	.5	.5
3. 25-50	.25	0	.25	.25	.25	.25	.25	.25	.25	.75	.75	1	1	.75	.75	.5	.5	.5	1	1	1	1	.75	1
4. 50-75	0	0	.25	.25	.25	.25	0	0	0	1	1	1	1	.5	.25	0	.25	.25	.5	1	1	.5	1	.75
5. >75	0	0	0	0	.25	.25	0	0	0	1	1	1	.75	.25	.25	0	.25	0	.25	.5	.5	.25	1	.25
8. Water level fluctuation																								
1. Stable	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2. Slow rise (0.5-1 m)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3. Rapid rise (1-2 m)	.75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	.75	1	1
4. Rapid fall (0.5-1 m)	0	.25	.5	.5	.5	.75	.5	.5	.75	.25	.25	.5	.25	.5	.5	.25	.25	.25	.25	.25	.5	.5	.5	.75
9. Variation in water depth, coefficient of variation, %																								
Mean depth < 1 meter																								
1. 0-25	.25	.25	.5	.75	.75	1	.25	.5	.75	.5	.5	.5	.25	.5	.75	.25	.5	.75	.25	.25	.25	.25	.25	.5
2. 25-50	.50	.75	.75	1	1	1	.5	.75	1	.75	.75	.75	.5	1	1	.75	1	1	.75	.75	.5	.75	.75	.75
3. 50-100	.75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	.75	1	1	1
4. >100	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mean depth > 1 meter																								
1. 0-20	.25	.25	.5	.75	.75	1	.25	.5	.75	.5	.5	.5	.25	1	.75	.25	.5	.75	.25	.25	.25	.25	.25	.5
2. 20-30	.50	.75	.75	1	1	1	.5	.75	1	.75	.75	.75	.5	1	1	.75	1	1	.75	.75	.5	.75	.75	.75
3. 30-50	.75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	.75	1	1	1
4. >50	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10. Percent of area with water depth greater than 1 m (lentic habitats only)																								
1. 0-10	0	0	.25	.5	.75	.75				.5	.25	.25	.75	.5	.25	.25	.25	.25	.5	.25	.25	.75	.5	.25
2. 10-25	.25	.50	.50	.75	1	1				.75	.5	.5	1	.75	.25	.5	.5	.25	.75	.5	.25	1	.75	.5
3. 25-50	.5	.75	.75	1	1	1				1	.75	.75	1	1	.5	.75	.75	.5	1	.75	.5	1	1	.75
4. 50-75	.75	1	1	1	1	1				1	1	1	.75	1	.75	1	1	.75	1	1	.75	1	1	1
5. >75	1	1	1	1	1	1				1	1	1	.5	1	1	1	1	1	1	1	1	1	1	1

Figure B-4. AHAG Matrix (Page 2 of 4).

Table 5. Continued

Habitat Variable	Suitability Index (SI) Score by Species and Life Stage																							
	WHITE BASS			EMERALD SHINER			RIVER DARTER			NORTHERN PIKE			SMALLMOUTH BUFFALO			WALLEYE			LARGEMOUTH BASS			BLUEGILL		
	S	R	J/A	S	R	J/A	S	R	J/A	S	R	J/A	S	R	J/A	S	R	J/A	S	R	J/A	S	R	J/A
11. Percent of year/season backwaters are contiguous with the mainstem river (lentic habitats only)																								
1. 0	.75	.25	.75	.5	.5	.5				.25	.5	.25	0	0	.5	.5	.5	.5	.25	.5	.5	.5	.75	1
2. 1-25	1	.50	1	.75	.75	.75				.75	1	.5	.25	.25	.75	.5	.5	.75	.5	.75	.5	.75	.75	1
3. 25-50	1	.75	1	1	1	1				1	1	.75	.5	.75	1	1	.75	1	.75	1	.75	1	1	1
4. 50-75	1	1	1	1	1	1				1	1	1	.75	1	1	1	1	1	1	1	1	1	1	1
5. >75	1	1	1	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12. Average water velocity, cm/s																								
1. 0	0	1	.5	.5	1	.25	0	.25	0	1	1	1	1	1	1	.25	1	.75	1	1	1	1	1	1
2. 0.1-1	0	1	.5	.75	1	.5	0	.25	.25	1	1	1	1	1	1	1	1	1	1	.75	1	.75	1	1
3. 1-4	.25	1	.75	1	1	1	.25	.75	.75	.75	.75	1	.75	.75	1	1	.75	1	.25	.5	1	.25	.5	1
4. 4-10	.75	.75	1	1	.75	1	.75	1	1	.5	.75	.75	.5	.5	.75	1	.25	1	0	.25	.75	.25	.25	.5
5. 10-25	1	.5	1	.75	.5	1	1	.75	1	0	.5	.5	.5	.5	.75	.5	0	.75	0	0	.25	0	0	.25
6. 25-50	1	.25	1	.5	.25	1	1	.5	1	0	.25	.5	.25	.5	.75	.25	0	.5	0	0	.25	0	0	0
7. 50-75	.75	0	1	.25	.25	.75	.5	.25	1	0	.25	.25	0	.25	.5	0	0	.25	0	0	0	0	0	0
8. >75	.25	0	.5	.25	0	.5	.25	.25	1	0	0	.25	0	.25	.5	0	0	.25						
13. Average depth of thalweg, m (lotic habitats only)																								
1. < 3	1	1	.25	.5	.75	.5	.75	1	.75		1	.25		.5	.25	.25	.5	.25		.5	.25		.75	.25
2. 3-5	1	1	.75	.75	1	.75	1	1	1		1	1		.75	.5	.5	.75	.5		.5	.5		1	.75
3. 5-7	.75	.75	1	1	1	1	1	1	1		1	1		1	1	.75	1	.75		.75	.75		1	1
4. >7	.5	.5	1	1	1	1	1	1	1		1	1		1	1	1	1	1		1	1		1	1
14. Distance to nearest backwater with average water depth greater than 1 meter, miles (lotic habitats only)																								
1. < 1	1	1	1	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2. 1-2	1	.5	1	1	1	1				.75	.5	1	1	.75	1	1	.5	1	.75	.25	.75	.5	.25	1
3. 2-5	.75	.25	1	1	1	1				.5	.25	1	.75	.5	.5	.75	.25	.5	.5	0	.5	.25	0	.5
4. >5	.5	.25	1	1	1	1				.25	0	.5	.5	.25	.25	.5	0	.25	.25	0	.25	0	0	.25
15. Distance to side channel with permanent water > 2 m and year around connection to main channel, miles																								
1. < 0.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2. 0.5-0.75	1	.75	1	1	1	1	1	1	1	.75	.75	1	1	1	1	1	.75	1	1	.75	1	.75	.5	.75
3. 0.75-1	.75	.5	1	1	1	1	1	.5	1	.5	.5	.75	.75	.75	1	.75	.5	.75	.5	.25	.75	.25	.25	.5
4. 1-2	.5	.25	1	.5	.5	1	1	.25	1	.25	.25	.5	.5	.5	1	.5	.25	.5	.25	.25	.5	.75	.25	.75
5. >2 miles	.25	0	.75	.5	.5	1	1	0	1	.25	.25	.25	.5	.25	.75	.25	.25	.5	0	.25	.25	0	1	.25

Figure B-4. AHAG Matrix (Page 3 of 4).

Table 5. Concluded

Habitat Variable	Suitability Index (SI) Score by Species and Life Stage							
	WHITE BASS	EMERALD SHINER	RIVER DARTER	NORTHERN PIKE	SMALLMOUTH BUFFALO	WALLEYE	LARGEMOUTH BASS	BLUEGILL
	S R J/A	S R J/A	S R J/A	S R J/A	S R J/A	S R J/A	S R J/A	S R J/A
16. Percent of backwater area suitable as over-wintering habitat from Nov-Feb (no current, water temperature at least 1°C warmer than main channel, CO_2 3.0 mg/l, water depth ≥ 1.5 m, periodically contiguous with main river channel)								
1. 0	.25	.5		.25	.25	0	0	0
2. 1-25	.25	.75		.25	.25	.25	.25	.25
3. 25-50	.5	1		.5	.5	.5	.5	.5
4. 50-75	.75	1		.75	.75	.75	.75	.75
5. >75	1	1		1	1	1	1	1
CALCULATIONS								
Total Score								
Average HSI Value (total score/number of variables)								
Minimum HSI Value/1 (optional)								
Limiting Factor HSI Score (sum of selected variables/number of variables) (optional)								
Weighted HSI Value (see users manual) (optional)								
Total Acres								
Habitat Units (HSI x Total Acres								

Figure B-4. AHAG Matrix (Page 4 of 4).

Table B-7. Aquatic Habitat Appraisal Ratings, Large Slackwater Fishes.

Sites 1 & 2 (Page 1 of 4).

SITE 1			
Ratings			
Appraisal Item	Existing W Sp S F	Future Without W Sp S F	Future With W Sp S F
Av. Wat. Temp.	6 5 2 4	6 5 2 4	6 5 2 4
Av. Turbidity	1 3 2 3	1 3 2 3	1 3 2 3
Min. D. O.	4 4 4 4	4 4 4 4	4 4 4 4
Av. Conduct.	6 6 6 4	5 5 5 3	6 6 6 4
Dom. Substr.	2 2 2 2	2 2 2 2	2 2 2 2
% Cover	1 1 1 1	1 1 1 1	1 1 1 1
Wat. Lev. Fluc.	4 4 4 4	1 1 1 1	1 1 1 1
Dist. Gr.w/Fl.	2 2 2 2	2 2 2 2	2 2 2 2
% Dep. >1m	3 3 3 3	2 2 2 2	3 3 3 3
% Sur. w/Aq. V.	1 1 1 1	2 2 2 2	3 3 3 3
No. Da. Conw/R.	5 5 5 5	2 2 2 2	5 5 5 5
Av. Wat. Vel.	N/A	N/A	N/A
Av. Dep. Thal.	N/A	N/A	N/A
Dist. H2O w/>1m	N/A	N/A	N/A
SITE 2			
Av. Wat. Temp.	6 5 2 4	NO	6 5 2 4
Av. Turbidity	1 3 2 3		1 3 2 3
Min. D.O.	4 4 4 4	LONGER	4 4 4 4
Av. Conduct.	6 6 6 4		6 6 6 4
Dom. Substr.	2 2 2 2	AQUATIC	2 2 2 2
% Cover	1 1 1 1		1 1 1 1
Wat. Lev. Fluc.	4 4 4 4	HABITAT	1 1 1 1
Dist. Gr.w/Fl.	2 2 2 2		2 2 2 2
% Dep. >1m	4 4 4 4	DUE	4 4 4 4
% Sur. w/Aq. V.	1 1 1 1		3 3 3 3
No. Da. Conw/R.	5 5 5 5	TO	5 5 5 5
Av. Wat. Vel.	N/A		N/A
Av. Dep. Thal.	N/A	SILTATION	N/A
Dist. H2O w/>1m	N/A		N/A

Table B-7. Aquatic Habitat Appraisal Ratings, Large Slackwater Fishes (Continued).

Sites 3 & 4 (Page 2 of 4).

SITE 3			
	Ratings		
Appraisal Item	Existing W Sp S F	Future Without W Sp S F	Future With W Sp S F
Av. Wat. Temp.	7 5 2 4	6 5 2 4	6 5 2 4
Av. Turbidity	1 3 2 3	1 3 2 3	1 3 2 3
Min. D. O.	4 4 4 4	4 4 4 4	4 4 4 4
Av. Conduct.	6 6 6 4	5 5 5 3	6 6 6 4
Dom. Substr.	2 2 2 2	2 2 2 2	2 2 2 2
% Cover	1 1 1 1	2 2 2 2	1 1 1 1
Wat. Lev. Fluc.	4 4 4 4	1 1 1 1	1 1 1 1
Dist. Gr.w/Fl.	1 1 1 1	1 1 1 1	1 1 1 1
% Dep. >1m	N/A	1 1 1 1	N/A
% Sur. w/Aq. V.	N/A	3 3 3 3	N/A
No. Da. Conw/R.	N/A	2 2 2 2	N/A
Av. Wat. Vel.	3 3 3 3	N/A	2 2 2 2
Av. Dep. Thal.	3 3 3 3	N/A	3 3 3 3
Dist. H2O w/>1m	1 1 1 1	N/A	1 1 1 1
SITE 4			
Av. Wat. Temp.	7 5 2 4	6 5 2 4	6 5 2 4
Av. Turbidity	1 3 2 3	2 3 3 3	1 3 2 3
Min. D.O.	4 4 4 4	4 4 4 4	4 4 4 4
Av. Conduct.	6 6 6 4	5 5 5 3	6 6 6 4
Dom. Substr.	3 3 3 3	2 2 2 2	3 3 3 3
% Cover	1 1 1 1	2 2 2 2	1 1 1 1
Wat. Lev. Fluc.	4 4 4 4	4 4 4 4	1 1 1 1
Dist. Gr.w/Fl.	1 1 1 1	1 1 1 1	1 1 1 1
% Dep. >1m	N/A	1 1 1 1	N/A
% Sur. w/Aq. V.	N/A	1 1 1 1	N/A
No. Da. Conw/R.	N/A	5 5 5 5	N/A
Av. Wat. Vel.	2 2 2 2	N/A	2 2 2 2
Av. Dep. Thal.	2 2 2 2	N/A	2 2 2 2
Dist. H2O w/>1m	1 1 1 1	N/A	1 1 1 1

Table B-7. Aquatic Habitat Appraisal Ratings, Large Slackwater Fishes (Continued).

Sites 5 & 6 (Page 3 of 4).

SITE 5			
Ratings			
Appraisal Item	Existing W Sp S F	Future Without W Sp S F	Future With W Sp S F
Av. Wat. Temp.	6 5 2 4	NO	6 5 2 4
Av. Turbidity	1 3 2 3		1 3 2 3
Min. D. O.	4 4 4 4	LONGER	4 4 4 4
Av. Conduct.	6 6 6 4		6 6 6 4
Dom. Substr.	2 2 2 2	AQUATIC	2 2 2 2
% Cover	1 1 1 1		1 1 1 1
Wat. Lev. Fluc.	4 4 4 4	HABITAT	1 1 1 1
Dist. Gr.w/Fl.	1 1 1 1		1 1 1 1
% Dep. >1m	2 2 2 2	DUE	2 2 2 2
% Sur. w/Aq. V.	1 1 1 1		4 4 4 4
No. Da. Conw/R.	5 5 5 5	TO	5 5 5 5
Av. Wat. Vel.	N/A		N/A
Av. Dep. Thal.	N/A	SILTATION	N/A
Dist. H2O w/>1m	N/A		N/A
SITE 6			
Av. Wat. Temp.	7 5 2 4	7 5 2 4	6 5 2 4
Av. Turbidity	1 3 2 3	1 3 2 3	1 3 2 3
Min. D.O.	4 4 4 4	4 4 4 4	4 4 4 4
Av. Conduct.	6 6 6 4	6 6 6 4	6 6 6 4
Dom. Substr.	4 4 4 4	4 4 4 4	4 4 4 4
% Cover	1 1 1 1	1 1 1 1	1 1 1 1
Wat. Lev. Fluc.	4 4 4 4	4 4 4 4	1 1 1 1
Dist. Gr.w/Fl.	1 1 1 1	2 2 2 2	1 1 1 1
% Dep. >1m	N/A	3 3 3 3	N/A
% Sur. w/Aq. V.	N/A	1 1 1 1	N/A
No. Da. Conw/R.	N/A	5 5 5 5	N/A
Av. Wat. Vel.	1 1 1 1	N/A	1 1 1 1
Av. Dep. Thal.	1 1 1 1	N/A	1 1 1 1
Dist. H2O w/>1m	1 1 1 1	N/A	1 1 1 1

Table B-7. Aquatic Habitat Appraisal Ratings, Large Slackwater Fishes (Continued).

Sites 7 & 8 (Page 4 of 4).

SITE 7			
Ratings			
Appraisal Item	Existing W Sp S F	Future Without W Sp S F	Future With W Sp S F
Av. Wat. Temp.	7 5 2 4	6 5 2 4	6 5 2 4
Av. Turbidity	1 3 2 3	1 3 2 3	1 3 2 3
Min. D. O.	4 4 4 4	4 4 4 4	4 4 4 4
Av. Conduct.	6 6 6 4	6 6 6 4	6 6 6 4
Dom. Substr.	2 2 2 2	2 2 2 2	2 2 2 2
% Cover	1 1 1 1	1 1 1 1	1 1 1 1
Wat. Lev. Fluc.	4 4 4 4	4 4 4 4	1 1 1 1
Dist. Gr.w/Fl.	1 1 1 1	2 2 2 2	2 2 2 2
% Dep. >1m	N/A	1 1 1 1	N/A
% Sur. w/Aq. V.	N/A	1 1 1 1	N/A
No. Da. Conw/R.	N/A	5 5 5 5	N/A
Av. Wat. Vel.	2 2 2 2	N/A	2 2 2 2
Av. Dep. Thal.	2 2 2 2	N/A	1 1 1 1
Dist. H2O w/>1m	1 1 1 1	N/A	1 1 1 1
SITE 8			
Av. Wat. Temp.	6 5 2 4	6 5 2 4	6 5 2 4
Av. Turbidity	1 3 2 3	1 3 2 3	1 3 2 3
Min. D.O.	4 4 4 4	4 4 4 4	4 4 4 4
Av. Conduct.	6 6 6 4	6 6 6 4	6 6 6 4
Dom. Substr.	2 2 2 2	2 2 2 2	2 2 2 2
% Cover	1 1 1 1	2 2 2 2	1 1 1 1
Wat. Lev. Fluc.	1 1 1 1	1 1 1 1	1 1 1 1
Dist. Gr.w/Fl.	2 2 2 2	2 2 2 2	2 2 2 2
% Dep. >1m	1 1 1 1	1 1 1 1	1 1 1 1
% Sur. w/Aq. V.	1 1 1 1	1 1 1 1	3 3 3 3
No. Da. Conw/R.	4 4 4 4	4 4 4 4	4 4 4 4
Av. Wat. Vel.	N/A	N/A	N/A
Av. Dep. Thal.	N/A	N/A	N/A
Dist. H2O w/>1m	N/A	N/A	N/A

Table B-8. HSI Values for Selected Indicator Fish Species.

Batchtown Project Area ALL SEASONS/LIFE STAGES COMBINED			
Site	Existing ES SB FC LMB	Future Without ES SB FC LMB	Future With ES SB FC LMB
# 1	.45 .44 .44 .38	.45 .45 .45 .39	.79 .73 .69 .63
# 2	.45 .45 .45 .39	L A N D	.76 .78 .71 .75
# 3	.44 .44 .44 .40	.42 .44 .43 .41	.85 .79 .77 .70
# 4	.46 .44 .45 .42	.44 .44 .44 .39	.88 .77 .79 .74
# 5	.45 .43 .43 .37	L A N D	.77 .74 .69 .67
# 6	.45 .43 .44 .41	.47 .44 .45 .40	.87 .78 .76 .76
# 7	.44 .44 .44 .40	.45 .43 .42 .37	.79 .75 .71 .66
# 8	.45 .45 .43 .39	.42 .44 .42 .42	.73 .75 .68 .69
Average	.45 .44 .44 .40	.44 .44 .44 .40	.81 .76 .73 .70
Management Unit			
DNR-B	.45 .44 .44 .40	.45 .44 .43 .40	.82 .77 .76 .71
FWS-M	.45 .45 .43 .39	.42 .44 .42 .42	.73 .75 .68 .69
FWS-L	.45 .44 .44 .38	.45 .45 .45 .39	.79 .73 .69 .63

Notes:
ES - Emerald Shiner
SB - Smallmouth Buffalo - Indicator species for Large Slackwater Fishes Guild
FC - Flathead Catfish
LMB - Largemouth Bass
DNR-B - Illinois Department of Natural Resources - Backwater
FWS-M - Fish and Wildlife Service - Middle Management Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit

Table B-9. HSI Values for Large Slackwater Fishes.

Batchtown Project Area

Life Stage	Existing					Future Without					Future With				
	W	Sp	S	F	Av	W	Sp	S	F	Av	W	Sp	S	F	Av
Spawning*	-	.25	-	-	.25	-	.25	-	-	.25	-	.71	-	-	.71
Rearing*	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	.72	.74	.80	.80	.76
Adult	.76	.80	.83	.87	.81	.77	.79	.82	.86	.81	.79	.82	.84	.89	.83
Average	.50	.43	.54	.56	.44	.51	.43	.53	.56	.44	.75	.78	.82	.84	.77

* The AHAG team agreed to assign a value of .25 for the spawning and rearing life stages because of the number and severity of water level fluctuations in most years and the detrimental affect these level changes have on the smaller life stages.

4. DISCUSSION.

The large slackwater fish guild was selected by the AHAG team for fisheries management emphasis. Table B-11 shows the incremental effects of the various study options on this fish group.

Plans A and B show relatively modest habitat improvement gains for large slackwater fishes (see Table B-12). Under Plan C, the placement of the various components results in substantial habitat improvement gains for large slackwater fishes. The major contributors to these gains are the water control structures, exterior levee, dredging, hillside sediment control and lowland sediment control, respectively. A more detailed analysis of the incremental effects of the component measures of Plan C are provided in the alternatives discussion of the DPR main report.

5. CONCLUSION.

The selected plan as shown in Table B-12 provides important benefits to large slackwater fish species.

Table B-10. AHAG Analysis - Large Slackwater Fishes, All Seasons/Life Stages Combined.

Plan F (Future Without)						
Management Unit	1992		1994		2042	
	Acres	HSI	Acres	HSI	Acres	HSI
DNR-B	1512	(.44)	1473	(.44)	529	(.44)
FWS-M	427	(.45)	418	(.45)	207	(.44)
FWS-L	153	(.44)	150	(.44)	77	(.45)
Other	0	(-)	51	(-)	1279	(-)
Total	2092		2092		2092	
Plan A (Partial Wetlands Protection)						
DNR-B	1512	(.44)	1493	(.77)	769	(.77)
FWS-M	427	(.45)	412	(.75)	365	(.75)
FWS-L	153	(.44)	152	(.73)	138	(.73)
Other	0	(-)	35	(-)	820	(-)
Total	2092		2092		2092	
Plan B (Backwater Protection)						
DNR-B	1512	(.44)	1494	(.77)	806	(.77)
FWS-M	427	(.45)	412	(.75)	365	(.75)
FWS-L	153	(.44)	152	(.73)	138	(.73)
Other	0	(-)	34	(-)	783	(-)
Total	2092		2092		2092	
Plan C (Wetlands Protection - Dike/Levee 434.0+ NGVD)						
DNR-B	1512	(.44)	1485	(.47)	747	(.47)
FWS-M	427	(.45)	421	(.48)	285	(.48)
FWS-L	153	(.44)	151	(.47)	107	(.47)
Other	0	(-)	35	(-)	953	(-)
Total	2092		2092		2092	

Table B-10. AHAG Analysis - Large Slackwater Fishes, All Seasons/Life Stages Combined, (Continued).

Management Unit	1992		1994		2042	
	Acres	(HSI)	Acres	(HSI)	Acres	(HSI)
Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD)						
DNR-B	1512	(.44)	1502	(.47)	964	(.47)
FWS-M	427	(.45)	424	(.48)	365	(.48)
FWS-L	153	(.44)	152	(.47)	117	(.47)
Other	0	(-)	14	(-)	646	(-)
Total	2092		2092		2092	
Plan C (Wetlands Protection - Dike/Levee 437.0+ NGVD)						
DNR-B	1512	(.44)	1502	(.47)	1005	(.47)
FWS-M	427	(.45)	425	(.48)	390	(.48)
FWS-L	153	(.44)	152	(.47)	127	(.47)
Other	0	(-)	13	(-)	570	(-)
Total	2092		2092		2092	
Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD + Hillside Sediment Control)						
DNR-B	1512	(.44)	1497	(.48)	1163	(.48)
FWS-M	427	(.45)	424	(.48)	365	(.48)
FWS-L	153	(.44)	152	(.48)	139	(.48)
Other	0	(-)	19	(-)	425	(-)
Total	2092		2092		2092	
Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD + Hillside Sediment Control + Lowland Sediment Control)						
DNR-B	1512	(.44)	1497	(.49)	1134	(.49)
FWS-M	427	(.45)	424	(.48)	365	(.48)
FWS-L	153	(.44)	152	(.49)	138	(.49)
Other	0	(-)	19	(-)	455	(-)
Total	2092		2092		2092	

Table B-10. AHAG Analysis - Large Slackwater Fishes, All Seasons/Life Stages Combined, (Continued).

Management Unit	1992		1994		2042	
	Acres	(HSI)	Acres	(HSI)	Acres	(HSI)
Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD + Hillside Sediment Control + Lowland Sediment Control + Water Control Structures						
DNR-B	1512	(.44)	1497	(.68)	1134	(.68)
FWS-M	427	(.45)	424	(.69)	365	(.69)
FWS-L	153	(.44)	152	(.68)	138	(.68)
Other	0	(-)	19	(-)	455	(-)
Total	2092		2092		2092	
Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD + Hillside Sediment Control + Lowland Sediment Control + Water Control Structures + Pumps						
DNR-B	1512	(.44)	1497	(.68)	1134	(.68)
FWS-M	427	(.45)	424	(.69)	365	(.69)
FWS-L	153	(.44)	152	(.68)	138	(.68)
Other	0	(-)	19	(-)	455	(-)
Total	2092		2092		2092	
Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD + Hillside Sediment Control + Lowland Sediment Control + Water Control Structures + Pumps + Dredge Cuts)						
DNR-B	1512	(.44)	1497	(.77)	1134	(.77)
FWS-M	427	(.45)	424	(.75)	365	(.75)
FWS-L	153	(.44)	152	(.73)	138	(.73)
Other	0	(-)	19	(-)	455	(-)
Total	2092		2092		2092	

DNR-B - Illinois Department of Natural Resources - Backwater
FWS-M - Fish and Wildlife Service - Middle Management Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit

Table B-11. Annualized Large Slackwater Fish Habitat Units for Plan C - Incremental Components.

Management Unit	DNR-B			FWS-M			FWS-L			TOTAL			Potential AAHU Contribution
Alternative	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	
Dike/Levee													
434.0 NGVD	531	449	82	171	142	29	61	51	10	763	642	121	+121
435.5 NGVD	583	449	134	190	142	48	63	51	12	836	642	194	+194
437.0 NGVD	593	449	144	196	142	54	66	51	15	855	642	213	+213
Hillside Sediment Control (+ D/L 435.5 NGVD)													
435.5 NGVD	634	449	185	190	142	48	70	51	19	894	642	252	+ 58
Lowland Sediment Control (+ D/L 435.5 NGVD + H. S. C.)													
435.5 NGVD	647	449	198	190	142	48	71	51	20	908	642	266	+ 14
Water Control Structures (+ D/L 435.5 NGVD + H. S. C. + L. S. C.)													
435.5 NGVD	892	449	443	271	142	129	98	51	47	1261	642	619	+353
Pumps (+ D/L 435.5 NGVD + H. S. C. + L. S. C. + W. C. S.)													
435.5 NGVD	892	449	443	271	142	129	98	51	47	1261	642	619	+ 0
Dredging (+ D/L 435.5 NGVD + H. S. C. + L. S. C. + W. C. S. + Pumps)													
435.5 NGVD	1009	449	560	290	142	148	105	51	54	1404	642	762	+143

Notes:
DNR-B - Illinois Department of Natural Resources - Backwater
FWS-M - Fish and Wildlife Service - Middle Management Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit

Table B-12. Annualized Large Slackwater Fish Habitat Units, Plan Comparisons.

Unit	DNR-B			FWS-M			FWS-L			TOTAL		
Plan	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET	FW	FWO	NET
A	872	449	423	290	142	148	105	51	54	1267	642	625
B	886	449	437	290	142	148	105	51	54	1281	642	639
C	1009	449	560	290	142	148	105	51	54	1404	642	762

Notes:
DNR-B - Illinois Department of Natural Resources - Backwater
FWS-M - Fish and Wildlife Service - Middle Management Unit
FWS-L - Fish and Wildlife Service - Lower Management Unit

SUBSECTION III. FRESHWATER MUSSEL HABITAT APPRAISAL METHOD.

1. BACKGROUND.

The presence of a freshwater mussel bed within the Batchtown project area necessitated an appraisal of the existing and future habitat conditions for mussels. The major goal of the project as it relates to mussels is maintenance of the existing bed while improving habitat conditions for fish and waterfowl. A habitat suitability index model for riverine freshwater mussel communities was developed by WES based upon studies of prominent mussel beds having commercial and ecological value in sandy gravel or gravelly sand shoals of four major rivers. Modification of this model by WES was necessary because of the location of the bed at Batchtown in a side channel with a silt/clay substrate and subject to the impact of sediment deposition (See Figure B-6). The mussel habitat evaluation team included representation from the USFWS, IDNR, INHS, WES and the St. Louis District.

2. ASSUMPTIONS.

Certain assumptions were developed regarding existing and future conditions during the mussel habitat evaluation. These assumptions are listed below.

a. Existing Conditions

(1) Water levels fluctuate during the year due to pool management and may limit the extent of the existing mussel bed.

(2) Wetland habitat at the site is rapidly being degraded due to siltation.

FWS - There will be a 50% loss of surface area and water depth over the next 50 years without the project.

IDNR - There will be a 65% loss of surface area and water depth over the next 50 years without the project, resulting in the closure of both side channels, loss of access to Big Hole and the loss of overall habitat diversity.

b. Future Conditions

(1) General. The following general assumptions were applied to the analysis for all future changes in habitat during the 50-year project life.

(a) Target years of 0, 2 and 50 are sufficient to annualize HUs and to characterize habitat changes over the life of the project.

(b) The modified habitat suitability index model developed by WES specifically for the Batchtown project area is suitable for the incremental analysis of this project

(See Figure B-6.)

(2) Specific. Specific assumptions employed in evaluating alternative plans F, A, B and C are given below.

(a) <u>Alternative Plan F, No Action Plan</u> (also represents future without project conditions).

(1) Severe water level fluctuations will continue to impact the size of the mussel bed.

(2) Approximately 50-65 percent of the existing wetlands in the project area will be lost over the next 50 years, resulting in the loss of the mussel bed.

(3) The HSI values developed from the field data are a fair representation of the habitat quality of unprotected habitat in all target years and for all future conditions with or without a project.

(b) <u>Alternative Plan A, Partial Wetlands Protection</u>
This plan would address many of the concerns of the wetland associated wildlife species but would not address survival of the mussel bed or fish management concerns.

(c) <u>Alternative Plan B, Partial Backwater Protection</u>

(1) This plan would address some wildlife and fisheries management concerns and may provide for the survival of the freshwater mussels.

(2) Operation and maintenance costs under this alternative were felt to be excessive due to seepage and the longer lengths of levee to be maintained in the state backwater part of the project.

(d) <u>Alternative Plan C, Wetlands Protection</u>

(1) Water levels would be stabilized and would no longer prevent expansion of the existing bed.

(2) Sediment should be reduced by 60 percent from the existing rate in the state backwater part of the project where the mussel bed is located. Wetland losses would continue to occur but at a much slower rate than at present and was estimated at 25 percent over the life of the project.

(3) Water control structures will provide a source of flow during most of the year, with some flow expected from seepage even during the drawdown for moist soil plant management.

3. RESULTS.

Site Locations. The habitat suitability index analysis locations were selected as described in Figure B-6 and are generally shown in Figure B-5. The number and location of the transects were judged to be representative of the prevailing habitat conditions.

Appraisal Items. Figure B-6 provides the methodology for determining the HSIs for both existing and future conditions. Table B-13 provides a tabulated prediction of the habitat acreage and HSI changes expected for the backwater part of the project over the next 50 years for various alternative plans and component plan options. The rate of existing sedimentation was determined from available literature describing the site. The determination of the future sedimentation rate with a project took sedimentation rate half-life and levee entrapment effects into consideration. Future sedimentation with a project took applicable hydraulic engineering estimates of percent reduction in sediment input into account.

Table B-15 provides the HU value changes resulting from the application of the Corps' HES software to the Table B-13 values. The HUs ares tabulated for freshwater mussels according to the modified model for each alternative project plan and component measures.

Table B-13. Habitat Suitability Index Analysis. Freshwater Mussels - IDNR-B*.

Plan F (Future Without)		
1992	1994	2042
Acres HSI	Acres HSI	Acres HSI
405 (.64)	395 (.62)	142 (.24)
Plan A (Partial Wetlands Protection)		
405 (.64)	398 (.61)	206 (.24)
Plan B (Partial Backwater Protection)		
405 (.64)	398 (.64)	216 (.64)
Plan C (Wetlands Protection - Dike/Levee 434.0+ NGVD)		
405 (.64)	395 (.62)	200 (.24)
Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD)		
405 (.64)	398 (.61)	304 (.35)
Plan C (Wetlands Protection - Dike/Levee 437.0+NGVD)		
405 (.64)	398 (.61)	306 (.35)
Plan C (Wetlands Protection - D/L 435.5+ NGVD + H.S.C.)		
405 (.64)	398 (.61)	304 (.37)
Plan C (Wetlands Protection - D/L 435.5+ NGVD + H.S.C. + L.S.C.)		
405 (.64)	398 (.61)	304 (.38)
Plan C (Wetlands Protection - D/L 435.5+NGVD + H.S.C. + L.S.C. + W.C.S.)		
405 (.64)	398 (.62)	304 (.49)
Plan C (Wetlands Protection - D/L 435.5+NGVD + H.S.C. + L.S.C. + W.C.S. + Pumps)		
405 (.64)	398 (.62)	304 (.49)
Plan C (Wetlands Protection - D/L 435.5+NGVD + H.S.C. + L.S.C. + W.C.S. + Pumps + Dredge Cut)		
405 (.64)	398 (.62)	304 (.49)

* Includes only the mussel habitat acres within the Illinois Department of Natural Resources - Backwater where mussels currently exist.

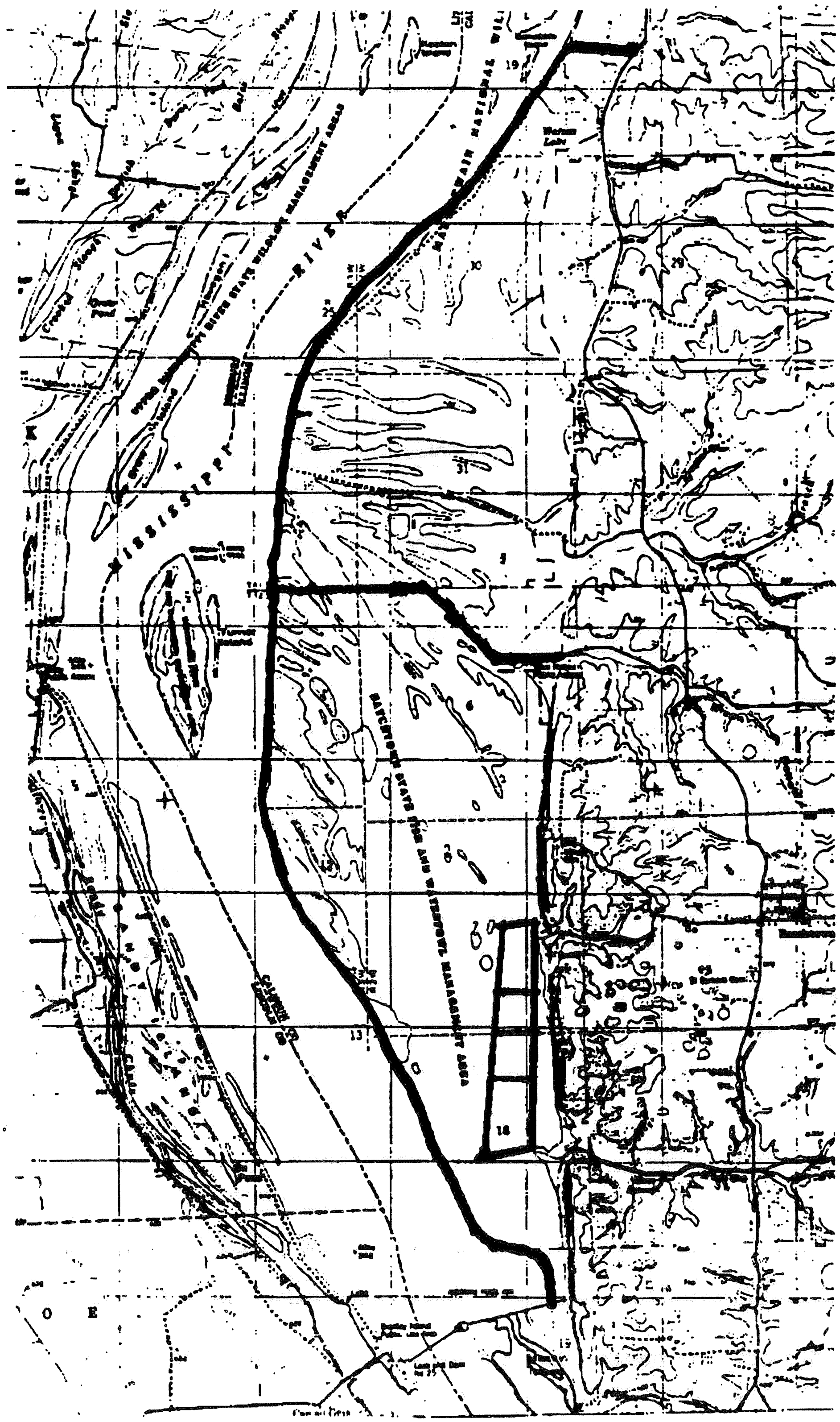

Figure B-5. Freshwater Mussel Habitat Appraisal Model Sample Location.

MEMORANDUM FOR RECORD

SUBJECT: EVALUATION OF MUSSEL HABITAT IN THE BATCHTOWN PROJECT AREA, UPPER MISSISSIPPI RIVER JUST ABOVE L&D 25.

FROM: ~~BARRY PAYNE~~, CEWES-ER-A BP 6Aug92

TO: T. MILLER, CMS-PD-AE

1. This memorandum summarizes the results field assistance provided on 9 July 1992 in response to a recent WOTS. A WES Habitat Suitability Index (HSI) model (enclosure 1) developed for riverine mussel communities is applied to the Batchtown habitat improvement project.

2. This HSI model is based on studies of prominent mussel beds of commercial and ecological value in sandy gravel or gravelly sand shoals of the Mississippi, Ohio, Tennessee, and Cumberland rivers. The model depends on eight habitat variables:

Physical conditions(Cp):

V1 Water current velocity
V2 Sediment particle type
V3 Sediment stability
V4 Deposited sediment annually retained
V5 Minimum depth
V6 Maximum sustained temperature

Water quality conditions (Cwq):

V7 Minimum sustained dissolved oxygen
V8 Calcium hardness

The model weights variables according to the following formulae:

$$Cp = (V1 + 2(V2) + 2(V3) + V4 + V5 + V6) / 8$$

$$Cwq = (V7 + V8) / 2$$

$$HSI = (2Cp + Cwq) / 3$$

For application to the silt/clay back channel at the Batchtown site, it is apparent that deposited sediment annually retained is of great importance with respect to mussel habitat quality, and that sediment stability is of less concern than for the sandy/gravelly shoals upon which the original model was based. Thus, revision of the model for Batchtown is as follows:

$$Cp = (V1+ 2V2 + V3 + 2V4 + V5 + V6) / 8$$

$$Cwq + (V7 + V8) / 2$$

$$HSI = (2Cp + Cwq) / 3$$

Figure B-6. Mussel Habitat Appraisal Guide "Matrix" (Page 1 of 5).

2. The model is applied to conditions at the end of the fifty year project life for two alternatives: no project and project alternative C (see enclosure 2). Water quality conditions (Cwq) are assumed to be ideal. The upper Mississippi River is suitably hard to support mussels (it has one of the richest faunas on this planet) and dissolved oxygen availability is high. Precise quantitative prediction of physical conditions (Cp) fifty years hence is not possible, but a qualitative assessment of relative conditions under the two future conditions is made to apply the HSI model. In addition, the model is applied to existing conditions to provide a reference.

3. The following summarizes application of the HSI model to existing conditions:

a. Existing conditions for mussels were evaluated based on field measurements of depth, velocity, and substrate conditions on 9 July 1992 during pool conditions. These measurements were made at three locations (mid-channel plus right and left descending bank) along 5 transects spanning the back channel that presently supports a substantial mussel community. At pool condition, this channel is shallow with slowly flowing water. Sediments are clay and silt. Maximum depth of this back channel ranges from 4 to 7 feet among the five transects. Current velocity at 1 m depth ranges from 0 cm per second to 15 cm per second, and averaged 6 cm per second. Substrate is generally clay and silt with a very small fraction (<5 %) of sand. Approximately 50 % of all sediments are mucky clay and silt, the other 50 % are firmer but nonetheless almost entirely clay and silt.

b. Lee (enclosure 3) estimates that the present sedimentation rate, averaged for the entire Batchtown project area, is approximately 0.77 inches per year. It is not known what the sedimentation rate is within the back channel supporting the existing mussel bed. To apply the HSI model, Lee's average rate is used.

c. Based on this information, SI's per habitat variable are as follows:

variable	SI	notes
V1	0.6	some areas with no measurable velocity during pool conditions
V2	0.1	clay and silt not preferred by most unionid species of the upper Mississippi River

Figure B-6. Mussel Habitat Appraisal Guide "Matrix" (Page 2 of 5).

V3	0.5	velocities reach 2 ft/sec during higher flows, and silt and clays, be scoured in some locations
V4	0.25	annual deposition of clay and silt is 0.77 inches/year
V5	1.0	minimum depth in back channel is generally greater than 1 foot
V6	1.0	high summer temperatures are within the range of thermal adaptation of unionids
V7	1.0	dissolved oxygen is high
V8	1.0	Mississippi River water is sufficiently hard to support mussels

d. Thus, estimation of HSI is as follows:

$$Cp = (0.6 + 2(0.1) + 0.5 + 2(0.2) + 1.0 + 1.0) / 8$$
$$= 0.46$$
$$Cwq = (1.0 + 1.0) / 2$$
$$= 1.0$$
$$HSI = (2(0.53) + 1.0) / 3$$
$$= 0.64$$

e. This HSI indicates moderately good existing habitat for riverine mussels and is consistent with the observations by Atwood (enclosure 4) of a moderately dense but not speciose fauna heavily dominated by the impoundment tolerant three ridge mussel, Amblema plicata plicata.

4. The following summarizes application of the HSI model to a without project condition fifty years from now:

a. It is assumed that secondary channels, including the back channel presently supporting mussels, will be largely filled by sedimentation (see enclosure 2) Conversion of the permanent, slowly flowing channel to impermanent aquatic or exceptionally shallow and nonflowing permanent aquatic habitat 50 years hence will make this area essentially unsuitable for mussels. A 50 year-projection of conditions suggests that SI values are as follows:

variable	SI	notes
V1	0.0	ambient velocity during pool conditions will be diminished by reduced discharge throught the filled back channels
V2	0.0	deep deposits of silt and clay will

Figure B-6. Mussel Habitat Appraisal Guide "Matrix" (Page 3 of 5).

		dominate the area
V3	0.0	mucky deposits of silt and clay will not be stable if exposed to flow
V4	0.2	sediment annually retained will remain high
V5	0.1	where permanent aquatic habitat remains it will be shallow with respect to mussels' requirements
V6	0.1	Solar insolation will increase maximum sustained temperature in shallow, nonflowing water
V7	0.1	Shallow, nonflowing aquatic habitat will be subject to large diurnal fluctuations in dissolved oxygen
V8	1.0	Water will still be moderately hard

b. Thus, the estimated HSI is as follows:

$$Cp = (0.0 + 2(0.0) + 0.0 + 2(0.2) + 0.1 + 0.1) /8$$

$$= 0.08$$

$$Cwq = (0.1 + 1.0) / 2$$

$$= 0.55$$

$$HSI = 0.24$$

c. This low HSI indicates a poor future for mussel habitat under a no project condition.

5. The following summarizes application of the HSI model to project alternative C, fifty years from the present:

a. Conditions respect to mussel habitat in the back channel are predicted to be intermediate between present conditions and the unsuitable conditions predicted for the without project alternative. The channel will remain relatively shallow, slow-flowing, and lined by silt and clay. External levees should prevent much bedload transport of sand into the back channel, thereby slowing the rate at which this channel is filled. However, precise spatial patterns of sediment deposition with respect the present mussel bed location are uncertain. Depositional patterns will attain a new equilibrium in reponse to structural modification of this river reach.

b. Predicted SIs' per habitat variable are as follows:

Variable	SI	Notes
V1	0.3	The "design velocity" during pool conditions should be sufficient for mussel, but uncertiantly exists as to the precise spatial pattern of currents with respect to the existing mussel bed.

Figure B-6. Mussel Habitat Appraisal Guide "Matrix" (Page 4 of 5).

V2	0.1	Silt and clay is still likely to be the dominant substrate for mussels
V3	0.5	Stability of silt and clay during high flow will still be low
V4	0.4	Annual deposition of silt and clay should be decreased by sediment control structures
V5	0.3	Minimum depth will decrease as the Batchtown area continues to fill despite structural manipulations to slow the rate of sediment accumulation
V6	0.6	Susceptibility to solar heating will be increased by a greater percentage of shallow habitat 50 years.
V7	0.6	Increase in shallow habitat should increase occurrence, diurnally, of low dissolved oxygen conditions.
V8	1.0	Water will remain suitably hard for mussels

c. Thus, estimation of HSI is as follows:

Cp = (0.3 + 2(0.1) + 0.5 + 2(0.4) + 0.3 + 0.6) / 8

= 0.34

Cwq = (0.6 + 1.0) / 2

= 0.8

HSI = 0.49

d. This HSI reflects expected decline in the condition of mussel habitat in relation to present conditions, but indicates that the decline should be less than without project alternative C in place.

6. If you have any questions concerning this evaluation, please call me at 601-634-3837.

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Figure B-6. Mussel Habitat Appraisal Guide "Matrix" (Page 5 of 5).

4. DISCUSSION.

Table B-14 shows the incremental effects of the various study options on the freshwater mussels. Plan A shows habitat degradation as it relates to flow needed to maintain a viable mussel population. Plan B takes the needs of the mussels into account although operation and maintenance costs were judged to be prohibitive for the levied management unit in the state backwater part of the project. Under Plan C, the placement of the various components results in modest habitat improvement gains for freshwater mussels. The major contributors to these gains are the exterior levee, water control structures, hillside sediment control and lowland sediment control, respectively. A more detailed analysis of the incremental effects of the component measures of Plan C are provided in the alternative discussions of the DPR main report.

5. CONCLUSION.

The selected plan as shown in Table B-16 provides modest benefits to freshwater mussels.

Table B-14. Habitat Suitability Index Analysis, Freshwater Mussels - IDNR-B *

Plan F (Future Without)					
1992		1994		2042	
Acres	HSI	Acres	HSI	Acres	HSI
405	(.64)	395	(.62)	142	(.24)
Plan A (Partial Wetlands Protection)					
405	(.64)	398	(.61)	206	(.24)
Plan B (Partial Backwater Protection)					
405	(.64)	398	(.64)	216	(.64)
Plan C (Wetlands Protection - Dike/Levee 434.0+ NGVD)					
405	(.64)	395	(.62)	200	(.24)
Plan C (Wetlands Protection - Dike/Levee 435.5+ NGVD)					
405	(.64)	398	(.61)	304	(.35)
Plan C (Wetlands Protection - Dike/Levee 437.0+NGVD)					
405	(.64)	398	(.61)	306	(.35)
Plan C (Wetlands Protection - D/L 435.5+ NGVD + H.S.C.)					
405	(.64)	398	(.61)	304	(.37)
Plan C (Wetlands Protection - D/L 435.5+ NGVD + H.S.C. + L.S.C.)					
405	(.64)	398	(.61)	304	(.38)
Plan C (Wetlands Protection - D/L 435.5+NGVD + H.S.C. + L.S.C. + W.C.S.)					
405	(.64)	398	(.62)	304	(.49)
Plan C (Wetlands Protection - D/L 435.5+NGVD + H.S.C. + L.S.C. + W.C.S. + Pumps)					
405	(.64)	398	(.62)	304	(.49)
Plan C (Wetlands Protection - D/L 435.5+NGVD + H.S.C. + L.S.C. + W.C.S. + Pumps + Dredge Cut)					
405	(.64)	398	(.62)	304	(.49)

* Includes only the mussel habitat acres within the Illinois Department of Natural Resources - Backwater where mussels currently exist.

Table B-15. Annualized Freshwater Mussel Habitat Units for Plan C.
Incremental components - IDNR-B*

Alternative	FW	FWO	NET	Potential AAHU Contribution
Dike/Levee				
434.0 NGVD	151	144	7	+7
435.5 NGVD	178	144	34	+34
437.0 NGVD	178	144	34	+34
Hillside Sediment Control (+D/L)				
435.5 NGVD	181	144	37	+3
Lowland Sediment Control (+D/L + HSC)				
435.5 NGVD	182	144	38	+1
Water Control Structures (+D/L + HSC + LSC)				
435.5 NGVD	200	144	56	+18
Pumps (+D/L + HSC + LSC + WCS)				
435.5 NGVD	200	144	56	+0
Dredge Cut (+D/L + HSC + LSC + WCS + Pumps)				
435.5 NGVD	200	144	56	+0

* Illinois Department of Natural Resources - Backwater

Table B-16. Annualized Freshwater Mussel Habitat Units.

Plan Comparisons - IDNR-B*

Alternative	FW	FWO	NET
Plan A	150	144	6
Plan B	199	144	55
Plan C	200	144	56

* Illinois Department of Natural Resources - Backwater

APPENDIX C

SECTION 404(b)(1) EVALUATION REPORT ON THE EFFECTS OF THE DISCHARGE OF DREDGED OR FILL MATERIAL INTO WATERS OF THE UNITED STATES

BATCHTOWN HABITAT REHABILITATION AND ENHANCEMENT PROJECT POOL 25, MISSISSIPPI RIVER, CALHOUN COUNTY, ILLINOIS

UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM

I. PURPOSE OF THIS EVALUATION

The proposed habitat rehabilitation and enhancement project at Batchtown, Pool 25, Mississippi River, Calhoun County, Illinois, will involve placement of dredged and fill materials into waters of the United States. Discharges of dredged or fill material into such waters are regulated under Section 404 of the Clean Water Act.

Under Section 404(b) of the Act, proposed discharges of dredged or fill material must conform to guidelines developed by the U. S. Environmental Protection Agency. On 5 September 1975, the Environmental Protection Agency published regulations (40 CFR 230) which outline criteria and procedures for evaluating activities subject to Section 404. On 24 December 1980, revised Section 404(b)(1) guidelines were published, and became effective 30 March 1981. It is mandatory that the guidelines be applied to all proposed discharges of dredged or fill material subject to approval under Section 404. This evaluation will address proposed discharges of dredged and fill material required for the habitat rehabilitation and enhancement at Batchtown.

On 25 August 1993 the final "Excavation Rule" was published (33 CFR Parts 323 and 328), and became effective on 24 September 1993. This regulation modifies the definition of "discharge of dredged material," which now means any addition of dredged material into, including any redeposit of dredged material within, the waters of the United States. The term includes, but is not limited to, a) the addition of dredged material to a specified discharge site located in waters of the United States; b) the runoff or overflow from a contained land or water disposal area; and c) any addition, including any redeposit, of dredged material, including excavated material, into waters of the United States which is incidental to any activity, including mechanized landclearing, ditching, channelization, or other excavation.

II. PROJECT DESCRIPTION

a. Location - The Batchtown project area is located in Calhoun County, Illinois, adjacent to the Mississippi River and just west of the Village of Batchtown. The 3,327-acre area lies in the floodplain of the river. Approximately one-third (989 acres) of the project area is bottomland forest, and approximately one-half (1,534 acres) is non-forested wetlands, with the majority of the remainder being cropland (224 acres). Approximately 1407 acres is part of the Batchtown Unit of Mark Twain National Fish and Wildlife Refuge, the remaining 1920 acres is managed by the Illinois Department of Natural Resources as part of the Mississippi River Fish and Wildlife Area.

b. General Description

(1) Area Subject to Section 404 Jurisdiction - Much of the project area is considered to be a water of the United States, and therefore subject to Section 404 review requirements. This is because most of the project area is below the management level for Pool 25 of 434.0. Dam 25 is located at the lower end of the project area and will be modified to include a water control structure that will assist in maintaining water flows within the project area.

Areas classified as wetland according to COE (1987) exhibit positive evidence of wetland soils, wetland vegetation, and wetland hydrology. The Beaucoup-Tice Association consists of soils in the Mississippi River flood plain. This association is poorly drained to somewhat poorly drained, nearly level, silty soils formed in alluvium. This association covers the entire project area. The predominant soil types are: Beaucoup silty clay loam - wet, which is subject to annual flooding and ponding; Beaucoup silty clay loam, also subject to annual flooding and ponding but on slightly higher elevations; Sarpy sand, subject to frequent flooding and having little or no profile. These three soil types combined cover over 80 percent of the project area and are the primary soils in the lower, state managed portion.

The Tice soils, which comprise the remainder of the project area, are somewhat poorly drained, located on slightly higher elevations, have high water tables, may be subject to flooding on an annual basis, but are suitable for cropland. For Calhoun County, all of the Beaucoup, Beaucoup wet, and Sarpy mapping units are considered hydric or wetland soils, whereas only inclusions of Beaucoup within the Tice unit are hydric. Overall, 3103 acres of the project area is considered wetland, with 144 acres of the remaining 224 acres of cropland classified as prior converted farmland.

(2) <u>Proposed Project Features - Recommended Plan</u> - The proposed project consists of the following features.

(a) Riverside dike/levee. A 35,500-foot (6.7-mile) long riverside dike/levee forming a closed system, with a Mississippi River downstream tie-in elevation of 435.5 NGVD, tapering in the upstream direction to 436.5 NGVD at the levee tie-in at the upper end of the project area. The levee will vary in height from 0 to 6 feet, will have 1 on 3 side slopes, a 10-foot wide crown, and rock placed on the crown as a road bedding. The levee includes rock covered overflow structures (elevation 434.0 NGVD), four totaling 700 feet long (FWS Middle Pool) and one 1500 feet long (State managed area, near Dam 25). Rip-rap protection, either on or off shore, will be provided at locations where sideslopes are vulnerable to erosion. The levee will permit enhanced interior water control for all of the management units, and will also serve to safeguard the loss of habitat to river sedimentation.

(b) Water Control Facilities.

(i) USFWS Middle Pool. An eight foot wide concrete stop-log structure will be located in the levee toward the upper end of the pool to allow water to be added to this management unit when water levels in the river and pool are compatible for this management practice.

The extreme southwest part of the management unit has three facilities to assist with water level management: an existing 44 cfs pump, an eight foot wide concrete stop-log structure and an overflow structure.

The pump is currently used to assist in flooding the area after the summer drawdown to establish moist soil plants and will continue to be used for this purpose.

The stop-log structure will allow the passage of fish when the river and the management unit have at or close to the same water levels. The placement of stop-logs into the structure will allow managers to maintain the water level in the management unit at various levels when the river drops below the managed pool level or rises to a level below the point where the exterior levee is over-topped.

The overflow structures, which are armored with rock, allows the in-flow of water from the river at a controlled point when the river raises because of flood events. The structure allows the water levels to equalize thus preventing damage to the levee from over-topping.

(ii) USFWS Lower Pool. There are four water level management facilities associated with this management unit:

A 50 foot wide rocked overflow structure over the access road that serves as the north levee of this unit allows water to flow between the Middle Pool and the Lower Pool when Pool 25 water levels exceed 435.5 (NGVD) Flow could be in either direction depending upon how fast the river might be raising and to what level.

A 15 cfs pump will be located on the river and will allow flooding of the unit when it is not possible to flood by gravity flow.

There is an existing 36-inch CMP with gate through a sediment control levee around the perimeter of an agriculture field at the east end of this unit.

Finally, there is an eight foot wide concrete stop-log structure in the lower interior levee. The stop-log structure will allow fish passage between the Lower Pool and the state-managed area and will allow water flow to assist with water level control between these two management units.

(iii) IDNR Managed Area. There are several water control facilities in this management unit in addition to those shared with the Lower Pool as described in (ii), above:

Two eight foot concrete stop-log structure will be located in the perimeter levee at the entrance to the 70's channel to allow fish passage and maintain water flow down this side channel.

Four eight foot concrete stop-log structures will be located in the perimeter levee at the entrance to the 40's channel to allow fish passage and maintain water flow down this side channel.

A 90 cfs pump will also be located in this vicinity to assist in raising the water level in this unit if gravity flow is not possible.

The lower portion of the state managed area will have four concrete stop-log structures to allow fish and water passage and an overflow structure to allow water levels in the unit and the river to equalize when the river is high due to flood events. There will be two 54-inch concrete pipes with gates through the east end of Dam 25 that can be used to lower the water level in this management unit and to assist in maintaining water flow over the mussel bed in the combined side channel off-shore of Cockrell Hollow.

(iv) Turner Island. A 36-inch cmp with gate is already in place on Turner Island to assist with water level management in the interior backwater. A six cfs pump will be added to allow flooding of the area as part of the water level management regime. A boat pull-over will be added to facilitate access to the interior backwater.

(c) Perimeter Levee Protection. The perimeter levee along the state managed portion of the project will be protected where necessary and feasible by revetment.

(d) Lowland Sediment Control. Two lowland sediment traps will be constructed to reduce the amount of sediment that is impacting all of the management units adjacent to the uplands. The FWS Middle Management Unit would have a sediment trap along the eastern edge of the project area to intercept run-off from portions of five watersheds. Currently, this unit receives approximately 13% of all hillside sediment going into the project area. 7,200 linear feet of levee at elevation 441.0 would be required. Construction of this sediment trap would require the purchase of approximately 41 acres of private land. The second sediment trap would be in conjunction with an existing sediment trap that receives the sediment from Turner Branch which contributes approximately 25% of the total hillside sediment to the project area. A portion of the levee of the existing trap would be used in addition to 2,600 linear feet of new levee at elevation 440.5, to receive sediment from Dixon Hollow which contributes approximately 11% of the total hillside sediment entering the project area.

(e) Dredging. Portions of all of the management units except Turner Island will require dredging of shallow water areas to facilitate dewatering, water flow, fish access and overwintering areas for fish. Clam shell dredging is the method felt to be most cost effective, with the dredged material side cast adjacent to the dredged area and used to form islands staggered on opposite sides of the dredged area where possible. All excavated materials would remain inside the perimeter levee. All islands would be shaped and seeded and would provide habitat diversity for aquatic species and nesting, feeding and loafing areas for resident and migratory wildlife.

The dredge cut through the FWS Middle Pool will connect the upper and lower water control structures in the perimeter levee. Approximately 98,800 cubic yards of material will be excavated, creating about 40 acres of islands.

Another dredge cut will connect the area in the FWS Lower Pool known as "Big Hole" to the stoplog structure in the interior levee separating this pool from the state-managed portion of the project area. The cut will continue into the state area to the 70's channel. Approximately 42,600 cubic yards of material will be excavated and used to raise the natural levee between the two management areas or to create islands.

Another dredge cut will be at the lower end of the project area perpendicular to the spillway area of Dam 25 and connecting the water control structure through the dam with the side channel flowing through the state area. Approximately 35,600 cubic yards of material will be excavated and used to form a seepage berm about 1000 feet from the excavated area.

(f) Bottomland Forest Enhancement Plan. Approximately 100 total acres of hard mast trees will be planted in the project area in the state managed portion. Part of these trees will be hand planted as seedlings from two gallon containers and part as seedlings planted with a tree planter. These plantings will be grouped in areas one to two acres in size with survival facilitated by the use of spot herbicide applications at planting and for two years thereafter. Seedlings will be released once, after eleven years, through vegetative manipulation.

c. Authority and Purpose - Public Law (PL) 95-502 authorized the construction of a new dam and 1,200-foot lock at Alton, Illinois, and directed the Upper Mississippi River Basin Commission to prepare a Comprehensive Master Plan for the Management of the Upper Mississippi River System. The Basin Commission completed the Master Plan report and submitted it to Congress on 1 January 1982. The report recommended an environmental management program that included construction of habitat rehabilitation and enhancement projects.

The 1985 Supplemental Appropriations Bill (PL 99-88), signed into law by President Reagan on 15 August 1985, provided initial authorization and appropriations for an environmental management program for the Upper Mississippi River System. A more comprehensive authorization was later provided by the Water Resources Development Act of 1986 (PL 99-662).

d. General Description of Dredged or Fill Material

(1) General Characteristics of Material (grain size, soil type)

(a) Fill Material - Fill materials include rock (quarry run limestone consisting of graded B stone, graded C stone, revetment C stone, 30" riprap, 3" minus stone, 6" minus stone, 9" bedding material, crushed stone), concrete, and earthen material (silts and clays).

(b) Dredged Material - Dredged material is defined as material that is either dredged or excavated from waters of the United States. Earthen material consisting of alluvial silts and clays will be mechanically dredged and excavated.

(2) Quantity of Material - The following quantities of materials will be handled:

Riverside dike/levee		
FWS Middle Pool		
earthen material	4,100	cubic yards
FWS Lower Pool		
earthen material	2,410	cubic yards
IDNR Backwater		
earthen material	24,000	cubic yards
Water control facilities		
FWS Middle Pool		
excavation/fill	900	cubic yards
concrete	110	cubic yards
6" minus stone	675	tons
3" minus stone	220	tons
FWS Lower Pool		
channel excavation	9,400	cubic yards
excavation/fill	450	cubic yards
concrete	55	cubic yards
6" minus stone	125	cubic yards
3" minus stone	95	cubic yards
State Managed Area		
excavation/fill	2,375	cubic yards
concrete	415	cubic yards
6" minus stone	1,050	tons
3" minus stone	400	tons
"C" stone	1,180	tons
Turner Island		
Interior levees		
FWS/IDNR		
earthen material	600	cubic yards
FWS/FWS		
earthen material	3,340	cubic yards
Pump Stations		
IDNR/backwater 90 cfs		
excavation/fill	230	cubic yards
concrete	5	cubic yards
bedding stone	400	tons
riprap	900	tons
FWS/Middle-Lower 15 cfs		
excavation/fill	200	cubic yards
concrete	5	cubic yards
bedding stone	240	tons
riprap	540	tons
IDNR/Turner Island 6 cfs		
excavation/fill	200	cubic yards
concrete	4	cubic yards
bedding stone	100	tons
riprap	200	tons
Middle Pool dredging		
sediment	98,800	cubic yards
Lower Pool/State Area dredging		
sediment	42,600	cubic yards
State Area dredging		
sediment	35,600	cubic yards
Overflow Structures		
FWS Middle Pool		
grade "B" stone	780	tons
IDNR Backwater		
grade "B" stone	2670	tons
Boat Pullovers		
IDNR Backwater		
grade "C" stone	170	tons
IDNR Turner Island		
grade "C" stone	170	tons

(3) Source of Material - Stone used for the project will be obtained from commercial stone quarries in the vicinity of the project area. Concrete will be obtained commercially. Earthen material will be obtained from onsite.

e. Description of the Proposed Discharge Sites

(1) Location - The location of the proposed features and work is shown in FIGURE 17 and design plates 1. Dredge material will be used to create islands in the middle pool, levees in the lower pool and a seepage berm in the state managed area. All discharge areas will be contained by the perimeter levee.

(2) Size (acres) and Types of Habitat - Construction of the riverside dike/levee will require clearing and grubbing of 61.2 acres. Some of this clearing will occur in bottomland forest to accommodate the footprint of the levee, the remainder will be spot clearing to fill low areas to the necessary levee elevation. Disposal of mechanically dredged sediment from FWS Middle Pool will impact 40 acres of wetland but will be side cast to form islands and create habitat diversity. Dredged material from the FWS Lower Pool will be used to form part of the interior levee and the lowland sediment control levee any remaining will be used to create islands. Dredged material from the State Managed Area will be used to form a seepage berm. Excavation to provide drainage approach channels will affect about 4 acres of shallow water habitat.

(3) Type of Site (confined, unconfined, open water)

(a) Permanent Deposits of Dredged and Fill Material The construction sites for water control structures will be confined by excavation in these aquatic areas. The exterior and interior levee construction sites will be unconfined as will the deposit of dredged material to form islands, levees and the seepage berm.

(b) Temporary Deposits of Fill Materials - Excavation of areas where water control structures are to be built will require movement of earthen material to adjacent areas. This material will be returned to the excavation site after construction is complete.

(4) Timing and Duration of Discharge - Work to be performed will need to be accomplished during normal (nonflood) pool conditions (?). Depending on local weather and flooding conditions, the estimated duration of the construction period is about 36 months. Actual duration of discharges will only be a fraction of that time.

f. <u>Description of Disposal Method (clam shell)</u>
Sediment removed from aquatic areas will be dredged mechanically. Heavy equipment such as a backhoe will be used to excavate sites for water control structures and filling low spots in levees. A clam shell dredge will be used to construct some of the levees, seepage berm and islands.

III. FACTUAL DETERMINATIONS

a. Physical Substrate Determinations

(1) Substrate Elevation and Slope - Batchtown lies in the floodplain of the upper Mississippi River and consists of alluvial material. The floodplain area is relatively flat, with elevations ranging from about 429.5 up to 447 feet NGVD, but much of the area is below 434 NGVD. Much of the project site is sloped no greater than 1-2 percent.

(2) Sediment Type (grain size) - The soil survey for Calhoun County describes the soils within the project area as silt loams and silty clay loams. Sediments within the interior sloughs consist of fine silts, clays, and organics.

(3) Dredged/Fill Material Movement - Earthen and dredged material used for levee construction, and as backfill will be compacted. Stone used for the overflow area and as riprap on the exterior dike/levee has been sized to withstand the force of flood waters, and is not expected to move. Earthen material used for levees is subject to erosion but will be stabilized through the use of relatively flat sideslopes and revegetation measures.

(4) Physical Effects on Benthos (burial, changes in sediment type, etc.) - Benthos are found only in the aquatic portions of the project area. Construction of the water control structures will result in the burial and loss of some benthic organisms. Removal of sediment from aquatic areas for construction of drainage approach channels, deep water fish habitat and levees will also result in loss of benthic organisms. However, these areas are expected to be recolonized within one year, possibly with different assemblages of benthic organisms.

(5) Other Effects - No other effects are expected.

(6) Actions Taken to Minimize Impacts - The primary actions taken to avoid adverse effects on the substrate are designing stable slopes on structures, the use of immobile stone for constructing some structures (rather than earthen material), and revegetation measures to minimize erosion (lateral movement) of disposal areas.

b. Water Circulation, Fluctuation and Salinity Determinations

(1) Water

(a) Salinity - Not applicable.

(b) Water Chemistry - Mechanical dredging is not expected to release unacceptable levels of un-ionized ammonia to the water column at the point of removal or at the disposal site.

(c) Clarity - Elevated suspended sediment levels are expected to occur in localized areas in aquatic habitats during mechanical dredging. Likewise, slightly elevated suspended sediment levels can be expected in the Mississippi River during the excavation of sites for water control structures. Decreased water clarity is expected to be short-term at these sites.

(d) Color - No change is expected.

(e) Odor - The project is not expected to have an impact on water odors.

(f) Taste - The project is not expected to impact water taste.

(g) Dissolved Gas Levels - Construction activities associated with the project will have no significant adverse impact on dissolved gas levels.

(h) Nutrients - Some nutrients will be released to the water column during sediment removal; however, this will represent a temporary increase and is not considered significant.

(i) Eutrophication - The project is not expected to contribute toward eutrophication of the water column.

(j) Water Temperature - Temperatures are not expected to change.

(2) Current Patterns and Circulation

(a) Current Patterns and Flow - Small floods (those occurring once every two to three years) will be excluded from the project area by the exterior dike/levee. Overall, the project will slightly alter circulation and flow patterns, however, side channels will remain functional due to the placement of water control structures.

(b) Velocity - Small increases in current velocity of the Mississippi River is expected only during 2-3 year frequency floods when the exterior dike/levee is not overtopped. When the structure is overtopped, there should be no change in current velocity.

(c) Stratification - Stratification does not occur within the project area because of shallow depths.

(d) Hydrologic Regime - The project will not alter the hydrologic regime of Pool 25, but it may raise slightly the flood profiles of the Mississippi River.

(3) Normal Water Level Fluctuations (tides, river stage, etc.) - The project will not affect normal fluctuations in the elevation of Pool 25.

(4) Salinity Gradients - Not applicable.

(5) Actions Taken to Minimize Impacts - The riverside dike/levee will be constructed to a relatively low elevation (436.5 - 435.5 feet NGVD) so as to minimize the effect of the structure on flood heights. If mechanical dredging in aquatic areas causes unacceptably high levels of un-ionized ammonia during the summer months, then dredging will be postponed until the potential for this problem disappears.

c. Suspended Particulate/Turbidity Determinations

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site - Increases in suspended particulates and turbidity due to construction of water control structures are expected to be minimal because excavations will confine the construction sites, and the area within the excavation will be dewatered during the construction process. Such levels will be elevated locally in aquatic areas during mechanical dredging. The disposal areas for mechanically dredged material will have elevated levels of suspended particulates and turbidity, but this will be of short duration.

(2) Effects (degree and duration) on Chemical and Physical Properties of the Water Column - Mechanical dredging in aquatic areas has the greatest potential to adversely affect the water column.

(a) Light Penetration - Dredging is expected to give rise to reductions in light penetration that range from slight to moderate. These impacts should last up to several days once dredging is complete.

(b) Dissolved Oxygen - A short-term, localized decrease in dissolved oxygen (DO) levels is expected to occur during dredging.

(c) Toxic Metals and Organics - Results of the analysis of sediment samples for agricultural chemicals and metals indicated no detection of either parameter. The disturbance of sediments during project construction should have no significant impact.

(d) Pathogens - There is no reason to believe any pathogens exist in any of the proposed areas of construction.

(e) Aesthetics - Increased levels of suspended particulates and turbidity could be aesthetically unpleasant to the visiting public or people who live near the project area.

(f) Water Temperature - No short-term changes in water temperatures are expected to occur.

(3) Effects on Biota

(a) Primary Production, Photosynthesis - Minor short-term impacts to primary production and photosynthetic processes are expected to occur locally.

(b) Suspension/Filter Feeders - A localized, short-term, and minor reduction in benthos production due to increased suspended sediments is expected in aquatic areas.

(c) Sight Feeders - Impacts to sight-feeders associated with mechanical dredging are expected to be short-term and range from slight to moderate, depending on proximity to the disturbed area.

(4) Actions taken to Minimize Impacts - Actions to minimize impacts associated with suspended particulates and turbidity include excavation by mechanical means to allow particulate and turbidity levels to return to ambient conditions more quickly, compaction of earthen materials, and revegetation of disturbed terrestrial areas.

d. Contaminant Determinations - Sediment samples were analyzed for metals and agricultural chemicals, and results indicated that neither parameter was present.

e. Aquatic Ecosystem and Organism Determinations

(1) Effects on Plankton - Increased suspended sediments and turbidity levels associated with cleanout will adversely impact phytoplankton production. This impact will be short-term and last for the duration of elevated levels. In the long term, the project is expected to maintain and protect plankton production by preventing the conversion of aquatic habitat to terrestrial habitat due to sedimentation.

(2) Effects on Benthos - Benthic organisms in the immediate vicinity of open-water sites designated for the placement of earthen or dredged material probably will be lost due to burial. Loss of benthos will also occur as a result of mechanical dredging. Also in the long term, the project is expected to maintain and protect benthic production in the project area by preventing the conversion of aquatic habitat to

terrestrial habitat due to sedimentation.

(3) Effects on Nekton - The term "nekton" refers basically to larger, free-swimming aquatic organisms, such as fishes. Adverse impacts on sight-feeding fish due to hydraulic dredging are expected to be short-term and minor. In the long-term, the project is expected to maintain and protect fish habitat in the side channels by preventing the conversion of aquatic habitat to terrestrial habitat due to sedimentation and to provide protected, deep water overwintering habitat.

(4) Effects on Aquatic Food Web - Construction activities are expected to disrupt the aquatic food chain of the interior sloughs to a minor degree.

(5) Effects on Special Aquatic Sites

(a) Sanctuaries and Refuges - The project area is managed by the Illinois Department of Natural Resources and U.S. Fish and Wildlife Service as a waterfowl rest area and hunting area. The project is expected to benefit migratory and resident waterfowl, fisheries, and other wetland wildlife.

(b) Wetlands - The 3327-acre project area consists of about 3193 acres of wetlands subject to Section 404 of the Clean Water Act. The wetlands include about 989 acres of bottomland forest, 2101 acres of emergent and open water wetlands (interior sloughs), 13 acres of moist soil management and 90 acres of farmed wetland. The project area also includes 134 acres of prior-converted cropland, but this landcover type is not wetland.

About 61.5 acres of bottomland forest will be lost to construction activities, all of which is wetland. Mechanical dredging will deepen about 25 acres of shallow-water wetlands in the three management units other than Turner Island. Disposal sites for mechanically dredged sediment will directly affect about 13 acres of farmed wetland, and about 50 acres of nonforested wetland.

(c) Mud Flats - Under the current management, seasonal mud flats occur within the moist-soil management units during the summer months. The project will provide the capability to create mud flats in these sloughs on a more reliable basis.

(d) Vegetated Shallows - Vegetated shallows occur in the project area when moist-soil plants are mature and the moist-soil management unit is flooded in the fall. The project will increase the area of moist-soil plant production by about 1009 acres through the construction of water control structures and levees to allow a water management regime favoring moist-soil plants.

(e) Coral Reefs - Not applicable.

(f) Riffle and Pool Complexes - There are no riffle and pool complexes in the project area, although there is side channel habitat.

(6) Threatened and Endangered Species - The bald eagle, Indiana bat and decurrent false aster are Federally listed endangered or threatened species that may be found in the project area. There currently is no designated critical habitat in the project area. With the inclusion of efforts to eliminate adverse impacts on the bald eagle, Indiana bat and decurrent false aster the project will not adversely affect any of these species.

(7) Other Wildlife - Adverse impacts to wildlife habitat caused by construction activities include the loss of about 61.5 acres of bottomland forest and 4 acres of nonforested wetland. Vegetation clearing and other construction activities will destroy some wildlife, whereas other wildlife in the immediate vicinity will be displaced to adjacent areas.

The affected habitats will be replaced by 100 acres of bottomland forest enhancement created by tree planting on the forested portion of the state managed area. Mast tree species will be planted in clearings created in bottomland forest where trees have died due to the 1993 flood or where managers desire to establish hard mast tree species. Wetland wildlife, especially migrating waterfowl, will benefit from increases in habitat quality and quantity within the moist-soil management areas on all four management units.

(8) Actions to Minimize Impacts - Actions that will minimize impacts to the aquatic ecosystem and its organisms include the following. Mechanical dredging will be used instead of hydraulic dredging. Dredging will cease if un-ionized ammonia levels exceed state water quality standards, and will resume when the appropriate ambient temperatures are attained. Tree planting will occur in 100 acres of clearings created within bottomland forest. Contractors will be required to submit an environmental protection plan to include protection methods and procedures for avoiding landscape defacement, providing for water and air pollution prevention, for disposal of solid and chemical waste, and for protecting fish and wildlife resources. Government inspectors will oversee construction projects to ensure that personnel, equipment, and construction techniques meet all contract specifications, including environmental requirements.

f. Proposed Disposal Site Determinations

(1) Mixing Zone Determination - The discharges of fill

and dredged material will largely occur in aquatic areas, but will be used to create levees, seepage berms or islands for habitat diversity. The concentration of resuspended material associated with construction of water control structures will not be high enough to require a mixing zone.

(2) Determination of Compliance with Applicable Water Quality Standards - The project is expected to comply with applicable water quality standards. The District has coordinated with the Illinois Environmental Protection Agency (IEPA) in regard to water quality requirements for mechanical dredging, and has incorporated that agency's recommendations into the proposed project. A request for Section 401 water quality certification from the IEPA will be forthcoming.

(3) Potential Effects on Human Use Characteristics

(a) Municipal and Private Water Supply - No municipal water supply will be adversely impacted by project construction.

(b) Recreational and Commercial Fisheries - The proposed project is expected to improve winter and summer habitat conditions for fish, and thereby the likelihood of successful recreational fishing opportunities.

(c) Water Related Recreation - Water-related recreation (hunting, boating, fishing, etc.) is expected to be positively impacted by the project in the long-term. Certain opportunities may be unavailable during the construction period, such as boating within interior backwaters while dredging is in progress.

(d) Aesthetics - Construction activities will have minor impacts on the aesthetic quality of the project area during the duration of the work. The most visible activities will occur adjacent to the Mississippi River (construction of the riverside dike/levee and dredging in three management units). Most construction activities will not be visible except from the main channel of the Mississippi River.

(e) Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves - The project will not impact any of these resources.

g. Determination of Cumulative Effects on the Aquatic Ecosystem - The Environmental Management Program should have a positive impact on the Upper Mississippi River System. Other projects within the program have been examined in conjunction with the proposal at Batchtown in terms of cumulative effects of riverside levees on flood heights of the Mississippi River, and no cause for concern has been identified. No other work in the aquatic environment is proposed for the project area.

h. Determination of Secondary Effects on the Aquatic Ecosystem - No significant secondary impacts to the aquatic ecosystem have been identified.

IV. FINDINGS OF COMPLIANCE OR NON-COMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE

a. Adaptation of the Section 404(b)(1) Guidelines to this Evaluation - In our evaluation of discharges proposed in connection with the Batchtown Habitat Rehabilitation and Enhancement Project, the Environmental Protection Agency's Section 404(b)(1) Guidelines of 24 December 1980 were applied without significant adaptation.

b. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem - Because most of the project area is a water of the United States, the selection of non-wetland (upland) disposal sites was limited. Siting of dredging and disposal sites for mechanically dredged material included non-forested wetland and open water wetland. The alinement of the riverside dike/levee parallels the Mississippi River, and overlaps with nonwetland soil for about half of its length along the river.

c. Compliance with Applicable State Water Quality Standards - Water quality certification under Section 401 of the Clean Water Act has not been issued yet, but is anticipated.

d. Compliance with Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act - The proposed activities will not violate the toxic effluent standards of Section 307 of the Clean Water Act.

e. Compliance with Endangered Species Act of 1973 - The habitat rehabilitation project will not jeopardize the existence of Federally listed endangered or threatened species or their critical habitat. With the inclusion of measures to avoid adverse impacts, the project is unlikely to affect the Indiana bat, bald eagle or decurrent false aster.

f. Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972 - not applicable.

g. Findings of Significant Degradation of the Waters of the United States - The proposed project will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife would not be adversely affected in a significant manner. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic and economic values would not occur.

h. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem - All appropriate and practicable measures have been taken through application of procedures contained in Subpart H of the Guidelines to insure minimal adverse effects of the proposed discharges.

i. On the Basis of the Guidelines the Proposed Disposal Sites for the Discharge of Dredged and Fill Material - Based on this evaluation, the proposed work 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 aquatic ecosystem.

20 Aug 96
Date

Thomas J. Hodgini
Thomas J. Hodgini
Colonel, U.S. Army
District Engineer

Appendix D - Correspondence and Memos

Encl D-1	Letter on Oct. 23, 1991 to IDNR
Encl D-2	WOTS Request for Assistance, (Barry Payne's letter) with 14 enclosures describing Plans A and B.
Encl D-2	March 19, 1992 letter from IDNR to Col. Craig requiring accommodations be made for mussels and aquatic ecosystem.
Encl D-3	October 28, 1992 memo to T. Miller from Neil Booth subject: Batchtown Desirable Water Level Management Regime
Encl D-4	October 30, 1992 letter from Karen L. (K.L.) Drews- to T. Miller, subject: planned water management activities for the Middle and Lower Pools
Encl D-5	April 16, 1993 response from Corps to IDNR, recommending Plan C2.
Encl D-6	August 18, 1993 letter from IDNR to District Engineer, Col. Craig, encouraging us to reinstate the project in the DPR process.
Encl D-7	December 7, 1993 LOI from IDNR, agreeing with Plan C2 and attached water level management plan.
Encl D-8	Memo from WES on the Hydraulic and Biological Characteristics of the Batchtown Area.
Encl D-9	Payne's memo to record of 9 Nov 93
Encl D-10	Calhoun County Soil & Water Conservation District LOI for hillside sediment control features.
Encl D-11	Batchtown Sportsmen Club's pledge to support in the planning process.

Batchtown

October ~~18~~ 23, 1991

Plan Formulation Branch
Planning Division

Mr. Edward Hoffman
Division Head
Illinois Department of Conservation
524 South Second
Springfield, Illinois 62706

Dear Mr. Hoffman:

On October 7, 1991, an interagency meeting was held at Brussels, Illinois. The primary purpose of the meeting was to assess a newly proposed Plan C for the Batchtown Habitat Rehabilitation and Enhancement Project. Enclosure 1 provides a list of meeting attendees. Plan C was compared to the previous plan of choice--Plan B. Plan B would provide a gap in the riverside levee to introduce flowing water thru the site's interior. The state waterfowl management area would then be subdivided around this swale with two low profile ring levees. Plan C (originating from a discussion at the last UMRCC wildlife technical section meeting) would consist of enclosing the state area with a levee system tying-in at the south to the landside end of the L&D 25 spillway. Gated culverts would be placed thru the spillway structure, and along the upper and lower riverside sections of the peninsula levee. Stop-log structures would be placed next to each of the riverside water control structures.

New project information was presented at the meeting, and served as a background to subsequent plan comparisons and discussion. This along with some additional information is summarized below:

1. WES Analysis. On 14-15 August, WES staff members Dr. Tony Thomas, hydraulics expert, and Dr. Barry Payne, mussels expert, were invited to the St. Louis District to review and assess the Batchtown site. Their analysis included consideration of Plan B. Various vintage maps and photos, and an HEC model of the side channel, were furnished by the District. It was the conclusion of WES that the site has in the past, and will continue in the future, to rapidly convert from water to land habitat. The transformation will be complete within decades. It was also the conclusion of WES, that Plan B would be a reasonable attempt to preserve the site's mussels bed, since it would come close to maintaining the existing flow and sediment conditions.

Encl D-1a

2. IDOC Mussels Survey. A recent IDOC quantitative mussels survey indicated that mussels are distributed in a streak pattern along the main channel of the site's interior. The average bed density was about 4 mussels per square meter. Three small areas of higher bed density were found at the site. The area of highest density, was near Cockerill Hollow, with 17 mussels per square meter, representing more than 10 species. Due to a preponderance of younger-aged mussels in the sampling, it was concluded by IDOC that the bed has been heavily harvested. No endangered mussels were found, and the mussels present were dominant river species.

3. District/WES Conversations. Prior to quantitative analysis, it had been speculated that the Batchtown mussels bed was large, and of high density. In a September 23, 1991 phone conversation with Dr. Payne, Mr. Gates (St. Louis District, Planning Division) asked what might be considered a large bed of high density. Dr. Payne responded by indicating that no strict definition of a mussels bed exists. However, he felt that a large bed would be measured in miles long, and he felt that most Upper Mississippi River biologists would consider a high density bed as one with concentrations of mussels on the order of 40-100 mussels per square meter. Applying these criteria, the Batchtown bed may be best described as one of very low density, except for several small areas of low to moderate density. In a October 9, 1991 conversation between Mr. Gates and Dr. Andrew Miller (another WES mussels expert), Dr. Miller also agreed with this description of the bed, and added that in spite of its harvested condition, it is "not a valuable bed" and would consider the bed as "marginal". Plan C was discussed, he agreed with Dr. Payne that Plan B would be more conducive to mussels survival, and that future flow conditions would dictate the fate of the bed. Flow requirements for mussels were discussed. Dr. Miller indicated that mussels require a flow, but that they can withstand flows approaching zero, but more optimal flows would be in the range of .2 to 1.5 feet/second. Sediment deposition was discussed. While the highwater flows that create some periodic sweeping of silts from the mussels bed would be reduced, the presence of a levee barrier should reduce the total input of such sediments to the site.

4. Plan C HEC 2 Analysis. Since the October 7 meeting, the District has performed an HEC 2 analysis of summer water flow thru the site's interior channel. Enclosure 2 indicates that while maintaining a 2-foot drawdown on the interior, the flow rates in the main channel would be very low. 6-54" culverts would be required to create a flow of about 0.1 feet/second at Cockerill Hollow, a flow rate less than optimal for mussels.

However, 2-54" culverts has been found to be the maximum that can be placed in the overflow structure without jeopardizing the integrity of that structure. Thus, the maximum flow would be about 0.05 feet/second. At this rate of flow it is likely that the mussels would die out. Within channel dikes could enhance the flow conditions, but this represents one more layer of expensive site alterations. In view of the low value of the mussels bed, the inclusion of additional modifications seems questionable. The likelihood of success in such a highly engineered environment must also be questioned.

Mussels issue aside, the Enclosure 3 analysis shows that filling and drainage time using 3-48" culverts upstream with 2-54" culverts downstream appears to be reasonable.

5. Geotech Survey. The District has completed the soils and seepage analysis for Batchtown. The interior of the site has been determined to be relatively high in sand content. Because of this sand, the potential for seepage would be high, and the resulting pumping costs for watering and dewatering would also be high. In addition, under a significant head pressure, underseepage could lead to boils and possibly levee failure. The boil problem can be alleviated (using relief wells or a seepage berm), but would substantially increase project costs. This increase in costs would be most dramatic for the Plan B configuration.

6. Preliminary Construction Costs Analysis. The District has developed estimates of construction costs for two versions of Plan B, Plan B-1 (using pumps and pool-based gravity drains) and Plan B-2 (using a combination of tailwater and pool-based gravity drains, but no pumps), and Plan C. The cost of Plan B-1, excluding the costs for the refuge and Turner Island portions of the project, are $6 million for Plan B-1, and $8 million for Plan B-2, and $4 million for Plan C. Considering that the state managed area consists of only 600 acres of aquatic habitat, the viability of a $6-8 million dollar expenditure for Plan B is questionable. By comparison, Swan Lake provides protection to 3,000 aquatic acres at a cost of $7.5 million. Assuming a $2 million upgrade for the refuge and island, a $4 million Plan C expenditure for the state area seems more reasonable.

Encl D-1c

7. <u>Stage Hydrographs.</u> During the October 7 meeting, Bill Donels made a request for historical stage hydrograph data as an aid to interpreting waterfowl/fisheries management compatibilities. In particular, he was interested in river stages at the time of the proposed stop-log removal for fish passage during the fall waterfowl migration. Enclosure 4 provides that data. It would appear that for about 70 percent of the last 50 years, stop-logs could be removed for most of the November-December period, without adversely affecting desired water levels for waterfowl management.

A major portion of the meeting was devoted to a discussion of the effects of Plan B versus Plan C. The Enclosure 5 plans comparison was provided by the District. Enclosure 6 shows the basic components of each plan. It would appear that regardless of the plan selected, a with-project condition is preferable to a no project condition. In the absence of a project, the site will complete its water to land transformation with progressively fewer biological benefits. With a project, biological benefits are increased, although the specific nature of those benefits is plan specific. Plan B would provide better conditions for the mussels, while Plan C could result in the elimination of the bed. However, Plan C would provide a more long-term deepwater flow protected setting for wintering fish. Plan C may improve fish spawning conditions, by protecting the area from frequent and severe changes in spring river stages. Plan C would appear to yield greater benefits to waterfowl than Plan B.

Plan C would be the least costly alternative from both a construction and an O&M standpoint. With a tailwater drain, no summer season pumping should be required to deal with underseepage, and by managing at pool stage in the fall, the need for pumping is essentially eliminated.

It should be noted that the Corps has not yet fully explored the implementability of the Plan C concept. The placement of culverts thru the spillway appears to be engineeringly feasible; however, it may raise some policy concerns with those responsible for river navigation. If IDOC shows a strong interest in pursuing Plan C, this aspect will be explored further within the Corps.

Encl D-1d

It is clear from the above, that all of the management plans have trade-offs, and the act of managing an area places emphasis on one resource over another. To place the plans into perspective, consideration needs to be given to the objectives of the EMP program, and of the Batchtown site in particular. The intent of the overall EMP program is to provide environmental improvement to all resources, including waterfowl and fisheries. From a system-wide perspective, this is a worthwhile objective. However, the physical characteristics of the various HREP site locations differ, some are by nature more conducive to use as waterfowl areas or as fisheries areas as a primary management purpose. As reflected in the original IDOC project fact sheet, Batchtown was earmarked for waterfowl management as its primary purpose. It is the District's contention that waterfowl should be reflected in the project objectives as the primary site concern, and that fisheries' needs (including mussels) should be a secondary concern. This does not mean that fisheries' concerns should be ignored, but rather an attempt should be made to maintain, and if possible, to even enhance these values to the extent compatible with the primary purpose of waterfowl management. Enclosure 7 provides a list of primary and secondary goals and objectives developed at the meeting. Please note that based on the preceding discussion, some of these comparisons could be changed.

It is the District's opinion that in view of the high construction costs, potentially high O&M costs, and because of the marginal importance (low density and potentially short-term future life span) of the Batchtown mussels bed, the Plan B option should be dropped from further consideration. Because of its lower construction cost, potentially low O&M costs, its potential for improving conditions for wintering and spawning fish, its potential for reducing sedimentation to the entire site, and because of its ability to optimize benefits for waterfowl, Plan C is recommended as the preferred concept plan for future analysis. It appeared from the October 7 meeting, that waterfowl biologists had a high comfort level with the Plan C option, and that fisheries biologists, while having a lower comfort level, were at least indicating that they might be able to work within the confines of a Plan C option. Such a variation in comfort levels is understandable, and predictable, with an HREP project that focuses primarily on waterfowl and secondarily on fisheries.

Encl D-le

The intent of this letter is to obtain written concurrence from your agency on refocusing to Plan C as the selected project concept plan. However, it should be recognized that if Plan C is selected, it could meet with opposition from certain interest groups. In such an event, it would be critical that IDOC render its full support for the project, and speak of the plan from a unified singular Departmental position. The District requests your timely response to this action, so that future detailed engineering and environmental studies may proceed. If you have questions, please contact Mr. Dave Gates of our staff at telephone 314/331-8478

Sincerely,

Owen D. Dutt
Acting Chief, Planning Division

Enclosures

Copy Furnished:

Mr. Mike Bornstein
EMP Coordinator
U.S. Fish and Wildlife Service
Mark Twain National Wildlife Refuge
Route 2
Wapello, Iowa 62653

Mr. Bill Donels
Illinois Department of Conservation
Division Planning
524 South Second Street
Springfield, Illinois 62706

Mr. Greg Franke
Migratory Waterfowl Hunters
P.O. Box 175
Batchtown, Illinois 62006

Encl D-1f

DITCHTOWN HREP
7 OCT 91
BRUSSELS, IL.

ORGANIZATION	NAME
Corps - St. Louis	Dave Gates
~~IDOC~~	Neil Booth
U.S. Fish & Wildlife Ecological Services	Tim Santel
USFWS, Mark Twain NWR	K. LaDrews
USFWS- FISHERIES ASST. OFF.	- CHARLES SURPRENANT
USFWS, Mark Twain NWR	Jerry Olmsted
USFWS, Mark Twain NWR	Michael Bornstein
IDOC FISH. BIO	BUTCH ATWOOD
Corps - St. Louis Planning Div., Env. Br.	Tim George
IL.D.O.C.	Bill Donels
IL DOC	
IL DOC	Dave Harper
	Deck Major - Alton
Ill. DOC - Alton	Rick Messinger
Corps - St. Louis Geotech Branch	Lynda Kliewer
Corps - Geotech Branch	Pat Conroy
CORPS- Hydraulic Engineering	Dennis Stephens
USFWS, Mark Twain NWR - Brussels	Gordon Warrick
Corps - Civil Engg. Sect	John Poullain

ENCL 1

Encl D-1g

IBM-PC-XT VERSION AUGUST 1985
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BATCHTOWN MUSSELS STUDY
CELMS ED-HE STEPHENS
T3 BATCHTOWN SIDE CHANNEL /LEVEE IMPACTS / EXISTING

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q
	0.	5.	0.	0.	.000000	.00	.0	0.

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW
	15.000	.000	-1.000	.000	.000	.000	.000	.0

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18 OCT 91 8:40: 2.8

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HEC2 RELEASE DATED NOV 76 UPDATED MAY 1984
ERROR CORR - 01,02,03,04,05,06
MODIFICATION - 50,51,52,53,54,55,56
IBM-PC-XT VERSION AUGUST 1985
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY

BATCHTOWN SIDE CHANNEL

SUMMARY PRINTOUT

SECNO transect#	CWSEL Elevation	flow Q cfs	velocity mean VCH f/sec	culvert
1.000	432.00	180.00	.03	2-54"
1.000	432.00	270.00	.05	3-54"
1.000	432.00	360.00	.06	4-54"
1.000	432.00	540.00	.09	6-54"
2.000	432.00	180.00	.06	2-54"
2.000	432.00	270.00	.08	3-54"
2.000	432.00	360.00	.11	4-54"
2.000	432.00	540.00	.17	6-54"
3.000	432.00	180.00	.05	2-54"
3.000	432.00	270.00	.08	3-54"
3.000	432.00	360.00	.10	4-54"
3.000	432.01	540.00	.15	6-54"
4.000	432.00	180.00	.23	2-54"
4.000	432.01	270.00	.35	3-54"
4.000	432.01	360.00	.46	4-54"
4.000	432.03	540.00	.68	6-54"

Amount of Culverts restricted by L&D 25 overflow structURE.
2-54" is about the maximum amount of culverts that can be placed in the overflow structure

ENCL 2

Encl. D-1h

5.000	432.02	180.00	.42	2-54"
5.000	432.05	270.00	.62	3-54"
5.000	432.09	360.00	.81	4-54"
5.000	432.19	540.00	1.15	6-54"
6.000	432.06	180.00	.27	2-54"
6.000	432.12	270.00	.39	3-54"
6.000	432.20	360.00	.50	4-54"
6.000	432.40	540.00	.69	6-54"

1
18 OCT 91 8:40: 2.8

SUMMARY OF ERRORS AND SPECIAL NOTES

1
18 OCT 91 8:40: 4.1

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  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  IODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION AUGUST 1985
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ER

UNEXPECTED END OF FILE ABORT IN SUBROUTINE H2MAIN

BATCHTOWN 6/18/91

0.95 Average Velocity

Velocity Transect

TRANSECT LOCATIONS

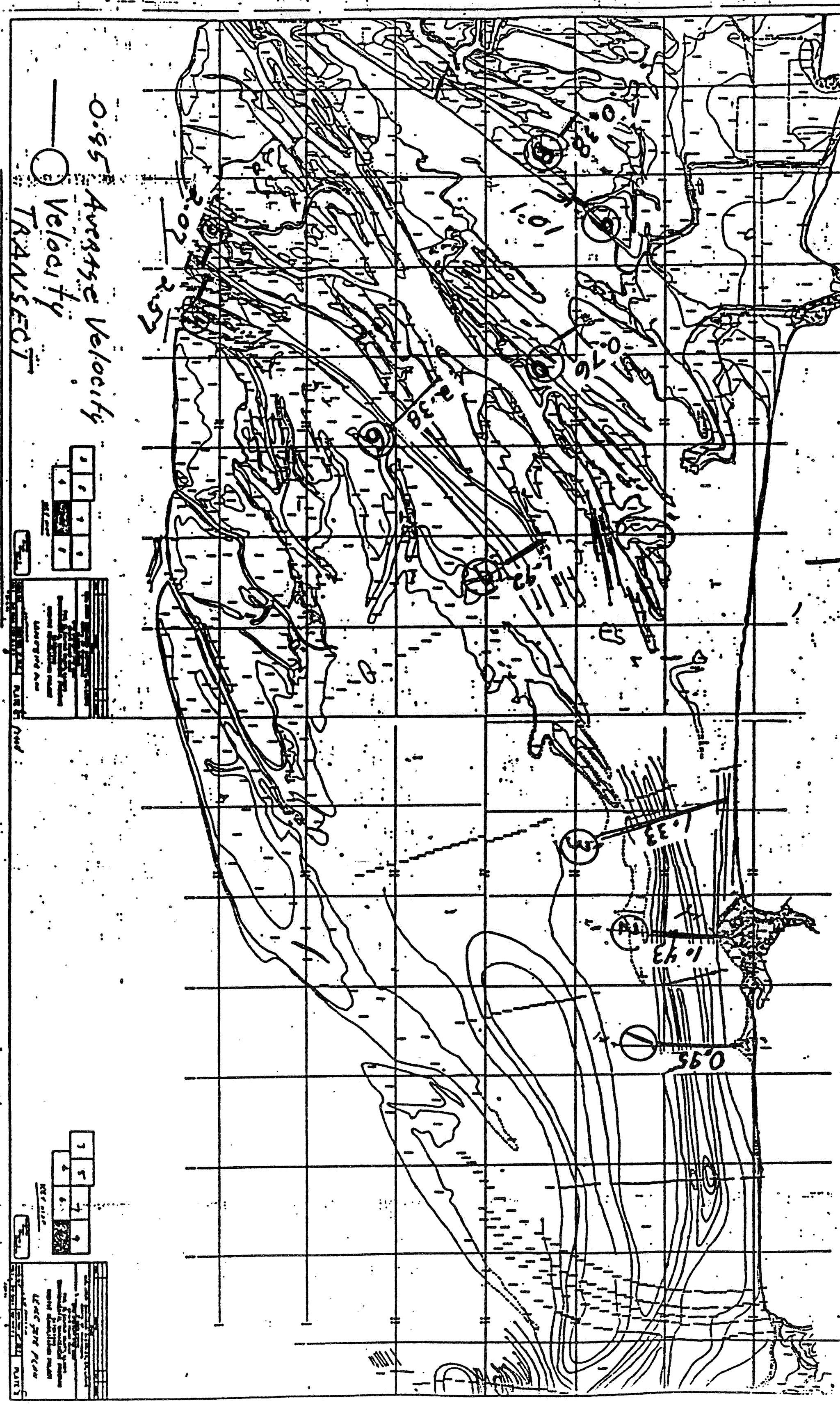


FIGURE 1

Encl D-1j

PROJECT Batchtown	Page _ of 4	COMPUTED BY DLS	DATE 10-18-9?
SUBJECT Number of Culverts San plan C		CHECKED BY	DATE

Culverts to drain Batchtown through LSD25

Days to lower Interior 2 feet w/o inflow 434' to 432'

Size	Q	Days
2-48"	150 cfs	19
3-48"	225 cfs	11
* 2-54"	180 cfs	15
3-54"	270 cfs	9

Culverts to drain through LSD25
Days to evacuate 2 year event at interior at 432' w/o inflow

Size	Q	Days
2-48"	150 cfs	8.6
3-48"	225 cfs	5
2-54"	180 cfs	6.5
3-54"	270 cfs	4

Culvert to fill Batchtown interior 2 feet
Assume exterior at 434, Interior at 432

Size	Q	Days
1-48"	60 cfs	38
2-48"	160 cfs	18
* 3-48"	240 cfs	14

LMV FORM 1 FEB 79 107e—R COMPUTATION SHEET

ENCL 3

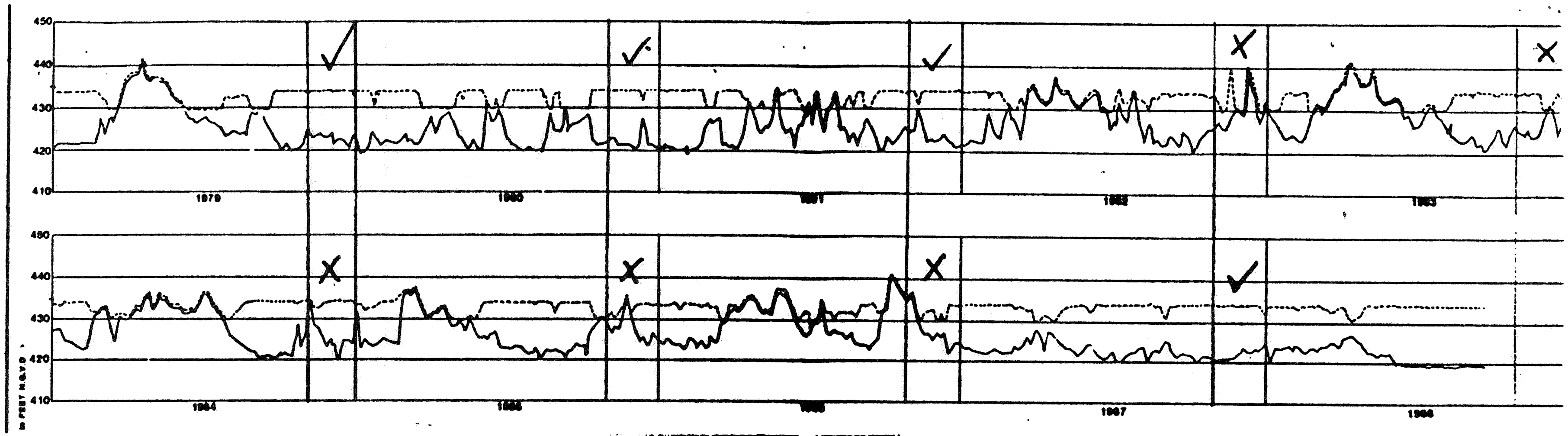
Encl D-1k

BILL

IT APPEARS THAT IN ABOUT 70% OF YEARS THAT THE STOP-LOG STRUCTURES COULD BE LEFT OPEN TO THE RIVER DURING THE LATE FALL/EARLY WINTER PERIOD FOR FISH WINTERING. THE UPPER OF THE TWO LINES ON THE HYDROGRAPH REFERS TO POOL 25 STAGES.

ENCL 4

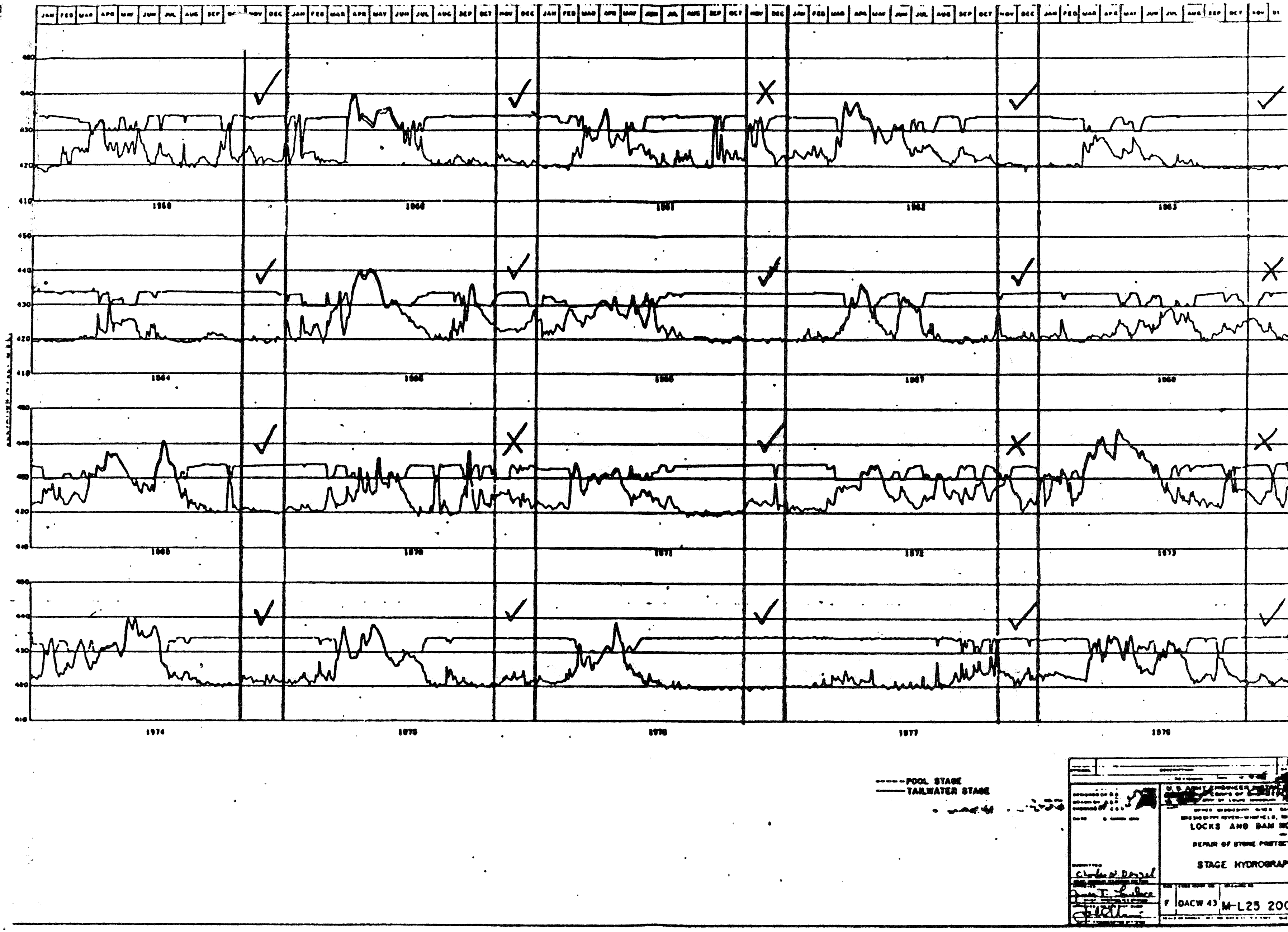
Encl D-1L



✓ = >75% OF NOV-DEC TIMEFRAME WITH STABLE WATER CONDITIONS + GATES OPEN FOR WINTERING FISH ACCESS TO INTERIOR

X = < 75% WINDOW, BECAUSE OF ERRATIC RIVER STAGE CONDITIONS (GATES CLOSED FOR GREATER LENGTH OF TIME

Encl D-1a



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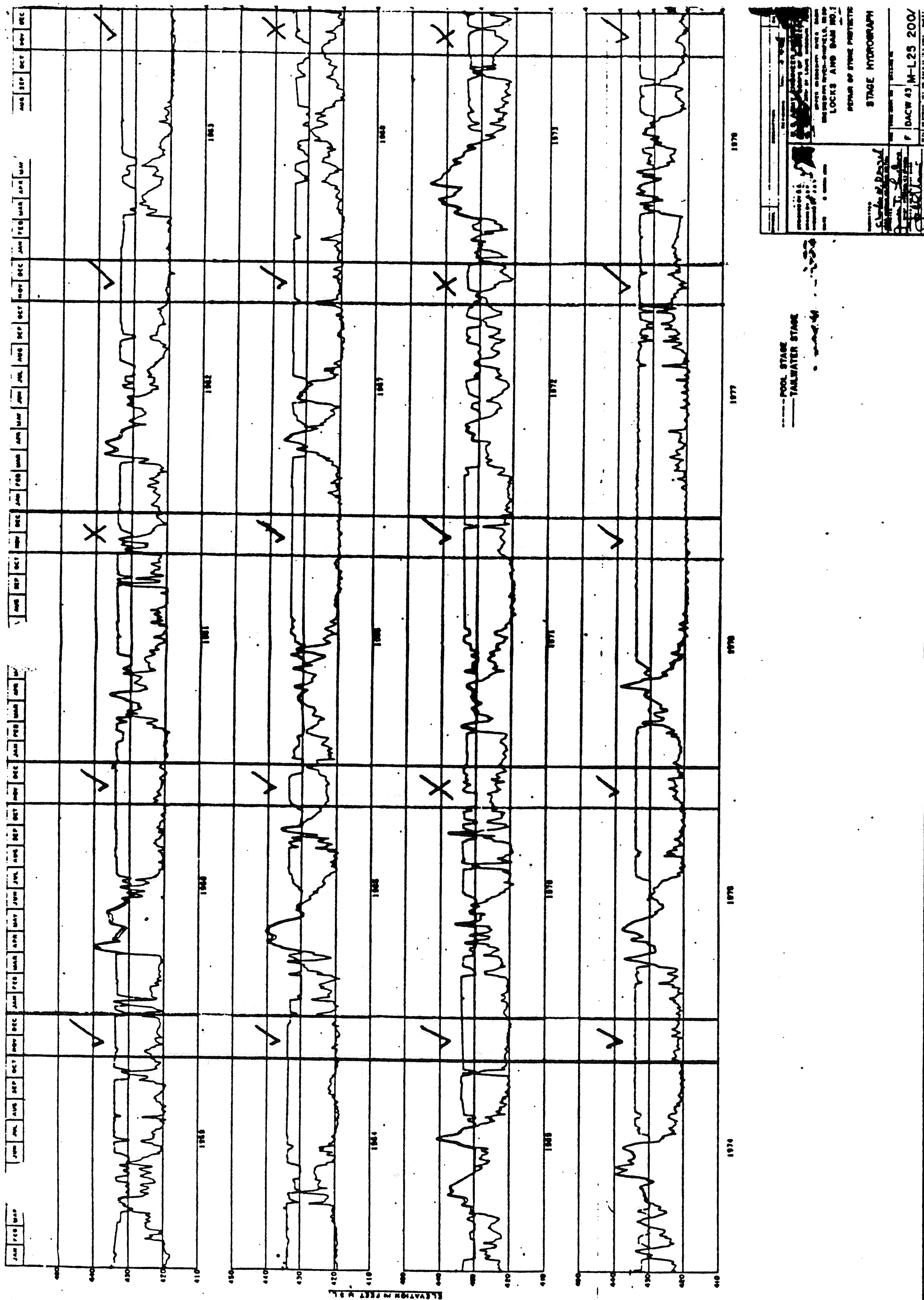
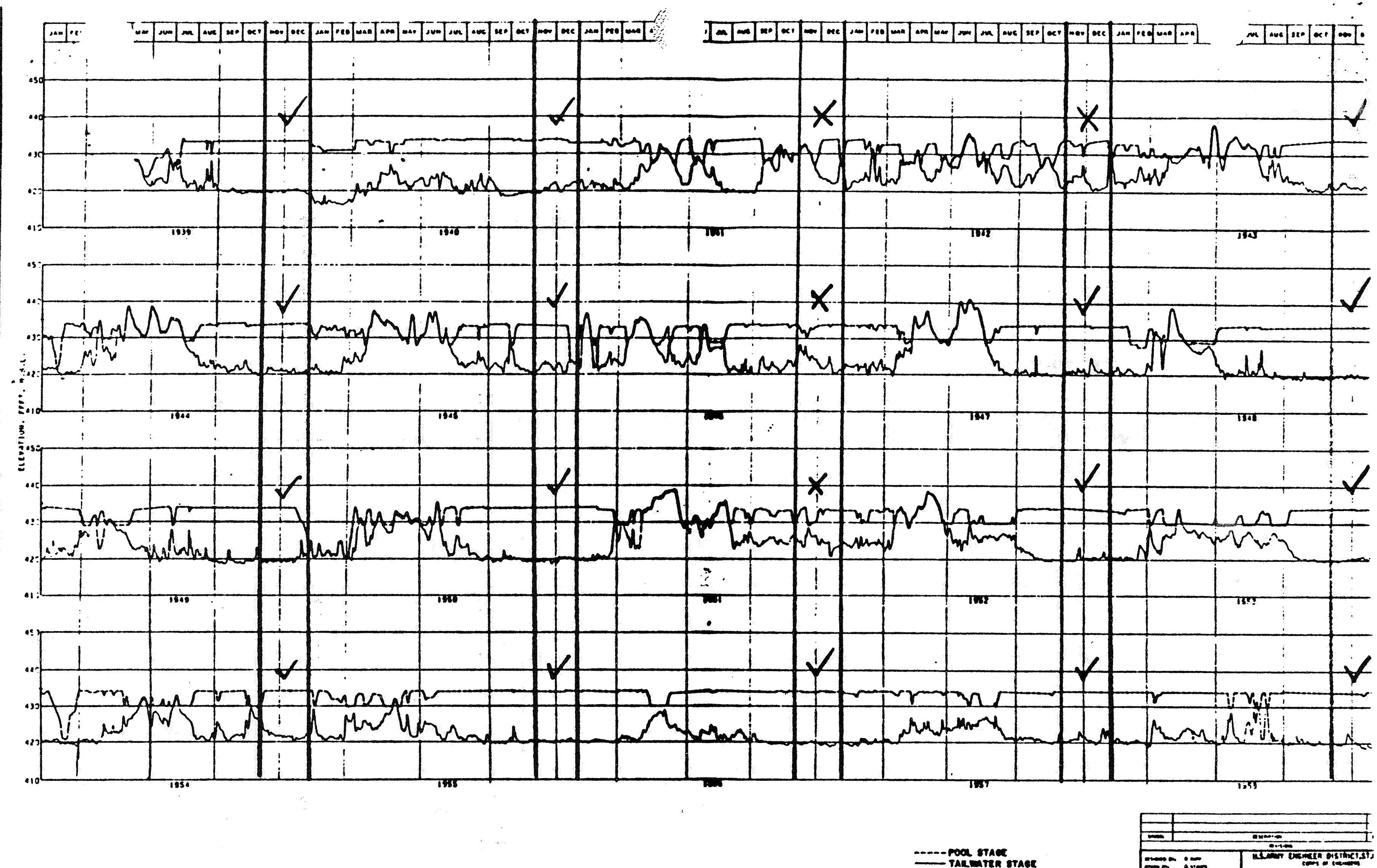
POOL STAGE
TAILWATER STAGE
LOCKS AND DAM NO
REPAIR OF STONE PROTECTI
STAGE HYDROGRAPH
DACW 43
M-L25 200

Encl D-1a



STAGE HYDROGRAPH
POOL STAGE
TAILWATER STAGE
ELEVATION IN FEET M.S.L.

Encl D-10



U.S. ARMY ENGINEER DISTRICT, ST.
CORPS OF ENGINEERS

MISSISSIPPI RIVER
LOCK AND DAM NO. 2

NEW ACCESS BRI
STAGE HYDROGRA

BACB 43

25AB1BL

M-L25

Encl D-1p

BATCH Y HREP-
PLANS PARISON

RESOURCE FACTOR	PLAN B-1	PLAN B-2	PLAN C	NO ACTION
RIVER SEDIMENT PROTECTION	MODERATE (SC-Minor to no protection WU-High due to levee protection)	MODERATE (SC-Minor to none WU-High, levee protected)	HIGH (Entire site levee protected)	NONE (Entire area becomes progressively shallower)
HILLSIDE SEDIMENT PROTECTION	HIGH (Hillside and lowland trappage and some sediment flushing to river via side channel)	HIGH (Hillside & lowland trappage & some sediment flushing to river via side channel)	MODERATE (Hillside & lowland trappage, but most untrapped material stays in wetlands interior)	NONE
MUSSELS SURVIVAL	HIGH (A flow pattern similar to existing condition prevails; however, sedimentation may eliminate bed in 2-3 decades)	HIGH (A flow pattern similar to existing condition prevails; however, sedimentation may eliminate be in 2-3 decades)	MODERATE TO LOW (Existing flow pattern not duplicated, mussels will dis appear over a number of years)	HIGH (Bed continues until extinguished by sedimentation)
DEEPWATER FISH WINTERING HABITAT	SHORT-TERM (Slough becomes increasingly with time)	SHORT-TERM (Slough becomes increasingly shallow with time; some long-term habitat in WU from ditch cuts)	LONG-TERM (If managed at normal pool in fall-winter period)	SHORT-TERM (Entire site becomes increasingly shallow with time)
FLOW PROTECTED FISH WINTERING HABITAT	UNPROTECTED (SC open to river)	UNPROTECTED (SC open to river)	PROTECTED (SC closed to river)	UNPROTECTED (SC open to river)

Encl D-19

ENCL 5

RESOUR FACTOR	PLAN B-1	PLAN B-2	PLAN C	NO ACTION
FISH PASSAGE	MODERATE (Free access to side channel, but little access to WU)	MODERATE (Free access to side channel, stop-log access to WU except in summer)	MODERATE (Stop-log access to entire site except during summer)	~~NONE~~ HIGH (No existing barriers to fish passage; however, future sedimentation could reduce access somewhat)
FISH SPAWNING	POOR (Poor in side channel dug to L&D 25 gate operation, restricted in WU)	FAIR TO POOR (Poor in SC due to L&D 25 gate operation fair in WU due to stop-log structures & water level mgmt independent of river stage)	FAIR (Gates can be closed to hold water constant until time of summer drawdown)	POOR (Subject to frequent spring drawdowns due to L&D 25 gate operation)
SEEPAGE CONTROL	HIGH (But much pumping & many relief wells or restricted drawdown level)	HIGH (No pumping, but many many relief wells or restricted drawdown level)	HIGH (No pumping, but many relief wells or restricted drawdown level)	N/A
HILLSIDE RUNOFF CONTROL	GOOD (Runoff enters SC and vents to river above dam)	GOOD (Runoff enters SC and vents to river above dam)	FAIR (Runoff may back-up for a short period, but is then vented to tailwater)	N/A

Encl D-1r

RESOURC FACTOR	PLAN B-1	PLAN	PLAN C	NO ION
HUNTER ACCESS	SOMEWHAT IMPEDED (An over levee boat pullover needed for lower WU)	UNIMPEDED (Free passage thru open stop-log structure)	UNIMPEDED (Free passage thru open stop-log structure)	UNIMPEDED
PUBLIC RIVER ACCESS	GOOD (All traditional launch areas feed to SC)	GOOD (All traditional launch areas feed to SC)	FAIR (All traditional areas blocked, but road extentions & ramps could mitigate lost access)	N/A
O&M COSTS	HIGH (High costs due to pumping to offset seepage & for above pool fall management)	LOW (Low cost since seepage routed to tail-water, managed at normal pool elev. in fall-winter)	LOW (low cost since seepage routed to tail-water managed at normal pool elev. in fall-winter)	N/A
CONSTRUCTION COSTS	$ 6 MILLION	$ 8 MILLION	$ 4 MILLION	

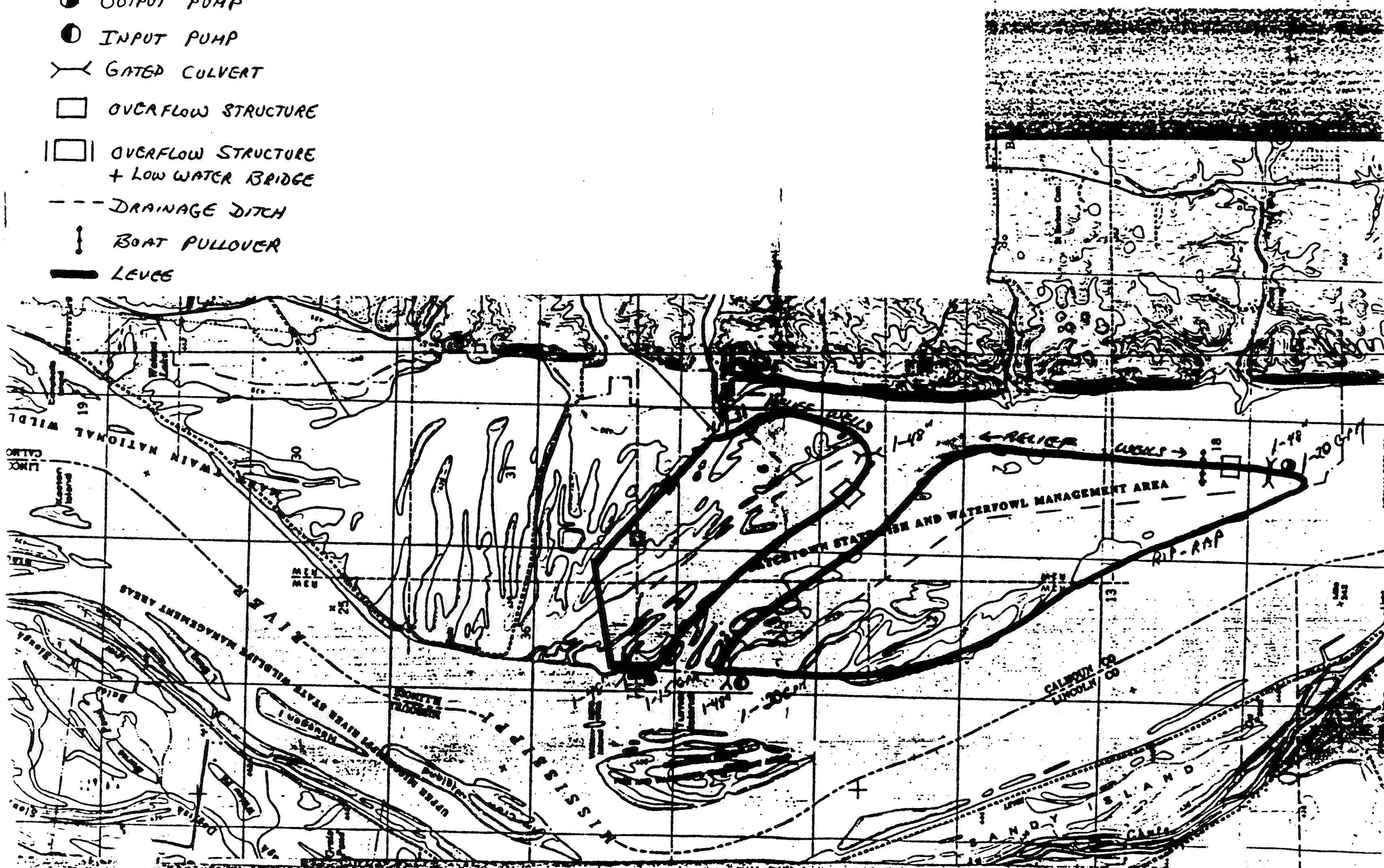
SC=SIDE CHANNEL
WU=WATERFOWL UNITS

Encl D-15

Encl 6

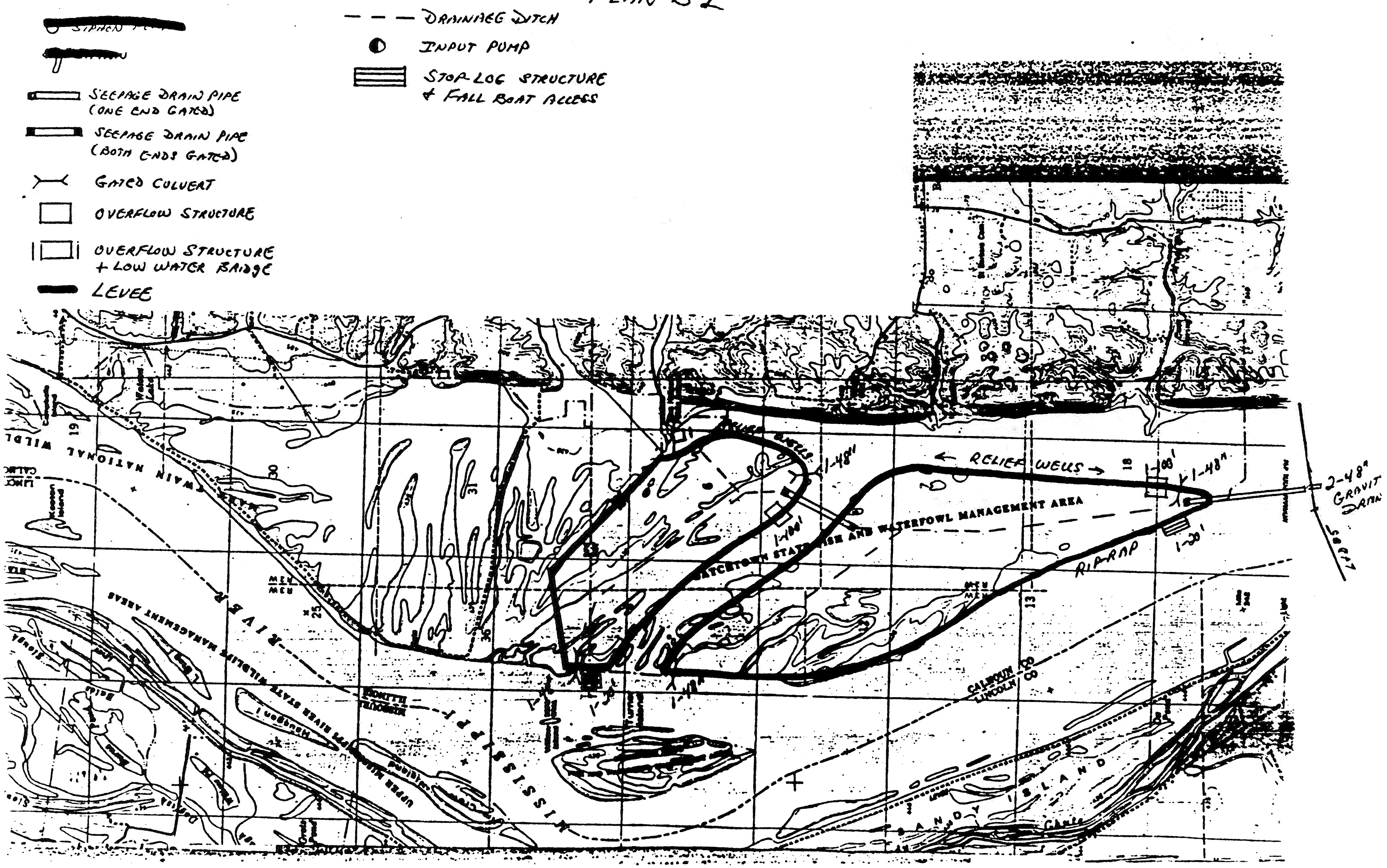
PLAN B-1

- ● Reversible Pump
- ◑ Output Pump
- ◐ Input Pump
- Gated Culvert
- ☐ Overflow Structure
- Overflow Structure + Low Water Bridge
- - - - Drainage Ditch
- Boat Pullover
- ▬ Levee



Encl D-17

PLAN B-2



Encl D-14

PLAN C

~~SIPHON PUMP~~

INPUT PUMP

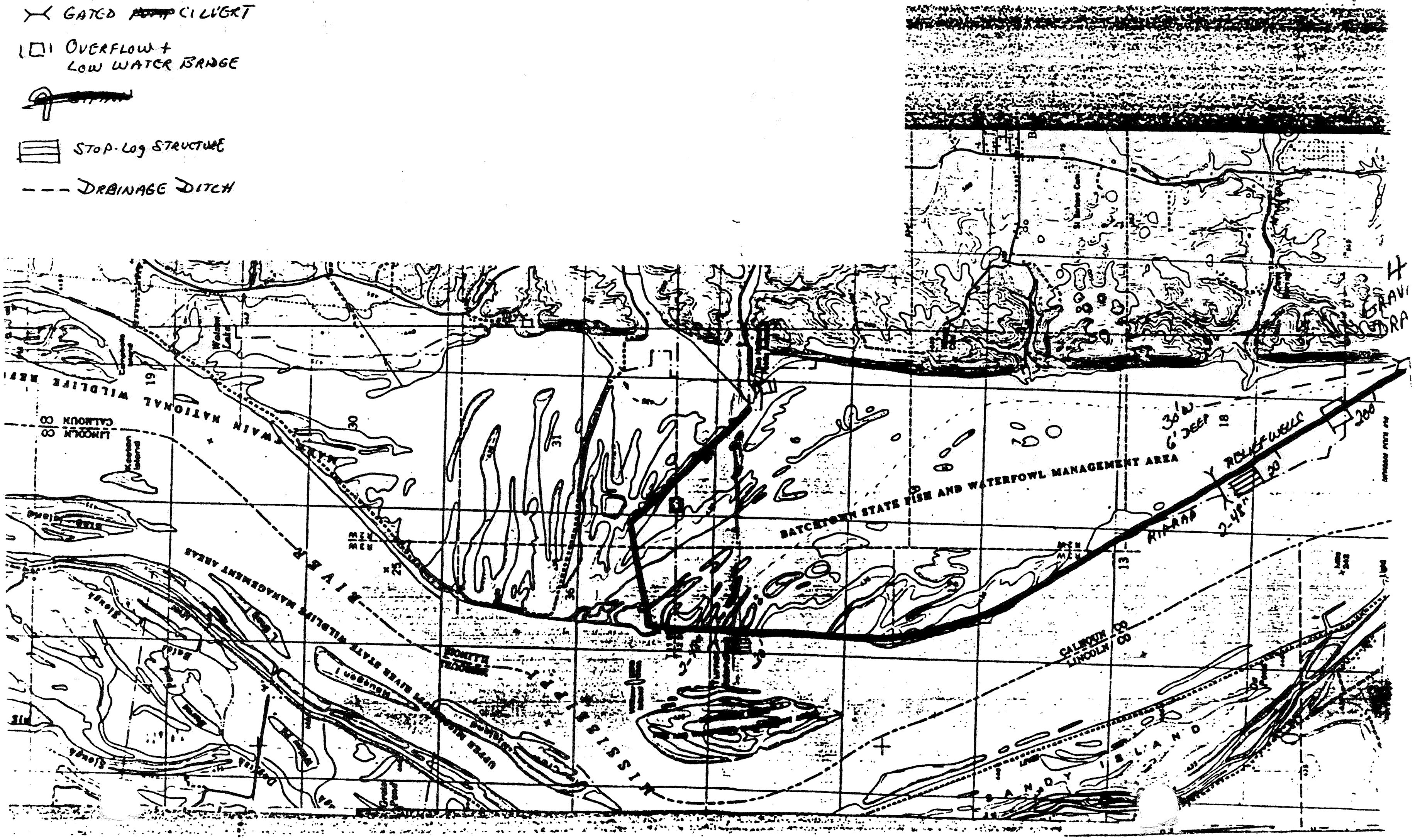
GATED ~~PUMP~~ CULVERT

OVERFLOW + LOW WATER BRIDGE

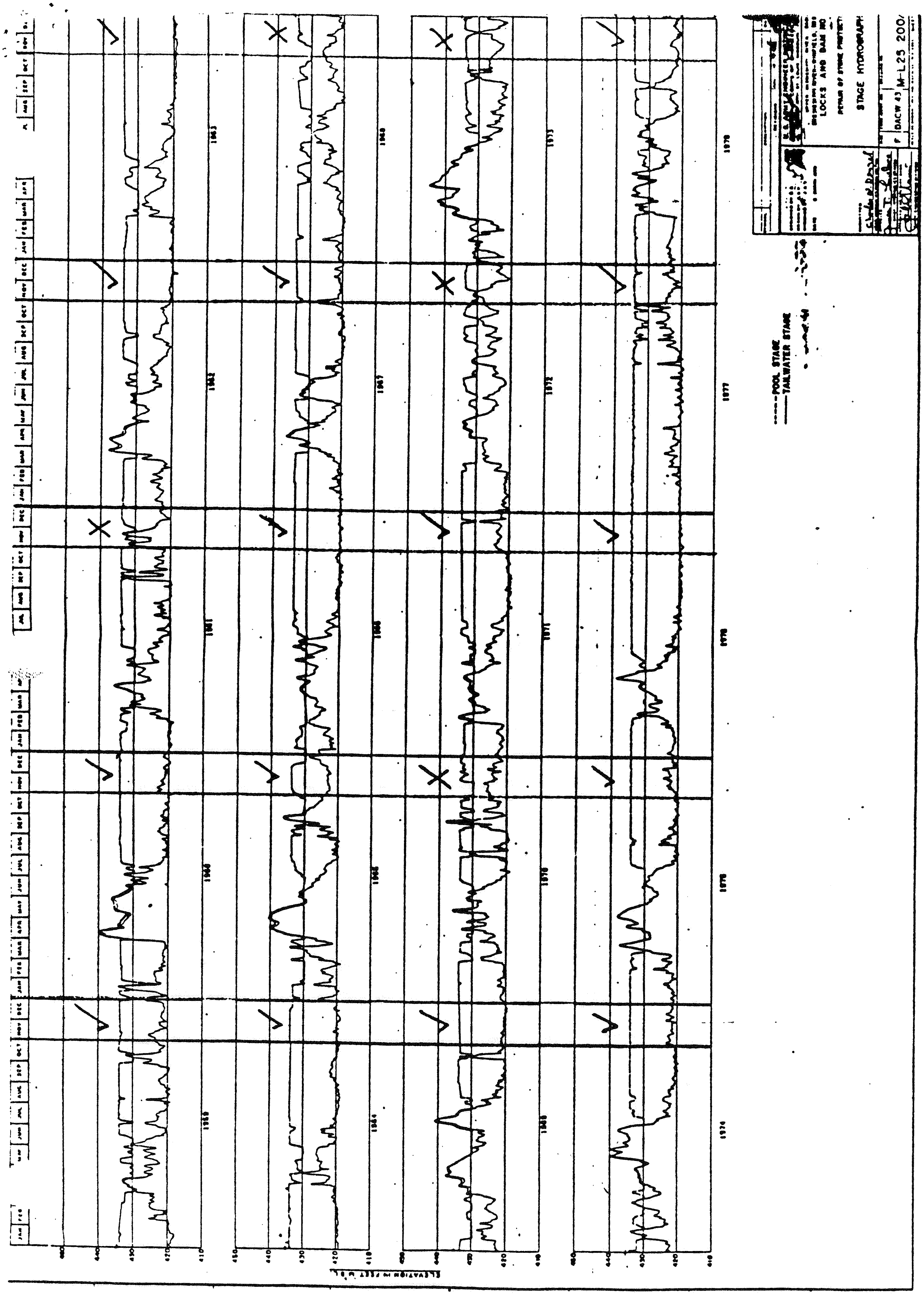
~~SIPHON~~

STOP-LOG STRUCTURE

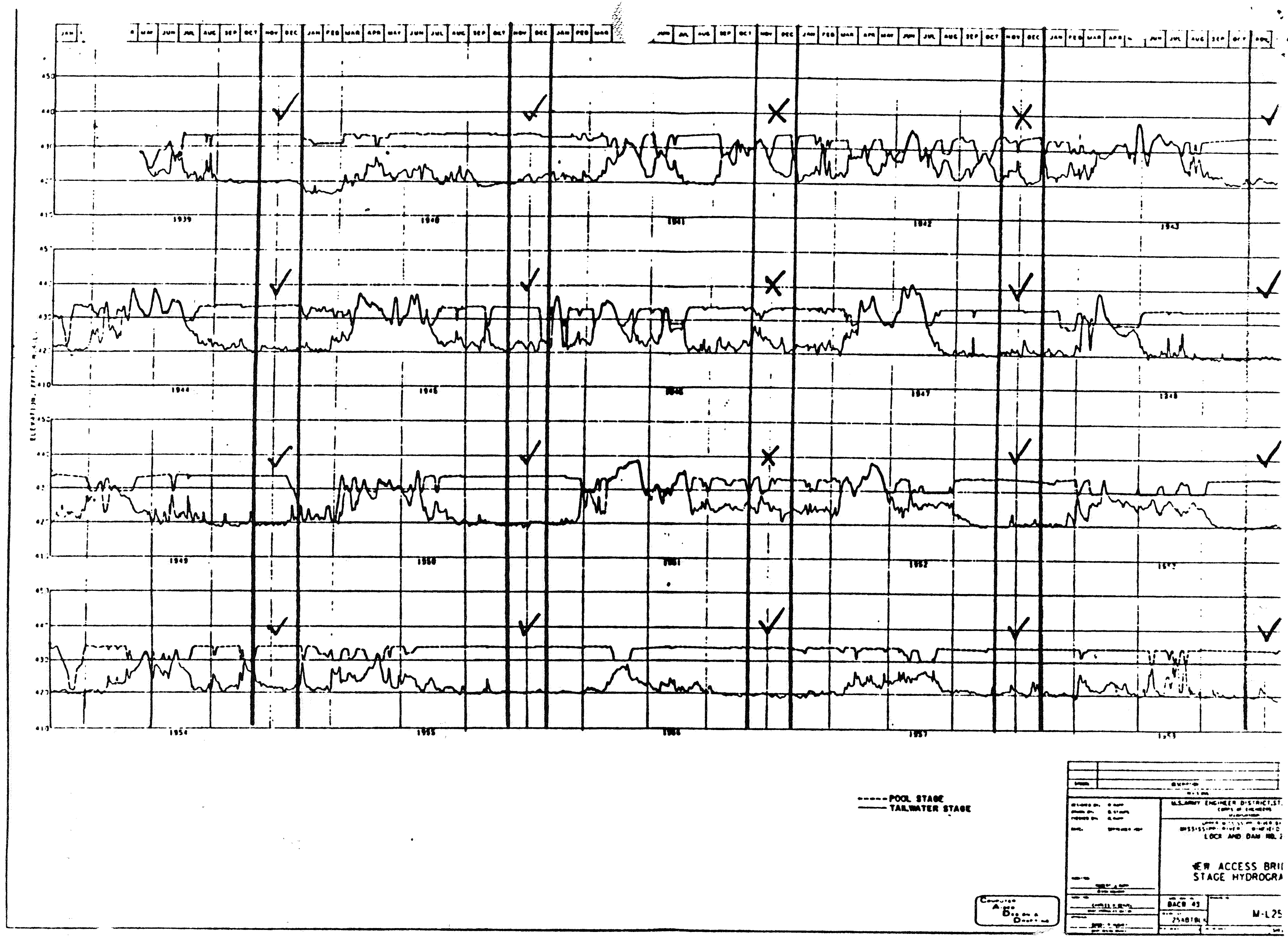
--- DRAINAGE DITCH



Encl D-1v


STAGE HYDROGRAPH
LOCKS AND DAM NO
POOL STAGE
TAILWATER STAGE
DACW 43
M-L25 200
ELEVATION IN FEET M.S.L.

End D-1w



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ELEVATION, FEET, M.S.L.
POOL STAGE
TAILWATER STAGE
U.S. ARMY ENGINEER DISTRICT, ST.
CORPS OF ENGINEERS
LOCK AND DAM NO. 2
NEW ACCESS BRI
STAGE HYDROGRA
M-L25

Enel D-1x

BATCHTOWN HREP--

GOALS/OBJECTIVES/MEASURES FOR STATE MANAGED AREA

GOAL	OBJECTIVES	MEASURES
	PRIMARY	
FOOD PRODUCTION FOR MIGRATORY WATERFOWL	REDUCE RIVER SEDIMENTATION	LEVEE
	REDUCE HILLSIDE SEDIMENTATION	HILL TRAPS, LOWLAND TRAP
	PROVIDE WATER CONTROL	LEVEE, GATED CMP, PORTABLE PUMP, STOP-LOG STRUCT'S
	WOODY VEGETATION CONTROL	LEVEE, GATED CMP, PORTABLE PUMP
	SECONDARY	
PROVIDE FOR MUSSELS TO EXTENT COMPATIBLE WITH PRIMARY OBJECTIVE	PROVIDE FLOWING WATER	GATED CMP, STOP-LOG STRUCT'S
PROVIDE FOR WINTERING FISH TO EXTENT COMPATIBLE WITH PRIMARY OBJECTIVE	PROVIDE ACCESS TO INTERIOR DEEPWATER HABITAT DURING LATE FALL/EARLY WINTER	STOP-LOG STRUCT'S
PROVIDE FOR FISH SPAWNING TO EXTENT COMPATIBLE WITH PRIMARY OBJECTIVE	PROVIDE ACCESS TO INTERIOR DURING SPRING, EXCEPT DURING HIGH WATER CONDITIONS	STOP-LOG STRUCT'S
	MAINTAIN INTERIOR WATER LEVEL INDEPENDENT OF RIVER FLUCTUATIONS	LEVEE, WATER CONTROL STRUCT'S

ENCL 7

Encl D-1y

DEPARTMENT OF THE ARMY
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS
3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199

REPLY TO
ATTENTION OF

CEWES-EP-L (70-1r)

26 Nov 91

MEMORANDUM FOR Commander, USAE District, St. Louis, ATTN: CELMS-PD-F (Mr. Dave Gates), 1222 Spruce St., St. Louis, Missouri 63103-2833

SUBJECT: WOTS Request for Assistance

1. Enclosed is the response to your WOTS request for assistance in assessing hydraulics and biological issues regarding the proposed Batchtown Habitat Rehabilitation and Enhancement Project (HREP). This response was developed by Mr. William Thomas of the Hydraulics Laboratory and Dr. Barry Payne of the Environmental at the Waterways Experiment Station.

2. We appreciate the opportunity of assisting you through the WOTS Program and if you have any questions, please contact Mr. Thomas at 601-634-2511 or Dr. Payne at 601-634 3837.

FOR THE CHIEF, ENVIRONMENTAL LABORATORY:

JL Decell
J. L. DECELL, PE
Water Operations
Technical Support Program

Encl

CF: wo/encl
W. Thomas, HR
B. Payne, ER-A

Encl D-2

CEWES 25 October 1991

MEMORANDUM FOR RECORD

SUBJECT: Batchtown Habitat Rehabilitation and Enhancement Project, WOTS Activity

1. Introduction. Our meeting began at 0900 on 14 August 1991 in the Planning Division Conference Room, St. Louis District, CE with the following attending:

*Barry Payne, CEWES-ER-A
Claude Strauser, CELMS-PD-A
*Dennis Stephens, CELMS-ED-HE
*Tony Thomas, CEWES-HR
Dan Ragland, CELMS-PD-AE
*Dave Gates, CELMS-PD-F

Note: * denotes those also attending afternoon meeting with project sponsor.

2. Objective. The objective of the meeting was for WES personnel to give their opinions on hydraulic and biological characteristics of the Batchtown Project area. Emphasis was on a comparison of project Plans A and B with respect to their effects on depositional patterns and the future welfare of the mussel bed in the project area.

3. In-house Meeting. The Batchtown project is a Habitat Rehabilitation and Enhancement Project of the Upper Mississippi River Environmental Management Program. At the start of the meeting, Gates handed out information on Plans A (no handout provided, map of plan was displayed) and B (encl 1), results of physical studies (encls 2-11) and mussel surveys (encls 12-14). Gates summarized Plans A and B, and provided an overview of the result of the Illinois Department of Conservation's mussel survey. Strauser explained how he believes the Mississippi River is evolving at this location. Stephens presented flow velocity, depth, and sediment data he collected during June 1991.

4. All in attendence agreed that Batchtown is a depositional area. Its depositional nature is due to its location on the inside of a bend (i.e., the point bar side) and not to its proximity to Lock and Dam 25. Pool 25 was impounded in 1939. The pattern of deposition of sediment in the Batchtown Project area was traced using 1881 and 1989 CE maps and 1940, 1968, 1973, and 1988 aerial photographs. Both the 1881 and 1940 data clearly indicated that Batchtown was a deposition zone prior to pool impoundment. In 1940 photographs, the same flood-plain and channel patterns existed in the Batchtown area as exists on the 1988 photographs. The rapid rate of deposition was clear in a comparison of flood-plain cross sections from the 1881 map to the 1989 map (encls 2 and 3). This comparison depicts the classical process of natural levee deposition. The table in encl 4 shows average deposition rates based on those two surveys. This flood plain area is rapidly being converted from aquatic to terrestrial habitat.

5. The most significant parameter in the rate of development of this terrestrial habitat will be the occurance of floods. Much development took place between the 1968 and 1973 photographs. Field data collected by Stephens support the view that much of the bottom is sand (encls 5-9). Sand typically deposits on the point bar side of bends. At the Batchtown location, silt and clays probably will deposit on top of such sand during low flows and will be eroded during high flows.

6. Changes in water velocity during high flow in the project area are predicted to be insignificant (encl 10). Water velocity may be slightly higher in the vicinity of the mussel bed after project levees are in place, but should not be so high as to scour mussels from the relatively compact mud and clay at that location.

7. To extrapolate to discharges other than the one existing when data were collected, Stephens set up a HEC-2 Data Set and confirmed it with his measured data (encl 11). The HEC-2 analysis indicated the discharge in the chute during his survey was 5100 CFS. Projections for discharges up to 11,000 CFS indicated that average velocity ranged from 1 to 2.5 fps. That converts to bed shear stress from 0.002 to 0.013 pounds per square foot.

8. Comparison of project Plans A and B showed that the essential difference is that Plan A sequesters more of the complex mix of aquatic and terrestrial habitat on the point bar into leveed areas for moist soil management. Plan B represents a compromise between provision of leveed management areas and retention of some flow from the point bar chute behind Turner Island over the mussel bed. Plan A does not provide for maintenance of flow over the area of the mussel bed, and in general does not maintain sufficient lotic connection between the point bar chute and the inlets from this chute into the diverse aquatic habitat that anastimoses the evolving point bar.

9. An apparently dense, diverse, and commercially harvested mussel bed occurs along the left bank of the backwater channel at Cockrell Hollow (encls 12-14). Data provided by the Illinois Department of Conservation indicate that this is a small bed, extending approximately 150 feet upstream to 1,500 feet downstream of the Cockrell Harbor boat harbor. Nine species were included among 60 individual mussels obtained by brail at this location; based on this limited sample, the community appears similar in composition to other mussel beds throughout the Upper Mississippi River. The threeridge mussel, _Amblema plicata_, comprised 52 % of the community sample. The threeridge mussel is the most abundant species in the Upper Mississippi River and is a commercially important taxon. _Quadrula quadrula_ (13 %), _Obliquaria reflexa_ (8%), and _Fusconaia flava_ (8%) were moderately abundant as is typical of other Upper Mississippi River mussel beds.

10. The mussel bed in the backwater channel at Cockrell Hollow occurs in firm clay that is neither scoured to a hardpan condition that would preclude mussel burrowing nor depositional to the extent that flocculent clay and silt would bury mussels. Data provided by Stephens (encls 8-9) indicate that near-maximum water velocities at the site of the mussel bed range from 0.3 to 1.8 ft per second (i.e., sufficient to prevent heavy sedimentation of silt and clay but insufficient to support bedload transport and deposition of sand. The principal inlet that brings water from the point bar chute to this back channel has a sandy bottom that appears to receive periodic deposits of river bedload. The back channel just downstream of the mussel bed is broad, shallow, and lined by soft deposits of clay and silt that indicate conditions too depositional for establishment of a riverine mussel bed.

11. In summary, hydraulic conditions in a limited portion of the back channel at Cockrell Hollow appear to be optimum for recruitment, growth, and survival of mussels. Conditions are neither too erosional nor depositional to scour or bury mussels.

12. Plan B represents a design for the habitat rehabilitation and enhancement project with considerable likelihood of maintaining existing physical conditions associated with the mussel bed. In addition to its aim to continue the hydraulic and sedimentation conditions that allow the back channel mussel bed to exist, Plan B will also provide important diversity of aquatic habitat with respect to riverine fishes. Back channels provide important velocity refuges. Flooded, vegetated flats confluent with the river channel offer important spawning and nursery habitat for many species of riverine fishes.

13. _Conclusions_. Even without a major flood, the Batchtown Project area is expected to continue to fill until it forms a prominent overbank. During that evolution, the location of the mussel bed will continue to collect flood plain overflows from the upstream direction and consequently is expected to be the last of the existing channel features to be converted to terrestrial habitat.

14. Present hydraulic conditions could exist over the mussel bed until the storage prism for water is exhausted. With no action, Plan A, or Plan B, this storage prism will someday be exhausted. The rate of loss will be greater under Plan A than under Plan B. Plan B appears to be a reasonable attempt to sustain hydaulic conditions over the mussel bed in concert with a plan to increase moist soil management areas in the Batchtown area. However, we believe that even Plan B places the mussel bed at increased risk of earlier demise that would occur without any levee construction within the water storage prism of the Batchtown Project area.

15. The reasoning behind these conclusions is as follows. Overbank flows and the fluctuation of pool 25 have probably aided in preserving the bed historically by cleaning off the deposits of silts and clays. (Silt/clay deposits are assumed, not measured, because this is the location in a reservoir where such deposits typically occur.) The levees in plan B will eliminate the storage volume and thereby the need for water to flow along the bluff line. Therefore, silts and clays are not as likely to be eroded as they have been in the past. The result is expected to shorten the life of the mussel bed compared to what it would be without the project.

16. It is not possible to estimate how much the life might be shortened without performing extensive and expensive hydrologic, hydraulic, and sedimentation studies. Even the best forecast would be for the average future conditions. If there were a large flood the very first year, the mussel bed could disappear. It does not seem a wise use of project dollars to do such studies and still not extend the life of the mussel bed a significant amount. We agreed that we are talking, at most, about shortening the life of the bed. Its fate is sealed already by the normal evolution of the river.

17. The meeting was reconvened after lunch with the following project sponsors present:

Michael Bornstein, Mark Twain National Wildlife Refuge
Bill Donels, Illinois State Department of Conservation

We reconstructed the morning's conclusions for Bornstein and Donels. All participants agreed that Plan B was preferable to Plan A in that the former provided for maintenance of off-channel aquatic habitat that is confluent with the point bar chute. Retention of such complexity of aquatic habitat represents a reasonable attempt to maintain the mussel bed and should also provide fisheries benefits.

18. Field Trip. On 15 August, Gates, Stephens, Payne, and Thomas drove to the project area and Illinois Department of Conservation gave us a reconnaissance trip through the existing channels and the mussel bed area. The pool was about normal, and depth was less than 2 feet in some places in the main inlet from the point bar chute to the mussel bed area.

19. The field trip supported our impression that overbank evolution was the principal process driving the conversion of aquatic to terrestrial habitat in the Batchtown Project area. The field trip made it apparent that the mussel bed of concern was somewhat limited in size (perhaps 1,500 ft by 150 ft). The relatively low density of shells washed ashore suggested that mussel density was low (< 10 individuals per m^2). It is not unusual for major mussel beds in the Upper Mississippi River to support 30-100 individuals per m^2. It was suggested during the field trip that a more rigorous survey of the mussel bed be conducted to determine the approximate density of individuals and the limits of the bed. Such quantitative information would be useful in judging the quality of this mussel bed in relation to other riverine assemblages of mussels. Such an evaluation may prove useful in establishing project priorities.

20. Taylor Island existed before the impoundment of pool 25. This island will likely remain a prominent feature. The channel on the point bar side of the island (the point bar chute) will likely remain, as such chutes are common features of the Mississippi River.

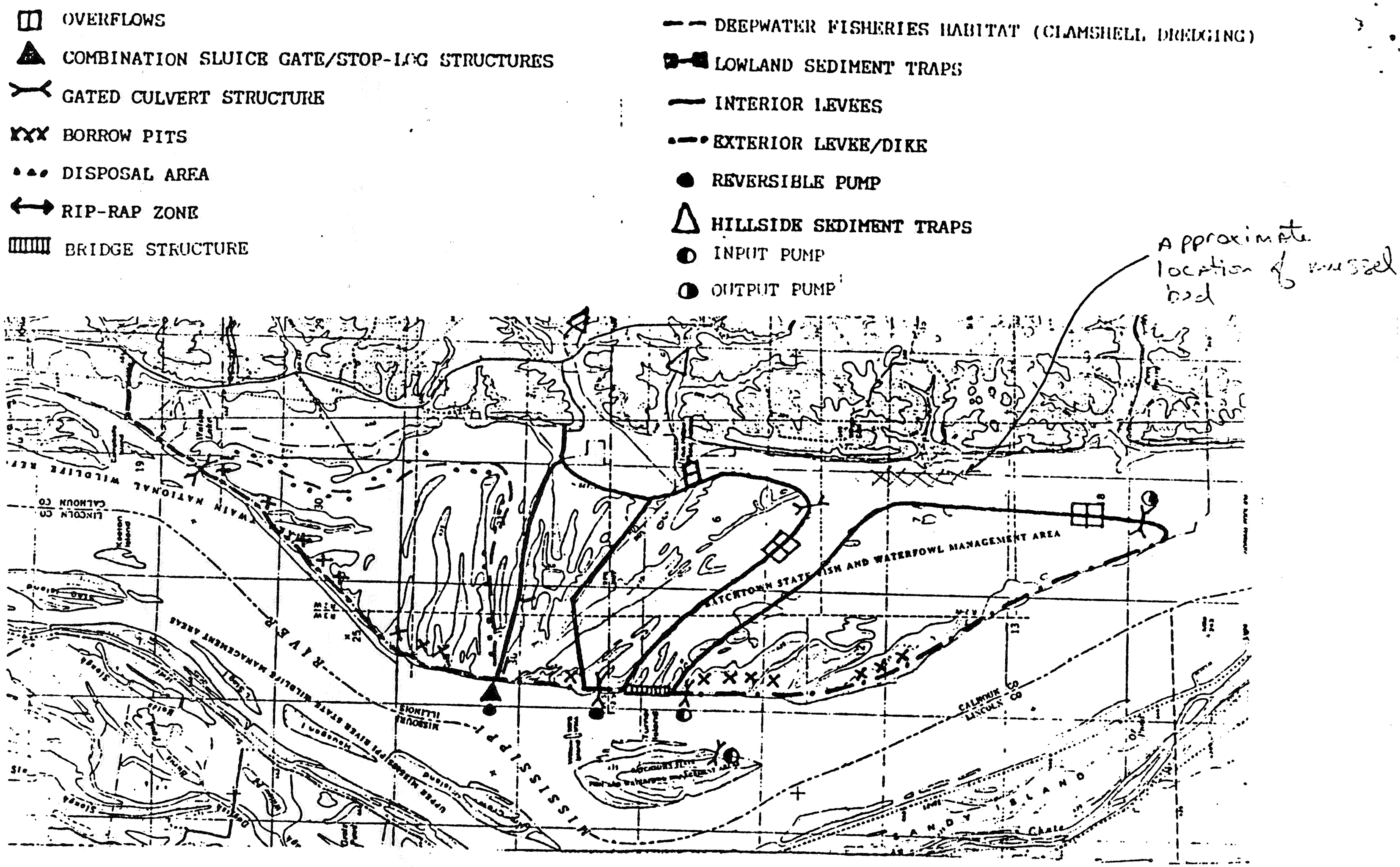
William A. Thomas

William A. Thomas
Research Hydraulic Engineer
Hydraulics Laboratory

Barry S. Payne

Barry S. Payne
Research Biologist
Environmental Laboratory

14 enclosure as:

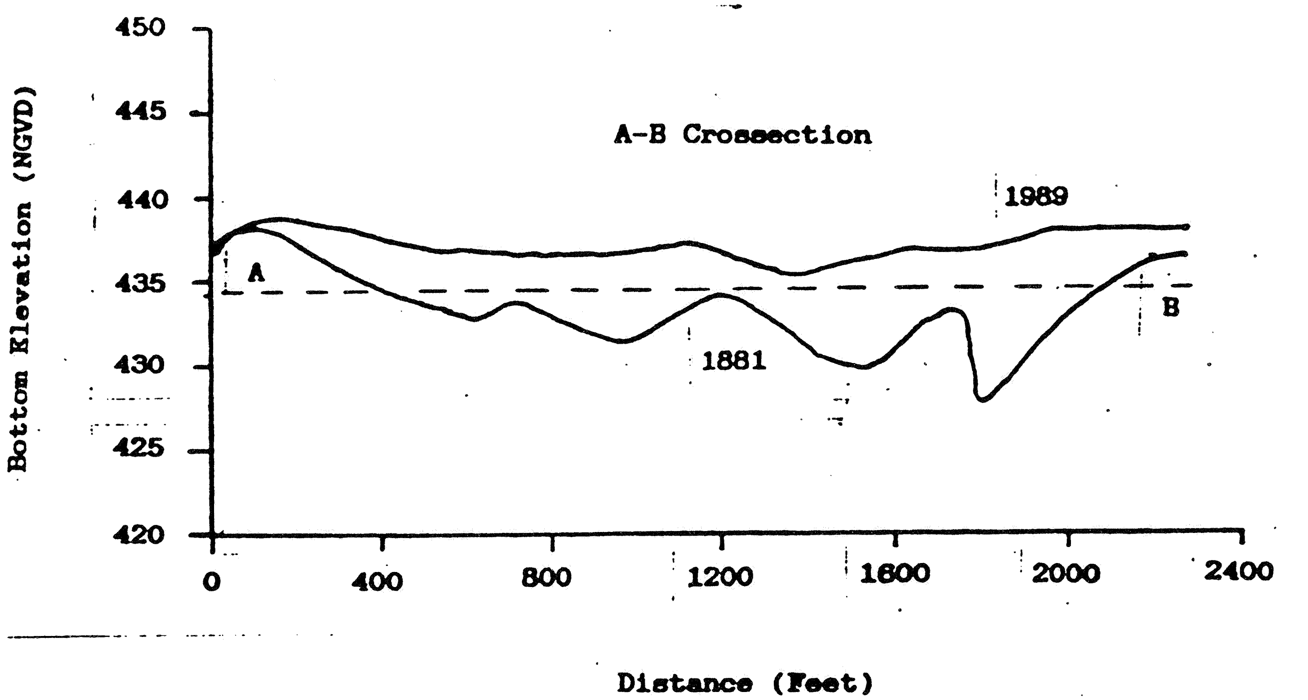


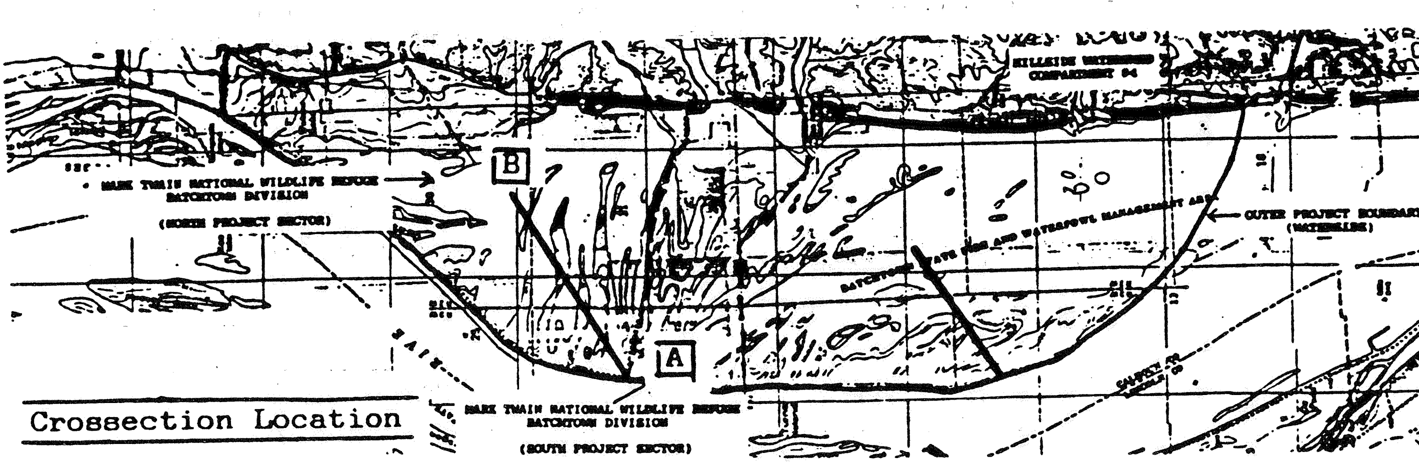
OVERFLOWS
COMBINATION SLUICE GATE/STOP-LOG STRUCTURES
GATED CULVERT STRUCTURE
BORROW PITS
DISPOSAL AREA
RIP-RAP ZONE
BRIDGE STRUCTURE
DEEPWATER FISHERIES HABITAT (CLAMSHELL DREDGING)
LOWLAND SEDIMENT TRAPS
INTERIOR LEVEES
EXTERIOR LEVEE/DIKE
REVERSIBLE PUMP
HILLSIDE SEDIMENT TRAPS
INPUT PUMP
OUTPUT PUMP
Approximate location of mussel bed
FISH AND WATERFOWL MANAGEMENT AREA
MISSISSIPPI
RIVER
CALHOUN CO
LINCOLN CO

ENCL 1

HISTORICAL SEDIMENTATION--BATCHTOWN REFUGE

1881 TO 1989



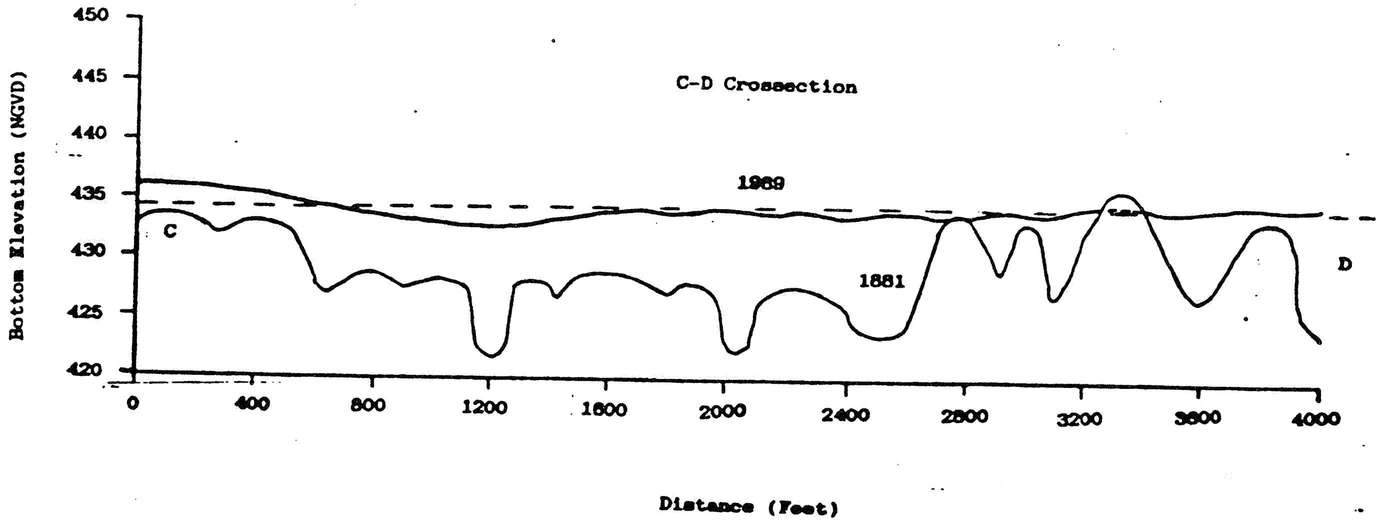


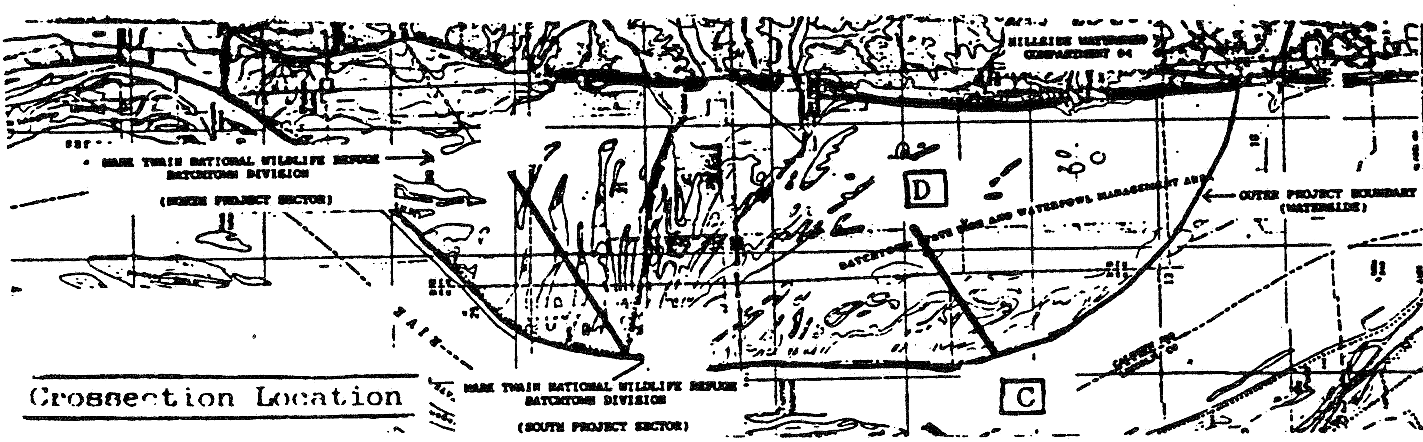
Crossection Location

Encl 2

HISTORICAL SEDIMENTATION--BATCHTOWN MANAGEMENT AREA

1881 TO 1989





Crossection Location

End

BATCHTOWN PROJECT--

HISTORICAL SEDIMENTATION SUMMARY

LOCATION	HISTORICAL SEDIMENTATION RATE	AVERAGE FEET BELOW NORMAL POOL	
		1881	1989
REFUGE--NORTH END	0.4 INCHES/YEAR	4	0
STATE MGMT AREA	0.6 INCHES/YEAR	5	1

NOTE: Rate based on crossection profiles

CELMS-ED-HE 20 Jun 91

MEMORANDUM FOR RECORD

SUBJECT: Velocity Measurements at Batchtown

1. On 18 June 1991, Ed Pelc, Fred McLard and Dennis Stephens obtained velocity measurements for 10 transects in the Batchtown EMP area. Figure 1 depicts the approximate locations of the transects. The observed velocities at the transects are shown in Table 1.

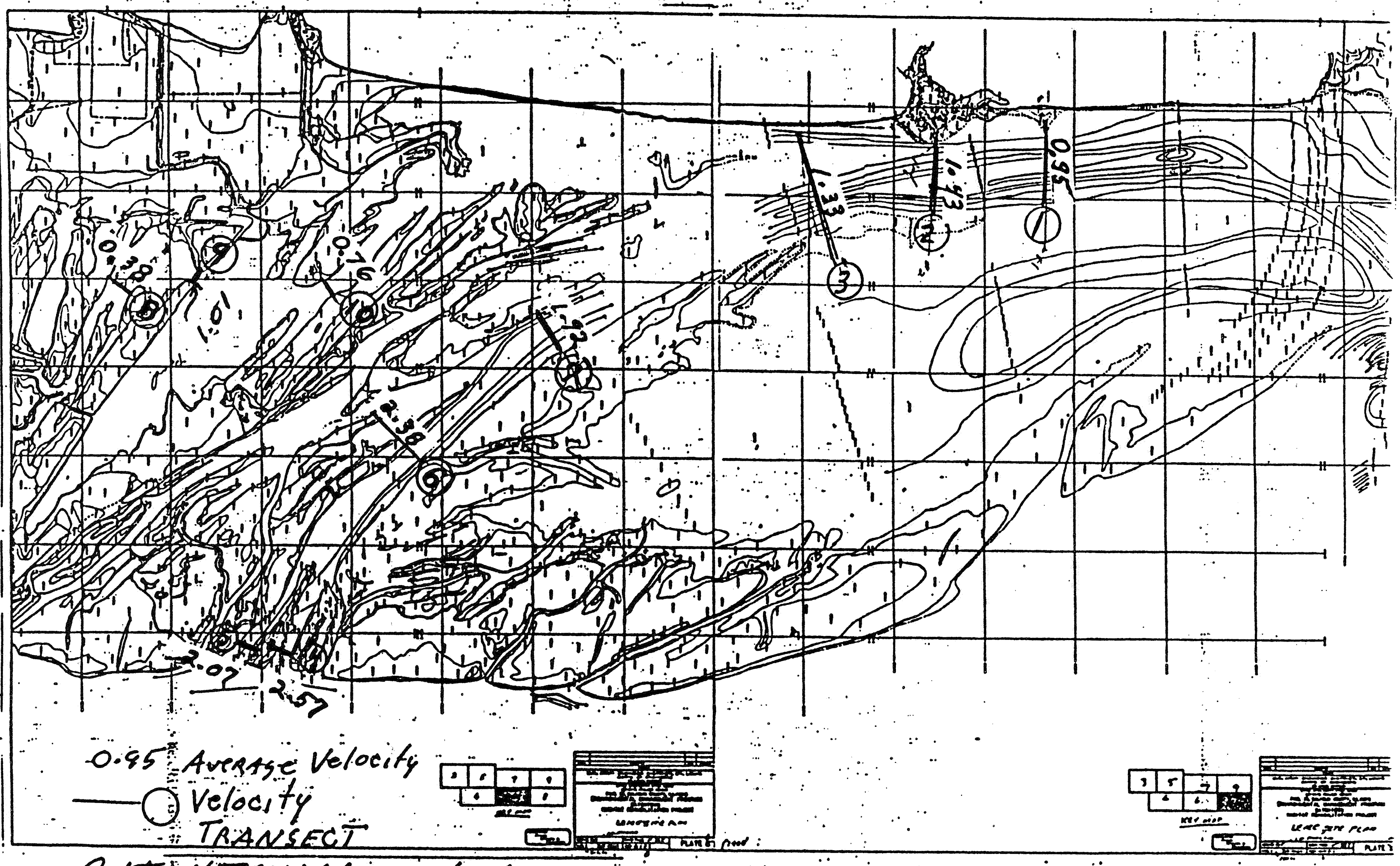
2. Lock and Dam 25 pool elevation was at 434.3 feet NGVD at 0600 on 18 June 1991. Dam 25 was at open river with the river on tilt because of upstream floodwaters.

3. Scouring velocities above 4 ft/sec were not observed on this date.

Dennis Stephens
Hydraulic Engineer

Encl

10 of 2



BATCHTOWN 6/18/91 FIGURE 1

TABLE 1
BATCHTOWN OBSERVED VELOCITIES

TRANSECT NUMBER	STATION FEET	TOTAL DEPTH FEET	OBSERVED DEPTH %	VELOCITY FT/SEC	BOTTOM/COMMENTS
1	0				LEFT BANK
	220	3.5	.6	0.57	SOLID,HARD BOTTOM
	400	7.0	.2	0.34	SOLID,HARD BOTTOM
			.8	0.73	
	600	5.0	.2	1.48	SOLID
			.8	1.13	
	800	5.0	.2	1.47	MUD
			.8	1.13	
	1200	2.3	.6	0.77	MUD
2	0				LEFT BANK
	150	5.3	.2	1.91	SOLID,HARD BOTTOM
			.8	1.26	
	300	6.0	.2	1.41	SOLID,HARD BOTTOM
			.8	1.03	
	450	6.7	.2	1.75	SOLID,HARD BOTTOM
			.8	1.10	
	650	5.8	.2	1.75	SOLID,HARD BOTTOM
			.8	1.47	
	850	5.3	.2	1.64	MEDIUM SOLID
			.8	1.23	
	1000	2.5	.6	1.25	MEDIUM SOLID
3	0				LEFT BANK
	75	6.1	.2	1.38	MUD
			.8	0.91	
	250	3.0	.6	1.13	MEDIUM HARD
	400	3.0	.6	1.50	SOLID
	600	4.0	.2	1.44	SOFT MEDIUM
			.8	1.15	
	850	6.0	.2	1.57	HARD
			.8	1.29	
	1100	4.7	.2	1.60	MUD
			.8	1.41	
4	0				LEFT BANK
	30	4.0	.6	2.43	SAND
	75	5.5	.2	2.65	SAND
			.8	2.08	
	120	7.0	.2	2.90	SAND
			.8	2.78	
	150				RIGHT BANK

Encl

TABLE 1
CONTINUED
BATCHTOWN OBSERVED VELOCITIES

TRANSECT NUMBER	STATION FEET	TOTAL DEPTH FEET	OBSERVED DEPTH %	VELOCITY FT/SEC	BOTTOM/COMMENTS
5	0				RIGHT BANK
	60	4.8	.2	2.13	SAND
			.8	1.68	
	112	5.7	.2	2.23	SAND
			.8	1.56	
	180	5.0	.2	2.72	MUD SOLID
			.8	2.13	
					LEFT BANK
	225				
6	0				RIGHT BANK
	80	6.5	.2	2.65	LIKE SAND
			.8	2.23	
	180	5.5	.2	2.38	SAND
			.8	2.08	
	250	5.3	.2	2.57	SAND & MUD,HARD
			.8	2.48	
	340	5.3	.2	2.48	HARD BOTTOM
			.8	2.23	
					LEFT BANK
	380				
7	0				RIGHT BANK
	40	4.5	.2	2.48	MUD & HARD
			.8	1.83	
	120	5.2	.2	2.38	SAND
			.8	1.87	
	220	2.9	.6	2.03	MUD DEEPER
	400	6.0	.2	1.57	SOLID
			.8	1.29	
					LEFT BANK
	450				
8	0				RIGHT BANK
	70	3.5	.6	0.58	HARD MUD
	110	3.5	.6	0.27	SOFT MUD
	200	3.6	.6	0.28	SOFT MUD
					LEFT BANK
	240				
9	0				LEFT BANK
	30	4.5	.2	1.13	SOLID
			.8	0.91	
	70	5.5	.2	1.13	SLICK MUD
			.8	0.91	
	110	4.5	.2	1.13	HARD/SLICK MUD
			.8	0.86	
					RIGHT BANK
	140				

Encl
13 of

TABLE 1
CONTINUED
BATCHTOWN OBSERVED VELOCITIES

TRANSECT NUMBER	STATION FEET	TOTAL DEPTH FEET	OBSERVED DEPTH %	VELOCITY FT/SEC	BOTTOM/COMMENTS
10	0				LEFT BANK
	50	5.6	.2	0.99	MUD
			.8	0.88	
	105	5.3	.2	0.83	MUD
			.8	0.67	
	170	3.8	.6	0.46	MUD
	210				RIGHT BANK

End

CELMS-ED-HE RDM 7 AUG 91

MEMORANDUM FOR: CELMS-PD-A (Strauser)
CELMS-PD-AE (Ragland)
CELMS-PD-F (Gates)
CELMS-ED-HP (Davinroy)
CELMS-ED-DG (Poullain)

SUBJECT: Batchtown Channel Velocities due to Project

1. The HEC-2 model of Batchtown was created to determine the effects the proposed levee alignment would have on velocities because of the presence of mussels. The model was calibrated using the field measurements obtained on 18 June 1991 by adjusting flow values to match observed velocities. Sections taken on 18 June and HEC-2 sections are shown in figure 1. The model was then modified for with-project condition by assuming flow will only enter the area through the upstream openings (HEC-2 Section 6). A summary of the field measurements and the HEC-2 results are shown in Table 1.

TABLE 1

HEC-2 SECTION	FIELD SECTION	OBSERVED		CALIBRATED		PROJECT	
		DEPTH FT	VELOCITY FT/SEC	DEPTH FT	VELOCITY FT/SEC	DEPTH FT	VELOCITY FT/SEC
1	1*	7.0	.95	6.4	.95	6.4	1.04
2	2*	6.7	1.43	6.5	1.49	6.5	1.19
3	3*	6.1	1.33	6.5	1.28	6.5	1.05
4	7	6.0	1.92	5.8	1.98	5.8	2.05
5	6	6.5	2.38	6.3	2.36	6.4	3.31
6	4&5	7.0	2.32	6.9	2.32	7.3	2.09
WATER SURFACE AT SECTION 6 FT(NGVD)		436.1**		435.9		436.4	

2. The with-project condition model was then modified to determine the effects higher discharges would have on velocities in the levee area. The results of this sensitivity of discharges and velocities are shown in Table 2.

* MUSSEL BED LOCATION
** ESTIMATED FROM GAGE READINGS

Encl 10

15 of 2?

TABLE 2

HEC-2 SECTION	OBS	DISCHARGE (CFS) 5100***	6000	7000	8000	9000	10000	11000
		VELOCITY (FT/SEC)						
1*	0.95	1.04	1.23	1.43	1.63	1.84	2.04	2.25
2*	1.43	1.19	1.40	1.62	1.84	2.05	2.26	2.46
3*	1.33	1.05	1.22	1.41	1.58	1.75	1.91	2.05
4	1.92	2.05	2.32	2.60	2.85	3.08	3.29	3.49
5	2.38	3.31	3.62	3.92	4.19	4.45	4.69	4.91
6	2.32	2.09	2.29	2.49	2.66	2.83	2.99	3.13
WATER SURFACE AT SECTION #6 FT(NGVD)	436.1**	436.4	436.7	437.1	437.4	437.7	438.0	438.3

* MUSSEL BED LOCATION
** ESTIMATED FROM GAGE READINGS
*** ESTIMATED FLOW OF 18 JUNE 1991 BETWEEN LEVEES IF PROJECT WAS IN PLACE

Dennis L. Stephens
Hydraulic Engineer

Encl

Illinois Department of Conservation
life and land together

memorandum

Bill.

to: Bill Donels

from: Bob Schanzle RWS

date: May 9, 1991

reference:

subject: Batchtown EMP Project

I received a telephone call recently from Albert Waters, a commercial sheller who works in the Batchtown area. Among other things, Mr. Waters expressed concern that the proposed Batchtown EMP project might impact a commercially-harvested mussel bed located in the backwater area at Cockrell Hollow (river mile 243).

Butch Atwood and I visited the area on May 8 and took a series of hauls through the area with a five-foot crowfoot brail. Several of the hauls fouled because of debris on the river bottom, but we recovered significant numbers of mussels in an area extending from roughly 50 yards upstream from the Cockrell Hollow boat harbor to approximately 500 yards downstream, and from 100 to 200 yards offshore. Attached is a map showing the approximate locations of the hauls and a listing of the mussel species and numbers collected.

Time prevented us from identifying the limits of the mussel bed or performing any quantitative sampling, but we hope to visit the site again later this summer to collect more information. I wanted you to know that a mussel bed <u>is</u> present at the site, and that it may extend some distance upstream and/or downstream from Cockrell Hollow. This should be considered in your future deliberations concerning the EMP project.

Please let me know if you need any further information.

RWS:ts

cc: Butch Atwood

ENCL 12

COCKRELL HOLLOW MUSSEL SAMPLING
Mississippi River Mile 243, left bank
May 8, 1991

Hauls 1-3: 100 yds. offshore. **No mussels collected** (debris)

Haul 4: 200 yds. offshore.
- Amblema plicata - 7 (65-95mm)
- Obliquaria reflexa - 1 (45mm)
- Quadrula nodulata - 1 (55mm)
- Quadrula quadrula - 4 (60-70mm)

Haul 5: 100 yds. offshore.
- Amblema plicata - 8
- Anodonta grandis - 1
- Arcidens confragosus - 1
- Fusconaia flava - 2
- Megalonaias nervosa - 1
- Obliquaria reflexa - 3
- Quadrula quadrula - 5

Haul 6: 150 yds. offshore.
- Amblema plicata - 4
- Fusconaia flava - 1
- Megalonaias nervosa - 1
- Quadrula nodulata - 1
- Quadrula quadrula - 1
- Truncilla truncata - 1

Haul 7: 200 yds. offshore.
- Amblema plicata - 12
- Fusconaia flava - 1
- Quadrula quadrula - 3

Haul 8: 300 yds. offshore. **No mussels collected** (debris)

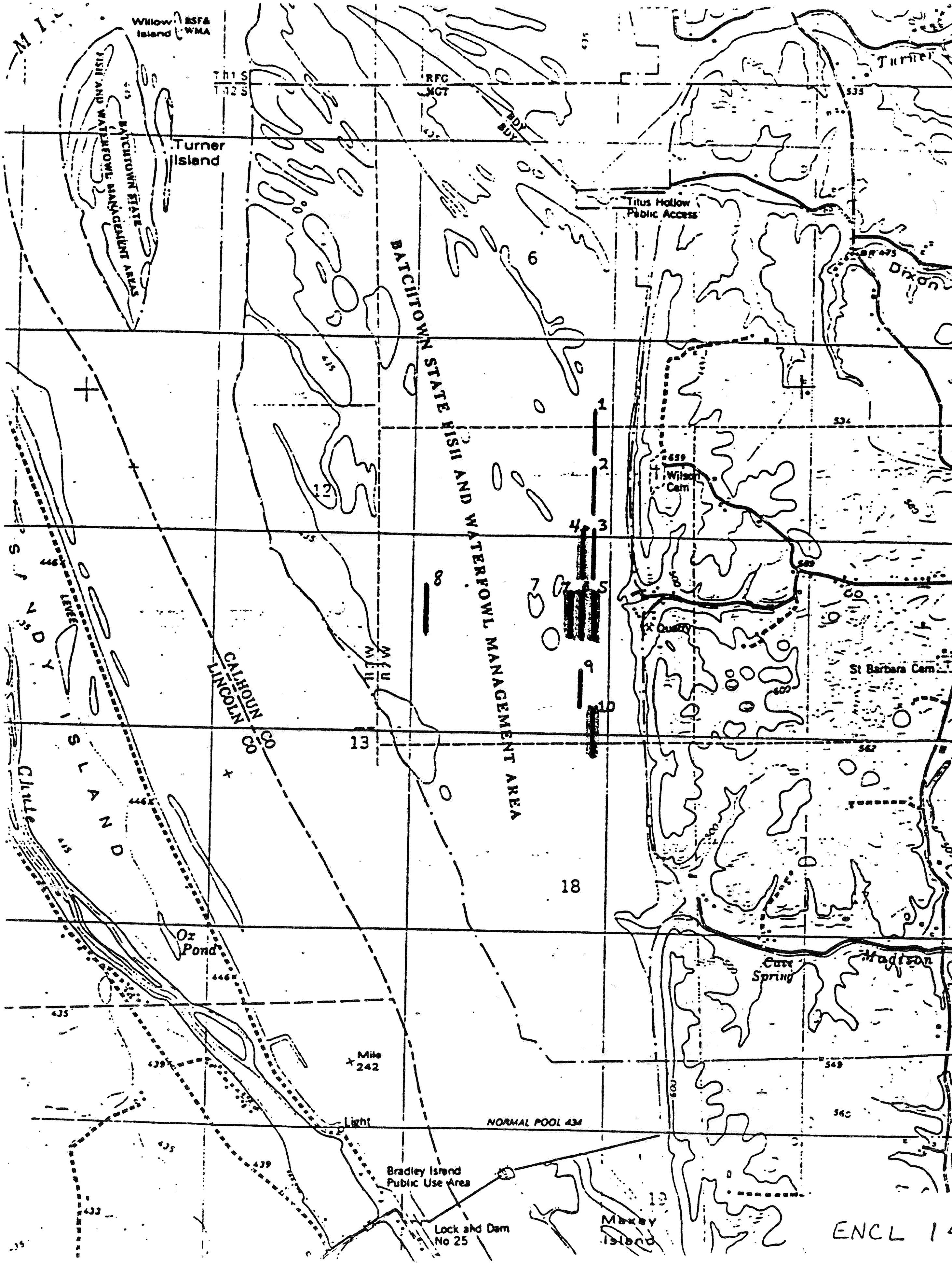
Haul 9: 200 yds. offshore. **No mussels collected** (debris)

Haul 10: 100 yds. offshore.
- Fusconaia flava - 1
- Obliquaria reflexa - 1

Five-foot crowfoot bar. All hauls 3-minute duration.
Minimum-maximum length ranges (measured parallel with hinge) provided for specimens taken in haul 4.

Amblema plicata - threeridge
Anodonta grandis - floater
Arcidens confragosus - rock pocketbook
Fusconaia flava - Wabash pigtoe
Megalonaias nervosa - washboard
Quadrula nodulata - wartyback
Quadrula quadrula - mapleleaf
Obliquaria reflexa - threehorn
Truncilla truncata - deertoe

ENCL 13


Willow Island BSF& WMA
BATCHTOWN STATE FISH AND WATERFOWL MANAGEMENT AREAS
Turner Island
T11S
T12S
RFG MGT BDY
Titus Hollow Public Access
Turner
Dixon
BATCHTOWN STATE FISH AND WATERFOWL MANAGEMENT AREA
6
12
13
18
19
1
2
3
4
5
7
8
9
10
Wilson Cem
Quarry
St Barbara Cem
SANDY ISLAND
LEVEE
CALHOUN CO
LINCOLN CO
Ox Pond
Chute
Cave Spring
Madison
Mile 242
Light
NORMAL POOL 434
Bradley Island Public Use Area
Lock and Dam No 25
Maxey Island

ENCL 1

19 of 2

D6K

nt Manning
ector

n W. Comerio
puty Director

ce F. Clay
sistant Director

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

March 19, 1992

Colonel James D. Craig
District Engineer, St. Louis District
U.S. Army Corps of Engineers
1222 Spruce Street
St. Louis, MO 63103-2833

Dear Colonel Craig:

In response to your letter of March 9, 1992, we would like to inform you that the Department has now reached decisions on the project scope for the Batchtown Habitat Rehabilitation and Enhancement Project in the Environmental Management Program. Staff from the Divisions of Fisheries, Land Management, Planning and Wildlife Resources researched solutions to our concerns and developed modifications for Option C.

The Department recognizes the importance of the mussel beds to the ecology of the area and acknowledges that their protection also facilitates fish habitat and access. The following modifications to Option C will ensure appropriate consideration of these critical aspects of the aquatic ecosystem within the project area:

1. Revise the project scope to indicate "integrated fish, mussel and waterfowl management priorities."

2. Facilitate sufficient flow through the project area to sustain the mussel beds within the area via water control structures of adequate number and capacity.

   This modification was investigated by Fisheries with a variety of mussel experts. It must be achieved to ensure aquatic biotic integrity of the habitat. Protection of the mussel bed will result in de-facto protection of the fish populations and the rest of the aquatic food chain.

3. Design water control structures to allow fish passage at critical times, determined by ongoing sport fish restoration research, and install a stop-log structure for boat access (possibly of half stop logs and half culverts).

4. Design the outflow through the dam so as not to impact the bottomland woods but to create habitat benefit.

Encl D-2

My staff also articulated the following site management requirements:

1. Summer control of water level is critical but most probably will not be a problem with respect to fish nursery areas. This activity however will be monitored and adjustments made, as necessary, to ensure balanced resource management.

2. During fall recharge, tilt pool closure will probably not result in significant negative fisheries impacts. This activity will however also be monitored and adjustments made, as necessary, to ensure balanced resource management.

3. Land Management, Wildlife Resources and Fisheries staffs will coordinate management to ensure balanced benefit/mitigation for all interests.

My staff also determined that additional information, including the results of fish movement and use studies being conducted by Southern Illinois University for the Department, is needed to design the project to achieve the desired results. I therefore encourage you and your staff to facilitate the modification of Option C by accomplishing the following:

1. Determine what hydraulic conditions exist in falling, rising and stable pools in the project area.

2. Using the results of the detailed hydraulic condition studies and expert opinion on minimum flow requirements of mussels, design the project to ensure needed flows over the mussel bed.

3. Using the results of the fish movement and use study, being conducted by Southern Illinois University, design the project to ensure fish access and egress during critical periods.

4. Solicit river engineering input from your Engineering Division, Hydrology Branch, Potomoloty Section for the design team.

Your cooperation and patience are appreciated. We look forward to developing a well-balanced and diversified habitat project.

Sincerely,

Brent Manning

Brent Manning
Director

BM:BD:ts

cc: Jerry Beverlin
John Tranquilli

U.S. Army Corps of Engineers' response to the issues itemized in March 19, 1992 letter from Brent Manning, Director, IDOC:

Page 1:

1. The original Fact Sheet for the project emphasized waterfowl management. Fishery objectives, and still more recently, mussels, have been integrated into the management priorities.

2. We agreed that the District would design inlet and outlet structures in the IDOC managed area to provide 0.45 feet per second of flow over the mussel bed at Cockrell Hollow. We wish to emphasize that preliminary design and cost estimates indicate that this feature alone will add nearly $900,000 more to the project first costs, and may be a target of criticism during the review process.

3. Stop-log/sluice gate structures will allow for both fish and boat passage when managed water levels are compatible with pool 25 levels.

4. The outflow through the spillway will follow an existing channel to pool 26, and will not impact forest habitat.

Page 2:

The first three items pertain to IDOC management of the site.

The last four items:

1. We believe that the features currently in Plan C will allow for the intended management scheme of keeping the IDOC managed area at pool during winter, spring, and fall, and at a two-foot drawdown during summer. Existing flow conditions have been determined for a pool tilt situation. This data was the basis for the analysis of flow effects under a two foot interior summer drawdown.

2. We consulted with experts at the Waterways Experiment Station, Vicksburg, Mississippi. They gave us a range of water velocity over the mussel bed of 0.2 to 1.5 feet per second as being desirable.

3. This was addressed by response to item 3, page 1.

4. We have had both a hydraulic engineer and a potomoligist on the Interdisciplinary Planning Team.

Illinois Department of Conservation
life and land together

office memorandum

7 Nov 92

to: T. Miller

from: Neil Booth

date: October 28, 1992

subject: Batchtown Desirable Water Level Management Regime

The following depicts the desirable water level management, relative to waterfowl food production and availability during the fall migration period. The management objective is moist soil plant production. Successful re-establishment of submersed aquatics would alter this regime but not totally eliminate it.

Batchtown Hunting Area Pool Elevations

Jan	Feb	Mar	Apr	May	Jun
434.0	434.0	434.0	434.0	434.0	434.0*
Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
432.0**	432.0	434.0	434.0	434.0	434.0

* Gradual drawdown would begin the third week of June.

** Two foot drawdown is target for annual cycle. System response will dictate modification.

NB/pw

Encl D-3

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
Mark Twain National Wildlife Refuge
Brussels District
HCR, Box 107
Brussels, Illinois 62013

(618) 883-2524

October 30, 1992

T 2 Nov 92

Mr. T. Miller (PD-AE)
St. Louis District
U.S. Corps of Engineers
1222 Spruce St.
St. Louis, MO 63103-2833

Dear Mr. Miller:

The tables attached highlight planned (estimated) water management activities for Middle Pool and Lower Pool of the Batchtown Division of Mark Twain NWR, attendant to the EMP project (HREP). These management objectives will be pursued in most years. Should Mississippi River flooding preclude water control past mid-June, objectives levels will likely be abandoned. Pumping costs will be greatly determined by Pool 25 water levels. Gravity flow into Middle Pool and Lower Pool will be utilized as much as management objectives will allow.

Middle Pool will be managed primarily for migratory waterfowl and fishery resources. Lower Pool management will emphasize that for wood duck habitat and fishery resources. Migratory waterfowl needs also will be considered in Lower Pool.

These objectives are preliminary and may change as additional data, such as that from the Swan Lake HREP, becomes available. If you have additional questions, you may contact Gordon Warrick, who was involved with the Batchtown WHAG.

Sincerely,

K. L. Drews

Karen L. Drews-olmsted
Refuge Manager

Encl D-4

TABLE 1. MIDDLE POOL

Date	Planned Elevations For Program Year (Feet)	Remarks
Jan. 1	434.25	Full pool level; waterfowl maintenance
Jan. 15	434.25	
Feb. 1	434.25	
Feb. 15	434.25	
Mar. 1	434.25	
Mar. 15	434.25	
Apr. 1	434.25	
Apr. 15	434.25	
May 1	434.25	Delay drawdown; discourage willow and cottonwood seed establishment
May 15	434.25	
Jun. 1	434.25	Gradual drawdown; establish moist soil plants
Jun. 15	433.75	
Jul. 1	433.25	
Jul. 15	432.75	Maximum drainage level
Aug. 1	432.75	
Aug. 15	432.75	
Sep. 1	432.75	Begin flooding slowly
Sep. 15	433.0	
Oct. 1	433.5	
Oct. 15	434.0	
Nov. 1	434.25	Full pool level; waterfowl maintenance
Nov. 15	434.25	
Dec. 1	434.25	
Dec. 15	434.25	

TABLE 2. LOWER POOL

Date	Planned Elevations For Program Year (Feet)	Remarks
Jan. 1	434.0	Full pool level; wood duck and fish habitat; gates closed
Jan. 15	434.0	
Feb. 1	434.0	
Feb. 15	434.0	
Mar. 1	434.0	
Mar. 15	434.0	Open gates for fish movement if normal (maximum) pool
Apr. 1	434.0	
Apr. 15	434.0	
May 1	434.0	
May 15	434.0	
Jun. 1	434.0	
Jun. 15	434.0	Gradual drawdown; establish moist soil plants
Jul. 1	433.75	
Jul. 15	433.5	Maximum drainage level
Aug. 1	433.5	
Aug. 15	433.5	
Sep. 1	433.5	
Sep. 15	433.5	Begin flooding slowly
Oct. 1	433.75	
Oct. 15	434.0	Full pool level; wood duck habitat and fish access; gates will be open during normal (maximum) pool
Nov. 1	434.0	
Nov. 15	434.0	
Dec. 1	434.0	
Dec. 15	434.0	

April 16, 1993

Plan Formulation Branch
Planning Division

Mr. Brent Manning, Director
Illinois Department of Conservation
524 South Second Street
Springfield, Illinois 62706

Dear Brent Manning:

Over the past year we have had extensive coordination with your staff regarding the Batchtown Habitat Rehabilitation and Enhancement Project. We were pleased with the progress made during this coordination and the understanding that we are now in a position to move forward with the selection of the recommended Plan C. The purpose of this letter is to address concerns on one unresolved issue: the mussel bed at Cockrell Hollow.

The problems and costs associated with maintaining sufficient water flow velocity across the mussel bed have been thoroughly discussed. The Corps agreed to design inlet and outlet structures in the IDOC managed area to provide approximately 0.45 foot per second (fps) of flow over the mussel bed.

We have considered several alternatives to address the problem, and have more closely examined three methods for achieving the desired velocity: a siphon system over Lock and Dam 25's spillway, box culverts through the spillway, and enlarged water-passage structures at several points along the levee. An earlier alternative to provide nominal water control--two 54 inch concrete pipes through the spillway--was compared to the three alternatives cited above.

Table 1 (**Encl 1**) summarizes the costs of the four alternates. Table 2 (**Encl 2**) summarizes the incremental annual costs per average annual habitat units (AAHUs) produced for alternates 2, 3 & 4. In certain cases, initial costs and operation, maintenance, and replacements costs were estimated by Planning Division by extrapolating from similar cost information furnished by our Cost Engineering Branch.

Encl D-5

Also enclosed for each of the four alternates are plan views and stylized cross-sections showing the hydraulic "operating plans" for cases when the Mississippi River pool is higher, lower, or equal to the water level within the State Area (**Encl 3**).

Alternate 1 was the nominal water control configuration in the recommended Plan C as agreed upon in April 1992.

Alternates 3 and 4 attempt to provide 0.45 fps flow over the mussel bed year-round. Our analysis has shown that the pumping of water into the State Area that would be required to maintain the 0.45 fps or greater flow year-round would be cost prohibitive.

We believe that Alternate 2 is a good compromise and provides a life-sustaining flow of 0.28 fps for the mussels for seven months of the year. Dr. Barry Payne of the Corps' Waterways Experiment Station believes that mussels can survive for periods of several months with little or no flow.

Alternates 2, 3 & 4 generate essentially the same AAHUs because they have similar mussel habitat suitability indexes and habitat acreage. The habitat evaluation model that was used and modified specifically for the site is not sensitive enough to varying flows to produce substantial differences in AAHUs.

We request your concurrence to proceed with recommending Alternate 2. It appears to be the most cost-effective alternative towards accommodating the mussels. We believe that the incremental annual costs per annual habitat units of 1,090 will be acceptable to our higher review elements.

If you have any questions, please contact me or my study manager, Mr. Dave Kirkpatrick, at (314) 331-8492.

Sincerely,

Owen D. Dutt
Chief, Planning Division

Enclosures

Copy Furnished w/ Enclosures:

Mr. Bill Donels
Illinois Department of Conservation
Division of Planning
524 South Second Street
Springfield, Illinois. 62706

Mr. Dale Burkett
Illinois Department of Conservation
Office of Resource Management
600 North Grand Avenue West
Springfield, Illinois 62702

Mr. Rick Messinger
Illinois Department of Conservation
4521 Alton Commerce Parkway
Alton, Illinois 62002

Mr. Greg Franke
Migratory Waterfowl Hunters
P.O. Box 175
Batchtown, IL 62006

Mr. Michael Bornstein
US Fish & Wildlife Service
Mark Twain National Refuge Service
Route 1, Box 75
Wapello, IA 52653

Table 1. Summary of Initial Costs for Four Alternatives.

Alternate	Primary Features	Initial Cost ($)
1	2-54 inch gated pipes, 4-48 inch gated pipes, 90 cfs pump 4-8' wide concrete stop-log structures	647,000 316,800 449,000 581,000
	subtotal	1,993,800
2	2-54 inch gated pipes, 4-48 inch gated pipes, 90 cfs pump 4-8' wide concrete stop-log structures	647,000 316,800 449,000 581,000
	4 additional 8' wide concrete stop-log structures	581,000
	subtotal	2,574,800
3	Siphon system	1,200,000
	4-48 inch gated pipes, 4-8' wide concrete stop-log structures	316,800 581,000
	7 additional 8' wide concrete stop-log structures	1,016,750
	increased pumping for certain periods	10,000,000
	protection for siphon and pumphouse	20,000
	subtotal	13,134,550
4	6-6' x 7' gated box culvert	5,680,000
	4-48 inch gated pipes, 4-8' wide concrete stop-log structures	316,800 581,000
	9 additional 8' wide concrete stop-log structures	1,307,250
	increased pumping for certain periods	10,000,000
	subtotal	17,885,050

ENCL 1

Table 2. Summary of Incremental Costs and Annual Costs per Annual Habitat Units for Alternates 2,3 & 4 as Compared to Alternate 1.

Alternate	Primary Features	Initial Cost ($)	Annualized Initial Cost ($)	Annual Operating, Maintenance, and Replacement Cost ($)	Total Annual Costs ($)	Average Annual Mussel Habitat Units (AAHU)	Annual Cost per Average Annual Habitat Units ($/AAHU)
2	4 additional 8' wide concrete stop-log structures	581,000	50,235	13,000†	63,235	58	1,090
3	Siphon system	1,200,000	103,756	23,303	127,059		
	7 additional 8' wide concrete stop-log structures	1,016,750	87,912	22,750†	110,662		
	increased pumping for certain periods	10,000,000	864,633	93,212†	957,845		
	protection for siphon and pumphouse	20,000†	1,729†	112†	1,841		
	(subtract 2-54 inch gated pipes)	-647,000	-55,942	-12,956	-68,898		
	subtotal	11,589,750	1,002,088	126,421	1,128,509	58	19,457
4	6-6' x 7' gated box culvert	5,680,000	491,112	40,313	531,425		
	9 additional 8' wide concrete stop-log structures	1,307,250	113,029	27,220	140,249		
	increased pumping for certain periods	10,000,000	864,633	93,212†	957,845		
	(subtract 2-54 inch gated pipes)	-647,000	-55,942	-12,956	-68,898		
	subtotal	16,340,250	1,412,832	147,789	1,560,621	58	26,907

Notes:

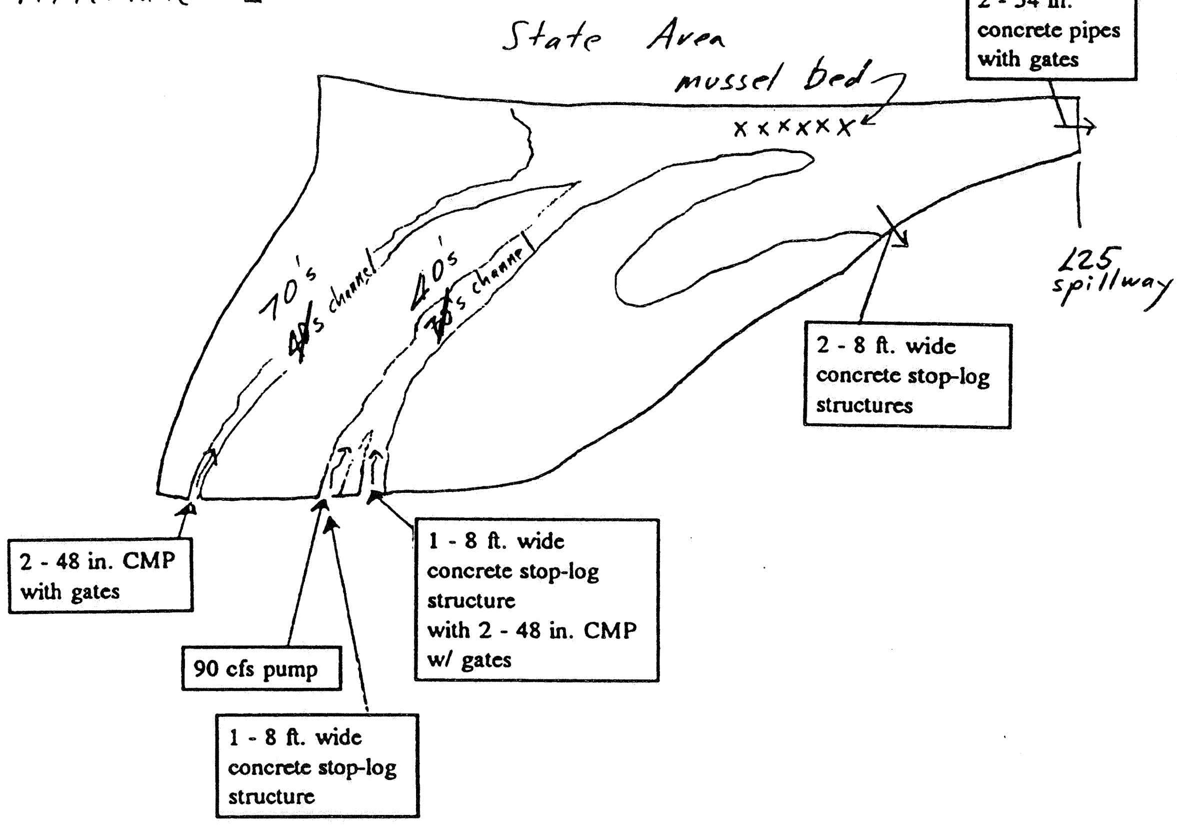
† not estimated by Cost Engineering Branch.

There could be additional inflow into the State Area from hillside runoff, and from the F&WL lower refuge. This would increase water velocities over the mussel bed.

ENCL 2

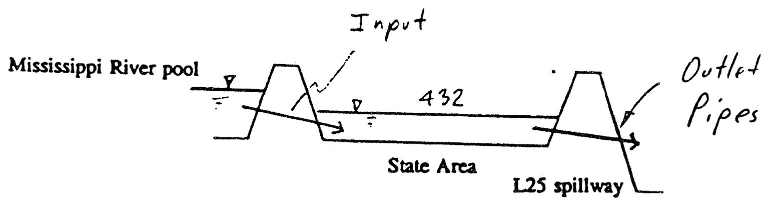
PROJECT	Page — of —	COMPUTED BY Dave K	DATE
SUBJECT		CHECKED BY	DATE

Alternate 1



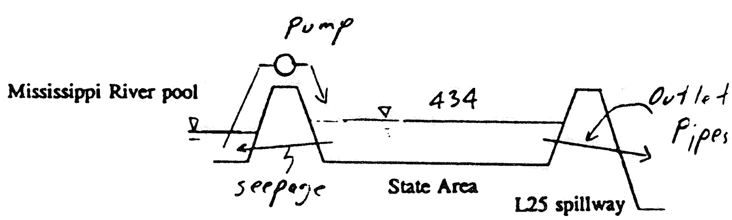
ALTERNATE 1.

- OPERATION WITH 2-54 INCH PIPES, POOL HIGHER THAN STATE AREA
- NOT ATTEMPTING TO PRODUCE 0.45 FPS FLOW OVER MUSSEL BED
- VELOCITY APPROX. 0.06 FPS OVER MUSSEL BED



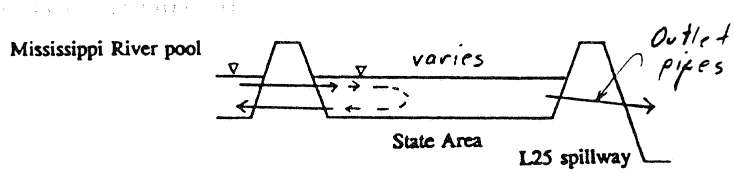
Jul - Aug			
Input		Output	
2 - 48 inch pipes with gates	100 cfs	2 - 54 inch pipes	180 cfs
1 - 48 inch pipe with gate	50 cfs		
seepage	35 cfs		

- OPERATION WITH 2-54 INCH PIPES, POOL LOWER THAN STATE AREA
- NOT ATTEMPTING TO PRODUCE 0.45 FPS FLOW OVER MUSSEL BED
- VELOCITY APPROX. 0.01 FPS OVER MUSSEL BED



Sep - Oct - Nov			
Input		Output	
pump	90 cfs	2 - 54 inch pipes	55 cfs
		seepage	35 cfs

- OPERATION WITH 2-54 INCH PIPES, POOL ELEV. EQUAL TO STATE AREA
- NOT ATTEMPTING TO PRODUCE 0.45 FPS FLOW OVER MUSSEL BED
- VELOCITY APPROX. 0.17 FPS OVER MUSSEL BED DURING OPEN RIVER



Dec - Jan - Feb - Mar - Apr - May - Jun			
Input		Output	
2 - 8 ft. wide stop log structures	350 cfs	2 - 54 inch pipes	200 cfs
4 - 48 inch pipes with gates	200 cfs	2 - 8 ft. wide stop log structures	350 cfs

PROJECT	Page __ of __	COMPUTED BY	DATE
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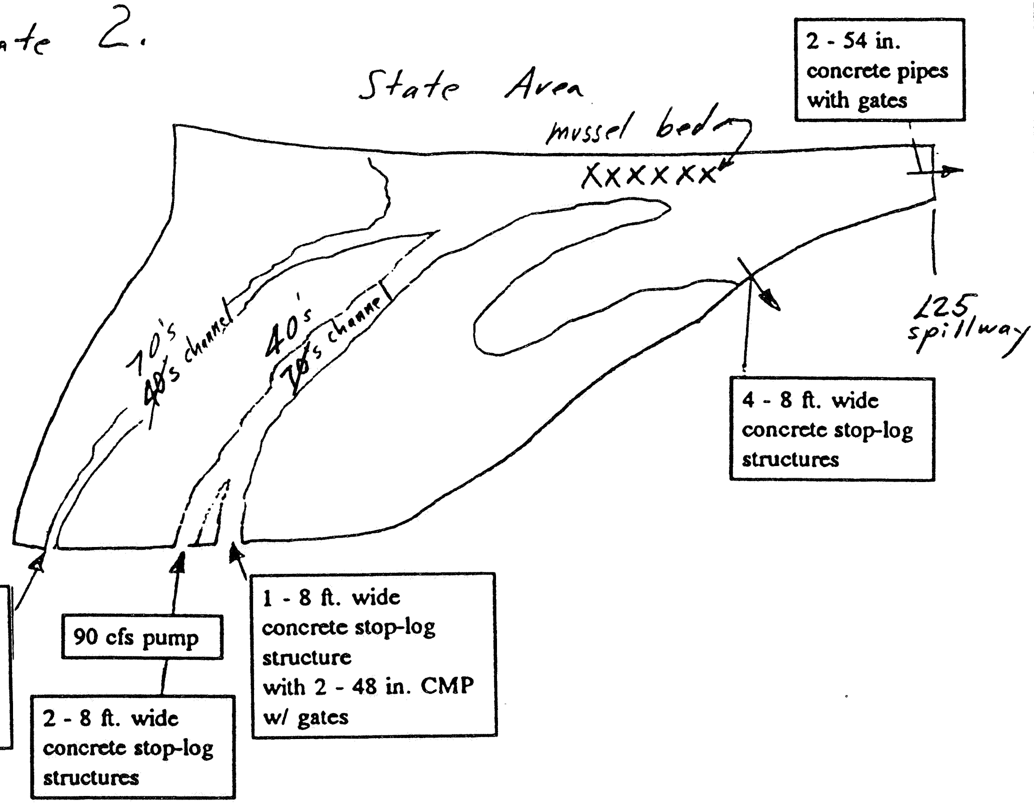
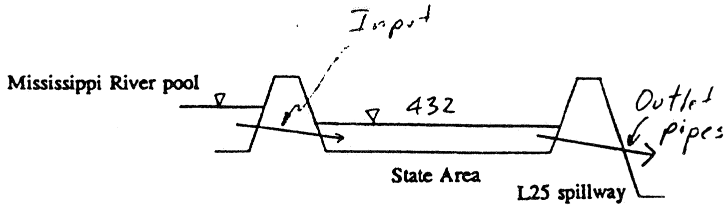
Alternate 2.



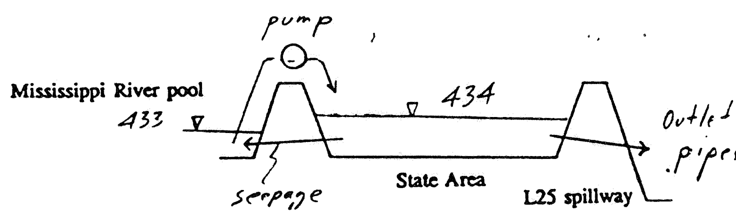
ALTERNATE 2.

- OPERATION WITH 2-54 INCH PIPES, POOL HIGHER THAN STATE AREA
- VELOCITY APPROX. 0.06 FPS OVER MUSSEL BED



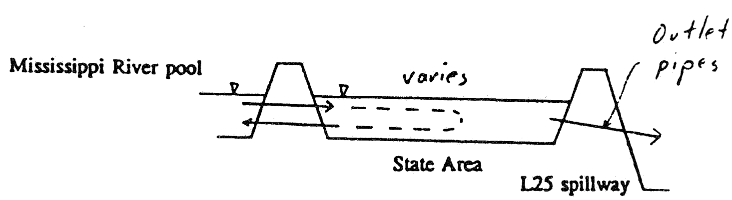
Jul - Aug			
Input		Output	
2 - 8 ft. wide stop-log structure	95 cfs	2 - 54 inch pipes	180 cfs
1 - 48 inch pipe with gates	50 cfs		
seepage	35 cfs		

- OPERATION WITH 2-54 INCH PIPES, POOL LOWER THAN STATE AREA
- VELOCITY APPROX. 0.01 FPS OVER MUSSEL BED



Sep - Oct - Nov			
Input		Output	
pump	90 cfs	2 - 54 inch pipes	55 cfs
		seepage	35 cfs

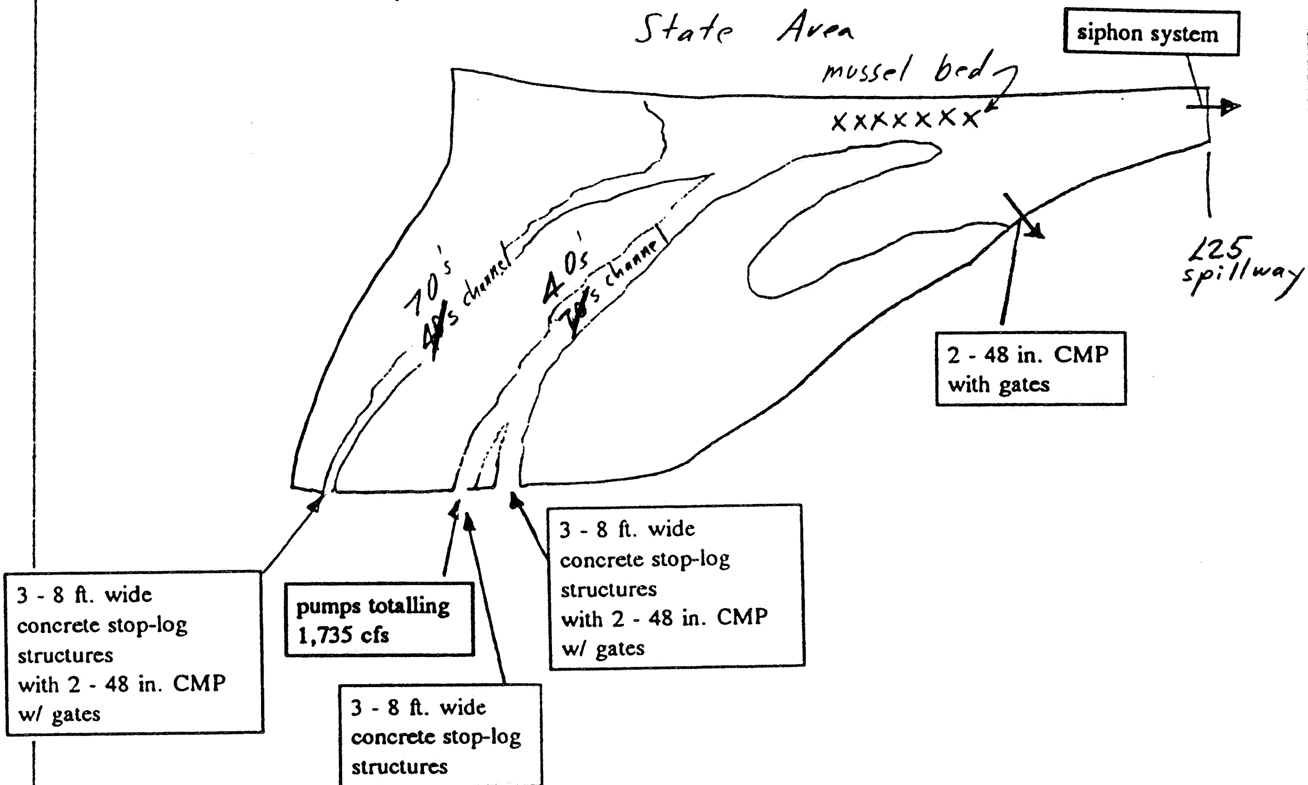
- OPERATION WITH 2-54 INCH PIPES, POOL ELEV. EQUAL TO STATE AREA
- VELOCITY APPROX. 0.28 FPS OVER MUSSEL BED DURING OPEN RIVER



Dec - Jan - Feb - Mar - Apr - May - Jun			
Input		Output	
4 - 8 ft. wide stop-log structures	700 cfs	2 - 54 inch pipes	200 cfs
4 - 48 inch pipes with gates	200 cfs	4 - 8ft. wide stop-log structures	700 cfs

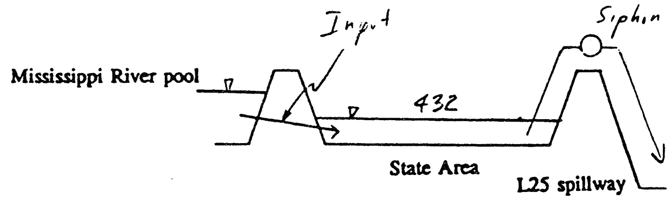
PROJECT	Page __ of __	COMPUTED BY	DATE
SUBJECT		CHECKED BY	DATE

Alternate 3.



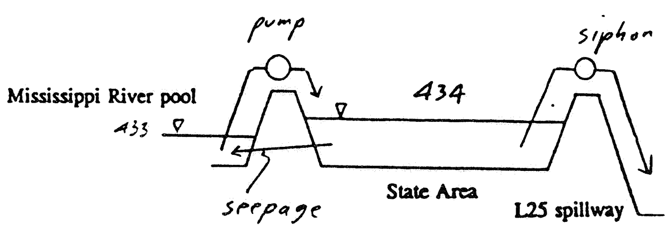
ALTERNATE 3.

- OPERATION WITH SIPHON, POOL HIGHER THAN STATE AREA
- ATTEMPTING TO PRODUCE 0.45 FPS FLOW OVER MUSSEL BED



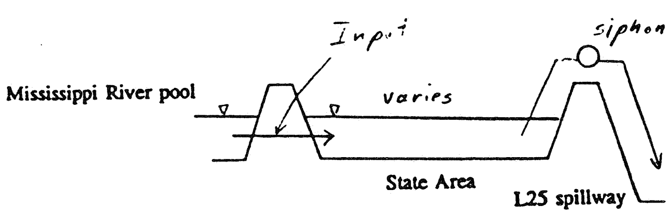
Jul - Aug			
Input		Output	
6 - 8 ft. wide stop-log structures	1,465 cfs	siphon	1,700 cfs
4 - 48 inch pipes with gates	200 cfs		
seepage	35 cfs		

- OPERATION WITH SIPHON, POOL LOWER THAN STATE AREA
- ATTEMPTING TO PRODUCE 0.45 FPS FLOW OVER MUSSEL BED DURING OPEN RIVER



Sep - Oct - Nov			
Input		Output	
pump	1,735 cfs	siphon	1,700 cfs
		seepage	35 cfs

- OPERATION WITH SIPHON, POOL ELEV. EQUAL TO STATE AREA
- ATTEMPTING TO PRODUCE 0.45 FPS FLOW OVER MUSSEL BED DURING OPEN RIVER



Dec - Jan - Feb - Mar - Apr - May - Jun			
Input		Output	
9 - 8 ft. wide stop-log structures	1,500 cfs	siphon	1,350 cfs
4 - 48 inch pipes with gates	200 cfs	2 - 8 ft. wide stop log structures	350 cfs

PROJECT	Page __ of __	COMPUTED BY	DATE
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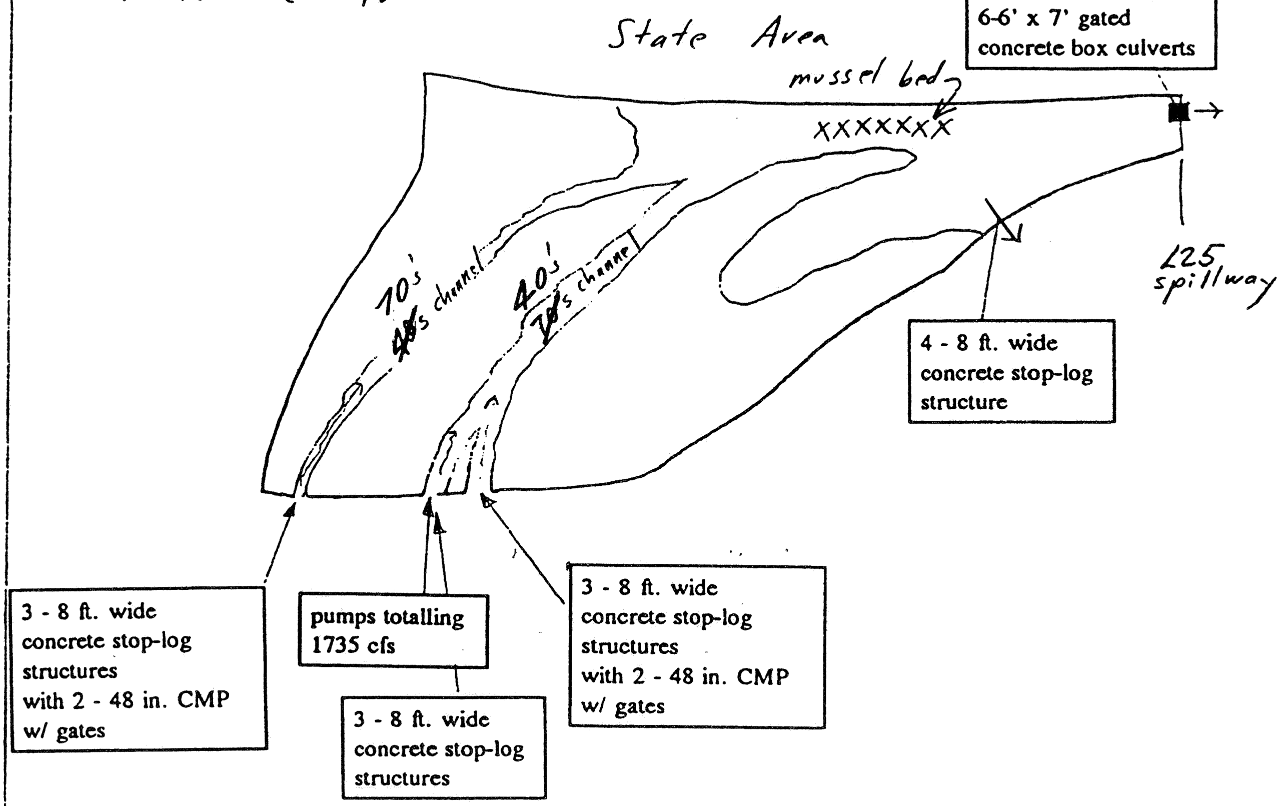
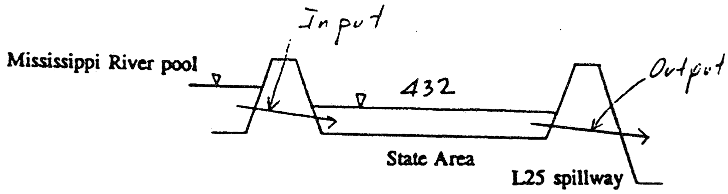
Alternate 4.



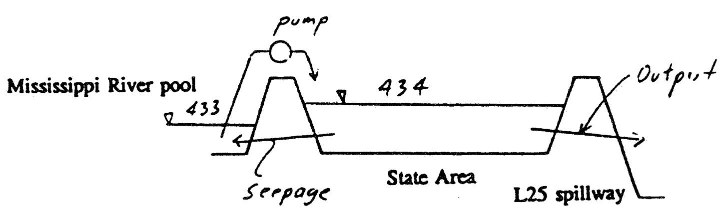
ALTERNATE 4

- OPERATION WITH SIX 6' x 7' GATED CONCRETE BOX CULVERTS
- POOL HIGHER THAN STATE AREA
- VELOCITY APPROX. 0.45 FPS OVER MUSSEL BED



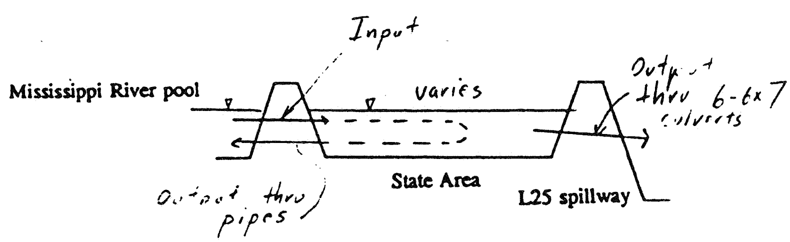
Jul - Aug			
Input		Output	
6 - 8 ft. wide stop-log structure	1,465 cfs	Six 6' x 7' gated concrete box culverts	1,700 cfs
4 - 48 inch pipes with gates	200 cfs		
seepage	35 cfs		

- OPERATION WITH SIX 6' x 7' GATED CONCRETE BOX CULVERTS
- POOL LOWER THAN STATE AREA
- VELOCITY APPROX. 0.45 FPS OVER MUSSEL BED



Sep - Oct - Nov			
Input		Output	
pump	1,735 cfs	Six 6' x 7' gated concrete box culverts	1,700 cfs
		seepage	35 cfs

- OPERATION WITH SIX 6' x 7' GATED CONCRETE BOX CULVERTS
- POOL ELEV. EQUAL TO STATE AREA
- VELOCITY APPROX. 0.45 FPS OVER MUSSEL BED DURING OPEN RIVER



Dec - Jan - Feb - Mar - Apr - May - Jun			
Input		Output	
9 - 8 ft. wide stop-log structures	1,500 cfs	Six 6' x 7' gated concrete box culverts	1,000 cfs
4 - 48 inch pipes with gates	200 cfs	4 - 8ft. wide stop-log structures	700 cfs

Illinois Department of Conservation

Brent Manning Director   John W. Comerio Deputy Director   Bruce F. Clay Assistant Director

'93 AUG 30 P1:11

August 18, 1993

Colonel James D. Craig
District Engineer, St. Louis District
U.S. Army Corps of Engineers
1222 Spruce Street
St. Louis, MO 63103-2833

Dear Colonel Craig:

With this letter I would like to comment on recent discussions regarding the Batchtown Habitat Rehabilitation and Enhancement Project and to encourage you to reinstate the project in the Definite Project Report process.

Mr. Owen Dutt's letter of April 16, 1993, requesting the Department's selection of one of the four alternatives to Plan C, concerned the Department because the alternatives inadequately address water flow over the mussel bed. The Department is also concerned about making a decision at this time on the fate of the mussel bed without adequate information on the existing condition of the area. The information needed for an informed determination was identified in my letter to you of March 19, 1993, and I again ask that your office pursue the additional information and expertise requested.

We agree with Mr. Dutt's assessment that the second alternative is probably the best alternative to continue working with. However, we do not believe the project is ready for the Fish and Wildlife Service Coordination Act process. The information we previously requested is needed before the project proceeds.

I encourage you to give this request a high priority. We remain ready and willing to offer any staff assistance in this matter.

Sincerely,

Brent Manning

Brent Manning
Director

BM:BD:mip

cc: Congressman Richard Durbin

Encl D-6

Illinois Department of Conservation

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

Brent Manning, Director John W. Comerio, Deputy Director Bruce F. Clay, Assistant Director

PD-F

rec'd 12/21/93 - ok

December 7, 1993

Mr. Owen ~~Dutt~~ OOD
Chief, Planning Division
Corps of Engineers
1222 Spruce Street
St. Louis, MO 63103-2833

Dear Mr. Dutt:

Our staff met on November 18, 1993, to discuss the Batchtown EMP project water level management plan with the new hydrographs and stage information your staff provided. We believe that the plan C-2 project can provide the necessary water levels and flows needed for us to manage for fish and wildlife with some possible design modifications identified during the Definite Project Report (DPR) process.

The attached water level and flow plan we identified addressed three factors: water level, water flow and gate openings. We realize the complexity of the site and these variables; however, for the most part we believe we can manage the site if provided the maximum flexibility in the design features. Some of these features (we discussed and will want to look at with your staff and the Fish and Wildlife Service) are water control structure location, levee alignment, vanes, pump sizes and flows through the refuge area.

We look forward to your continued cooperation and a draft DPR on this project.

Sincerely,

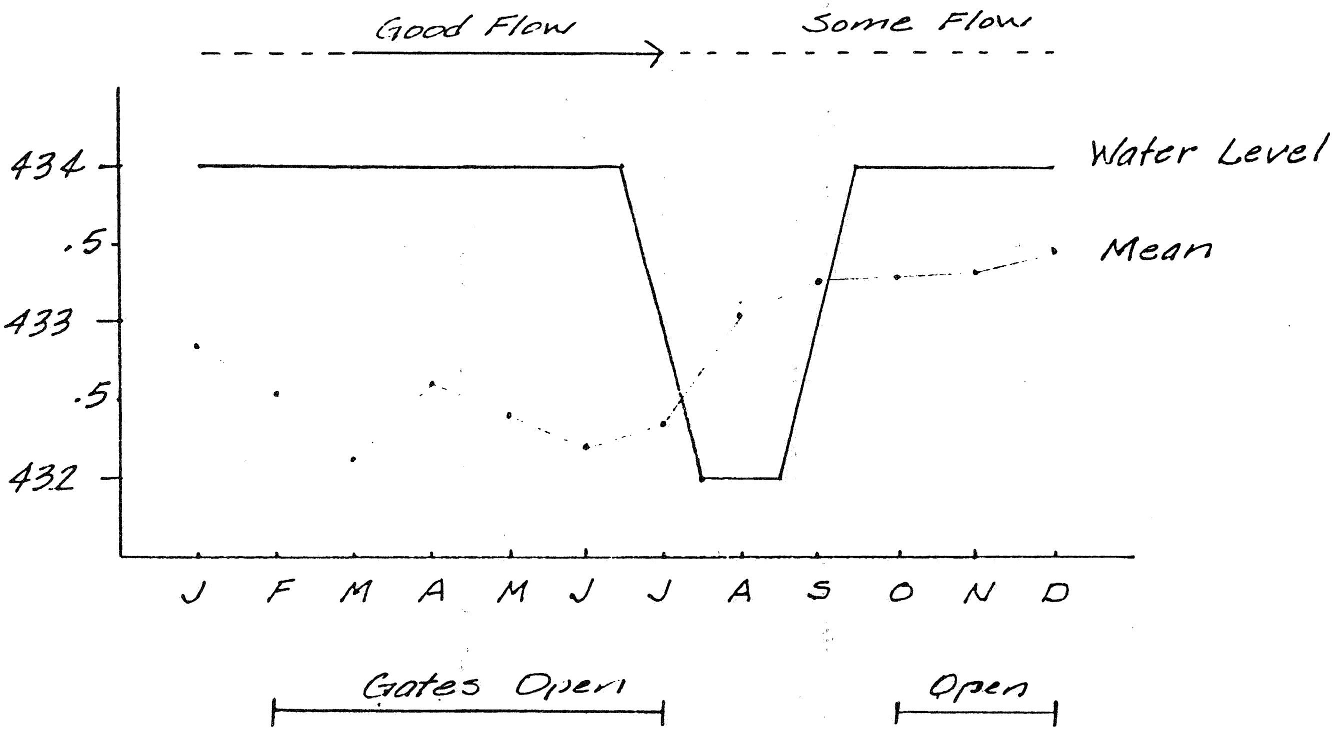
Bruce A. Clark
Director
Office of Planning and Development

BAC:BD:mk

cc: John Tranquilli
Jerry Beverlin

Encl D-7

BATCHTOWN EMP HABITAT PROJECT
Water-Level Management Plan



NOV. 1993

4H ~~RE~~ ~~F~~ ~~R~~ DL F

Calhoun County Soil & Water Conservation District
P.O. Box 516 - Hardin, IL 62047 - Phone 576-2723

Owen Dutt
Acting Chairman of Planning
St. Louis District, Corps of Engineers
1222 Spruce St.
St. Louis, MO 63103

June 25, 1992

Dear Mr. Dutt,

The Calhoun Co. Soil and Water Conservation District (CCSWCD) with the technical assistance of the U.S.D.A. Soil Conservation Service (SCS) has worked closely with the St. Louis Corps District in developing a strategy for hillside sediment control on the Batchtown Habitat Rehabilitation and Enhancement Project.

By this letter, it is the intent of the CCSWCD to serve as the local sponsor for the hillside sediment control feature of the project. It is understood that the CCSWCD's cost share for the construction of this feature is 25 percent. A number of possible sources of funding exist for the 25 percent local cost share. These sources include state Conservation Practices Program funds, Ducks Unlimited M.A.R.S.H. Program funds, EPA 319 funds, and landowner contributions.

It is also the intent of the CCSWCD to incure the total cost of theoperations and maintenance of the hillside sediment control feature as outlined in the draft operation and maintenance agreement between the SCS and the CCSWCD.

The agreement will be accomplished in accordance with Sec. 906 (E) of the Water Resource Development Act of 1986. Any mutually agreed to rehabilition will be cost shared on a 75 percent federal and 25 percent local sponsor basis.

The CCSWCD gives its full support to the hillside sediment control program and to its mutually beneficial benefits of soil erosion control and habitat rehabilitation and enhancement.

Sincerely,

Kenneth Kronable

Kenneth Kronable, Chairman
Calhoun Co. Soil and Water Conservation District

Local Support:

The Batchtown Sportsmen's Club has pledged to help with Resource planning for the watershed area. The support of a group like this will benefit the entire planning process. They have also indicated a willingness to supply labor and small machine use (as available) on practices such as streambank stabilization that are labor intensive. I look forward to starting the entire Resource planning process in August when I have additional help scheduled for my office.

Martha Sheppard
District Conservationist

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL	# of pages ▸ 2
To Dave Kirkpatrick	From Martha Sheppard
Dept./Agency	Phone # 618-576-2723
Fax #	Fax # 618-576-2328

NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

APPENDIX E

HYDROLOGY AND HYDRAULICS
BATCHTOWN HREP

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TABLES

PLATES

APPENDIX E

HYDROLOGY AND HYDRAULICS
BATCHTOWN HREP

1. General.

The Batchtown project area shown on Plate 1 is located on the Mississippi River, between River Mile 241.4 (Locks and Dam 25) and 248.5. This appendix will present the hydrologic and hydraulic effort leading to the proposed improvements to the Batchtown area.

2. Climate.

The climate of the area is typical midwestern, with warm, humid summers and cold, relatively-dry winters. Normal temperature extremes may range from the 100 degree or more in mid-summer to below zero in mid-winter. The average annual temperature is 51 degrees.

Significant precipitation occurs in every month of the year, with the greatest amounts normally in April-May and the least in January-February. The area averages slightly under 35 inches precipitation per year, with about 24 inches of snowfall in a typical winter. Average annual evaporation is not available for this immediate area. Table E-1 gives average monthly precipitation totals at Grafton, Illinois, about 23 miles downstream of the Batchtown area, and the average monthly evaporation totals at the National Weather Service gage at St. Louis, Missouri.

Table E-1. Average Monthly Precipitation and Evaporation.

Month	Precip. (inches)	Evap. (inches)	Month	Precip. (inches)	Evap. (inches)
January	1.66	0.69	July	3.69	5.89
February	2.05	1.01	August	3.15	4.87
March	3.25	2.00	September	3.04	3.48
April	3.70	3.24	October	2.42	2.32
May	3.90	4.59	November	2.65	1.22
June	3.56	5.24	December	2.22	0.69

3. Existing Hydraulics, Mississippi River.

Mississippi stages at Batchtown are controlled during non-flood river condition by the regulation of Lock and Dam 25 at River Mile 241.4 . The normal pool stage for Lock and Dam 25 is 434.0 ft NGVD but exceeds this elevation when flows approach bankfull or greater conditions. Because the hinge point for Lock and Dam 25 is at Mozier Landing, River Mile 260.3, the elevation of the pool can be lower than the normal pool elevation when the pool on "tilt". As shown on Table E-2, which gives the annual stage-duration relationship at Lock and Dam 25, stages are less than 434 NGVD more than 90% of the time on an annual basis.

Table E-2. Stage-Duration for Lock and Dam 25.

Elevation FT (NGVD)	% of Time at or above
441.1	.2
440.1	.4
439.1	.7
438.1	1.3
437.1	2.0
436.1	3.0
435.1	4.2
434.1	10.8
433.1	64.0
432.1	72.4
431.1	79.1
430.1	84.7
429.1	100.0

a. Floods.

The Mississippi River discharge- and stage-frequency relationships for the reach have been well established from previous analytical and physical model studies. Flood-frequency relationships at the downstream and upstream end of Batchtown are shown on Table E-3. The Mississippi River Profiles are shown in Plate 15.

Table E-3. Stage - Frequency.

Frequency (yrs)	Mile 241.4 Elevation FT(NGVD)	Mile 248.5 Elevation FT(NGVD)
2	434.1	435.0
5	435.3	436.2
10	436.6	437.8
25	438.9	439.9
50	439.9	440.9
100	441.1	442.4

The flood-of-record occurred in 1993 and reached an elevation of 446.6 NGVD at L&D 25. Plate 16 shows the stage-hydrograph for L&D 25 for the period of record (1939-1994).

4. Sedimentation.

The Batchtown area receives sediment from the Mississippi River and from hillside runoff. These two separate sources combine to make deposition a major problem.

a. Mississippi River.

Deposition at Batchtown occurs due to its location on the inside of a bend (i.e., the point bar side) and contributed by its proximity to Lock and Dam 25. Pool 25 was impounded in 1939. The pattern of deposition of sediment in the Batchtown Project area was traced using 1881 and 1989 topographic maps and 1940, 1968, 1973 and 1988 aerial photographs. The 1881 topographic map clearly indicate that Batchtown was a deposition zone prior to pool impoundment. The 1940 photographs showed that the same food-plain and channel patterns existed in the Batchtown area as exists on the 1988 photographs. The rapid rate of deposition was clear in a comparison was made of flood plain cross sections from the 1881 map. This comparison depicts the classical process of natural levee deposition. This flood plain area is rapidly being converted from aquatic to terrestrial habitat.

b. Hillside.

Deposition is occurring in the Batchtown area as a result of hillside runoff from four major watersheds. (Figure O-1). No continuous records of deposition in the area have been kept, but sediment rates were determined by the National Resource Conservation Service, as shown in Table E-4. The total existing sediment load for the Batchtown area is estimated as 17.65 acre-ft/year. Hillside sediment control measures for the Batchtown area were considered by NRCS. If implemented, hillside control measures could reduce the sediment load delivered to the

Batchtown area by an average of 26%. A detailed description of the hillside sediment control plan is discussed in Appendix O of this report.

Table E-4. Sedimentation Rates.

Watershed Number	Stream	Area (ACRES)	Sediment Load Existing (acres-ft/year)	Sediment Load Hillside Measures (acres-ft/year)
3	USF&WL UPPER PL	834	1.12	0.95
4	Turner Branch	2346	4.47	3.40
5	Dixon Hollow	1060	1.90	1.52
6	Madison Creek	2403	7.73	5.41

5. Batchtown Mussels.

During the early phases of the Batchtown study, a mussel bed was located along the left bank of the backwater channel at Cockrell Hollow. This mussel bed is dense, diverse, and commercially harvested. Data provided by the Illinois Department of Conservation indicated that this is a small bed, extending approximately 150 feet upstream to 1,500 feet downstream of Cockrell Harbor boat harbor.

Variable water velocity over a mussel bed is essential for its survival. Water velocities must not be too swift during high flows to scour mussels from the location. Nor, can the velocities be too slow to eliminate food sources for survival and reproduction.

a. Existing Velocities.

Velocity measurements were taken at 10 sections in the Batchtown area on 18 June 1991. They were taken when Lock and Dam 25 was at open river, with the river on "tilt". Appendix D, Inclosure 5 depicts the locations of the sections and the measurements. The hydraulic conditions in a limited portion of the back channel at Cockrell Hollow appear to be optimum for recruitment, growth, and survival of mussels. Conditions are neither too erosional nor depositional to scour or bury the mussels.

6. Existing Conditions for Turner Island.

Turner Island is a State of Illinois Fish and Waterfowl Management Area, located directly west of the Batchtown area between the Missouri and Illinois shores of the Mississippi River. The island is between river mile 244.2 and 245.6. Turner

Island is an oblong island with a low level levee surrounding the island. The depression created inside the levee retains water when Mississippi floodwaters recede, creating a perched condition. During low water and nonflood years, the water needs to be replenished by pumping.

7. Project Hydraulics.

To minimize continued sediment deposition from the Mississippi River and to improve management of the system for wildlife habitat, a number of alternatives were evaluated for the Illinois mainland area. Primary components of the recommended plan are shown on Plates 1 through 12. Three compartments were created for management objectives; United States Fish and Wildlife Service (USFWS) Middle Pool, USFWS Lower Pool and Illinois Department of Natual Resources (IDNR) managed area.

a. Riverfront Berm.

A low earthen berm was designed to prevent frequent Mississippi River floods from depositing sediments within the Batchtown area. The berm will extend from the Lock and Dam 25 overflow structure at River Mile 241.5 upstream to River Mile 248.5. An HEC-2 water surface profile analysis was performed on the Mississippi River with the low berms proposed and without (existing conditions) for a range of floods from the 2-year to the 500-year recurrence interval. No significant increase in water surface elevation was determined. Table E-5 shows the effects of the proposed Batchtown berm on the Mississippi River.

Table E-5. Effect of Batchtown Berm on Upstream Water Surface Profile.

Location Mississippi River River Mile	Increase in Depth over Existing Conditions (feet) by Return Period in years					
	5	10	25	50	100	500
241.2	0.0	0.0	0.0	0.0	0.0	0.0
245.4	0.2	0.1	0.1	0.0	0.0	0.0
255.5	0.1	0.1	0.1	0.0	0.0	0.0
270.5	0.0	0.0	0.0	0.0	0.0	0.0

(1) **Crown Elevation.**

A range of crown elevations for the riverfront berm were analyzed to determine appropriate elevations to exclude most of the sediment, while minimizing construction cost. Plate 17 shows the average annual duration associated with various berm crown elevations. Due to an absence of sediment data, it was assumed that the percent reduction in sediment inflow to the area would be similar to the percent time reduction of the inundation. This assumption is admittedly qualitative, the actual reduction could be higher or lower. The 434 feet NGVD height of the lower overflow structure at Lock and Dam 25 will prevent sediment-carrying waters from entering the Batchtown complex about 89% of the time. This elevation was selected by comparing different berm heights with possible sedimentation reduction. This high level of reduction in sediment is reflective of the operation of Lock and Dam 25. Deposited material within the area will be minimal, with possible exceptions during a major, long duration event such as the 1993 flood. Therefore, even through much of the sediment is transported during floods, the assumption that sediment reduction to the project area is proportional to the time duration is judged reasonable and valid.

Table E-6. Average Annual Duration vs. Structure Elevation.

Reference Point River Mile 241.5		Reference Point River Mile 243.5		Reference Point River Mile 248.5	
Crown Elev. (NGVD)	Sediment Reduction (%)	Crown Elev. (NGVD)	Sediment Reduction (%)	Crown Elev (NGVD)	Sediment Reduction (%)
432.1	0	432.9	0	434.6	0
433.1	36	433.9	36	435.6	36
434.1	89	434.9	89	436.6	89
435.1	93	435.9	93	437.6	93
436.1	97	436.9	97	438.6	97
438.1	99	438.9	99	440.6	99

(2) **Berm Overtopping.**

Overtopping of these structures will be a fairly frequent occurrence. The berm crown at Lock and Dam 25 overflow structure will be 434.5 NGVD with a recurrence interval of 5 years. Floods and overtopping would normally occur in the late winter-early spring of the year, due to upstream snowmelt and normal spring rains. When the low earthen berms are overtopped, some local damage may occur, but should be minimal due to the low head differential. Any berm damage during most of these events would be repairable prior to the fall season, when higher interior water levels are required. To ensure minimal damage from overtopping of the main berm, a 1500 feet length near the downstream end will be set at elevation 434.0 and protected by stone riprap. This reach will be used for initial overflow into the IDOC Managed Area. An overflow structures was also designed for the USF&WL Middle Area and for the sediment detention areas.

b. Drainage Structures.

(1) Exterior Drainage.

The proposed riverfront berm forms three closed systems during low flow conditions. New structures were required to fill or to drain the interior system by gravity whenever river conditions allow.

The upper closed system is identified as the USF&WL Upper Pool. One eight foot wide concrete stop-log structure is located at the upstream portion of the berm. This structure will let fresh water enter the system. At the downstream portion of this system, one eight feet wide concrete stop-log structure will be used to drain the interior system. The lower eight feet wide concrete stop-log structure will be used for fish passage into the new channel in the interior area.

The middle system is identified as the USF&WL Lower Pool. One eight feet wide concrete stop-log structure will be placed between the USF&WL Lower Pool and the IDOC Managed Area for the pasage of water and fish.

The lower closed system is the IDOC Managed Area. At the upstream end water will enter by six 8 feet wide concrete stop-log structures. The water will exit downstream utilizing four 8 feet wide concrete stop-log structures in the riverfront berm and two gated 54-inch concrete pipes through the Lock and Dam 25 overflow weir. The design for this system was inflow into the system will be equal outflow from the system. When the interior water surface is drawn down, the physical adjustments of the upper six stop-log structures would be required to maintain flow over the identified mussels bed. The average velocity of water over the mussels bed during this period was estimated to be 0.06 feet per second using information obtained from modeling the interior channel using HEC-2.

The rating curve for the 2-54 inch concrete pipes is shown in Plate E-1. The performed score hole dissipator at the outlet of the 2-54 inch concrete pipes is shown in Plate E-2. The maximum velocity at the outlet is 10.2 feet per second. This velocity will require 1000 pound topsize riprap placed 42 inch thick on 9 inch bedding material. Riprap protection was also placed at the entrance of the culverts.

(2) Pumping Plants.

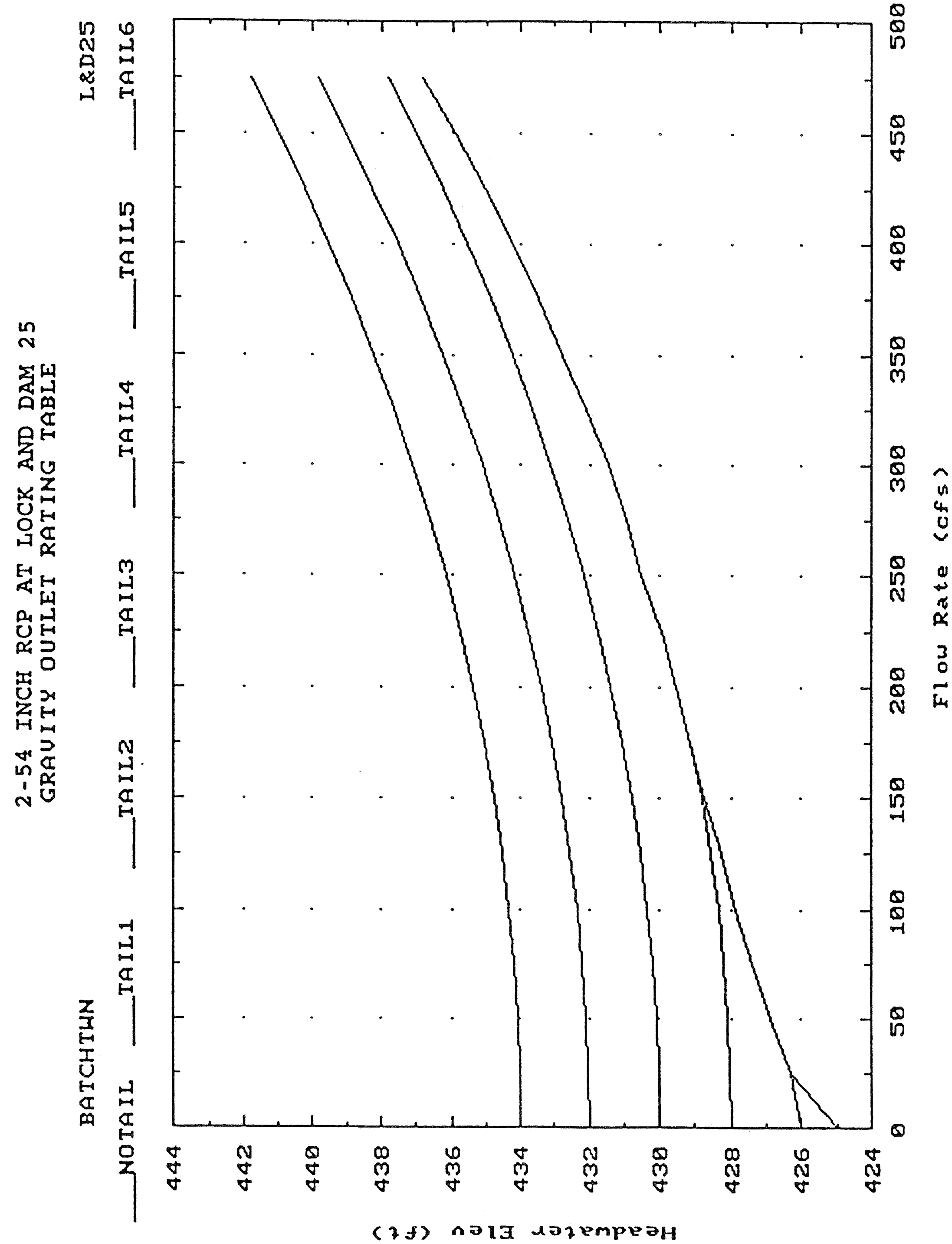
To have the capability to either flood or drain the system, three pumping stations were designed. The pump sizes were determined by knowing the volume of water pumped and the days required to pump the areas. A 15 cfs pump will be utilized for the USF&WL Lower Pool. A 90 cfs pump will be located at the upper chute of the 40's channel. The pumps will be located on the Mississippi side of the system to take advantage of the deeper water in the Mississippi for a natural sump. The filling or emptying of the systems could be accomplished in about 10 days without seepage with the 15 cfs pump for the USF&WL Lower Pool and 20 days with the 90 cfs pump for the IDOC Managed Area without seepage.

A third pump with a capacity of 6 cfs is needed to provide separate water management for Turner Island. The filling or emptying time is about 10 days with the selected pumping capacity.

c. Sediment Traps.

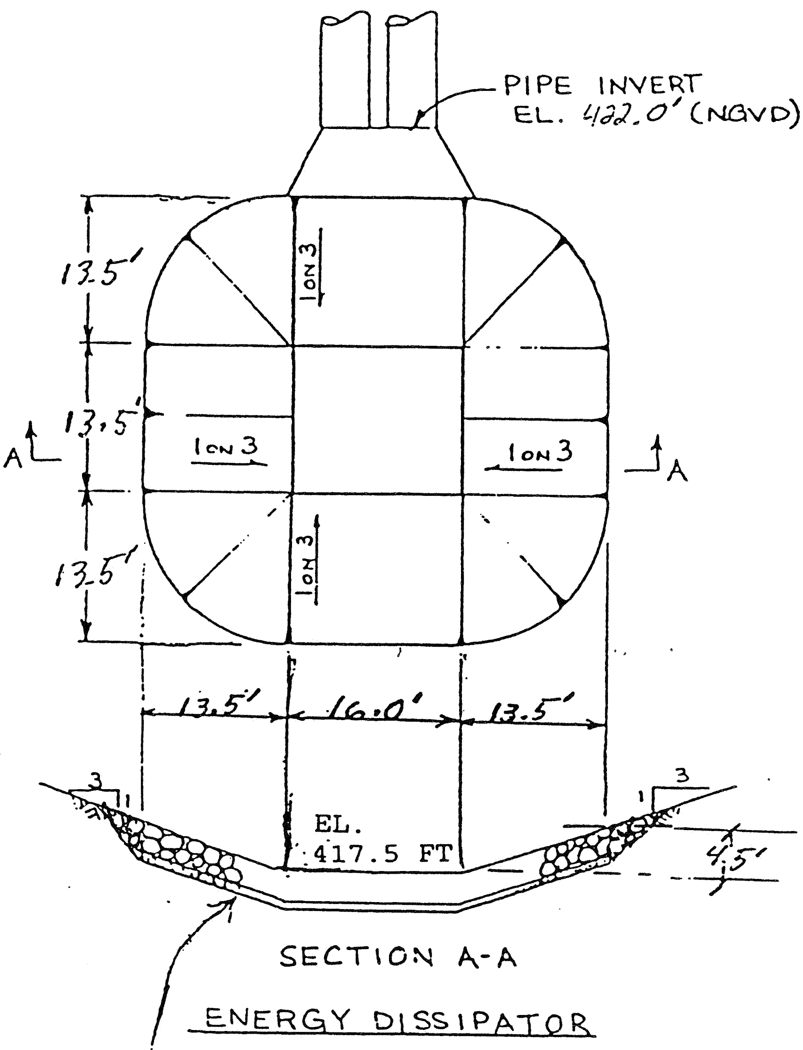
Two new, and one existing lowland sediment traps are part of the proposed project. No specific hydrologic frequency design was associated with the design of the overflow structures nor culverts for rainfall events. An existing shallow sediment trap at Turner Branch was the design followed. When a rainfall event occurs on Turner Branch, the runoff is drained through the sediment trap by a 60 inch arch CMP and by overtopping the grass covered holding embankment. Two reasons for this design exist. The first reason is that no damage will occur downstream of the sediment trap when the embankment is overtopped. The second reason is that sufficient storage can not be obtained for even a 5-year frequency event without overtopping the embankment. This is due to the large upstream drainage area contributing to the sediment trap. Physical restrictions were also placed on the sediment traps. The embankment height could not induce flooding upstream on private property. The sediment traps could not encroach in forested areas or wetlands.

Additional storage for the lowland sediment traps were obtained by excavation. The USFWS Middle Pool sediment trap will have 70 acre-feet of storage with a 60 inch CMP. The existing sediment trap at Turner Branch will be excavated to increase the storage to 170 area-feet using the existing 60 inch arch CMP. The sediment trap for Dixon Hollow will have 76 acre-feet of storage available with a 60 inch CMP. All flood events exceeding the available storage in the lowland sediment trap will result in overtopping the grass covered holding embankment.



BATCHTOWN EMP
RATING CURVE FOR 2-54 INCH RCP
AT LOCK AND DAM 25

PLATE E-1



Velocity$_{max}$ = 10.2 fps
1000 lb topsize riprap, 42 inch thick
on 9 inch bedding material

STORM DRAIN OUTLETS
RIPRAP ENERGY DISSAPATORS
PREFORMED SCOUR HOLE GEOMETRY

HYDRAULIC DESIGN CHART 722-6

WES 7-73

BATCHTOWN EMP
PERFORMED SCORE HOLE
DOWNSTREAM AT 2-54 INCH RCP
AT LOCK AND DAM 25

Appendix F - Geotechnical Considerations

APPENDIX F: GEOTECHNICAL CONSIDERATIONS

1. GENERAL

a. This section presents the results of Geotechnical studies and analyses including:

i. Subsurface exploration program.

ii. Stratigraphy.

iii. Soils Testing program.

iv. Slope stability analyses, bearing capacity, settlement and lateral earth pressure analyses.

v. Underseepage analyses.

b. The boring logs referenced by this section may be found at the end of this appendix.

2. SUBSURFACE EXPLORATION PROGRAM

a. General. The subsurface exploration program was designed to determine the vertical and horizontal extent of the foundation features and the engineering characteristics of the earthen materials used in this project. The exploration program was carried out by Brotcke Engineering Incorporated of St. Louis, Missouri. The drillers advanced 16 borings with a Central Mining Equipment drill rig using augers and rotary methods obtaining split spoon and bag samples. Where conditions prohibited access by the drill rig, the drillers advanced 14 borings with a hand-held power auger obtaining only bag samples. Table 1 lists all the borings taken for this project.

b. Sampling.

i. Deep borings were taken to rock. The drillers utilized general sampling techniques on 5-foot centers in the fine grained materials and split spoon sampling techniques on 10-foot centers in the coarse grained materials.

ii. Shallow borings completely penetrated the overlying fine grained blanket and extended 10-feet into the underlying sands. The drillers utilized general sampling techniques at 5-foot centers in fine grained materials and split spoon techniques at 10-foot centers in the coarse grained materials. Where the holes were drilled with a hand held power auger, the drillers used general sampling techniques in the coarse grained materials.

iii. All borrow pit borings are 5 to 15 feet deep and were advanced with augers.

3. STRATIGRAPHY

a. General. The project extends from Mississippi River mile 248.5 downstream to Lock and Dam No. 25 (river mile 241.4). The stratigraphy of this reach is shown on the boring logs and consists of fine grained materials overlying a coarse grained substratum. The St. Louis District field located all borings as shown on Figure F-1.

b. U.S. Fish and Wildlife Refuge. The stratigraphy of that part of the proposed levee which encompasses the U.S. Fish and Wildlife refuge consists of 10 to 30 feet thick blanket of fat and lean clays overlying 87 to 100 feet of fine, fine to coarse, poorly graded sands and gravely sands. The fine grained layer appear to be thickest near the edge of the river valley. These borings are shown on Figures F-2 through F-11.

c. Illinois Department of Conservation Refuge. The stratigraphy of that part of the proposed levee which encompasses the Illinois Department of Conservation refuge consists of a fine grained layer of fat and lean clays which vary from 9 to 20 thick. Since no deep borings were taken in this area, it is assumed that the thickness of the underlying coarse grained materials is the same as described above. These borings are shown on Figures F-12 to F-24

d. Borrow Area Borings. Conditions within the landside borrow pits may be estimated from the adjacent centerline borings. Conditions within the first 5 to 15 feet of some alternate borrow areas are shown by the field logs shown on Figures F-25 through F-28.

e. Lock and Dam 25 Overflow Section. In 1981, three borings were drilled in the Lock and Dam No. 25 overflow section for a liquefaction analyses. Figure F-29 shows the boring locations and Figure F-30 shows the boring logs.

4. SOILS TESTING PROGRAM

a. General. Geotechnology's St. Louis Laboratory determined the Atterburg limits of all fine grained samples and the grain size distribution of all coarse grained samples. No strength tests were performed on undisturbed or compacted samples in this testing program. A statistical analyses of the plastic indexes of all fine grained samples in the top 10-feet of each boring are shown on Figures F-32a and 32b. Assuming a 90% confidence limit (90% confident that any plastic index will be larger than this number) and a normal distribution, the analyses yields an expected plastic index of 12.6. The drained and undrained strength parameters of in-situ and compacted soils are based on charts in TR 3-604 "Engineering Properties of Fine Grained Soils in Meander Belt and Backswamp Deposits" and the previously submitted DPR for the Calhoun Point Habitat Rehabilitation and Enhancement Project.

b. Design Parameters for In-Situ Foundation Clays.

i. Based on Figure 32 in TR 3-604, the undrained shear strength of fine grained soils with a plastic index of 12.6 is $\phi=0°$, C=40 psf. This strength seems too low based on visual inspections of the soil samples obtained in the exploration program. The design undrained shear strength of the fine grained soils at the Batchtown site will be set the same as that determined for the Calhoun Point project: $\phi=0°$, C=200 psf.

ii. Based on Figure 31 in TR 3-604, the drained shear strength of fine grained soils with a plastic index of 12.6 is $\phi=28°$, C=0 psf. This strength seems reasonable based on visual inspections of the disturbed soil samples obtained in the exploration program.

iii. The design unit weight of the in-situ clays is assumed to be 125 pcf.

c. Design Parameters for Compacted Clay.

i. The undrained shear strength of compacted fine grained materials for the Batchtown project will be based on the results of unconfined compression tests on compacted samples performed for the Calhoun Point project. As described in paragraph 4c of Appendix F in the Calhoun Point DPR, the design undrained shear strength of the compacted material is $\phi=0°$, C=400 psf for the on-site borrow pits. These strengths are for semi-compacted samples (15-blow method) compacted at water contents 2% to 4% wet of optimum.

ii. The drained shear strength of the compacted samples is the same as the in-situ material.

iii. The saturated unit weight of the compacted clays is 125 pcf.

5. SLOPE STABILITY ANALYSES. No detailed slope stability analyses were performed. The embankments for this project will be constructed of semi-compacted earthen materials obtained from the identified borrow pits. The embankments will be 4 to 6 feet high and will be required to hold back no more than 2-feet of differential head. Based on experience with the final design of two other similar EMP projects in the region, the shear strengths of the foundation and compacted clays are adequate to perform their desired function.

6. BEARING CAPACITY, SETTLEMENT AND LATERAL EARTH PRESSURES ANALYSES. These detailed analyses will be performed for the pumpstations, gravity drains and other various water control structures during the plans and specification phase of this project. This exploration and testing program provides all the information necessary complete these detailed analyses.

7. UNDERSEEPAGE ANALYSES.

a. General. Underseepage studies were performed to estimate the quantity of underseepage into the U.S. Fish and Wildlife and Illinois Department of Conservation portions of the project and to estimate the gradients at the landside toe. Seepage in-flow rates were determined for the river at 434 NGVD and interior water surface elevations of 431, 432 and 433. Seepage out-flow rates were estimated for interior water surface at elevation 434 and river elevations of 431, 432 and 433. The irregularity of the landside and the proximity of the river channel precluded the use of the traditional closed-form underseepage solutions. The program LEVEEMSU (see WES Technical Report GL-89-13) was used because of its capability to analyze irregular sections.

b. Permeability. Aquifer permeability was estimated from the D_{10} sizes of sand samples from the deep borings taken at the project. The average permeability of the aquifer sands of the deep borings is as follows:

BT-4	$1192*10^{-4}$ cm/sec
BT-6	$1273*10^{-4}$ cm/sec
BT-9	$1022*10^{-4}$ cm/sec
BT-32	$1146*10^{-4}$ cm/sec
BT-35	$1596*10^{-4}$ cm/sec

The aquifer permeability was set to $1200*10^{-4}$ cm/sec for these underseepage studies. The permeability of the overlying fine grained blanket was set to $3*10^{-4}$ cm/sec.

c. Topography. The topography of the adjacent river channel was determined from 1987 hydrographic surveys. The topography of the project interior was determined from the 1991 2-foot contour maps. Two sections (Nos 1 and 2) were established and analyzed in the USFW portion of the project. Three sections (Nos 3, 4 and 5) were established and analyzed in the IDOC portion of the project. These sections are shown on figure F-1.

d. Results.

i. LEVEEMSU reports the piezometric head in the aquifer at various points including under the levee toes. The headloss between the riverside and landside toes was divided by the distance between these toes to determine a flow gradient. The aquifer permeability is described above. The flow area is equal to the thickness of the aquifer as determined by the deep borings. The unit underseepage flow beneath the levee is determined with the equation:

$$q = K*i*A.$$

This unit flow is multiplied by the length of project that the section represents and this value is reported as the volume of underseepage into the protected area.

ii. It has been assumed that a portion of the project built in the IDOC area will set directly on top of the aquifer sands (no overlying blanket). Case 1, figure 22 on page 62 of TM-3-424 "**Investigation of Underseepage and Its Control, Lower Mississippi River**" provides a solution to this configuration. The unit flow obtained from this solution is multiplied by the length of project that the section represents and this value is reported as the volume of underseepage into the protected area.

iii. The results of the underseepage analyses are summarized in Table 2.

Appendix F, Table 2.

Section	Length	Crit Grad	Unit Flow	Total Flow	Crit Grad	Unit Flow	Total Flow	Crit Grad	Unit Flow	Total Flow
		Interior Water @ 431			Interior Water @ 432			Interior Water @ 433		
USFW S-1	5500	.68	.134	737	.45	.085	468	.23	.043	237
USFW S-3	3900	.19	.065	254	.13	.042	164	.06	.018	70
USFW S-4	8000	.21	.07	560	.14	.047	376	.07	.023	184
		Total Flow:		1551	Total Flow:		1008	Total Flow:		491
IDOC S-5	8000	.14	.052	416	.09	.036	288	.045	.015	120
IDOC S-6	6000	.22	.064	384	.15	.043	258	.07	.021	126
IDOC S-7	6000	N/A	.24	1440	N/A	.16	960	N/A	.08	480
		Total Flow:		2240	Total Flow:		1506	Total Flow:		726
		Project Flow		3791	Project Flow		2514	Project Flow		1217

Appendix F, Table 1.

Boring	Project Feature	Boring Type*	Proj Station
Borings In the U.S. Fish and Wildlife Refuge			
BT-3	CL	S	0+00
BT-4	CL	D	10+00
BT-5	CL	S	40+00
BT-6	CL	D	65+00
BT-7	CL	S	92+00
BT-8	Stop Log Struc	S	112+00
BT-9	Pump Stat + Over Flow	D	126+00
BT-27	CL	S	Flank
BT-20	CL	S	Flank
BT-32	Grav Drain	D	Flank
BT-1	Borrow Area	B	
BT-22	Borrow Area	B	
BT-23	Borrow Area	B	
BT-24	Borrow Area	B	
Borings In the Illinois Department of Conservation Refuge			
BT-28	Over Flow Struc	P	Flank
BT-30	CL	P	Flank
BT-31	CL	P	Flank
BT-11	Grav Dr + Stop Log	P	140+00
BT-12	Grav Dr + Stop Log	P	170+00
BT-13	CL	P	185+00
BT-14	CL	P	230+00
BT-15	CL	P	250+00
BT-35	Interior Boring	D	
BT-36	Interior Boring	D	
BT-37	Interior Boring	P	
BT-38	Interior Boring	P	
BT-39	Interior Boring	P	
Lock and Dam 25 Overflow Section			
25E7	As shown on Figure F-		
25E8	As shown on Figure F-		
25E9	As shown on Figure F-		

*Notes:
- 'S'- Shallow machine boring
- 'D'- Deep machine boring
- 'B'- Borrow pit boring
- 'P'- hand-held Power auger boring

8. LOCK AND DAM OVERFLOW SECTION. Additional geotechnical engineering must be completed for this portion of the job. CELMS-ED-G estimates that the work outlined below will cost $48,000.00. If the drilling and testing outlined can be done using land-based methods, the additional cost will be less.

a. Exploration and Testing.

i. Additional exploratory borings must be made upstream, downstream and on the centerline of the overflow section in the vicinity of the proposed outlet. Access to the site will be difficult and may require use of barge mounted drill rigs. The results of these borings will be used in all additional geotechnical engineering.

ii. The Atterburg limits of all fine grained samples obtained from the exploration will be determined. The particle gradation of all coarse grained samples obtained from the exploration will be determined.

iii. Strengths of sands will be obtained from empirical relations based on standard blow counts. Strengths of fine grained materials will be determined from unconfined compression tests on both undisturbed and compacted samples.

b. Earthen Cofferdam.

i. The plan includes placing a portion of the earthen fill for the cofferdam in the wet using a either a clay or a gravelly clay. (Gravelly clay is available at a quarry located 10 miles from the site.) The engineering characteristics (gradation, shear strength and compactability) of this borrow material must be determined.

ii. Detailed land-based and hydrographic surveys must be made of the work area in the upstream and downstream vicinity of the overflow section.

iii. Slope stability determination of the earthen cofferdam must be completed.

iv. Seepage analyses and dewatering requirements must be determined for the cofferdammed area.

c. New Structure.

i. Stability analyses must be completed of the new structure including bearing capacity, settlement potential and lateral earth pressures.

ii. The area where the new outlet pipes pass through the existing sheetpile structure must be studied to ensure that it remains watertight and can tolerate differential settlement without transferring additional loads to the sheetpile wall.

d. Existing Structure. The new structure must be designed so that its construction does not cause any detrimental impacts on the existing structure.

i. Stability analyses of the excavated slopes in the fill surrounding the existing sheetpile diaphragm cell overflow section must be analyzed. All cases including the after construction, steady-seepage and rapid drawdown will be analyzed.

ii. The top of the excavated slope must be places far enough away from the last diaphragm cell so that cell takes no notice of the excavation. It is anticipated that locating the top of the excavation so that it is beyond the at-rest pressure zone of the diaphragm cell will be appropriate.

iii. The new outlet pipes must be founded on a sturdy bedding. A concrete bedding will provide the best support to the new pipe. Backfill around the new pipe must be done with great care to ensure that the new pipe is properly supported and that the backfill is watertight.

Fig. 1

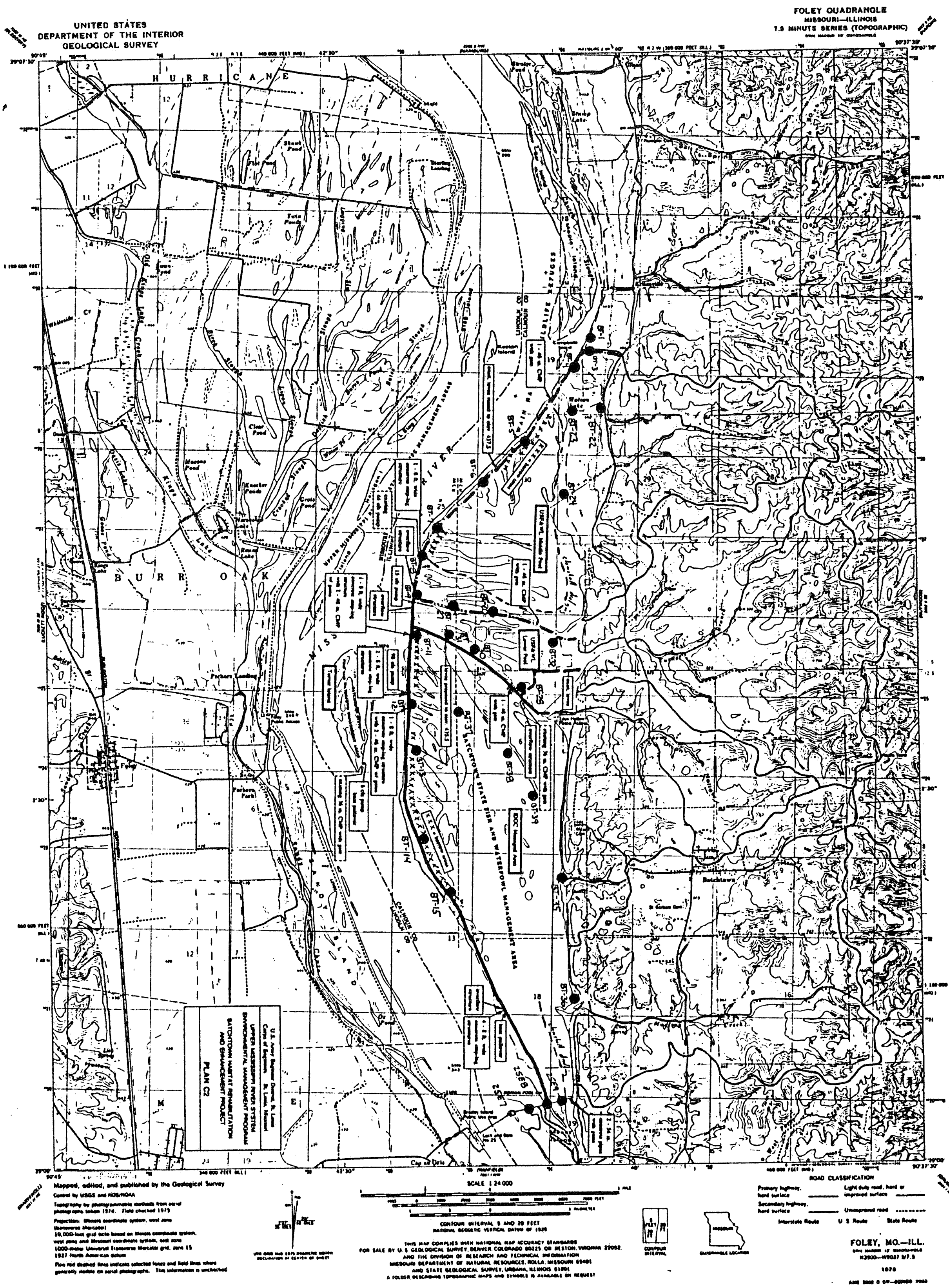

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
FOLEY QUADRANGLE
MISSOURI—ILLINOIS
7.5 MINUTE SERIES (TOPOGRAPHIC)
HURRICANE
BURR OAK
RIVER
BATCHTOWN STATE FISH AND WATERFOWL MANAGEMENT AREA
Batchtown
Foley
Cap au Gris
U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
BATCHTOWN HABITAT REHABILITATION
AND ENHANCEMENT PROJECT
PLAN C2
Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs taken 1974. Field checked 1975
SCALE 1:24 000
CONTOUR INTERVAL 5 AND 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
AND THE DIVISION OF RESEARCH AND TECHNICAL INFORMATION
MISSOURI DEPARTMENT OF NATURAL RESOURCES, ROLLA, MISSOURI 65401
AND STATE GEOLOGICAL SURVEY, URBANA, ILLINOIS 61801
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
ROAD CLASSIFICATION
FOLEY, MO.—ILL.
1975

FIG F1

BORING No. BT-3

Project: Batchtown   Begin Rotary:

Driller: Jeff Ludman   Inspector: Bill Roundcount

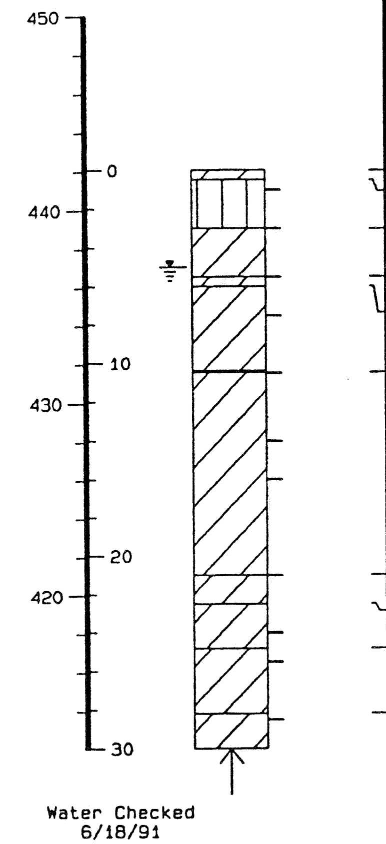
Boring No: BT-3   Date Started: 6/18/91   Finish: 6/18/91

Total Depth: 30.0   Ground Surf Elev: 442.1   Station: ?

Water Depth: 5.0   Date Measured: 6/18/91   Offset: ?

Number of Samples Taken: Jars 11   Tubes: 0   Bags: 0

ELEV (NGVD) / DEPTH (FT) — SOIL SYMBOLS / SAMPLER SYMBOLS / FIELD TEST DATA



USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
CL	Topsoil							
ML	Silty, M St, Br & Gr, rt	25	33	24	9	.3	.25	
CL	Silty, M St, dGr&Br, worm holes	29	40	22	18	.35	.25	
CL	Silty, M St, Gr & Br Mot, Ox stains	29	43	20	23	.15	.32	
CL	M St, Gr & Br Mot, Ox stains	28	44	19	25	.25	.39	
CL	St, Gr & Br Mot, Ox stains	28	48	18	30	.55	.55	
		28	50	20	30	.80	.88	
		32	50	18	32	.60	.88	
CL	M St, Gr & Br Mot, Ox stains & nodules	30	39	18	21	.25	.34	
CL	Sandy, Gr & Br	25	30	15	15	.10	.20	
CL	Silty, M St, gnGr, Tr-SAS	31	37	20	17	.25	.30	
CL	Silty, So, dGr, SAS	36	40	22	18	.1	.22	

US ARMY CORPS OF ENGINEERS - ST. LOUIS DISTRICT

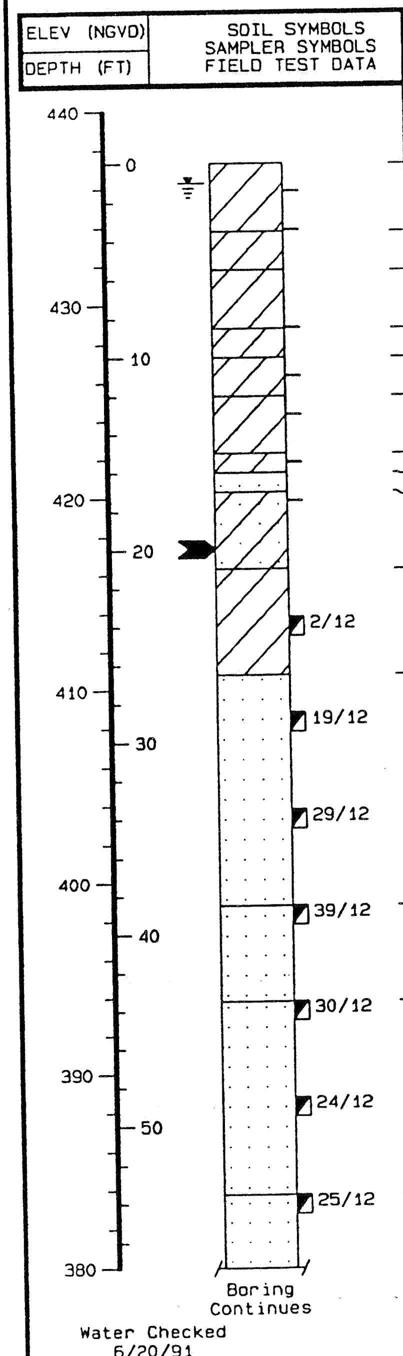
FIG 2

BORING No. BT-4

Project: Batchtown
Driller: Jeff Ludman
Boring No: BT-4
Total Depth: 115.0
Water Depth: 1.1

Begin Rotary: 20
Inspector: Bill Roundcount
Date Started: 6/19/91 Finish: 6/21/91
Ground Surf Elev: 437.3 Station: ?
Date Measured: 6/20/91 Offset: ?

Number of Samples Taken: Jars 26 Tubes: 0 Bags: 0

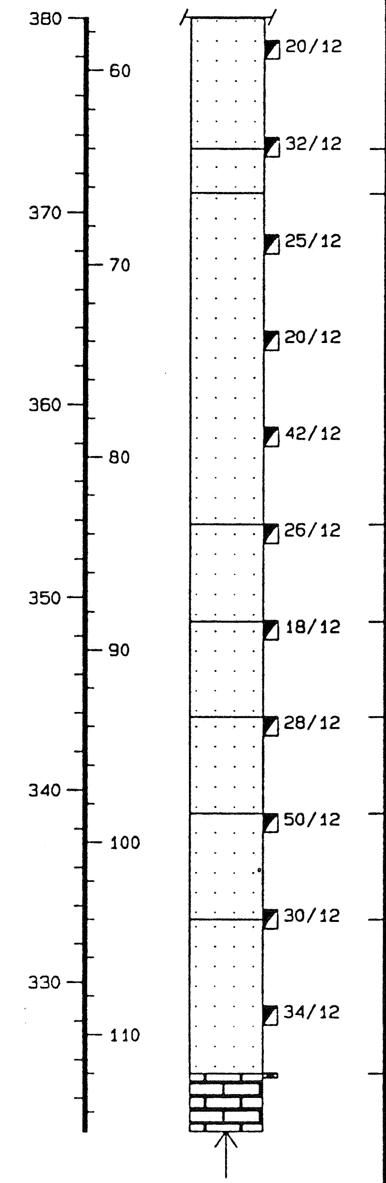


USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
CL	Slightly silty, Brn & Gr	23	43	24	19	.75	.65	
CL	St, dk Gr, Mot, Nodules	28	48	19	29	.30	.625	
CL	St, Gr & Br, Mot, Nodules							
CL	St, Gr & Br, Nodules	26	43	19	24	.55	.85	
CL	St, Br & Gr, Mot	28	45	18	27	.30	.725	
CL	Slightly silty, M St, Br & Gr, Mot, Ox stains	29	36	19	17	.25	.35	
CL	S, Silty, Brn	27						
SP	F grained, Br							
SC	F grained, Slightly clayey, CS, Wd fragments, Gr 25% Passed #200 sieve							
CL	Slightly S, Sand pockets, slf, dGr, vSo to So	32	33	19	14			
SP	M to F grained, CS, Tr-F gravel M dense, Gr	0.2 mm						
		0.2 mm						
SP	M to F grained, Dense, Gr	0.2 mm						
SP	M to F grained, Tr-C sand, Gr, Dense	0.2 mm						
		0.2 mm						
SP	M to F grained, Tr-C sand, Gr & br Gr, M dense to dense	0.2 mm						

FIG 3

BORING No. BT-4

Project: Batchtown | Begin Rotary: 20
Driller: Jeff Ludman | Inspector: Bill Roundcount
Boring No: BT-4 | Date Started: 6/19/91 | Finish: 6/21/91
Total Depth: 115.0 | Ground Surf Elev: 437.3 | Station: ?
Water Depth: 1.1 | Date Measured: 6/20/91 | Offset: ?
Number of Samples Taken: Jars 26 | Tubes: 0 | Bags: 0



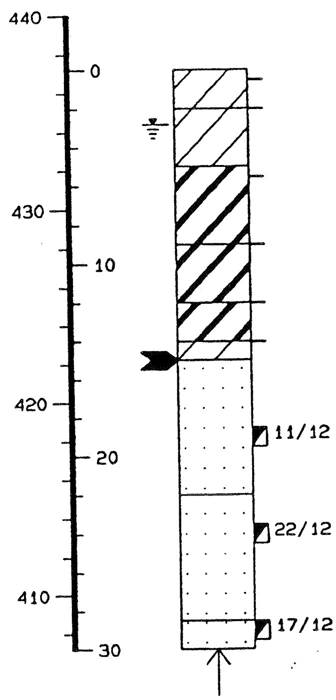
Field Test Data	USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
20/12			0.3 mm						
32/12	SP	F to C grained, Tr-F gravel, Br, Dense	0.3 mm						
	SP	G, C-F grained, M dense, br Gr							
25/12			0.2 mm						
20/12			0.2 mm						
42/12			0.3 mm						
26/12	SP	F to C grained, Tr-F gravel, M dense, br Gr	0.2 mm						
18/12	SP	C to F grained, M dense, br Gr	0.2 mm						
28/12	SP	C to F grained, br Gr, Tr-F gravel, M dense to dense (Sample destroyed)							
50/12	SP	M to F grained, br Gr, Dense to vDense	0.2 mm						
30/12	SP	F to C grained, Slightly gravelly, Dense, Br & Gr	0.3 mm						
34/12			0.2 mm						
	LS	Rock, Limestone & Chert, Tr-CS							

Fig 3 (cont

BORING No. BT-5

Project: Batchtown
Driller: Mike Foppe
Boring No: BT-5
Total Depth: 30.0
Water Depth: 2.8
Begin Rotary: 15
Inspector: Bill Roundcount
Date Started: 6/12/91 Finish: 6/12/91
Ground Surf Elev: 437.2 Station: ?
Date Measured: 6/12/91 Offset: ?
Number of Samples Taken: Jars 9 Tubes: 0 Bags: 0

ELEV (NGVD) / DEPTH (FT)	SOIL SYMBOLS / SAMPLER SYMBOLS / FIELD TEST DATA



Water Checked
6/12/91

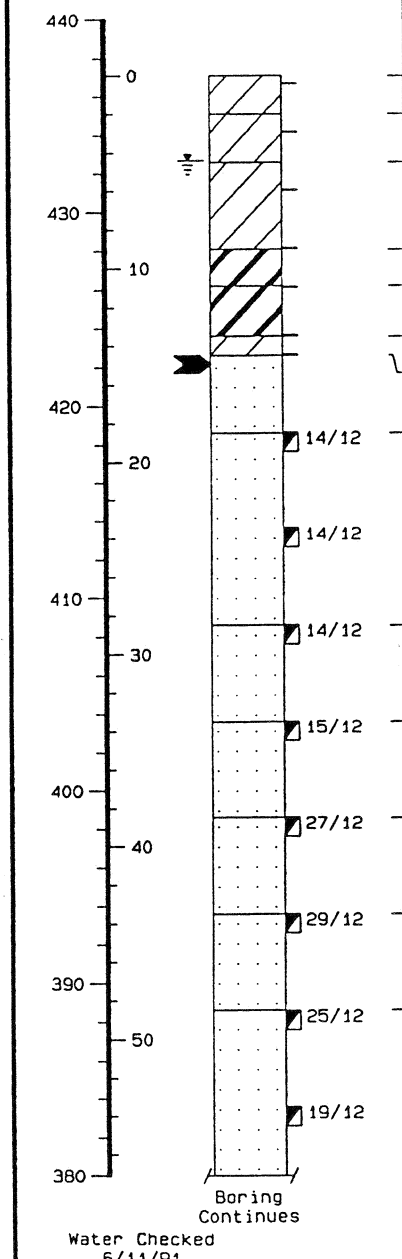
USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
CL	F Sandy, M St, Br & Gr, rt, Sand pockets	27	33	22	11	.25	.34	
CL	Slightly sandy, St, dGr & Br, rt, Sand pockets, Ox stains	24	44	20	24	1.1	.9	
CH	St, Gr to gnGr & Br Mot, Ox stains	29	65	19	46	.55	.9	
CH	St to vSt, Gr to gnGr & Br Mot, Fe nodules, Sand pockets	27	65	17	48	.7	.12	
CH	M St, Gr & Br Mot, Sand pockets Ox stains & nodules	28	56	18	38	.5	.85	
CL	Slightly sandy, M St, Gr & Br Mot, Sand pockets, Ox stains	28	47	17	30	.4	.8	
SP	F grained, Slightly silty, M dense, brGr	0.09mm						
SP	M to F grained, M dense, Gr	0.2 mm						
SP	M to F grained, Tr-C sand, M dense, Gr	0.2 mm						

FIG 4

BORING No. BT-6

Project: Batchtown Begin Rotary: 15
Driller: Mike Foppe Inspector: Bill Roundcount
Boring No: BT-6 Date Started: 6/10/91 Finish: 6/11/91
Total Depth: 109.5 Ground Surf Elev: 437.1 Station: ?
Water Depth: 4.5 Date Measured: 6/11/91 Offset: ?
Number of Samples Taken: Jars 24 Tubes: 0 Bags: 0

ELEV (NGVD) / DEPTH (FT) — SOIL SYMBOLS, SAMPLER SYMBOLS, FIELD TEST DATA



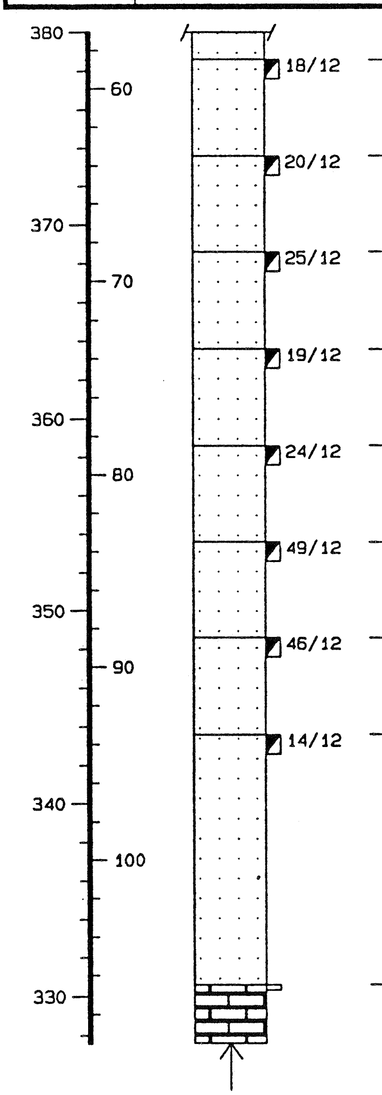
USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
CL	Silty, Slightly F sandy, M St, Br & Gr Mot	26	39	25	14	.35	.42	
CL	Silty clay pockets, M St, rt Br & Gr Mot	31	48	23	25	.30	.41	
CL	M St, gnGr & Br Mot, Ox stains	29	49	19	30	.25	.35	
CH	St to vSt, gnGr & Br Mot, Ox stains	28	66	20	46	.75	1.2	
CH	Slightly sandy, Sand pockets, St, gnGr & Br Mot, Ox stains	23	51	15	36	.65	1.2	
CL	Slightly sandy, sand pockets, St, gnGr & Br Mot, Ox stains	20	39	16	23	.35	.895	
SP	M to F grained, Br & Gr	0.2 mm						
SP	M to F grained, Tr-C sand, M dense, Gr 12% passed # 200 sieve							
		0.2 mm						
SP	F grained, Slightly silty, Clay partings, M dense, Gr	0.08mm						
SP	M to F grained, M dense, Gr	0.2 mm						
SP	M to F grained, Tr-C sand & F gravel, M dense to dense, Gr	0.2 mm						
SP	M to F grained, Tr-C sand, M dense to dense, Gr	0.2 mm						
SP	F to C grained, Tr-gravel, M dense, Gr	0.3 mm						
		0.2 mm						

US ARMY CORPS OF ENGINEERS - ST. LOUIS DISTRICT

FIG 5

BORING No. BT-6

Project: Batchtown   Begin Rotary: 15
Driller: Mike Foppe   Inspector: Bill Roundcount
Boring No: BT-6   Date Started: 6/10/91   Finish: 6/11/91
Total Depth: 109.5   Ground Surf Elev: 437.1   Station: ?
Water Depth: 4.5   Date Measured: 6/11/91   Offset: ?
Number of Samples Taken: Jars 24   Tubes: 0   Bags: 0

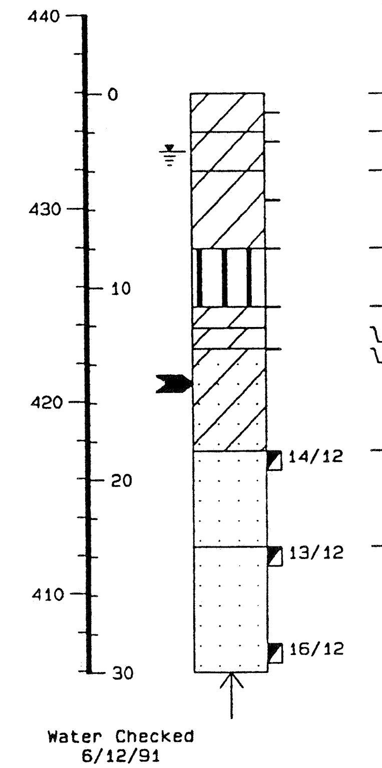


Field Test Data	USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
18/12	SP	M to F grained, Tr-gravel, M dense, Gr	0.3 mm						
20/12	SP	M to F grained, Tr-C sand, M dense, Gr	0.2 mm						
25/12	SP	M to F grained, M dense, Gr	0.2 mm						
19/12	SP	M to F grained, Tr-gravel, M dense, brGr	0.2 mm						
24/12	SP	M to F grained, Tr-C sand & F gravel, m dense, brGr	0.2 mm						
49/12	SP	F grained, Dense - vDense, brGr	0.1 mm						
46/12	SP	C to F grained, Tr-F gravel, Dense - vDense, brGr	0.2 mm						
14/12	SP	M to F grained, Tr-C sand & gravel, M dense, brGr	0.2 mm						
		Rock, Limestone & Chert							

BORING No. BT-7

Project: Batchtown   Begin Rotary: 15
Driller: Mike Foppe   Inspector: Bill Roundcount
Boring No: BT-7   Date Started: 6/12/91   Finish: 6/12/91
Total Depth: 30.0   Ground Surf Elev: 435.9   Station: ?
Water Depth: 3.0   Date Measured: 6/12/91   Offset: ?
Number of Samples Taken: Jars 9   Tubes: 0   Bags: 0

ELEV (NGVD) / DEPTH (FT) — SOIL SYMBOLS, SAMPLER SYMBOLS, FIELD TEST DATA



USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
CL	vSt, dGr & Br Mot, rt, Ox stns	23	46	19	27	1.3	1.2	
CL	F sandy, vSt, dGr & Br Mot, Ox stains, CS w/F sand	16	31	17	14	1.1	1.4	
CL	vSt, dGr to gnGr & Br Mot, F sand pockets, Ox stains	28	49	22	27	.65	1.1	
MH	vSt, Br & Gr Mot, F sand pockets, Ox stains	25	53	20	23	.85	1.4	
CL	mSt to St, Br & Gr Mot, Sand pockets, Ox stains	28	46	15	31	.4	.69	
CL	F sandy, silty, brGr							
SC	F grained, Slightly clayey, CS, Br & Gr 14% passed #200 sieve							
SP	M to F grained, SAS, M dense, Gr	0.2 mm						
SP	M to F grained, M dense, Gr	0.2 mm						
		0.2 mm						

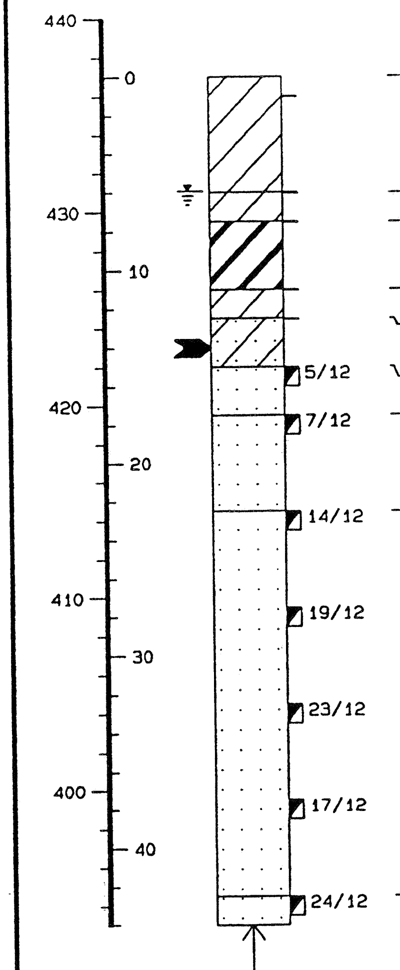
FIG 6

BORING No. BT-8

Project: Batchtown	Begin Rotary: 14		
Driller: Mike Foppe	Inspector: Bill Roundcount		
Boring No: BT-8	Date Started: 5/24/91	Finish: 5/24/91	
Total Depth: 44.0	Ground Surf Elev: 437.0	Station: ?	
Water Depth: 5.9	Date Measured: 5/24/91	Offset: ?	

Number of Samples Taken: Jars 12 Tubes: 0 Bags: 0

ELEV (NGVD) / DEPTH (FT) — SOIL SYMBOLS, SAMPLER SYMBOLS, FIELD TEST DATA



Water Checked
5/24/91

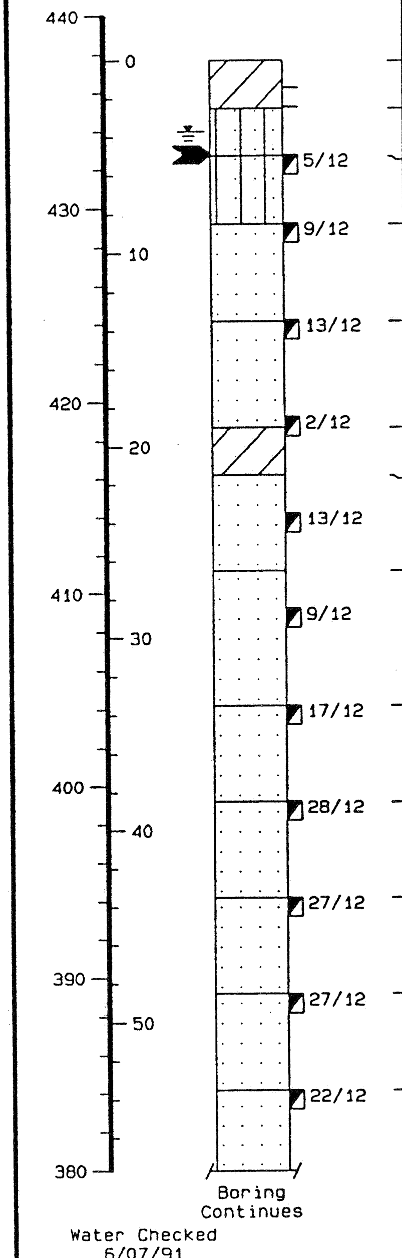
USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
CL	St, Br & Gr Mot, Sand pockets, Ox stains	28	43	16	27	.5	.75	
CL	St, Gr & gnGr Mot, Ox specks	27	48	21	27	.45	.725	
CH	vSt, Br & Gr Mot, Sand pockets, Ox specks	26	59	20	39	1.35	1.44	
CL	St, Br & Gr Mot, Sand pockets, Ox stains	26	49	20	29	.60	.75	
SC	M to F grained, Slightly clayey brGr 13% passed #200 sieve	0.1 mm						
SP	Loose, Slightly Clayey, M to F grained, Br & Gr							
SP	Loose, Clayey, F grained, CS, Br & Gr 11% passed #200 sieve							
SP	M to F grained, M dense, Gr	0.2 mm						
		0.2 mm						
		0.2 mm						
		0.3 mm						
SP	M to F grained, M dense, Gr Tr-C sand & F gravel	0.2 mm						

FIG 7

BORING No. BT-9

Project: Batchtown   Begin Rotary: 5
Driller: Mike Foppe   Inspector: Bill Roundcount
Boring No: BT-9   Date Started: 6/06/91   Finish: 6/06/91
Total Depth: 112.0   Ground Surf Elev: 437.7   Station: ?
Water Depth: 3.8   Date Measured: 6/07/91   Offset: ?
Number of Samples Taken: Jars 24   Tubes: 0   Bags: 0

ELEV (NGVD) / DEPTH (FT) — SOIL SYMBOLS, SAMPLER SYMBOLS, FIELD TEST DATA



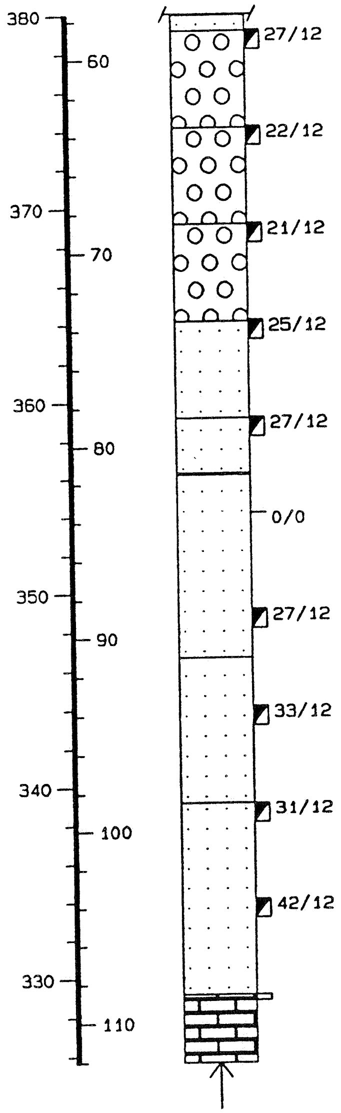
USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
CL	Slightly sandy, vSt, Br & Gr Mot, Ox stains	21	47	17	30	1.4	1.95	
SM	Silty, F grained, Slightly clayey, Br 27% passed #200 sieve							
SM	Silty, Clayey, F grained, Loose Br to Br & Gr, Tr-CS 46% passed #200 sieve							
SP	M to F grained, Loose, Br, Tr-CS	0.2 mm						
SP	M to F grained, M dense, Br, Tr-C sand	0.2 mm						
CL	Silty, F sandy, Tr-SIS & SAS, So, Gr 51% passed #200 sieve							
SP	F grained, M dense, brGr	0.2 mm						
SP	F grained, Slightly silty, Loose, Gr 11% passed #200 sieve							
SP	F to M grained, Tr-c sand & F gravel, M dense, Gr	0.2 mm						
SP	F to C grained, Tr-F gravel, Dense to M dense, Gr	0.2 mm						
SP	F to M grained, Tr-C sand, Dense to M dense, Gr	0.2 mm						
SP	F to C grained, Tr-F gravel, Dense to M dense, Gr	0.3 mm						
SP	M to F grained, M dense, Br&Gr	0.2 mm						

FIG 8

BORING No. BT-9

Project: Batchtown
Driller: Mike Foppe
Boring No: BT-9
Total Depth: 112.0
Water Depth: 3.8
Number of Samples Taken: Jars 24 Tubes: 0 Bags: 0

Begin Rotary: 5
Inspector: Bill Roundcount
Date Started: 6/06/91 Finish: 6/06/91
Ground Surf Elev: 437.7 Station: ?
Date Measured: 6/07/91 Offset: ?

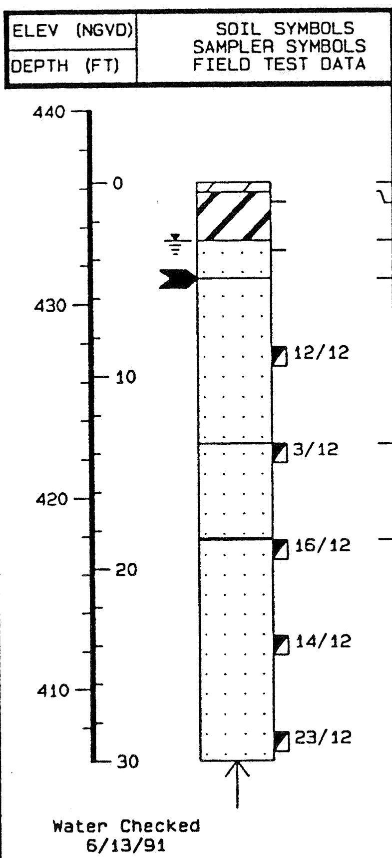


SOIL SYMBOLS SAMPLER SYMBOLS FIELD TEST DATA	USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
27/12	SW	M to F grained, Tr-F gravel, Br&Gr, M dense to dense	0.2 mm						
22/12	SW	F grained, Tr-M sand, M dense, Br&Gr	0.2 mm						
21/12	SW	F grained, Tr-M sand, M dense, Gr 11% passed #200 sieve							
25/12	SP	M to F grained, M dense, Gr	0.2 mm						
27/12	SP	M to F grained, M dense-dense, Gr, Tr-CS	0.2 mm						
	SP	F to C grained, G, dense, Gr							
0/0			0.2 mm						
27/12			0.2 mm						
	SP	M to F grained, dense, Gr							
33/12			0.2 mm						
31/12	SP	M to F grained, dense, Tr-C sand & F gravel, Gr	0.2 mm						
42/12			0.2 mm						
	LS	Rock, Limestone & Chert							

FIG 8 (Cont

BORING No. BT-27

Project: Batchtown
Begin Rotary: 5
Driller: Mike Foppe
Inspector: Bill Roundcount
Boring No: BT-27
Date Started: 6/13/91
Finish: 6/13/91
Total Depth: 30.0
Ground Surf Elev: 436.3
Station: ?
Water Depth: 3.0
Date Measured: 6/13/91
Offset: ?
Number of Samples Taken: Jars 8
Tubes: 0
Bags: 0



Field Test Data	USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
	CL	Topsoil							
	CH	St-vSt, Br & Gr Mot, rt, Sand pockets, Ox stains	25	52	18	34	.55	1.0	
	SP	Clayey, M to F grained, Br, Tr-C sand	0.08mm						
	SP	F grained, M dense, Br							
12/12			0.2 mm						
3/12	SP	F grained, Loose, Gr	0.09mm						
16/12	SP	F grained, M dense, brGr	0.2 mm						
14/12			0.2 mm						
23/12			0.2 mm						

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FIG 9

BORING No. BT-20

Project: Batchtown

Driller: Mike Foppe

Boring No: BT-20

Total Depth: 30.0

Water Depth: 2.5

Begin Rotary: 5'

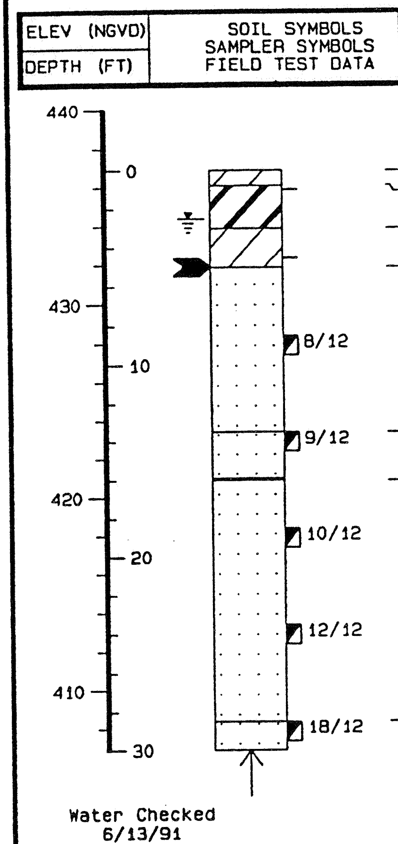
Inspector: Bill Roundcount

Date Started: 6/13/91 Finish: 6/13/91

Ground Surf Elev: 436.9 Station: ?

Date Measured: 6/13/91 Offset: ?

Number of Samples Taken: Jars 7 Tubes: 0 Bags: 0



USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
CL	Topsoil							
CH	M St-St, Br&Gr, rt, Wd fragmts	31	54	22	32	.30	.63	
CL	Slightly silty & sandy, SAS, Br & Gr Mot, Ox stains	25	38	17	21	.30	.42	
SP	M to F grained, Loose, Br							
		0.2 mm						
SP	M to F grained, Loose, CS, Br	0.2 mm						
SP	M to F grained, M dense, Gr							
		0.2 mm						
		0.1 mm						
SP	M to F grained, Tr-C sand, Gr, M dense	0.3 mm						

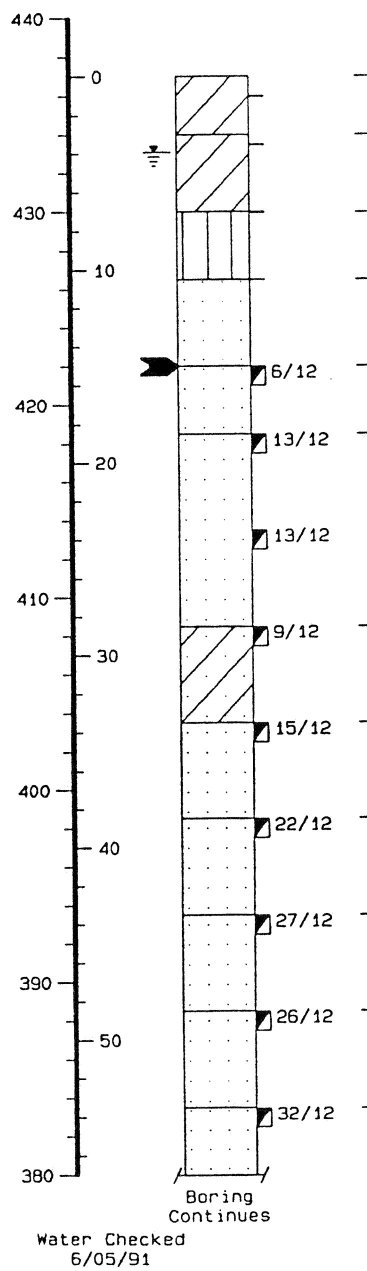
FIG 10

BORING No. BT-32

Project:	Batchtown	Begin Rotary:	15		
Driller:	Mike Foppe	Inspector:	Bill Roundcount		
Boring No:	BT-32	Date Started:	6/05/91	Finish:	6/06/91
Total Depth:	116.1	Ground Surf Elev:	437	Station:	?
Water Depth:	3.9	Date Measured:	6/05/91	Offset:	?

Number of Samples Taken: Jars 24 Tubes: 0 Bags: 0

ELEV (NGVD) / DEPTH (FT) — SOIL SYMBOLS / SAMPLER SYMBOLS / FIELD TEST DATA



USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
CL	Silty, M St, Br & Gr Mot	24	34	21	13	.30	.33	
CL	Silty, So, Gr	34	37	23	14	.15	.22	
ML	Silty, vSo, Gr	28	26	25	1	0	0.05	
SP	Clayey, M to F grained, Gr	0.2 mm						
SP	F to M grained, Gr, Loose	0.3 mm						
SP	M to F grained, Gr, M dense	0.2 mm						
		0.2 mm						
SC	F grained, Slightly clayey, Gr 12% passed #200 sieve							
SP	F grained, Gr, M dense	0.1 mm						
SP	F grained, Gr, M dense, CS	0.2 mm						
SP	F to M grained, Gr&Br, M dense	0.3 mm						
SP	F to C grained, Gr&Br, M dense, Tr-F gravel	0.2 mm						
SP	F to M grained, Gr&Br, Dense, Tr-C sand & F gravel	0.3 mm						

US ARMY CORPS OF ENGINEERS - ST. LOUIS DISTRICT

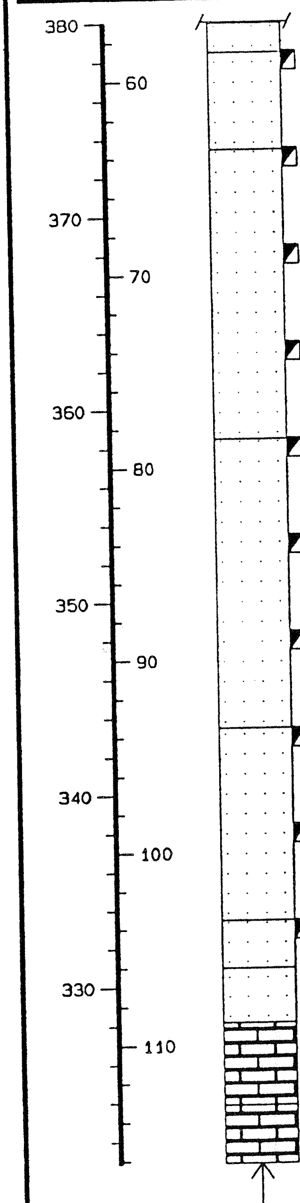
FIG 11

BORING No. BT-32

Project: Batchtown
Driller: Mike Foppe
Boring No: BT-32
Total Depth: 116.1
Water Depth: 3.9
Number of Samples Taken: Jars 24 Tubes: 0 Bags: 0

Begin Rotary: 15
Inspector: Bill Roundcount
Date Started: 6/05/91 Finish: 6/06/91
Ground Surf Elev: 437 Station: ?
Date Measured: 6/05/91 Offset: ?

ELEV (NGVD) / DEPTH (FT) | SOIL SYMBOLS / SAMPLER SYMBOLS / FIELD TEST DATA



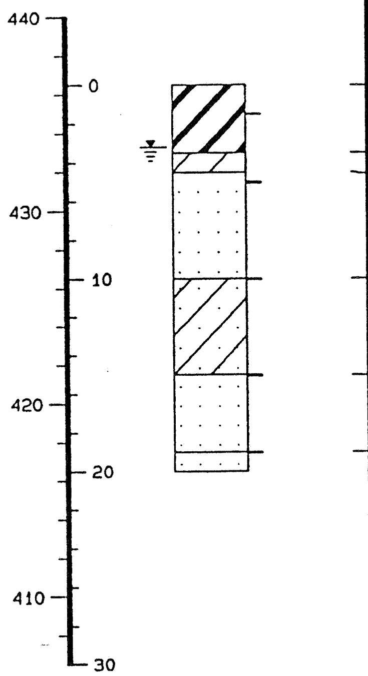
FIELD TEST DATA	USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
18/12	SP	F grained, Gr&Br, M dense, Tr-F gravel	0.3 mm						
28/12	SP	M to F grained, M dense-dense, Gr & Br	0.2 mm						
27/12			0.2 mm						
42/12			0.2 mm						
28/12	SP	F to C grained, M dense, Gr&Br, F gravel	0.2 mm						
26/12			0.3 mm						
39/12			0.2 mm						
32/12	SP	M to F grained, Dense, Gr & Br, Tr-C sand & F gravel	0.3 mm						
35/12			0.2 mm						
50/12	SP	M to F grained, Dense - vDense, Tr-C sand , Gr&Br, LS pebbles	0.2 mm						
	SP	Sand and Gravel							
	LS	Weathered Limestone & Chert							
	LS	Rock							

FIG 11 (Con

BORING No. BT-28

Project: Batchtown
Begin Rotary:
Driller: Mike Foppe
Inspector: Bill Roundcount
Boring No: BT-28
Date Started: 7/03/91 Finish: 7/03/91
Total Depth: 20.0
Ground Surf Elev: 436.5 Station: ?
Water Depth: 3.2
Date Measured: 7/03/91 Offset: ?
Number of Samples Taken: Jars 5 Tubes: 0 Bags: 0

ELEV (NGVD) / DEPTH (FT)	SOIL SYMBOLS SAMPLER SYMBOLS FIELD TEST DATA	USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
		CH	Slightly silty, St, Br&Gr Mot, Ox specks	27	53	22	31	.9	1.0	
		CL	Sandy, Br & Gr							
		SP	M to F grained, Br & Gr	0.2 mm						
		SC	F grained, CS, Br & Gr 21% passed #200 sieve							
		SP	M to F grained, Br & Gr	0.2 mm						
		SP	M - F grained, Br&Gr, Tr-C sand	0.2 mm						



Water Checked
7/03/91

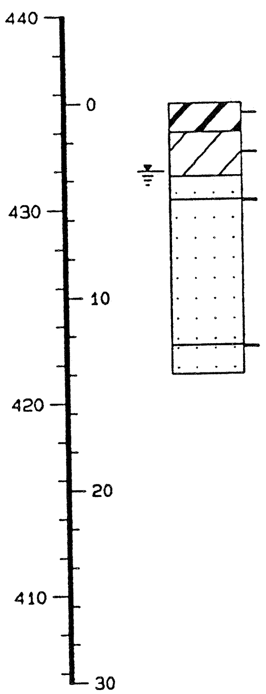
FIG 12

BORING No. BT-30

Project: Batchtown
Driller: Mike Foppe
Boring No: BT-30
Total Depth: 14.0
Water Depth: 3.5
Number of Samples Taken: Jars 4 Tubes: 0 Bags: 0

Begin Rotary:
Inspector: Bill Roundcount
Date Started: 7/02/91 Finish: 7/02/91
Ground Surf Elev: 435.5 Station: ?
Date Measured: 7/02/91 Offset: ?

ELEV (NGVD) / DEPTH (FT)	SOIL SYMBOLS SAMPLER SYMBOLS FIELD TEST DATA	USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
		CH	vSt, dGr & Br, rt	18	52	22	30	1.6	1.53	
		CL	Slightly sandy, St, Br & Gr Mot Ox specks, SAS	20	40	20	20	.5	.9	
		SP	M to F grained, Clayey							
		SP	F grained, Br & Gr	0.2 mm						
		SP	M to F grained, Br & Gr	0.2 mm						



Water Checked
7/02/91

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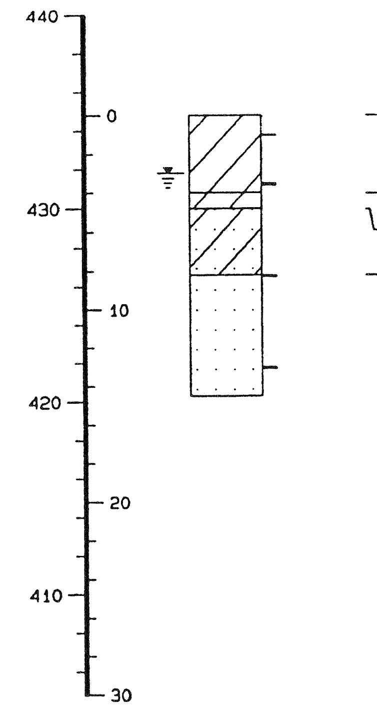
FIG 13

BORING No. BT-31

Project: Batchtown Begin Rotary:
Driller: Mike Foppe Inspector: Bill Roundcount
Boring No: BT-31 Date Started: 7/01/91 Finish: 7/01/91
Total Depth: 14.5 Ground Surf Elev: 434.8 Station: ?
Water Depth: 3.0 Date Measured: 7/02/91 Offset: ?
Number of Samples Taken: Jars 5 Tubes: 0 Bags: 0

ELEV (NGVD) / DEPTH (FT)	SOIL SYMBOLS / SAMPLER SYMBOLS / FIELD TEST DATA	USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
		CL	Slightly silty, Br & Gr , rt	22	46	21	25			
		CL	Silty, Br & Gr , F sandy, SAS, Ox specks	23				.15		
		SC	F grained, Br & Gr, Occs clayey 28% passed #200 sieve							
		SP	M to F grained, Tr-C sand, Br to Br & Gr	0.2 mm						
				0.1 mm						



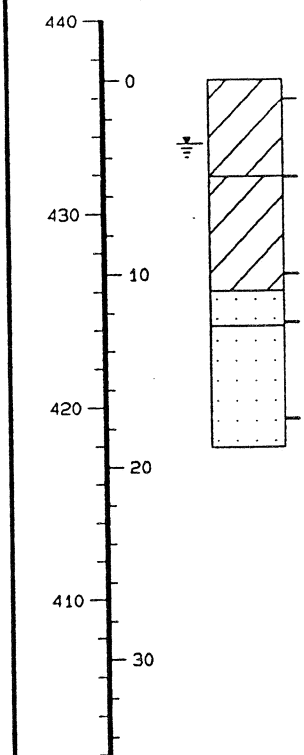
Water Checked
7/02/91

FIG 14

BORING No. BT-11

Project: Batchtown Begin Rotary:
Driller: Mike Foppe Inspector: Bill Roundcount
Boring No: BT-11 Date Started: 7/08/91 Finish: 7/08/91
Total Depth: 19.0 Ground Surf Elev: 436.9 Station: ?
Water Depth: 3.3 Date Measured: 7/08/91 Offset: ?
Number of Samples Taken: Jars 5 Tubes: 0 Bags: 0

ELEV (NGVD) / DEPTH (FT) — SOIL SYMBOLS / SAMPLER SYMBOLS / FIELD TEST DATA



USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
CL	Silty, vSt, Br & Gr Mot, Sand pockets, rt	14	37	19	18	1.2	1.1	
CL	Slightly silty, M St, Br & Gr Mot, Silty F sand pockets	27	37	19	18	.4		
		25	35	20	15	.25		
SP	F grained, Gr							
SP	M to F grained, Br & Gr	0.2 mm						
		0.09mm						

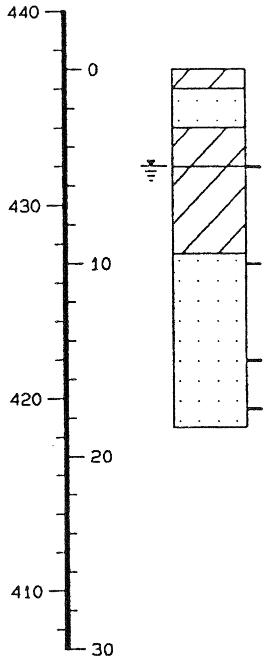
Water Checked
7/08/91

FIG 15

BORING No. BT-12

Project: Batchtown Begin Rotary:
Driller: Mike Foppe Inspector: Bill Roundcount
Boring No: BT-12 Date Started: 7/09/91 Finish: 7/09/91
Total Depth: 18.5 Ground Surf Elev: 437 Station: ?
Water Depth: 5.0 Date Measured: 7/09/91 Offset: ?
Number of Samples Taken: Jars 4 Tubes: 0 Bags: 0

ELEV (NGVD) / DEPTH (FT)	SOIL SYMBOLS / SAMPLER SYMBOLS / FIELD TEST DATA	USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
		CL	Sandy, Silty, St, Br & Gr, rt							
		SP	F grained, Gr, CS							
		CL	F sandy, Br & Gr							
		CL	F sandy, M St, Br & Gr Mot, Ox specks	22	32	18	14	.30		
		SP	F grained, Br & Gr	0.1 mm						
				0.08mm						
				0.09mm						



Water Checked
7/09/91

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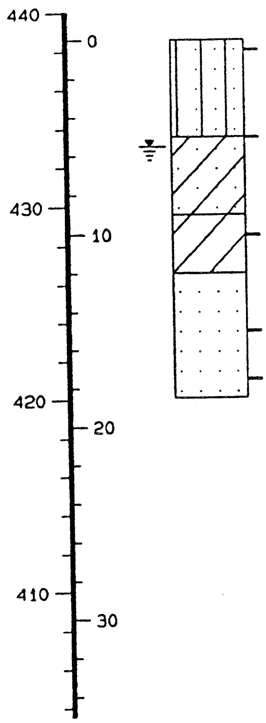
FIG 16

BORING No. BT-13

Project: Batchtown	Begin Rotary:		
Driller: Mike Foppe	Inspector: Bill Roundcount		
Boring No: BT-13	Date Started: 7/09/91	Finish: 7/09/91	
Total Depth: 18.5	Ground Surf Elev: 438.6	Station: ?	
Water Depth: 5.5	Date Measured: 7/09/91	Offset: ?	
Number of Samples Taken: Jars 5	Tubes: 0	Bags: 0	

ELEV (NGVD) / DEPTH (FT)	SOIL SYMBOLS SAMPLER SYMBOLS FIELD TEST DATA	USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
		SM	F grained, Occas clayey, CS, Gr, rt 25% passed #200 sieve							
		SC	F grained, Clayey, CS, Br & Gr 37% passed #200 sieve							
		CL	M St, Br & Gr Mot	28	46	20	26	.30		
		SP	M to F grained, Br & Gr, Tr-C sand							
				0.2 mm						
				0.2 mm						



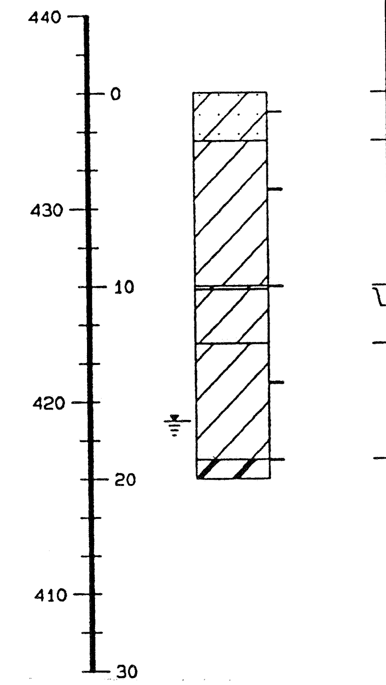
Water Checked
7/09/91

FIG 17

BORING No. BT-14

Project: Batchtown Begin Rotary:
Driller: Mike Foppe Inspector: Bill Roundcount
Boring No: BT-14 Date Started: 7/11/91 Finish: 7/11/91
Total Depth: 20.0 Ground Surf Elev: 436 Station: ?
Water Depth: 17.0 Date Measured: 7/11/91 Offset: ?
Number of Samples Taken: Jars 5 Tubes: 0 Bags: 0

ELEV (NGVD) / DEPTH (FT)	SOIL SYMBOLS / SAMPLER SYMBOLS / FIELD TEST DATA	USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
		SC	F grained, Clayey, CS, Br & Gr 40% passed #200 sieve							
		CL	Slightly silty, St, SAS, rt, dGr & Br	24	43	21	22	.9		
		CL	Slightly silty, Br & Gr	32	29	20	9			
		CL	Sandy, SAS, gnGr							
		CL	Slightly silty, St, Br & Gr Mot, Ox specks	28	48	17	31	.6		
		CH	Silty, M St, Gr	35	56	26	30	.35		



Water Checked
7/11/91

US ARMY CORPS OF ENGINEERS - ST. LOUIS DISTRICT

FIG 18

BORING No. BT-15

Project: Batchtown Begin Rotary:

Driller: Jeff Ludman Inspector: Bill Roundcount

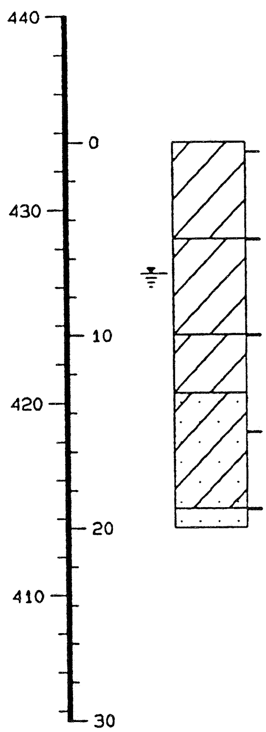
Boring No: BT-15 Date Started: 7/19/91 Finish: 7/22/91

Total Depth: 20.0 Ground Surf Elev: 433.5 Station: ?

Water Depth: 6.8 Date Measured: 7/19/91 Offset: ?

Number of Samples Taken: Jars 5 Tubes: 0 Bags: 0

ELEV (NGVD) / DEPTH (FT)	SOIL SYMBOLS / SAMPLER SYMBOLS / FIELD TEST DATA	USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
		CL	Silty, SAS, dGr & Br, M St	33	45	20	25	.35	.35	
		CL	Silty, SAS, dGr & Br	28	41	24	17			
		CL	Silty, St, dGr & Br, SAS	31	41	20	21	.6		
		SC	F grained, CS, Gr 19% passed #200 sieve							
		SP	M to F grained, Gr, Tr-C sand	0.2 mm						



Water Checked
7/19/91

FIG 19

BORING No. BT-35

Project: Batchtown　　Begin Rotary: 10
Driller: Jeff Ludman　　Inspector: Bill Roundcount
Boring No: BT-35　　Date Started: 6/14/91　　Finish: 6/14/91
Total Depth: 68.5　　Ground Surf Elev: 433　　Station: ?
Water Depth: 2.1　　Date Measured: 6/14/91　　Offset: ?
Number of Samples Taken: Jars 14　　Tubes: 0　　Bags: 0

ELEV (NGVD) / DEPTH (FT)	SOIL SYMBOLS / SAMPLER SYMBOLS / FIELD TEST DATA	USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
433 / 0		CL	Silty & F sandy, St, Br & Gr, Tr-G (Fill)	21	39	20	19	1.1	.8	
		CH	m St, dGr, SAS	24	53	12	41	.35	.45	
10	19/12	CL	F sandy, dBr	25	45	15	30			
		SP	F grained, vLoose, Tr-C sand, Br							
	4/12, 4/12	CL	F sandy, So, dGr, SAS	0.08mm 26		?				
		SP	C to F grained, M dense, Gr							
20	12/12			0.2 mm						
	14/12	SP	C to F grained, M dense, Gr, Tr-F gravel	0.2 mm						
30	3/12	CL	F sandy, So, dGr, SAS	36	40	21	19			
	3/12	MH	Silty, vSo, dGr, SAS	47	63	24	39			
40	9/12	SP	M to F grained, Tr-C sand, Gr, Loose, Wd & slf, CS	0.3 mm						
	35/12	SP	C to F grained, G. Dense, Gr	0.2 mm						
50	32/12	SP	F grained, Dense, Gr	0.1 mm						
380		SP	C to F grained, Dense, Br & Gr, Tr-G							

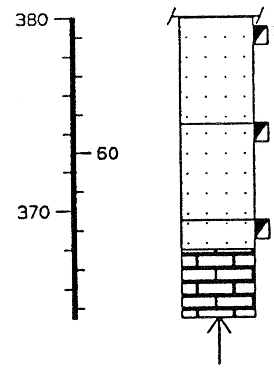
Boring Continues

Water Checked 6/14/91

FIG 20

BORING No. BT-35

Project: Batchtown Begin Rotary: 10
Driller: Jeff Ludman Inspector: Bill Roundcount
Boring No: BT-35 Date Started: 6/14/91 Finish: 6/14/91
Total Depth: 68.5 Ground Surf Elev: 433 Station: ?
Water Depth: 2.1 Date Measured: 6/14/91 Offset: ?
Number of Samples Taken: Jars 14 Tubes: 0 Bags: 0



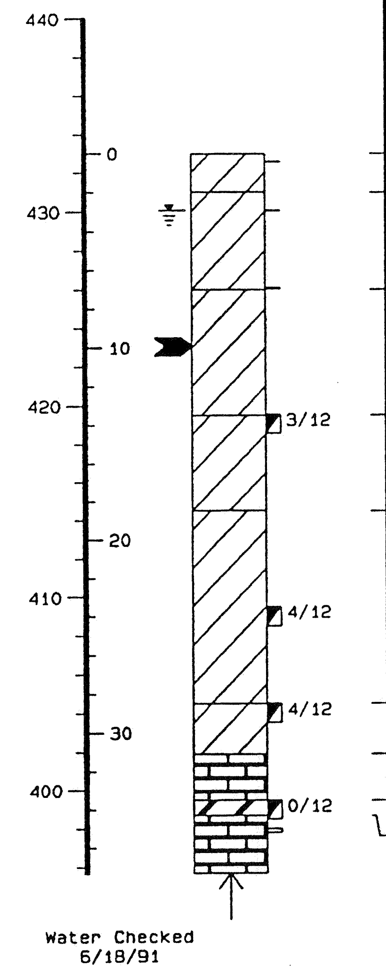
ELEV (NGVD) / DEPTH (FT)	SOIL SYMBOLS / SAMPLER SYMBOLS / FIELD TEST DATA	USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
	32/12			0.3 mm						
	28/12	SP	F grained, M dense-dense, brGr	0.1 mm						
	54/12	SP	F to C grained, Tr-F gravel, Dense to vDense, brGr	0.3 mm						
		LS	Rock, Limestone							

FIG 20 (Con

BORING No. BT-36

Project: Batchtown — Begin Rotary: 10
Driller: Jeff Ludman — Inspector: Bill Roundcount
Boring No: BT-36 — Date Started: 6/17/91 — Finish: 6/18/91
Total Depth: 37.3 — Ground Surf Elev: 433 — Station: ?
Water Depth: 3.03 — Date Measured: 6/18/91 — Offset: ?
Number of Samples Taken: Jars 9 — Tubes: 0 — Bags: 0

ELEV (NGVD) / DEPTH (FT) — SOIL SYMBOLS / SAMPLER SYMBOLS / FIELD TEST DATA



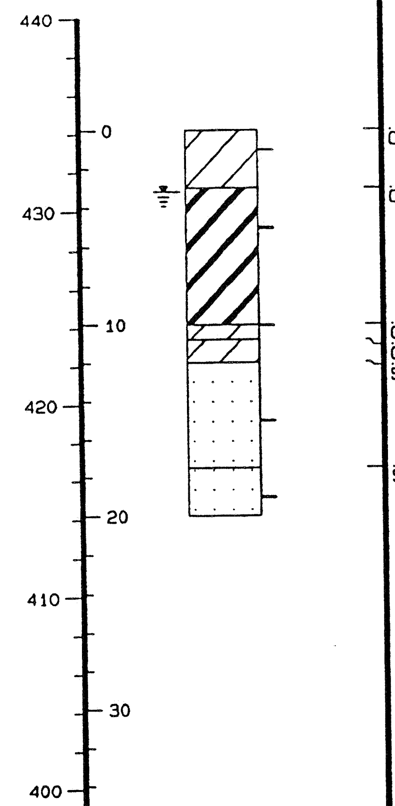
USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
CL	Silty, St, Br & Gr Mot, rt, Ox stains	36	46	26	20	1.1	.7	
CL	Silty, M St, Gr to gnGr, Wd	30		?				
CL	Silty, vSo-So, Gr to gnGr, Wd	27	30	22	8	0.0	.12	
CL	Silty, vSo-So, Gr, Wd fragments Slightly sandy, CS (Sample destroyed)	38						
CL	Silty, Sandy, Gr, M St to So (Insufficient sample)							
		27						
CL	Silty, SAS, Gr, M St to So, Wd	26	34	19	15	0.0		
LS	Rock cuttings, LS & CT, R & Br							
CH	G, vSt, R & Br, Ox stains (Blow cts refused)	32	71	16	55			
LS	Rock, LS & CT							

FIG 21

BORING No. BT-37

Project: Batchtown
Driller: Mike Foppe
Boring No: BT-37
Total Depth: 20.0
Water Depth: 3.2
Begin Rotary:
Inspector: Bill Roundcount
Date Started: 7/11/91 Finish: 7/12/91
Ground Surf Elev: 434.2 Station: ?
Date Measured: 7/12/91 Offset: ?
Number of Samples Taken: Jars 5 Tubes: 0 Bags: 0

ELEV (NGVD) / DEPTH (FT) — SOIL SYMBOLS / SAMPLER SYMBOLS / FIELD TEST DATA



Water Checked
7/12/91

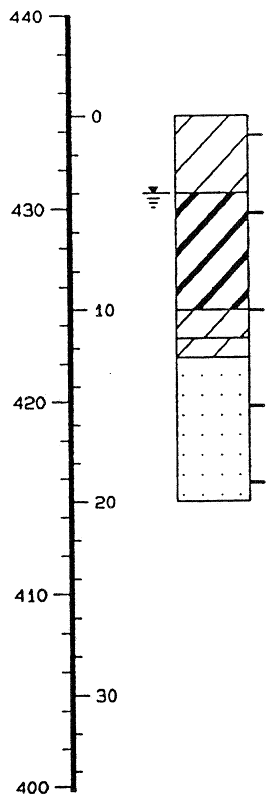
USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
CL	Silty, F Sandy, So, dGr&Br, SAS	29	32	21	11	.15	.15	
CH	St, Gr to gnGr Mot	34	64	27	37	.5		
CL	M St, Br & Gr, Mot	26	31	19	12	.4		
CL	Sandy, Br & Gr							
SP	F grained, Br & Gr	0.2 mm						
SP	F to C grained, Br & Gr	0.2 mm						

FIG 22

BORING No. BT-38

Project: Batchtown   Begin Rotary:
Driller: Jeff Ludman   Inspector: Bill Roundcount
Boring No: BT-38   Date Started: 7/17/91   Finish: 7/17/91
Total Depth: 20.0   Ground Surf Elev: 434.8   Station: ?
Water Depth: 4.0   Date Measured: 7/17/91   Offset: ?
Number of Samples Taken: Jars 5   Tubes: 0   Bags: 0

ELEV (NGVD) / DEPTH (FT) — SOIL SYMBOLS / SAMPLER SYMBOLS / FIELD TEST DATA



Water Checked
7/17/91

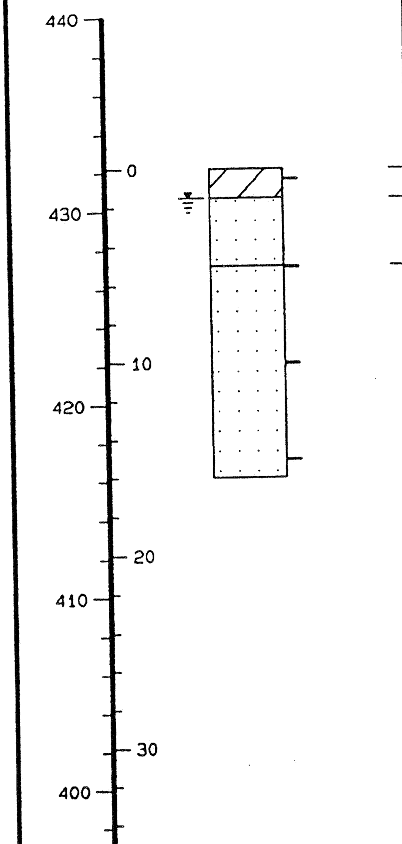
USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
CL	Silty, M St, Br & Gr Mot, rt, Worm holes	33	41	24	17	.45	.35	
CH	St, dGr	27	58	19	39	.6		
CL	St, Br & Gr Mot, Ox specks	24	45	19	26	.60		
CL	Sandy, Br & Gr							
SP	F grained, Br & Gr							
		0.2 mm						
		0.2 mm						

FIG 23

BORING No. BT-39

Project: Batchtown Begin Rotary:
Driller: Jeff Ludman Inspector: Bill Roundcount
Boring No: BT-39 Date Started: 7/18/91 Finish: 7/18/91
Total Depth: 16.0 Ground Surf Elev: 432.2 Station: ?
Water Depth: 1.5 Date Measured: 7/18/91 Offset: ?
Number of Samples Taken: Jars 4 Tubes: 0 Bags: 0

ELEV (NGVD) / DEPTH (FT)	SOIL SYMBOLS SAMPLER SYMBOLS FIELD TEST DATA	USCS	Visual Description	D10 or Moist	Liquid Limit	Plast Limit	Plast Index	PP TSF	Tv TSF	Shear Test
		CL	Sandy, M St, Br & Gr Mot	27	37	18	19	.35	.31	
		SP	M to F grained, Br & Gr, CS							
		SP	M - F grained, Br&Gr, Tr-C sand	0.2 mm						
				0.2 mm						
				0.3 mm						



Water Checked
7/18/91

FIG 24

Hole No. BT-1

DRILLING LOG	DIVISION CELMS-ED-C	INSTALLATION St Louis District	SHEET 1 OF 2 SHEETS
1. PROJECT Batchtown Habitat		10. SIZE AND TYPE OF BIT See Remarks	
2. LOCATION (Coordinates or Station) See Map 10' offset from BT-3		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) TBM	
3. DRILLING AGENCY Brotcke Engineering		12. MANUFACTURER'S DESIGNATION OF DRILL CME -55 ATV	
4. HOLE NO. (As shown on drawing title and file number) BT-1		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED 2 Bags 3 Jars — UNDISTURBED	
5. NAME OF DRILLER Jeff Ludman		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.		15. ELEVATION GROUND WATER -5.0	
		16. DATE HOLE — STARTED 6/19/91 — COMPLETED 6/19/91	
7. THICKNESS OF OVERBURDEN —		17. ELEVATION TOP OF HOLE 0.0	
8. DEPTH DRILLED INTO ROCK —		18. TOTAL CORE RECOVERY FOR BORING — %	
9. TOTAL DEPTH OF HOLE 15'		19. SIGNATURE OF INSPECTOR Bill Rosendorf	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
0.0			Clay, silty, brown + gray CL			3 3/4" Hollow stem Auger
	1					
	2					
	3					
	4					
	5		Clay, brown + gray CH		Bag #1 (5-10)	▼ Static water 6/19/91 1hr. Borrow starts @ 5.0
	6					
	7				JAR #1A	LL 41 PL 19 PI 22 WC 29 D10 –
	8					
	9					
-10.0						

FIG 25

Hole No. BT-1

DRILLING LOG	DIVISION CELMN-CT-C	INSTALLATION	SHEET 2 OF 2 SHEETS

1. PROJECT: Buchtown Habitat
2. LOCATION (Coordinates or Station): See Map
3. DRILLING AGENCY: Bricker Engineering
4. HOLE NO. (As shown on drawing title and file number): BT-1
5. NAME OF DRILLER
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN | DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE | STARTED | COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR: Bill Roundtree

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-10.0			Clay, brown + gray CH			3 3/4" Hollow stem Augers
	11			Bag #2 (10-15)		
	12			JAH 28		LL 46 PL 19 PI 27 WC 32 D10 –
	13					
	14					
	15		Bottom of Borrow Boring			
	16					
	17					
	18					
	19					
-20.0						

FIG 25 (Cont

Hole No. BT-22

DRILLING LOG

DRILLING LOG	DIVISION: CELMS-CT-C	INSTALLATION: St Louis District	SHEET 1 OF 1 SHEETS

1. PROJECT: Batch Town Habitat	10. SIZE AND TYPE OF BIT: 3 1/4" Auger Hollow Stem
2. LOCATION (Coordinates or Station): Soil Map + Remarks	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): TBM
3. DRILLING AGENCY: Broicke Engineering	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55 ATV
4. HOLE NO. (As shown on drawing title and file number): BT-22	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED: 2 Bags, 2 Jars; UNDISTURBED:
5. NAME OF DRILLER: Jeff Ludman	14. TOTAL NUMBER CORE BOXES: —
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: —
	16. DATE HOLE — STARTED: 6/19/91; COMPLETED: 6/19/91
7. THICKNESS OF OVERBURDEN: —	17. ELEVATION TOP OF HOLE: 0.0
8. DEPTH DRILLED INTO ROCK: —	18. TOTAL CORE RECOVERY FOR BORING: — %
9. TOTAL DEPTH OF HOLE: 6.5	19. SIGNATURE OF INSPECTOR: Bill Rountree

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
0.0	0		Clay, dark gray + brown CH		BAG 22A JAR-22A	
	1		22A: LL 42, PL 17, PI 25, WC 22, D10 —			
	2				BAG 22B JAR-22B	22B: LL 41, PL 20, PI 21, WC 21, D10 —
	3					
	4					
	5					
	6		Auger refusal @ 6.5'			
	7					
	8					
	9					

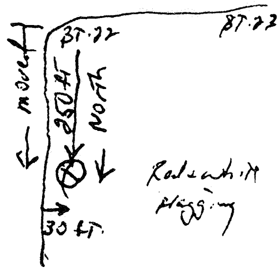


FIG 26

Hole No. BT-23

DRILLING LOG	DIVISION CELMS-CTC	INSTALLATION ST Louis District	SHEET 2 OF 2 SHEETS

1. PROJECT: Batch Town Habitat
2. LOCATION (Coordinates or Station): See Map - Red & white flagging
3. DRILLING AGENCY: Brotcke Engineering
4. HOLE NO. (As shown on drawing title and file number): BT-23
5. NAME OF DRILLER: Jeff Ludman
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: —
8. DEPTH DRILLED INTO ROCK: —
9. TOTAL DEPTH OF HOLE:
10. SIZE AND TYPE OF BIT: 3 1/4 Hollow Stem Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): TBM
12. MANUFACTURER'S DESIGNATION OF DRILL: CME - 55 ATV
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2 Bags 2 Jars | UNDISTURBED
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: -10.5
16. DATE HOLE: STARTED 6/19/91 | COMPLETED 6/19/91
17. ELEVATION TOP OF HOLE: 0.0
18. TOTAL CORE RECOVERY FOR BORING: — %
19. SIGNATURE OF INSPECTOR: Bill Roundcount

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
0.0	0–5		Clay, silty, brown & gray CL		Bag 23A; JAR 23A (0-5)	LL 56; PL 22; PI 34; WC 29; D10 —
	5–10		Clay, gray & brown CH		Bag 23B; JAR 23B (5-15)	LL 52; PL 16; PI 36; WC 30; D10 —
-10.0						

FIG 27

Hole No. BT-23

DRILLING LOG	DIVISION CELMS-CT-C	INSTALLATION	SHEET 2 OF 2 SHEETS

1. PROJECT Batchtown Habitat
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file number) BT-23
5. NAME OF DRILLER
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN | DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE | STARTED | COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Bill Rowndtree

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-10.0			Clay, gray & brown CH			▼ Static water 6/14/91 1 hr. + water seeping in hole - slowly
	11				~~B~~ ~~23~~	
	12				~~B~~ ~~23~~ ~~[illegible]~~	
	13					
	14					
	15		Bottom of hole			

FIG 27 (co

Hole No. BT-24

DRILLING LOG	DIVISION CELMS-CT-C	INSTALLATION St Louis District	SHEET 1 OF 2 SHEETS

1. PROJECT: Batchtown Habitat	10. SIZE AND TYPE OF BIT: Hand Auger
2. LOCATION (Coordinates or Station): See Map	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): TBM
3. DRILLING AGENCY: Brotcke Engineering	12. MANUFACTURER'S DESIGNATION OF DRILL: —
4. HOLE NO. (As shown on drawing title and file number): BT-24	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 2 Bags, 2 Jars; UNDISTURBED —
5. NAME OF DRILLER: Jeff Ludman	14. TOTAL NUMBER CORE BOXES: —
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: -4.5
	16. DATE HOLE: STARTED 7/23/91; COMPLETED 7/23/91
7. THICKNESS OF OVERBURDEN: —	17. ELEVATION TOP OF HOLE: ~~0.0~~ 441
8. DEPTH DRILLED INTO ROCK: —	18. TOTAL CORE RECOVERY FOR BORING: — %
9. TOTAL DEPTH OF HOLE: 11.0	19. SIGNATURE OF INSPECTOR: Bill Roundcount

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
0.0	0		Clay, silty, dark gray & brown (CL)			
	1				Bag 24A	
	2				JAR 24A	LL 43, PL 8, PI 35, WC 28, D10 —
	3					
	4					▼ Static Water 7/23/91 1 hr.
	5					
	5.5		Clay, gray & brown (CH)			
	6				Bag 24B	
	7				JAR 24B	LL 43, PL 18, PI 25, WC 28, D10 —
	8					
	9					
-10.0	10					

FIG 28

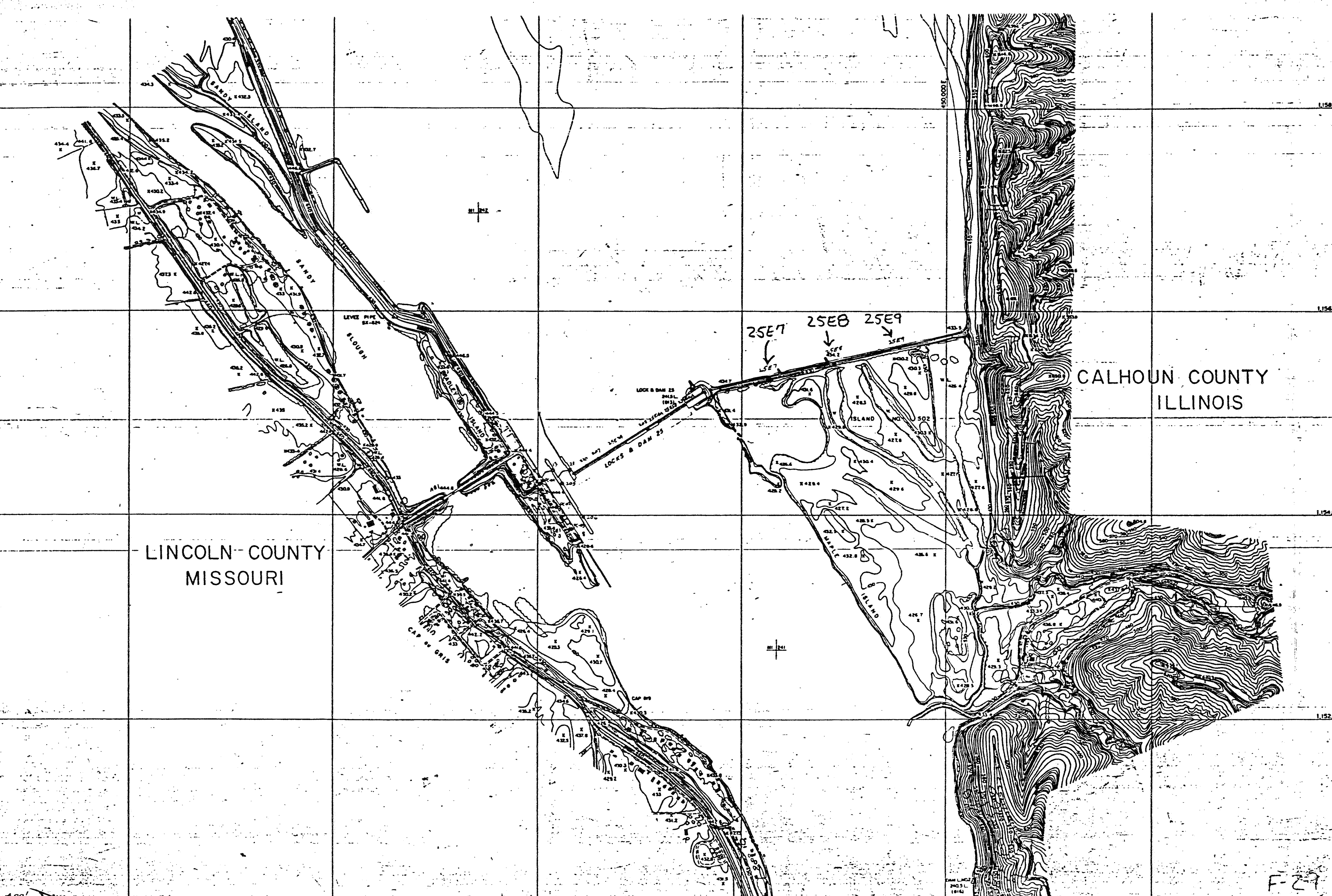
Hole No. BT-24

DRILLING LOG	DIVISION CELMS-CT-C	INSTALLATION	SHEET 2 OF 2 SHEETS

1. PROJECT Batchtown Habitat	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) BT-24	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR Bill Rowndcount

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-10.0			Clay, gray & brown			
	11		Sand			
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					

FIG 28 (con



CALHOUN COUNTY
ILLINOIS
LINCOLN COUNTY
MISSOURI
25E7
25E8
25E9
LOCKS & DAM 25
SANDY ISLAND
BRADLEY ISLAND
MAPLE ISLAND
ISLAND NO 502
SLOUGH
LEVEE PIPE
CAP AU GRIS
1,158,000
1,156,000
1,154,000
1,152,000
450,000 E
F-29

Fig 29

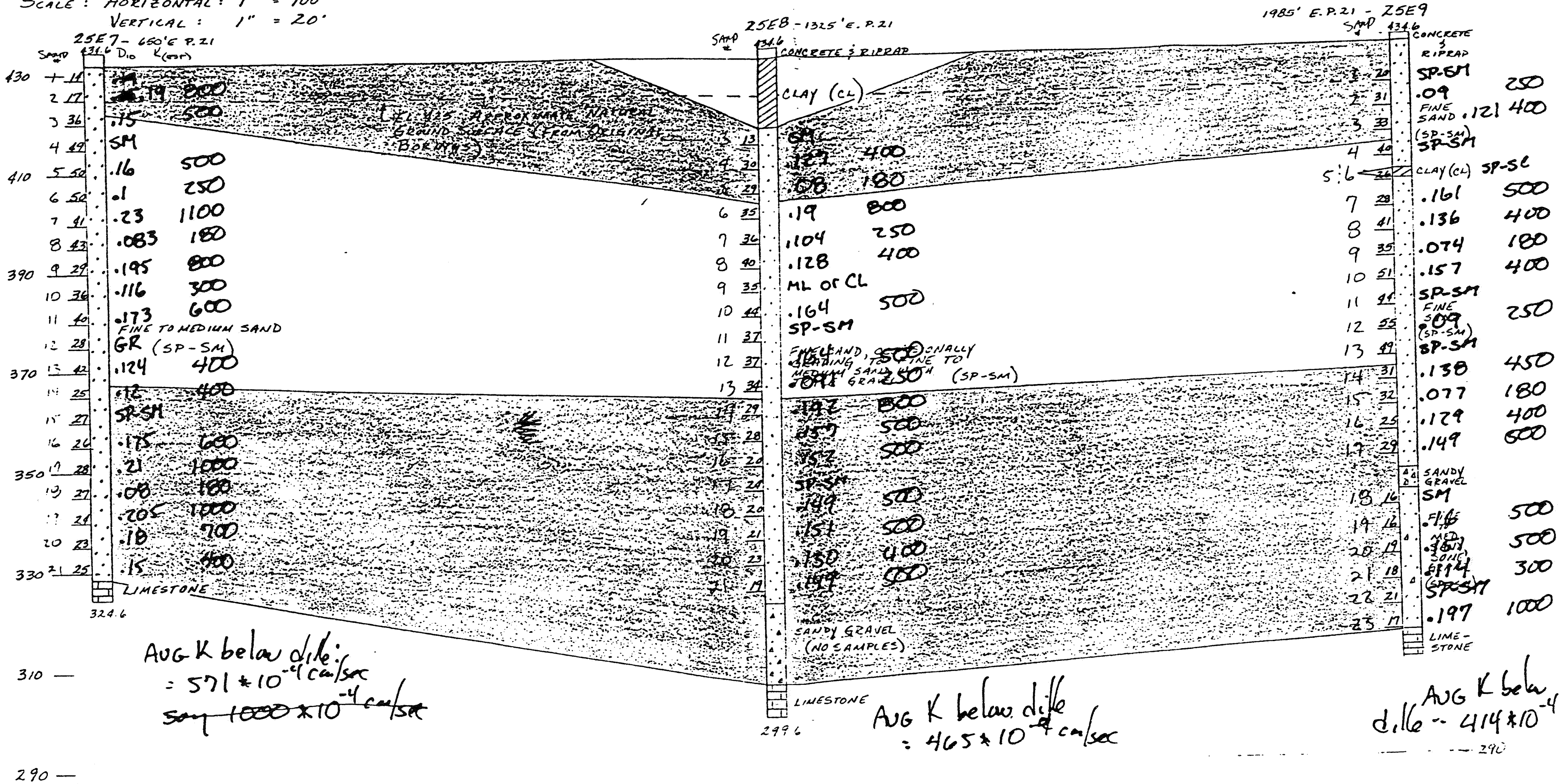
BY MMD DATE 1/E ? SUBJECT Lock and Dam No 25 SHEET NO. 2 OF 2

CHKD. BY ______ DATE ______ Liquefaction Analysis JOB NO. ______

Borings Thru Overflow Dike

Scale: Horizontal: 1" = 100'

Vertical: 1" = 20'



~~Plate 3~~

FIG 30

Fig. 30

Legend:

Symbol:	Description:
	LEAN CLAY, Sandy Clay, Silty Clay, of low to medium plasticity
	SAND, Poorly-Graded, gravelly sands
	CLAYEY SAND, sand-clay mixtures
	Limestone
	FAT CLAY, inorganic clay of high plasticity
	SILT, fine sandy or silty soil with high plasticity
	SILTY SAND, sand-silt mixtures
	SAND, Well-Graded, gravelly sands
	SILT & very fine sand, silty or clayey fine sand or clayey silt with slight plasticity
7/6 5/6	Stand Split Spoon
	Cont H-Stem Auger
	Begin mud rotary drilling.

Symbol:	Description:
	General Sample
	Water measured at time indicated
	End of Boring

Project No. .001

US ARMY CORPS OF ENGINEERS - ST. LOUIS DISTRICT

Fig 31

PROJECT B-Town	Page __ of __	COMPUTED BY Conroy	DATE 3/14/95
SUBJECT Statistical analy of PI's		CHECKED BY	DATE

Plasticity Index of Soils in Top 10 feet

9	14	30	22
18	25	34	9
23	30	32	25
25	46	21	17
30	36	13	21
19	23	14	19
29	27	31	41
24	14	1	30
27	27	30	20
17	23	20	8
11	31	25	11
24	27	18	37
46	27	18	12
48	39	15	17
38	29	14	39
30	26	26	19

$\overline{PI} = 24.6$

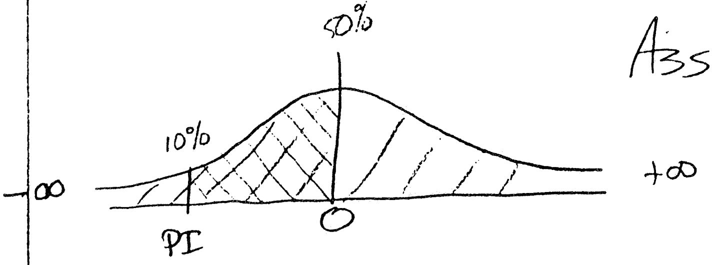
$\sigma = 9.369$

$V = 87.79$

Fig 32a

PROJECT	Page __ of __	COMPUTED BY	DATE
SUBJECT		CHECKED BY	DATE

What PI should be picked so that you can be 90% confident that any PI will be larger?



Assume Normally distributed
Table 1.11-1 in Harr

Area under LH side of curve = 0.50 (from -∞ to 0)
Area under curve from -∞ to PI = 10%

$\psi(n) = .40$

$n = 1.28$

$$1.28 = \frac{PI - PI_{10}}{\sigma_{PI}}$$

$$(1.28)(9.37) = 24.6 - PI_{10}$$

$$PI_{10} = 12.6$$

From TR 3-604 "Engineering Properties of Fined Grained ...."

FIG 31 For PI = 13 DRAINED: ϕ = 28 c = 0

FIG 32 For PI = 13 UNDRAINED: ϕ = 0 c = 40

Same analyses but use 70% confidence limit
PI = 19.6 Drained: ϕ = 26 c = 0
unDrained ϕ = 0 C = 60

Fig. 32 b

Appendix G - Fish and Wildlife Coordination Act Documentation

G-1 thru G-8	The U.S. Fish and Wildlife Service's Planning Aid Letter, dated December 22, 1993.
G-9 thru G-19	The Draft Fish and Wildlife Coordination Act Report (FWCAR), dated February 2, 1995. It reflects general agreement with the proposed project configuration.
G-20	St. Louis District's responses to the U.S. Fish and Wildlife Service's specific project recommendations in the FWCAR. The District will continue to involve the Service in all future phases of the project effort.
G-21	Refuge Compatibility Statement from USFWS, dated June 12, 1996
G-22 thru G-31	The Final Fish and Wildlife Coordination Act Report (FWCAR), dated July 24, 1996.

rec'd 12/27/93 DGK

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
Marion Illinois Suboffice (ES)
Rural Route 3, Box 328
Marion, Illinois 62959
(618) 997-5491

IN REPLY REFER TO:

December 22, 1993

Mr. Owen Dutt
Chief, Planning Division
U.S. Army Corps of Engineers
St. Louis District
1222 Spruce Street
St. Louis, Missouri 63103-2833

ATTN: Mr. Dave Kirkpatrick, CELMS-PD-F

Dear Mr. Dutt:

We have reviewed the draft Project Habitat Quantification (PHQ) for the Batchtown Habitat Rehabilitation and Enhancement Project (Batchtown). This information was provided to us during the October 5, 1993, meeting in the St. Louis District concerning this project. We offer the following comments/questions to aid in the further development of the Definite Project Report for this project, should it proceed further in planning.

<u>**Wildlife Habitat Appraisal Guide (WHAG) Method**</u>

1. Utilizing the data provided in the PHQ, we calculated the WHAG Habitat Suitability Indexes (HSI's) for the project site. These HSI's differ substantially from those in the PHQ (see enclosure). This may be the result of using different versions of the WHAG program. The WHAG team should determine which HSI's are appropriate.

2. The Incremental Components Analysis Table contains HSI's labeled as "Other". This habitat is described as wetlands converting to bottomland hardwoods due to siltation and succession. How were these HSI's determined?

3. The Incremental Components Analysis Table contains HSI's for the future without project condition through the future with project condition. How were the HSI's developed for each of the incremental components.

4. The habitat losses expected to occur as a result of construction of the project (i.e. levee) do not appear to be accounted for in the annualized waterfowl habitat units or the incremental components analysis.

5. Annualized habitat units for other wetland species in the evaluation matrix need to be provided in order to accurately assess the positive and negative benefits of the project. This cannot be accurately determined with HSI's alone.

<u>**Aquatic Habitat Appraisal Guide (AHAG) Method**</u>

1. The AHAG HSI values for large slackwater fishes during the summer period in the future with project condition appear to be high considering this will be the drawdown period for moist-soil plant production and much of the area may be unavailable for fish use. These HSI's need to be reevaluated. It will be difficult to make adjustments for this in the incremental components analysis.

2. A separate table for each evaluated area (i.e. DOC-B, FWS-M, FWS-L and Other) should be included to display the seasonal HSI's according to the life stage and the averages of these. The single table is inadequate to determine how the average HSI's were determined for all areas.

3. The Incremental Components Analysis Table contains HSI's for the future without project condition through the future with project condition. How were the HSI's developed for each of the incremental components?

<u>Freshwater Mussel Habitat Appraisal Method</u>

1. The Incremental Components Analysis Table contains HSI's for the future without project condition through the future with project condition. How were these HSI's developed?

Thank you for the opportunity to review the draft Project Habitat Quantification. We look forward to working with your staff should this project proceed. Please contact Joyce Collins of my staff if we can be of further assistance or these comments need further clarification.

Sincerely,

for Joyce A Collins
Thomas M. Groutage
Assistant Field Supervisor

Enclosure

cc: IDOC (Donels, Atwood, Booth)
USFWS (Bornstein, Drews, Surprenant)

MISSOURI DEPARTMENT OF CONSERVATION

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

1	N	NONFOREST WETLAND
2	B	BOTTOMLAND HARDWOODS-WETLAND
3	C	CROPLAND-WETLAND
4	G	GRASSLAND-WETLAND

SPECIES ABREVIATIONS

1	MALL	MALLARD	7	HERO	GREEN-BACKED HERON
2	GOOS	CANADA GOOSE	8	DUCK	WOOD DUCK
3	BITT	LEAST BITTERN	9	BEAV	BEAVER
4	YLEG	LESSER YELLOWLEGS	10	COOT	AMERICAN COOT
5	MUSK	MUSKRAT	11	PARU	NORTHERN PARULA
6	RAIL	KING RAIL	12	PROT	PROTHONOTARY WARBLER

PROJECT NAME batch

MATRIX NAME WETLAND
DATA FILE NAME BATCH

PLANNING CONDITION present

DATE FIELD WORK 11/23/93
TODAYS DATE 11-23-1993

SAMPLE SITE HABITAT INDEXES

HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL	HERO	DUCK	BEAV	COOT	PARU	PROT
N	SITE 1	0.10	0.10	0.10	0.65	0.16	0.63	0.49			0.10		
B	SITE 2	0.10						0.58	0.54	0.57		0.62	0.56
B	SITE 3	0.10						0.57	0.10	0.62		0.10	0.10
N	SITE 4	0.44	0.54	0.10	0.10	0.54	0.41	0.66			0.10		
C	SITE 5	0.23	0.42										
B	SITE 6	0.10						0.56	0.50	0.46		0.45	0.50

THIS DATA SET CONTAINS:
2 NONFOREST WETLAND SAMPLE SITES
3 BOTTOMLAND HARDWOODS-WETLAND SAMPLE SITES
1 CROPLAND-WETLAND SAMPLE SITES
0 GRASSLAND-WETLAND SAMPLE SITES

AVERAGE HABITAT INDEXES BY HABITAT TYPE

HAB	MALL	GOOS	BITT	YLEG	MUSK	RAIL	HERO	DUCK	BEAV	COOT	PARU	PROT
N	0.27	0.32	0.10	0.37	0.35	0.52	0.58			0.10		
B	0.10						0.57	0.38	0.55		0.39	0.39
C	0.23	0.42										
G												

MISSOURI DEPARTMENT OF CONSERVATION

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

1	N	NONFOREST WETLAND
2	B	BOTTOMLAND HARDWOODS-WETLAND
3	C	CROPLAND-WETLAND
4	G	GRASSLAND-WETLAND

SPECIES ABREVIATIONS

1	MALL	MALLARD	7	HERO	GREEN-BACKED HERON
2	GOOS	CANADA GOOSE	8	DUCK	WOOD DUCK
3	BITT	LEAST BITTERN	9	BEAV	BEAVER
4	YLEG	LESSER YELLOWLEGS	10	COOT	AMERICAN COOT
5	MUSK	MUSKRAT	11	PARU	NORTHERN PARULA
6	RAIL	KING RAIL	12	PROT	PROTHONOTARY WARBLER

PROJECT NAME   BATCH

MATRIX NAME   WETLAND
DATA FILE NAME BATCHA

PLANNING CONDITION   FUTWO

DATE FIELD WORK 11/23/92
TODAYS DATE   11-23-1993

SAMPLE SITE HABITAT INDEXES

HAB	SITE						
		MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	SITE 1	0.10	0.10	0.51	0.61	0.13	0.66
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.69			0.10		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
B	SITE 2	0.10					
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.60	0.57	0.52		0.60	0.70
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
B	SITE 3	0.10					
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.54	0.55	0.52		0.55	0.56
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	SITE 4	0.41	0.51	0.34	0.10	0.46	0.37
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.79			0.53		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
C	SITE 5	0.23	0.42				
		HERO	DUCK	BEAV	COOT	PARU	PROT
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
B	SITE 6	0.10					
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.48	0.60	0.41		0.60	0.63

THIS DATA SET CONTAINS:
2 NONFOREST WETLAND SAMPLE SITES
3 BOTTOMLAND HARDWOODS-WETLAND SAMPLE SITES
1 CROPLAND-WETLAND SAMPLE SITES
0 GRASSLAND-WETLAND SAMPLE SITES

AVERAGE HABITAT INDEXES BY HABITAT TYPE

HAB	MALL	GOOS	BITT	YLEG	MUSK	RAIL	HERO	DUCK	BEAV	COOT	PARU	PROT
N	0.26	0.31	0.43	0.36	0.29	0.51	0.74			0.31		
B	0.10						0.54	0.58	0.48		0.58	0.63
C	0.23	0.42										
G												

MISSOURI DEPARTMENT OF CONSERVATION

WILDLIFE HABITAT APPRAISAL GUIDE

HABITAT TYPE ABREVIATIONS

1	N	NONFOREST WETLAND
2	B	BOTTOMLAND HARDWOODS-WETLAND
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3	BITT	LEAST BITTERN	9	BEAV	BEAVER
4	YLEG	LESSER YELLOWLEGS	10	COOT	AMERICAN COOT
5	MUSK	MUSKRAT	11	PARU	NORTHERN PARULA
6	RAIL	KING RAIL	12	PROT	PROTHONOTARY WARBLER

PROJECT NAME BATCH

MATRIX NAME WETLAND
DATA FILE NAME BATCHB

PLANNING CONDITION FUTURE

DATE FIELD WORK 11/23/93
TODAYS DATE 11-23-1993

SAMPLE SITE HABITAT INDEXES

HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	SITE 1	0.65	0.77	0.79	0.73	0.61	0.66
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.56			0.61		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
B	SITE 2	0.63					
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.70	0.61	0.62		0.62	0.56
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
B	SITE 3	0.64					
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.71	0.65	0.61		0.60	0.70
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
N	SITE 4	0.76	0.73	0.10	0.10	0.64	0.47
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.55			0.10		
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
C	SITE 5	0.73	0.57				
		HERO	DUCK	BEAV	COOT	PARU	PROT
HAB	SITE	MALL	GOOS	BITT	YLEG	MUSK	RAIL
B	SITE 6	0.52					
		HERO	DUCK	BEAV	COOT	PARU	PROT
		0.63	0.67	0.56		0.42	0.44

THIS DATA SET CONTAINS:
2 NONFOREST WETLAND SAMPLE SITES
3 BOTTOMLAND HARDWOODS-WETLAND SAMPLE SITES
1 CROPLAND-WETLAND SAMPLE SITES
0 GRASSLAND-WETLAND SAMPLE SITES

AVERAGE HABITAT INDEXES BY HABITAT TYPE

HAB	MALL	GOOS	BITT	YLEG	MUSK	RAIL	HERO	DUCK	BEAV	COOT	PARU	PROT
N	0.71	0.75	0.44	0.41	0.62	0.56	0.56			0.36		
B	0.60						0.68	0.65	0.60		0.54	0.57
C	0.73	0.57										
G												

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Marion Illinois Suboffice (ES)
Rural Route 3, Box 328
Marion, Illinois 62959

IN REPLY REFER TO:

February 2, 1995

Colonel Thomas C. Suermann
U.S. Army Corps of Engineers
St. Louis District
1222 Spruce Street
St. Louis, Missouri 63103-2833

ATTN: Mr. Dave Kirkpatrick, CELMS-PD-F

Dear Colonel Suermann:

This letter constitutes our draft Fish and Wildlife Coordination Act Report (FWCAR) for the Batchtown Habitat Rehabilitation and Enhancement Project (HREP) in Pool 25, Calhoun County, Illinois. This report is intended to provide compliance with Subsection 2(b) of the Fish and Wildlife Coordination Act and Section 7 consultation requirements of the Endangered Species Act of 1973, as amended.

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

The project area is owned in fee title by the Army Corps of Engineers (Corps). The Middle and Lower Pool areas are operated under a General Plan and Cooperative Agreement with the U.S. Fish and Wildlife Service (Service) as part of the Brussels District of the Mark Twain National Wildlife Refuge. The Batchtown Wildlife Management Area is managed by the Illinois Department of Conservation (IDOC) under cooperative agreements with the Service and the Corps. The National Wildlife Refuge System Administration Act requires that a compatibility study be approved and special use permits issued prior to construction. These documents are approved by our Regional Director and will be forward to you under a separate cover.

INTRODUCTION

Batchtown is located in Calhoun County, Illinois, at the tailwaters of Lock and Dam 25. Woodlands along backwater sloughs and lakes provide habitat for nesting waterfowl and their broods. Water levels on moist soil units are manipulated to encourage natural development of vegetation for wildlife. Local farmers plant corn, soybeans and wheat on specific areas under cooperative agreements, leaving a share of the crops in the fields for wildlife.

Sedimentation has severely impacted deep water habitat and very little aquatic vegetation is present in the project area. In addition, the turbidity and shallow depth decreases the habitat value of the area for most fish species. Because of its importance in providing habitat for waterfowl, fish and other species, the involved agencies are interested in enhancing the resources and management potential at Batchtown. For this reason, Batchtown has been included in EMP.

RESOURCE PROBLEMS AND OPPORTUNITIES

Sedimentation at Batchtown and other backwater areas is drastically reducing available habitat for fish and wildlife. Silt deposition inhibits the reestablishment of submerged aquatic vegetation and mast-producing trees and allows the encroachment of woody vegetation species which are generally considered undesirable, such as, silver maple, cottonwood and willow. Reduced water depths result in seasonally low dissolved oxygen levels and water temperature extremes. Silt eliminates firm substrates and clear water needed for spawning sunfishes. Backwaters are becoming increasingly isolated, thus limiting fish movement.

Batchtown is a unique backwater due to its braided channel habitat and the presence of a mussel bed. This unique habitat is being affected by river-borne sediment deposition and sediment input from the uplands. Upland sediment input estimates include: Dixon Hollow, 1.8 acre feet/year; Turner Hollow, 4.3 acre feet/year; and Titus Hollow, approximately 6.0 acre feet/year. Such sedimentation rates may soon eliminate the unique habitat present at Batchtown.

In addition, Batchtown is strongly influenced by the Corps' water level management in Pool 25. During certain times of the year, the pool may go on "tilt" to maintain the 9- foot navigation channel. During these times, Batchtown can be completely dewatered, eliminating fish and wildlife habitat and inhibiting management opportunities. All these factors were considered in the development of the Batchtown HREP.

GOALS AND OBJECTIVES

The goal of this project is to rehabilitate and enhance the fish and wildlife resources of Batchtown. The primary wildlife goal for the management of Batchtown is to enhance wetland values for migratory waterfowl, while maintaining suitable habitats for non-target species. The major fisheries goal of the project is to enhance aquatic habitat conditions for slackwater fish, particularly larger slackwater fish. The major goal of the project as it relates to mussels is maintenance of the existing bed while improving habitat conditions for fish and waterfowl. These goals can be accomplished by attempting to meet the following project objectives:

1. Reduce sedimentation in Batchtown by construction of a peripheral levee around the state area, raising the peripheral levee around the federal area and construction of hillside and lowland sediment traps. Sediment reduction is critically important for any habitat enhancement activity in the project area.

2. To provide additional moist-soil management capability by providing water-control structures and pumps. This will improve habitat conditions for waterfowl and fish and control woody vegetation encroachment.

3. Create deepwater habitat in portions of Middle Pool and provide fish access into this area during stress periods.

4. Provide fish access into the area for spawning during spring.

5. To provide sufficient water flow in the state area to sustain the mussel bed.

6. To maintain interior water level independent of river fluctuations.

PROPOSED PROJECT FEATURES

At the current time, the Corp's recommended plan proposes the following features to meet the goals and objectives;

a. Riverside perimeter flood protection levee constructed to 435.5 NGVD, which would extend from the northern boundary of the state area southward to the southern perimeter of the project to tie into Lock and Dam 25. A levee would also be constructed to separate Lower Pool from the state area.

b. Raising the perimeter levee around the federal area to 437.5 NGVD.

c. Dredging on the federal area consisting of an approximately 50-60 foot wide, 2.5 mile long channel extending east and north from the riverside water control structure.

d. Dredging to obtain borrow along the inside of the levee in the state area.

e. One 8-foot wide stop-log structure and two 48-inch wide CMP's at the Mississippi River entrance to the 40's channel.

f. Two 8-foot wide stop-log structures and a 90 cfs pump at the north fork of the 70's channel.

g. One 8-foot wide stop-log structure with two 48-inch CMP's at the south fork of the 70's channel.

h. Four 8-foot wide stop-log structures about three/quarters of the way southward along the state area.

i. Two 54-inch gated concrete pipes adjacent to the spillway at Lock and Dam 25.

j. Two 48-inch CMP's and one 8-foot wide concrete stop-log structure in the perimeter levee around Middle Pool.

k. One 48-inch CMP in the levee between Lower Pool and the state area.

METHODOLOGY

Batchtown wildlife and fishery habitats were analyzed by using the Wildlife Habitat Appraisal Guide (WHAG) and the Aquatic Habitat Analysis Guide (AHAG). Existing conditions, future without project conditions and future with project conditions were examined. This analysis employed an interagency team with team members representing the Corps, IDOC and the Service.

The WHAG and AHAG analyses produce a rating of habitat quality for each respective habitat type. This rating is referred to as a Habitat Suitability Index (HSI). The HSI, a value ranging from 0.1 to 1.0, measures the existing and future habitat conditions compared to optimum habitat which is 1.0. This value when multiplied by the available habitat within the project area, will provide a measure of available habitat quality and quantity known as habitat units.

Each analysis includes limiting factors in each matrix. Absence of critical life requisites for a particular species makes the habitat unsuitable and results in a HSI value of 0.1 regardless of other habitat characteristic scores. Average Annual Habitat Units (AAHU's) for each species are calculated to reflect expected habitat conditions over a 50-year project life.

The presence of a freshwater mussel bed within the Batchtown project area necessitated an appraisal of the existing and future habitat conditions for mussels. A HSI model for riverine freshwater mussel communities was developed by the Waterways Experiment Station (WES) based upon studies of prominent mussel beds having commercial and ecological value in sandy gravel or gravelly sand shoals of four major rivers. This model was then modified because of the location of the Batchtown bed in a side channel with a silt/clay substrate and subject to sediment deposition. The mussel evaluation team included representation from the Corps, IDOC, Illinois Natural History Survey, WES and the Service.

EXISTING AND FUTURE WITHOUT PROJECT CONDITIONS

A number of assumptions were made about what the project area and vicinity would be like 50 years in the future without any project. Chief assumptions were that severe water level fluctuations will continue to limit aquatic food production capabilities for waterfowl and will continue to impact spawning and rearing life stages for all fish species in all management units. Approximately 50-65 percent of the non-forested wetlands in the project area are expected to be lost over the next 50 years because of the sedimentation that is occurring in the Mississippi River backwaters. Table 1 displays the existing HSI's for the project area.

TABLE 1: EXISTING CONDITIONS

WHAG HSI's

Target Species	Nonforested Wetlands*	Forested Wetlands**	Cropland
Mallard	0.10	0.10	0.22
Divers	0.25	---	---
Wood Duck	---	0.31	---
Canada Goose	0.12	---	0.10
Nontarget Species			
Lesser Yellowlegs	0.38	---	---
King Rail	0.52	---	---
Green-backed Heron	0.52	0.43	---
Northern Parula	---	0.40	---
Prothonotary Warbler	---	0.36	---

AHAG HSI's

Target Species	DOC-B	FWS-M	FWS-L
Smallmouth Buffalo	0.44	0.45	0.44
Flathead Catfish	0.44	0.43	0.44
Nontarget Species			
Emerald Shiner	0.45	0.45	0.45
Largemouth Bass	0.40	0.39	0.38

*Average for sample sites 1N and 4N
**Average for sample sites 2B, 3B and 6B

Backwaters and Nonforested Wetlands

The available nonforested wetland and aquatic type habitats are expected to decline from approximately 2,114 acres to 821 acres. This is a loss of approximately 1,293 acres (61%). Although the HSI's for wildlife and aquatic species are not expected to significantly change (Tables 1 and 2), this represents a significant decrease in the available habitat for waterfowl and fishery resources.

Bottomland Forest

Without a project, the forested wetlands at Batchtown are expected to increase from approximately 989 acres to 2,269 acres. This would be an increase of approximately 1,280 acres. HSI's for wildlife species are not expected to change significantly (Tables 1 and 2), however, the available habitat units would increase. While initially, this habitat increase appears to be beneficial, the forested habitat which would develop would consist of a silver maple/cottonwood/willow dominated forest. While such forest provide benefits to some species, this forest type is not limiting within the project area. Allowing a successional change from nonforested wetlands and backwaters to forested wetland would significantly decrease the available habitat for waterfowl and fishery resources and would not be in accordance with project goals and objectives.

TABLE 2: FUTURE WITHOUT PROJECT (YEAR 50)

WHAG HSI's

Target Species	Nonforested Wetlands*	Forested Wetlands**	Cropland
Mallard	0.11	0.10	0.22
Divers	0.27	---	---
Wood Duck	---	0.49	---
Canada Goose	0.12	---	0.10
Nontarget Species			
Lesser Yellowlegs	0.36	---	---
King Rail	0.52	---	---
Green-backed Heron	0.74	0.46	---
Northern Parula	---	0.63	---
Prothonotary Warbler	---	0.23	---

AHAG HSI's

Target Species	DOC-B	FWS-M	FWS-L
Smallmouth Buffalo	0.44	0.44	0.45
Flathead Catfish	0.43	0.42	0.45
Nontarget Species			
Emerald Shiner	0.45	0.42	0.45
Largemouth Bass	0.40	0.42	0.39

*Average for sample sites 1N and 4N
**Average for sample sites 2B, 3B, and 6B

Cropland

Cropland quality and quantity are not expected to change without the project (Tables 1 and 2).

FUTURE WITH PROJECT CONDITIONS

A number of assumptions were also made about what the project would be like 50 years in the future with a project. Water levels would be predictable and controlled. This will greatly increase the reliability of moist-soil and aquatic plant production and will ensure that the food produced is available to waterfowl during migration. Sedimentation should be reduced by 60% from its existing rate in the state backwater area and by 70% in the Service part of the project. Wetland losses would continue to occur but at a much slower rate than at present and is estimated at 25% over the life of the project.

TABLE 3: FUTURE WITH PROJECT (YEAR 50)

WHAG HSI's

Target Species	Nonforested Wetlands*	Forested Wetlands**	Cropland
Mallard	0.51	0.31	0.73
Divers	0.51	---	---
Wood Duck	---	0.59	---
Canada Goose	0.48	---	0.48
Nontarget Species			
Lesser Yellowlegs	0.65	---	---
King Rail	0.57	---	---
Green-backed Heron	0.55	0.69	---
Parula Warbler	---	0.53	---
Prothonotary Warbler	---	0.63	---

AHAG HSI's

Target Species	DOC-B	FWS-M	FWS-L
Smallmouth Buffalo	0.77	0.75	0.73
Flathead Catfish	0.76	0.68	0.69
Nontarget Species			
Emerald Shiner	0.82	0.73	0.79
Largemouth Bass	0.71	0.69	0.63

*Average for sample sites 1N and 4N
**Average for sample sites 2B, 3B and 6B

It should be noted here that the future habitat conditions predicted in this section assume upland and lowland sediment treatment will be included as part of the project. Without these measures the sedimentation rates will be higher than anticipated. The HSI's may be lower and the available AAHU's will significantly decrease due to the continued loss of habitat. The upland and lowland sediment treatment measures are vital to the success of the Batchtown HREP. If not included, the WHAG and AHAG analyses will require reevaluation.

Nonforested Wetlands and Backwaters

The available nonforested wetland and aquatic type habitats are expected to decline from approximately 2,114 to 1,654 acres. This is a loss of about 460 acres but will occur at a significantly decreased rate. HSI's for wildlife and fish species are expected to increase (Tables 1 and 3).

Bottomland Forest

Forested habitat is expected to increase from approximately 989 to 1449 acres. This is primarily due to encroachment of woody vegetation. However, this will occur at a significantly lower rate. Habitat quality for wildlife is expected to increase through the life of the project (Tables 1 and 3). The levee will protect the Batchtown area from frequent flooding and may allow mast producing tree regeneration at higher elevations.

Cropland

The amount of cropland is not expected to change with the project as currently proposed. However, habitat quality will increase with the increased management capability (Tables 1 and 3). If reforestation measures are incorporated into project design, the amount of available cropland may decrease. However, this should not significantly adversely affect the species utilizing this habitat.

THREATENED AND ENDANGERED SPECIES

To facilitate compliance with Section 7(c) of the Endangered Species Act of 1973, as amended, Federal agencies are required to obtain from the Service information concerning any species, listed or proposed to be listed, which may be present in the area of a proposed action. Therefore, we are furnishing you the following list of species that have ranges that include the concerned area:

Classification	Common Name	Scientific Name	Habitat
Endangered	Bald eagle	*Haliaeetus leucocephalus*	Breeding and wintering along major rivers and reservoirs
Endangered	Indiana bat	*Myotis sodalis*	Caves, mines; well developed riparian woods; upland forests
Threatened	Decurrent false aster	*Boltonia decurrens*	Disturbed alluvial soils

There is no designated critical habitat in the project area at this time.

No bald eagle nests are known to occur in the project area. Bald eagles are known to utilize the area in the vicinity of Lock and Dam 25 for foraging and winter roosting. No winter roosts are known to occur in the project area. Most feeding and loafing is concentrated on the Missouri side of the Mississippi River, due to the presence of more suitable habitat.

The Indiana bat utilizes trees with rough or exfoliating bark to roost and to form maternity colonies. To avoid impacting this species, no tree clearing should occur between May 1 and August 31. The decurrent false aster is not known to occur in the project area. Therefore, if the tree clearing restriction for Indiana bats is adhered to, the Service would concur that the proposed activity is not likely to adversely the Indiana bat or any other known federally listed threatened or endangered species. This precludes the need for further action on this project as required under Section 7 of the Endangered Species Act of 1973, as amended. Should the project be modified or new information indicate endangered species may be affected, consultation should be initiated.

DISCUSSION

The project proposed has been predicted to result in a net gain of 1,334 AAHU's for target wildlife species (Table 4) and 1,503 AAHU's for target fish species (Table 5). In addition, the project will provide significant habitat benefits for a variety of non-target species, as well. The loss of 144 AAHU's for the Northern parula (Table 4) is due to the reduction in the conversion of aquatic habitat to terrestrial habitat. To reemphasize, these AAHU's were developed assuming upland and lowland sediment treatment measures were a part of the proposed project. These will require reevaluation if these measures are not carried forward as part of the project.

Sedimentation is seen as the most severe problem affecting fish and wildlife resources in the Mississippi River. Sediment deposition occurs due to overbank flooding and inputs from surrounding uplands. Aquatic vegetation production is inhibited by soft substrates and high turbidity. Surface areas of sloughs, side channels and backwaters continue to decline, reverting to terrestrial habitat. The aquatic vegetation forms the basis of the substrate needed for aquatic macroinvertebrate production. These invertebrates, as well as the vegetative parts of aquatic plants, provide an important food base for many species of migratory birds and riverine fish. The aquatic vegetation also provides important spawning and brood rearing habitat for fish.

It is a challenge for the Corps and fish and wildlife managers to develop techniques to reduce sedimentation in backwaters and side channels before these important habitats are lost forever. Batchtown presents a unique opportunity for many agencies to work together to address this increasingly difficult problem.

CONCLUSIONS AND RECOMMENDATIONS

The project proposed represents a significant effort by various agencies to address the resource concerns at Batchtown. However, the current project plan developed by the Corps does not fully address many of these concerns and may lead to further degradation of the habitat for both fish and wildlife.

The project, as proposed, does not address the biological monitoring of the mussel bed resource located at Batchtown. Monitoring of this bed is necessary to determine if the mussel bed is maintained or if deterioration occurs as a result of project implementation. It will also be required in order to determine if the goals and objectives for this resource are met. Therefore, prior to project approval, the Corps must develop, in coordination with involved agencies, a suitable monitoring plan to address this concern. This monitoring effort should be included as a project cost.

The Flood of 1993 has caused a great deal of tree mortality in much of the Mississippi River floodplain. This mortality is estimated at 60% in some areas and may increase over the next few years. In addition, some forested wetlands located in the project area may be impacted due to levee construction. To compensate for this loss, the Service recommends a reforestation and/or timber stand improvement component be included as a project feature in the Batchtown HREP. Tree planting will provide additional habitat benefits that will supplement other habitat enhancement efforts. This is particularly important to wood ducks and dabbling ducks, as well as other species of migratory birds and resident wildlife.

TABLE 4: Projected habitat effects (in AAHU's) on wildlife species derived from all proposed management measures (includes upland and lowland sediment treatment measures).

Species	Future With Project	Future Without Project	Net Change
Target Species			
Mallard	853	303	550
Divers	545	251	294
Wood Duck	465	413	52
Canada Goose	620	182	438
"Other"**	72	139	-67
Subtotal	2,555	1,288	1,267
Nontarget Species			
Lesser Yellowlegs	1,151	775	376
King Rail	1,150	907	243
Green Heron	1,562	1,358	204
Northern Parula	517	661	-144
Prothonotary Warbler	586	455	131
Subtotal	4,966	4,156	810
Total AAHU's	7,521	5,444	2,077

**Averaged target species for habitat category "Other"

The projected fish and wildlife benefits for the project are dependent upon the water-level management proposed for the area. This management primarily involves a slow drawdown in mid to late June for moist-soil plant production and then reflooding the area in September, with water level maintained at around 434.0 NGVD the rest of the year. To ensure fish and wildlife benefits, we recommend the proposed water level management schemes be incorporated in the project plans and HREP documents.

We are aware of the development and testing of an inexpensive, small-scale modelling system being developed by the Corps (i.e. micro-model). Given the unique nature of the habitat, hydrology and hydraulics in the Batchtown project area, we recommend such a micro-model be developed and utilized to determine the sedimentation patterns of the area with the proposed project. This inexpensive tool will better enable the visualization of projected fish and wildlife habitat benefits and could be funded with EMP funds.

TABLE 5: Projected habitat effects (in AAHU's) on fish species derived from all proposed management measures (includes upland and lowland sediment treatment measures).

Species	Future With Project	Future Without Project	Net Change
Target Species			
Smallmouth Buffalo	1,408	642	766
Flathead Catfish	1,362	625	737
Subtotal	2,770	1,267	1,503
Nontarget Species			
Emerald Shiner	1,474	651	823
Largemouth Bass	1,291	579	712
Subtotal	2,765	1,230	1,535
Total AAHU's	5,535	2,497	3,038

A stop-log structure to allow fish passage from the river to Lower Pool has been omitted from the project plans. The Service has been assured in previous discussions this feature would be included. Therefore, this feature should be incorporated into the project plans.

Finally, the current Corps project plan does not contain the hillside and lowland sediment treatment measures. The upland and lowland sediment treatment is absolutely critical to the success of the Batchtown HREP. Many of the proposed project features were incorporated into this HREP to ensure the mussel bed and important aquatic habitat located in the Batchtown area would not deteriorate as a result of the project. Without upland and lowland sediment treatment this habitat will deteriorate regardless. Therefore, many of the stop-log structures and CMP's will also need to be eliminated from project design as their construction would not accomplish the goal intended.

The elimination of upland and lowland sediment treatment measure virtually ensures the mussel bed will deteriorate and continued sedimentation will eliminate or reduce the habitat benefits to be created with other project features. The life of the project will be shortened. Since sediment reduction was a key assumption in the WHAG and AHAG analyses, the fish and wildlife habitat analysis will be nullified.

The upland and lowland sediment treatment measures are intimately tied to a successful project and must be addressed in project design, alternative analysis, cost/benefit analysis, etc. If these features are not incorporated into and approved as part of the project plan, their construction may never occur. Therefore, many of the fish and wildlife benefits will be negated. This does not represent an appropriate use of federal funding and the Service recommends the project not proceed if these measures are not incorporated into the project plan or until some acceptable assurances are given that they will be constructed.

Thank you for the opportunity to provide this draft report. A final report will be prepared after project plans have been revised to incorporate the hillside and lowland sediment treatment measures, a fish passage structure into Lower Pool, a mussel monitoring plan and a micro-model are developed and after further coordination with IDOC and review of planning documents.

Sincerely,

Joyce A. Collins

Joyce A. Collins
Acting Assistant Field Supervisor

cc: IDOC (Lutz, Hubbell, Glosser, Booth, Atwood)
IESPB (Lauzon)
USFWS (Blankenship, Nelson, Bornstein, Drews, Surprenant)
USEPA (Winn)

SLD Response to Draft FWCAR Recommendations:

1. Biological Monitoring-Freshwater Mussels.

Prior to final project approval, the Corps, in conjunction with the Fish and Wildlife Service and the Illinois Department of Natural Resources, will develop a suitable mussel monitoring plan to assess project impacts. Monitoring costs will be included as part of project costs.

2. Reforestation.

Enhancement of the bottomland forest has been added as a feature of the HREP as a result of the flood of 1993. The FWS has already initiated a reforestation effort on that portion of the project under their management. Consequently, the HREP will only address that portion of the project under the management of IDNR. A reforestation plan for the state managed portion of the project area is included in the DPR.

3. Water Level Management.

Water level management schemes for the FWS and IDNR managed portions of the project area after completion of the project are included as Figures 16 and 17, respectively.

4. Micro-modelling.

The Corps will consider the development of a micro-model for the project as proposed. The feasability and cost of such a micro-model will be discussed with the Hydrologic and Hydraulics Branch, Engineering Division, and a response to this recommendation inclluded in the final DPR.

5. Stop-log Structure-FWS Lower Pool.

The stop-log structure allowing fish passage from the river into the Lower Pool has been included in the project plans.

6. Hillside and Lowland Sediment Treatment.

Hillside and lowland sediment treatment have been included in the draft DPR in Appendix O and Figure 11, respectively.

United States Department of the Interior

Fish and Wildlife Service
Mark Twain National Wildlife Refuge
1704 N. 24th Street
Quincy, Illinois 62301

June 12, 1996

Mr. Dave Kirkpatrick
CEMLMS-PD-F
U.S. Army Corps of Engineers
St. Louis District
1222 Spruce Street
St. Louis, Missouri 63103-2833

Dear Mr. Kirkpatrick:

This is to advise you that Project Leader Steinbach has determined that the proposed Batchtown Habitat Rehabilitation and Enhancement Project is compatible with the purpose for which the Mark Twain National Wildlife Refuge was established. Project Leader Steinbach has forwarded the determination to the Regional Office for review and concurrence.

If you have any questions or comments, please phone me at 217/224-8580.

Sincerely,

Ross Adams

Ross Adams
EMP Coordinator

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Marion Illinois Suboffice (ES)
Rural Route 3, Box 328
Marion, Illinois 62959

IN REPLY REFER TO:

July 24, 1996

Colonel Thomas C. Suermann
U.S. Army Corps of Engineers
St. Louis District
1222 Spruce Street
St. Louis, Missouri 63103-2833

ATTN: Mr. Dave Kirkpatrick, CELMS-PD-F

Dear Colonel Suermann:

This letter constitutes our Final Fish and Wildlife Coordination Act Report (FWCAR) for the Batchtown Habitat Rehabilitation and Enhancement Project (HREP) in Pool 25, Calhoun County, Illinois. This report is intended to provide compliance with Subsection 2(b) of the Fish and Wildlife Coordination Act and Section 7 consultation requirements of the Endangered Species Act of 1973, as amended.

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

The project area is owned in fee title by the U.S. Army Corps of Engineers (Corps). The Middle and Lower Pool areas are operated under a General Plan and Cooperative Agreement with the U.S. Fish and Wildlife Service (Service) as part of the Brussels District of the Mark Twain National Wildlife Refuge. The Batchtown Wildlife Management Area (State Area) is managed by the Illinois Department of Natural Resources (IDNR) under cooperative agreements with the Service and the Corps. The National Wildlife Refuge System Administration Act requires that a compatibility study be approved and special use permits issued prior to construction. These documents are approved by our Regional Director and will be forward to you under a separate cover.

INTRODUCTION

Batchtown is located in Calhoun County, Illinois, immediately above Lock and Dam 25. Woodlands along backwater sloughs and lakes provide habitat for nesting waterfowl and their broods. Water levels on moist soil units are manipulated to encourage natural development of vegetation for wildlife. Local farmers plant corn, soybeans and wheat on specific areas under cooperative agreements, leaving a share of the crops in the fields for wildlife.

Sedimentation has severely impacted deep water habitat and very little aquatic vegetation is present in the project area. In addition, the turbidity and shallow depth decreases the habitat value of the area for most fish species. Because of its importance in providing habitat for waterfowl, fish and other species, the involved agencies are interested in enhancing the resources and management potential at Batchtown. For this reason, Batchtown has been included in the EMP.

RESOURCE PROBLEMS AND OPPORTUNITIES

Sedimentation at Batchtown and other backwater areas is drastically reducing available habitat for fish and wildlife. Silt deposition and frequent water-level fluctuation inhibits the reestablishment of submerged aquatic vegetation and allows the encroachment of woody vegetation species which are generally considered undesirable, such as, silver maple, cottonwood and willow. Reduced water depths result in seasonally low dissolved oxygen levels and water temperature extremes. Silt eliminates firm substrates and clear water needed for spawning sunfishes. Backwaters are becoming increasingly isolated, thus limiting fish movement. The amount of deepwater habitat available for overwintering fish has declined.

Batchtown is a unique backwater due to its braided channel habitat and the presence of a mussel bed. This unique habitat is being affected by river-borne sediment deposition and sediment input from the uplands. Upland sediment input estimates include: Dixon Hollow, 1.8 acre feet/year; Turner Hollow, 4.3 acre feet/year; and Titus Hollow, approximately 6.0 acre feet/year. Such sedimentation rates may soon eliminate the unique habitat present at Batchtown.

In addition, Batchtown is strongly influenced by the Corps' water level management in Pool 25. When the pool is on "tilt" the Batchtown Management area can be completely dewatered, eliminating fish and wildlife habitat and inhibiting management opportunities. For these reasons, sedimentation and frequent water level fluctuations were key factors in development of the Batchtown HREP.

GOALS AND OBJECTIVES

The management goal for this HREP is to rehabilitate the area's riverine habitat diversity to benefit fish, wildlife and freshwater mussels. The primary wildlife goal for the management of Batchtown is to enhance wetland values for migratory waterfowl, while maintaining suitable habitats for non-target species. The major fisheries goal of the project is to enhance aquatic habitat conditions for slackwater fish, particularly larger slackwater fish. The major goal of the project as it relates to mussels is maintenance of the existing bed while improving habitat conditions for fish and waterfowl. An interagency planning team identified the following project objectives to address the resource problems in the project area:

1. Increase diversity of wetland types within the project area.

2. Create a water-level management capability that is independent of water levels in Pool 25.

3. Reduce the rate of siltation throughout the project area.

4. Improve habitat quality and quantity of bottomland forest within the project area.

5. Improve spawning habitat for riverine fishes.

6. Improve overwintering habitat for fish in side channels and backwaters.

7. Improve side channel habitat by preventing river-borne sediment from filling the side channels.

8. Ensure adequate long-term water flow over the freshwater mussel beds.

PROPOSED PROJECT FEATURES

Due to various resource concerns and funding reductions in EMP, the proposed plan for the Batchtown HREP has been modified a number of times. At the current time, the recommended plan has the following features to meet the goals and objectives:

a. Riverside perimeter berm constructed to 435.5 NGVD and tapering to 434.5 NGVD, which would extend from the northern boundary of the State Area southward to the southern perimeter of the project to tie into Lock and Dam 25.

b. Construct a riverside berm in Lower Pool to 435.5 NGVD.

c. Construct an interior berm between Lower Pool and the State Area to 435.5 NGVD.

d. Construct two lowland sediment traps.

e. Hillside sediment control measures in watersheds affecting Middle and Lower Pools and the State Area.

f. Dredging in Middle and Lower Pools to deepen existing shallow water areas to facilitate dewatering, waterflow and to provide refuge for fish during winter stress periods.

g. Dredging in the State Area to deepen existing shallow water areas to facilitate dewatering, waterflow and to provide refuge for fish during winter stress periods.

h. Two 8-foot wide stop-log structures in Middle Pool.

i. Ten 8-foot wide stop-log structures in the State Area.

j. A 15 cfs portable pump and a ditch constructed in Lower Pool.

k. A permanently mounted 90 cfs pump in the State Area.

l. A 6 cfs portable pump on Turner Island.

m. Two 54-inch concrete pipes with gates through Lock and Dam 25 spillway.

n. One 8-foot wide concrete stop-log structure between Lower Pool and the State Area.

o. Bottomland forest improvements.

METHODOLOGY

Batchtown wildlife and fishery habitats were analyzed by using the Wildlife Habitat Appraisal Guide (WHAG) and the Aquatic Habitat Analysis Guide (AHAG). Existing conditions, future without project conditions and future with project conditions were examined. This analysis employed an interagency team with team members representing the Corps, IDNR and the Service.

The WHAG and AHAG analyses produce a rating of habitat quality for each respective habitat type. This rating is referred to as a Habitat Suitability Index (HSI). The HSI, a value ranging from 0.1 to 1.0, measures the existing and future habitat conditions compared to optimum habitat which is 1.0. This value when multiplied by the available habitat within the project area, will provide a measure of available habitat quality and quantity known as habitat units.

Each analysis includes limiting factors in each matrix. Absence of critical life requisites for a particular species makes the habitat unsuitable and results in a HSI value of 0.1 regardless of other habitat characteristic scores. Average Annual Habitat Units (AAHU's) for each species are calculated to reflect expected habitat conditions over a 50-year project life.

The presence of a freshwater mussel bed within the Batchtown project area necessitated an appraisal of the existing and future habitat conditions for mussels. A HSI model for riverine freshwater mussel communities was developed by the Waterways Experiment Station (WES) based upon studies of prominent mussel beds having commercial and ecological value in sandy gravel or gravelly sand shoals of four major rivers. This model was then modified because of the location of the Batchtown bed in a side channel with a silt/clay substrate and subject to sediment deposition. The mussel evaluation team included representation from the Corps, IDNR, WES and the Service.

EXISTING AND FUTURE WITHOUT PROJECT CONDITIONS

A number of assumptions were made about what the project area and vicinity would be like 50 years in the future without any project. Chief assumptions were that severe water level fluctuations will continue to limit aquatic food production capabilities for waterfowl and will continue to impact spawning and rearing life stages for all fish species in all management units. Approximately 50-65 percent of the non-forested wetlands in the project area are expected to be lost over the next 50 years because of the sedimentation that is occurring in the Mississippi River backwaters. Table 1 displays the existing HSI's for the project area.

Backwaters and Nonforested Wetlands

Based on estimated sedimentation rates, the available nonforested wetland and aquatic type habitats are expected to decline from approximately 2,114 acres to 821 acres. This is a loss of approximately 1,293 acres (61%). Although the HSI's for wildlife and aquatic species are not expected to significantly change (Tables 1 and 2), this represents a significant decrease in the available habitat for waterfowl and fishery resources.

Bottomland Forest

Without a project, the forested wetlands at Batchtown are expected to increase from approximately 989 acres to 2,269 acres. This would be an increase of approximately 1,280 acres. HSI's for wildlife species are not expected to change significantly (Tables 1 and 2), however, the available habitat units would increase. While initially, this habitat increase appears to be beneficial, the forested habitat which would develop would be dominated by silver maple/cottonwood/willow. While such forest provide benefits to some species, this forest type is not limiting within this portion of the Mississippi River. Allowing a successional change from nonforested wetlands and backwaters to forested wetland would significantly decrease the available habitat for waterfowl and fishery resources and would not be in accordance with project goals and objectives.

Cropland

Cropland quality and quantity are not expected to change without the project (Tables 1 and 2).

TABLE 1: EXISTING CONDITIONS

WHAG HSI's

Target Species	Nonforested Wetlands*	Forested Wetlands**	Cropland
Mallard	0.10	0.10	0.22
Divers	0.25	---	---
Wood Duck	---	0.31	---
Canada Goose	0.12	---	0.10
Nontarget Species			
Lesser Yellowlegs	0.38	---	---
King Rail	0.52	---	---
Green-backed Heron	0.52	0.43	---
Northern Parula	---	0.40	---
Prothonotary Warbler	---	0.36	---

AHAG HSI's

Target Species	DOC-B	FWS-M	FWS-L
Smallmouth Buffalo	0.44	0.45	0.44
Flathead Catfish	0.44	0.43	0.44
Nontarget Species			
Emerald Shiner	0.45	0.45	0.45
Largemouth Bass	0.40	0.39	0.38

*Average for sample sites 1N and 4N
**Average for sample sites 2B, 3B and 6B

FUTURE WITH PROJECT CONDITIONS

A number of assumptions were also made about what the project area would be like 50 years in the future with a project. Water levels would be predictable and controlled. This will greatly increase the reliability of moist-soil and aquatic plant production and will ensure that the food produced is available to waterfowl during migration. Sedimentation should be reduced by 60% from its existing rate in the State Area and by 70% in Middle and Lower Pools. Wetland losses would continue to occur but at a much slower rate than at present and is estimated at 25% over the life of the project.

Nonforested Wetlands and Backwaters

The available nonforested wetland and aquatic type habitats are expected to decline from approximately 2,114 to 1,654 acres. This is a loss of about 460 acres but will occur at a significantly decreased rate. HSI's for wildlife and fish species are expected to increase (Tables 1 and 3).

Bottomland Forest

Forested habitat is expected to increase from approximately 989 to 1449 acres. This is primarily due to encroachment of woody vegetation. However, this will occur at a significantly lower rate. Habitat quality for wildlife is expected to increase through the life of the project (Tables 1 and 3). The riverside berm will protect the Batchtown area from unseasonable water level fluctuations which limit vegetation production and resuspends sediments and may allow mast producing tree regeneration at higher elevations.

TABLE 2: FUTURE WITHOUT PROJECT (YEAR 50)

WHAG HSI's

Target Species	Nonforested Wetlands*	Forested Wetlands**	Cropland
Mallard	0.11	0.10	0.22
Divers	0.27	---	---
Wood Duck	---	0.49	---
Canada Goose	0.12	---	0.10
Nontarget Species			
Lesser Yellowlegs	0.36	---	---
King Rail	0.52	---	---
Green-backed Heron	0.74	0.46	---
Northern Parula	---	0.63	---
Prothonotary Warbler	---	0.23	---

AHAG HSI's

Target Species	DOC-B	FWS-M	FWS-L
Smallmouth Buffalo	0.44	0.44	0.45
Flathead Catfish	0.43	0.42	0.45
Nontarget Species			
Emerald Shiner	0.45	0.42	0.45
Largemouth Bass	0.40	0.42	0.39

*Average for sample sites 1N and 4N
**Average for sample sites 2B, 3B, and 6B

Cropland

The amount of cropland is not expected to change with the project as currently proposed. However, habitat quality will increase with the increased management capability (Tables 1 and 3). If reforestation measures are incorporated into project design, the amount of available cropland may decrease. However, this should not significantly adversely affect the species utilizing this habitat.

TABLE 3: FUTURE WITH PROJECT (YEAR 50)

WHAG HSI's

Target Species	Nonforested Wetlands*	Forested Wetlands**	Cropland
Mallard	0.51	0.31	0.73
Divers	0.51	---	---
Wood Duck	---	0.59	---
Canada Goose	0.48	---	0.48
Nontarget Species			
Lesser Yellowlegs	0.65	---	---
King Rail	0.57	---	---
Green-backed Heron	0.55	0.69	---
Parula Warbler	---	0.53	---
Prothonotary Warbler	---	0.63	---

AHAG HSI's

Target Species	DOC-B	FWS-M	FWS-L
Smallmouth Buffalo	0.77	0.75	0.73
Flathead Catfish	0.76	0.68	0.69
Nontarget Species			
Emerald Shiner	0.82	0.73	0.79
Largemouth Bass	0.71	0.69	0.63

*Average for sample sites 1N and 4N
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THREATENED AND ENDANGERED SPECIES

To facilitate compliance with Section 7(c) of the Endangered Species Act of 1973, as amended, Federal agencies are required to obtain from the Service information concerning any species, listed or proposed to be listed, which may be present in the area of a proposed action. Therefore, we are furnishing you the following list of species that have ranges that include the concerned area:

Classification	Common Name	Scientific Name	Habitat
Threatened	Bald eagle	*Haliaeetus leucocephalus*	Breeding and wintering along major rivers and reservoirs
Endangered	Indiana bat	*Myotis sodalis*	Caves, mines; well developed riparian woods; upland forests
Threatened	Decurrent false aster	*Boltonia decurrens*	Disturbed alluvial soils

There is no designated critical habitat in the project area at this time.

No bald eagle nests are known to occur in the project area. Bald eagles are known to utilize the area in the vicinity of Lock and Dam 25 for foraging and winter roosting. No winter roosts are known to occur in the project area. Most feeding and loafing is concentrated on the Missouri side of the Mississippi River, due to the presence of more suitable habitat.

The Indiana bat utilizes trees with rough or exfoliating bark to roost and to form maternity colonies. To avoid impacting this species, no tree clearing should occur between May 1 and August 31. The decurrent false aster is not known to occur in the project area. Therefore, if the tree clearing restriction for Indiana bats is adhered to, the Service would concur that the proposed activity, including the upland sediment control measures, is not likely to adversely the Indiana bat or any other known federally listed threatened or endangered species. This precludes the need for further action on this project as required under Section 7 of the Endangered Species Act of 1973, as amended. Should the project be modified or new information indicate endangered species may be affected, consultation should be initiated.

DISCUSSION

The proposed project is predicted to result in a net gain of 1,267 AAHU's for target wildlife species (Table 4) and 1,503 AAHU's for target fish species (Table 5). In addition, the project will provide significant habitat benefits for a variety of non-target species, as well. The loss of 144 AAHU's for the Northern parula (Table 4) is due to the reduction in the conversion of aquatic habitat to terrestrial habitat. Construction of the hillside sediment control features should also improve habitat conditions for upland species. Habitat conditions for freshwater mussels is not expected to improve. However, the decline of mussel habitat in the area is expected to be less than that expected without a project.

Sedimentation is considered by many as the most severe problem affecting fish and wildlife resources in the Mississippi River. Sediment deposition occurs due to overbank flooding and inputs from surrounding uplands. Aquatic vegetation production is inhibited by soft substrates and high turbidity. This aquatic vegetation forms the basis of the substrate needed for aquatic macroinvertebrate production. These invertebrates, as well as the vegetative parts of aquatic plants, provide an important food base for many species of migratory birds and riverine fish. The aquatic vegetation also provides important spawning and brood rearing habitat for fish.

In addition to the above, surface areas of sloughs, side channels and backwaters continue to decline, reverting to terrestrial habitat. Both upland and lowland sediment treatment measures are included as part of this project to address this problem. The construction of these measures and the riverside berm are expected to significantly decrease sedimentation rates in the Batchtown project area and improve the overall habitat quality of the area.

It is a challenge for the Corps and fish and wildlife managers to develop techniques to reduce sedimentation in backwaters and side channels before these important habitats are lost. Batchtown presents a unique opportunity for many agencies to work together to address this increasingly difficult problem.

TABLE 4: Projected habitat effects (in AAHU's) on wildlife species derived from all proposed management measures.

Species	Future With Project	Future Without Project	Net Change
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**Averaged target species for habitat category "Other"

CONCLUSIONS AND RECOMMENDATIONS

The project proposed represents a significant effort by various agencies to address the resource concerns at Batchtown. A number of project features are proposed to address the sedimentation and water-level fluctuation problems in the Batchtown area. It is difficult to visualize and measure how these features will work together to collectively achieve the project goals and objectives.

Given the unique nature of the habitat, hydrology and hydraulics in the Batchtown project area, we recommend a micro-model be developed during the Plans and Specifications phase of this project. Such a model would enable testing of the effectiveness of the project features, individually and collectively, prior to construction and help determine the best location for various features to obtain maximum fish and wildlife benefits.

Finally, the draft Definite Project Report (DPR) states that it is unlikely that a performance evaluation will be conducted on this project because construction of the project is not scheduled to be completed before the year 2001 and the EMP is only authorized through the year 2002. Given the complexity of this proposed project and the habitat within the project area, it is vital that a post-construction evaluation be conducted in order to determine if project objectives are achieved.

TABLE 5: Projected habitat effects (in AAHU's) on fish species derived from all proposed management measures.

Species	Future With Project	Future Without Project	Net Change
Target Species			
Smallmouth Buffalo	1,408	642	766
Flathead Catfish	1,362	625	737
Subtotal	2,770	1,267	1,503
Nontarget Species			
Emerald Shiner	1,474	651	823
Largemouth Bass	1,291	579	712
Subtotal	2,765	1,230	1,535
Total AAHU's	5,535	2,497	3,038

Thank you for the opportunity to provide this final report. We appreciate the efforts of your staff to include the upland and lowland sediment treatment measures in the project plans. According to the draft DPR, the hillside sediment control feature is expected to be funded as a part of the Batchtown HREP. Therefore, provided the results of the micro-model testing are favorable, the proposed project represents an appropriate use of federal funding to enhance fish and wildlife resources and the Service recommends planning for this project proceed to the Plans and Specifications phase.

Sincerely,

Joyce A Collins

Joyce A. Collins
Acting Assistant Field Supervisor

cc: IDNR (Hubbell, Glosser, Kruse, Booth, Atwood)
IESPB (Lauzon)
USFWS (Blankenship, Nelson, Steinbach, Adams, Drews, Surprenant)
USEPA (Orzehoskie)

APPENDIX H

FEDERALLY ENDANGERED SPECIES: BIOLOGICAL ASSESSMENT.

a. Introduction. This biological assessment evaluates the environmental effects of the habitat rehabilitation and enhancement at the Batchtown project area on Federally endangered and threatened species. In compliance with Section 7(c) of the Endangered Species Act of 1973, as amended, the St. Louis District requested that the U. S. Fish and Wildlife Service (USFWS) provide a listing of Federally threatened or endangered species, currently classified or proposed for classification, that may be found in the project area. The USFWS, in a letter dated October 3, 1991, and in the draft Fish and Wildlife Coordination Act Report dated February 2, 1995, provided the following list:

Common Name	Scientific Name	Classification	Habitat
Indiana bat	Myotis sodalis	Endangered	Caves, mines, well developed riparian woods; upland forests
Bald eagle	Haliaeetus leucocephalus	Threatened	Breeding and Wintering along major rivers and reservoirs
Decurrent false aster	Boltonia decurrens	Threatened	Disturbed alluvial soils

There is no designated critical habitat in the project area at this time. No eagle nests are known to occur in the vicinity of the project site.

a. Indiana Bat. In the central and southern portions of the eastern United States, Indiana bats (Myotis sodalis) hibernate during the winter in caves and mines (hibernacula) with cool and stable temperatures throughout the winter (Brady et al., 1983). Only seven hibernacula support about 85 percent of the entire known population (Brady et al., 1983). Two mines and 11 caves have been designated as critical winter habitat by the U.S. Fish and Wildlife Service. Although seven of these hibernacula occur in Missouri and Illinois, none of these are near the Batchtown project area. The most serious known cause of decline of the Indiana bat is human disturbance of hibernating bats (Clawson, 1987). Because there are no hibernacula in the project area, the proposed habitat rehabilitation work would not impact winter hibernating habitat of the Indiana bat.

In general, Indiana bats disperse from hibernacula in the spring and migrate to summer habitat in midwestern and eastern United States. They are entirely insectivorous. Clawson and Titus (1988) reviewed food habitat studies and determined that this bat preys upon insects from eight or more orders. These include (in order of preference): Lepidoptera (moths), Coleoptera (beetles), Diptera (flies and mosquitos), Trichoptera (caddis flies), Plecoptera (stone flies), Homoptera (aphids and scale insects), Neuroptera (lacewings), and Hymenoptera (bees, wasps, and ants). The bat's foraging strategy is apparently dependent upon prey availability - when preferred prey species are abundant, it will feed selectively, whereas the bat becomes opportunistic and feeds on a wider variety of prey items when the preferred ones are less abundant (Clawson and Titus, 1988).

In general, summer habitat requirements are not well known. Foraging habitat usually consists of the tree canopy of riparian and upland forest, but this bat may also feed along forest edges and over old fields and pastures (Clawson and Titus, 1988). During the warm months, female Indiana bats give birth to young. Brady et al. (1983) stated that maternity colonies are established mostly in riparian and flood plain areas of small to medium-sized streams. However, Gardner (1990) recently discovered a maternity roost on an island in the Mississippi River near Quincy, Illinois. Such colonies are formed in holes in trees, or more commonly under the loose bark of live or dead trees. Tree species known to be used for roosting in Illinois include silver maple, cottonwood, shingle oak, slippery elm, northern red oak, butternut hickory, sassafras, shagbark hickory, sugar maple, post oak, and white oak (Gardner, Hofmann, and Garner, 1988, 1989). Not every tree with cavities or loose bark provides the microclimate of a suitable roost; probably only a small portion of such trees possess the properties required to shelter maternity colonies from weather extremes (hot temperatures, early freezes, extended periods of rain, etc.) (Gardner, 1990). Recent studies of summer habitat use indicate that wooded uplands may be used more extensively for rearing of young than has been previously known (Clark, Bowles, and Clark, 1987; Clawson, 1987; Gardner, Hofmann, and Garner, 1989).

Studies of banded Indiana bats indicate they may return to the same summer locality in successive years. However, an individual tree may serve as a roost for only a relatively short time, perhaps 6 to 8 years. Thus, the bats seem to have the behavioral flexibility to move their homesite every few years, probably to nearby trees that permit them to use the same general foraging area (Humphrey, Richter, and Cope, 1977).

Essentially all of Illinois and Missouri are within the known and suspected range of the Indiana bat (Brady et al., 1983; Clawson and Titus, 1988). The species apparently has not been found in Calhoun County, where the project site is located, but has been encountered in Madison, Macoupin, Morgan, Scott, and Pike Counties (Gardner, Hofmann, and Garner, 1989), which range from about 15 to 55 miles away. Calhoun County undoubtedly supports suitable summer habitat, and the apparent absence of this species is most likely due to a lack of fieldwork to locate it. Indiana bats were captured by Gardner and Gardner (1980) along McKee Creek on the flood plain of the Illinois River in northern Pike County. This locality is about 50 miles north of the project site.

According to Gardner (1990), Indiana bats probably use the flood plain forests of the Illinois and Mississippi Rivers as summer habitat. However, since the project does not include major clearing impacts to any Indiana bats using the project area are expected to be minimal.

b. Bald Eagle. The bald eagle (Haliaeetus leucocephalus) is a common winter inhabitant of the major river systems of Illinois and Missouri. As winter arrives on the breeding grounds of northern Alaska and Canada, deep snows and sub-freezing temperatures cause waterways to become icebound. This reduces the availability of fish, the preferred food of the bald eagle. Eagles respond to this annual paucity of food by migrating south to milder climates and more accessible food resources. Eagles winter as far north as open water and food permit.

Havera, Crompton and Bellrose (1994) summarized the results of 13 years (1972-1984) of aerial censusing of wintering bald eagles for the Mississippi River from Rock Island to St. Louis. Aerial counts were conducted weekly from early October to mid-December, once in early to mid-January, and weekly from late February to mid-April. Eagles generally arrived during the period October 8 to 28. The average number of eagles observed weekly peaked in mid-December and stayed elevated through mid-February. The average weekly counts declined by late February. No eagles were observed after April 20.

According to Dunstan, Ives and Harper (1982), there are three types of impacts to wintering eagles: destruction or harm to the source of food on the wintering site, destruction of wintering habitat and disturbance of daily eagle behavior.

Food Source. Eagles feed primarily upon fish, but also eat waterfowl and other birds as well as carrion. Eagles concentrate around areas of open water to feed upon fish. Open water on rivers during the winter is often immediately below dams or in the channel at the confluence of tributaries or where navigation keeps the channel open. The project is not expected to impact food resources for eagles.

Habitat. Eagles use perch trees at night for roosting, and during the day for foraging, feeding and resting. Dunstan, Ives and Harper (1982) and Harper (1983) reported that trees used as foraging perch sites are 1) located along the shoreline usually near open water, and usually lean out toward the water or have limbs which jut out over the water, 2) are most often cottonwoods, and 3) are taller than adjacent trees. These authors stated that foraging perches may sometimes serve as feeding perches, but preferred feeding perches consist of silver maples with dense branches which are located away from the shoreline; the use of such trees apparently reduces the chances of food being pirated by other eagles. Eagles may rest at foraging perches during the day or use other trees located away from the shoreline.

Bald eagles are known to utilize the area in the vicinity of Lock and Dam 25 for foraging and winter roosting. No winter roosts are known to occur in the project area. Most feeding and loafing is concentrated on the Missouri side of the Mississippi River because the habitat there is more suitable. However, it is likely that eagles sporadically use some large trees along the riverside of the project area as perching sites during foraging activities. There should be only minor impacts to eagle activity in the project area since few trees will be disturbed and eagle use is light.

Eagle Disturbances. Although bald eagles concentrate in large numbers in the winter near human activities, most observations indicate that certain types of human activities within certain distances will cause bald eagles to leave an area. Stalmaster and Newman (1978) reported that high human activity, such as that occurring frequently in the sight of eagles, caused the birds to use less suitable habitat. They report that feeding behavior was the most sensitive activity observed. Activities directly on the channel of the river, such as boating and fishing, were most disturbing if the activities did not regularly occur there. Harper (1983) reported disruptions of daily activities of eagles at Lock and Dam 24 by hunters, fisherman in watercraft and aircraft. Eagles disturbed on a feeding ground usually fly to nearby perch sites and do not resume feeding for long periods (Stalmaster, 1976).

The proposed habitat enhancement work at Batchtown may occur in part during winter months when eagles are present. Any disturbance by the proposed work to eagles sporadically using the project area is expected to be short term.

c. Decurrent False Aster. The following information is taken from Keevin et al.(1990). The decurrent false aster (*Boltonia decurrens*), a perennial plant of the Aster family, is endemic to Illinois and Missouri. Its historical range includes a 400 km segment of the Illinois and Mississippi River floodplain extending from LaSalle, Illinois to the vicinity of St. Louis, Missouri. It is not known to occur at the project site. The species was found on the Mississippi River floodplain in St. Clair County, Illinois and in St. Charles County, Missouri, to the south and east of the project site. Its historical distribution also includes Lincoln County, Missouri, to the immediate north.

This tall, bushy plant usually grows to a height of 1.5 meters, but sometimes exceeds two meters. Aster-like flower heads about the size of a quarter-dollar are produced from August to October. The flower consists of yellow disks 7-14 mm wide, and white to pale violet rays about 1-1.8 cm long. The leaves, narrow and elongated, are about 5-15 cm long and about 5-20 cm wide. The leaves are decurrent - the base of each leaf extends downward along the stem to which it is attached. B. decurrens reproduces both vegetatively (asexually) by producing basil shoots, and sexually by producing seeds.

The decurrent false aster grows in open wetland habitats, and it appears to require abundant light. Historical collection data indicates that this species once inhabited the shores of lakes and the banks of streams. Although it grows in these habitats today, it is most common in disturbed lowland areas where it appears to be dependent on human activity for survival. The species' decline appears to be caused by habitat destruction and modification: drainage of natural lakes, wet prairies and marshes with conversion to cropland; alterations of natural flood regimes by man-made levee systems; and high rates of silt deposition upon floodplains. Other threats to its existence may include such agricultural practices as discing and the use of herbicides for weed control. However, almost all currently known populations are found in open habitats that are kept free of woody vegetation by occasional cropping. Prolonged flooding during the growing season is also believed to limit natural reproduction and survival.

The project will not affect the decurrent false aster.

d. Efforts to Eliminate Adverse Impacts on Species and Habitats.

(1) Bald Eagle. Eagles are expected to occasionally use the Batchtown area for feeding and resting during the winter. Their use of the area is so sporadic that construction activities, even during winter, will have little impact. Any impact would be of short duration, with more suitable habitat available for disbursement by the eagles. Consideration (in coordination with the USFWS) will be given during the preparation of Plans and Specifications to sequencing construction activities in a manner that minimizes impacts to eagles. Specific restrictions relative to any sequencing will be included as part of the contract specifications. The contracting officer will ensure appropriate compliance.

(2) Indiana Bat. Although this species' summer habitat requirements are not well known, the riparian habitat and flood plain forest within the Batchtown project site may provide foraging and roosting habitat. However, since there will be a minimum of tree clearing activity impacts to Indiana bats should be minimal. Special conditions on the contracted work will require that tree clearing activities be scheduled outside the period May 1 - August 31 when Indiana bats are known to inhabit summer habitat. If for any reason tree clearing activities have to be carried out during the period May 1 - August 31, a site visit will be conducted first by a team of biologists to determine if any roost trees are among those proposed to be removed. If none are found, tree clearing activities could resume. If removal of a roost tree is proposed during the period May 1 - August 31, then the District must enter into section 7 consultation with the U. S. Fish and Wildlife Service to determine if the proposed action is likely to jeopardize the continued existence of the Indiana bat.

e. Conclusions. It is the St. Louis District's perspective that the habitat enhancement of Batchtown site would have no effect on Federally threatened or endangered species or their critical habitat. The USFWS will be given an opportunity to review the Draft Definite Project Report and comment on this Biological Assessment.

f. Literature Cited.

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Appendix I - Farmland Protection Policy Act Documentation

State of Illinois
DEPARTMENT OF AGRICULTURE
State Fairgrounds / P.O. Box 19281 / Springfield 62794-9281 TDD: 217/524-6858

Bureau of Environmental Programs 217/785-2427 · Bureau of Farmland Protection 217/782-6297 · Bureau of Soil and Water Conservation 217/782-6297

Copy to PD-F
Orig to PD-A

December 12, 1994

Mr. Owen Dutt
Chief, Planning Division
St. Louis District, Corps of Engineers
1222 Spruce Street
St. Louis, Missouri 63103-2833

Re: Batchtown Habitat Rehabilitation and
Enhancement Project
Calhoun County, Illinois

Dear Mr. Dutt:

The Illinois Department of Agriculture has examined the proposal for its potential impact to agricultural land as well as its compliance with Illinois' Farmland Preservation Act. Accordingly, we submit the following comments.

The 3,327 acre project area is located on the floodplain of the Mississippi River and encompasses various terrestrial and aquatic habitats, including Turner Island. Cropland accounts for 224 acres and bottomland forest has 989 acres; non-forested wetland has 1,165 herbaceous acres and 936 acres of open water.

The Batchtown area was a prime site for migrating waterfowl about 40 years ago and has served as backwater habitat for a variety of aquatic species. Over the past 50 years, wetland and backwater habitats have been degraded by siltation. The proposed project would limit additional sediment deposition and allow for control of interior water levels by constructing low levees, stop-log and gravity structures, and pumping structures.

The proposed improvements lie entirely within the boundaries of the Batchtown Waterfowl Management Area. No additional property will be acquired in order to complete the habitat rehabilitation project. While some cropland may be used to further fortify or construct new levees within its interior, these actions will more adequately protect the cropland which is used for wildlife habitat.

Because the area has been utilized as a waterfowl management area for more than four decades, we do not object to the proposal's implementation and have found the project to be in compliance with Illinois' Farmland Preservation Act.

Sincerely,

Teresa J. Savko

Teresa J. Savko
Bureau of Farmland Protection

TJS:mdg

Enclosure

U.S. Department of Agriculture

NOV 21 1994

FARMLAND CONVERSION IMPACT RATING

PART I (To be completed by Federal Agency)	Date Of Land Evaluation Request: 8 November 1994
Name Of Project: Batchtown Habitat Enhancement & Rehabilitation	Federal Agency Involved: U.S. Army Corps of Engineers, St. Louis
Proposed Land Use: Existing & Proposed: wildlife mgmt. (incl. crops)	County And State: Calhoun, Illinois
PART II (To be completed by SCS)	Date Request Received By SCS: 11-21-94

Does the site contain prime, unique, statewide or local important farmland? (If no, the FPPA does not apply — do not complete additional parts of this form).	Yes ☒	No ☐	Acres Irrigated: —	Average Farm Size: 321
Major Crop(s): Corn, Soybeans, Wheat, Hay	Farmable Land In Govt. Jurisdiction Acres: 29,633,500 % 97		Amount Of Farmland As Defined in FPPA Acres: 27,695,900 % 91	
Name Of Land Evaluation System Used: Illinois	Name Of Local Site Assessment System: Statewide		Date Land Evaluation Returned By SCS: 11-29-94	

PART III (To be completed by Federal Agency)	Maximum Points	Site A	Site B	Site C	Site D
		Alternative Site Rating			
A. Total Acres To Be Converted Directly		43			
B. Total Acres To Be Converted Indirectly		0			
C. Total Acres In Site		91			
PART IV (To be completed by SCS) Land Evaluation Information					
A. Total Acres Prime And Unique Farmland		32			
B. Total Acres Statewide And Local Important Farmland		3			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted		0.00012			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value		18			
PART V (To be completed by SCS) Land Evaluation Criterion Relative Value Of Farmland To Be Converted (Scale of 0 to 100 Points)		63			
PART VI (To be completed by Federal Agency) Site Assessment Criteria (These criteria are explained in 7 CFR 658.5(b)	Maximum Points				
1. Area In Nonurban Use					
2. Perimeter In Nonurban Use					
3. Percent Of Site Being Farmed					
4. Protection Provided By State And Local Government					
5. Distance From Urban Builtup Area	(See attached Illinois Site Assessment Factors)				
6. Distance To Urban Support Services					
7. Size Of Present Farm Unit Compared To Average					
8. Creation Of Nonfarmable Farmland					
9. Availability Of Farm Support Services					
10. On-Farm Investments					
11. Effects Of Conversion On Farm Support Services					
12. Compatibility With Existing Agricultural Use					
TOTAL SITE ASSESSMENT POINTS	*200 ~~160~~	109			
PART VII (To be completed by Federal Agency)					
Relative Value Of Farmland (From Part V)	100	63			
Total Site Assessment (From Part VI above or a local site assessment)	*200 ~~160~~	109			
TOTAL POINTS (Total of above 2 lines)	*300 ~~260~~	172			

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No X State Site Assessment System

Reason For Selection:

* When utilizing the state Site Assessment factors, 200 points are assigned to the Site Assessment section of the LESA system for a maximum score of 300 points.

(See Instructions on reverse side)

Form AD-1006 (10-83)

Batchtown Habitat Enhancement and Rehabilitation
Calhoun County, Illinois
U.S. Army Corps of Engineers

PART VI-A Illinois Site Assessment Criteria	**Maximum Point**	**Site A**
1. Land Use on the Site	20	15
2. Adjacent Land Use	20	8
3. General Character of Area Within 1½ Miles of Site	20	10
4. Distance to City	20	16
5. Zoned Use of Proposed Site	20	20
6. Zoned Use of Land Adjacent to Proposed Site	20	20
7. Planned Land Use of Proposed Site	20	0
8. Compatibility of Proposed Use with Surrounding Land Uses	20	0
9. Alternative Sites Proposed on Less Productive Land	10	10
10. Availability of Central Water System	10	0
11. Availability of Central Waste Disposal System (Sewer)	10	0
12. Transportation	10	10
TOTAL SITE ASSESSMENT POINTS	**200**	**109**

PART VII		
Relative Value of Farmland	100	63
Total Site Assessment	200	109
TOTAL ILLINOIS LESA POINTS	**300**	**172**

120794
TJS:mdg

Appendix J - Letters of Intent (LOI) and Agreements

J-1 LOI from USFWS to sign MOA between the U.S. Army Corps of Engineers and USFWS.

J-2 MOA between the U.S. Army Corps of Engineers and USFWS. This MOA established the relationships, arrangements, and general procedures under which the USFWS and the Corps will operate in constructing, operating, maintaining, repairing, and rehabilitating the Project.

J-3 LOI from NRCS to sign a Hillside Sediment Control Measure MOA between the U.S. Army Corps of Engineers and the NRCS.

J-4 Hillside Sediment Control Measure MOA between the U.S. Army Corps of Engineers and the NRCS.

United States Department of the Interior

Fish and Wildlife Service
Mark Twain National Wildlife Refuge
1704 N. 24th Street
Quincy, Illinois 62301

July 25, 1996

Mr. Dave Kirkpatrick
CELMS-PD-F
U.S. Army Corps of Engineers
St. Louis District
1222 Spruce Street
St. Louis, Missouri 63103-2833

Dear Mr. Kirkpatrick:

This letter is to advise you that I have reviewed the Draft Memorandum of Agreement between the the U.S. Fish and Wildlife Service and the Department of the Army for the construction, operation, maintenance, and rehabilitation of the Batchtown Habitat Rehabilitation and Enhancement Project.

The draft document appears to be complete and sound. I will recommend to Regional Director Hartwig that he sign the document as written.

Sincerely,

Ross Adams

Ross Adams
EMP Coordinator

cc: Dick Steinbach
John Dobrovolny
K. L. Drews

J-1

DRAFT
MEMORANDUM OF AGREEMENT
BETWEEN
THE UNITED STATES FISH AND WILDLIFE SERVICE
AND
THE DEPARTMENT OF THE ARMY
FOR THE
CONSTRUCTION, OPERATION, MAINTENANCE, AND REHABILITATION
OF THE
BATCHTOWN HABITAT REHABILITATION AND ENHANCEMENT PROJECT

I. PURPOSE.

The purpose of this memorandum of agreement (MOA) is to establish the relationships, arrangements, and general procedures under which the U.S. Fish and Wildlife Service (USFWS), the Illinois Department of Natural Resources (IDNR), and the Department of the Army (DOA) will construct, operate, maintain, repair, and rehabilitate the Batchtown Habitat Rehabilitation and Enhancement Project (HREP), a part of the Upper Mississippi River System-Environmental Management Program (UMRS-EMP). This MOA is a component of, and is contained in an appendix of the Batchtown HREP Definite Project Report.

II. BACKGROUND.

A. The project lands of the Batchtown HREP area are managed under a General Plan, dated March 1961, that was approved jointly by the Assistant Secretary of the Army, the Secretary of the Interior, and the Illinois Department of Conservation; and as prescribed in a Cooperative Agreement, dated February 1963, between the Department of the Army and the Department of the Interior.

B. Section 1103 of the Water Resources Development Act of 1986, Public Law 99-662, authorizes construction of measures for the purpose of enhancing fish and wildlife resources in the Upper Mississippi River System. Under conditions of Section 906(e) of the Water Resources Development Act of 1986, Public Law 99-662, all construction costs of those fish and wildlife features for the Batchtown HREP are 100 percent Federal, and pursuant to Section 107(b) of the Water Resources Development Act of 1992, Public Law 102-580, all costs of operation, maintenance, and rehabilitation for the Batchtown HREP are 100 percent to be borne by the local sponsors: the USFWS and IDNR.

III. GENERAL SCOPE.

The project to be accomplished pursuant to this MOA is described in detail in the Definite Project Report, and in brief consists of:

1. A riverside berm on the IDNR-managed area to reduce sediment input to the site, and to stabilize interior water levels to facilitate ecosystem management.

2. Selective deepwater dredging to enhance fish passage and overwintering, and to facilitate water flow and boat passage through the interior lakes and backwaters.

3. Exterior and interior stop-log structures for regulating interior water levels independent of river stages, and for allowing fish and boat passage.

4. Minimal placement of fill to create an interior berm to enhance the independent management of the USFWS Lower Pool management unit.

5. Replacement of the existing pump at the USFWS Middle Pool, provide for a portable pump for the USFWS Lower Pool, and construct a new pump station for IDNR-managed area for water control and ecosystem management.

6. Construction of a water control structure through the L&D No. 25 overflow structure to aide in water level management, to reduce pumping costs, and to maintain water flow through the IDNR-managed area.

7. Bottomland forest habitat improvements.

8. Implementation of a hillside sediment control program in conjunction with the Natural Resources Conservation Service to reduce sediment input into the project area.

IV. RESPONSIBILITIES.

A. DOA is responsible for:

1. All planning, engineering and design prior to and during construction.

2. Construction. Construction of the project which consists of constructing the aforementioned project features.

3. Major Rehabilitation. The Federal share of any mutually agreed upon rehabilitation of the project that exceeds the annual operation and maintenance requirements identified in the definite project report and that is needed as a result of specific storm or flood events.

4. Construction Management. Subject to and using funds appropriated by the Congress of the United States, [and in accordance with Section 906(e) of the Water Resources Development Act of 1986, Public Law 99-662,] DOA will construct the Batchtown HREP as described in the Definite Project Report dated July 1996, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The USFWS and IDNR will be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. If DOA encounters potential delays related to construction of the project, DOA will promptly notify USFWS and IDNR of such delays.

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

B. USFWS Responsibilities: Upon completion of construction as determined by the District Engineer, St. Louis, subject to and using funds appropriated by Congress of the United States the USFWS shall accept 100 percent of all costs associated with the operation, maintenance, and rehabilitation of the features and measures of the Batchtown HREP that are on the lands that they presently manage.

C. IDNR Responsibilities: Upon completion of construction as determined by the District Engineer, St. Louis, the Illinois Department of Natural Resources shall accept 100 percent of all costs associated with the operation, maintenance, and rehabilitation of the features and measures of the Batchtown HREP that are on the lands that they presently manage.

IV. MODIFICATION AND TERMINATION.

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

VI. REPRESENTATIVES.

The following individuals or their designated representatives shall have authority to act under this MOA for their respective parties. This MOA shall become effective when signed by the appropriate representatives of all parties.

USFWS: WILLIAM F. HARTWIG

_________________________ (signature) __________ Date

Regional Director
U.S. Fish and Wildlife Service
Federal Building, Fort Snelling
Twin Cities, MN 55111

DOA: THOMAS J. HODGINI

_________________________ (signature) __________ Date

District Engineer
U.S. Army Engineer District, St. Louis
1222 Spruce Street
St. Louis, MO 63103-2833

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

1902 Fox Drive
Champaign, IL 61820

DE
DR
Dutt

March 5, 1996

Colonel Thomas C. Suermann
District Engineer
USAED, St. Louis
1222 Spruce Street
St. Louis, MO 63103

Dear Colonel Suermann:

We are pleased to learn that the Draft Definite Project Report (DPR) for the Batchtown, Illinois Habitat Rehabilitation and Enhancement Project is almost completed. I understand that the DPR soon will be forwarded to your higher headquarters for review and approval, and that the DPR will include a recommendation to implement hillside sedimentation control measures similar to the measures which have been implemented for the Swan Lake Habitat Rehabilitation and Enhancement Project.

The purpose of this letter is to let you know that we have reviewed the preliminary draft Batchtown Memorandum of Agreement (MOA) which covers the implementation of the Project's hillside sedimentation control measures and that we concur with all of its provisions. We intend to enter into the MOA with you as soon as it is prepared in final form. As you know, the draft Batchtown MOA is similar to the one we entered into with you on September 13, 1995 in order to implement the hillside sedimentation control measures for Swan Lake. The Swan Lake Project is proceeding extremely well and we look forward to working with you on the Batchtown Project in a similar manner.

Please let me know if you have any questions regarding this matter, or if there is anything else we can do to help you.

Sincerely,

Thomas W. Christensen

THOMAS W. CHRISTENSEN
State Conservationist

cc:
Bill Lewis, Planning Team Leader, NRCS, Champaign, IL
Gary Parker, ASTC (MS&P), NRCS, Champaign, IL
Steve Mozley, ASTC (FOD #2), NRCS, Springfield, IL
Martha Sheppard, DC, NRCS, Hardin

GNP:sr:Suermann.dcx

PRELIMINARY DRAFT
02/23/96

MEMORANDUM OF AGREEMENT
BETWEEN
THE UNITED STATES DEPARTMENT OF THE ARMY
AND
THE UNITED STATES DEPARTMENT OF AGRICULTURE,
NATURAL RESOURCES CONSERVATION SERVICE
FOR
IMPLEMENTATION
OF THE
HILLSIDE SEDIMENT CONTROL MEASURES
FOR THE
BATCHTOWN HABITAT REHABILITATION
AND
ENHANCEMENT PROJECT, ILLINOIS

WHEREAS, the Batchtown Habitat Rehabilitation and Enhancement Project, Illinois at Pool 26, Illinois River, Calhoun County, Illinois (hereinafter referred to as the "Authorized Project"), was authorized under the provisions of the Upper Mississippi River Management Act of 1986 (Section 1103, Public Law 99-662), as amended;

WHEREAS, the United States Department of the Army acting by and through the Commander, U.S. Army Engineer Division, Lower Mississippi Valley, (hereinafter referred to as the "Department") intends to provide funds, pursuant to the terms of this Memorandum of Agreement, to the United States Department of Agriculture, Natural Resources Conservation Service (hereinafter referred to as the "NRCS") for implementing the Hillside Sedimentation Control Measures of the Authorized Project (hereinafter referred to as "HSCM" and defined in paragraph 1.a. herein);

WHEREAS, Section 906 and Section 1103 of Public Law 99-662, as amended, specify the cost sharing requirements applicable to the Authorized Project and provides that the non-Federal share of the HSCM costs, as defined in paragraph 1.d. of this Memorandum of Agreement, shall be 25 percent, with the remaining 75 percent of such costs to be borne by the Department; and,

WHEREAS, the Economy Act, 31 U.S.C. 1535, provides the authority for agencies of the Federal Government to reimburse other agencies of the Federal Government for services.

NOW THEREFORE, the parties hereto agree as follows:

1. For purposes of this Memorandum of Agreement:

a. The term "HSCM" shall mean conservation measures that reduce the runoff of sediments from hillside areas in the Batchtown Project area. Such measures are identified in Appendix O (Hillside Sediment Control Plan) as described in the "Upper Mississippi River System, Environmental Management Program Definite Project Report (DPR) with Integrated Environmental Assessment: Batchtown Rehabilitation and Enhancement Project, Pool 25, Mississippi River, Calhoun County, Illinois" prepared by the United States Army Engineer District, St. Louis dated **[DATE]**.

b. The term "LTA" shall mean a binding multi-year agreement between the NRCS and a willing and eligible individual non-Federal participant for implementation of HCSM's in accordance with the NRCS's National Conservation Planning Handbook, NRCS's National Manual for Assisting Cost-Share Programs, and supplemental guidance provided by the NRCS's State Conservationist.

c. The term "operating agreement" shall mean a binding agreement between the NRCS and any soil and water conservation district created under the laws of the State of Illinois that provides for technical assistance and design services related to the implementation of the HSCM's.

d. The terms "HSCM costs" and "cost of HSCM's" shall mean all costs directly related to the implementation of HSCM's, whether incurred by the Department, by the NRCS, or by non-Federal interests under the terms of LTA's or operating agreements. Such costs shall include actual in-house costs of the Department and the NRCS (including, but not limited to, engineering, design, technical assistance, supervision, and administration); the actual costs to the Department and the NRCS of contracts and contract dispute settlements or awards; and the value, as determined by the NRCS, of work performed by non-Federal interests under LTA's and operating agreements (including, but not limited to, engineering, design, technical assistance, and the provision of labor, equipment and equipment rental, materials, and other services for HSCM implementation).

e. The term "fiscal year" shall mean one fiscal year of the United States Government, unless otherwise specifically indicated. The Government fiscal year begins on October 1 and ends on September 30.

2. Using funds made available by the Department, the Department and the NRCS shall provide for the implementation of the HSCM's, as follows:

a. Not later than 30 days after the effective date of this Memorandum of Agreement, the NRCS and the Department shall develop a joint estimate of all HSCM costs for the first fiscal year of HSCM implementation, including such costs incurred prior to execution of this Memorandum of Agreement. For the second and subsequent fiscal years of HSCM implementation, the Department and the NRCS shall, prior to the beginning of the fiscal year, develop a joint estimate of all HSCM costs for that fiscal year. As further specified in paragraphs 3. and 4. of this Memorandum of Agreement, in response to requests from the NRCS, the Department shall, subject to the availability of appropriations for that purpose, obligate funds for each fiscal year to the NRCS in an amount equal to the Federal share of the joint estimate for that fiscal year, less the estimated in-house HSCM costs of the Department for that fiscal year. Thereafter, the NRCS shall obligate from those funds such funds as are necessary for the implementation of HCSM's under LTA's with non-Federal participants. Upon a showing by the NRCS that funds are required for payments to non-Federal participants for the Federal share of HSCM costs incurred by non-Federal participants for HSCM's satisfactorily completed under LTA's, and for other HSCM costs incurred by the NRCS, the Department shall pay the required amount to the NRCS. The NRCS shall reimburse non-Federal entities for the Federal share of HSCM costs incurred by the non-Federal entities, as provided in the LTA's and the operating agreements.

b. The NRCS shall ensure that the implementation of the HSCM's will be accomplished in accordance with the cost sharing provisions of Section 1103 and Section 906 of Public Law 99-662. In this regard, the non-Federal share of HSCM costs shall be 25 percent. The remaining 75 percent of the HSCM costs shall be borne by the Department.

3. The NRCS shall:

a. Establish and apply criteria, according to NRCS procedures, for determining the eligibility of non-Federal participants to implement HSCM's, for selecting the HSCM's to be implemented, and for determining the allowability and value of work performed by non-Federal interests under the terms of LTA's and operating agreements.

b. Select HSCM's to be implemented by non-Federal participants and enter into LTA's with non-Federal participants to implement those HSCM's.

c. Furnish, and enter into operating agreements that provide for furnishing such design and technical assistance as is necessary for implementation of HSCM's.

d. Prior to the performance of work by a non-Federal participant under an LTA, determine the value of that work.

e. As soon as practicable after execution of this Memorandum of Agreement, and not later than October 1 of each fiscal year thereafter, submit to the Department a Form SF-270, Request for Advance or Reimbursement in an amount equal to the Federal share of the joint estimate of HSCM costs for that fiscal year, less the estimated in-house HSCM costs of the Department for that fiscal year.

f. Upon approval of the SF-270 by the Department, obligate such funds as are necessary for payment of the Federal share of HSCM costs incurred by non-Federal entities in accordance with the terms of the LTA's and the operating agreements.

g. Inspect HSCM'S performed by non-Federal participants under the LTA's to verify satisfactory completion of the HSCM's.

h. Using Form SF-1080, submit to the Department monthly statements showing that funds are required for payments to non-Federal participants for the Federal share of the costs of HSCM's satisfactorily completed under the LTA's in the preceding month, and for other HSCM costs incurred by the NRCS.

i. Reimburse non-Federal entities for the Federal share, as provided in the LTA's and the operational agreements, of the costs of the HSCM's satisfactorily completed and technical and design services satisfactorily provided.

j. Notify the Department of the amount of additional funds necessary to complete the work planned for that fiscal year if the NRCS forecasts actual costs for a fiscal year to exceed the amount of funds obligated under the SF-270 for that fiscal year. The Department shall either obligate the additional funds, or require that the remaining work be limited to that which can be paid for with the already obligated funds, or direct the suspension of work for that fiscal year.

k. Not later than 90 days after each fiscal year in which HSCM costs are funded under this Memorandum of Agreement, submit to the Department a final detailed accounting of HSCM costs for the fiscal year.

l. Maintain adequate records of HSCM costs sufficient to enable the Department to audit such records for the purpose of ascertaining compliance with paragraph 2.b. of this Memorandum of Agreement.

m. Inform the Department of all LTA's, operating agreements, and any contracts entered into under this Memorandum of Agreement.

n. Be responsible for government-furnished equipment, for administration and audit of any contracts entered into under this Memorandum of Agreement, and for rights to any data, software and intellectual property developed under this Memorandum of Agreement.

4. The Department shall:

a. As soon as practicable after the execution of this Memorandum of Agreement, and not later than October 1 of each fiscal year thereafter, subject to the availability of funds appropriated for that purpose, obligate funds to the NRCS, by means of an SF-270 approved by the Department, in an amount equal to the Federal share of the joint estimate of HSCM costs for that fiscal year, less the in-house costs of the Department for that fiscal year.

b. Subject to the approval by the Department of any Form SF-1080 submitted by the NRCS, pay to the NRCS within 30 calendar days of the Department's approval of the SF-1080, an amount equal to the funds required for payments to non-Federal participants for the Federal share of the costs of the HSCM's satisfactorily completed under the LTA's, and for other HSCM costs incurred by the NRCS.

c. Conduct such audits of the NRCS's records as are necessary to assure compliance with paragraph 2.b. of this Memorandum of Agreement.

5. Notwithstanding any other provision of this Memorandum of Agreement, no activities covered under the terms of this Memorandum of Agreement shall occur which obligate or expend Federal funds after **[DATE]**. In addition, if the execution of any LTA, or the component of funds for a HSCM under any LTA, would result in HSCM costs exceeding **[DOLLAR AMOUNT]**, such execution or commitment, and subsequent executions or commitments, shall be deferred until such time as both parties to this Memorandum of Agreement agree to resume the implementation of HSCM's.

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

If to the Department:

Commander
U.S. Army Engineer District, St. Louis
1222 Spruce Street
St. Louis, Missouri 63103

If to the NRCS:

State Conservationist
U.S. Dept. of Agriculture, Natural Resources Conservation Service
1902 Fox Drive
Champaign, Illinois 61820

7. No member of or delegate to Congress or Resident Commissioner shall be admitted to any share or part of this Memorandum of Agreement or to any benefit that may arise therefrom.

8. This Memorandum of Agreement shall be in effect from the date this Memorandum of Agreement is signed by the Commander, U.S. Army Engineer District, St. Louis, through and including, **[DATE]** unless otherwise modified or extended in writing by the parties thereto. Either party to this Memorandum of Agreement may elect without penalty to terminate this Memorandum of Agreement pursuant to this paragraph, or to defer future performance hereunder, by providing written notice to the other party; however, neither termination nor deferral of future performance under this Memorandum of Agreement shall affect existing obligations or relieve the parties of liability for any obligation previously incurred. Such termination or deferral shall be effective upon the sixtieth calendar day following such notice, unless a later date is set forth in the notice. In the event that either party elects to terminate this Memorandum of Agreement pursuant to this paragraph, both parties shall conclude their activities relating to HSCM's and proceed to a final accounting in accordance with paragraph 3.j. of this Memorandum of Agreement. In the event either party elects to defer future performance under this Memorandum of Agreement pursuant to this paragraph, such deferral shall remain in effect until such time as both parties agree in writing to resume performance under this Memorandum of Agreement or until either party elects to terminate this Memorandum of Agreement.

9. Activities under this Memorandum of Agreement shall be conducted in compliance with the nondiscrimination provisions as contained in Titles VI and VII of the Civil Rights Act of 1964, as amended, the Civil Rights Restoration Act of 1987 (Public Law 100-259) and other nondiscrimination statutes, including Section 504 of the Rehabilitation Act of 1973, Title IX of the Education Amendments of 1972, the Age Discrimination Act of 1975, and in accordance with regulations of the Secretary of Agriculture (7 CFR 15, Subparts A and B) which provide that no person in the United States shall, on the grounds of race, color, national origin, age, sex, religion, marital status, or handicap be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or

activity receiving Federal financial assistance from the Department of Agriculture or any agency thereof.

10. The NRCS shall hold and save the Department free from all damages arising from the implementation of the HSCM's, except for damages due to the fault or negligence of the Department or the Department's contractors.

IN WITNESS WHEREOF, the parties have executed this Memorandum of Agreement which shall become effective upon the date it is signed by the Commander, U.S. Army Engineer District, St. Louis.

THE UNITED STATES DEPARTMENT OF THE ARMY	**THE UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICE**
BY: ______________________	**BY:** ______________________
Thomas C. Suermann **Col., U.S. Army** **Commander**	**Thomas W. Christensen** **State Conservationist**
DATE: ______________________	**DATE:** ______________________

Appendix K - Project Fact Sheets

K-1	9 May 1988 Fact Sheet from the Sixth Annual Addendum, May 1991, Upper Mississippi River System Environmental Management Program
K-2 to K-4	Mississippi River Area, Illinois Department of Natural Resources
K-5 to K-6	Batchtown Division, Mark Twain National Wildlife Refuge - Illinois

CELMS-PD-F

9 May 1988

Upper Mississippi River System Environmental Management Program
Fact Sheet
BATCHTOWN WATERFOWL MANAGEMENT AREA
Pool 25, Mississippi River, Illinois

LOCATION: The Batchtown Waterfowl Management Area consists of about 2,069 acres and is located along the left (Illinois) bank of Pool 25 between approximate rivermiles 242.5 and 246.

RESOURCE PROBLEM: The Batchtown area was once a prime site for migrating aterfowl, with over one million ducks recorded as visiting the site in the fall of 1953. Since that time, the degradation of the habitrat due to silation has caused a profound decline in the numbers of migratory waterfowl that use the area.

PROPOSED PROJECT: The proposed project would limit additional sediment deposition and allow for control of interior water levels by constructing a series of low level levees and by providing gravity drainage and pumping facilities.

PROJECT OUTPUTS: Analyses of data recoridng waterfowl usage over the yers indicate that two factors are controlling: Suitable interior water levels and the availability of food. by restricting sediment deposition and providng the means by which interior water levels could be varied for wildlife foodd production, the negative habitat impacts can be reversed to approach the former conditions.

FINANCIAL DATA: Costs for general design are estimated at $315,000, and construction costs are estimated at $2,350,000. Annual OMRR costs are estimated at $8,000. The project area is included in certain lands acquired for the navigation project that were identified in a Teneral Plan and made available to the States, through Cooperative Agreements between the Corps of Engineers and the Department of Interior (DOI), and between the DOI and each State. These lands were made available "for use in the conservation and management of wildlife resources thereof, and its habitat thereon, in connection with the national migratory bird program" The cooperative Agreements stipulate that the areas shall be maintained "in accordance with an annual management program ... submitted to the Service." Under Section 906(e) of the 1986 Water Resources Development Act, the project area is "managed as a national wildlife refuge" and qualifies for 100 percent Federal funding of general design and construction. Costs for OM&R would be shared 75 percent Federal/25 percent non-Federal. The non-Federal sponsor would be the Illinois Department of Conservation.

Fishing

Anglers are welcome, but certain areas are restricted during waterfowl season. These areas are clearly posted each year.

Boating

Boating along the Mississippi and Illinois rivers provides many opportunities for relaxing, sunning, enjoying the scenic shoreline and bluffs, bird-watching and viewing the majesty of these great river systems. Smaller boats and canoes might better appreciate the shelter and quiet beauty that can be found in the backwater lakes.

Nearly 40 miles of the mighty Mississippi River are available via the Piasa Creek Access Area and Royal Landing; and the Glades, Godar Diamond, Hadley Landing and Michael Landing provide access along 35 miles of the Ilinois River. All of these areas are contained in Navigation Pool 26.

Above Winfield Dam (Lock and Dam 25), Cockrell Hollow, Red's Landing and Riprap Landing provide access to 33 miles of Navigation Pool 25.

Picnicking

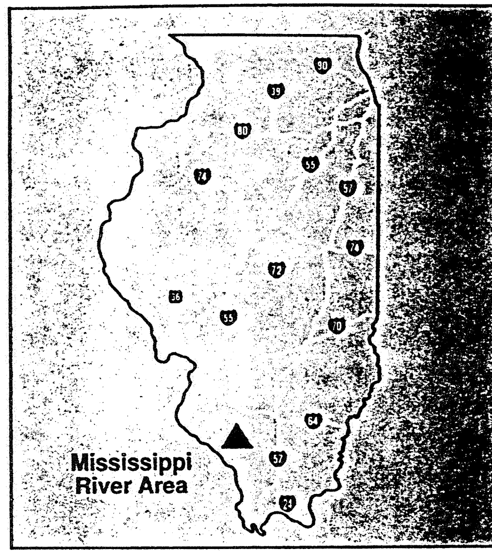
In keeping with the pristine beauty of the area, primitive picnic areas are available.

Camping

Camping is strictly prohibited in the entire MRA, but is available at Pere Marquette State Park, just north of Grafton on the Great River Road.

For more information, contact Mississippi River Area site superintendent, R.R. 1, Box 182, Grafton, IL 62037, phone (618) 376-3303.

K-2



Mississippi River Area
R.R.1, Box 182, Grafton, IL 62037, 618-376-3303

- While groups of 25 or more are welcome and encouraged to use the park's facilities, they are required to register in advance with the site office to avoid crowding or scheduling conflicts.
- At least one responsible adult must accompany each group of 15 minors.
- Pets must be kept on leashes at all times.
- Actions by nature can result in closed roads and other facilities. Please call ahead to the park office before you make your trip.
- Alcohol restrictions apply at certain state sites. Contact site for specific information.
- We hope you enjoy your stay. Remember, take only memories, leave only footprints.
- For more information on state parks write to the Illinois Department of Conservation, Office of Public Information, 524 S. Second St., Springfield, Ill., 62701-1787, or call (217) 782-7454.
- For more information on tourism in Illinois, call the Illinois Department of Commerce and Community Affairs, Bureau of Tourism at 1-800-ABE-0121.

Illinois Department of Conservation

Jim Edgar
Governor
Brent Manning
Director, Dept. of Conservation

Illinois
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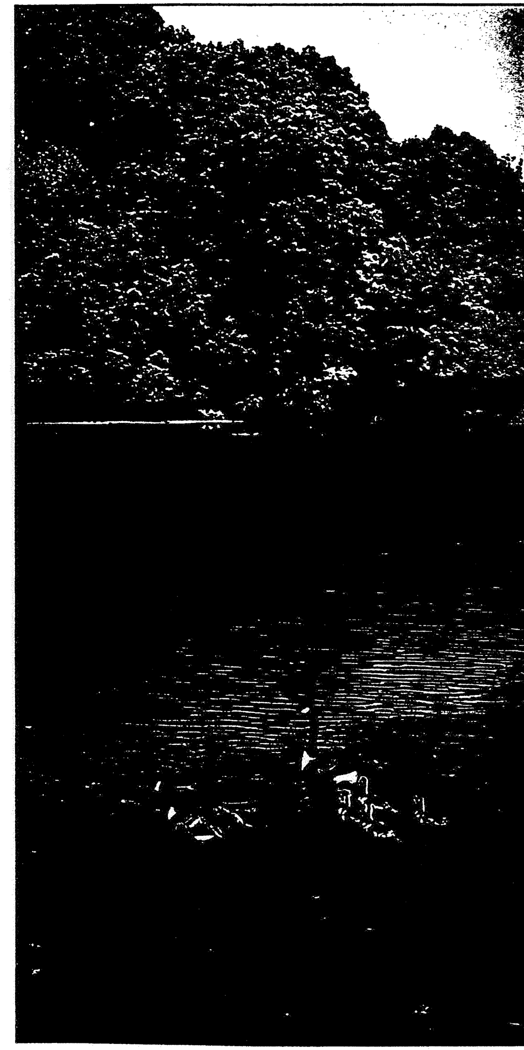
Mississippi
R I V E R A R E A

ILLINOIS DEPARTMENT OF CONSERVATION



open spaces... family places

Mississippi River Area

Imagine an area that includes 15 wildlife management areas and 13 public access areas, spanning more than 24,000 acres, and scattered along 75 miles of two major rivers. Add to this awe-inspiring bluffs that tower over the river valley, providing breathtaking views, and you begin to get some idea of what awaits you at the Mississippi River Fish and Wildlife Area (MRA).

As its name implies, the area lies within Mississippi River Navigation Pools 25 and 26, and includes portions of both the Illinois and Mississippi Rivers. The total project area consists of 24,386 acres of General Plan Lands. Of this total, 16,875 acres are actively managed for wetland habitat enhancement and public recreation.

The Mississippi River Area's main emphasis is wetland management, with waterfowl as the primary species of concern. Hunters, fishermen, boaters and birdwatchers can enjoy the beauty of the area, yet there is ample opportunity for access to civilization just a few miles away.

A drive along the scenic Great River Road leads through Grafton, past Elsah, a quaint 19th century village, and on to Alton, with many antique stores and other accomodations. A ride on the Brussels Ferry takes you across the Illinois River and into Calhoun County where apple orchards and roadside markets await. There is truly something for every type of visitor to the area.

History

The Mississippi River Area has a rich history. Evidence of millions of years of geological change can be seen throughout, including four to five thousand feet of sedimentary rock. The bluffs between Alton and Grafton are only a tiny fraction of the thousands of feet of rock extending below the surface.

The Ice Age saw the advancement and regression of four glaciers. The last glacier, the Wisconsin, did not enter the area, but the melting ice widened the river valleys and contributed silt, sand and gravels to the two river systems. The melding of two such major river systems strongly influenced both ancient and modern man.

Archeologists have identified four cultural periods within the Upper Mississippi River Valley. They are: Paleo (prior to 5000 B.C.); Eastern Archaic (5000 to 1000 B.C.); Woodland (2000 B.C. to 1400 A.D.), and the Mississippian (800 to 1700 A.D.). The Mississippian was strongly influenced by the Woodland Culture as evidenced by large populated sites, intensive agriculture and religious cults.

Europeans began exploring the area in the mid-18th century. By 1824, the importance of the Mississippi River as a trade and transportation route had been established, and Congress appropriated $75,000 to remove dead trees (snags) from the river.

Congress appropriated funds in 1907 to create a six-foot navigation channel, but existing technology was not adequate. The 1927 River and Harbors Act authorized study of the Mississippi between Minneapolis and the Missouri River. The outcome of this study was a 1930 authorization to build 24 low-head dams with locks between Minneapolis and Alton.

In 1944, Congress approved the Flood Control Act, which authorized the development of recreational facilities on public access areas. The Fish and Wildlife Act of 1946 provided for establishment of a General Plan and Cooperative Agreement to use the navigation channel project lands and waters for fish and wildlife conservation and management.

The majority of MRA lands and waters are referred to as General Plan lands, under management by the State of Illinois in accordance with a 1961 General Plan and 1963 cooperative agreement with the Department of the Interior. These lands are managed as fish and wildlife areas, while day use and access are under separate lease agreement with the U.S. Army Corps of Engineers.

K-3

Federal Involvement

In 1937, the Federal Aid in Wildlife Restoration Act, better known as the Pittman-Robertson Act, imposed an 11 per cent manufacturer's tax on sporting arms and ammunition, which is used to fund wildlife restoration and management activities. The Federal Aid in Fish Restoration Act, known as the Dingell-Johnson Act, was passed in 1950 and created a 10 per cent manufacturers tax on fishing tackle, which is used to fund fish restoration and management efforts. The MRA has participated in these federal programs since 1958.

Hunting

Most of the areas within the MRA are specifically managed for waterfowl, with 360 blind sites allocated by public drawing for three-year periods. Five waterfowl check stations are operated on the more intensively-used areas.

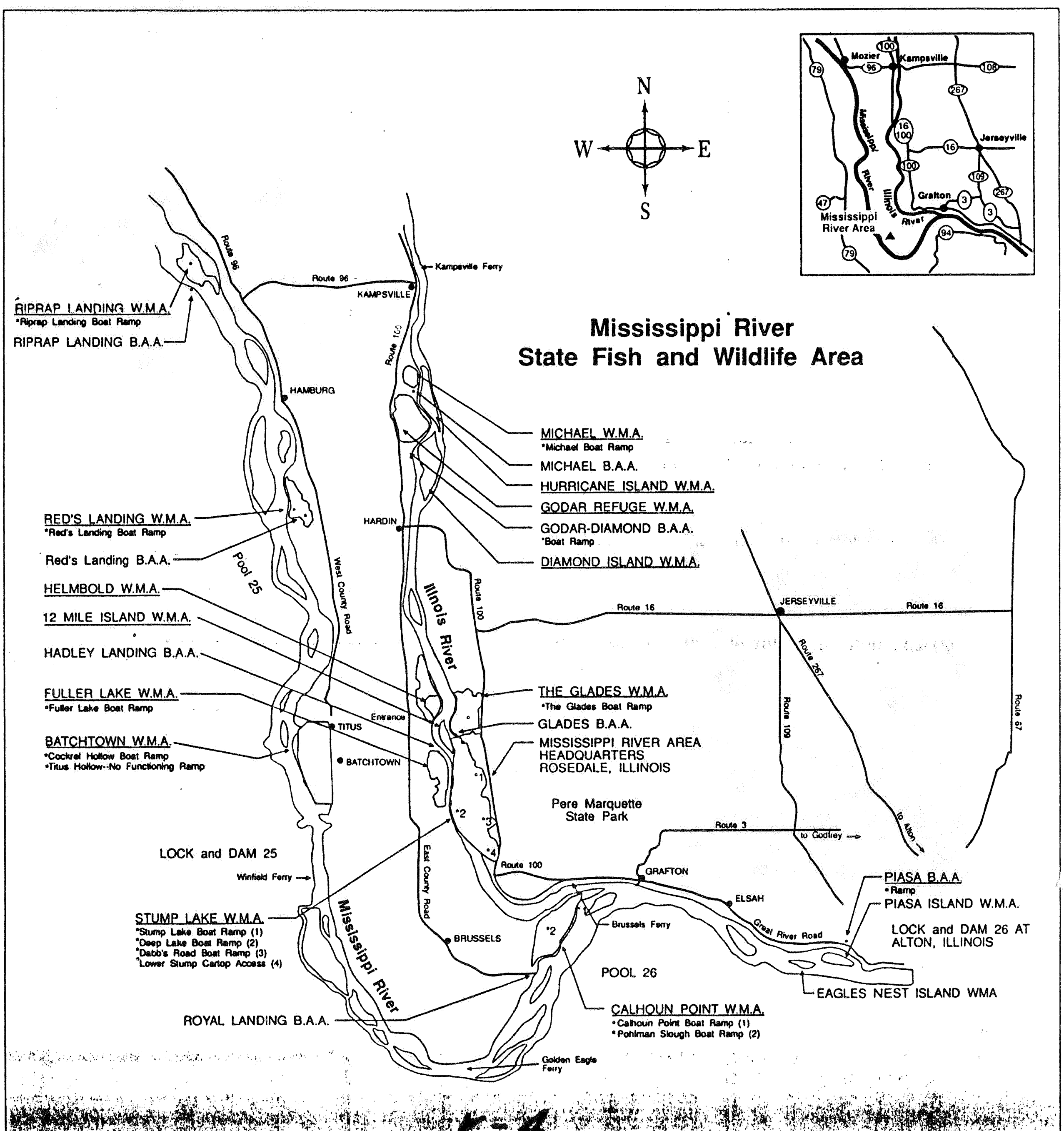
Forest game hunting is popular in most areas. Upland game is available, but not productive, due to annual flooding of the areas. Site staff usually plant up to 125 acres of sunflowers each year to attract doves. The river level or weather conditions reduces or eliminates this program in some years.

open spaces... family places

*HUNTING
G - Good
F - Fair
P - Poor

M - MISSISSIPPI (Pools 25 and 26)
I - ILLINOIS (Pool 26)
L - Backwater Lakes
WMA - Wildlife Management Area
AA - Access Area

	ACREAGE	WATER	AGRICULTURAL	WOODLAND	PICNICKING	FISHING	BOAT RAMPS	RIVER ACCESS	DOVES	WATERFOWL	FOREST GAME	UPLAND GAME	WATERFOWL REST AREAS	WATERFOWL CHECK STATIONS
BATCHTOWN WMA	2463	1788	11	664		M				G	F	P		YES
Titus Hollow AA														
Cockerel Hollow AA						M	1	M						
CALHOUN POINT WMA	2215	322	154	1739		I/L	1		●	F	G	P		YES
Pohlman Slough AA					●	L	2							
Royal Landing AA					●	M	1	M						
DIAMOND ISLAND WMA	657	292	36	329						G	G	P		YES
FULLER LAKE WMA	1088	347	181	560		L	1		●	G	F	F		
Hadley Landing AA					●	I	1	I						
GLADES WMA/AA	1591	328	65	1198	●	I	2	I		G	G	P		YES
GODAR WMA/AA	1027	327	201	499	●	I	1	I			G	P	●	
HELMBOLD SLOUGH WMA	729	59	0	672						G	G	P		
HURRICANE ISLAND WMA	397	58	18	321						G	G	P		YES
MICHAEL WMA/AA	536	75	90	371		I	2	I	●	G	F	P		YES
PIASA ISLAND WMA/AA	400			400	●	M	1	M		F	P	P		
RED'S LANDING WMA/AA	737	246	182	309	●	M/L	2	M	●	F	G	F		
RIPRAP LANDING WMA/AA	1232	200	173	859	●	M/L	2	M	●	F	G	F		
STUMP LAKE WMA/AA	3580	1181	413	1986	●	L	3		●	G	G	P	●	YES
Dabbs Road AA						L	1							
Deep Lake AA					●	L								
12-MILE ISLAND WMA	223	6		217						F	G	P		YES



Batchtown is a division of the Brussels District of Mark Twain National Wildlife Refuge. The division is managed for the benefit of wildlife with an emphasis on migratory birds.

Management

Woodlands along backwater sloughs and lakes provide habitat for nesting waterfowl and their broods. Water levels on areas called moist soil units are manipulated to encourage natural development of vegetation for wildlife. Local farmers plant corn, soybeans and wheat on specific areas under cooperative agreements, leaving a share of the crops in the fields for wildlife.

Wildlife

White-tailed deer, squirrel, raccoon, opossum, bobwhite quail, rabbit, beaver and muskrat in addition to numerous bird species are common to the Batchtown Division. The greatest attractions however, are the annual waterfowl and bald eagle migrations. Each fall and winter thousands of ducks and geese and numerous bald eagles migrate through the area stopping on the refuge for food and shelter.

K-5

Public Use

The Batchtown Division is open to sport fishing. Access to backwater areas is from the Prairie Pond parking area. A Mississippi River access area is located at the southwest parking area.

Bluegill, crappie and catfish are the most common catch in the backwater areas. State fishing regulations apply. Commercial fishing is not permitted.

Wildlife observation, photography and nut, berry and mushroom gathering are also permitted. All other activities are prohibited without specific authorization.

Wildlife-related public use is permitted and encouraged so long as it does not conflict with the refuge's primary purpose of providing migratory birds with food and shelter during their migrations.

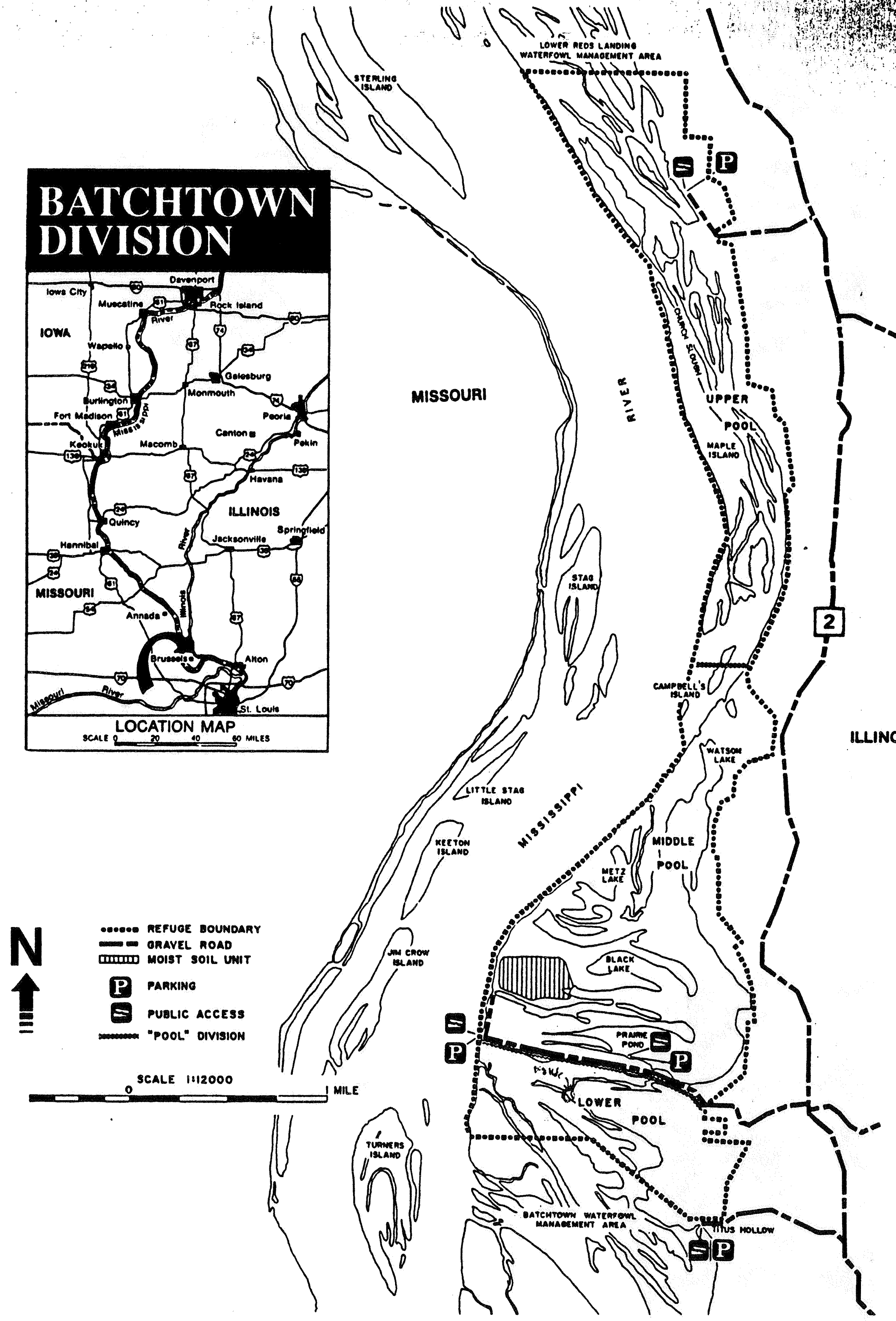
To provide an undisturbed rest area for waterfowl, bald eagles and other birds, all but the Visitor Contact Station and office at the Calhoun Division is closed annually from October 15th through December 15th.

For Additional Information
call, write or visit the:
Mark Twain National Wildlife Refuge
Brussels District Office
Box 107 Brussels, Il 62013
(618) 883-2524
Visitor Contact Station and Office Hours:
7:30 a. m.- 4:00 p. m. Monday through Friday

RF-3-33621-1-8/88
☆ GPO: 1988—557-687

BATCHTOWN DIVISION

Mark Twain
National Wildlife Refuge - Illinois



BATCHTOWN DIVISION
LOCATION MAP
SCALE 0 20 40 60 MILES
Davenport
Iowa City
Muscatine
Rock Island
IOWA
Wapello
Galesburg
Burlington
Monmouth
Fort Madison
Peoria
Canton
Keokuk
Macomb
Pekin
Havana
ILLINOIS
Quincy
Springfield
Hannibal
Jacksonville
MISSOURI
Annada
Brussels
Alton
St. Louis
Missouri River
Illinois River
Mississippi River
LOWER REDS LANDING WATERFOWL MANAGEMENT AREA
STERLING ISLAND
MISSOURI
MISSISSIPPI RIVER
CHURCH SLOUGH
UPPER POOL
MAPLE ISLAND
STAG ISLAND
CAMPBELL'S ISLAND
WATSON LAKE
ILLINOIS
2
LITTLE STAG ISLAND
KEETON ISLAND
METZ LAKE
MIDDLE POOL
JIM CROW ISLAND
BLACK LAKE
PRAIRIE POND
LOWER POOL
TURNERS ISLAND
BATCHTOWN WATERFOWL MANAGEMENT AREA
TITUS HOLLOW
N
REFUGE BOUNDARY
GRAVEL ROAD
MOIST SOIL UNIT
PARKING
PUBLIC ACCESS
"POOL" DIVISION
SCALE 1:12000
0
1 MILE

Appendix L - Cost Estimates

MCACES cost estimate dated July 25, 1996

BATCHTOWN HREP PRINTED ON: 15-Mar-96
ESTIMATING INITIAL COSTS FOR PURPOSES OF 9-EASY STEPS
INCLUDING CONTINGENCIES, ENG. & DESIGN, AND CONSTR. MANAGEMENT (CM OR S&A)

MEAS. A, RIVERSIDE LEVEE, USFWS MIDDLE POOL

A-1, FILL LOW SPOTS TO 435.5

CLEARING AND GRUBBING	2.3	AC.	1980	4554
EMBANKMENT	1200	C.Y.	2.75	3300
SEEDING	1.3	AC.	1320	1716

SUBTOTAL				9570
25% CONTIN.				2393
SUBTOTAL				11963
32% E&D + S&A				3828
TOTAL				15791

FILL LOW SPOTS TO 436.5, revised figures received 5/8/95

CLEARING AND GRUBBING	11.5	AC.	1980	22770
EMBANKMENT	4100	C.Y.	2.75	11275
SEEDING	8.2	AC.	1320	10824
CRUSHED STONE	4630	TON	13.2	61116

SUBTOTAL				105985
25% CONTIN.				26496
SUBTOTAL				132481
32% E&D + S&A				42394
TOTAL				174875

A-2, RAISE LEVEE TO 437.5 (roughly interpolated between A-1 and A-3)

TOTAL				200000

A-3, RAISE LEVEE TO 439.0

CLEARING AND GRUBBING	30.6	AC.	1980	60588
EMBANKMENT	24700	C.Y.	2.75	67925
SEEDING	10.7	AC.	1320	14124

SUBTOTAL				142637
25% CONTIN.				35659
SUBTOTAL				178296
32% E&D + S&A				57055
TOTAL				235351

MEAS. B, RIVERSIDE LEVEE, USFWS LOWER POOL

B-1, BUILD LEVEE TO 434.0

CLEARING AND GRUBBING	1.8	AC.	1980	3564
EMBANKMENT	850	C.Y.	2.75	2337.5
SEEDING	1.1	AC.	1320	1452

SUBTOTAL				7354
25% CONTIN.				1838
SUBTOTAL				9192
32% E&D + S&A				2941
TOTAL				12133

B-2, BUILD LEVEE TO 435.5

CLEARING AND GRUBBING	3.2	AC.	1980	6336
EMBANKMENT	2410	C.Y.	2.75	6627.5
SEEDING	1.3	AC.	1320	1716

SUBTOTAL				14680
25% CONTIN.				3670
SUBTOTAL				18349
32% E&D + S&A				5872
TOTAL				24221

BUILD LEVEE TO 435.5, revised with data received 5/8/95

CLEARING AND GRUBBING	3.2	AC.	1980	6336
EMBANKMENT	2410	C.Y.	2.75	6627.5
SEEDING	1.3	AC.	1320	1716
CRUSHED STONE	480	TON	13.2	6336

SUBTOTAL				21016
25% CONTIN.				5254
SUBTOTAL				26269

	32% E&D + S&A				8406
	TOTAL				34676
B-3, BUILD LEVEE TO 437.0					
	CLEARING AND GRUBBING	4.3	AC.	1980	8514
	EMBANKMENT	3430	C.Y.	2.75	9432.5
	SEEDING	1.6	AC.	1320	2112

	SUBTOTAL				20059
	25% CONTIN.				5015
	SUBTOTAL				25073
	32% E&D + S&A				8023
	TOTAL				33097
MEAS. C, RIVERSIDE LEVEE, STATE AREA					
C-1, BUILD LEVEE TO 434.0					
	CLEARING AND GRUBBING	32.9	AC.	1980	65142
	EMBANKMENT	18900	C.Y.	2.75	51975
	SEEDING	17.7	AC.	1320	23364

	SUBTOTAL				140481
	25% CONTIN.				35120
	SUBTOTAL				175601
	32% E&D + S&A				56192
	TOTAL				231794
BUILD LEVEE TO 435.5 TAPERING TO 434.5, data received 5/8/95					
	CLEARING AND GRUBBING	42.9	AC.	1980	84942
	EMBANKMENT	24100	C.Y.	2.75	66275
	SEEDING	18.2	AC.	1320	24024
	CRUSHED STONE	7590	TON	13.2	100188

	SUBTOTAL				275429
	25% CONTIN.				68857
	SUBTOTAL				344286
	32% E&D + S&A				110172
	TOTAL				454458
C-2, BUILD LEVEE TO 435.5					
	CLEARING AND GRUBBING	46.5	AC.	1980	92070
	EMBANKMENT	33200	C.Y.	2.75	91300
	SEEDING	19.8	AC.	1320	26136

	SUBTOTAL				209506
	25% CONTIN.				52377
	SUBTOTAL				261883
	32% E&D + S&A				83802
	TOTAL				345685
C-3, BUILD LEVEE TO 437.0					
	CLEARING AND GRUBBING	75.6	AC.	1980	149688
	EMBANKMENT	59600	C.Y.	2.75	163900
	SEEDING	27.6	AC.	1320	36432

	SUBTOTAL				350020
	25% CONTIN.				87505
	SUBTOTAL				437525
	32% E&D + S&A				140008
	TOTAL				577533
MEAS. D, LOWLAND SED. TRAP, USFWS MIDDLE POOL					
	CLEARING AND GRUBBING	5.3	AC.	1980	10494
	EMBANKMENT	23500	C.Y.	2.75	64625
	SEEDING	3.8	AC.	1320	5016
	36 IN. CMP	34	L.F.	60	2040

	SUBTOTAL				82175
	25% CONTIN.				20544
	SUBTOTAL				102719

32% E&D + S&A				32870
TOTAL				135589
MEAS. E, LOWLAND SED. TRAP, STATE AREA				
CLEARING AND GRUBBING	6.1	AC.	1980	12078
EMBANKMENT	10100	C.Y.	2.75	27775
SEEDING	3	AC.	1320	3960
36 IN. CMP	34	L.F.	60	2040
SUBTOTAL				45853
25% CONTIN.				11463
SUBTOTAL				57316
32% E&D + S&A				18341
TOTAL				75657
MEAS. F, DREDGING, USFWS MIDDLE POOL				
EXCAVATION	98800	C.Y.	4	395200
DISPOSAL, 3 FT. HIGH	40	AC.	500	20000
SUBTOTAL				415200
25% CONTIN.				103800
SUBTOTAL				519000
32% E&D + S&A				166080
TOTAL				685080
MEAS. FC, APPROXIMATELY 1/8 OF MEAS. F				85635
MEAS. FB, APPROXIMATELY 1/8 OF MEAS. F				85635
MEAS. G, DREDGING, STATE AREA				
EXCAVATION	35600	C.Y.	4	142400
DISPOSAL, 3 FT. HIGH	0	AC.	500	0
SEEDING	5.6	AC.	1320	7392
SUBTOTAL				149792
25% CONTIN.				37448
SUBTOTAL				187240
32% E&D + S&A				59917
TOTAL				247157
MEAS. H, PUMPS IN USFWS MIDDLE POOL				
H-1 (USE EXISTING PUMP)				0
H-2, REHABILITATE PUMP STATION				
ESTIMATED AMOUNT BY PD-F				30000
H-3, INCREASE PUMPING CAPACITY BY ADDING 9 CFS PUMP				
ESTIMATED AMOUNT BY PD-F				60000
25% CONTIN.				15000
SUBTOTAL				75000
32% E&D + S&A				24000
TOTAL				99000
MEAS. I, PUMPS IN USFWS LOWER POOL				
I-1, ADD PAD WITH PORT. 7 CFS PUMP, CUT DITCH				
ESTIMATED AMOUNT BY PD-F				60000
25% CONTIN.				15000
SUBTOTAL				75000
32% E&D + S&A				24000
TOTAL				99000
I-2, ADD PAD WITH PORT. 15 CFS PUMP, CUT DITCH				
ESTIMATED AMOUNT BY PD-F				65000
25% CONTIN.				16250
SUBTOTAL				81250
32% E&D + S&A				26000
TOTAL				107250

BATCHTOWN HREP PRINTED ON: 15-Mar-96
ESTIMATING INITIAL COSTS FOR PURPOSES OF 9-EASY STEPS
INCLUDING CONTINGENCIES, ENG. & DESIGN, AND CONSTR. MANAGEMENT (CM OR S&A)

I-3, ADD PAD WITH PORT. 30 CFS PUMP, CUT DITCH

ESTIMATED AMOUNT BY PD-F	70000
25% CONTIN.	17500
SUBTOTAL	87500
32% E&D + S&A	28000
TOTAL	115500

MEAS. J, PUMPS IN STATE AREA

J-2, 90 CFS PUMP

ESTIMATED AMOUNT FROM ED-C, 3/4/93	274500
24% CONTIN.	65500
SUBTOTAL	340000
32% E&D + S&A	108800
TOTAL, ROUNDED UP SLIGHTLY	449000

J-1, 45 CFS PUMP

ESTIMATED AMOUNT BY PD-F	250000
25% CONTIN.	62500
SUBTOTAL	312500
32% E&D + S&A	100000
TOTAL	412500

J-3, 135 CFS PUMP

ESTIMATED AMOUNT BY PD-F	300000
25% CONTIN.	75000
SUBTOTAL	375000
32% E&D + S&A	120000
TOTAL	495000

HILLSIDE SEDIMENT CONTROL

TOTAL COST ESTIMATED AMOUNT BY NRCS	504385

K, HILLSIDE SEDIMENT CONTROL RELATED TO MIDDLE POOL, 20% OF TOTAL WATERSHEDS	100877
KB, HILLSIDE SED. CONTROL, STATE AREA, 50% OF TOTAL WATERSHEDS	252193
KC, HILLSIDE SED. CONTROL, LOWER POOL, 31% OF TOTAL WATERSHEDS	151316

MEAS. L, INTERIOR LEVEE BETWEEN USFWS LOWER POOL AND STATE AREA

L-1, BUILD LEVEE TO 434.0

CLEARING AND GRUBBING	.5	AC.	1980	990
EMBANKMENT	190	C.Y.	2.75	522.5
SEEDING	.3	AC.	1320	396

SUBTOTAL				1909
25% CONTIN.				477
SUBTOTAL				2386
32% E&D + S&A				763
TOTAL				3149

BUILD LEVEE TO 434.5, revised data received 5/8/95

CLEARING AND GRUBBING	.8	AC.	1980	1584
EMBANKMENT	3340	C.Y.	2.75	9185
SEEDING	18.2	AC.	1320	24024
CRUSHED STONE	330	TON	13.2	4356

SUBTOTAL				39149
25% CONTIN.				9787
SUBTOTAL				48936
32% E&D + S&A				15660
TOTAL				64596

L-2, BUILD LEVEE TO 435.5

CLEARING AND GRUBBING	2.4	AC.	1980	4752
EMBANKMENT	1090	C.Y.	2.75	2997.5
SEEDING	1.5	AC.	1320	1980

SUBTOTAL				9730

	25% CONTIN.				2432
	SUBTOTAL				12162
	32% E&D + S&A				3892
	TOTAL				16054
L-3, BUILD LEVEE TO 437.0					
	CLEARING AND GRUBBING	7.1	AC.	1980	14058
	EMBANKMENT	4470	C.Y.	2.75	12292.5
	SEEDING	3.5	AC.	1320	4620

	SUBTOTAL				30971
	25% CONTIN.				7743
	SUBTOTAL				38713
	32% E&D + S&A				12388
	TOTAL				51101

REASONING FOR CMPS AND STOP-LOGS:
(1-42 IN. CMP = 40000, PLUS 62.5% FOR MISC. ASSOC. WORK)
(1-8 FT. CONC. STOP LOG = 35,000, PLUS 62.5% FOR MISC. WORK)
(1-42 IN. CMP PLUS 1-8 FT. CONC. STOP-LOG = 75,000, PLUS 62.5% MISC FOR ASSOC. WOR

MEAS. M, EXTERIOR WATER CONTROL, USFWS MIDDLE POOL

M-1, 1-42 IN. CMP		
	ESTIMATED AMOUNT BY PD-F	65000
	25% CONTIN.	16250
	SUBTOTAL	81250
	32% E&D + S&A	26000
	TOTAL	107250
M-2, 2-48 IN. CMP		
	ESTIMATED AMOUNT BY PD-F	130000
	25% CONTIN.	32500
	SUBTOTAL	162500
	32% E&D + S&A	52000
	TOTAL	214500
M-3, 1-8 FT. WIDE CONC. STOP-LOG STRUCTURE		
	ESTIMATED AMOUNT BY PD-F	56875
	25% CONTIN.	14219
	SUBTOTAL	71094
	32% E&D + S&A	22750
	TOTAL	93844
M-4, 2-8 FT. WIDE CONC. STOP-LOG STRUCTURE		
	ESTIMATED AMOUNT BY PD-F	113750
	25% CONTIN.	28438
	SUBTOTAL	142188
	32% E&D + S&A	45500
	TOTAL	187688

MEAS. N, EXTERIOR WATER CONTROL, USFWS LOWER POOL

N-1, 1-42 IN. CMP, PLUS 1-8 FT. CONC. STOP-LOG		
	ESTIMATED AMOUNT BY PD-F	121875
	25% CONTIN.	30469
	SUBTOTAL	152344
	32% E&D + S&A	48750
	TOTAL	201094
N-2, 1-8 FT. CONC. STOP-LOG		
	ESTIMATED AMOUNT BY PD-F	56875
	25% CONTIN.	14219
	SUBTOTAL	71094
	32% E&D + S&A	22750
	TOTAL	93844

MEAS. O, EXTERIOR WATER CONTROL, STATE AREA

O-1, 2-42 IN. CMP PLUS 2-8 FT. WIDE CONC. STOP-LOGS		
	ESTIMATED AMOUNT BY PD-F	220000
	25% CONTIN.	55000

SUBTOTAL	275000
32% E&D + S&A	88000
TOTAL	363000

O-2, 3-42 IN. CMP PLUS 4-8 FT. WIDE CONC. STOP-LOGS

ESTIMATED AMOUNT BY PD-F	250000
25% CONTIN.	62500
SUBTOTAL	312500
32% E&D + S&A	100000
TOTAL	412500

O-3, 5-42 IN. CMP PLUS 10-8 FT. WIDE CONC. STOP-LOGS

ESTIMATED AMOUNT BY PD-F	893750
25% CONTIN.	223438
SUBTOTAL	1117188
32% E&D + S&A	357500
TOTAL	1474688

O-4, 2-8 FT. WIDE CONC. STOP-LOGS

ESTIMATED AMOUNT BY PD-F	113750
25% CONTIN.	28438
SUBTOTAL	142188
32% E&D + S&A	45500
TOTAL	187688

O-5, 4-8 FT. WIDE CONC. STOP-LOGS

ESTIMATED AMOUNT BY PD-F	227500
25% CONTIN.	56875
SUBTOTAL	284375
32% E&D + S&A	91000
TOTAL	375375

O-6, 10-8 FT. WIDE CONC. STOP-LOGS

ESTIMATED AMOUNT BY PD-F	568750
25% CONTIN.	142188
SUBTOTAL	710938
32% E&D + S&A	227500
TOTAL	938438

MEAS. P, INTERIOR WATER CONTROL BETWEEN USFWS MIDDLE POOL AND LOWER POOL (ELIMINATED AFTER USFWS CONDUCTED POST-FLOOD OF 1993 REPAIRS IN 1995)

MEAS. Q, INTERIOR WATER CONTROL BETWEEN USFWS LOWER POOL AND STATE AREA

Q-1, 1-42 IN. CMP PLUS 1-8 FT.-WIDE CONC. STOP-LOG

ESTIMATED AMOUNT BY PD-F	121875
25% CONTIN.	30469
SUBTOTAL	152344
32% E&D + S&A	48750
TOTAL	201094

Q-2, 1-8 FT. WIDE CONC. STOP-LOG

ESTIMATED AMOUNT BY PD-F	56875
25% CONTIN.	14219
SUBTOTAL	71094
32% E&D + S&A	22750
TOTAL	93844

MEAS. R, STOP-LOG STRUCT. ON EXT. LEVEE, USFWS MIDDLE POOL

R-1, 1-42 IN. CMP

ESTIMATED AMOUNT BY PD-F	65000
25% CONTIN.	16250
SUBTOTAL	81250
32% E&D + S&A	26000
TOTAL	107250

R-2, 2-42 IN. CMPS

ESTIMATED AMOUNT BY PD-F	130000
25% CONTIN.	32500
SUBTOTAL	162500

ESTIMATING INITIAL COSTS FOR PURPOSES OF 9-EASY STEPS
INCLUDING CONTINGENCIES, ENG. & DESIGN, AND CONSTR. MANAGEMENT (CM OR S&A)

	32% E&D + S&A	52000
	TOTAL	214500

R-3, 1-8 FT. WIDE CONC. STOP-LOG

	ESTIMATED AMOUNT BY PD-F	56875
	25% CONTIN.	14219
	SUBTOTAL	71094
	32% E&D + S&A	22750
	TOTAL	93844

R-4, 2-8 FT. WIDE CONC. STOP-LOG

	ESTIMATED AMOUNT BY PD-F	113750
	25% CONTIN.	28438
	SUBTOTAL	142188
	32% E&D + S&A	45500
	TOTAL	187688

MEAS. S, STOP-LOG STRUCT. ON EXT. LEVEE, USFWS LOWER POOL
(COMBINED WITH MEASURE N)

MEAS. T, STOP-LOG STRUCT. ON EXT. LEVEE, STATE AREA
(COMBINED WITH MEASURE O)

MEAS. U, STOP-LOG STRUCT. ON INT. LEVEE, BETWEEN USFWS MIDDLE AND LOWER POOLS
(COMBINED WITH MEASURE P)

MEAS. V, STOP-LOG STRUCT. ON INT. LEVEE, BETWEEN USFWS LOWER POOL AND STATE AREA

V-1, 1-8 FT. WIDE STOP-LOG STRUCTURE

	ESTIMATED AMOUNT BY PD-F	56875
	25% CONTIN.	14219
	SUBTOTAL	71094
	32% E&D + S&A	22750
	TOTAL	93844

MEAS. W, FLOW THROUGH L25 SPILLWAY

W-1, SIPHON SYSTEM

	TOTAL, EST. BY ED-C	1200000

W-2, 2-54 IN. CONCRETE PIPES

	TOTAL, EST. BY ED-C	647000

W-3, 6-6 FT. X 7 FT. GATED BOX CULVERTS

	TOTAL, EST. BY ED-C	5680000

MEAS. X, PUMPS ON TURNER ISLAND

X-2		
6 CFS PUMP	ESTIMATED AMOUNT FROM ED-C, 12/16/92	57310
	25% CONTIN.	14328
	SUBTOTAL	71638
	32% E&D + S&A	22924
	TOTAL	94562
X-1		
3 CFS PUMP	ESTIMATED AMOUNT BY PD-F	50000
	25% CONTIN.	12500
	SUBTOTAL	62500
	32% E&D + S&A	20000
	TOTAL	82500
X-3		
9 CFS PUMP	ESTIMATED AMOUNT BY PD-F	60000
	25% CONTIN.	15000
	SUBTOTAL	75000
	32% E&D + S&A	24000
	TOTAL	99000

BATCHTOWN HREP PRINTED ON: 15-Mar-96

ESTIMATING INITIAL COSTS FOR PURPOSES OF 9-EASY STEPS
INCLUDING CONTINGENCIES, ENG. & DESIGN, AND CONSTR. MANAGEMENT (CM OR S&A)

MEAS. Y, OFF-BANKLINE REVETMENT (STATE-MANAGED AREA)
ASSUME 9 FT. HIGH DIKE, SIDES SLOPING 1 FT. OUT, 2 FT. DOWN, AREA OF 162 S.F.
VOLUME PER LINEAR FT. = 162 C.F. OR 6 C.Y.
WEIGHT PER L.F. IS 1.5 TONS/C.Y. X 6 C.Y. PER L.F. = 9 TONS/L.F.
COST TO TRANSPORT AND PLACE/L.F. = 9 TONS/L.F. X $5.50/TON = $50/L.F.

			'A' STONE COST/L.F. TRANSPORT AND PLACE		
Y-1, 3 DIKES		12391 ft.	50		619550
	25% CONTIN.				154888
	SUBTOTAL				774438
	32% E&D + S&A				247820
	TOTAL				1022258
Y-2, 4 DIKES		17713 ft.	50		885650
	25% CONTIN.				221413
	SUBTOTAL				1107063
	32% E&D + S&A				354260
	TOTAL				1461323

MEAS. Z, OFF-BANKLINE REVETMENT (USFWS MIDDLE AND LOWER POOLS)

Z-1, REHAB 10% OF 6,808					
		681 ft.	50		34040
	25% CONTIN.				8510
	SUBTOTAL				42550
	32% E&D + S&A				13616
	TOTAL				56166
Z-2, REHAB 10% OF 6,808 PLUS NEW 1,906					
		681 ft.	50		34040
		1906 ft.	50		95300
				SUBTOTAL	129340
	25% CONTIN.				32335
	SUBTOTAL				161675
	32% E&D + S&A				51736
	TOTAL				213411
Z-3, REHAB 10% OF 6,808 PLUS NEW 1,906 AND 2,995					
		681 ft.	50		34040
		1906 ft.	50		95300
		2995 ft.	50		149750
				SUBTOTAL	279090
	25% CONTIN.				69773
	SUBTOTAL				348863
	32% E&D + S&A				111636
	TOTAL				460499

AA, AB, AC, BOTTOMLAND FOREST HABITAT IMPROVEMENTS, SEE SEPARATE COST ESTIMATE SHEET

BATCHTOWN HREP PRINTED ON: 16-Mar-96

ESTIMATING OM&R COSTS FOR PURPOSES OF 9-EASY STEPS

I= .07625

	ANNUAL OM&R
MEAS. A, RIVERSIDE LEVEE, USFWS MIDDLE POOL	
A-1, FILL LOW SPOTS TO 436.5	1000
A-2, RAISE LEVEE TO 437.5	3000
A-3, RAISE LEVEE TO 439.0	5000
MEAS. B, RIVERSIDE LEVEE, USFWS LOWER POOL	
B-1, BUILD LEVEE TO 434.0	200
B-2, BUILD LEVEE TO 435.5	300
B-3, BUILD LEVEE TO 437.0	300
MEAS. C, RIVERSIDE LEVEE, STATE AREA	
C-1, BUILD LEVEE TO 434.0	5000
C-2, BUILD LEVEE TO 435.5	5500
C-3, BUILD LEVEE TO 437.0	6000
MEAS. D, LOWLAND SED. TRAP, USFWS MIDDLE POOL	1000
MEAS. E, LOWLAND SED. TRAP, STATE AREA	500

MEAS. F, DREDGING, USFWS MIDDLE POOL

YR	CASH FLOW	NPV	ANNUALIZED
25	415200	66135	5174

MEAS. FC AND FB, DREDGING, USFWS LOWER POOL AND STATE AREA

YR	CASH FLOW	NPV	ANNUALIZED
25	50000	7964	623

MEAS. G, DREDGING, STATE AREA

YR	CASH FLOW	NPV	ANNUALIZED
25	149972	23888	1869

MEAS. H, PUMPS IN USFWS MIDDLE POOL	
H-1 (USE EXISTING PUMP)	12000
H-2, REHABILITATE PUMP STATION	10000
H-3, INCREASE PUMPING CAPACITY BY ADDING 9 CFS PUMP	18000
MEAS. I, PUMPS IN USFWS LOWER POOL	
I-1, ADD PAD WITH PORT. 7 CFS PUMP, CUT DITCH	6000
I-2, ADD PAD WITH PORT. 15 CFS PUMP, CUT DITCH	6500
I-3, ADD PAD WITH PORT. 30 CFS PUMP, CUT DITCH	7000
MEAS. J, PUMPS IN STATE AREA	
J-2, 90 CFS PUMP	27000
J-1, 45 CFS PUMP	20000
J-3, 135 CFS PUMP	33000
K, HILLSIDE SEDIMENT CONTROL	3000

BATCHTOWN HREP PRINTED ON: 16-Mar-96
ESTIMATING OM&R COSTS FOR PURPOSES OF 9-EASY STEPS
I= .07625

	ANNUAL OM&R
MEAS. L, INTERIOR LEVEE BETWEEN USFWS LOWER POOL AND STATE AREA	
L-1, BUILD LEVEE TO 434.0	1000
L-2, BUILD LEVEE TO 435.5	1100
L-3, BUILD LEVEE TO 437.0	1200
MEAS. M, EXTERIOR WATER CONTROL, USFWS MIDDLE POOL	
M-1, 1-42 IN. CMP	500
M-2, 2-42 IN. CMP	700
M-3, 1-8 FT. CONC. STOP-LOGS	500
M-4, 2-8 FT. CONC. STOP-LOGS	700
MEAS. N, EXTERIOR WATER CONTROL, USFWS LOWER POOL	
N-1, 1-42 IN. CMP PLUS 1-8 FT. CONC. STOP-LOG	1000
N-2, 1-8 FT. CONC. STOP-LOG	500
MEAS. O, EXTERIOR WATER CONTROL, STATE AREA	
O-1, 2-42 IN. CMPS PLUS 2-8 FT. CONC. STOP-LOGS	2000
O-2, 3-42 IN. CMPS PLUS 4-8 FT. CONC. STOP-LOGS	3500
O-3, 5-42 IN. CMPS PLUS 10-8 FT. CONC. STOP-LOGS	7500
O-4, 2-8 FT. CONC. STOP-LOGS	1000
O-5, 4-8 FT. CONC. STOP-LOGS	2000
O-6, 10-8 FT. CONC. STOP-LOGS	5000
MEAS. P, INTERIOR WATER CONTROL BETWEEN USFWS MIDDLE POOL AND LOWER POOL (THIS MEASURE ELIMINATED AFTER USFWS CONDUCTED POST-FLOOD OF 1993 REPAIRS)	
MEAS. Q, INTERIOR WATER CONTROL BETWEEN USFWS LOWER POOL AND STATE AREA	
Q-1, 1-42 IN. CMP PLUS 1-8 FT. CONC. STOP-LOG	1000
Q-2, 1-8 FT. CONC. STOP-LOG	500
MEAS. R, STOP-LOG STRUCT. ON EXT. LEVEE, USFWS MIDDLE POOL	
R-1, 1-42 IN. CMP	500
R-2, 2-42 IN. CMPS	1000
R-3, 1-8 FT. WIDE STOP-LOG STRUCTURE	500
R-4, 2-8 FT. WIDE STOP-LOG STRUCTURES	1000
MEAS. S COMBINED WITH MEASURE N	
MEAS. T COMBINED WITH MEASURE O	
MEAS. U COMBINED WITH MEASURE P	
MEAS. V, STOP-LOG STRUCT. ON INT. LEVEE, BETWEEN USFWS LOWER POOL AND STATE AREA	
V-1, 1-8 FT. WIDE STOP-LOG STRUCTURE	500
MEAS. W, FLOW THROUGH L25 SPILLWAY	
W-1, SIPHON SYSTEM	23303
W-2, 2-54 IN. CONCRETE PIPES	12956
W-3, 6-6 FT. X 7 FT. GATED BOX CULVERTS	

	YR	CASH FLOW	NPV	ANNUALIZED
REPLACEMENT	25	359500	57262	4480

MEAS. X, PUMPS ON TURNER ISLAND

X-2, 6 CFS PUMP 6000

BATCHTOWN HREP PRINTED ON: 16-Mar-96
ESTIMATING OM&R COSTS FOR PURPOSES OF 9-EASY STEPS
I= .07625

	ANNUAL OM&R
X-1, 3 CFS PUMP	4000
X-3, 9 CFS PUMP	8000

MEAS. Y, OFF-BANKLINE REVETMENT, STATE-MANAGED AREA

Y-1	100
Y-2	200

MEAS. Z, OFF-BANKLINE REVETMENT, USFWS MIDDLE AND LOWER POOLS

Z-1	0
Z-2	50
Z-3	100

AA, BOTTOMLAND FOREST HABITAT IMPROVEMENTS, USFWS MIDDLE POOL

YR	CASH FLOW	NPV	ANNUALIZED
2	2250	1942	
3	2250	1805	
11	7500	3342	
		7089	555

AC, BOTTOMLAND FOREST HABITAT IMPROVEMENTS, USFWS LOWER POOL

YR	CASH FLOW	NPV	ANNUALIZED
2	750	647	
3	750	602	
11	2500	1114	
		2363	185

AB, BOTTOMLAND FOEST HABITAT IMPROVEMENTS, STATE-MANAGED AREA

YR	CASH FLOW	NPV	ANNUALIZED
2	3000	2590	
3	3000	2406	
11	10000	4456	
		9453	740

rcv'd 12/18/92

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BATCHTOWN
SIPHON AT L & D 25
ESTIMATE OF ANNUAL OPERATION, MAINTENANCE. AND REPLACEMENT COST
(OCTOBER 1992 PRICE LEVEL)

OPERATING COST:

Item	Years	Quantity (Hrs.)	Oper. Cost ($)	Labor Cost ($)	Unit Price ($)	Annual Cost ($)
Vacuum Pump (50 Hp.)	Annual	180	10	30	40	7,200
Electric Gaging Station	Annual	13	--	30	30	390
Pump Setup and Transportation	Annual			Sum Job		2,000
			ANNUAL OPERATING COST:			$9,590

MAINTENANCE COST: 1/

					Annualized Cost
Vacuum Pump	@	$3,000	/	Year	3,000
Riprap 650 Lbs.Topsize	@	1000	/	Year	1,000
Bedding Material	@	500	/	Year	500
Steel Trestle	@	1000	/	Year	1,000
Pump house	@	1000	/	Year	1,000
Valves & Discharge Pipe Sys.(4	@	2000	/	Year	2,000
Electric Gaging Station	@	400	/	Year	400
TOTAL MAINTENANCE COST FOR 1 YEAR:					$8,900

REPLACEMENT COST: 2/

				Annualized Cost
Siphon at L & D 25	@	25 Years/Interval	428,303	
				4,818
TOTAL REPLACEMENT COST FOR 25 YEARS:			$428,303	

P/F, F = 428,303 i = 0.085 N = 25
P = 55,719

a/P, P = 55,719, i = 0.085
n = 50 a = 4,818

$23,308

1/ Maintenace costs are defined as those costs of repair and replacement associated with hydrologic events (including minor storm and flood events) that do not exceed the level of design for the project.

2/ Replacement is defined as reconstruction work needed in excess of estimated annual O & M as a result specific storm or flood events. Replacement cost includes 25% contingencies.

- \0276100

BATCHTOWN
2-54" DIA. GATED PIPES
ESTIMATE OF ANNUAL OPERATION, MAINTENANCE. AND REPLACEMENT COST
(Alternate "C" to Plan C
(OCTOBER 1992 PRICE LEVEL)

OPERATING COST:

Item	Years	Quantity (Hrs.)	Oper. Cost ($)	Labor Cost ($)	Unit Price ($)	Annual Cost ($)
Gate Operation (Labor)	Annual	120	--	30	30	3,600
Electric Gaging Station	Annual	13	--	30	30	390
Generator Operatrion	Annual	120	5	30	35	4,200
ANNUAL OPERATING COST:						$8,190

MAINTENANCE COST: 1/				Annualized Cost
Hydraulic Operator (1)	Annual	$1,000	for 1 operator	1,000
Sluice Gates (2)	Annual	1600	for 2 gates	1,600
Electric	Annual	100	for 2 gates	100
Paint, Grease, Misc.	Annual	500	for 2 gates	500
Electric Gaging Station	Annual	400	for 1 station	400
Stop Log Building	Annual	300		300
TOTAL MAINTENANCE COST FOR 1 YEAR:				$3,900

REPLACEMENT COST: 2/			P/F		Annualized Cost
Replace Gates and Operators	75000	1 in 25 Years	9,757	75,000	844
Suppliment Riprap and Bedding	2000	1 in 25 Years	260	2,000	22
$i=0.085$ $N=25$					
TOTAL REPLACEMENT COST FOR 25 YEARS:				$77,000	866

$12,956

1/ Maintenace costs are defined as those costs of repair and replacement associated with hydrologic events (including minor storm and flood events) that do not exceed the level of design for the project.

2/ Replacement is defined as reconstruction work needed in excess of estimated annual O & M as a result specific storm or flood events. Replacement cost includes 25% contingencies.

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BATCHTOWN
BOX CULVERT AT L&D 25
ESTIMATE OF ANNUAL OPERATION, MAINTENANCE. AND REPLACEMENT COST
(Alternate "A" to Plan C
(OCTOBER 1992 PRICE LEVEL)

OPERATING COST:

Item	Years	Quantity (Hrs.)	Oper. Cost ($)	Labor Cost ($)	Unit Price ($)	Annual Cost ($)
Gate Operation (6)	Annual	360	--	30	30	10,800
Electric Gaging Station	Annual	13	--	30	30	390
Generator Operatrion	Annual	360	5	30	35	12,600
Stop Logs	Annual	16		30	30	480
					ANNUAL OPERATING COST:	$24,270

MAINTENANCE COST: 1/

Item	Years	Amount		Annualized Cost
Hydraulic Operator (1)	Annual	$1,000	for 1 operator	3,000
Sluice Gates Paint & Lub (6)	Annual	4,800	for 2 gates	4,800
Electric	Annual	100	for 2 gates	100
Storage Bldg.	Annual	200	for 1 Bldg.	200
Paint, Grease, Misc.	Annual	500	for 2 gates	500
Electric Gaging Station	Annual	400	for 2 gates	400
Riprap Maintenace	Annual	3000		3,000
			TOTAL MAINTENANCE COST FOR 1 YEAR:	$12,000

REPLACEMENT COST: 2/

Item	Cost	Frequency	P/F	F	Annualized Cost
Replace Gates and Operators	357500	1 in 25 Years	46,509	357,500	4,021
Suppliment Riprap and Bedding	2000	1 in 25 Years	260	2,000	22
		n=25 i=0.085			
TOTAL REPLACEMENT COST FOR 25 YEARS:				$359,500	4,043

a/P i=0.085 n=50 P

$40,313

1/ Maintenace costs are defined as those costs of repair and replacement associated with hydrologic events (including minor storm and flood events) that do not exceed the level of design for the project.

2/ Replacement is defined as reconstruction work needed in excess of estimated annual O & M as a result specific storm or flood events. Replacement cost includes 25% contingencies.

revised 12 May 95

DRAFT
Bottomland Forest Habitat Improvements
Creation of 1-2 acre Forest Clearings with Planting of Hard Mast Tree Species

100 acreas total to be planted with trees in the USFWS area (cost estimate can be duplicated for the State-managed area):

Initial costs:

1.	Mechanized clearing - none required	=	$0
2.	Spot herbicide application - $30/acre	=	3,000
3.	Plant seedlings - 2 gallon containers		
	$648/acre - purchase seedlings	=	64,800
	$200/acre - planting with planter	=	20,000

			$87,800

OM&R costs:

1. Spot herbicide application for years 2 and 3 - $30/ac

2. Release oak seedings, once after 11 years - $100/acre

BATCHTOWN - (HREP)
HABITAT REHAB & ENHANCEMENT
PROJECT, UPPER MISSISSIPPI RIVER
SYSTEM-ENVIRONMENTAL MANAGEMENT
PROGRAM, POOL 25,

Designed By: CORPS OF ENGINEERS-ST. LOUIS, MO
Estimated By: C.MUELLER & R.RAUH

Prepared By:

Preparation Date: 07/25/96
Effective Date of Pricing: 07/25/96
Est Construction Time: 720 Days

Sales Tax: 0.00%

SUMMARY REPORTS SUMMARY PAGE

DETAILED ESTIMATE DETAIL PAGE

BACKUP REPORTS BACKUP PAGE

* * * END TABLE OF CONTENTS * * *

** PROJECT OWNER SUMMARY - Level 1 **

	QUANTY UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT
06 Fish and Wildlife Facilities		4,513,926	858,888	5,372,814	
30 Planning, Engineering and Design		1,418,000	148,000	1,566,000	
31 Construction Management		754,000	106,000	860,000	
TOTAL BATCHTOWN - (HREP)		6,685,926	1,112,888	7,798,814	

	QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT
06 Fish and Wildlife Facilities						
06 03 Wildlife Facilities & Sanctuary			4,513,926	858,888	5,372,814	
TOTAL Fish and Wildlife Facilities			4,513,926	858,888	5,372,814	
30 Planning, Engineering and Design						
30 23 Constructn Contracts(s) Documnts	1.00	EA	534,000	142,000	676,000	676000
30 24 Value Engineerng Study			64,000	6,000	70,000	
30 26 Planning			820,000	0	820,000	
TOTAL Planning, Engineering and Design			1,418,000	148,000	1,566,000	
31 Construction Management						
31 23 Construction Contracts			754,000	106,000	860,000	
TOTAL Construction Management			754,000	106,000	860,000	
TOTAL BATCHTOWN - (HREP)			6,685,926	1,112,888	7,798,814	

	QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT
06 Fish and Wildlife Facilities						
06 03 Wildlife Facilities & Sanctuary						
06 03 73 Habitat and Feeding Facilities						
06 03 73 09 Channels and Canals						
06 03 73 09 FB Dredging, State Area (fisheries)			92,069	18,414	110,483	
06 03 73 09 FC Dredging, USFWS Lower(fisheries)			92,069	18,414	110,483	
06 03 73 09 F-1 Dredging,USFWS Middle(fisheries)			736,554	147,311	883,864	
06 03 73 09 G-1 Dredging, State Area			242,291	48,458	290,749	
06 03 73 09 M-3 Exterior Water Control, USFWS						
06 03 73 09 M-3 001 Excavation	200.00	CY	2,257	451	2,708	13.54
06 03 73 09 M-3 002 6" Minus Stone	75.00	TON	1,520	152	1,673	22.30
06 03 73 09 M-3 003 3" Minus Stone	25.00	TON	723	72	795	31.81
06 03 73 09 M-3 004 Geogrid	136.00	SY	668	67	735	5.41
06 03 73 09 M-3 005 Geotextile	136.00	SY	324	32	357	2.62
06 03 73 09 M-3 006 Cofferdam	775.00	CY	13,073	4,576	17,648	22.77
06 03 73 09 M-3 007 Concrete, Reinforced	50.00	CY	29,119	5,824	34,943	698.86
06 03 73 09 M-3 008 Stop Logs	72.00	LF	3,308	662	3,970	55.13
06 03 73 09 M-3 009 Jib Crane	1.00	EA	8,496	1,274	9,770	9770.31
06 03 73 09 M-3 010 Handrail	25.00	LF	1,082	108	1,190	47.61
06 03 73 09 M-3 011 Metal Grate	176.00	SY	23,656	2,366	26,021	147.85
06 03 73 09 M-3 012 Backfill	200.00	CY	1,767	265	2,032	10.16
TOTAL Exterior Water Control, USFWS			85,994	15,849	101,843	
06 03 73 09 0-6 Exterior Water Control, State						
06 03 73 09 0-6 001 2-8' Stop Log Structure	1.00	EA	140,546	35,137	175,683	175683
06 03 73 09 0-6 002 4-8' Stop Log Structure	1.00	EA	277,214	69,304	346,518	346518
06 03 73 09 0-6 003 1-8' Stop Log Structure	4.00	EA	343,928	85,982	429,910	107477
TOTAL Exterior Water Control, State			761,688	190,422	952,110	
06 03 73 09 Q-2 Interior Water Control Between						
06 03 73 09 Q-2 001 Excavation	200.00	CY	2,257	451	2,708	13.54
06 03 73 09 Q-2 002 6" Minus Stone	75.00	TON	1,520	152	1,673	22.30
06 03 73 09 Q-2 003 3" Minus Stone	25.00	TON	723	72	795	31.81
06 03 73 09 Q-2 004 Geogrid	136.00	SY	668	67	735	5.41
06 03 73 09 Q-2 005 Geotextile	136.00	SY	324	32	357	2.62
06 03 73 09 Q-2 006 Cofferdam	775.00	CY	13,073	4,576	17,648	22.77
06 03 73 09 Q-2 007 Concrete, Reinforced	50.00	CY	29,119	5,824	34,943	698.86
06 03 73 09 Q-2 008 Stop Logs	72.00	LF	3,308	662	3,970	55.13

		QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT
06 03 73 09 Q-2 009	Jib Crane	1.00	EA	8,496	1,274	9,770	9770.31
06 03 73 09 Q-2 010	Handrail	25.00	LF	1,082	108	1,190	47.6'
06 03 73 09 Q-2 011	Metal Grate	176.00	SY	23,656	2,366	26,021	147.8
06 03 73 09 Q-2 012	Backfill	200.00	CY	1,767	265	2,032	10.16
	TOTAL Interior Water Control Between			85,994	15,849	101,843	
06 03 73 09 R-3	Stop-Log Structure on Exterior						
06 03 73 09 R-3 001	Excavation	200.00	CY	2,257	451	2,708	13.54
06 03 73 09 R-3 002	6" Minus Stone	75.00	TON	1,520	152	1,673	22.30
06 03 73 09 R-3 003	3" Minus Stone	25.00	TON	723	72	795	31.81
06 03 73 09 R-3 004	Geogrid	136.00	SY	668	67	735	5.41
06 03 73 09 R-3 005	Geotextile	136.00	SY	324	32	357	2.62
06 03 73 09 R-3 006	Cofferdam	775.00	CY	13,073	4,576	17,648	22.77
06 03 73 09 R-3 007	Concrete, Reinforced	50.00	CY	29,119	5,824	34,943	698.86
06 03 73 09 R-3 008	Stop Logs	72.00	LF	3,308	662	3,970	55.13
06 03 73 09 R-3 009	Jib Crane	1.00	EA	8,496	1,274	9,770	9770.31
06 03 73 09 R-3 010	Handrail	25.00	LF	1,082	108	1,190	47.61
06 03 73 09 R-3 011	Metal Grate	176.00	SY	23,656	2,366	26,021	147.85
06 03 73 09 R-3 012	Backfill	200.00	CY	1,767	265	2,032	10.16
	TOTAL Stop-Log Structure on Exterior			85,994	15,849	101,843	
06 03 73 09 W-2	Flow Through Lock 25 Spillway						
06 03 73 09 W-2 001	Excavation, Rock	280.00	CY	42,115	12,635	54,750	195.54
06 03 73 09 W-2 002	Excavation, Earth	870.00	CY	4,336	867	5,203	5.98
06 03 73 09 W-2 003	Cofferdam, Earth (place/remove)	2610.00	CY	38,440	13,454	51,895	19.88
06 03 73 09 W-2 004	Concrete, Reinforced	32.00	CY	19,721	3,944	23,665	739.53
06 03 73 09 W-2 005	Riprap, 650 Lb. Topsize	350.00	TON	9,198	920	10,118	28.91
06 03 73 09 W-2 006	Bedding Material	90.00	TON	1,825	182	2,007	22.30
06 03 73 09 W-2 007	Sheet Pile Removal (existing)	260.00	SF	1,564	235	1,799	6.92
06 03 73 09 W-2 008	Dewatering			98,014	29,404	127,418	
06 03 73 09 W-2 009	Sluice Gates, 54" Diameter	2.00	EA	66,538	6,654	73,192	36596
06 03 73 09 W-2 010	Backfill Gravelly Clay	650.00	CY	5,744	862	6,605	10.16
06 03 73 09 W-2 011	Electric Gaging Station	1.00	EA	18,801	3,760	22,562	22562
06 03 73 09 W-2 012	Hydraulic Operator	1.00	EA	19,554	2,933	22,487	22487
06 03 73 09 W-2 013	Cofferdam Mucking	2930.00	CY	27,555	9,644	37,199	12.70
06 03 73 09 W-2 014	"C" Stone	830.00	TON	22,706	2,271	24,977	30.09
06 03 73 09 W-2 015	Grating, Fiberglass	60.00	SF	1,470	294	1,764	29.40
06 03 73 09 W-2 016	Stop Logs 6" x 10"	1494.00	BF	9,200	1,840	11,040	7.39
06 03 73 09 W-2 017	Stop Log Building 8' x 8'			18,218	3,644	21,862	
06 03 73 09 W-2 018	Jib Crane			8,496	1,274	9,770	
06 03 73 09 W-2 019	Concrete Pipe, 54" Diameter	220.00	LF	37,653	5,648	43,301	196.82
06 03 73 09 W-2 020	Signs, Information			1,504	150	1,655	
06 03 73 09 W-2 021	Miscellaneous Metals			3,760	1,128	4,888	

	QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT
TOTAL Flow Through Lock 25 Spillway			456,413	101,743	558,157	
TOTAL Channels and Canals			2,639,067	572,309	3,211,376	
06 03 73 11 Levees						
06 03 73 11 AB Bottomland Forest Habitat			87,800	8,780	96,580	
06 03 73 11 KB Hillside Sediment Control			252,193	25,219	277,412	
06 03 73 11 KC Hillside Sediment Control			151,316	15,132	166,448	
06 03 73 11 B-2 Riverside Levee, USFWS Lower			25,587	5,117	30,705	
06 03 73 11 C-2 Riverside Levee, State Area			257,380	51,476	308,857	
06 03 73 11 D-1 Lowland Sediment Trap, USFWS			111,902	22,380	134,283	
06 03 73 11 E-1 Lowland Sediment Trap, State			59,486	11,897	71,383	
06 03 73 11 K-1 Hillside Sediment Control			100,877	10,088	110,965	
06 03 73 11 L-2 Interior Levee Between USFWS			11,632	2,326	13,958	
06 03 73 11 XXX Overflow Structure, State-			270,081	40,512	310,594	
06 03 73 11 XXZ Boat Pullover			25,755	3,863	29,618	
TOTAL Levees			1,354,009	196,791	1,550,801	
06 03 73 13 Pumping Plant						
06 03 73 13 H-1 Pump in USFWS Middle Pool						
06 03 73 13 H-1 001 44 CFS Pump	1.00	EA	33,278	6,656	39,933	39933
TOTAL Pump in USFWS Middle Pool			33,278	6,656	39,933	
06 03 73 13 I-2 Pump in USFWS Lower Pool						
06 03 73 13 I-2 001 15 CFS Portable, Trailer Mounted	1.00	EA	28,604	5,721	34,324	34324
06 03 73 13 I-2 003 500 Gallon Portable Fuel Tank	1.00	EA	18,049	3,610	21,659	21659
TOTAL Pump in USFWS Lower Pool			46,653	9,331	55,984	
06 03 73 13 J-2 Pumps in State Area, 90 CFS						
06 03 73 13 J-2 001 90 CFS Permanently Mtd Pump	1.00	EA	121,269	24,254	145,522	145522
06 03 73 13 J-2 002 Portable Diesel Engine Drive	1.00	EA	60,165	12,033	72,198	72198
06 03 73 13 J-2 003 1,000 Gallon Portable Fuel Tank	1.00	EA	22,562	4,512	27,074	27074
06 03 73 13 J-2 004 42" Diameter Steel Pipe	132.00	LF	14,396	1,440	15,835	119.96
06 03 73 13 J-2 005 42" Diameter Flap Gate	1.00	EA	4,023	402	4,426	4425.62
06 03 73 13 J-2 006 6' High Fence	70.00	LF	1,579	158	1,737	24.82
06 03 73 13 J-2 007 6' High and 10' Wide Fence Gate	1.00	EA	752	75	827	827.26
06 03 73 13 J-2 008 Concrete Pad & Curb	5.00	CY	2,256	338	2,595	518.92
06 03 73 13 J-2 009 30" Riprap	1700.00	TON	30,223	3,022	33,245	19.56
06 03 73 13 J-2 010 Excavation	120.00	CY	1,794	359	2,153	17.94

Σ 305,612

		QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT
06 03 73 13 J-2 011	Cofferdam, Gravelly Clay	230.00	CY	4,301	1,505	5,807	25.25
06 03 73 13 J-2 012	Staff Gages	2.00	EA	5,264	526	5,791	2895
06 03 73 13 J-2 013	Pipe Bedding Material	75.00	TON	1,620	162	1,782	23.[illegible]
06 03 73 13 J-2 014	9" Bedding	550.00	TON	11,881	1,188	13,069	23.76
06 03 73 13 J-2 015	PZ27 Sheetpile Retaining Wall	4224.00	LF	158,835	23,825	182,660	43.24
	TOTAL Pumps in State Area, 90 CFS			440,919	73,801	514,720	
	TOTAL Pumping Plant			520,850	89,787	610,637	
	TOTAL Habitat and Feeding Facilities			4,513,926	858,888	5,372,814	
	TOTAL Wildlife Facilities & Sanctuary			4,513,926	858,888	5,372,814	
	TOTAL Fish and Wildlife Facilities			4,513,926	858,888	5,372,814	
30	Planning, Engineering and Design						
30 23	Constructn Contracts(s) Documnts						
30 23 01	Plans and Specifications (P&S)			350,000	100,000	450,000	
30 23 04	Environmental & Regulatory			7,000	0	7,000	
30 23 07	Cost Estimates			20,000	5,000	25,000	
30 23 08	Miscellaneous			20,000	0	20,000	
30 23 09	Memorandum of Agreement			7,000	0	7,000	
30 23 10	Engineering During Construction			75,000	25,000	100,000	
30 23 14	Project Management			55,000	12,000	67,000	
	TOTAL Constructn Contracts(s) Documnts	1.00	EA	534,000	142,000	676,000	676000
30 24	Value Engineerng Study			64,000	6,000	70,000	
30 26	Planning			820,000	0	820,000	
	TOTAL Planning, Engineering and Design			1,418,000	148,000	1,566,000	
31	Construction Management						
31 23	Construction Contracts						
31 23 11	Supervision and Administration						
31 23 11 01	Contract Administration			100,000	20,000	120,000	
31 23 11 02	Benchmarks/Surveys			75,000	15,000	90,000	
31 23 11 03	Review Shop Drawings			50,000	8,000	58,000	
31 23 11 04	Inspection/QA			117,000	20,000	137,000	
31 23 11 05	Project Office			400,000	40,000	440,000	
31 23 11 06	Project Management			12,000	3,000	15,000	

	QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT
TOTAL Supervision and Administration			754,000	106,000	860,000	
TOTAL Construction Contracts			754,000	106,000	860,000	
TOTAL Construction Management			754,000	106,000	860,000	
TOTAL BATCHTOWN - (HREP)			6,685,926	1,112,888	7,798,814	

** PROJECT INDIRECT SUMMARY - Level 1 **

	QUANTY UOM	DIRECT	FIELDMOB	HOME OFC	IOOC	BOND	PROFIT	TOTAL COST	UNIT
06 Fish and Wildlife Facilities		3,199,525	732,293	166,982	33,333	44,006	337,788	4,513,926	
30 Planning, Engineering and Des		1,418,000	0	0	0	0	0	1,418,000	
31 Construction Management		754,000	0	0	0	0	0	754,000	
BATCHTOWN - (HREP)		5,371,525	732,293	166,982	33,333	44,006	337,788	6,685,926	
Contingency								1,112,888	
TOTAL INCL OWNER COSTS								7,798,814	

** PROJECT INDIRECT SUMMARY - Level 2 **

	QUANTY UOM	DIRECT	FIELDMOB	HOME OFC	IOOC	BOND	PROFIT	TOTAL COST	UNIT
06 Fish and Wildlife Facilities									
06 03 Wildlife Facilities & Sanc		3,199,525	732,293	166,982	33,333	44,006	337,788	4,513,926	
TOTAL Fish and Wildlife Faciliti		3,199,525	732,293	166,982	33,333	44,006	337,788	4,513,926	
30 Planning, Engineering and Des									
30 23 Constructn Contracts(s) Do	1.00 EA	534,000	0	0	0	0	0	534,000	534000
30 24 Value Engineerng Study		64,000	0	0	0	0	0	64,000	
30 26 Planning		820,000	0	0	0	0	0	820,000	
TOTAL Planning, Engineering and		1,418,000	0	0	0	0	0	1,418,000	
31 Construction Management									
31 23 Construction Contracts		754,000	0	0	0	0	0	754,000	
TOTAL Construction Management		754,000	0	0	0	0	0	754,000	
TOTAL BATCHTOWN - (HREP)		5,371,525	732,293	166,982	33,333	44,006	337,788	6,685,926	
Contingency								1,112,888	
TOTAL INCL OWNER COSTS								7,798,814	

	QUANTY	UOM	DIRECT	FIELDMOB	HOME OFC	IOOC	BOND	PROFIT	TOTAL COST	UNIT
06 Fish and Wildlife Facilities										
06 03 Wildlife Facilities & Sanc										
06 03 73 Habitat and Feeding Fac										
06 03 73 09 Channels and Canals										
06 03 73 09 FB Dredging, State			61,212	17,192	3,920	783	1,033	7,930	92,069	
06 03 73 09 FC Dredging, USFWS			61,212	17,192	3,920	783	1,033	7,930	92,069	
06 03 73 09 F-1 Dredging,USFWS M			489,692	137,534	31,361	6,260	8,265	63,441	736,554	
06 03 73 09 G-1 Dredging, State			161,085	45,242	10,316	2,059	2,719	20,869	242,291	
06 03 73 09 M-3 Exterior Water C										
06 03 73 09 M-3 001 Excavation	200.00	CY	1,500	421	96	19	25	194	2,257	11.28
06 03 73 09 M-3 002 6" Minus Sto	75.00	TON	1,011	284	65	13	17	131	1,520	20.27
06 03 73 09 M-3 003 3" Minus Sto	25.00	TON	481	135	31	6	8	62	723	28.92
06 03 73 09 M-3 004 Geogrid	136.00	SY	444	125	28	6	7	58	668	4.91
06 03 73 09 M-3 005 Geotextile	136.00	SY	216	61	14	3	4	28	324	2.39
06 03 73 09 M-3 006 Cofferdam	775.00	CY	8,691	2,441	557	111	147	1,126	13,073	16.87
06 03 73 09 M-3 007 Concrete, Re	50.00	CY	19,360	5,437	1,240	247	327	2,508	29,119	582.38
06 03 73 09 M-3 008 Stop Logs	72.00	LF	2,199	618	141	28	37	285	3,308	45.94
06 03 73 09 M-3 009 Jib Crane	1.00	EA	5,648	1,586	362	72	95	732	8,496	8495.93
06 03 73 09 M-3 010 Handrail	25.00	LF	719	202	46	9	12	93	1,082	43.28
06 03 73 09 M-3 011 Metal Grate	176.00	SY	15,727	4,417	1,007	201	265	2,038	23,656	134.41
06 03 73 09 M-3 012 Backfill	200.00	CY	1,175	330	75	15	20	152	1,767	8.84
TOTAL Exterior Wat			57,172	16,057	3,661	731	965	7,407	85,994	
06 03 73 09 0-6 Exterior Water C										
06 03 73 09 0-6 001 2-8' Stop Lo	1.00	EA	93,441	26,244	5,984	1,195	1,577	12,106	140,546	140546
06 03 73 09 0-6 002 4-8' Stop Lo	1.00	EA	184,304	51,763	11,803	2,356	3,111	23,877	277,214	277214
06 03 73 09 0-6 003 1-8' Stop Lo	4.00	EA	228,658	64,220	14,644	2,923	3,859	29,623	343,928	85982
TOTAL Exterior Wat			506,403	142,227	32,431	6,474	8,547	65,606	761,688	
06 03 73 09 Q-2 Interior Water C										
06 03 73 09 Q-2 001 Excavation	200.00	CY	1,500	421	96	19	25	194	2,257	11.28
06 03 73 09 Q-2 002 6" Minus Sto	75.00	TON	1,011	284	65	13	17	131	1,520	[illegible]7
06 03 73 09 Q-2 003 3" Minus Sto	25.00	TON	481	135	31	6	8	62	723	2[illegible].92
06 03 73 09 Q-2 004 Geogrid	136.00	SY	444	125	28	6	7	58	668	4.91
06 03 73 09 Q-2 005 Geotextile	136.00	SY	216	61	14	3	4	28	324	2.39
06 03 73 09 Q-2 006 Cofferdam	775.00	CY	8,691	2,441	557	111	147	1,126	13,073	16.87
06 03 73 09 Q-2 007 Concrete, Re	50.00	CY	19,360	5,437	1,240	247	327	2,508	29,119	582.38
06 03 73 09 Q-2 008 Stop Logs	72.00	LF	2,199	618	141	28	37	285	3,308	45.94

		QUANTY	UOM	DIRECT	FIELDMOB	HOME OFC	IOOC	BOND	PROFIT	TOTAL COST	UNIT
06 03 73 09 Q-2 009	Jib Crane	1.00	EA	5,648	1,586	362	72	95	732	8,496	8495.93
06 03 73 09 Q-2 010	Handrail	25.00	LF	719	202	46	9	12	93	1,082	43.28
06 03 73 09 Q-2 011	Metal Grate	176.00	SY	15,727	4,417	1,007	201	265	2,038	23,656	134.41
06 03 73 09 Q-2 012	Backfill	200.00	CY	1,175	330	75	15	20	152	1,767	8.84
TOTAL	Interior Wat			57,172	16,057	3,661	731	965	7,407	85,994	
06 03 73 09 R-3	Stop-Log Structu										
06 03 73 09 R-3 001	Excavation	200.00	CY	1,500	421	96	19	25	194	2,257	11.28
06 03 73 09 R-3 002	6" Minus Sto	75.00	TON	1,011	284	65	13	17	131	1,520	20.27
06 03 73 09 R-3 003	3" Minus Sto	25.00	TON	481	135	31	6	8	62	723	28.92
06 03 73 09 R-3 004	Geogrid	136.00	SY	444	125	28	6	7	58	668	4.91
06 03 73 09 R-3 005	Geotextile	136.00	SY	216	61	14	3	4	28	324	2.39
06 03 73 09 R-3 006	Cofferdam	775.00	CY	8,691	2,441	557	111	147	1,126	13,073	16.87
06 03 73 09 R-3 007	Concrete, Re	50.00	CY	19,360	5,437	1,240	247	327	2,508	29,119	582.38
06 03 73 09 R-3 008	Stop Logs	72.00	LF	2,199	618	141	28	37	285	3,308	45.94
06 03 73 09 R-3 009	Jib Crane	1.00	EA	5,648	1,586	362	72	95	732	8,496	8495.93
06 03 73 09 R-3 010	Handrail	25.00	LF	719	202	46	9	12	93	1,082	43.28
06 03 73 09 R-3 011	Metal Grate	176.00	SY	15,727	4,417	1,007	201	265	2,038	23,656	134.41
06 03 73 09 R-3 012	Backfill	200.00	CY	1,175	330	75	15	20	152	1,767	8.84
TOTAL	Stop-Log Str			57,172	16,057	3,661	731	965	7,407	85,994	
06 03 73 09 W-2	Flow Through Loc										
06 03 73 09 W-2 001	Excavation,	280.00	CY	28,000	7,864	1,793	358	473	3,627	42,115	150.41
06 03 73 09 W-2 002	Excavation,	870.00	CY	2,883	810	185	37	49	373	4,336	4.98
06 03 73 09 W-2 003	Cofferdam, E	2610.00	CY	25,557	7,178	1,637	327	431	3,311	38,440	14.73
06 03 73 09 W-2 004	Concrete, Re	32.00	CY	13,111	3,682	840	168	221	1,699	19,721	616.27
06 03 73 09 W-2 005	Riprap, 650	350.00	TON	6,115	1,718	392	78	103	792	9,198	26.28
06 03 73 09 W-2 006	Bedding Mate	90.00	TON	1,213	341	78	16	20	157	1,825	20.27
06 03 73 09 W-2 007	Sheet Pile R	260.00	SF	1,040	292	67	13	18	135	1,564	6.02
06 03 73 09 W-2 008	Dewatering			65,164	18,302	4,173	833	1,100	8,442	98,014	
06 03 73 09 W-2 009	Sluice Gates	2.00	EA	44,237	12,424	2,833	566	747	5,731	66,538	33269
06 03 73 09 W-2 010	Backfill Gra	650.00	CY	3,819	1,072	245	49	64	495	5,744	8.84
06 03 73 09 W-2 011	Electric Gag	1.00	EA	12,500	3,511	801	160	211	1,619	18,801	18801
06 03 73 09 W-2 012	Hydraulic Op	1.00	EA	13,000	3,651	833	166	219	1,684	19,554	19554
06 03 73 09 W-2 013	Cofferdam Mu	2930.00	CY	18,320	5,145	1,173	234	309	2,373	27,555	9.40
06 03 73 09 W-2 014	"C" Stone	830.00	TON	15,096	4,240	967	193	255	1,956	22,706	27.36
06 03 73 09 W-2 015	Grating, Fib	60.00	SF	977	275	63	12	16	127	1,470	24.50
06 03 73 09 W-2 016	Stop Logs 6"	1494.00	BF	6,117	1,718	392	78	103	792	9,200	6.16
06 03 73 09 W-2 017	Stop Log Bui			12,112	3,402	776	155	204	1,569	18,218	
06 03 73 09 W-2 018	Jib Crane			5,648	1,586	362	72	95	732	8,496	
06 03 73 09 W-2 019	Concrete Pip	220.00	LF	25,033	7,031	1,603	320	423	3,243	37,653	171.15
06 03 73 09 W-2 020	Signs, Infor			1,000	281	64	13	17	130	1,504	
06 03 73 09 W-2 021	Miscellaneou			2,500	702	160	32	42	324	3,760	

	QUANTY	UOM	DIRECT	FIELDMOB	HOME OFC	IOOC	BOND	PROFIT	TOTAL COST	UNIT
TOTAL Flow Through			303,443	85,224	19,433	3,879	5,121	39,312	456,413	
TOTAL Channels and			1,754,563	492,783	112,367	22,431	29,613	227,308	2,639,067	
06 03 73 11 Levees										
06 03 73 11 AB Bottomland Fores			87,800	0	0	0	0	0	87,800	
06 03 73 11 KB Hillside Sedimen			252,193	0	0	0	0	0	252,193	
06 03 73 11 KC Hillside Sedimen			151,316	0	0	0	0	0	151,316	
06 03 73 11 B-2 Riverside Levee,			17,011	4,778	1,089	217	287	2,204	25,587	
06 03 73 11 C-2 Riverside Levee,			171,117	48,060	10,959	2,188	2,888	22,169	257,380	
06 03 73 11 D-1 Lowland Sediment			74,398	20,895	4,765	951	1,256	9,638	111,902	
06 03 73 11 E-1 Lowland Sediment			39,549	11,108	2,533	506	667	5,124	59,486	
06 03 73 11 K-1 Hillside Sedimen			100,877	0	0	0	0	0	100,877	
06 03 73 11 L-2 Interior Levee B			7,733	2,172	495	99	131	1,002	11,632	
06 03 73 11 XXX Overflow Structu			179,562	50,431	11,500	2,296	3,031	23,263	270,081	
06 03 73 11 XXZ Boat Pullover			17,123	4,809	1,097	219	289	2,218	25,755	
TOTAL Levees			1,098,679	142,253	32,437	6,475	8,549	65,617	1,354,009	
06 03 73 13 Pumping Plant										
06 03 73 13 H-1 Pump in USFWS Mi										
06 03 73 13 H-1 001 44 CFS Pump	1.00	EA	22,124	6,214	1,417	283	373	2,866	33,278	33278
TOTAL Pump in USFW			22,124	6,214	1,417	283	373	2,866	33,278	
06 03 73 13 I-2 Pump in USFWS Lo										
06 03 73 13 I-2 001 15 CFS Porta	1.00	EA	19,017	5,341	1,218	243	321	2,464	28,604	28604
06 03 73 13 I-2 003 500 Gallon P	1.00	EA	12,000	3,370	769	153	203	1,555	18,049	18049
TOTAL Pump in USFW			31,017	8,711	1,986	397	523	4,018	46,653	
06 03 73 13 J-2 Pumps in State A										
06 03 73 13 J-2 001 90 CFS Perma	1.00	EA	80,624	22,644	5,163	1,031	1,361	10,445	121,269	121269
06 03 73 13 J-2 002 Portable Die	1.00	EA	40,000	11,234	2,562	511	675	5,182	60,165	60165
06 03 73 13 J-2 003 1,000 Gallon	1.00	EA	15,000	4,213	961	192	253	1,943	22,562	22562
06 03 73 13 J-2 004 42" Diameter	132.00	LF	9,571	2,688	613	122	162	1,240	14,396	1[illegible]
06 03 73 13 J-2 005 42" Diameter	1.00	EA	2,675	751	171	34	45	347	4,023	4023.29
06 03 73 13 J-2 006 6' High Fenc	70.00	LF	1,050	295	67	13	18	136	1,579	22.56
06 03 73 13 J-2 007 6' High and	1.00	EA	500	140	32	6	8	65	752	752.06
06 03 73 13 J-2 008 Concrete Pad	5.00	CY	1,500	421	96	19	25	194	2,256	451.23
06 03 73 13 J-2 009 30" Riprap	1700.00	TON	20,093	5,643	1,287	257	339	2,603	30,223	17.78
06 03 73 13 J-2 010 Excavation	120.00	CY	1,193	335	76	15	20	155	1,794	14.95

	QUANTY UOM	DIRECT	FIELDMOB	HOME OFC	IOOC	BOND	PROFIT	TOTAL COST	UNIT
06 03 73 13 J-2 011 Cofferdam, G	230.00 CY	2,860	803	183	37	48	370	4,301	18.70
06 03 73 13 J-2 012 Staff Gages	2.00 EA	3,500	983	224	45	59	453	5,264	2632.20
06 03 73 13 J-2 013 Pipe Bedding	75.00 TON	1,077	303	69	14	18	140	1,620	21.60
06 03 73 13 J-2 014 9" Bedding	550.00 TON	7,899	2,218	506	101	133	1,023	11,881	21.60
06 03 73 13 J-2 015 PZ27 Sheetpi	4224.00 LF'	105,600	29,659	6,763	1,350	1,782	13,681	158,835	37.60
TOTAL Pumps in Sta		293,142	82,331	18,774	3,748	4,948	37,977	440,919	
TOTAL Pumping Plan		346,283	97,257	22,177	4,427	5,845	44,862	520,850	
TOTAL Habitat and		3,199,525	732,293	166,982	33,333	44,006	337,788	4,513,926	
TOTAL Wildlife Fac		3,199,525	732,293	166,982	33,333	44,006	337,788	4,513,926	
TOTAL Fish and Wil		3,199,525	732,293	166,982	33,333	44,006	337,788	4,513,926	
30 Planning, Engineering and Des									
30 23 Constructn Contracts(s) Do									
30 23 01 Plans and Specification		350,000	0	0	0	0	0	350,000	
30 23 04 Environmental & Regulat		7,000	0	0	0	0	0	7,000	
30 23 07 Cost Estimates		20,000	0	0	0	0	0	20,000	
30 23 08 Miscellaneous		20,000	0	0	0	0	0	20,000	
30 23 09 Memorandum of Agreement		7,000	0	0	0	0	0	7,000	
30 23 10 Engineering During Cons		75,000	0	0	0	0	0	75,000	
30 23 14 Project Management		55,000	0	0	0	0	0	55,000	
TOTAL Constructn C	1.00 EA	534,000	0	0	0	0	0	534,000	534000
30 24 Value Engineerng Study		64,000	0	0	0	0	0	64,000	
30 26 Planning		820,000	0	0	0	0	0	820,000	
TOTAL Planning, En		1,418,000	0	0	0	0	0	1,418,000	
31 Construction Management									
31 23 Construction Contracts									
31 23 11 Supervision and Adminis									
31 23 11 01 Contract Administrat		100,000	0	0	0	0	0	100,000	
31 23 11 02 Benchmarks/Surveys		75,000	0	0	0	0	0	75,000	
31 23 11 03 Review Shop Drawings		50,000	0	0	0	0	0	50,000	
31 23 11 04 Inspection/QA		117,000	0	0	0	0	0	117,000	
31 23 11 05 Project Office		400,000	0	0	0	0	0	400,000	
31 23 11 06 Project Management		12,000	0	0	0	0	0	12,000	

	QUANTY UOM	DIRECT	FIELDMOB	HOME OFC	IOOC	BOND	PROFIT	TOTAL COST	UNIT
TOTAL Supervision		754,000	0	0	0	0	0	754,000	
TOTAL Construction		754,000	0	0	0	0	0	754,000	
TOTAL Construction		754,000	0	0	0	0	0	754,000	
TOTAL BATCHTOWN -		5,371,525	732,293	166,982	33,333	44,006	337,788	6,685,926	
Contingency								1,112,888	
TOTAL INCL OWNER COSTS								7,798,814	

** PROJECT DIRECT SUMMARY - Level 1 **

	QUANTY UOM	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 Fish and Wildlife Facilities		633,908	358,981	696,251	1,510,385	3,199,525	
30 Planning, Engineering and Design		0	0	0	1,418,000	1,418,000	
31 Construction Management		0	0	0	754,000	754,000	
TOTAL BATCHTOWN - (HREP)		633,908	358,981	696,251	3,682,385	5,371,525	
Field Office Overhead & MOB/DEMOB						732,293	
SUBTOTAL						6,103,818	
Home Office Overhead						166,982	
SUBTOTAL						6,270,800	
Interest on Operating Capital						33,333	
SUBTOTAL						6,304,133	
Bond						44,006	
SUBTOTAL						6,348,139	
Profit						337,788	
TOTAL INCL INDIRECTS						6,685,926	
Contingency						1,112,888	
TOTAL INCL OWNER COSTS						7,798,814	

** PROJECT DIRECT SUMMARY - Level 2 **

	QUANTY UOM	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 Fish and Wildlife Facilities							
06 03 Wildlife Facilities & Sanctuary		633,908	358,981	696,251	1,510,385	3,199,525	
TOTAL Fish and Wildlife Facilities		633,908	358,981	696,251	1,510,385	3,199,525	
30 Planning, Engineering and Design							
30 23 Constructn Contracts(s) Documnts	1.00 EA	0	0	0	534,000	534,000	534000
30 24 Value Engineerng Study		0	0	0	64,000	64,000	
30 26 Planning		0	0	0	820,000	820,000	
TOTAL Planning, Engineering and Design		0	0	0	1,418,000	1,418,000	
31 Construction Management							
31 23 Construction Contracts		0	0	0	754,000	754,000	
TOTAL Construction Management		0	0	0	754,000	754,000	
TOTAL BATCHTOWN - (HREP)		633,908	358,981	696,251	3,682,385	5,371,525	
Field Office Overhead & MOB/DEMOB						732,293	
SUBTOTAL						6,103,818	
Home Office Overhead						166,982	
SUBTOTAL						6,270,800	
Interest on Operating Capital						33,333	
SUBTOTAL						6,304,133	
Bond						44,006	
SUBTOTAL						6,348,139	
Profit						337,788	
TOTAL INCL INDIRECTS						6,685,926	
Contingency						1,112,888	
TOTAL INCL OWNER COSTS						7,798,814	

	QUANTY	UOM	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 Fish and Wildlife Facilities								
06 03 Wildlife Facilities & Sanctuary								
06 03 73 Habitat and Feeding Facilities								
06 03 73 09 Channels and Canals								
06 03 73 09 FB Dredging, State Area (fisheries)			3,019	4,470	0	53,722	61,212	
06 03 73 09 FC Dredging, USFWS Lower(fisheries)			3,019	4,470	0	53,722	61,212	
06 03 73 09 F-1 Dredging,USFWS Middle(fisheries)			24,152	35,760	0	429,780	489,692	
06 03 73 09 G-1 Dredging, State Area			1,294	451	4,480	154,860	161,085	
06 03 73 09 M-3 Exterior Water Control, USFWS								
06 03 73 09 M-3 001 Excavation	200.00	CY	967	533	0	0	1,500	7.50
06 03 73 09 M-3 002 6" Minus Stone	75.00	TON	98	286	356	270	1,011	13.48
06 03 73 09 M-3 003 3" Minus Stone	25.00	TON	231	40	119	90	481	19.23
06 03 73 09 M-3 004 Geogrid	136.00	SY	183	17	245	0	444	3.27
06 03 73 09 M-3 005 Geotextile	136.00	SY	76	4	136	0	216	1.59
06 03 73 09 M-3 006 Cofferdam	775.00	CY	4,967	3,725	0	0	8,691	11.21
06 03 73 09 M-3 007 Concrete, Reinforced	50.00	CY	10,777	350	8,233	0	19,360	387.19
06 03 73 09 M-3 008 Stop Logs	72.00	LF	1,404	201	594	0	2,199	30.55
06 03 73 09 M-3 009 Jib Crane	1.00	EA	945	204	4,500	0	5,648	5648.45
06 03 73 09 M-3 010 Handrail	25.00	LF	97	6	616	0	719	28.78
06 03 73 09 M-3 011 Metal Grate	176.00	SY	3,491	214	12,023	0	15,727	89.36
06 03 73 09 M-3 012 Backfill	200.00	CY	1,139	36	0	0	1,175	5.87
TOTAL Exterior Water Control, USFWS			24,374	5,616	26,822	360	57,172	
06 03 73 09 0-6 Exterior Water Control, State								
06 03 73 09 0-6 001 2-8' Stop Log Structure	1.00	EA	39,015	7,372	46,334	720	93,441	93441
06 03 73 09 0-6 002 4-8' Stop Log Structure	1.00	EA	76,555	13,641	92,668	1,440	184,304	184304
06 03 73 09 0-6 003 1-8' Stop Log Structure	4.00	EA	97,465	22,466	107,286	1,440	228,658	57164
TOTAL Exterior Water Control, State			213,036	43,479	246,288	3,600	506,403	
06 03 73 09 Q-2 Interior Water Control Between								
06 03 73 09 Q-2 001 Excavation	200.00	CY	967	533	0	0	1,500	7.50
06 03 73 09 Q-2 002 6" Minus Stone	75.00	TON	98	286	356	270	1,011	13.48
06 03 73 09 Q-2 003 3" Minus Stone	25.00	TON	231	40	119	90	481	19.23
06 03 73 09 Q-2 004 Geogrid	136.00	SY	183	17	245	0	444	3.27
06 03 73 09 Q-2 005 Geotextile	136.00	SY	76	4	136	0	216	1.59
06 03 73 09 Q-2 006 Cofferdam	775.00	CY	4,967	3,725	0	0	8,691	11.21
06 03 73 09 Q-2 007 Concrete, Reinforced	50.00	CY	10,777	350	8,233	0	19,360	387.19
06 03 73 09 Q-2 008 Stop Logs	72.00	LF	1,404	201	594	0	2,199	30.55

		QUANTY	UOM	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 09 Q-2 009	Jib Crane	1.00	EA	945	204	4,500	0	5,648	5648.45
06 03 73 09 Q-2 010	Handrail	25.00	LF	97	6	616	0	719	28.78
06 03 73 09 Q-2 011	Metal Grate	176.00	SY	3,491	214	12,023	0	15,727	89.36
06 03 73 09 Q-2 012	Backfill	200.00	CY	1,139	36	0	0	1,175	5.87
	TOTAL Interior Water Control Between			24,374	5,616	26,822	360	57,172	
06 03 73 09 R-3	Stop-Log Structure on Exterior								
06 03 73 09 R-3 001	Excavation	200.00	CY	967	533	0	0	1,500	7.50
06 03 73 09 R-3 002	6" Minus Stone	75.00	TON	98	286	356	270	1,011	13.48
06 03 73 09 R-3 003	3" Minus Stone	25.00	TON	231	40	119	90	481	19.23
06 03 73 09 R-3 004	Geogrid	136.00	SY	183	17	245	0	444	3.27
06 03 73 09 R-3 005	Geotextile	136.00	SY	76	4	136	0	216	1.59
06 03 73 09 R-3 006	Cofferdam	775.00	CY	4,967	3,725	0	0	8,691	11.21
06 03 73 09 R-3 007	Concrete, Reinforced	50.00	CY	10,777	350	8,233	0	19,360	387.19
06 03 73 09 R-3 008	Stop Logs	72.00	LF	1,404	201	594	0	2,199	30.55
06 03 73 09 R-3 009	Jib Crane	1.00	EA	945	204	4,500	0	5,648	5648.45
06 03 73 09 R-3 010	Handrail	25.00	LF	97	6	616	0	719	28.78
06 03 73 09 R-3 011	Metal Grate	176.00	SY	3,491	214	12,023	0	15,727	89.36
06 03 73 09 R-3 012	Backfill	200.00	CY	1,139	36	0	0	1,175	5.87
	TOTAL Stop-Log Structure on Exterior			24,374	5,616	26,822	360	57,172	
06 03 73 09 W-2	Flow Through Lock 25 Spillway								
06 03 73 09 W-2 001	Excavation, Rock	280.00	CY	0	0	0	28,000	28,000	100.00
06 03 73 09 W-2 002	Excavation, Earth	870.00	CY	761	2,122	0	0	2,883	3.31
06 03 73 09 W-2 003	Cofferdam, Earth (place/remove)	2610.00	CY	13,776	11,781	0	0	25,557	9.79
06 03 73 09 W-2 004	Concrete, Reinforced	32.00	CY	7,385	235	5,492	0	13,111	409.72
06 03 73 09 W-2 005	Riprap, 650 Lb. Topsize	350.00	TON	1,556	534	2,275	1,750	6,115	17.47
06 03 73 09 W-2 006	Bedding Material	90.00	TON	118	344	428	324	1,213	13.48
06 03 73 09 W-2 007	Sheet Pile Removal (existing)	260.00	SF	0	0	0	1,040	1,040	4.00
06 03 73 09 W-2 008	Dewatering			51,788	13,376	0	0	65,164	
06 03 73 09 W-2 009	Sluice Gates, 54" Diameter	2.00	EA	5,219	1,450	37,569	0	44,237	22119
06 03 73 09 W-2 010	Backfill Gravelly Clay	650.00	CY	3,700	118	0	0	3,819	5.87
06 03 73 09 W-2 011	Electric Gaging Station	1.00	EA	0	0	0	12,500	12,500	12500
06 03 73 09 W-2 012	Hydraulic Operator	1.00	EA	0	0	0	13,000	13,000	13000
06 03 73 09 W-2 013	Cofferdam Mucking	2930.00	CY	3,641	14,679	0	0	18,320	6.25
06 03 73 09 W-2 014	"C" Stone	830.00	TON	1,089	4,462	5,395	4,150	15,096	18.19
06 03 73 09 W-2 015	Grating, Fiberglass	60.00	SF	97	2	879	0	977	16.29
06 03 73 09 W-2 016	Stop Logs 6" x 10"	1494.00	BF	4,678	579	450	410	6,117	4.09
06 03 73 09 W-2 017	Stop Log Building 8' x 8'			4,533	1,157	6,422	0	12,112	
06 03 73 09 W-2 018	Jib Crane			945	204	4,500	0	5,648	
06 03 73 09 W-2 019	Concrete Pipe, 54" Diameter	220.00	LF	7,149	1,786	16,097	0	25,033	113.79
06 03 73 09 W-2 020	Signs, Information			0	0	0	1,000	1,000	
06 03 73 09 W-2 021	Miscellaneous Metals			0	0	0	2,500	2,500	

	QUANTY	UOM	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
TOTAL Flow Through Lock 25 Spillway			106,433	52,830	79,506	64,674	303,443	
TOTAL Channels and Canals			424,076	158,310	410,738	761,439	1,754,563	
06 03 73 11 Levees								
06 03 73 11 AB Bottomland Forest Habitat			0	0	0	87,800	87,800	
06 03 73 11 KB Hillside Sediment Control			0	0	0	252,193	252,193	
06 03 73 11 KC Hillside Sediment Control			0	0	0	151,316	151,316	
06 03 73 11 B-2 Riverside Levee, USFWS Lower			6,385	5,578	3,320	1,728	17,011	
06 03 73 11 C-2 Riverside Levee, State Area			86,776	68,501	15,840	0	171,117	
06 03 73 11 D-1 Lowland Sediment Trap, USFWS			33,864	36,439	4,095	0	74,398	
06 03 73 11 E-1 Lowland Sediment Trap, State			18,699	17,395	3,455	0	39,549	
06 03 73 11 K-1 Hillside Sediment Control			0	0	0	100,877	100,877	
06 03 73 11 L-2 Interior Levee Between USFWS			3,858	2,676	1,200	0	7,733	
06 03 73 11 XXX Overflow Structure, State-			41,503	57,851	43,838	36,370	179,562	
06 03 73 11 XXZ Boat Pullover			820	2,044	12,198	2,062	17,123	
TOTAL Levees			191,905	190,484	83,944	632,346	1,098,679	
06 03 73 13 Pumping Plant								
06 03 73 13 H-1 Pump in USFWS Middle Pool								
06 03 73 13 H-1 001 44 CFS Pump	1.00	EA	3,732	1,892	15,000	1,500	22,124	22124
TOTAL Pump in USFWS Middle Pool			3,732	1,892	15,000	1,500	22,124	
06 03 73 13 I-2 Pump in USFWS Lower Pool								
06 03 73 13 I-2 001 15 CFS Portable, Trailer Mounted	1.00	EA	0	0	19,017	0	19,017	19017
06 03 73 13 I-2 003 500 Gallon Portable Fuel Tank	1.00	EA	0	0	12,000	0	12,000	12000
TOTAL Pump in USFWS Lower Pool			0	0	31,017	0	31,017	
06 03 73 13 J-2 Pumps in State Area, 90 CFS								
06 03 73 13 J-2 001 90 CFS Permanently Mtd Pump	1.00	EA	3,732	1,892	75,000	0	80,624	80624
06 03 73 13 J-2 002 Portable Diesel Engine Drive	1.00	EA	0	0	40,000	0	40,000	40000
06 03 73 13 J-2 003 1,000 Gallon Portable Fuel Tank	1.00	EA	0	0	15,000	0	15,000	15000
06 03 73 13 J-2 004 42" Diameter Steel Pipe	132.00	LF	1,199	438	7,934	0	9,571	72.51
06 03 73 13 J-2 005 42" Diameter Flap Gate	1.00	EA	431	120	2,124	0	2,675	2674.85
06 03 73 13 J-2 006 6' High Fence	70.00	LF	0	0	1,050	0	1,050	15.00
06 03 73 13 J-2 007 6' High and 10' Wide Fence Gate	1.00	EA	0	0	500	0	500	500.00
06 03 73 13 J-2 008 Concrete Pad & Curb	5.00	CY	0	0	0	1,500	1,500	300.00
06 03 73 13 J-2 009 30" Riprap	1700.00	TON	5,113	1,755	7,475	5,750	20,093	11.82
06 03 73 13 J-2 010 Excavation	120.00	CY	315	878	0	0	1,193	9.94

	QUANTY UOM	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 13 J-2 011 Cofferdam, Gravelly Clay	230.00 CY	1,697	1,163	0	0	2,860	12.43
06 03 73 13 J-2 012 Staff Gages	2.00 EA	0	0	3,500	0	3,500	1750.00
06 03 73 13 J-2 013 Pipe Bedding Material	75.00 TON	205	246	356	270	1,077	14.36
06 03 73 13 J-2 014 9" Bedding	550.00 TON	1,503	1,804	2,613	1,980	7,899	14.36
06 03 73 13 J-2 015 PZ27 Sheetpile Retaining Wall	4224.00 LF	0	0	0	105,600	105,600	25.00
TOTAL Pumps in State Area, 90 CFS		14,195	8,296	155,551	115,100	293,142	
TOTAL Pumping Plant		17,927	10,188	201,568	116,600	346,283	
TOTAL Habitat and Feeding Facilities		633,908	358,981	696,251	1,510,385	3,199,525	
TOTAL Wildlife Facilities & Sanctuary		633,908	358,981	696,251	1,510,385	3,199,525	
TOTAL Fish and Wildlife Facilities		633,908	358,981	696,251	1,510,385	3,199,525	
30 Planning, Engineering and Design							
30 23 Constructn Contracts(s) Documnts							
30 23 01 Plans and Specifications (P&S)		0	0	0	350,000	350,000	
30 23 04 Environmental & Regulatory		0	0	0	7,000	7,000	
30 23 07 Cost Estimates		0	0	0	20,000	20,000	
30 23 08 Miscellaneous		0	0	0	20,000	20,000	
30 23 09 Memorandum of Agreement		0	0	0	7,000	7,000	
30 23 10 Engineering During Construction		0	0	0	75,000	75,000	
30 23 14 Project Management		0	0	0	55,000	55,000	
TOTAL Constructn Contracts(s) Documnts	1.00 EA	0	0	0	534,000	534,000	534000
30 24 Value Engineerng Study		0	0	0	64,000	64,000	
30 26 Planning		0	0	0	820,000	820,000	
TOTAL Planning, Engineering and Design		0	0	0	1,418,000	1,418,000	
31 Construction Management							
31 23 Construction Contracts							
31 23 11 Supervision and Administration							
31 23 11 01 Contract Administration		0	0	0	100,000	100,000	
31 23 11 02 Benchmarks/Surveys		0	0	0	75,000	75,000	
31 23 11 03 Review Shop Drawings		0	0	0	50,000	50,000	
31 23 11 04 Inspection/QA		0	0	0	117,000	117,000	
31 23 11 05 Project Office		0	0	0	400,000	400,000	
31 23 11 06 Project Management		0	0	0	12,000	12,000	

	QUANTY UOM	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
TOTAL Supervision and Administration		0	0	0	754,000	754,000	
TOTAL Construction Contracts		0	0	0	754,000	754,000	
TOTAL Construction Management		0	0	0	754,000	754,000	
TOTAL BATCHTOWN - (HREP)		633,908	358,981	696,251	3,682,385	5,371,525	
Field Office Overhead & MOB/DEMOB						732,293	
SUBTOTAL						6,103,818	
Home Office Overhead						166,982	
SUBTOTAL						6,270,800	
Interest on Operating Capital						33,333	
SUBTOTAL						6,304,133	
Bond						44,006	
SUBTOTAL						6,348,139	
Profit						337,788	
TOTAL INCL INDIRECTS						6,685,926	
Contingency						1,112,888	
TOTAL INCL OWNER COSTS						7,798,814	

0 01. Prime Contractor		QUANTY UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT

0 01. Prime Contractor

$$\text{Interest on Operating Capital} = \frac{(5{,}000{,}000) * (0.08) * (24)}{(24) * (12)}$$

= $33,333

0 01 0. FOOH and Mob/Demob

0 01 0 01. Field Office Overhead

		QUANTY UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
USR	Supervisor	24.00 MOS		0.00	96,000	0	0	0	96,000	4000.00
USR	Quality Control Inspector Quantity = 3 Each	72.00 MOS		0.00	216,000	0	0	0	216,000	3000.00
USR	Trailer	24.00 MOS		0.00	0	8,400	0	0	8,400	350.00
USR	Utilities(phone,elec,water ,etc)	24.00 MOS		0.00	0	6,000	0	0	6,000	250.00
USR	Pickup Truck Quantity = 3 Each	72.00 MOS		0.00	0	18,000	0	0	18,000	250.00
USR	Safety Sign	1.00 LS		0.00	0	0	0	300	300	300.00
USR	Safety Equipment	24.00 MOS		0.00	0	24,000	0	0	24,000	1000.00
USR	Project Sign	1.00 LS		0.00	0	0	0	300	300	300.00
USR	Sanitary Facilities	24.00 MOS		0.00	0	10,800	0	0	10,800	450.00
USR	Environmental Protection	1.00 LS		0.00	0	0	0	1,500	1,500	1500.00
TOTAL	Field Office Overhead				312,000	67,200	0	2,100	381,300	

0 01 0 02. Mob/Demob Dredging

Assume one contract for all dredging.

					LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
TOTAL	Mob/Demob Dredging				0	0	0	300,000	300,000	

0 01. Prime Contractor QUANTY UOM CREW ID OUTPUT LABOR EQUIPMNT MATERIAL OTHER TOTAL COST UNIT

0 01 0 03. Mob/Demob General

Assume demobilization to be 50% of mobilization costs. Assume a distance of 100 miles. Assume that enough equipment is mobilized to enable the contractor to work at multiple sites simultaneously. Equipment is hauled to the site. Only load/unload time will be charged to the hauled equipment. All trucks and truck drivers will be driven at the rate of 50 mph (2 hour/truck). Only one marine crew will mobilized to the site.

```
   load        2 hour
   transport   3 hour
   unload      2 hour
   return      3 hour
              ---------
              10 hours/roundtrip
```

There will be 23 trips, which results in 230 hours for the truck/lowboy combo, laborer, and truck driver. An operator will be used for load/unload time (23 trips * 4 hours/trip = 92 hours).

Take into account demobilization.

```
   230 * 1.5 = 345 hours => truck/lowboy combo, laborer, & truck driver
    92 * 1.5 = 138 hours => operator
     4 * 1.5 =   6 hours => each piece of hauled equipment
     3 * 1.5 = 4.5 hours => drive each truck to site with truck driver
```

Marine crew trip time:

```
   load                        4 hours
   travel (40 miles @ 4 mph)  10 hours
   lock (thru one lock)        2 hours
                              ----------
                              16 hours
```

Take into account demobilization:

16 hours * 1.5 = 24 hours => crane, boat, 2-barges, operator, 2-deckhands

		QUANTY UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
MIL	Outside Laborer (Semi-Skilled)	345.00 HR	X-LABORER	1.00	9,540	0	0	0	9,540	27.65
MIL	Outside Truck Dr. Heavy	345.00 HR	X-TRKDVRHV	1.00	9,510	0	0	0	9,510	27.57
MIL	TRLR,LOWBOY, 50T, 3 AXLE (ADD TOWING TRUCK)	345.00 HR	T45XX016	1.00	0	2,576	0	0	2,576	7.47
MIL	TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	345.00 HR	T50F0014	1.00	0	8,011	0	0	8,011	23.22
MIL	Outside Equip. Op. Heavy	138.00 HR	X-EQOPRHVY	1.00	4,525	0	0	0	4,525	32.79
MIL	ROLLER,WK-BH,VIB DBL,0.9T, 23.6"W Quantity = 3 each	18.00 HR	C10B0011	1.00	0	107	0	0	107	5.93
UPB	CONC VIBRATOR, 2.50D, EL,HI-FREQ (ADD 2KV GENERATOR) Quantity = 6 each	36.00 HR	C65WC002	1.00	0	58	0	0	58	1.61
UPB	GENERATOR, 5.5 KW, 120/240 V,PORT Quantity = 3 each	18.00 HR	G10H0004	1.00	0	30	0	0	30	1.
MIL	HYD EXCAV,CRWLR, 1.00CY BKT,LONG Quantity = 3 each	18.00 HR	H25CA004	1.00	0	768	0	0	768	42.66
MIL	LDR,FE, CRWLR, 2.00 CY Quantity = 3 each	18.00 HR	L35CA005	1.00	0	756	0	0	756	41.99

0 01. Prime Contractor		QUANTY UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
MIL	LDR,FE, WH, 2.00 CY, ARTIC , 926E Quantity = 3 each	18.00 HR	L40CA003	1.00	0	448	0	0	448	24.88
MIL	PUMP,CENTRF,DW,4"D, 485GPM /60'HD Quantity = 6 each	36.00 HR	P60GF003	1.00	0	204	0	0	204	5.67
MIL	ROLLER,VIB,DD,S/P,17.1T, 8 4"W Quantity = 3 each	18.00 HR	R45DY004	1.00	0	1,018	0	0	1,018	56.55
UPB	BLADE, ANGLE, HYDR, D-6 (ADD D-6 TRACTOR DOZER) Quantity = 3 each	18.00 HR	T10CA010	1.00	0	78	0	0	78	4.32
MIL	BLADE, ANGLE, HYDR, D-8 (ADD D-8 TRACTOR DOZER)	6.00 HR	T10CA018	1.00	0	44	0	0	44	7.41
MIL	ROTARY HOE, 120" WIDE ROTE RRA (ADD 50 PTO HP TRACTOR) Quantity = 3 each	18.00 HR	T10LE003	1.00	0	27	0	0	27	1.49
MIL	DOZER,CWLR, D-6H,LGP (ADD BLADE & ATTACHMENTS) Quantity = 3 each	18.00 HR	T15CA011	1.00	0	894	0	0	894	49.64
UPB	DOZER,CWLR, D-8N,PS (ADD BLADE & ATTACHMENTS)	6.00 HR	T15CA016	1.00	0	434	0	0	434	72.25
MIL	WELDER, 250 AMP, W/1 AXLE TRLR Quantity = 3 each	18.00 HR	W35XX001	1.00	0	55	0	0	55	3.07
UPB	MISC. POWER TOOLS Quantity = 9 each	54.00 HR	XMIXX010	1.00	0	346	0	0	346	6.40
UPB	SMALL TOOLS Quantity = 9 each	54.00 HR	XMIXX020	1.00	0	85	0	0	85	1.57
MIL	CRANE,HYD,S/P,RT,4WD, 9T/4 4'BOOM	4.50 HR	C75BD002	1.00	0	115	0	0	115	25.47
MIL	Outside Truck Dr. Heavy	4.50 HR	X-TRKDVRHV	1.00	124	0	0	0	124	27.57
MIL	CRANE,HYD,S/P,RT,4WD,22T/7 2'BOOM	4.50 HR	C75PH004	1.00	0	183	0	0	183	40.67
MIL	Outside Truck Dr. Heavy	4.50 HR	X-TRKDVRHV	1.00	124	0	0	0	124	27.57
UPB	DRILL,R-BLASTH, 6.75"-9.88 ",TRK (ADD DRILL STEEL, BITS,&STR BAR)	4.50 HR	D35R0002	1.00	0	473	0	0	473	105.02
MIL	Outside Truck Dr. Heavy	4.50 HR	X-TRKDVRHV	1.00	124	0	0	0	124	27.57
UPB	REAR DUMP BODY, 12.0CY (ADD 36,000 GVW TRUCK)	13.50 HR	T40XX010	1.00	0	38	0	0	38	2.82
MIL	TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	13.50 HR	T50F0013	1.00	0	308	0	0	308	22.84
MIL	Outside Truck Dr. Heavy	13.50 HR	X-TRKDVRHV	1.00	372	0	0	0	372	27.57
MIL	FLATBED, 8'x 12.0' (ADD TRUCK)	4.50 HR	T40XX014	1.00	0	3	0	0	3	0.59
MIL	TRK,HWY,10,00GVW,4X2, 1T-P ICKUP	4.50 HR	T50GM008	1.00	0	40	0	0	40	8.81
MIL	Outside Truck Dr. Heavy	4.50 HR	X-TRKDVRHV	1.00	124	0	0	0	124	27.57
MIL	WATER TANK, 2000 GAL (ADD 28,000 GVW TRUCK)	4.50 HR	T40XX031	1.00	0	14	0	0	14	3.04

	0 01. Prime Contractor	QUANTY UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
MIL	TRK,HWY,10,000GVW,4X4, 1T-PICKUP	4.50 HR	T50GM009	1.00	0	42	0	0	42	9.39
MIL	Outside Truck Dr. Heavy	4.50 HR	X-TRKDVRHV	1.00	124	0	0	0	124	27.57
MIL	TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	4.50 HR	T50KE003	1.00	0	151	0	0	151	33.66
MIL	Outside Truck Dr. Heavy	4.50 HR	X-TRKDVRHV	1.00	124	0	0	0	124	27.57
MIL	Outside Equip. Op. Heavy	24.00 HR	X-EQOPRHVY	1.00	787	0	0	0	787	32.79
MIL	Outside Laborer (Semi-Skilled) Quantity = 2 each	48.00 HR	X-LABORER	1.00	1,327	0	0	0	1,327	27.65
MIL	BUCKET,DRAGLINE, 4.5CY, LT WT (CRANE ATTACHMENT& ADD TEETH COS	24.00 HR	B35HE009	1.00	0	93	0	0	93	3.89
MIL	WORK BARGE-S,MED DUTY,50'X 14'X4'	24.00 HR	M10MZ007	1.00	0	98	0	0	98	4.09
UPB	FLOATING CRANE, 150T, 250FT BOOM 250ft Boom	24.00 HR	XX0XX001	1.00	0	4,636	0	0	4,636	193.18
UPB	TUG BOAT, 500 TO 800 HP	24.00 HR	XX0XX002	1.00	0	1,528	0	0	1,528	63.68
UPB	DREDGE BARGE, 500 TO 800 TON	24.00 HR	XX0XX006	1.00	0	529	0	0	529	22.03
	TOTAL Mob/Demob General				26,806	24,187	0	0	50,993	
	TOTAL FOOH and Mob/Demob				338,806	91,387	0	302,100	732,293	

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06. Fish and Wildlife Facilities										
06 03. Wildlife Facilities & Sanctuary										
06 03 73. Habitat and Feeding Facilities										
06 03 73 09. Channels and Canals										
06 03 73 09 FB. Dredging, State Area (fisheries) Reference is made to Stump Lake-Item II, which had a similar item and quantity of work. Mobilization/demobilization is included in the excavation item. The disposal portion consists of the land based equipment to distribute the material over the designated area. Deepening of existing shallow water areas to facilitate dewatering, water flow, and to provide access for fish prior to winter stress periods, and to connect the channel from "Big Hole" to the Lower Pool boundary (measure FC-1) with the deeper channels in the State-Managed Area.										
USR PM Excavation	12350	CY		0.00	0	0	0	53,722	53,722	4.35
USR PM Disposal, 3 Feet High	5.00	ACR	Z4EMBD60PR	0.05	3,019	4,470	0	0	7,489	1497.80
TOTAL Dredging, State Area (fish					3,019	4,470	0	53,722	61,212	
06 03 73 09 FC. Dredging, USFWS Lower(fisheries) Reference is made to Stump Lake-Item II, which had a similar item and quantity of work. Mobilization/demobilization is included in the excavation item. The disposal portion consists of the land based equipment to distribute the material over the designated area. Deepening of existing shallow water areas to facilitate dewatering, water flow, and to provide refuge for fish during winter stress periods, and to connect "Big Hole" with the fish passage and water control structure between the USFWS Lower Pool and the State-Managed Area.										
USR PM Excavation	12350	CY		0.00	0	0	0	53,722	53,722	4.35
USR PM Disposal, 3 Feet High	5.00	ACR	Z4EMBD60PR	0.05	3,019	4,470	0	0	7,489	1497.80
TOTAL Dredging, USFWS Lower(fish					3,019	4,470	0	53,722	61,212	

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 09 F-1. Dredging,USFWS Middle(fisheries)										
Reference is made to Stump Lake-Item II, which had a similar item and quantity of work. Mobilization/demobilization is included in the excavation item. The disposal portion consists of the land based equipment to distribute the material over the designated area.										
Deepening of existing shallow water areas to facilitate dewatering, water flow, and to provide refuge for fish during winter stress periods. This dredging will reach from the proposed concrete stop-log water control structure ar "Watson Lake," run through the Middle Pool, and terminate at the location of the existing 44 cfs pump station and the proposed 8 foot wide concrete stop-log structure.										
USR PM Excavation	98800	CY		0.00	0	0	0	429,780	429,780	4.35
USR PM Disposal, 3 Feet High	40.00	ACR	Z4EMBD60PR	0.05	24,152	35,760	0	0	59,912	1497.80
TOTAL Dredging,USFWS Middle(fish					24,152	35,760	0	429,780	489,692	
06 03 73 09 G-1. Dredging, State Area										
Reference is made to Stump Lake-Item II, which had a similar item and quantity of work. Mobilization/demobilization is included in the excavation item. The disposal portion consists of the land based equipment to distribute the material over the designated area.										
Deepening of existing shallow water areas to facilitate dewatering, water flow to the proposed water control structure through the L&D No. 25 overflow structure.										
USR PM Excavation	35600	CY		0.00	0	0	0	154,860	154,860	4.35
USR PM Seeding	5.60	ACR	Z4TURFHYDR	0.50	1,294	451	0	0	1,745	311.69
M USR PM Seeding Material	5.60	ACR		0.00	0	0	4,480	0	4,480	800.00
TOTAL Dredging, State Area					1,294	451	4,480	154,860	161,085	
06 03 73 09 M-3. Exterior Water Control, USFWS Middle Pool, 1-8' Wide Concrete Stop-Log Structure										
06 03 73 09 M-3 001. Excavation										
USR PM Excavation	200.00	CY	Z4EMBSTRUC	25.00	705	145	0	0	850	4.25
USR PM Excavation, Shaping	200.00	CY	Z4EMBD60PR	25.00	262	388	0	0	651	3.25
TOTAL Excavation	200.00	CY			967	533	0	0	1,500	7.50
06 03 73 09 M-3 002. 6" Minus Stone										
USR PM 6" Stone	75.00	TON	Z3PL9903B	25.00	98	286	356	270	1,011	13.48
Assume a 20 mile haul at $0.18/ton-mile => $3.60/ton.										
TOTAL 6" Minus Stone	75.00	TON			98	286	356	270	1,011	13.48

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 09 M-3 003. 3" Minus Stone										
USR PM 3" Stone	25.00	TON	Z4EMBSTRBK	12.50	231	40	119	90	481	19.23
Assume a 20 mile haul at $0.18/ton-mile => $3.60/ton										
TOTAL 3" Minus Stone	25.00	TON			231	40	119	90	481	19.23
06 03 73 09 M-3 004. Geogrid										
L HTW PM Biaxial, 13.1' x 164' Roll s	1224.00	SF	USKCF	1500.00	183	17	245	0	444	0.36
Tensile Modulus = 18,500 #/SF										
TOTAL Geogrid	136.00	SY			183	17	245	0	444	3.27
06 03 73 09 M-3 005. Geotextile										
CIV PM Geotextile Fabric, 90 Mils Thick	136.00	SY	ULABJ	150.00	76	4	136	0	216	1.59
Non-Woven Polypropylene										
TOTAL Geotextile	136.00	SY			76	4	136	0	216	1.59
06 03 73 09 M-3 006. Cofferdam										
USR PM Excavation and Embankment	775.00	CY	Z4EMBPLAC1	50.00	1,445	1,492	0	0	2,937	3.79
USR PM Dewatering	40.00	HR	Z3LEVEE09	1.00	2,158	557	0	0	2,715	67.88
USR PM Degrade	775.00	CY	Z4EMBFEDMP	100.00	1,364	1,675	0	0	3,039	3.92
TOTAL Cofferdam	775.00	CY			4,967	3,725	0	0	8,691	11.21
06 03 73 09 M-3 007. Concrete, Reinforced										
USR PM Purchase Redi-Mix	50.00	CY		0.00	0	0	3,400	0	3,400	68.00
MIL PM Int Wall Form,Plywd 8-16', 1 Use	1000.00	SF	ACARL	33.75	4,050	97	1,750	0	5,897	5.90
(2.4 M to 4.8 M) High										
B MIL PM Pour Conc Walls,12"Tk, Dir Chute	50.00	CY	ALABE	5.00	1,694	59	0	0	1,753	35.06
(31cm) 3000 PSI Conc										
MIL PM Conc Curing, Sprayed Membr ane	20.00	CSF	ULABB	11.88	117	1	83	0	201	10.05
Curing Compound										
USR PM Additional Crew,Assist w/P lacing	50.00	CY	Z1EARTH08	5.00	881	157	0	0	1,038	20.75
B MIL PM Gr 60 Resteel,Bm,Clmn,Wall ,#7-Up	5.00	TON	SIWRC	0.15	4,035	36	3,000	0	7,071	1414.21
TOTAL Concrete, Reinforced	50.00	CY			10,777	350	8,233	0	19,360	387.19

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 09 M-3 008. Stop Logs										
USR PM 8" x 8" Timbers	72.00	LF		0.00	0	0	144	0	144	2.00
USR PM Miscellaneous Metals	300.00	LBS		0.00	0	0	450	0	450	1.50
USR PM Prepare 9 Each Timbers	9.00	EA	Z4STPLGPRP	1.00	1,052	99	0	0	1,151	127.89
USR PM Trial Stack	4.00	HR	Z4STPLGSTK	1.00	352	102	0	0	454	113.56
TOTAL Stop Logs	72.00	LF			1,404	201	594	0	2,199	30.55
06 03 73 09 M-3 009. Jib Crane Assume 8 hours to install.										
USR PM Jib Crane	1.00	EA		0.00	0	0	4,500	0	4,500	4500.00
MIL PM Outside Carpenter	8.00	HR	X-CARPNTER	1.00	225	0	0	0	225	28.10
MIL PM Outside Carpenter	8.00	HR	X-CARPNTER	1.00	225	0	0	0	225	28.10
MIL PM Outside Equip. Op. Heavy	8.00	HR	X-EQOPRHVY	1.00	262	0	0	0	262	32.79
MIL PM Outside Carpenter-Foreman	8.00	HR	X-CARPNTER	1.00	233	0	0	0	233	29.10
MIL PM CRANE,HYD,S/P,RT,4WD, 9T/4 4'BOOM	8.00	HR	C75BD002	1.00	0	204	0	0	204	25.47
TOTAL Jib Crane	1.00	EA			945	204	4,500	0	5,648	5648.45
06 03 73 09 M-3 010. Handrail										
MIL PM 2"D(51mm)Welded Pipe Hdrl, 2-Rail 3'H (.92M)w/Shop Paint,Stair Mtd	25.00	LF	SIWSC	31.88	97	6	616	0	719	28.78
TOTAL Handrail	25.00	LF			97	6	616	0	719	28.78
06 03 73 09 M-3 011. Metal Grate										
MIL PM 1-3/4"x3/16"Galv Steel Gra ting Welded Steel,12.5 #/SF(2 Oz /SF)	1584.00	SF	SIWSC	56.25	3,491	214	12,023	0	15,727	9.93
TOTAL Metal Grate	176.00	SY			3,491	214	12,023	0	15,727	89.36
06 03 73 09 M-3 012. Backfill										
USR PM Compact Backfill w/Vib Pla te Around Structures and Trenches	200.00	CY	CLACC	14.75	1,139	36	0	0	1,175	5.87
TOTAL Backfill	200.00	CY			1,139	36	0	0	1,175	5.87
TOTAL Exterior Water Control, US					24,374	5,616	26,822	360	57,172	

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 09 0-6. Exterior Water Control, State Area, 10-8' Wide Concrete Stop-Logs. Four 1-8' wide structure, one 2-8' wide structure, and one 4-8' wide structure. For details of the associated costs, please see account 06 03 73 09 M-3.										
06 03 73 09 0-6 001. 2-8' Stop Log Structure										
USR PM Excavation	300.00	CY		0.00	1,452	798	0	0	2,250	7.50
USR PM 6" Minus Stone	150.00	TON		0.00	198	572	713	540	2,022	13.48
USR PM 3" Minus Stone	50.00	TON		0.00	463	82	238	180	962	19.23
USR PM Geogrid	200.00	SY		0.00	270	24	360	0	654	3.27
USR PM Geotextile	200.00	SY		0.00	112	6	200	0	318	1.59
USR PM Cofferdam	875.00	CY		0.00	5,609	4,200	0	0	9,809	11.21
USR PM Concrete, Reinforced	85.00	CY		0.00	18,321	595	13,995	0	32,911	387.19
USR PM Stop Logs	144.00	LF		0.00	2,808	403	1,188	0	4,399	30.55
USR PM Jib Crane	1.00	EA		0.00	937	204	4,500	0	5,640	5640.45
USR PM Handrail	50.00	LF		0.00	195	12	1,232	0	1,439	28.78
USR PM Metal Grate	350.00	SY		0.00	6,944	424	23,909	0	31,276	89.36
USR PM Backfill	300.00	CY		0.00	1,707	54	0	0	1,761	5.87
TOTAL 2-8' Stop Log Structure	1.00	EA			39,015	7,372	46,334	720	93,441	93441
06 03 73 09 0-6 002. 4-8' Stop Log Structure										
USR PM Excavation	600.00	CY		0.00	2,904	1,596	0	0	4,500	7.50
USR PM 6" Minus Stone	300.00	TON		0.00	396	1,143	1,425	1,080	4,044	13.48
USR PM 3" Minus Stone	100.00	TON		0.00	925	163	475	360	1,923	19.23
USR PM Geogrid	400.00	SY		0.00	540	48	720	0	1,308	3.27
USR PM Geotextile	400.00	SY		0.00	224	12	400	0	636	1.59
USR PM Cofferdam	1520.00	CY		0.00	9,743	7,296	0	0	17,039	11.21
USR PM Concrete, Reinforced	170.00	CY		0.00	36,642	1,190	27,991	0	65,822	387.19
USR PM Stop Logs	288.00	LF		0.00	5,616	806	2,376	0	8,798	30.55
USR PM Jib Crane	2.00	EA		0.00	1,873	408	9,000	0	11,281	5640.45
USR PM Handrail	100.00	LF		0.00	390	24	2,464	0	2,878	28.78
USR PM Metal Grate	700.00	SY		0.00	13,888	847	47,817	0	62,552	89.36
USR PM Backfill	600.00	CY		0.00	3,414	108	0	0	3,522	5.87
TOTAL 4-8' Stop Log Structure	1.00	EA			76,555	13,641	92,668	1,440	184,304	184304
06 03 73 09 0-6 003. 1-8' Stop Log Structure										
USR PM Excavation	800.00	CY	Z4EMBSTRUC	25.00	2,819	580	0	0	3,399	4.25
USR PM Excavation, Shaping	800.00	CY	Z4EMBD60PR	25.00	1,049	1,553	0	0	2,603	3.25
USR PM 6" Minus Stone	300.00	TON	Z3PL9903B	25.00	393	1,145	1,425	1,080	4,043	13.48
Assume a 20 mile haul at $0.18/ton-mile => $3.60/ton.										
USR PM 3" Minus Stone	100.00	TON	Z4EMBSTRBK	12.50	926	162	475	360	1,923	19.23
Assume a 20 mile haul at $0.18/ton-mile => $3.60/ton.										
L HTW PM Biaxial, 13.1' x 164' Rolls	544.00	SY	USKCF	166.67	731	67	979	0	1,777	3.27
Tensile Modulus = 18,500 #/SF										

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
CIV PM Geotextile Fabric, 90 Mils Thick Non-Woven Polypropylene	544.00	SY	ULABJ	150.00	305	14	544	0	863	1.5[illegible]
USR PM Cofferdam, Excavation/Embankment	3100.00	CY	Z4EMBPLAC1	50.00	5,780	5,968	0	0	11,748	3.79
USR PM Cofferdam, Dewatering	160.00	HR	Z3LEVEE09	1.00	8,631	2,229	0	0	10,861	67.88
USR PM Cofferdam, Degrade	3100.00	CY	Z4EMBFEDMP	100.00	5,456	6,700	0	0	12,157	3.92
USR PM Reinf Conc, Purchase Redi-Mix	200.00	CY		0.00	0	0	13,600	0	13,600	68.00
MIL PM Int Wall Form,Plywd 8-16', 1 Use (2.4 M to 4.8 M) High	4000.00	SF	ACARL	33.75	16,198	390	7,000	0	23,588	5.90
B MIL PM Pour Conc Walls,12"Tk, Dir Chute (31cm) 3000 PSI Conc	200.00	CY	ALABE	5.00	6,774	237	0	0	7,011	35.06
MIL PM Conc Curing, Sprayed Membrane Curing Compound	80.00	CSF	ULABB	11.88	469	3	332	0	804	10.05
USR PM Additional Crew,Assist w/Placing	200.00	CY	Z1EARTH08	5.00	3,524	627	0	0	4,151	20.75
B MIL PM Gr 60 Resteel,Bm,Clmn,Wall,#7-Up	20.00	TON	SIWRC	0.15	16,142	142	12,000	0	28,284	1414.21
USR PM 8"x8" Timbers for Stop Logs	288.00	LF		0.00	0	0	576	0	576	2.00
USR PM Misc Metals for Stop Logs	1200.00	LBS		0.00	0	0	1,800	0	1,800	1.50
USR PM Prepare 9 Each Timbers	36.00	EA	Z4STPLGPRP	1.00	4,206	398	0	0	4,604	127.89
USR PM Trial Stack Timbers	16.00	HR	Z4STPLGSTK	1.00	1,409	408	0	0	1,817	113.56
USR PM Jib Crane	4.00	EA		0.00	0	0	18,000	0	18,000	4500.00
MIL PM Outside Carpenter	32.00	HR	X-CARPNTER	1.00	899	0	0	0	899	28.10
MIL PM Outside Carpenter	32.00	HR	X-CARPNTER	1.00	899	0	0	0	899	28.10
MIL PM Outside Equip. Op. Heavy	32.00	HR	X-EQOPRHVY	1.00	1,049	0	0	0	1,049	32.79
L MIL PM Outside Carpenter - Foreman	32.00	HR	X-CARPNTER	1.00	899	0	0	0	899	28.10
MIL PM CRANE,HYD,S/P,RT,4WD, 9T/44'BOOM	32.00	HR	C75BD002	1.00	0	815	0	0	815	25.47
MIL PM 2"D(51mm)Welded Pipe Hdrl, 2-Rail 3'H (.92M)w/Shop Paint,Stair Mtd	100.00	LF	SIWSC	31.88	389	24	2,465	0	2,878	28.78
MIL PM 1-3/4"x3/16"Galv Steel Grating Welded Steel,12.5 #/SF(2 Oz /SF)	6336.00	SF	SIWSC	56.25	13,962	857	48,090	0	62,910	9.93
MIL PM Compact Backfill w/Vib Plate Around Structures and Trenches	800.00	CY	CLACC	14.75	4,554	146	0	0	4,700	5.87
TOTAL 1-8' Stop Log Structure	4.00	EA			97,465	22,466	107,286	1,440	228,658	57164
TOTAL Exterior Water Control, St					213,036	43,479	246,288	3,600	506,403	

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 09 Q-2. Interior Water Control Between USFWS Lower Pool and State Area, 1-8' Wide Concrete Stop-Log Structure										
06 03 73 09 Q-2 001. Excavation										
USR PM Excavation	200.00	CY	Z4EMBSTRUC	25.00	705	145	0	0	850	4.25
USR PM Excavation, Shaping	200.00	CY	Z4EMBD60PR	25.00	262	388	0	0	651	3.25
TOTAL Excavation	200.00	CY			967	533	0	0	1,500	7.50
06 03 73 09 Q-2 002. 6" Minus Stone										
USR PM 6" Stone Assume a 20 mile haul at $0.18/ton-mile => $3.60/ton.	75.00	TON	Z3PL9903B	25.00	98	286	356	270	1,011	13.48
TOTAL 6" Minus Stone	75.00	TON			98	286	356	270	1,011	13.48
06 03 73 09 Q-2 003. 3" Minus Stone										
USR PM 3" Stone Assume a 20 mile haul at $0.18/ton-mile => $3.60/ton.	25.00	TON	Z4EMBSTRBK	12.50	231	40	119	90	481	19.23
TOTAL 3" Minus Stone	25.00	TON			231	40	119	90	481	19.23
06 03 73 09 Q-2 004. Geogrid										
L HTW PM Biaxial, 13.1' x 164' Rolls Tensile Modulus = 18,500 #/SF	1224.00	SF	USKCF	1500.00	183	17	245	0	444	0.36
TOTAL Geogrid	136.00	SY			183	17	245	0	444	3.27
06 03 73 09 Q-2 005. Geotextile										
CIV PM Geotextile Fabric, 90 Mils Thick Non-Woven Polypropylene	136.00	SY	ULABJ	150.00	76	4	136	0	216	1.59
TOTAL Geotextile	136.00	SY			76	4	136	0	216	1.59
06 03 73 09 Q-2 006. Cofferdam										
USR PM Excavation and Embankment	775.00	CY	Z4EMBPLAC1	50.00	1,445	1,492	0	0	2,937	3.79
USR PM Dewatering	40.00	HR	Z3LEVEE09	1.00	2,158	557	0	0	2,715	67.88
USR PM Degrade	775.00	CY	Z4EMBFEDMP	100.00	1,364	1,675	0	0	3,039	3.92
TOTAL Cofferdam	775.00	CY			4,967	3,725	0	0	8,691	11.21

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 09 Q-2 007. Concrete, Reinforced										
USR PM Purchase Redi-Mix	50.00	CY		0.00	0	0	3,400	0	3,400	68.00
MIL PM Int Wall Form,Plywd 8-16', 1 Use (2.4 M to 4.8 M) High	1000.00	SF	ACARL	33.75	4,050	97	1,750	0	5,897	5.90
B MIL PM Pour Conc Walls,12"Tk, Dir Chute (31cm) 3000 PSI Conc	50.00	CY	ALABE	5.00	1,694	59	0	0	1,753	35.06
MIL PM Conc Curing, Sprayed Membrane Curing Compound	20.00	CSF	ULABB	11.88	117	1	83	0	201	10.05
USR PM Additional Crew,Assist w/Placing	50.00	CY	Z1EARTH08	5.00	881	157	0	0	1,038	20.75
B MIL PM Gr 60 Resteel,Bm,Clmn,Wall ,#7-Up	5.00	TON	SIWRC	0.15	4,035	36	3,000	0	7,071	1414.21
TOTAL Concrete, Reinforced	50.00	CY			10,777	350	8,233	0	19,360	387.19
06 03 73 09 Q-2 008. Stop Logs										
USR PM 8" x 8" Timbers	72.00	LF		0.00	0	0	144	0	144	2.00
USR PM Miscellaneous Metals	300.00	LBS		0.00	0	0	450	0	450	1.50
USR PM Prepare 9 Each Timbers	9.00	EA	Z4STPLGPRP	1.00	1,052	99	0	0	1,151	127.89
USR PM Trial Stack	4.00	HR	Z4STPLGSTK	1.00	352	102	0	0	454	113.56
TOTAL Stop Logs	72.00	LF			1,404	201	594	0	2,199	30.55
06 03 73 09 Q-2 009. Jib Crane Assume 8 hours to install.										
USR PM Jib Crane	1.00	EA		0.00	0	0	4,500	0	4,500	4500.00
MIL PM Outside Carpenter	8.00	HR	X-CARPNTER	1.00	225	0	0	0	225	28.10
MIL PM Outside Carpenter	8.00	HR	X-CARPNTER	1.00	225	0	0	0	225	28.10
MIL PM Outside Equip. Op. Heavy	8.00	HR	X-EQOPRHVY	1.00	262	0	0	0	262	32.79
MIL PM Outside Carpenter-Foreman	8.00	HR	X-CARPNTER	1.00	233	0	0	0	233	29.10
MIL PM CRANE,HYD,S/P,RT,4WD, 9T/4 4'BOOM	8.00	HR	C75BD002	1.00	0	204	0	0	204	25.47
TOTAL Jib Crane	1.00	EA			945	204	4,500	0	5,648	5648.45
06 03 73 09 Q-2 010. Handrail										
MIL PM 2"D(51mm)Welded Pipe Hdrl, 2-Rail 3'H (.92M)w/Shop Paint,Stair Mtd	25.00	LF	SIWSC	31.88	97	6	616	0	719	28.78
TOTAL Handrail	25.00	LF			97	6	616	0	719	28.78

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 09 Q-2 011. Metal Grate										
MIL PM 1-3/4"x3/16"Galv Steel Grating Welded Steel,12.5 #/SF(2 Oz /SF)	1584.00	SF	SIWSC	56.25	3,491	214	12,023	0	15,727	9.93
TOTAL Metal Grate	176.00	SY			3,491	214	12,023	0	15,727	89.36
06 03 73 09 Q-2 012. Backfill										
MIL PM Compact Backfill w/Vib Plate Around Structures and Trenches	200.00	CY	CLACC	14.75	1,139	36	0	0	1,175	5.87
TOTAL Backfill	200.00	CY			1,139	36	0	0	1,175	5.87
TOTAL Interior Water Control Bet					24,374	5,616	26,822	360	57,172	
06 03 73 09 R-3. Stop-Log Structure on Exterior Levee, USFWS Middle Pool, 1-8' Wide Concrete Stop-Log										
06 03 73 09 R-3 001. Excavation										
USR PM Excavation	200.00	CY	Z4EMBSTRUC	25.00	705	145	0	0	850	4.25
USR PM Excavation, Shaping	200.00	CY	Z4EMBD60PR	25.00	262	388	0	0	651	3.25
TOTAL Excavation	200.00	CY			967	533	0	0	1,500	7.50
06 03 73 09 R-3 002. 6" Minus Stone										
USR PM 6" Stone Assume a 20 mile haul at $0.18/ton-mile => $3.60/ton.	75.00	TON	Z3PL9903B	25.00	98	286	356	270	1,011	13.48
TOTAL 6" Minus Stone	75.00	TON			98	286	356	270	1,011	13.48
06 03 73 09 R-3 003. 3" Minus Stone										
USR PM 3" Stone Assume a 20 mile haul at $0.18/ton-mile => $3.60/ton.	25.00	TON	Z4EMBSTRBK	12.50	231	40	119	90	481	19.23
TOTAL 3" Minus Stone	25.00	TON			231	40	119	90	481	19.23
06 03 73 09 R-3 004. Geogrid										
L HTW PM Biaxial, 13.1' x 164' Rolls Tensile Modulus = 18,500 #/SF	1224.00	SF	USKCF	1500.00	183	17	245	0	444	0.36
TOTAL Geogrid	136.00	SY			183	17	245	0	444	3.27

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 09 R-3 005. Geotextile										
CIV PM Geotextile Fabric, 90 Mils Thick Non-Woven Polypropylene	136.00	SY	ULABJ	150.00	76	4	136	0	216	1.59
TOTAL Geotextile	136.00	SY			76	4	136	0	216	1.59
06 03 73 09 R-3 006. Cofferdam										
USR PM Excavation and Embankment	775.00	CY	Z4EMBPLAC1	50.00	1,445	1,492	0	0	2,937	3.79
USR PM Dewatering	40.00	HR	Z3LEVEE09	1.00	2,158	557	0	0	2,715	67.88
USR PM Degrade	775.00	CY	Z4EMBFEDMP	100.00	1,364	1,675	0	0	3,039	3.92
TOTAL Cofferdam	775.00	CY			4,967	3,725	0	0	8,691	11.21
06 03 73 09 R-3 007. Concrete, Reinforced										
USR PM Purchase Redi-Mix	50.00	CY		0.00	0	0	3,400	0	3,400	68.00
MIL PM Int Wall Form,Plywd 8-16', 1 Use (2.4 M to 4.8 M) High	1000.00	SF	ACARL	33.75	4,050	97	1,750	0	5,897	5.90
B MIL PM Pour Conc Walls,12"Tk, Dir Chute (31cm) 3000 PSI Conc	50.00	CY	ALABE	5.00	1,694	59	0	0	1,753	35.06
MIL PM Conc Curing, Sprayed Membr ane Curing Compound	20.00	CSF	ULABB	11.88	117	1	83	0	201	10.05
USR PM Additional Crew,Assist w/P lacing	50.00	CY	Z1EARTH08	5.00	881	157	0	0	1,038	20.75
B MIL PM Gr 60 Resteel,Bm,Clmn,Wall ,#7-Up	5.00	TON	SIWRC	0.15	4,035	36	3,000	0	7,071	1414.21
TOTAL Concrete, Reinforced	50.00	CY			10,777	350	8,233	0	19,360	387.19
06 03 73 09 R-3 008. Stop Logs										
USR PM 8" x 8" Timbers	72.00	LF		0.00	0	0	144	0	144	2.00
USR PM Miscellaneous Metals	300.00	LBS		0.00	0	0	450	0	450	1.50
USR PM Prepare 9 Each Timbers	9.00	EA	Z4STPLGPRP	1.00	1,052	99	0	0	1,151	127.89
USR PM Trial Stack	4.00	HR	Z4STPLGSTK	1.00	352	102	0	0	454	113.56
TOTAL Stop Logs	72.00	LF			1,404	201	594	0	2,199	30.55
06 03 73 09 R-3 009. Jib Crane										
USR PM Jib Crane	1.00	EA		0.00	0	0	4,500	0	4,500	4500.00
MIL PM Outside Carpenter	8.00	HR	X-CARPNTER	1.00	225	0	0	0	225	28.10
MIL PM Outside Carpenter	8.00	HR	X-CARPNTER	1.00	225	0	0	0	225	28.10
MIL PM Outside Equip. Op. Heavy	8.00	HR	X-EQOPRHVY	1.00	262	0	0	0	262	32.79
MIL PM Outside Carpenter-Foreman	8.00	HR	X-CARPNTER	1.00	233	0	0	0	233	29.10

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
MIL PM CRANE,HYD,S/P,RT,4WD, 9T/4 4'BOOM	8.00	HR	C75BD002	1.00	0	204	0	0	204	25.47
TOTAL Jib Crane	1.00	EA			945	204	4,500	0	5,648	5648.45
06 03 73 09 R-3 010. Handrail										
MIL PM 2"D(51mm)Welded Pipe Hdrl, 2-Rail 3'H (.92M)w/Shop Paint,Stair Mtd	25.00	LF	SIWSC	31.88	97	6	616	0	719	28.78
TOTAL Handrail	25.00	LF			97	6	616	0	719	28.78
06 03 73 09 R-3 011. Metal Grate										
MIL PM 1-3/4"x3/16"Galv Steel Gra ting Welded Steel,12.5 #/SF(2 Oz /SF)	1584.00	SF	SIWSC	56.25	3,491	214	12,023	0	15,727	9.93
TOTAL Metal Grate	176.00	SY			3,491	214	12,023	0	15,727	89.36
06 03 73 09 R-3 012. Backfill										
MIL PM Compact Backfill w/Vib Pla te Around Structures and Trenches	200.00	CY	CLACC	14.75	1,139	36	0	0	1,175	5.87
TOTAL Backfill	200.00	CY			1,139	36	0	0	1,175	5.87
TOTAL Stop-Log Structure on Exte					24,374	5,616	26,822	360	57,172	
06 03 73 09 W-2. Flow Through Lock 25 Spillway 2-54" Concrete Pipes With Gates										
TOTAL Excavation, Rock	280.00	CY			0	0	0	28,000	28,000	100.00
06 03 73 09 W-2 002. Excavation, Earth										
USR PM Excavation	870.00	CY	Z4EMBBRWT1	75.00	761	2,122	0	0	2,883	3.31
TOTAL Excavation, Earth	870.00	CY			761	2,122	0	0	2,883	3.31
06 03 73 09 W-2 003. Cofferdam, Earth (place/remove)										
USR PM Excavation and Embankment	2610.00	CY	Z4EMBPLAC1	50.00	4,866	5,025	0	0	9,891	3.79
USR PM Dewatering	80.00	HR	Z3LEVEE09	1.00	4,316	1,115	0	0	5,430	67.88
USR PM Degrade	2610.00	CY	Z4EMBFEDMP	100.00	4,594	5,641	0	0	10,235	3.92
TOTAL Cofferdam, Earth (place/re	2610.00	CY			13,776	11,781	0	0	25,557	9.79

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 09 W-2 004. Concrete, Reinforced										
USR PM Purchase Redi-Mix	32.00	CY		0.00	0	0	2,176	0	2,176	68.[illegible]
MIL PM Int Wall Form,Plywd 8-16', 1 Use (2.4 M to 4.8 M) High	750.00	SF	ACARL	33.75	3,037	73	1,313	0	4,423	5.[illegible]
B MIL PM Pour Conc Walls,12"Tk, Dir Chute (31cm) 3000 PSI Conc	32.00	CY	ALABE	5.00	1,084	38	0	0	1,122	35.06
MIL PM Conc Curing, Sprayed Membr ane Curing Compound	20.00	CSF	ULABB	11.88	117	1	83	0	201	10.05
USR PM Additional Crew,Assist w/P lacing	32.00	CY	Z1EARTH08	5.00	564	100	0	0	664	20.75
B MIL PM Gr 60 Resteel,Bm,Clmn,Wall ,#7-Up	3.20	TON	SIWRC	0.15	2,583	23	1,920	0	4,525	1414.21
TOTAL Concrete, Reinforced	32.00	CY			7,385	235	5,492	0	13,111	409.72
06 03 73 09 W-2 005. Riprap, 650 Lb. Topsize										
M USR PM Rip Rap, 50# to 1,000# Pie ces Random, Dumped from Truck Assume a 20 mile haul at $0.25/ton-mile => $5.00/ton.	350.00	CY	COETF	25.00	1,556	534	2,275	1,750	6,115	17.47
TOTAL Riprap, 650 Lb. Topsize	350.00	TON			1,556	534	2,275	1,750	6,115	17.47
06 03 73 09 W-2 006. Bedding Material										
USR PM Bedding Material Assume a 20 mile haul at $0.18/ton-mile => $3.60/ton.	90.00	TON	Z3PL9903B	25.00	118	344	428	324	1,213	13.48
TOTAL Bedding Material	90.00	TON			118	344	428	324	1,213	13.48
06 03 73 09 W-2 007. Sheet Pile Removal (existing)										
USR PM Sheet Pile Removal (existi ng)	260.00	SF		0.00	0	0	0	1,040	1,040	4.00
TOTAL Sheet Pile Removal (existi	260.00	SF			0	0	0	1,040	1,040	4.00
06 03 73 09 W-2 008. Dewatering										
USR PM Dewatering 960 hours equals to two pumping crews to be used for 12 weeks.	960.00	HR	Z3LEVEE09	1.00	51,788	13,376	0	0	65,164	67.88
TOTAL Dewatering					51,788	13,376	0	0	65,164	

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 09 W-2 009. Sluice Gates, 54" Diameter										
CIV PM 54"x 54"Heavy Duty Sluice Gates Self Contained w/Crank Oper Gate	2.00	EA	SIWSE	0.04	5,219	1,450	37,569	0	44,237	22119
TOTAL Sluice Gates, 54" Diameter	2.00	EA			5,219	1,450	37,569	0	44,237	22119
06 03 73 09 W-2 010. Backfill Gravelly Clay										
MIL PM Compact Backfill w/Vib Pla te Around Structures and Trenches	650.00	CY	CLACC	14.75	3,700	118	0	0	3,819	5.87
TOTAL Backfill Gravelly Clay	650.00	CY			3,700	118	0	0	3,819	5.87
TOTAL Electric Gaging Station	1.00	EA			0	0	0	12,500	12,500	12500
TOTAL Hydraulic Operator	1.00	EA			0	0	0	13,000	13,000	13000
06 03 73 09 W-2 013. Cofferdam Mucking										
USR PM Cofferdam Mucking	2930.00	CY	Z4EMBDGLN1	100.00	3,641	14,679	0	0	18,320	6.25
TOTAL Cofferdam Mucking	2930.00	CY			3,641	14,679	0	0	18,320	6.25
06 03 73 09 W-2 014. "C" Stone										
USR PM "C" Stone Assume a 20 mile haul at $0.25/ton-mile => $5.00/ton.	830.00	TON	Z3PL9905B	25.00	1,089	4,462	5,395	4,150	15,096	18.19
TOTAL "C" Stone	830.00	TON			1,089	4,462	5,395	4,150	15,096	18.19
06 03 73 09 W-2 015. Grating, Fiberglass										
L CIV PM 2"Fbgs Grating,2"x 2" Mesh ,Green For Mod Corrosive Environment	60.00	SF	SIWSB	50.00	97	2	879	0	977	16.29
TOTAL Grating, Fiberglass	60.00	SF			97	2	879	0	977	16.29
06 03 73 09 W-2 016. Stop Logs 6" x 10"										
USR PM 6" x 10" Timbers	205.00	LF		0.00	0	0	0	410	410	2.00
USR PM Miscellaneous Metals	300.00	LBS		0.00	0	0	450	0	450	1.50
USR PM Prepare 34 Each Timbers	34.00	EA	Z4STPLGPRP	1.00	3,973	375	0	0	4,348	127.89
USR PM Trial Stack	8.00	HR	Z4STPLGSTK	1.00	705	204	0	0	909	113.56
TOTAL Stop Logs 6" x 10"	1494.00	BF			4,678	579	450	410	6,117	4.09

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 09 W-2 017. Stop Log Building 8' x 8'										
L MIL PM Crushed Stone Paving, Small Area Prepare and Roll Subbase	12.00	SY	XSGRA	6.00	329	153	5	0	487	40.59
L MIL PM 8' x 8' => 64 SF Building Metal Buildings,14'Eave Hgt,26Ga	1.00	EA	SIWSI	0.05	4,204	1,004	6,417	0	11,625	11625
TOTAL Stop Log Building 8' x 8'					4,533	1,157	6,422	0	12,112	
06 03 73 09 W-2 018. Jib Crane										
USR PM Jib Crane	1.00	EA		0.00	0	0	4,500	0	4,500	4500.00
MIL PM Outside Carpenter	8.00	HR	X-CARPNTER	1.00	225	0	0	0	225	28.10
MIL PM Outside Carpenter	8.00	HR	X-CARPNTER	1.00	225	0	0	0	225	28.10
MIL PM Outside Equip. Op. Heavy	8.00	HR	X-EQOPRHVY	1.00	262	0	0	0	262	32.79
MIL PM Outside Carpenter	8.00	HR	X-CARPNTER	1.00	233	0	0	0	233	29.10
MIL PM CRANE,HYD,S/P,RT,4WD, 9T/44'BOOM	8.00	HR	C75BD002	1.00	0	204	0	0	204	25.47
TOTAL Jib Crane					945	204	4,500	0	5,648	
06 03 73 09 W-2 019. Concrete Pipe, 54" Diameter										
MIL PM 54"(152cm) Dia Cl III Conc Pipe Reinforced without Gaskets	220.00	LF	UOEHC	5.13	7,149	1,786	16,097	0	25,033	113.79
TOTAL Concrete Pipe, 54" Diamete	220.00	LF			7,149	1,786	16,097	0	25,033	113.79
TOTAL Signs, Information					0	0	0	1,000	1,000	
TOTAL Miscellaneous Metals					0	0	0	2,500	2,500	
TOTAL Flow Through Lock 25 Spill					106,433	52,830	79,506	64,674	303,443	
TOTAL Channels and Canals					424,076	158,310	410,738	761,439	1,754,563	
06 03 73 11. Levees										
06 03 73 11 AB. Bottomland Forest Habitat Improvements, State-Managed Area										
One to two acre clearings, or spot clearings, with subsequent planting of hard mast trees on a total of 100 acres.										
USR Spot Herbicide Application	100.00	ACR		0.00	0	0	0	3,000	3,000	30.00
USR Purchase Seedlings Plant Seedlings - 2 Gallon Containers	100.00	ACR		0.00	0	0	0	64,800	64,800	648.00

06 03. Wildlife Facilities & Sanctua	QUANTY UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
USR Planting W/Planter Plant Seedlings - 2 Gallon Containers	100.00 ACR		0.00	0	0	0	20,000	20,000	200.00
TOTAL Bottomland Forest Habitat				0	0	0	87,800	87,800	

06 03 73 11 KB. Hillside Sediment Control
State Area

A hillside sediment control program to include all three measures (K-1, KB, and KC) totalling all 11 watersheds contributing to the project area.

This amount is provided by the Natural Resource Conservation Service (formerly the Soil Conservation Service). They provided a total of $504,385. This amount was prorated for each watershed. This watershed is assumed to be 50% of the total watershed.

	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST
TOTAL Hillside Sediment Control	0	0	0	252,193	252,193

06 03 73 11 KC. Hillside Sediment Control
Lower Pool

A hillside sediment control program to include all three measures (K-1, KB, and KC) totalling all 11 watersheds contributing to the project area.

This amount is provided by the Natural Resource Conservation Service (formerly the Soil Conservation Service). They provided a total of $504,385. This amount was prorated for each watershed. This watershed is assumed to be 31% of the total watershed.

	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST
TOTAL Hillside Sediment Control	0	0	0	151,316	151,316

06 03 73 11 B-2. Riverside Levee, USFWS Lower
Pool, Build Levee to 435.5

The berm will cross the USFWS Lower Pool from approximately Station 126+00 to 135+00. The elevation of the proposed berm will be 435.5, and will require fill when crossing the northern and smaller entrance to the 70's channel at Station 131+50, and again beginning at about Station 133+30.

	QUANTY UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
USR PM Clearing and Grubbing This is assumed to include minor grading to achieve required elevation.	3.20 ACR	Z1SITE03	0.25	2,976	1,312	0	0	4,288	1340.03
USR PM Embankment It is assumed that this small quantity will come from material dredged adjacent and be placed where needed. The costs covered here consider only compaction and shaping.	2410.00 CY	Z4EMBWWSH	125.00	1,797	2,587	0	0	4,385	1.82

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
USR PM Seeding	1.30	ACR	Z4TURFHYDR	0.50	300	105	0	0	405	311.69
USR PM Crushed Stone	480.00	TON	Z1STONE05	12.00	1,311	1,574	2,280	1,728	6,894	14.36
Assume a 20 mile haul at $0.18/ton-mile => $3.60/ton.										
USR PM Seeding Material	1.30	ACR		0.00	0	0	1,040	0	1,040	800.00
TOTAL Riverside Levee, USFWS Low					6,385	5,578	3,320	1,728	17,011	
06 03 73 11 C-2. Riverside Levee, State Area Build Levee to 435.5										
Build berm to 435.5, tapering to 434.5, with overflow at 434.0, beginning at Station 135+00 (the larger entrance to the 70's channel), ending at Station 343+00 at L&D No. 25.										
USR PM Clearing and Grubbing	46.50	ACR	Z1SITE03	0.25	43,243	19,068	0	0	62,311	1340.03
This is assumed to include minor grading to achieve required elevation.										
USR PM Embankment	33200	CY	Z4EMBFEDMP	150.00	38,957	47,838	0	0	86,795	2.61
USR PM Seeding	19.80	ACR	Z4TURFHYDR	0.50	4,577	1,595	15,840	0	22,011	1111.69
TOTAL Riverside Levee, State Are					86,776	68,501	15,840	0	171,117	
06 03 73 11 D-1. Lowland Sediment Trap, USFWS Middle Pool										
Build approximately 7,200 linear feet of berm to elevation 439.0 on the eastern edge of the project limits to retain sediment from watersheds 8, 12, 9, 3, and 10. This sediment trap would be positioned to intercept about 2% of the runoff from watershed 8, 100% from watersheds 12, 9, and 3, and 60% from watershed 10, accounting for about 194,597 tons per acre per year of sediment or about 13% of the net 50 year sediment delivery from the hillside area into the project boundary. The sediment trap is estimated to eliminate from 50 to 75% of the sediment input. It is estimated that this would pond water on approximately 83 acres of private farmland outside of the Federally-owned project boundary.										
USR PM Clearing and Grubbing	5.30	ACR	Z1SITE03	0.25	4,929	2,173	0	0	7,102	1340.03
USR PM Embankment	23500	CY	Z4EMBFEDMP	150.00	27,575	33,861	0	0	61,436	2.61
USR PM Seeding	3.80	ACR	Z4TURFHYDR	0.50	878	306	3,040	0	4,224	1111.69
MIL PM 36"(91cm) 16 Ga Corr Metal Pipe Galv Or Alum, Plain	34.00	LF	UOEHC	16.25	348	87	320	0	756	22.22
CIV PM 36"(91cm) Corr Metal Pipe Ends	2.00	EA	CODEK	2.50	133	12	735	0	879	439.
TOTAL Lowland Sediment Trap, USF					33,864	36,439	4,095	0	74,398	

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 11 E-1. Lowland Sediment Trap, State Area										
At Titus Hollow, build approximately 2,600 linear feet of berm to elevation 440.5 on the eastern edge of the project limits to retain sediment from Dixon Hollow (watershed 5). Dixon Hollow accounts for about 11% of the total hillside sediment being delivered into the project boundary. The sediment trap is estimated to eliminate from 50 to 75% of this sediment input.										
USR PM Clearing and Grubbing	6.10	ACR	Z1SITE03	0.25	5,673	2,501	0	0	8,174	1340.03
USR PM Embankment	10100	CY	Z4EMBFEDMP	150.00	11,851	14,553	0	0	26,404	2.61
USR PM Seeding	3.00	ACR	Z4TURFHYDR	0.50	693	242	2,400	0	3,335	1111.69
MIL PM 36"(91cm) 16 Ga Corr Metal Pipe Galv Or Alum, Plain	34.00	LF	UOEHC	16.25	348	87	320	0	756	22.22
CIV PM 36"(91cm) Corr Metal Pipe Ends	2.00	EA	CODEK	2.50	133	12	735	0	879	439.67
TOTAL Lowland Sediment Trap, Sta					18,699	17,395	3,455	0	39,549	
06 03 73 11 K-1. Hillside Sediment Control Related to Middle Pool										
A hillside sediment control program to include all three measures (K-1, Kß, and KC) totalling all 11 watersheds contributing to the project area.										
This amount is provided by the Natural Resource Conservation Service (formerly the Soil Conservation Service). They provided a total of $504,385. This amount was prorated for each watershed. This watershed is assumed to be 20% of the total watershed.										
TOTAL Hillside Sediment Control					0	0	0	100,877	100,877	
06 03 73 11 L-2. Interior Levee Between USFWS Lower Pool and State Area,										
Build Levee to 435.5. Almost all of the existing ground along this interior berm's alignment is at or above this elevation. Where this is the case, no berm construction nor the disturbance of the ground will be required. Only three locations along this berm will require earthwork; where the CMP water control structure is to be placed, a ditch that is to be crossed and closed off, and a swale that is crossed near the west end of the "berm". In addition, the only portion of this "berm" that will require a roadway will be the eastern-most 800 feet, from the concrete stop-log structure to the existing berm.										
USR PM Clearing and Grubbing	2.40	ACR	Z1SITE03	0.25	2,232	984	0	0	3,216	1340.03
USR PM Embankment	1090.00	CY	Z4EMBFEDMP	150.00	1,279	1,571	0	0	2,850	2.61
USR PM Seeding	1.50	ACR	Z4TURFHYDR	0.50	347	121	1,200	0	1,668	1111.69

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
TOTAL Interior Levee Between USF					3,858	2,676	1,200	0	7,733	
06 03 73 11 XXX. Overflow Structure, State-Managed Area, Station 313+00 to 328+00, elevation 434.0										
Portion of the berm lowered 0.5 foot and stone capped with Grade "C" Stone two feet thick.										
USR PM Excavation	8700.00	CY	Z4EMBCLAY1	150.00	7,309	6,398	0	0	13,707	1.58
USR PM Crushed Stone Assume a 20 mile haul at $0.18/ton-mile => $3.60/ton.	450.00	TON	Z1STONE05	25.00	590	708	2,138	1,620	5,056	11.24
USR PM "C" Stone Assume a 20 mile haul at $0.25/ton-mile => $5.00/ton.	6950.00	TON	Z4EMBDTCH1	25.00	33,604	50,745	41,700	34,750	160,799	23.14
TOTAL Overflow Structure, State-					41,503	57,851	43,838	36,370	179,562	
06 03 73 11 XXZ. Boat Pullover										
USR PM Concrete	19.00	CY		0.00	0	0	6,650	0	6,650	350.00
USR PM "C" Stone Assume a 20 mile haul at $0.25/ton-mile => $5.00/ton.	290.00	TON	Z4EMBBRWT1	30.00	634	1,769	1,740	1,450	5,592	19.28
USR PM 6" Minus Stone Assume a 20 mile haul at $0.18/ton-mile => $3.60/ton.	170.00	TON	Z4EMBD60PR	30.00	186	275	808	612	1,880	11.06
USR PM Misc. Metals & Boat Roller s	1.00	LS		0.00	0	0	3,000	0	3,000	3000.00
TOTAL Boat Pullover					820	2,044	12,198	2,062	17,123	
TOTAL Levees					191,905	190,484	83,944	632,346	1,098,679	

06 03 73 13. Pumping Plant

06 03 73 13 H-1. Pump in USFWS Middle Pool
Replace existing 44 cfs Pump

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT

06 03 73 13 H-1 001. 44 CFS Pump

Install pump on concrete support structure, extending into sump. The work is assumed to begin after the storm water structure is in place. The sequence of events is assumed to be as follows:

a) Hoist pump into place with crane and align pump discharge with pump.
b) Secure pump base to concrete structure.
c) Connect pump discharge to discharge pipe with dresser couplings.

Set Pump and Align Discharge	8 hours
Secure Pump Base	8 hours
Connect Piping	16 hours
	------------
	32 hours

	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
USR PM 44 CFS Pump As quoted from Peerless Pump. Other = Delivery	1.00	EA		0.00	0	0	15,000	1,500	16,500	16500
MIL PM Outside Carpenter	32.00	HR	X-CARPNTER	1.00	899	0	0	0	899	28.10
MIL PM Outside Equip. Op. Heavy	32.00	HR	X-EQOPRHVY	1.00	1,049	0	0	0	1,049	32.79
MIL PM Outside Laborer (Semi-Skilled)	32.00	HR	X-LABORER	1.00	885	0	0	0	885	27.65
L MIL PM Outside Carpenter-Foreman	32.00	HR	X-CARPNTER	1.00	899	0	0	0	899	28.10
MIL PM CRANE,HYD,S/P,RT,4WD, 9T/44'BOOM	32.00	HR	C75BD002	1.00	0	815	0	0	815	25.47
MIL PM TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	32.00	HR	T50KE003	1.00	0	1,077	0	0	1,077	33.66
					---------	---------	---------	---------	-----------	
TOTAL 44 CFS Pump	1.00	EA			3,732	1,892	15,000	1,500	22,124	22124
					---------	---------	---------	---------	-----------	
TOTAL Pump in USFWS Middle Pool					3,732	1,892	15,000	1,500	22,124	

06 03 73 13 I-2. Pump in USFWS Lower Pool

Provide a 15 cfs portable, trailer mounted submersible pump with a portable diesel engine drive unit mounted on an independent trailer frame. The pump will be similar to a Gator pump or a Crisafulli pump. Initially, all increments of this measure called for a concrete pad for the pump, and for a ditch to be cut to the interior lake. For cost savings, the pad and the ditch can be eliminated.

06 03 73 13 I-2 001. 15 CFS Portable, Trailer Mounted Submersible Pump

As quoted from Gator Pump Incorporated. Includes diesel engine and 50' of industrial hose.

	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
TOTAL 15 CFS Portable, Trailer M	1.00	EA			0	0	19,017	0	19,017	19017

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 13 I-2 002. Portable Diesel Engine Drive Unit Mounted with pump on independent trailer frame. This cost is included in the pump cost.										
TOTAL Portable Diesel Engine Dri	1.00	EA			0	0	0	0	0	0.00
06 03 73 13 I-2 003. 500 Gallon Portable Fuel Tank Unit										
TOTAL 500 Gallon Portable Fuel T	1.00	EA			0	0	12,000	0	12,000	12000
TOTAL Pump in USFWS Lower Pool					0	0	31,017	0	31,017	

06 03 73 13 J-2. Pumps in State Area, 90 CFS

The 90 cfs pump will be a permanently mounted 45 degree angle propeller pump as manufactured by the Couch Pump Company. The pump will be driven by a portable diesel engine.

06 03 73 13 J-2 001. 90 CFS Permanently Mtd Pump

Reference is made to Stump Lake Item III for material.

Install pump on concrete support structure, extending into sump. The work is assumed to begin after the storm water structure is in place. The sequence of events is assumed to be as follows:

a) Hoist pump into place with crane, align pump discharge with pipe.
b) Secure pump base to concrete structure.
c) Connect pump discharge to discharge pipe with dresser couplings.

Set Pump and Align Discharge	8 hours
Secure Pump Base	8 hours
Connect Piping	16 hours
	32 hours

	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
USR PM 90 CFS Pump Includes dresser couplings (2 per) - 30" diameter and delivery.	1.00	EA		0.00	0	0	75,000	0	75,000	75000
MIL PM Outside Carpenter	32.00	HR	X-CARPNTER	1.00	899	0	0	0	899	28.10
MIL PM Outside Equip. Op. Heavy	32.00	HR	X-EQOPRHVY	1.00	1,049	0	0	0	1,049	32.79
MIL PM Outside Laborer (Semi-Skilled)	32.00	HR	X-LABORER	1.00	885	0	0	0	885	27.65
L MIL PM Outside Carpenter - Foreman	32.00	HR	X-CARPNTER	1.00	899	0	0	0	899	28.10
MIL PM CRANE,HYD,S/P,RT,4WD, 9T/44'BOOM	32.00	HR	C75BD002	1.00	0	815	0	0	815	25.
MIL PM TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	32.00	HR	T50KE003	1.00	0	1,077	0	0	1,077	33.66
TOTAL 90 CFS Permanently Mtd Pum	1.00	EA			3,732	1,892	75,000	0	80,624	80624

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 13 J-2 002. Portable Diesel Engine Drive Unit										
Reference is made to Stump Lake Item III for material.										
USR PM Diesel Drive Unit	1.00	EA		0.00	0	0	30,000	0	30,000	30000
USR PM Jack Shaft Assembly & Drive Belt	1.00	EA		0.00	0	0	10,000	0	10,000	10000
TOTAL Portable Diesel Engine Dri	1.00	EA			0	0	40,000	0	40,000	40000
06 03 73 13 J-2 003. 1,000 Gallon Portable Fuel Tank Unit										
Reference is made to Stump Lake Item III for material.										
TOTAL 1,000 Gallon Portable Fuel	1.00	EA			0	0	15,000	0	15,000	15000
06 03 73 13 J-2 004. 42" Diameter Steel Pipe										
CIV PM 42"(106cm) Dia Uncoat Steel Pipe 5/8" Wall Thickness, PE, Welded	40.00	LF	XXPLC	11.25	1,199	438	7,934	0	9,571	239.27
TOTAL 42" Diameter Steel Pipe	132.00	LF			1,199	438	7,934	0	9,571	72.51
06 03 73 13 J-2 005. 42" Diameter Flap Gate										
CIV PM 42" Dia (106cm) Alum Flap Gates	1.00	EA	SIWSE	0.25	431	120	2,124	0	2,675	2674.85
TOTAL 42" Diameter Flap Gate	1.00	EA			431	120	2,124	0	2,675	2674.85
06 03 73 13 J-2 006. 6' High Fence										
USR PM 6' High Chain Link Fence	70.00	LF		0.00	0	0	1,050	0	1,050	15.00
TOTAL 6' High Fence	70.00	LF			0	0	1,050	0	1,050	15.00
06 03 73 13 J-2 007. 6' High and 10' Wide Fence Gate										
USR PM Chain Link Gate	1.00	EA		0.00	0	0	500	0	500	500.00
TOTAL 6' High and 10' Wide Fence	1.00	EA			0	0	500	0	500	500.00
TOTAL Concrete Pad & Curb	5.00	CY			0	0	0	1,500	1,500	300.00

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
06 03 73 13 J-2 009. 30" Riprap										
M USR PM Rip Rap, 25# to 500# Pieces Random, Dumped from Truck Assume a 20 mile haul at $0.25/ton-mile => $5.00/ton.	1150.00	CY	COETF	25.00	5,113	1,755	7,475	5,750	20,093	17.[illegible]
TOTAL 30" Riprap	1700.00	TON			5,113	1,755	7,475	5,750	20,093	11.82
06 03 73 13 J-2 010. Excavation										
USR PM Excavation	120.00	CY	Z4EMBBRWT1	25.00	315	878	0	0	1,193	9.94
TOTAL Excavation	120.00	CY			315	878	0	0	1,193	9.94
06 03 73 13 J-2 011. Cofferdam, Gravelly Clay										
USR PM Excavation and Embankment	230.00	CY	Z4EMBPLAC1	50.00	429	443	0	0	872	3.79
USR PM Dewatering	16.00	HR	Z3LEVEE09	1.00	863	223	0	0	1,086	67.88
USR PM Degrade	230.00	CY	Z4EMBFEDMP	100.00	405	497	0	0	902	3.92
TOTAL Cofferdam, Gravelly Clay	230.00	CY			1,697	1,163	0	0	2,860	12.43
TOTAL Staff Gages	2.00	EA			0	0	3,500	0	3,500	1750.00
06 03 73 13 J-2 013. Pipe Bedding Material Assume a 20 mile										
USR PM Pipe Bedding Material Assume a 20 mile haul at $0.18/ton-mile => $3.60/ton.	75.00	TON	Z1STONE05	12.00	205	246	356	270	1,077	14.36
TOTAL Pipe Bedding Material	75.00	TON			205	246	356	270	1,077	14.36
06 03 73 13 J-2 014. 9" Bedding										
USR PM 9" Bedding Stone Assume a 20 mile haul at $0.18/ton-mile => $3.60/ton.	550.00	TON	Z1STONE05	12.00	1,503	1,804	2,613	1,980	7,899	14.36
TOTAL 9" Bedding	550.00	TON			1,503	1,804	2,613	1,980	7,899	14.36
06 03 73 13 J-2 015. PZ27 Sheetpile Retaining Wall Includes furnish, deliver and install.										
TOTAL PZ27 Sheetpile Retaining W	4224.00	LF			0	0	0	105,600	105,600	25.00
TOTAL Pumps in State Area, 90 CF					14,195	8,296	155,551	115,100	293,142	

06 03. Wildlife Facilities & Sanctua	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
TOTAL Pumping Plant					17,927	10,188	201,568	116,600	346,283	
TOTAL Habitat and Feeding Facili					633,908	358,981	696,251	1,510,385	3,199,525	
TOTAL Wildlife Facilities & Sanc					633,908	358,981	696,251	1,510,385	3,199,525	
TOTAL Fish and Wildlife Faciliti					633,908	358,981	696,251	1,510,385	3,199,525	

30 23. Constructn Contracts(s) Docum	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
30. Planning, Engineering and Design										
30 23. Constructn Contracts(s) Documnts										
TOTAL Plans and Specifications (					0	0	0	350,000	350,000	
TOTAL Environmental & Regulatory					0	0	0	7,000	7,000	
TOTAL Cost Estimates					0	0	0	20,000	20,000	
TOTAL Miscellaneous					0	0	0	20,000	20,000	
TOTAL Memorandum of Agreement					0	0	0	7,000	7,000	
TOTAL Engineering During Constru					0	0	0	75,000	75,000	
TOTAL Project Management					0	0	0	55,000	55,000	
TOTAL Constructn Contracts(s) Do	1.00	EA			0	0	0	534,000	534,000	534000
TOTAL Value Engineerng Study					0	0	0	64,000	64,000	
TOTAL Planning					0	0	0	820,000	820,000	
TOTAL Planning, Engineering and					0	0	0	1,418,000	1,418,000	

31 23. Construction Contracts	QUANTY UOM CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
31. Construction Management								
31 23. Construction Contracts								
31 23 11. Supervision and Administration								
TOTAL Contract Administration			0	0	0	100,000	100,000	
TOTAL Benchmarks/Surveys			0	0	0	75,000	75,000	
TOTAL Review Shop Drawings			0	0	0	50,000	50,000	
TOTAL Inspection/QA			0	0	0	117,000	117,000	
TOTAL Project Office			0	0	0	400,000	400,000	
TOTAL Project Management			0	0	0	12,000	12,000	
TOTAL Supervision and Administra			0	0	0	754,000	754,000	
TOTAL Construction Contracts			0	0	0	754,000	754,000	
TOTAL Construction Management			0	0	0	754,000	754,000	
TOTAL BATCHTOWN - (HREP)			633,908	358,981	696,251	3,682,385	5,371,525	

SRC	ITEM ID	DESCRIPTION	NO. UOM	RATE	LABOR HOURS	LABOR COST	EQUIP HOURS	EQUIP COST	TOTAL COST
	ACARL	4 B-carpnter + Misc Power Tools		PROD = 100%			CREW HOURS =		230
IL	B-CARPNTERL	Carpenters	2.00 HR	28.10	2.00	56.20			56.20
MIL	B-CARPNTERF	Carpenters	1.00 HR	29.10	1.00	29.10			29.10
MIL	B-CARPNTERA	Carpenters	1.00 HR	23.72	1.00	23.72			23.72
MIL	B-LABORER L	Laborer (Semi-Skilled)	1.00 HR	27.65	1.00	27.65			27.65
MIL	XMIXX010	E Misc. Power Tools	0.32 HR	6.40			0.32	2.05	2.05
MIL	XMIXX020	E Small Tools	0.79 HR	1.57			0.79	1.24	1.24
	TOTAL				5.00	136.67	1.11	3.29	139.96
	ALABE	4 B-laborer + 2 Electric Concrete Vibrators		PROD = 100%			CREW HOURS =		76
MIL	B-CEMTFINRL	Cement Finishers	1.00 HR	30.08	1.00	30.08			30.08
MIL	B-LABORER L	Laborer (Semi-Skilled)	4.00 HR	27.65	4.00	110.62			110.62
MIL	B-LABORER F	Laborer (Semi-Skilled)	1.00 HR	28.65	1.00	28.65			28.65
MIL	C65WC002	E CONC VIB.,HI-FREQ,INT,2-1/2"HD	2.00 HR	1.61			2.00	3.21	3.21
MIL	XMIXX020	E Small Tools	0.68 HR	1.57			0.68	1.07	1.07
MIL	G10HO004	E GEN SET, 5.5 KW, PORTABLE	1.00 HR	1.65			1.00	1.65	1.65
	TOTAL				6.00	169.35	3.68	5.93	175.28
	CLACC	3 B-laborer + 1 Hand Vibrating Compactor, 4 Hp		PROD = 100%			CREW HOURS =		139
MIL	B-LABORER F	Laborer (Semi-Skilled)	1.00 HR	28.65	1.00	28.65			28.65
MIL	B-LABORER L	Laborer (Semi-Skilled)	2.00 HR	27.65	2.00	55.31			55.31
MIL	C10WC003	E RAMMER,VIB,MAN, 13" X 11" SHOE	1.00 HR	2.33			1.00	2.33	2.33
MIL	XMIXX020	E Small Tools	0.23 HR	1.57			0.23	0.36	0.36
	TOTAL				3.00	83.96	1.23	2.69	86.65
	CODEK	5 B-laborer + 1 Backhoe Loader, 55 Hp		PROD = 100%			CREW HOURS =		2
MIL	B-LABORER L	Laborer (Semi-Skilled)	4.00 HR	27.65	4.00	110.62			110.62
MIL	B-LABORER F	Laborer (Semi-Skilled)	1.00 HR	28.65	1.00	28.65			28.65
MIL	B-EQOPRMEDL	Eq Oper, Medium	1.00 HR	27.28	1.00	27.28			27.28
MIL	L50CS002	E LDR,W/BH,WH,1.0CY FE BKT/24"DIP	1.00 HR	13.67			1.00	13.67	13.67
MIL	XMIXX020	E Small Tools	0.48 HR	1.57			0.48	0.75	0.75
	TOTAL				6.00	166.55	1.48	14.42	180.97
	COETF	2 B-laborer + 1 Dump Truck, 8 Cy		PROD = 100%			CREW HOURS =		60
MIL	B-LABORER L	Laborer (Semi-Skilled)	2.00 HR	27.65	2.00	55.31			55.31
MIL	B-EQOPRMEDF	Eq Oper, Medium	1.00 HR	28.28	1.00	28.28			28.28
MIL	B-TRKDVRHVL	Truck Drivers, Heavy	1.00 HR	27.57	1.00	27.57			27.57
MIL	L50CS002	E LDR,W/BH,WH,1.0CY FE BKT/24"DIP	1.00 HR	13.67			1.00	13.67	13.67
MIL	XMIXX020	E Small Tools	0.37 HR	1.57			0.37	0.58	0.58
MIL	T40XX008	E TRUCK OPT,REAR DUMP BODY, 8 CY	1.00 HR	2.75			1.00	2.75	2.75
MIL	T50GM016	E TRK, HWY, 3 AXLE, 41000 GVW, 6X	1.00 HR	21.16			1.00	21.16	21.16
	TOTAL				4.00	111.15	3.37	38.16	149.31

SRC	ITEM ID	DESCRIPTION	NO. UOM	RATE	**** LABOR **** HOURS	COST	**** EQUIP **** HOURS	COST	TOTAL COST
	* SIWRC	3 B-rodman + Small Tools		PROD =	100%			CREW HOURS =	255
MIL	B-RODMAN	F Rodmen (reinforcing)	1.00 HR	31.02	1.00	31.02			31.02
MIL	B-RODMAN	L Rodmen (reinforcing)	3.00 HR	30.02	3.00	90.05			90.05
MIL	* XMIXX020	E Small Tools	0.68 HR	1.57			0.68	1.07	1.07
	TOTAL				4.00	121.06	0.68	1.07	122.13
	* SIWSB	2 B-strsteel + Small Tools		PROD =	100%			CREW HOURS =	1
MIL	B-STRSTEELL	Struct Stl Workers	2.00 HR	32.00	2.00	63.99			63.99
MIL	B-STRSTEELF	Struct Stl Workers	0.50 HR	33.00	0.50	16.50			16.50
MIL	* XMIXX020	E Small Tools	1.00 HR	1.57			1.00	1.57	1.57
	TOTAL				2.50	80.49	1.00	1.57	82.06
	SIWSC	4 B-strsteel + 1 Gasoline Welding Machine		PROD =	100%			CREW HOURS =	203
MIL	B-STRSTEELA	Struct Stl Workers	1.00 HR	26.97	1.00	26.97			26.97
MIL	B-STRSTEELL	Struct Stl Workers	2.00 HR	32.00	2.00	63.99			63.99
MIL	B-STRSTEELF	Struct Stl Workers	1.00 HR	33.00	1.00	33.00			33.00
MIL	XMIXX020	E Small Tools	0.72 HR	1.57			0.72	1.13	1.13
MIL	W35XX002	E WELDER, 200 AMP W/1 AXLE TRLR	1.00 HR	6.48			1.00	6.48	6.48
	TOTAL				4.00	123.95	1.72	7.61	131.57
	SIWSE	2 B-strsteel + 1- 12.5 Ton Crane, Hydraulic		PROD =	100%			CREW HOURS =	52
MIL	C75BD003	E CRANE,HYD,SELF 14T ROUGH TERRAI	1.00 HR	28.38			1.00	28.38	28.38
MIL	XMIXX020	E Small Tools	1.00 HR	1.57			1.00	1.57	1.57
MIL	B-STRSTEELF	Struct Stl Workers	0.50 HR	33.00	0.50	16.50			16.50
MIL	B-STRSTEELL	Struct Stl Workers	2.00 HR	32.00	2.00	63.99			63.99
MIL	B-EQOPRMEDL	Eq Oper, Medium	1.00 HR	27.28	1.00	27.28			27.28
	TOTAL				3.50	107.77	2.00	29.95	137.71
	SIWSI	4 B-strsteel + 1- 22 Ton Crane, Hydraulic		PROD =	100%			CREW HOURS =	20
MIL	B-STRSTEELF	Struct Stl Workers	1.00 HR	33.00	1.00	33.00			33.00
MIL	B-STRSTEELA	Struct Stl Workers	2.00 HR	26.97	2.00	53.93			53.93
MIL	B-STRSTEELL	Struct Stl Workers	2.00 HR	32.00	2.00	63.99			63.99
MIL	B-WELDERS	L Welders, Struct Steel	1.00 HR	32.00	1.00	32.00			32.00
MIL	B-EQOPRMEDL	Eq Oper, Medium	1.00 HR	27.28	1.00	27.28			27.28
MIL	C75PH004	E CRANE,HYD,SELF, 22 TON	1.00 HR	40.67			1.00	40.67	40.67
MIL	XMIXX020	E Small Tools	1.95 HR	1.57			1.95	3.06	3.06
MIL	W35XX002	E WELDER, 200 AMP W/1 AXLE TRLR	1.00 HR	6.48			1.00	6.48	6.48
	TOTAL				7.00	210.19	3.95	50.22	260.41
	ULABB	2 B-laborer + Small Tools		PROD =	100%			CREW HOURS =	13
MIL	B-LABORER	L Laborer (Semi-Skilled)	2.00 HR	27.65	2.00	55.31			55.31
MIL	B-LABORER	F Laborer (Semi-Skilled)	0.50 HR	28.65	0.50	14.33			14.33
MIL	XMIXX020	E Small Tools	0.27 HR	1.57			0.27	0.42	0.42
	TOTAL				2.50	69.64	0.27	0.42	70.06

SRC	ITEM ID	DESCRIPTION	NO. UOM	RATE	**** LABOR **** HOURS	COST	**** EQUIP **** HOURS	COST	TOTAL COST
	ULABJ	3 B-laborer + 1-3/4 Ton Pickup Truck		PROD = 100%			CREW HOURS =		6
IL	B-LABORER	L Laborer (Semi-Skilled)	2.00 HR	27.65	2.00	55.31			55.31
MIL	B-LABORER	F Laborer (Semi-Skilled)	1.00 HR	28.65	1.00	28.65			28.65
MIL	XMIXX020	E Small Tools	0.25 HR	1.57			0.25	0.39	0.39
MIL	T50GM008	E TRK,HWY,4X2 3500 PICKUP, 8600GV	0.40 HR	8.81			0.40	3.53	3.53
	TOTAL				3.00	83.96	0.65	3.92	87.88
	UOEHC	5 B-laborer + 1- 22 Ton Crane, Hydraulic		PROD = 100%			CREW HOURS =		47
MIL	B-LABORER	F Laborer (Semi-Skilled)	1.00 HR	28.65	1.00	28.65			28.65
MIL	B-LABORER	L Laborer (Semi-Skilled)	4.00 HR	27.65	4.00	110.62			110.62
MIL	B-EQOPRMEDL	Eq Oper, Medium	1.00 HR	27.28	1.00	27.28			27.28
MIL	C75PH004	E CRANE,HYD,SELF, 22 TON	1.00 HR	40.67			1.00	40.67	40.67
MIL	XMIXX020	E Small Tools	0.60 HR	1.57			0.60	0.94	0.94
	TOTAL				6.00	166.55	1.60	41.62	208.17
	USKCF	2 B-Skillwkr + 6 B-Laborer + 3T Flat B Truck		PROD = 100%			CREW HOURS =		6
MIL	B-LABORER	L Laborer (Semi-Skilled)	6.00 HR	27.65	6.00	165.93			165.93
MIL	B-SKILLWKRL	Skilled Worker	1.00 HR	28.53	1.00	28.53			28.53
MIL	B-SKILLWKRF	Skilled Worker	1.00 HR	29.53	1.00	29.53			29.53
MIL	XMIXX020	E Small Tools	1.00 HR	1.57			1.00	1.57	1.57
MIL	T50F0006	E TRK, HWY,F600,21,000 GVW, 2 AXL	1.00 HR	18.46			1.00	18.46	18.46
MIL	T40XX012	E TRUCK OPT,FLATBED, 8' x 9.0'	1.00 HR	0.53			1.00	0.53	0.53
	TOTAL				8.00	224.00	3.00	20.55	244.55
	XSGRA	2 X-eqoprmed + 1 Sheepsfoot Roller, 210 Hp		PROD = 100%			CREW HOURS =		2
MIL	G15CA003	E GRADER,MOTOR,CAT12-G, ARTIC	1.00 HR	33.04			1.00	33.04	33.04
MIL	XMIXX020	E Small Tools	2.00 HR	1.57			2.00	3.14	3.14
MIL	R30CA001	E ROLLER,STATIC,SELF,84"W,11 TIRE	1.00 HR	15.58			1.00	15.58	15.58
MIL	T40XX033	E WATER TANK, 3000 GAL (ADD TRUCK	1.00 HR	3.40			1.00	3.40	3.40
MIL	T50GM016	E TRK, HWY, 3 AXLE, 41000 GVW, 6X	1.00 HR	21.16			1.00	21.16	21.16
MIL	X-LABORER	L Outside Laborer	2.00 HR	27.65	2.00	55.31			55.31
MIL	X-EQOPRMEDL	Outside Equip. Op. Medium	2.00 HR	27.28	2.00	54.55			54.55
MIL	X-EQOPRMEDF	Outside Equip. Op. Medium	1.00 HR	28.28	1.00	28.28			28.28
MIL	X-TRKDVRLTL	Outside Truck Dr. Light	1.00 HR	26.57	1.00	26.57			26.57
	TOTAL				6.00	164.70	6.00	76.32	241.03
	XXPLC	8 X-Plumber + 1- 40 Ton Crane, 1 Semi Truck,		PROD = 100%			CREW HOURS =		4
MIL	A15XX011	E AIR COMPR, 450 CFM, 100 PSI	1.00 HR	16.19			1.00	16.19	16.19
MIL	C85LB002	E CR,ME,CWLR,LIFTING,40T,W/50'BOO	1.00 HR	45.18			1.00	45.18	45.18
MIL	XMIXX020	E Small Tools	2.50 HR	1.57			2.50	3.93	3.93
L	T45XX019	E TRK TRLR,LOWBOY, 75 TON, 3 AXLE	1.00 HR	9.93			1.00	9.93	9.93
MIL	T50GM008	E TRK,HWY,4X2 3500 PICKUP, 8600GV	1.00 HR	8.81			1.00	8.81	8.81
MIL	T50KE004	E TRK,HWY,3AXLE,50000GVW, 85000GC	1.00 HR	34.93			1.00	34.93	34.93
MIL	W35XX009	E ELEC DRIVE,WELDER,300 AMP,SKID	2.00 HR	1.65			2.00	3.29	3.29
MIL	A20XX005	E AIR HOSE, 2.0", 50', HARDROCK	1.00 HR	0.84			1.00	0.84	0.84
MIL	X-PLUMBER	F Outside Plumber	1.00 HR	32.87	1.00	32.87			32.87
MIL	X-PLUMBER	A Outside Plumber	1.00 HR	27.00	1.00	27.00			27.00

SRC	ITEM ID	DESCRIPTION	NO. UOM	RATE	**** LABOR **** HOURS	COST	**** EQUIP **** HOURS	COST	TOTAL COST
MIL	X-PLUMBER	L Outside Plumber	6.00 HR	31.87	6.00	191.22			191.22
MIL	X-EQOPRHVYL	Outside Equip. Op. Heavy	1.00 HR	32.79	1.00	32.79			32.79
MIL	X-EQOPROILL	Outside Oiler	1.00 HR	25.91	1.00	25.91			25.91
MIL	X-TRKDVRHVL	Outside Truck Dr. Heavy	1.00 HR	27.57	1.00	27.57			27.57
	TOTAL				11.00	337.35	10.50	123.09	460.45
	Z1EARTH08	Trenching		PROD = 100%				CREW HOURS =	76
MIL	L50JD004	E LDR,W/BH,WH,1.25CY FE W/24" DPR	1.00 HR	15.68			1.00	15.68	15.68
MIL	X-EQOPRHVYL	Outside Equip. Op. Heavy	1.00 HR	32.79	1.00	32.79			32.79
MIL	X-LABORER	L Outside Laborer (Semi-Skilled)	2.00 HR	27.65	2.00	55.31			55.31
	TOTAL				3.00	88.09	1.00	15.68	103.77
	Z1SITE03	Clearing and Grubbing - Heavy Trees >12"		PROD = 100%				CREW HOURS =	254
MIL	L35CA006	E LDR,FE,CRWLR, 2.5 CY, 963	1.00 HR	56.50			1.00	56.50	56.50
MIL	T10CA009	E BLADE, STRAIGHT,HYDR,FOR D6	1.00 HR	3.90			1.00	3.90	3.90
MIL	T15CA008	E DOZER,CWLR,D-6D,PS,(ADD BLADE)	1.00 HR	35.45			1.00	35.45	35.45
MIL	X-EQOPRHVYL	Outside Equip. Op. Heavy	2.00 HR	32.79	2.00	65.57			65.57
MIL *	X-LABORER	L Outside Laborer (Semi-Skilled)	5.00 HR	27.65	5.00	138.26			138.26
MIL	X-LABORER	F Foreman	1.00 HR	28.65	1.00	28.65			28.65
MIL *	C05H0001	E CHAINSAW, 31" BAR	4.00 HR	1.66			4.00	6.66	6.66
	TOTAL				8.00	232.49	7.00	102.52	335.01
	Z1STONE05	Bedding Material		PROD = 100%				CREW HOURS =	110
MIL	T10CA009	E BLADE, STRAIGHT,HYDR,FOR D6	1.00 HR	3.90			1.00	3.90	3.90
MIL	T15CA008	E DOZER,CWLR,D-6D,PS,(ADD BLADE)	1.00 HR	35.45			1.00	35.45	35.45
MIL	X-EQOPRHVYL	Outside Equip. Op. Heavy	1.00 HR	32.79	1.00	32.79			32.79
	TOTAL				1.00	32.79	2.00	39.35	72.14
	Z3LEVEE09	Dewatering (scour holes)		PROD = 100%				CREW HOURS =	1336
MIL *	P50H0005	E PUMP,WTR,TRASH, 39,720GPH/25'HD	2.00 HR	3.31			2.00	6.62	6.62
MIL *	T50F0003	E TRK,HWY,4X2,F250,3/4T,8600 GVW	1.00 HR	7.31			1.00	7.31	7.31
MIL *	X-EQOPRLT	L Outside Equip. Oper Light	1.00 HR	26.29	1.00	26.29			26.29
MIL *	X-LABORER	L Outside Laborer (Semi-Skilled)	1.00 HR	27.65	1.00	27.65			27.65
	TOTAL				2.00	53.95	3.00	13.93	67.88
	Z3PL9903B	Embankment, Compaction (Dozer)		PROD = 100%				CREW HOURS =	25
MIL *	T10CA016	E BLADE, STRAIGHT,HYDR,FOR D8	1.00 HR	7.45			1.00	7.45	7.45
MIL *	T15CA015	E DOZER,CWLR,CAT D-8L, (ADD BLADE	1.00 HR	87.97			1.00	87.97	87.97
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	1.00 HR	32.79	1.00	32.79			32.79
	TOTAL				1.00	32.79	2.00	95.42	128.2[illegible]

** CREW BACKUP **

SRC	ITEM ID	DESCRIPTION	NO. UOM	RATE	**** LABOR **** HOURS	COST	**** EQUIP **** HOURS	COST	TOTAL COST
	Z3PL9905B	Excavate With Hydraulic Excavator		PROD = 100%			CREW HOURS =		33
MIL *	H25CA008	E HYD EXCAV,CRWLR,3.125 CY BKT	1.00 HR	134.41			1.00	134.41	134.41
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	1.00 HR	32.79	1.00	32.79			32.79
	TOTAL				1.00	32.79	1.00	134.41	167.19
	Z4EMBBRWT1	HYD EXC, D-6		PROD = 0.00%			CREW HOURS =		26
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	2.00 HR	32.79	2.00	65.57			65.57
MIL *	H25CA008	E HYD EXCAV,CRWLR,3.125 CY BKT	1.00 HR	134.41			1.00	134.41	134.41
MIL *	T10CA010	E BLADE, ANGLE, HYDR, FOR D6	1.00 HR	4.32			1.00	4.32	4.32
MIL *	T15CA010	E DOZER,CWLR,D-6H,PS,(ADD BLADE)	1.00 HR	44.23			1.00	44.23	44.23
	TOTAL				2.00	65.57	3.00	182.95	248.52
	Z4EMBCLAY1	(2)D-6 W/DISK, ROLLER,		PROD = 100%			CREW HOURS =		58
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	3.00 HR	32.79	3.00	98.36			98.36
MIL *	X-LABORER	L Outside Laborer (Semi-Skilled)	1.00 HR	27.65	1.00	27.65			27.65
MIL *	R40S0002	E ROLLER,VIB,SD,TOW,SHPSFT,23.5T	1.00 HR	30.11			1.00	30.11	30.11
MIL *	T10CA009	E BLADE, STRAIGHT,HYDR,FOR D6	2.00 HR	3.90			2.00	7.80	7.80
MIL *	T15CA008	E DOZER,CWLR,D-6D,PS,(ADD BLADE)	2.00 HR	35.45			2.00	70.91	70.91
MIL *	T10LE003	E ROTARY HOE ATTACH, 120"W ROTERR	1.00 HR	1.49			1.00	1.49	1.49
	TOTAL				4.00	126.01	6.00	110.30	236.32
	Z4EMBD60PR	D-6		PROD = 0.00%			CREW HOURS =		982
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	1.00 HR	32.79	1.00	32.79			32.79
MIL *	T10CA010	E BLADE, ANGLE, HYDR, FOR D6	1.00 HR	4.32			1.00	4.32	4.32
MIL *	T15CA010	E DOZER,CWLR,D-6H,PS,(ADD BLADE)	1.00 HR	44.23			1.00	44.23	44.23
	TOTAL				1.00	32.79	2.00	48.54	81.33
	Z4EMBDGLN1	DRAGLINE, (2)D-6		PROD = 0.00%			CREW HOURS =		29
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	3.00 HR	32.79	3.00	98.36			98.36
MIL *	X-EQOPROILL	Outside Oiler	1.00 HR	25.91	1.00	25.91			25.91
MIL *	B35HE037	E BUCKET, DRAGLINE, HVWT, 3.5 CY	1.00 HR	4.22			1.00	4.22	4.22
MIL *	C85AM005	E CRANE,DRAG,23T,140'BOOM,ADD BKT	1.00 HR	399.67			1.00	399.67	399.67
MIL *	T10CA010	E BLADE, ANGLE, HYDR, FOR D6	2.00 HR	4.32			2.00	8.64	8.64
MIL *	T15CA010	E DOZER,CWLR,D-6H,PS,(ADD BLADE)	2.00 HR	44.23			2.00	88.45	88.45
	TOTAL				4.00	124.27	6.00	500.98	625.24
	Z4EMBDTCH1	HYD EXC, D-6		PROD = 100%			CREW HOURS =		278
UPB *	H25CA008	E HYD EXCAV, CRWLR, 3.125CY BKT	1.00 HR	134.41			1.00	134.41	134.41
UPB *	T10CA009	E BLADE, STRAIGHT, HYDR, D-6	1.00 HR	3.90			1.00	3.90	3.90
UPB *	T15CA010	E DOZER,CWLR, D-6H,PS	1.00 HR	44.23			1.00	44.23	44.23
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	2.00 HR	32.79	2.00	65.57			65.57
MIL *	X-LABORER	L Outside Laborer (Semi-Skilled)	2.00 HR	27.65	2.00	55.31			55.31
	TOTAL				4.00	120.88	3.00	182.53	303.41

SRC	ITEM ID	DESCRIPTION	NO. UOM	RATE	**** LABOR **** HOURS	**** LABOR **** COST	**** EQUIP **** HOURS	**** EQUIP **** COST	TOTAL COST
	Z4EMBFEDMP	FE LDR,(2)DUMP TRUCKS,D-6,DISK,SHEEPSFOOT		PROD = 0.00%			CREW HOURS =		535
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	2.00 HR	32.79	2.00	65.57			65.57
MIL *	X-LABORER	L Outside Laborer (Semi-Skilled)	2.00 HR	27.65	2.00	55.31			55.31
MIL *	X-TRKDVRHVL	Outside Truck Dr. Heavy	2.00 HR	27.57	2.00	55.13			55.13
MIL *	L35CA007	E LDR,FE,CRWLR, 3.75 CY, 973	1.00 HR	84.68			1.00	84.68	84.68
MIL *	T10LE003	E ROTARY HOE ATTACH, 120"W ROTERR	1.00 HR	1.49			1.00	1.49	1.49
MIL *	T10CA010	E BLADE, ANGLE, HYDR, FOR D6	1.00 HR	4.32			1.00	4.32	4.32
MIL *	T15CA010	E DOZER,CWLR,D-6H,PS,(ADD BLADE)	1.00 HR	44.23			1.00	44.23	44.23
MIL *	T40XX010	E TRUCK OPT,REAR DUMP BODY, 12 CY	2.00 HR	2.82			2.00	5.63	5.63
MIL *	T50F0013	E TRK, HWY, 52,400 GVW, 3 AXLE	2.00 HR	22.84			2.00	45.69	45.69
MIL *	R40S0002	E ROLLER,VIB,SD,TOW,SHPSFT,23.5T	1.00 HR	30.11			1.00	30.11	30.11
	TOTAL				6.00	176.01	9.00	216.14	392.15
	Z4EMBPLAC1	Shape & Compact Dredge Mat'l		PROD = 0.00%			CREW HOURS =		165
MIL *	R50DY005	E ROLLR,VIB,SD,SELF,84WX61D,22TON	1.00 HR	42.31			1.00	42.31	42.31
MIL *	T10CA010	E BLADE, ANGLE, HYDR, FOR D6	1.00 HR	4.32			1.00	4.32	4.32
MIL *	T15CA011	E DOZER,CWLR,D-6H,LGP,(ADD BLADE)	1.00 HR	49.64			1.00	49.64	49.64
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	2.00 HR	32.79	2.00	65.57			65.57
MIL *	X-LABORER	L Outside Laborer (Semi-Skilled)	1.00 HR	27.65	1.00	27.65			27.65
	TOTAL				3.00	93.23	3.00	96.27	189.49
	Z4EMBSTRBK	Structural Backfill		PROD = 100%			CREW HOURS =		14
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	1.00 HR	32.79	1.00	32.79			32.79
MIL *	X-LABORER	L Outside Laborer (Semi-Skilled)	3.00 HR	27.65	3.00	82.96			82.96
MIL *	C10B0005	E COMPACTOR, VIBROPLATE, 18.9"	1.00 HR	2.06			1.00	2.06	2.06
MIL *	L50CS003	E LDR,W/BH,WH,1.5CY FE BKT/30"DIP	1.00 HR	14.99			1.00	14.99	14.99
MIL *	XMIXX020	E Small Tools	2.00 HR	1.57			2.00	3.14	3.14
	TOTAL				4.00	115.74	4.00	20.19	135.94
	Z4EMBSTRUC	Structural Excavation		PROD = 100%			CREW HOURS =		56
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	1.00 HR	32.79	1.00	32.79			32.79
MIL *	X-LABORER	L Outside Laborer (Semi-Skilled)	2.00 HR	27.65	2.00	55.31			55.31
MIL *	L50CS003	E LDR,W/BH,WH,1.5CY FE BKT/30"DIP	1.00 HR	14.99			1.00	14.99	14.99
MIL *	XMIXX020	E Small Tools	2.00 HR	1.57			2.00	3.14	3.14
	TOTAL				3.00	88.09	3.00	18.13	106.22
	Z4EMBWVWSH	FE LDR, S/P SHEEPSFOOT, DISK		PROD = 0.00%			CREW HOURS =		19
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	2.00 HR	32.79	2.00	65.57			65.57
MIL *	X-LABORER	L Outside Laborer (Semi-Skilled)	1.00 HR	27.65	1.00	27.65			27.65
MIL *	L35CA007	E LDR,FE,CRWLR, 3.75 CY, 973	1.00 HR	84.68			1.00	84.68	84.68
MIL *	R45IN007	E ROLL,VIB,SELF,DD,84"WX60"D,HYDR	1.00 HR	48.02			1.00	48.02	48.0[illegible]
MIL	T10LE003	E ROTARY HOE ATTACH, 120"W ROTERR	1.00 HR	1.49			1.00	1.49	1.4[illegible]
	TOTAL				3.00	93.23	3.00	134.19	227.41

SRC	ITEM ID	DESCRIPTION	NO. UOM	RATE	**** LABOR **** HOURS	COST	**** EQUIP **** HOURS	COST	TOTAL COST
	Z4STPLGPRP	STOP LOGS PREPARATION ONE-TIMBER UNITS		PROD = 100%			CREW HOURS =		97
MIL *	X-CARPNTERL	Outside Carpenter	1.00 HR	28.10	1.00	28.10			28.10
MIL *	X-LABORER L	Outside Laborer (Semi-Skilled)	1.00 HR	27.65	1.00	27.65			27.65
MIL *	X-STRSTEELL	Outside Steel Worker	1.00 HR	32.00	1.00	32.00			32.00
MIL *	X-CARPNTERF	Outside Carpenter-Foreman	1.00 HR	29.10	1.00	29.10			29.10
MIL *	W35XX001 E	WELDER, 250 AMP, W/1 AXLE TRLR	1.00 HR	3.07			1.00	3.07	3.07
UPB *	XMIXX010 E	MISC. POWER TOOLS	1.00 HR	6.40			1.00	6.40	6.40
UPB *	XMIXX020 E	SMALL TOOLS	1.00 HR	1.57			1.00	1.57	1.57
	TOTAL				4.00	116.85	3.00	11.04	127.89
	Z4STPLGSTK	STOP LOGS TRIAL STACK		PROD = 100%			CREW HOURS =		36
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	1.00 HR	32.79	1.00	32.79			32.79
MIL *	X-LABORER L	Outside Laborer (Semi-Skilled)	1.00 HR	27.65	1.00	27.65			27.65
MIL	X-LABORER L	Outside Laborer (Semi-Skilled)	1.00 HR	27.65	1.00	27.65			27.65
MIL *	C75BD002 E	CRANE,HYD,S/P,RT,4WD, 9T/44'BOO	1.00 HR	25.47			1.00	25.47	25.47
	TOTAL				3.00	88.09	1.00	25.47	113.56
	Z4TURFHYDR	Establishment of Turf - Hydroseeder		PROD = 100%			CREW HOURS =		70
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	1.00 HR	32.79	1.00	32.79			32.79
MIL *	X-LABORER L	Outside Laborer (Semi-Skilled)	1.00 HR	27.65	1.00	27.65			27.65
MIL *	X-TRKDVRHVL	Outside Truck Dr. Heavy	2.00 HR	27.57	2.00	55.13			55.13
MIL *	T40XX031 E	WATER TANK, 2000 GAL (ADD TRUCK	1.00 HR	3.04			1.00	3.04	3.04
MIL *	T50F0014 E	TRK, HWY, 54,000 GVW, 3 AXLE	1.00 HR	23.22			1.00	23.22	23.22
USR	HYDROSEEDRE	Hydroseeder with motor & hose	1.00 HR	5.00			1.00	5.00	5.00
MIL *	T40XX014 E	FLATBED, 8'x 12.0'	1.00 HR	0.59			1.00	0.59	0.59
MIL *	T50F0005 E	TRK,HWY,10,000GVW,4X2, 1T-PICKU	1.00 HR	8.42			1.00	8.42	8.42
	TOTAL				4.00	115.57	5.00	40.27	155.84

ITEM ID	DESCRIPTION				
06. Fish and Wildlife Facilities					
ACARL	4 B-carpnter + Misc Power Tools	PROD =	100%	CREW HOURS =	230
ALABE	4 B-laborer + 2 Electric Concrete Vibrators	PROD =	100%	CREW HOURS =	76
CLACC	3 B-laborer + 1 Hand Vibrating Compactor, 4 Hp	PROD =	100%	CREW HOURS =	139
CODEK	5 B-laborer + 1 Backhoe Loader, 55 Hp	PROD =	100%	CREW HOURS =	2
COETF	2 B-laborer + 1 Dump Truck, 8 Cy	PROD =	100%	CREW HOURS =	60
* SIWRC	3 B-rodman + Small Tools	PROD =	100%	CREW HOURS =	255
* SIWSB	2 B-strsteel + Small Tools	PROD =	100%	CREW HOURS =	1
SIWSC	4 B-strsteel + 1 Gasoline Welding Machine	PROD =	100%	CREW HOURS =	203
SIWSE	2 B-strsteel + 1- 12.5 Ton Crane, Hydraulic	PROD =	100%	CREW HOURS =	52
SIWSI	4 B-strsteel + 1- 22 Ton Crane, Hydraulic	PROD =	100%	CREW HOURS =	20
ULABB	2 B-laborer + Small Tools	PROD =	100%	CREW HOURS =	13
ULABJ	3 B-laborer + 1-3/4 Ton Pickup Truck	PROD =	100%	CREW HOURS =	6
UOEHC	5 B-laborer + 1- 22 Ton Crane, Hydraulic	PROD =	100%	CREW HOURS =	47
USKCF	2 B-Skillwkr + 6 B-Laborer + 3T Flat B Truck	PROD =	100%	CREW HOURS =	6
XSGRA	2 X-eqoprmed + 1 Sheepsfoot Roller, 210 Hp	PROD =	100%	CREW HOURS =	2
XXPLC	8 X-Plumber + 1- 40 Ton Crane, 1 Semi Truck,	PROD =	100%	CREW HOURS =	4
Z1EARTH08	Trenching	PROD =	100%	CREW HOURS =	76
Z1SITE03	Clearing and Grubbing - Heavy Trees >12"	PROD =	100%	CREW HOURS =	254
Z1STONE05	Bedding Material	PROD =	100%	CREW HOURS =	110
Z3LEVEE09	Dewatering (scour holes)	PROD =	100%	CREW HOURS =	1336
Z3PL9903B	Embankment, Compaction (Dozer)	PROD =	100%	CREW HOURS =	25
Z3PL9905B	Excavate With Hydraulic Excavator	PROD =	100%	CREW HOURS =	33
Z4EMBBRWT1	HYD EXC, D-6	PROD =	0.00%	CREW HOURS =	26
Z4EMBCLAY1	(2)D-6 W/DISK, ROLLER,	PROD =	100%	CREW HOURS =	58
Z4EMBD6OPR	D-6	PROD =	0.00%	CREW HOURS =	982
Z4EMBDGLN1	DRAGLINE, (2)D-6	PROD =	0.00%	CREW HOURS =	29
Z4EMBDTCH1	HYD EXC, D-6	PROD =	100%	CREW HOURS =	278
Z4EMBFEDMP	FE LDR,(2)DUMP TRUCKS,D-6,DISK,SHEEPSFOOT	PROD =	0.00%	CREW HOURS =	535
Z4EMBPLAC1	Shape & Compact Dredge Mat'l	PROD =	0.00%	CREW HOURS =	165
Z4EMBSTRBK	Structural Backfill	PROD =	100%	CREW HOURS =	14
Z4EMBSTRUC	Structural Excavation	PROD =	100%	CREW HOURS =	56
Z4EMBWVWSH	FE LDR, S/P SHEEPSFOOT, DISK	PROD =	0.00%	CREW HOURS =	19
Z4STPLGPRP	STOP LOGS PREPARATION ONE-TIMBER UNITS	PROD =	100%	CREW HOURS =	97
Z4STPLGSTK	STOP LOGS TRIAL STACK	PROD =	100%	CREW HOURS =	36
Z4TURFHYDR	Establishment of Turf - Hydroseeder	PROD =	100%	CREW HOURS =	70

30. Planning, Engineering and Design
31. Construction Management

SRC	LABOR ID	DESCRIPTION	BASE	OVERTM	TXS/INS	FRNG	TRVL	RATE	UOM	UPDATE	**** TOTAL **** DEFAULT	HOURS
MIL	B-CARPNTER	Carpenters	18.55	0.0%	18.0%	6.21	0.00	28.10	HR	02/24/95	0.00	919
MIL	B-CEMTFINR	Cement Finishers	20.05	0.0%	17.0%	6.62	0.00	30.08	HR	02/24/95	0.00	76
MIL	B-EQOPRMED	Equip. Oper. Medium	17.74	0.0%	17.0%	6.52	0.00	27.28	HR	02/24/95	0.00	181
MIL	B-LABORER	Laborer (Semi Skilled)	23.25	0.0%	17.0%	0.45	0.00	27.65	HR	02/24/95	0.00	1479
MIL	B-RODMAN	Rodman (Reinf.)	19.80	0.0%	17.0%	6.85	0.00	30.02	HR	02/24/95	0.00	1019
MIL	B-SKILLWKR	Skilled Worker	23.60	0.0%	19.0%	0.45	0.00	28.53	HR	02/24/95	24.94	11
MIL	B-STRSTEEL	Structural Steel Workers	19.80	0.0%	27.0%	6.85	0.00	32.00	HR	02/24/95	0.00	1045
MIL	B-TRKDVRHV	Truck Driver Heavy	17.98	0.0%	17.0%	6.53	0.00	27.57	HR	02/24/95	0.00	60
MIL	B-WELDERS	Welders, Struct Stl	19.80	0.0%	27.0%	6.85	0.00	32.00	HR	02/24/95	28.05	20
MIL	X-CARPNTER	Outside Carpenter	18.55	0.0%	18.0%	6.21	0.00	28.10	HR	02/27/95	24.00	514
MIL	X-EQOPRHVY	Outside Equip. Op. Heavy	22.45	0.0%	17.0%	6.52	0.00	32.79	HR	02/27/95	24.33	4514
MIL	X-EQOPRLT	Outside Equip. Oper Light	16.90	0.0%	17.0%	6.52	0.00	26.29	HR	02/27/95	23.21	1336
MIL	X-EQOPRMED	Outside Equip. Op. Medium	17.74	0.0%	17.0%	6.52	0.00	27.28	HR	02/27/95	24.03	6
MIL	X-EQOPROIL	Outside Oiler	16.57	0.0%	17.0%	6.52	0.00	25.91	HR	02/27/95	18.51	33
MIL	X-LABORER	Outside Laborer (Semi-Skilled)	23.25	0.0%	17.0%	0.45	0.00	27.65	HR	02/27/95	21.01	5736
MIL	X-PLUMBER	Outside Plumber/Pipefitter	21.36	0.0%	14.0%	7.52	0.00	31.87	HR	04/29/94	27.57	28
MIL	X-STRSTEEL	Outside Steel Worker	19.80	0.0%	27.0%	6.85	0.00	32.00	HR	02/27/95	28.05	97
MIL	X-TRKDVRHV	Outside Truck Dr. Heavy	17.98	0.0%	17.0%	6.53	0.00	27.57	HR	02/27/95	22.09	1600
MIL	X-TRKDVRLT	Outside Truck Dr. Light	17.13	0.0%	17.0%	6.53	0.00	26.57	HR	02/27/95	21.86	2

SRC	LABOR ID	DESCRIPTION	BASE	OVERTM	TXS/INS	FRNG	TRVL	RATE	UOM	UPDATE	**** TOTAL **** DEFAULT	HOURS
06. Fish and Wildlife Facilities												
MIL	B-CARPNTER	Carpenters	18.55	0.0%	18.0%	6.21	0.00	28.10	HR	02/24/95	0.00	919
MIL	B-CEMTFINR	Cement Finishers	20.05	0.0%	17.0%	6.62	0.00	30.08	HR	02/24/95	0.00	76
MIL	B-EQOPRMED	Equip. Oper. Medium	17.74	0.0%	17.0%	6.52	0.00	27.28	HR	02/24/95	0.00	181
MIL	B-LABORER	Laborer (Semi Skilled)	23.25	0.0%	17.0%	0.45	0.00	27.65	HR	02/24/95	0.00	1479
MIL	B-RODMAN	Rodman (Reinf.)	19.80	0.0%	17.0%	6.85	0.00	30.02	HR	02/24/95	0.00	1019
MIL	B-SKILLWKR	Skilled Worker	23.60	0.0%	19.0%	0.45	0.00	28.53	HR	02/24/95	24.94	11
MIL	B-STRSTEEL	Structural Steel Workers	19.80	0.0%	27.0%	6.85	0.00	32.00	HR	02/24/95	0.00	1045
MIL	B-TRKDVRHV	Truck Driver Heavy	17.98	0.0%	17.0%	6.53	0.00	27.57	HR	02/24/95	0.00	60
MIL	B-WELDERS	Welders, Struct Stl	19.80	0.0%	27.0%	6.85	0.00	32.00	HR	02/24/95	28.05	20
MIL	X-CARPNTER	Outside Carpenter	18.55	0.0%	18.0%	6.21	0.00	28.10	HR	02/27/95	24.00	514
MIL	X-EQOPRHVY	Outside Equip. Op. Heavy	22.45	0.0%	17.0%	6.52	0.00	32.79	HR	02/27/95	24.33	4514
MIL	X-EQOPRLT	Outside Equip. Oper Light	16.90	0.0%	17.0%	6.52	0.00	26.29	HR	02/27/95	23.21	1336
MIL	X-EQOPRMED	Outside Equip. Op. Medium	17.74	0.0%	17.0%	6.52	0.00	27.28	HR	02/27/95	24.03	6
MIL	X-EQOPROIL	Outside Oiler	16.57	0.0%	17.0%	6.52	0.00	25.91	HR	02/27/95	18.51	33
MIL	X-LABORER	Outside Laborer (Semi-Skilled)	23.25	0.0%	17.0%	0.45	0.00	27.65	HR	02/27/95	21.01	5736
MIL	X-PLUMBER	Outside Plumber/Pipefitter	21.36	0.0%	14.0%	7.52	0.00	31.87	HR	04/29/94	27.57	28
MIL	X-STRSTEEL	Outside Steel Worker	19.80	0.0%	27.0%	6.85	0.00	32.00	HR	02/27/95	28.05	97
MIL	X-TRKDVRHV	Outside Truck Dr. Heavy	17.98	0.0%	17.0%	6.53	0.00	27.57	HR	02/27/95	22.09	1600
MIL	X-TRKDVRLT	Outside Truck Dr. Light	17.13	0.0%	17.0%	6.53	0.00	26.57	HR	02/27/95	21.86	2

30. Planning, Engineering and Design
31. Construction Management

SRC	ID.NO.	EQUIPMENT DESCRIPTION	DEPR	FCCM	FUEL	FOG	TR WR	TR REP	EQ REP	TOTAL RATE		** TOTAL ** HOURS
UPB	A15XX011	AIR COMPR, 450 CFM, 100 PSI	4.08	1.54	4.75	1.37	0.14	0.02	4.29	16.19	HR	4
UPB	A20XX005	AIR HOSE, 2.00", 100',HARDROCK	0.29	0.04					0.51	0.84	HR	4
MIL	B35HE009	BUCKET,DRAGLINE, 4.5CY, LTWT	1.79	0.45					1.66	3.89	HR	24
MIL	B35HE037	BUCKET,DRAGLINE, 3.5CY, HVWT	1.89	0.58					1.75	4.22	HR	29
MIL	C05H0001	CHAINSAW, 31" LONG BAR	0.16	0.02	0.36	0.62			0.51	1.66	HR	1016
MIL	C10B0005	COMPACTOR, VIBROPLATE,18.9"X27.4	0.66	0.12	0.18	0.04			1.07	2.06	HR	14
MIL	C10B0011	ROLLER,WK-BH,VIB DBL,0.9T,23.6"W	1.95	0.36	0.35	0.09			3.17	5.93	HR	18
MIL	C10WC003	COMPACTOR, RAMMER, 11"X13" SHOE	0.62	0.11	0.48	0.12			1.00	2.33	HR	139
UPB	C65WC002	CONC VIBRATOR, 2.50D, EL,HI-FREQ	0.31	0.05	0.07	0.17			1.01	1.61	HR	189
MIL	C75BD002	CRANE,HYD,S/P,RT,4WD, 9T/44'BOOM	4.94	2.10	9.76	3.22	0.30	0.05	5.11	25.47	HR	169
MIL	C75BD003	CRANE,HYD,S/P,RT,4WD,13.6T/49'BM	5.96	2.57	9.76	3.22	0.60	0.09	6.18	28.38	HR	52
MIL	C75PH004	CRANE,HYD,S/P,RT,4WD,22T/72'BOOM	13.42	5.75	4.80	1.48	1.14	0.18	13.89	40.67	HR	72
MIL	C85AM005	CRANE,DRAG/CLAM,10.0CY /140'BOOM	129.16	68.09	22.18	5.48			174.77	399.67	HR	29
MIL	C85LB002	CR,ME,CWLR,LIFTING, 40T/ 50'BOOM	17.58	7.82	2.32	0.48			16.99	45.18	HR	4
UPB	D35R0002	DRILL,R-BLASTH, 6.75"-9.88",TRK	28.81	13.45	15.62	6.11	2.29	0.35	38.40	105.02	HR	5
UPB	G10H0004	GENERATOR, 5.5 KW, 120/240V,PORT	0.23	0.06	0.95	0.24			0.17	1.65	HR	94
UPB	G15CA003	GRADER,MOTOR, ARTIC, CAT 12-G	10.86	4.86	3.92	1.37	0.55	0.09	11.39	33.04	HR	2
MIL	H25CA004	HYD EXCAV,CRWLR, 1.00CY BKT,LONG	15.83	4.80	3.63	1.42			16.98	42.66	HR	18
UPB	H25CA008	HYD EXCAV, CRWLR, 3.125CY BKT	42.67	15.46	10.45	2.37			63.46	134.41	HR	337
MIL	L35CA005	LDR,FE, CRWLR, 2.00 CY	11.29	3.81	3.78	1.48			21.64	41.99	HR	18
UPB	L35CA006	LDR,FE, CRWLR, 2.60 CY	15.16	5.11	5.15	2.01			29.07	56.50	HR	254
UPB	L35CA007	LDR,FE, CRWLR, 3.75 CY	22.94	7.73	7.21	2.82			43.98	84.68	HR	555
MIL	L40CA003	LDR,FE, WH, 2.00 CY, ARTIC, 926E	7.67	2.95	3.48	1.51	1.13	0.17	7.96	24.88	HR	18
MIL	L50CS002	LDR,BH,WH, 1.00CY FE BKT, 24"DIP	4.02	1.53	2.22	0.73	0.34	0.05	4.76	13.67	HR	62
MIL	L50CS003	LDR,BH,WH, 1.00CY FE BKT, 24"DIP	4.54	1.73	2.22	0.73	0.34	0.05	5.37	14.99	HR	70
MIL	M10MZ007	WORK BARGE-S,MED DUTY,50'X14'X4'	2.01	0.56					1.52	4.09	HR	24
MIL	P50H0005	PUMP,TRASH, 4"D, 39,720GPH/25'HD	0.29	0.09	1.92	0.63			0.38	3.31	HR	2672
MIL	P60GF003	PUMP,CENTRF,DW,4"D, 485GPM/60'HD	1.40	0.43	1.41	0.55	0.04	0.01	1.83	5.67	HR	36
UPB	R30CA001	ROLLR,STATIC,S/P,13T,84"W,11TIRE	5.11	1.54	2.44	0.60	0.98	0.15	4.75	15.58	HR	2
MIL	R45DY004	ROLLER,VIB,DD,S/P,17.1T, 84"W	16.33	4.51	9.24	3.05			23.42	56.55	HR	18
UPB	R50DY005	ROLLER,VIB,SD,S/P,22.0T, 84"W	12.61	3.57	6.64	2.19	0.66	0.10	16.53	42.31	HR	165
UPB	T10CA009	BLADE, STRAIGHT, HYDR, D-6	1.54	0.52		0.08			1.76	3.90	HR	758
UPB	T10CA010	BLADE, ANGLE, HYDR, D-6	1.71	0.58		0.08			1.96	4.32	HR	1786
UPB	T10CA016	BLADE, STRAIGHT, HYDR, D-8	2.95	0.99		0.12			3.38	7.45	HR	25
MIL	T10CA018	BLADE, ANGLE, HYDR, D-8	2.93	0.99		0.13			3.36	7.41	HR	6
MIL	T10LE003	ROTARY HOE, 120" WIDE ROTERRA	0.60	0.20					0.69	1.49	HR	631
MIL	T15CA008	DOZER,CWLR, D-6D,PS	9.01	3.34	4.80	1.78			16.52	35.45	HR	480
UPB	T15CA010	DOZER,CWLR, D-6H,PS	11.38	4.22	5.66	2.10			20.87	44.23	HR	1880
MIL	T15CA011	DOZER,CWLR, D-6H,LGP	13.06	4.85	5.66	2.10			23.97	49.64	HR	183
MIL	T15CA015	DOZER,CWLR, D-8L,PS	26.41	8.90	11.50	3.32			37.85	87.97	HR	25
UPB	T15CA016	DOZER,CWLR, D-8N,PS	21.53	7.26	9.78	2.82			30.86	72.25	HR	6
UPB	T40XX008	REAR DUMP BODY, 8.0CY	1.20	0.33		0.09			1.13	2.75	HR	60
UPB	T40XX010	REAR DUMP BODY, 12.0CY	1.23	0.34		0.09			1.16	2.82	HR	1084
MIL	T40XX012	FLATBED, 8'x 9.0'	0.25	0.07					0.20	0.53	HR	6
MIL	T40XX014	FLATBED, 8'x 12.0'	0.28	0.08					0.23	0.59	HR	75
MIL	T40XX031	WATER TANK, 2000 GAL	1.46	0.40					1.18	3.04	HR	75
UPB	T40XX033	WATER TANK, 3000 GAL	1.63	0.45					1.32	3.40	HR	2
MIL	T45XX016	TRLR,LOWBOY, 50T, 3 AXLE	2.57	1.21		0.50	0.97	0.15	2.07	7.47	HR	345
UPB	T45XX019	TRLR,LOWBOY, 75T, 3 AXLE	3.47	1.64		0.50	1.32	0.20	2.80	9.93	HR	4
UPB	T50F0003	TRK,HWY, 8,600GVW,4X2, 3/4T-PKUP	1.68	0.47	2.41	0.70	0.19	0.03	1.83	7.31	HR	1336
MIL	T50F0005	TRK,HWY,10,000GVW,4X2, 1T-PICKUP	1.86	0.53	2.83	0.82	0.31	0.05	2.04	8.42	HR	70

** EQUIPMENT BACKUP **

SRC	ID.NO.	EQUIPMENT DESCRIPTION	DEPR	FCCM	FUEL	FOG	TR WR	TR REP	EQ REP	TOTAL RATE	** TOTAL ** HOURS
MIL	T50F0006	TRK,HWY, 21,000 GVW, 4X2, 2 AXLE	2.09	0.68	9.89	3.06	0.52	0.08	2.14	18.46 HR	6
MIL	T50F0013	TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	5.11	1.52	7.64	2.20	1.28	0.20	4.88	22.84 HR	1084
MIL	T50F0014	TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	5.25	1.56	7.64	2.20	1.33	0.20	5.02	23.22 HR	415
MIL	T50GM008	TRK,HWY,10,00GVW,4X2, 1T-PICKUP	1.78	0.49	3.41	0.98	0.18	0.03	1.94	8.81 HR	11
MIL	T50GM009	TRK,HWY,10,000GVW,4X4, 1T-PICKUP	2.01	0.56	3.41	0.98	0.21	0.03	2.19	9.39 HR	5
MIL	T50GM016	TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	4.23	1.28	7.83	2.26	1.31	0.20	4.06	21.16 HR	62
MIL	T50KE003	TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	9.42	2.64	9.46	2.73	0.44	0.07	8.89	33.66 HR	69
UPB	T50KE004	TRK,HWY, 50,000 GVW, 6X4, 3 AXLE	10.00	2.80	9.46	2.73	0.44	0.07	9.43	34.93 HR	4
MIL	W35XX001	WELDER, 250 AMP, W/1 AXLE TRLR	0.67	0.23	1.07	0.26	0.04	0.01	0.79	3.07 HR	115
UPB	W35XX002	WELDER, 200 AMP, W/1 AXLE TRLR	0.49	0.17	4.18	1.03	0.03	0.01	0.57	6.48 HR	223
UPB	W35XX009	WELDER, 300 AMP, SKID,ELEC DRIVE	0.37	0.09	0.66	0.27			0.26	1.65 HR	7
UPB	XMIXX010	MISC. POWER TOOLS	2.17	0.76	0.60	0.27			2.60	6.40 HR	224
UPB	XMIXX020	SMALL TOOLS	0.50	0.22	0.16	0.07			0.63	1.57 HR	1043
UPB	XX0XX001	FLOATING CRANE, 150T, 250FT BOOM	64.50	23.00	18.19	7.94			79.55	193.18 HR	24
UPB	XX0XX002	TUG BOAT, 500 TO 800 HP	21.26	7.58	6.00	2.62			26.22	63.68 HR	24
UPB	XX0XX006	DREDGE BARGE, 500 TO 800 TON	7.36	2.63	2.08	0.90			9.07	22.03 HR	24

SRC	ID.NO.	EQUIPMENT DESCRIPTION	DEPR	FCCM	FUEL	FOG	TR WR	TR REP	EQ REP	TOTAL RATE	** TOTAL ** HOURS
06. Fish and Wildlife Facilities											
UPB	A15XX011	AIR COMPR, 450 CFM, 100 PSI	4.08	1.54	4.75	1.37	0.14	0.02	4.29	16.19 HR	4
UPB	A20XX005	AIR HOSE, 2.00", 100',HARDROCK	0.29	0.04					0.51	0.84 HR	4
MIL	B35HE009	BUCKET,DRAGLINE, 4.5CY, LTWT	1.79	0.45					1.66	3.89 HR	24
MIL	B35HE037	BUCKET,DRAGLINE, 3.5CY, HVWT	1.89	0.58					1.75	4.22 HR	29
MIL	C05H0001	CHAINSAW, 31" LONG BAR	0.16	0.02	0.36	0.62			0.51	1.66 HR	1016
MIL	C10B0005	COMPACTOR, VIBROPLATE,18.9"X27.4	0.66	0.12	0.18	0.04			1.07	2.06 HR	14
MIL	C10B0011	ROLLER,WK-BH,VIB DBL,0.9T,23.6"W	1.95	0.36	0.35	0.09			3.17	5.93 HR	18
MIL	C10WC003	COMPACTOR, RAMMER, 11"X13" SHOE	0.62	0.11	0.48	0.12			1.00	2.33 HR	139
UPB	C65WC002	CONC VIBRATOR, 2.50D, EL,HI-FREQ	0.31	0.05	0.07	0.17			1.01	1.61 HR	189
MIL	C75BD002	CRANE,HYD,S/P,RT,4WD, 9T/44'BOOM	4.94	2.10	9.76	3.22	0.30	0.05	5.11	25.47 HR	169
MIL	C75BD003	CRANE,HYD,S/P,RT,4WD,13.6T/49'BM	5.96	2.57	9.76	3.22	0.60	0.09	6.18	28.38 HR	52
MIL	C75PH004	CRANE,HYD,S/P,RT,4WD,22T/72'BOOM	13.42	5.75	4.80	1.48	1.14	0.18	13.89	40.67 HR	72
MIL	C85AM005	CRANE,DRAG/CLAM,10.0CY /140'BOOM	129.16	68.09	22.18	5.48			174.77	399.67 HR	29
MIL	C85LB002	CR,ME,CWLR,LIFTING, 40T/ 50'BOOM	17.58	7.82	2.32	0.48			16.99	45.18 HR	4
UPB	D35R0002	DRILL,R-BLASTH, 6.75"-9.88",TRK	28.81	13.45	15.62	6.11	2.29	0.35	38.40	105.02 HR	5
UPB	G10H0004	GENERATOR, 5.5 KW, 120/240V,PORT	0.23	0.06	0.95	0.24			0.17	1.65 HR	94
UPB	G15CA003	GRADER,MOTOR, ARTIC, CAT 12-G	10.86	4.86	3.92	1.37	0.55	0.09	11.39	33.04 HR	2
MIL	H25CA004	HYD EXCAV,CRWLR, 1.00CY BKT,LONG	15.83	4.80	3.63	1.42			16.98	42.66 HR	18
UPB	H25CA008	HYD EXCAV, CRWLR, 3.125CY BKT	42.67	15.46	10.45	2.37			63.46	134.41 HR	337
MIL	L35CA005	LDR,FE, CRWLR, 2.00 CY	11.29	3.81	3.78	1.48			21.64	41.99 HR	18
UPB	L35CA006	LDR,FE, CRWLR, 2.60 CY	15.16	5.11	5.15	2.01			29.07	56.50 HR	254
UPB	L35CA007	LDR,FE, CRWLR, 3.75 CY	22.94	7.73	7.21	2.82			43.98	84.68 HR	555
MIL	L40CA003	LDR,FE, WH, 2.00 CY, ARTIC, 926E	7.67	2.95	3.48	1.51	1.13	0.17	7.96	24.88 HR	18
MIL	L50CS002	LDR,BH,WH, 1.00CY FE BKT, 24"DIP	4.02	1.53	2.22	0.73	0.34	0.05	4.76	13.67 HR	62
MIL	L50CS003	LDR,BH,WH, 1.00CY FE BKT, 24"DIP	4.54	1.73	2.22	0.73	0.34	0.05	5.37	14.99 HR	70
MIL	M10MZ007	WORK BARGE-S,MED DUTY,50'X14'X4'	2.01	0.56					1.52	4.09 HR	24
MIL	P50H0005	PUMP,TRASH, 4"D, 39,720GPH/25'HD	0.29	0.09	1.92	0.63			0.38	3.31 HR	2672
MIL	P60GF003	PUMP,CENTRF,DW,4"D, 485GPM/60'HD	1.40	0.43	1.41	0.55	0.04	0.01	1.83	5.67 HR	36
UPB	R30CA001	ROLLR,STATIC,S/P,13T,84"W,11TIRE	5.11	1.54	2.44	0.60	0.98	0.15	4.75	15.58 HR	2
MIL	R45DY004	ROLLER,VIB,DD,S/P,17.1T, 84"W	16.33	4.51	9.24	3.05			23.42	56.55 HR	18
UPB	R50DY005	ROLLER,VIB,SD,S/P,22.0T, 84"W	12.61	3.57	6.64	2.19	0.66	0.10	16.53	42.31 HR	165
UPB	T10CA009	BLADE, STRAIGHT, HYDR, D-6	1.54	0.52		0.08			1.76	3.90 HR	758
UPB	T10CA010	BLADE, ANGLE, HYDR, D-6	1.71	0.58		0.08			1.96	4.32 HR	1786
UPB	T10CA016	BLADE, STRAIGHT, HYDR, D-8	2.95	0.99		0.12			3.38	7.45 HR	25
MIL	T10CA018	BLADE, ANGLE, HYDR, D-8	2.93	0.99		0.13			3.36	7.41 HR	6
MIL	T10LE003	ROTARY HOE, 120" WIDE ROTERRA	0.60	0.20					0.69	1.49 HR	631
MIL	T15CA008	DOZER,CWLR, D-6D,PS	9.01	3.34	4.80	1.78			16.52	35.45 HR	480
UPB	T15CA010	DOZER,CWLR, D-6H,PS	11.38	4.22	5.66	2.10			20.87	44.23 HR	1880
MIL	T15CA011	DOZER,CWLR, D-6H,LGP	13.06	4.85	5.66	2.10			23.97	49.64 HR	183
MIL	T15CA015	DOZER,CWLR, D-8L,PS	26.41	8.90	11.50	3.32			37.85	87.97 HR	25
UPB	T15CA016	DOZER,CWLR, D-8N,PS	21.53	7.26	9.78	2.82			30.86	72.25 HR	6
UPB	T40XX008	REAR DUMP BODY, 8.0CY	1.20	0.33		0.09			1.13	2.75 HR	60
UPB	T40XX010	REAR DUMP BODY, 12.0CY	1.23	0.34		0.09			1.16	2.82 HR	1084
IL	T40XX012	FLATBED, 8'x 9.0'	0.25	0.07					0.20	0.53 HR	6
MIL	T40XX014	FLATBED, 8'x 12.0'	0.28	0.08					0.23	0.59 HR	75
MIL	T40XX031	WATER TANK, 2000 GAL	1.46	0.40					1.18	3.04 HR	75
UPB	T40XX033	WATER TANK, 3000 GAL	1.63	0.45					1.32	3.40 HR	2
MIL	T45XX016	TRLR,LOWBOY, 50T, 3 AXLE	2.57	1.21		0.50	0.97	0.15	2.07	7.47 HR	345
UPB	T45XX019	TRLR,LOWBOY, 75T, 3 AXLE	3.47	1.64		0.50	1.32	0.20	2.80	9.93 HR	4
UPB	T50F0003	TRK,HWY, 8,600GVW,4X2, 3/4T-PKUP	1.68	0.47	2.41	0.70	0.19	0.03	1.83	7.31 HR	1336

** EQUIPMENT BACKUP - Level 1 **

SRC	ID.NO.	EQUIPMENT DESCRIPTION	DEPR	FCCM	FUEL	FOG	TR WR	TR REP	EQ REP	TOTAL RATE	** TOTAL ** HOURS
MIL	T50F0005	TRK,HWY,10,000GVW,4X2, 1T-PICKUP	1.86	0.53	2.83	0.82	0.31	0.05	2.04	8.42 HR	70
MIL	T50F0006	TRK,HWY, 21,000 GVW, 4X2, 2 AXLE	2.09	0.68	9.89	3.06	0.52	0.08	2.14	18.46 HR	6
MIL	T50F0013	TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	5.11	1.52	7.64	2.20	1.28	0.20	4.88	22.84 HR	1084
MIL	T50F0014	TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	5.25	1.56	7.64	2.20	1.33	0.20	5.02	23.22 HR	415
MIL	T50GM008	TRK,HWY,10,00GVW,4X2, 1T-PICKUP	1.78	0.49	3.41	0.98	0.18	0.03	1.94	8.81 HR	11
MIL	T50GM009	TRK,HWY,10,000GVW,4X4, 1T-PICKUP	2.01	0.56	3.41	0.98	0.21	0.03	2.19	9.39 HR	5
MIL	T50GM016	TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	4.23	1.28	7.83	2.26	1.31	0.20	4.06	21.16 HR	62
MIL	T50KE003	TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	9.42	2.64	9.46	2.73	0.44	0.07	8.89	33.66 HR	69
UPB	T50KE004	TRK,HWY, 50,000 GVW, 6X4, 3 AXLE	10.00	2.80	9.46	2.73	0.44	0.07	9.43	34.93 HR	4
MIL	W35XX001	WELDER, 250 AMP, W/1 AXLE TRLR	0.67	0.23	1.07	0.26	0.04	0.01	0.79	3.07 HR	115
UPB	W35XX002	WELDER, 200 AMP, W/1 AXLE TRLR	0.49	0.17	4.18	1.03	0.03	0.01	0.57	6.48 HR	223
UPB	W35XX009	WELDER, 300 AMP, SKID,ELEC DRIVE	0.37	0.09	0.66	0.27			0.26	1.65 HR	7
UPB	XMIXX010	MISC. POWER TOOLS	2.17	0.76	0.60	0.27			2.60	6.40 HR	224
UPB	XMIXX020	SMALL TOOLS	0.50	0.22	0.16	0.07			0.63	1.57 HR	1043
UPB	XXOXX001	FLOATING CRANE, 150T, 250FT BOOM	64.50	23.00	18.19	7.94			79.55	193.18 HR	24
UPB	XXOXX002	TUG BOAT, 500 TO 800 HP	21.26	7.58	6.00	2.62			26.22	63.68 HR	24
UPB	XXOXX006	DREDGE BARGE, 500 TO 800 TON	7.36	2.63	2.08	0.90			9.07	22.03 HR	24

30. Planning, Engineering and Design
31. Construction Management

No errors detected...

* * * END OF ERROR REPORT * * *

** PROJECT SETTINGS **

ESTIMATE TYPE : A-Crews with Auto Reprice

SALES TAX : 0.00%

DATE OF ESCALATION SCHEDULE : 07/25/96

PROJECT DIRECT COST COLUMNS

Col Type	L	E	M	U	X
Rep Width	10	10	10	10	0
Title	LABOR	EQUIPMNT	MATERIAL	OTHER	(Unused)

PROJECT INDIRECT COST COLUMNS

Col Type	O	U	U	B	P
Rep Width	10	10	10	10	10
Title	FIELDMOB	HOME OFC	IOOC	BOND	PROFIT

PROJECT OWNER COST COLUMNS

Col Type	C	X	X	X	X
Rep Width	10	0	0	0	0
Title	CONTINGN	(Unused)	(Unused)	(Unused)	(Unused)

PROJECT BREAKDOWN

PROJECT ID	Length	Trail Sep	Level Title	2nd View Order
Level 1 ID :	2		Level 1	0
Level 2 ID :	2		Level 2	0
Level 3 ID :	2		Level 3	0
Level 4 ID :	2		Level 4	0
Level 5 ID :	3		Level 5	0
Level 6 ID :	3		Level 6	0

Owner Cost Level : 0

** PROJECT SETTINGS **

2ND VIEW COLUMNS

Quantity Column Width : 10

Col Type	X	X	X	X	X
Rep Width	0	0	0	0	0
Title	(Unused)	(Unused)	(Unused)	(Unused)	(Unused)
Shadow	X	X	X	X	X

DETAIL REPORT FORMATTING

PAGE OPTIONS
Page Break Levels : 1
Table of Contents Levels : 2

0 1 2 3 4 5 6 7

ROW OPTIONS
Print Titles at Levels : Y Y Y Y Y Y
Print Totals at Levels : Y Y Y Y Y Y
Print Notes at Levels : Y Y Y Y Y Y Y Y
Print Unit Cost Row : N
Print Page Footer : Y
Show Cost Codes : Y

COLUMNS OPTIONS
Print Crew Id : Y
Crew Output : Y
Unit Cost : Y

UPB TITLES
No. of Levels to Print : 0
Bracket Titles With : N N
Include titles Notes : N

** PROJECT SETTINGS **

OTHER REPORT FORMATTING

COLUMN TITLES FOR SUMMARY REPORTS

Column 1 FIELDMOB : Field Office Overhead & MOB/DEMOB
Column 2 HOME OFC : Home Office Overhead
Column 3 IOOC : Interest on Operating Capital
Column 4 BOND : Bond
Column 5 PROFIT : Profit

Column 1 CONTINGN : Contingency
Column 2 (Unused) :
Column 3 (Unused) :
Column 4 (Unused) :
Column 5 (Unused) :

STANDARD COLUMN WIDTHS

Quantity Columns : 8
Total cost Columns : 12
Unit Cost Columns : 8

SUMMARY FEATURES

Round Totals Column : N-None
Contingency Notes : No
Show Project Totals : Yes

SPECIAL REPORT FORMATTING OPTIONS

First Alternate ID : (None)
Show Markup at Level : 0
Display Indirect/Owner Markup as : A - Unit Costs Only
CSI Sort at Level : (None)

** PROJECT SETTINGS **

REPORT SELECTION

Project Settings : Y   Profit Guidelines : N
Contractor Settings : N
Link Listing : N   Measurement Units : U.S.

	REPORT FORMAT TYPE			FOR LEVEL (S)
	Direct	Indirect	Owner	0 1 2 3 4 5 6
Detail :	Y			
Project :	Y	Y	Y	Y Y N N N Y
Contractor :	N	N		N N N N N N N
Division :	N	N	N	N N N N N N N
System :	N	N	N	N N N N N N N
2nd View :	N			
Crew :	Y			Y Y N N N N N
Labor :	Y			
Equipment :	Y			
Prime Labor Cost Level :	N			

** OWNER, OVERTIME, AND ADJUSTMENTS SETTINGS **

		AMOUNT	PERCENT	ESCALATN DATE BEGIN	ESCALATN DATE END	ESCALATN INDEX BEGIN	ESCALATN INDEX END
Project Information Record							
Contingency	P		0.00				
06 03 73 09 FB Dredging, State Area (fisheries)							
Contingency	P		20.00				
06 03 73 09 FC Dredging, USFWS Lower(fisheries)							
Contingency	P		20.00				
06 03 73 09 F-1 Dredging,USFWS Middle(fisheries)							
Contingency	P		20.00				
06 03 73 09 G-1 Dredging, State Area							
Contingency	P		20.00				
06 03 73 09 M-3 001 Excavation							
Contingency	P		20.00				
06 03 73 09 M-3 002 6" Minus Stone							
Contingency	P		10.00				
06 03 73 09 M-3 003 3" Minus Stone							
Contingency	P		10.00				
06 03 73 09 M-3 004 Geogrid							
Contingency	P		10.00				
06 03 73 09 M-3 005 Geotextile							
Contingency	P		10.00				
06 03 73 09 M-3 006 Cofferdam							
Contingency	P		35.00				
06 03 73 09 M-3 007 Concrete, Reinforced							
Contingency	P		20.00				
06 03 73 09 M-3 008 Stop Logs							
Contingency	P		20.00				
06 03 73 09 M-3 009 Jib Crane							
Contingency	P		15.00				
06 03 73 09 M-3 010 Handrail							
Contingency	P		10.00				
06 03 73 09 M-3 011 Metal Grate							
Contingency	P		10.00				
06 03 73 09 M-3 012 Backfill							
Contingency	P		15.00				

** OWNER, OVERTIME, AND ADJUSTMENTS SETTINGS **

	AMOUNT	PERCENT	*ESCALATN DATE* BEGIN	END	*ESCALATN INDEX* BEGIN	END
06 03 73 09 0-6 001 2-8' Stop Log Structure Contingency	P	25.00				
06 03 73 09 0-6 002 4-8' Stop Log Structure Contingency	P	25.00				
06 03 73 09 0-6 003 1-8' Stop Log Structure Contingency	P	25.00				
06 03 73 09 Q-2 001 Excavation Contingency	P	20.00				
06 03 73 09 Q-2 002 6" Minus Stone Contingency	P	10.00				
06 03 73 09 Q-2 003 3" Minus Stone Contingency	P	10.00				
06 03 73 09 Q-2 004 Geogrid Contingency	P	10.00				
06 03 73 09 Q-2 005 Geotextile Contingency	P	10.00				
06 03 73 09 Q-2 006 Cofferdam Contingency	P	35.00				
06 03 73 09 Q-2 007 Concrete, Reinforced Contingency	P	20.00				
06 03 73 09 Q-2 008 Stop Logs Contingency	P	20.00				
06 03 73 09 Q-2 009 Jib Crane Contingency	P	15.00				
06 03 73 09 Q-2 010 Handrail Contingency	P	10.00				
06 03 73 09 Q-2 011 Metal Grate Contingency	P	10.00				
06 03 73 09 Q-2 012 Backfill Contingency	P	15.00				
06 03 73 09 R-3 001 Excavation Contingency	P	20.00				
06 03 73 09 R-3 002 6" Minus Stone Contingency	P	10.00				

** OWNER, OVERTIME, AND ADJUSTMENTS SETTINGS **

	AMOUNT	PERCENT	*ESCALATN DATE* BEGIN	END	*ESCALATN INDEX* BEGIN	END
06 03 73 09 R-3 003 3" Minus Stone Contingency	P	10.00				
06 03 73 09 R-3 004 Geogrid Contingency	P	10.00				
06 03 73 09 R-3 005 Geotextile Contingency	P	10.00				
06 03 73 09 R-3 006 Cofferdam Contingency	P	35.00				
06 03 73 09 R-3 007 Concrete, Reinforced Contingency	P	20.00				
06 03 73 09 R-3 008 Stop Logs Contingency	P	20.00				
06 03 73 09 R-3 009 Jib Crane Contingency	P	15.00				
06 03 73 09 R-3 010 Handrail Contingency	P	10.00				
06 03 73 09 R-3 011 Metal Grate Contingency	P	10.00				
06 03 73 09 R-3 012 Backfill Contingency	P	15.00				
06 03 73 09 W-2 001 Excavation, Rock Contingency	P	30.00				
06 03 73 09 W-2 002 Excavation, Earth Contingency	P	20.00				
06 03 73 09 W-2 003 Cofferdam, Earth (place/remove) Contingency	P	35.00				
06 03 73 09 W-2 004 Concrete, Reinforced Contingency	P	20.00				
06 03 73 09 W-2 005 Riprap, 650 Lb. Topsize Contingency	P	10.00				
06 03 73 09 W-2 006 Bedding Material Contingency	P	10.00				
06 03 73 09 W-2 007 Sheet Pile Removal (existing) Contingency	P	15.00				

** OWNER, OVERTIME, AND ADJUSTMENTS SETTINGS **

		AMOUNT	PERCENT	*ESCALATN DATE* BEGIN	END	*ESCALATN INDEX* BEGIN	END
06 03 73 09 W-2 008 Dewatering Contingency	P		30.00				
06 03 73 09 W-2 009 Sluice Gates, 54" Diameter Contingency	P		10.00				
06 03 73 09 W-2 010 Backfill Gravelly Clay Contingency	P		15.00				
06 03 73 09 W-2 011 Electric Gaging Station Contingency	P		20.00				
06 03 73 09 W-2 012 Hydraulic Operator Contingency	P		15.00				
06 03 73 09 W-2 013 Cofferdam Mucking Contingency	P		35.00				
06 03 73 09 W-2 014 "C" Stone Contingency	P		10.00				
06 03 73 09 W-2 015 Grating, Fiberglass Contingency	P		20.00				
06 03 73 09 W-2 016 Stop Logs 6" x 10" Contingency	P		20.00				
06 03 73 09 W-2 017 Stop Log Building 8' x 8' Contingency	P		20.00				
06 03 73 09 W-2 018 Jib Crane Contingency	P		15.00				
06 03 73 09 W-2 019 Concrete Pipe, 54" Diameter Contingency	P		15.00				
06 03 73 09 W-2 020 Signs, Information Contingency	P		10.00				
06 03 73 09 W-2 021 Miscellaneous Metals Contingency	P		30.00				
06 03 73 11 AB Bottomland Forest Habitat Contingency	P		10.00				
06 03 73 11 KB Hillside Sediment Control Contingency	P		10.00				
06 03 73 11 KC Hillside Sediment Control Contingency	P		10.00				

** OWNER, OVERTIME, AND ADJUSTMENTS SETTINGS **

		AMOUNT	PERCENT	*ESCALATN DATE* BEGIN	END	*ESCALATN INDEX* BEGIN	END
06 03 73 11 B-2 Riverside Levee, USFWS Lower							
Contingency	P		20.00				
06 03 73 11 C-2 Riverside Levee, State Area							
Contingency	P		20.00				
06 03 73 11 D-1 Lowland Sediment Trap, USFWS							
Contingency	P		20.00				
06 03 73 11 E-1 Lowland Sediment Trap, State							
Contingency	P		20.00				
06 03 73 11 K-1 Hillside Sediment Control							
Contingency	P		10.00				
06 03 73 11 L-2 Interior Levee Between USFWS							
Contingency	P		20.00				
06 03 73 11 XXX Overflow Structure, State-							
Contingency	P		15.00				
06 03 73 11 XXZ Boat Pullover							
Contingency	P		15.00				
06 03 73 13 H-1 001 44 CFS Pump							
Contingency	P		20.00				
06 03 73 13 I-2 001 15 CFS Portable, Trailer Mounted							
Contingency	P		20.00				
06 03 73 13 I-2 003 500 Gallon Portable Fuel Tank							
Contingency	P		20.00				
06 03 73 13 J-2 001 90 CFS Permanently Mtd Pump							
Contingency	P		20.00				
06 03 73 13 J-2 002 Portable Diesel Engine Drive							
Contingency	P		20.00				
06 03 73 13 J-2 003 1,000 Gallon Portable Fuel Tank							
Contingency	P		20.00				
06 03 73 13 J-2 004 42" Diameter Steel Pipe							
Contingency	P		10.00				
06 03 73 13 J-2 005 42" Diameter Flap Gate							
Contingency	P		10.00				
06 03 73 13 J-2 006 6' High Fence							
Contingency	P		10.00				

** OWNER, OVERTIME, AND ADJUSTMENTS SETTINGS **

		AMOUNT	PERCENT	*ESCALATN DATE* BEGIN	END	*ESCALATN INDEX* BEGIN	END
06 03 73 13 J-2 007 6' High and 10' Wide Fence Gate Contingency	P		10.00				
06 03 73 13 J-2 008 Concrete Pad & Curb Contingency	P		15.00				
06 03 73 13 J-2 009 30" Riprap Contingency	P		10.00				
06 03 73 13 J-2 010 Excavation Contingency	P		20.00				
06 03 73 13 J-2 011 Cofferdam, Gravelly Clay Contingency	P		35.00				
06 03 73 13 J-2 012 Staff Gages Contingency	P		10.00				
06 03 73 13 J-2 013 Pipe Bedding Material Contingency	P		10.00				
06 03 73 13 J-2 014 9" Bedding Contingency	P		10.00				
06 03 73 13 J-2 015 PZ27 Sheetpile Retaining Wall Contingency	P		15.00				
30 23 01 Plans and Specifications (P&S) Contingency	A	100,000					
30 23 07 Cost Estimates Contingency	A	5,000					
30 23 10 Engineering During Construction Contingency	A	25,000					
30 23 14 Project Management Contingency	A	12,000					
30 24 Value Engineerng Study Contingency	A	6,000					
31 23 11 01 Contract Administration Contingency	A	20,000					
31 23 11 02 Benchmarks/Surveys Contingency	A	15,000					
31 23 11 03 Review Shop Drawings Contingency	A	8,000					

** OWNER, OVERTIME, AND ADJUSTMENTS SETTINGS **

		AMOUNT	PERCENT	*ESCALATN DATE* BEGIN	END	*ESCALATN INDEX* BEGIN	END
31 23 11 04 Inspection/QA							
Contingency	A	20,000					
31 23 11 05 Project Office							
Contingency	A	40,000					
31 23 11 06 Project Management							
Contingency	A	3,000					

Appendix M - Cultural Resources and SHPO Concurrence

M-1 SHPO Concurrence

M-2 Cultural Resources Review Form for the Hillside Sediment Control program

Illinois Historic
Preservation Agency

1 Old State Capitol Plaza • Springfield, Illinois 62701-1507 • (217) 782-4836 • TTY (217) 524-7128

217/785-4997

CALHOUN COUNTY
Batchtown
Habitat Rehabilitation & Enhancement Project

PLEASE REFER TO:
IHPA LOG #940330003M-C
American Resources Group
121 acres 7 sites

July 19, 1995

Ms. Suzanne Harris
US Army Corps of Engineers, St Louis Dst
PDAE Section
1222 Spruce Street
St. Louis, Missouri 63103-2833

Gentlemen:

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

Our staff has reviewed the archaeological Phase I reconnaissance report performed for the project referenced above. The Phase I survey and assessment of the archaeological resources appear to be adequate. We concur with your evaluation that sites 11-C- 207, C-208, C-209, and C-210 are potentially eligible for listing on the National Register of Historic Places while sites 11-C-205, C-206, and C-211 are ineligible for listing. Further it is our understanding that none of the sites determined to be potentially eligible will be impacted by project construction as planned.

Therefore we concur that the project as presently defined will have no effect upon any Historic Properties. We, therefore, have no objection to the undertaking proceeding as planned.

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

Sincerely,

Anne E. Haaker

Anne E. Haaker
Deputy State Historic
Preservation Officer

AEH:JSP

cc: Mr. Michael J. McNerney

M-1

United States Department of Agriculture
Natural Resources Conservation Service

4/96

Cultural Resources Review Form

To be completed for all "Undertakings" (refer to GM Subpart D Appendices 401.40)

Field Office: ______________________ County: ______________
Evaluator: ______________________ Evaluation Date: ______________

Area of Potential Effect (APE)

Owner/Operator: __________________________ County: ______________
USGS Quadrangle: __________ Township: _____ Range: _____ Section: _____ 1/4 Sec. _____
Tract #:______ Field #:______ Ground Cover: __________ Proposed Construction Date: ______
Name of Practice: ____
Funding: Federal__________ State__________ None__________

Cultural Resources Review	Yes	No
A. Is owner/operator aware of any historic structural remains, or artifacts from the APE? Describe:______________________		
B. Did the archaeological site files show the presence of cultural resources? *(CRS will fill in)*.....If yes, list sites:______________________		
C. Did you find any buildings shown in the old county atlases or platbooks? What year did the building first appear?______________________		
D. Are there any buildings over 50 years old in project area? Describe: ______________________		
E. Are there any National Register sites in APE?..		

Project Site Inspection

A. Date APE was walked and visually searched for physical evidence of historic and prehistoric artifacts:______________________
By:______________________ %Ground Visibility:____

B. Was anything found? *(if yes, fill out New Site Report Form)*..................................
Describe:______________________
____

(Attach copy of quadrangle map with APE marked to this form and send to Cultural Resources Specialist. Keep a copy for your files

M-2

Page

NEW SITE REPORT FORM

Reported by: ______________________________ Date: ______________________________

Location

County: ______________________ Quadrangle: ____________________

Township: _______ Range: _______ Section: ________ 1/4 Sec: ________

Landowner/Tenant/Farm Manager

Name: ____ Telephone: ______________

Address: ____

Current Land Use: ____

Site Description

Surface area: ___________ feet long by ____________ feet wide

Site Type: ____ visible building ____ mound _____ surface scatter

Other: ____

Artifacts: (check one or more)

____Projectile points ____Chert chips/chunks ____Grinding stones ____Metal

____Pottery ____Brick ____Glass ____Fire-cracked rock

____Bone ____Charcoal ____Burned clay

Other: ____

Amount of material:
____Sparse (only an occasional artifact)
____Moderate
____Dense (numerous artifacts visible from any spot on site)

Environment

Nearest natural water source: _________________________ Distance: _____________________
Soil Types: ____
Topographic setting: (upland, floodplain, wetland margin)
____

Present land use:_____________________________________% Visibility:___________

Procedure for Cultural Resources Consideration

Step 1: Determine if NRCS activity is an undertaking.

Undertakings have adverse effects on historic properties if they alter the soil at the location of the historic site.

Check list of conservation practices considered to be undertakings in General Manual Subpart B Appendices 401.40.

Step 2: Determine Area of Potential Effect

You must include all areas to be altered: access and haul roads, borrow areas, areas where spoil will be spread, viewshed of the landscape, as well as area of actual conservation structure. All of these areas are the "Area of Potential Effect" or APE.

Step 3: Determine if cultural resources are in APE.

Send location of APE to Cultural Resources Specialist (CRS) to be checked against the Illinois state site files. The CRS needs to know: county, quadrangle, township, range, and section. Send a copy of the relevant part of the quad map with the project area clearly marked.

Check historic plat maps for buildings that may have stood in the project area in the 18th, 19th and early 20th centuries.

Check the cultural resources file in the field office to see if APE is near a historic property listed on the National Register of Historic Places, or if a locally known site of importance is in or near the APE.

Step 4: Conduct field inspection for cultural resources.

Early in project planning, walk over the APE looking for artifactual material or remains of historic structures. (NRCS personnel should expect that a few of their projects will have cultural resources present, especially on uplands or terraces along permanent water sources.) If present, flag the location of the material to determine the site extent. Leave flags in field.

Reassure the landowner that all artifacts are the property of the landowner, and that NRCS policy is to protect cultural resources. The presence of cultural resources will rarely stop NRCS from continuing work on a project. Inform the CRS of the discovery of a new site.

Step 5: Avoid the cultural resource.

With involvement of the CRS and Landowner, redesign the conservation practice to maintain a distance of at least 50 feet away from the site. Most projects with cultural resources present will come to this conclusion.

However, if a cultural site cannot be avoided, go to Step 6.

Step 6: CRS will evaluate the significance of the site.

In some situations the cultural resource may lie precisely where the conservation activity must occur. The CRS with assistance from the State Historic Preservation Officer (SHPO) and possibly other archaeologists, will determine if the site is "significant" and eligible for listing on the National Register of Historic Places.

If the site is not significant, the conservation plan may proceed. If the site is significant, the landowner must protect the site by avoidance, select an alternative that doesn't cause disturbance, or mitigate effects to the resource. If the landowner does not want to mitigate, NRCS will withdraw assistance. The landowner may destroy a cultural resource (unless it is protected by state law, such as human remains or burial markings), but not with NRCS assistance.

If no alternative is selected and the landowner wants to proceed with the conservation practice, go to Step 7.

Step 7: Mitigate the adverse effect of the cultural resource.

Professional archaeologists or architects will be brought in to remove the historic property or excavate and collect data before the conservation practice is installed.

Procedure for Discovery During Construction

Step 1: Stop work immediately and protect site.

If human bone or burial markers are found or are suspected to be present, or if artifacts or building foundations are uncovered, stop work, protect the site by covering with plastic sheeting, and call the CRS and your supervisor.

If bone is found, contact the CRS and your supervisor immediately and the coroner within 48 hours.

Steps 6 and 7 above repeated.

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Appendix N - Cost Effectiveness Analysis

APPENDIX DPR-N

INCREMENTAL COST ANALYSIS

INTRODUCTION

The primary purpose of this project is the provision of wildlife habitat within the project area. When analyzing all potential habitat outputs the following were identified: Wildlife Average Annual Habitat Units (W-AAHU), Aquatic Average Annual Habitat Units (A-AAHU) and Mussel Average Annual Habitat Units. It was determined by the study team that the primary project purpose is the restoration of wildlife habitat. The secondary purpose is restoration of aquatic habitat and the third purpose is the restoration of mussel habitat. Therefore, the Incremental Cost Analysis was first completed on a strictly wildlife habitat unit basis. When the first analysis was completed, the second analysis, considering aquatic habitat, followed. When completing the second analysis, a certain level of wildlife habitat was considered to be optimum and was held constant and was thus utilized in conjunction with the aquatic analysis. The mussel restoration feature of the project was analyzed and it was determined that a complete Incremental Cost Analysis was not necessary or appropriate. Very few (five) measures contributed mussel habitat units. A certain flow of water is required to support the mussels and it is therefore not an area of incremental benefits and costs.

INCREMENTAL COST ANALYSIS - WILDLIFE

Step 1 - Display Outputs and Costs. Average Annual Costs were developed for all measures. The costs involved were construction costs (50 year project life), replacement costs as needed, and annual operation and maintenance costs.

A spreadsheet was created which displayed and analyzed several items:

a) The output measured in Wildlife Habitat Units (W-AAHUs) Aquatic Habitat Units (A-AAHUs) and Mussel Habitat Units per measure.

b) Cost data were entered into the spreadsheet See Exhibit N-1 for detailed information regarding itemized cost estimates for each potential project measure. The cost data were comprised of:

1. Initial Costs - Year 0, 1995 Price Level, including 25 percent Contingencies, 32 percent Engineering/Design, and Supervisory/ Administrative Costs;

2. Annual Operation & Maintenance Costs - Years 1-50; and
3. Replacement Costs as Necessary, including 25 percent Contingencies.

c) Output from the spreadsheet showed:

1. The Net Present Value of the 50 year cost stream for each measure, computed with a discount rate of 7.625 percent;
2. The Average Annual Cost per measure; and
3. The Average Annual Cost per W-AAHU per measure.

Exhibit N-2 displays the results of these computations.

<u>Step 2 - Identify Combinable Management Measures</u>. All combinable measures were determined from an exhibit which showed all project measures with any dependencies. See Exhibit N-3 for details of the relationships between project measures.

<u>Step 3 - Calculate Outputs and Costs of All Combinations</u>. Utilizing the information which delineates the combinable measures, there were over six hundred billion different combinations of measures available.

<u>Step 4 - Eliminate Economically Inefficient Combinations</u>
In order to make the number of measures manageable, a combination of Steps 4 and 5 below were applied. The economically inefficient and ineffective increments were first eliminated within each measure. For example:

Measure B2, 11 W-AAHU, \$3,000 Annual Cost;
Measure B3, 13 W-AAHU, \$2,900 Annual Cost; hence

-Plan B2 may be eliminated as economically inefficient.

The following scales of measures were determined to be inefficient or ineffective on a W-AAHU basis:

B2; C1; FB1; FC1; H2; H3; I3; J3; L1; M1; M2; M4; N1; O1; O2; O3; O5; O6; Q1; R1; R2; R4; W1;; W3; X3; Y1; Y2; Z1; Z2; Z3; AA1; AC1; and AB1.

Several measures displayed on the chart of dependencies are not included in the analysis. Measure "A" (Riverside Berm - Middle Area) has already been constructed by the U.S. Fish and Wildlife Service at no cost to the current project. Therefore, the costs and outputs associated with this measure are not included in the analysis. Measure "P with U" (Interior CMPs or Stop-Logs Between

Pools) was also completed in conjunction with repairs after the 1993 flood. Therefore, this measure is not included.

Some measures require other measures to be in service before they may be considered for implementation into a plan. (See Exhibit N-3). Note that the dependency relationships may be partitioned into independent "paths." The dependency paths begin with the implementation of Measure "B" or Measure "R." For example, after Measure "B" is included, one of the next tier, "X," "L" or "C" may be implemented. Both "L" and "C" have dependencies following: "L" is followed by "I," "N," "Q," and "KC." Measure "Q" is followed by "FC." Measure "C" is followed by "W," then "G," then "O," then "KB," "E," "J," and "FB" (all dependent on "O").
On the "R" path, the measures "D," "K," "H," and "F" are dependent on "R" first being implemented. After an "F" measure is included, measure "M" may be added.

After the elimination of the ineffective and inefficient measures and scales of measures, the remaining data were analyzed. In order to analyze the remaining data, a program developed by the U.S. Army Corps of Engineers - Waterways Experiment Station (for The Institute for Water Resources) was utilized. This program was developed as a tool for completing the "Nine Easy Steps." For this project, the program was utilized as a part of the whole analysis. The process utilized is summarized below:

1. The data were sorted into two separate areas - those measures which followed the "B Path" and those which followed the "R Path." The computer program has some restrictions and limitations so the program was essentially run twice to analyze the two separate areas.

2. The program analyzed the data and the following outputs were produced:

B Path:

- 24,091 possible combinations
- 103 effective and efficient combinations
- 14 final, smoothed data combinations

R Path:

- 25 possible combinations
- 9 effective and efficient combinations
- 5 final, smoothed data combinations

3. The two data sets had to be analyzed concurrently at this time. Therefore, the combinations contained within the final, smoothed data were utilized in the next step. A BASICA(© 1991, Microsoft Corporation) program was written which developed a list

of all potential solutions (utilizing the final 14 combinations from the "B Path" run and the final 5 combinations from the "R Path" run above).

4. A preliminary listing of all possible combinations (65) was the output from the BASICA program. (The 14 potential plans under the "B" path actually included two plans which had identical outputs and costs. Only one of the plans was utilized in the continuing analysis. In analyzing the final incremental plans, the duplicate plan was added to the list). This information was then analyzed and the economically inefficient and ineffective combinations were eliminated from further analysis. In order to accomplish this task, the data were sorted in ascending order by W-AAHU and secondly in ascending order by cost. Any plan which offered less or equal output for a greater cost than another plan was eliminated. After this process was complete, 35 plans remained.

<u>Step 5 - Eliminate Economically Ineffective Combinations</u>. See Step 4 discussed above.

<u>Step 6 - Calculate and Display Incremental Costs</u>. After all inefficient or ineffective combinations were eliminated (See Steps 4 and 5 above), 35 potentially economically efficient plans remained. The Incremental W-AAHU output, Incremental Annual Cost and Incremental Annual Cost per W-AAHU unit are displayed in Exhibit N-4. The column headings which read "Path Iden Numbers" represent the combinations of potential plans within the two sets of data. Later in the appendix, the final smoothed data includes the actual measures and scales identification numbers (Exhibit 8-A). Exhibits N-5 and N-6 display the Average Cost Curve and Incremental Cost Curve in graphical format.

<u>Step 7 - Calculate Change in Unit Cost from No-Action Plan to all Other Plans</u>. At this point in the analysis, the data was examined in order to determine a way in which the incremental data could be displayed in a manner more consistent with a classic incremental cost curve. The analysis performed revealed somewhat irregular, non-continuously increasing cost changes which are uncharacteristic of such a curve. Therefore, a method of "smoothing" the data was utilized. The total array of data for the 35 remaining combinations was examined.

The idea behind the smoothing process is to compare the incremental cost and incremental output of all plans over the no-action plan. The no-action plan is a baseline condition to which every other plan is compared. As a decision rule (according to <u>Nine Easy Steps</u> guidance), the plan with the lowest incremental cost per unit is the first baseline point. By definition, the plan with the smallest average annual cost per W-AAHU was chosen as the beginning point (compared to the no-action plan, the plan with the lowest average annual cost per W-AAHU is the plan with the lowest incremental cost per unit). The combinations preceding the chosen path (i.e. those paths whose total W-AAHU outputs were smaller) were not utilized within this analysis.

<u>Step 8 - Recalculate Change in Unit Cost From Last Selected Plan</u>. After the beginning point is established, the remaining database (the combination with the minimum average annual cost per W-AAHU unit and all combinations with greater outputs) is analyzed and compared to the "new" baseline point. Each combination is evaluated in relation to the beginning point. The incremental outputs and incremental costs are established and finally the incremental cost per additional unit of output is calculated. This value is examined for each separate combination and the combination with the lowest incremental cost per incremental output is chosen. This combination then becomes the beginning point in the next recalculation. This recalculation process continues until all combinations (with greater outputs than the initial beginning point) have either been eliminated or chosen. When the recalculation is completed, a number of combinations with corresponding outputs and costs are left. This data is utilized when plotting the final incremental cost curve.

The smoothing process was utilized within this analysis. See Exhibit N-7 for the analysis and outcome of the recalculations.

<u>Step 9 - Tabulate and Display Incremental Costs of Selected Plans</u>. Exhibit N-8 displays the Incremental Cost data for the plans which survived the smoothing process. (Exhibit N-8A displays the output and cost information and scales of measures which are included in the plans represented within Exhibit N-8). Exhibit N-9 displays the information in graphical form. Please note that while the smoothed data, when graphically displayed, depicts the recognizable incremental cost curve, any one of the 35 plans in the previous step were determined to be efficient and effective.

While primarily a "wildlife" driven project, another significant goal of the project is to enhance aquatic resources. Therefore, the same nine steps utilized for analyzing the data based on W-AAHU output were used to examine the data based on A-AAHU output given a constant level of W-AAHU units. This permitted the identification of the incremental costs of providing A-AAHU outputs given the recommended level of W-AAHU output.

The next step in the analysis was the evaluation of the aquatic habitat units. In order to proceed, a certain number of W-AAHUs were chosen and held constant. After analyzing the smoothed data from the W-AAHU analysis and meeting with the study team, a plan on the final incremental curve was chosen which produced 923 W-AAHUs at an average annual cost of $337,500. The next higher plan had an incremental cost (per unit) of approximately $1,200 and the previous (lower) several plans had incremental costs (per unit) of $722 and $780. The plan which was chosen had an incremental cost of $780. When observing the information in graphical form (Exhibit N-9), the plan chosen precedes a large jump in incremental costs. Any plan on the final incremental cost curve would have been a logical choice and, after analysis, the plan which produced 923 units was chosen.

INCREMENTAL COSTS ANALYSIS - AQUATIC

Step 1 - Display Outputs and Costs of Management Measures. Step One did not require changes.

Step 2 - Identify Combinable Management Measures. Step Two was identical to the process described in the Wildlife analysis.

Step 3 - Calculate Outputs and Costs of All Combinations. The complete delineation of all combinable measures again provided an unmanageable number of combinations (over 600 billion). Therefore, a similar process as was undertaken in the wildlife analysis was again utilized to reduce this number.

The following text provides guidelines concerning how any certain measure could be considered inefficient or ineffective and thus eliminated for further consideration in the A-AAHU analysis.

- The measures must contribute a total of 923 W-AAHU units. The 923 units were determined to be the quantity brought forward in the analysis (see above).

- Measures and scales of measures that were originally eliminated (in the W-AAHU analysis) must be reconsidered if they contribute Aquatic units. Therefore, after analyzing all measures and scales, the following scales were eliminated as economically ineffective or inefficient:

B2; C1; H2; H3; I3; J3; L1; M1; M2; M4; N1; O1; O2; O3; O5; O6; Q1; R1; R2; R4; W1; W3; X3; Y1; Y2; Z1; Z2; Z3; AA1; AC1; and AB1.

After elimination of all individually economically inefficient and ineffective measures and scales of measures, all remaining were analyzed for inclusion in potential plans. Again, BASICA was utilized. A program was written which essentially analyzed all combinations of measures with several restrictions. In order to be included in the final list of potential plans, the plan must contribute a total of 923 Wildlife units and the plan must also follow the dependency guidelines (the same guidelines as in the wildlife analysis). The program generated a total of 162 possible combinations of measures and computed the average annual A-AAHU and average annual cost of each combination of measures.

Step 4 - Eliminate Economically Inefficient Combinations. This step was completed in the above analysis for all combinable measures within each dependency path. The 162 possible combinations of "surviving" measures were then examined for economic efficiency and effectiveness. The combinations were sorted in ascending order by A-AAHU output and then by annual cost within equal output levels. The data were analyzed and inefficient combinations were eliminated. The method employed was the same as that used to eliminate inefficient combinations within dependency paths. All combinations that had equal or lower A-AAHU output for greater costs were eliminated as economically inefficient or ineffective.

Step 5 - Eliminate Economically Ineffective Combinations. See Step 4 discussed above.

Step 6 - Calculate and Display Incremental Costs. After all inefficient or ineffective combinations were eliminated (See Steps 4 and 5 above), 12 potentially economically efficient plans remained. Three of the 12 potentially economically efficient plans had another plan with the same number of habitat units at the same average annual cost. For purposes of the analysis, only one of each of the duplications was utilized in the analysis. The duplicate plans were re-entered in the final incremental cost data (see exhibit N-14). The Incremental A-AAHU output, Incremental Annual Cost and Incremental Annual Cost per A-AAHU unit are displayed in Exhibit N-10. Exhibits N-11 and N-12 illustrate the Average Cost Curve and the Incremental Cost Curve.

Step 7 - Calculate Change in Unit Cost from No-Action Plan to All Other Plans. Again, in order to display a typical incremental cost curve, the data was smoothed at this point. The same methods that were applied to the wildlife data were applied to the aquatic data. The Wildlife output was held constant at 923 units of output and the comparisons and recalculations were completed using the aquatic data. The same basis was utilized to choose the beginning point as that which was utilized in the wildlife analysis.

Step 8 - Recalculate Change in Unit Cost From Last Selected Plan. The smoothing process was utilized within this analysis. See Exhibit N-13 for the analysis and outcome of the recalculations.

Step 9 - Tabulate and Display Incremental Costs of Selected Plans. Exhibit N-14 displays the Incremental Cost data for the plans which survived the smoothing process. Exhibit N-15 displays the information in graphical form. Please note that while the smoothed data, when graphically displayed, depicts the recognizable incremental cost curve, any one of the 12 plans in the previous step were determined to be efficient and effective.

As previously mentioned, there were several measures which contributed to mussel habitation. However, there was not enough data to warrant a full Cost Effectiveness and Incremental Cost Analysis for the mussel habitat (holding the wildlife and aquatic habitats at a constant level). Therefore, one potential difference in the Study Team's Recommended Plan and the final Incremental Cost data would be the provision of mussel habitat. The actual Recommended Plan is compared to the final Incremental Cost data in the body of the report to which this is an appendix.

EXHIBIT N-1

(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

	Measure	Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
A	Riverside berm (USFWS Middle Pool)	A-1	Fill low spots to 436.5	32	29	0	174,875	13,681	1,000	14,681
		A-2	Raise berm to 437.5	94	48	0	200,000	15,647	3,000	18,647
		A-3	Raise berm to 439.0	116	54	0	235,351	18,413	5,000	23,413
B	Riverside berm (USFWS Lower Pool)	B-1	Build berm to 434.0	2	3	0	12,133	949	200	1,149
		B-2	Build berm to 435.5	11	4	0	34,676	2,713	300	3,013
		B-3	Build berm to 437.0	13	5	0	33,097	2,589	300	2,889
C	Riverside berm (State-managed Area)	C-1	Build berm to 434.0	186	82	7	454,458	35,555	5,000	40,555
		C-2	Build berm to 435.5	289	134	34	345,685	27,045	5,500	32,545
		C-3	Build berm to 437.0	343	144	34	577,533	45,183	6,000	51,183
D	Lowland sediment trap (USFWS Middle Pool)	D-1	Please see Table 9 for a description of this measure.	96	39	0	135,589	10,608	1,000	11,608
E	Lowland sediment trap (State-managed Area, Dixon Hollow to Titus Hollow)	E-1	Please see Table 9 for a description of this measure.	32	13	1	75,657	5,919	500	6,419
F	Dredging (fisheries) (USFWS Middle Pool)	F-1	Deepening of existing shallow water areas to facilitate dewatering, water flow, and to provide refuge for fish during winter stress periods.	40	19	0	685,080	53,597	5,174	58,771

(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

	Measure	Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
FC	Dredging (fisheries) (USFWS Lower Pool)	FC-1	Deepening of existing shallow water areas to facilitate dewatering, water flow, and to provide refuge for fish during winter stress periods.	0	15	0	85,635	6,700	623	7,323
FB	Dredging (fisheries) (State-managed Area)	FB-1	Deepening of existing shallow water areas to facilitate dewatering, water flow, and to provide refuge for fish during winter stress periods.	0	15	0	85,635	6,700	623	7,323
G	Dredging to L&D No. 25 overflow structure (State-managed Area)	G-1	Dredging to facilitate flow into a drainage structure (measure W) at the L&D No. 25 overflow structure.	0	117	0	247,157	19,336	1,869	21,205
H	Pump (USFWS Middle Pool)	H-1	Use existing 44 cfs pump.	40	0	0	0	0	12,000	12,000
		H-2	Rehabilitate existing pump station.	40	0	0	30,000	2,347	10,000	12,347
		H-3	Increase pumping capacity by adding 9 cfs pump.	40	0	0	99,000	7,745	18,000	25,745
I	Pump (USFWS Lower Pool)	I-1	Add pad for, and provide portable 7 cfs pump, and cut ditch to interior lake.	14	0	0	99,000	7,745	6,000	13,745
		I-2	Add pad for, and provide portable 15 cfs pump, and cut ditch to interior lake.	28	0	0	107,250	8,391	6,500	14,891

(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

Measure		Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
		I-3	Add pad for, and provide portable 30 cfs pump, and cut ditch to interior lake.	28	0	0	115,500	9,036	7,000	16,036
J	Pump (State-managed Area)	J-1	45 cfs	43	0	0	412,500	32,272	20,000	52,272
		J-2	90 cfs	86	0	0	449,000	35,127	27,000	62,127
		J-3	135 cfs	86	0	0	495,000	38,726	33,000	71,726
K	Hillside sediment control (USFWS Middle Pool)	K-1	Cultural and structural measures in watersheds #3, 8, 9, 10, 12 (see Figure O-1)	15	12	0	100,877	7,892	600	8,492
KB	Hillside sediment control (State-managed Area)	KB-1	Cultural and structural measures in watersheds #5, 6, 11, 13, 14 (see Figure O-1)	38	29	3	252,193	19,730	1,500	21,230
KC	Hillside sediment control (USFWS Lower Pool)	KC-1	Cultural and structural measures in watersheds #4 (see Figure O-1)	23	17	0	151,316	11,838	930	12,768
L	Interior berm (between USFWS Lower Pool and State-managed Area)	L-1	Build berm to 434.0	4	7	0	64,596	5,054	1,000	6,054
		L-2	Build berm to 435.5	21	8	0	16,054	1,256	1,100	2,356
		L-3	Build berm to 437.0	27	10	0	51,101	3,998	1,200	5,198
M	Exterior CMPs - or - Stop-log structures (upper end of USFWS Middle Pool)	M-1	1-42 in. CMP with gate	26	0	0	107,250	8,391	500	8,891
		M-2	2-42 in. CMPs with gates	26	0	0	214,500	16,781	700	17,481
		M-3	1-8 ft.-wide conc. stop-log structure	26	25	0	93,844	7,342	500	7,842

(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

Measure		Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
		M-4	2-8 ft.-wide conc. stop-log structures	26	25	0	187,688	14,684	700	15,384
N	Exterior water control (USFWS Lower Pool)	N-1	1-42 in. CMP with gate plus 1-8 ft.-wide concrete stop-log structure	10	0	0	201,094	15,732	1,000	16,732
		N-2	1-8 ft.-wide concrete stop-log structure	10	0	0	93,844	7,342	500	7,842
O	Exterior water control (State-managed Area)	O-1	2-42 in. CMPs w/ gates plus 2-8 ft.-wide conc. stop-log structures	100	0	0	363,000	28,399	2,000	30,399
		O-2	3-42 in. CMPs w/ gates plus 4-8 ft.-wide conc. stop-log structures	100	245	6	412,500	32,272	3,500	35,772
		O-3	5-42 in. CMPs w/ gates plus 10-8 ft.-wide conc. stop-log structures	100	245	6	1,474,688	115,372	7,500	122,872
		O-4	2-8 ft.-wide conc. stop-log structures	100	245	6	187,688	14,684	1,000	15,684
		O-5	4 ft.-wide conc. stop-log structures	100	245	6	375,375	29,367	2,000	31,367
		O-6	10-8 ft.-wide conc. stop-log structures	100	245	6	938,438	73,419	5,000	78,419

(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

	Measure	Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
P	Interior water control (between USFWS Middle Pool and USFWS Lower Pool) **(This measure eliminated after USFWS conducted post-flood of 1993 repairs)**	-	-	-	-	-	-	-	-	0
Q	Interior water control (between USFWS Lower Pool and State-managed Area)	Q-1	1-42 in. CMP with gate plus 1-8 ft.-wide concrete stop-log structure	10	0	0	201,094	15,732	1,000	16,732
		Q-2	1-8 ft.-wide concrete stop-log structure	10	14	0	93,844	7,342	500	7,842
R	Exterior CMPs - or - Stop-log structures on exterior berm (lower end of USFWS Middle Pool)	R-1	1-42 in. CMP with gate	0	40	0	107,250	8,391	500	8,891
		R-2	2-42 in. CMPs with gates	0	40	0	214,500	16,781	1,000	17,781
		R-3	1-8 ft.-wide conc. stop-log structure	0	40	0	93,844	7,342	500	7,842
		R-4	2-8 ft.-wide conc. stop-log structures	0	40	0	187,688	14,684	1,000	15,684

(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

Measure		Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
S	Stop-log structure on exterior berm (USFWS Lower Pool) **(This measure has been combined with measure N)**	-	-	-	-	-	-	-	-	0
T	Stop-log structure on exterior berm (State-managed Area) **(this measure has been combined with measure O)**	-	-	-	-	-	-	-	-	0
U	Stop-log structure (between USFWS Middle Pool and USFWS Lower Pool) **(This measure has been combined with measure P)**	-	-	-	-	-	-	-	-	0
V	Stop-log structure (between USFWS Lower Pool and State-managed Area) **(This measure has been combined with measure Q)**	-	-	-	-	-	-	-	-	0

(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

Measure		Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
W	Flow through L&D No.25 overflow structure (from State-managed Area)	W-1	Siphon system (major component from concept plan C3)	48	0	6	1,200,000	93,882	23,303	117,185
		W-2	2-54 inch concrete pipes (major component from concept plan C1 and C2)	48	0	6	647,000	50,618	12,956	63,574
		W-3	6-6 ft. x 7 ft. gated concrete box culverts (major component from concept plan C4)	48	0	6	5,680,000	444,374	4,480	448,854
X	Pump (on Turner Island)	X-1	3 cfs	14	0	0	82,500	6,454	4,000	10,454
		X-2	6 cfs	29	0	0	94,562	7,398	6,000	13,398
		X-3	9 cfs	29	0	0	99,000	7,745	8,000	15,745
Y	Off-bankline revetment (State-managed Area)	Y-1	Approx. 12,400 linear feet along lower portion of proposed berm on the State-managed area.	0	0	0	1,022,258	79,976	100	80,076
		Y-2	Approx. 3,300 additional linear feet along upper portion of proposed berm on the State-managed area, plus the length for measure Y-1, giving a total of 17,700 linear feet.	0	0	0	1,461,323	114,326	200	114,526

(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

	Measure	Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
Z	Off-bankline revetment (USFWS Middle and Lower Pools)	Z-1	Rehabilitate approx. 6,800 linear feet of existing off-bankline revetment along upper portion of USFWS Middle Pool.	0	0	0	56,166	4,394	0	4,394
		Z-2	Rehabilitate approx. 6,800 linear feet of existing off-bankline revetment along upper portion of USFWS Middle Pool, and construct approx. 1,900 linear feet of revetment continuing to entrance of 70's channel.	0	0	0	213,411	16,696	50	16,746
		Z-3	Rehabilitate approx. 6,800 linear feet of existing off-bankline revetment along upper portion of USFWS Middle Pool, construct 1,900 linear feet of revetment continuing approx. to entrance of 70's channel, and construct approx. 3,000 linear feet of revetment continuing to entrance of 40's channel.	0	0	0	460,499	36,027	100	36,127

(Initial Costs include contingencies, Engineering & Design, and Construction Management, for Annualized Initial Costs, i=0.07625/year, n=50 years)

	Measure	Designation for Incremental Cost Analysis	Brief Description for Identification	Outputs (AAHUs)			Costs			
				Wildlife	Aquatic	Mussel	Initial Costs $	Annualized Initial Costs $	Annual OM&R $	Costs (average annual $)
AA	Bottomland Forest Improvement (USFWS Middle Pool)	AA-1	One to two acre clearings, or spot clearings, with subsequent planting of hard mast trees for a total of 75 acres.	0	0	0	65,850	5,152	555	5,707
AC	Bottomland Forest Improvement (USFWS Lower Pool)	AC-1	One to two acre clearings, or spot clearings, with subsequent planting of hard mast trees for a total of 25 acres.	0	0	0	21,950	1,717	185	1,902
AB	Bottomland Forest Improvement (State-managed Area)	AB-1	One to two acre clearings, or spot clearings, with subsequent planting of hard mast trees for a total of 100 acres.	0	0	0	87,800	6,869	740	7,609

EXHIBIT N-2

MEASURES	B1	B2	B3	C1	C2	C3
AA WILDLIFE	2	11	13	186	289	343
AA AQUATIC	3	4	5	82	134	144
AA MUSSEL	0	0	0	7	34	34
YEAR						
1998	(12,133)	(34,676)	(33,097)	(454,458)	(345,685)	(577,533)
1999	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2000	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2001	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2002	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2003	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2004	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2005	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2006	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2007	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2008	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2009	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2010	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2011	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2012	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2013	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2014	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2015	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2016	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2017	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2018	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2019	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2020	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2021	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2022	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2023	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2024	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2025	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2026	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2027	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2028	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2029	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2030	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2031	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2032	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2033	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2034	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2035	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2036	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2037	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2038	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2039	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2040	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2041	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2042	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2043	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2044	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2045	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2046	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
2047	(200)	(300)	(300)	(5,000)	(5,500)	(6,000)
PRESENT VALUE OF COST STREAM	(14,684.33)	(38,502.99)	(36,923.99)	(518,241.23)	(415,846.55)	(654,072.87)
AVG ANNUAL COST	(1,100.00)	(3,000.00)	(2,900.00)	(40,500.00)	(32,500.00)	(51,200.00)
AVG ANNUAL COST PER W-AAHU	(550.00)	(270.00)	(220.00)	(220.00)	(110.00)	(150.00)

EXHIBIT N-2

MEASURES	D1	E1	F1	FC-1	FB-1	G1
AA WILDLIFE	96	32	40	0	0	0
AA AQUATIC	39	13	19	15	15	117
AA MUSSEL	0	1	0	0	0	0
YEAR						
1998	(135,589)	(75,657)	(685,080)	(85,635)	(85,635)	(247,157)
1999	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2000	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2001	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2002	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2003	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2004	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2005	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2006	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2007	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2008	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2009	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2010	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2011	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2012	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2013	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2014	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2015	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2016	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2017	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2018	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2019	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2020	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2021	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2022	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2023	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2024	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2025	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2026	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2027	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2028	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2029	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2030	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2031	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2032	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2033	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2034	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2035	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2036	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2037	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2038	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2039	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2040	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2041	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2042	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2043	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2044	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2045	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2046	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
2047	(1,000)	(500)	(5,174)	(623)	(623)	(1,869)
PRESENT VALUE OF COST STREAM	(148,345.65)	(82,035.32)	(751,082.88)	(93,582.39)	(93,582.39)	(270,999.17)
AVG ANNUAL COST	(11,600.00)	(6,400.00)	(58,800.00)	(7,300.00)	(7,300.00)	(21,200.00)
AVG ANNUAL COST PER W-AAHU	(120.00)	(200.00)	(1,470.00)	(ERR)	(ERR)	(0.00)

EXHIBIT N-2

MEASURES	H1	H2	H3	I1	I2	I3
AA WILDLIFE	40	40	40	14	28	28
AA AQUATIC	0	0	0	0	0	0
AA MUSSEL	0	0	0	0	0	0
YEAR						
1998	(0)	(30,000)	(99,000)	(99,000)	(107,250)	(115,500)
1999	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2000	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2001	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2002	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2003	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2004	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2005	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2006	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2007	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2008	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2009	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2010	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2011	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2012	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2013	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2014	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2015	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2016	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2017	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2018	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2019	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2020	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2021	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2022	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2023	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2024	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2025	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2026	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2027	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2028	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2029	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2030	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2031	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2032	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2033	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2034	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2035	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2036	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2037	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2038	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2039	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2040	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2041	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2042	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2043	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2044	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2045	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2046	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
2047	(12,000)	(10,000)	(18,000)	(6,000)	(6,500)	(7,000)
PRESENT VALUE OF COST STREAM	(153,079.74)	(157,566.45)	(328,619.61)	(175,539.87)	(190,168.19)	(204,796.52)
AVG ANNUAL COST	(12,000.00)	(12,300.00)	(25,700.00)	(13,700.00)	(14,900.00)	(16,000.00)
AVG ANNUAL COST PER W-AAHU	(300.00)	(310.00)	(640.00)	(980.00)	(530.00)	(570.00)

EXHIBIT N-2

MEASURES	J1	J2	J3	K1	KC-1	KB-1
AA WILDLIFE	43	86	86	15	23	38
AA AQUATIC	0	0	0	12	17	29
AA MUSSEL	0	0	0	0	0	3
<u>YEAR</u>						
1998	(412,500)	(449,000)	(495,000)	(100,877)	(151,316)	(252,193)
1999	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2000	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2001	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2002	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2003	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2004	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2005	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2006	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2007	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2008	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2009	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2010	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2011	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2012	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2013	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2014	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2015	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2016	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2017	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2018	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2019	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2020	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2021	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2022	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2023	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2024	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2025	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2026	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2027	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2028	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2029	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2030	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2031	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2032	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2033	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2034	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2035	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2036	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2037	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2038	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2039	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2040	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2041	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2042	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2043	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2044	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2045	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2046	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
2047	(20,000)	(27,000)	(33,000)	(600)	(930)	(1,500)
PRESENT VALUE OF COST STREAM	(667,632.90)	(793,429.42)	(915,969.29)	(108,530.99)	(163,179.68)	(271,327.97)
AVG ANNUAL COST	(52,200.00)	(62,100.00)	(71,700.00)	(8,500.00)	(12,800.00)	(21,200.00)
AVG ANNUAL COST PER W-AAHU	(1,210.00)	(720.00)	(830.00)	(570.00)	(560.00)	(560.00)

EXHIBIT N-2

MEASURES	L1	L2	L3	M1	M2	M3
AA WILDLIFE	4	21	27	26	26	26
AA AQUATIC	7	8	10	0	0	25
AA MUSSEL	0	0	0	0	0	0
<u>YEAR</u>						
1998	(64,596)	(16,054)	(51,101)	(107,250)	(214,500)	(93,844)
1999	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2000	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2001	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2002	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2003	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2004	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2005	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2006	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2007	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2008	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2009	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2010	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2011	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2012	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2013	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2014	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2015	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2016	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2017	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2018	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2019	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2020	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2021	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2022	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2023	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2024	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2025	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2026	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2027	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2028	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2029	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2030	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2031	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2032	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2033	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2034	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2035	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2036	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2037	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2038	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2039	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2040	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2041	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2042	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2043	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2044	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2045	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2046	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
2047	(1,000)	(1,100)	(1,200)	(500)	(700)	(500)
PRESENT VALUE OF COST STREAM	(77,352.65)	(30,086.31)	(66,408.97)	(113,628.32)	(223,429.65)	(100,222.32)
AVG ANNUAL COST	(6,100.00)	(2,400.00)	(5,200.00)	(8,900.00)	(17,500.00)	(7,800.00)
AVG ANNUAL COST PER W-AAHU	(1,530.00)	(110.00)	(190.00)	(340.00)	(670.00)	(300.00)

EXHIBIT N-2

MEASURES	M4	N1	N2	O1	O2	O3
AA WILDLIFE	26	10	10	100	100	100
AA AQUATIC	25	0	0	245	245	245
AA MUSSEL	0	0	0	0	6	6
YEAR						
1998	(187,688)	(201,094)	(93,844)	(363,000)	(412,500)	(1,474,688)
1999	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2000	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2001	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2002	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2003	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2004	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2005	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2006	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2007	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2008	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2009	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2010	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2011	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2012	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2013	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2014	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2015	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2016	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2017	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2018	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2019	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2020	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2021	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2022	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2023	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2024	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2025	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2026	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2027	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2028	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2029	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2030	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2031	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2032	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2033	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2034	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2035	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2036	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2037	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2038	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2039	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2040	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2041	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2042	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2043	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2044	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2045	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2046	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
2047	(700)	(1,000)	(500)	(2,000)	(3,500)	(7,500)
PRESENT VALUE OF COST STREAM	(196,617.65)	(213,850.65)	(100,222.32)	(388,513.29)	(457,148.26)	(1,570,362.84)
AVG ANNUAL COST	(15,400.00)	(16,700.00)	(7,800.00)	(30,400.00)	(35,800.00)	(122,900.00)
AVG ANNUAL COST PER W-AAHU	(590.00)	(1,670.00)	(780.00)	(300.00)	(360.00)	(1,230.00)

EXHIBIT N-2

MEASURES	O4	O5	O6	Q1	Q2	R1
AA WILDLIFE	100	100	100	10	10	0
AA AQUATIC	245	245	245	0	14	40
AA MUSSEL	6	6	6	0	0	0
YEAR						
1998	(187,688)	(375,375)	(938,438)	(201,094)	(93,844)	(107,250)
1999	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2000	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2001	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2002	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2003	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2004	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2005	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2006	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2007	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2008	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2009	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2010	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2011	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2012	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2013	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2014	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2015	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2016	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2017	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2018	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2019	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2020	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2021	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2022	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2023	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2024	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2025	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2026	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2027	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2028	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2029	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2030	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2031	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2032	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2033	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2034	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2035	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2036	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2037	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2038	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2039	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2040	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2041	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2042	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2043	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2044	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2045	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2046	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
2047	(1,000)	(2,000)	(5,000)	(1,000)	(500)	(500)
PRESENT VALUE OF COST STREAM	(200,444.65)	(400,888.29)	(1,002,221.23)	(213,850.65)	(100,222.32)	(113,628.32)
AVG ANNUAL COST	(15,700.00)	(31,400.00)	(78,400.00)	(16,700.00)	(7,800.00)	(8,900.00)
AVG ANNUAL COST PER W-AAHU	(160.00)	(310.00)	(780.00)	(1,670.00)	(780.00)	(0.00)

EXHIBIT N-2

MEASURES	R2	R3	R4	W1	W2	W3
AA WILDLIFE	0	0	0	48	48	48
AA AQUATIC	40	40	40	0	0	0
AA MUSSEL	0	0	0	6	6	6
<u>YEAR</u>						
1998	(214,500)	(93,844)	(187,688)	(1,200,000)	(647,000)	(5,680,000)
1999	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2000	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2001	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2002	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2003	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2004	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2005	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2006	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2007	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2008	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2009	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2010	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2011	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2012	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2013	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2014	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2015	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2016	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2017	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2018	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2019	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2020	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2021	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2022	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2023	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2024	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2025	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2026	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2027	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2028	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2029	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2030	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2031	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2032	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2033	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2034	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2035	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2036	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2037	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2038	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2039	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2040	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2041	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2042	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2043	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2044	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2045	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2046	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
2047	(1,000)	(500)	(1,000)	(23,303)	(12,956)	(4,480)
PRESENT VALUE OF COST STREAM	(227,256.65)	(100,222.32)	(200,444.65)	(1,497,268.10)	(812,275.10)	(5,737,149.77)
AVG ANNUAL COST	(17,800.00)	(7,800.00)	(15,700.00)	(117,100.00)	(63,500.00)	(448,800.00)
AVG ANNUAL COST PER W-AAHU	(0.00)	(0.00)	(0.00)	(2,440.00)	(1,320.00)	(9,350.00)

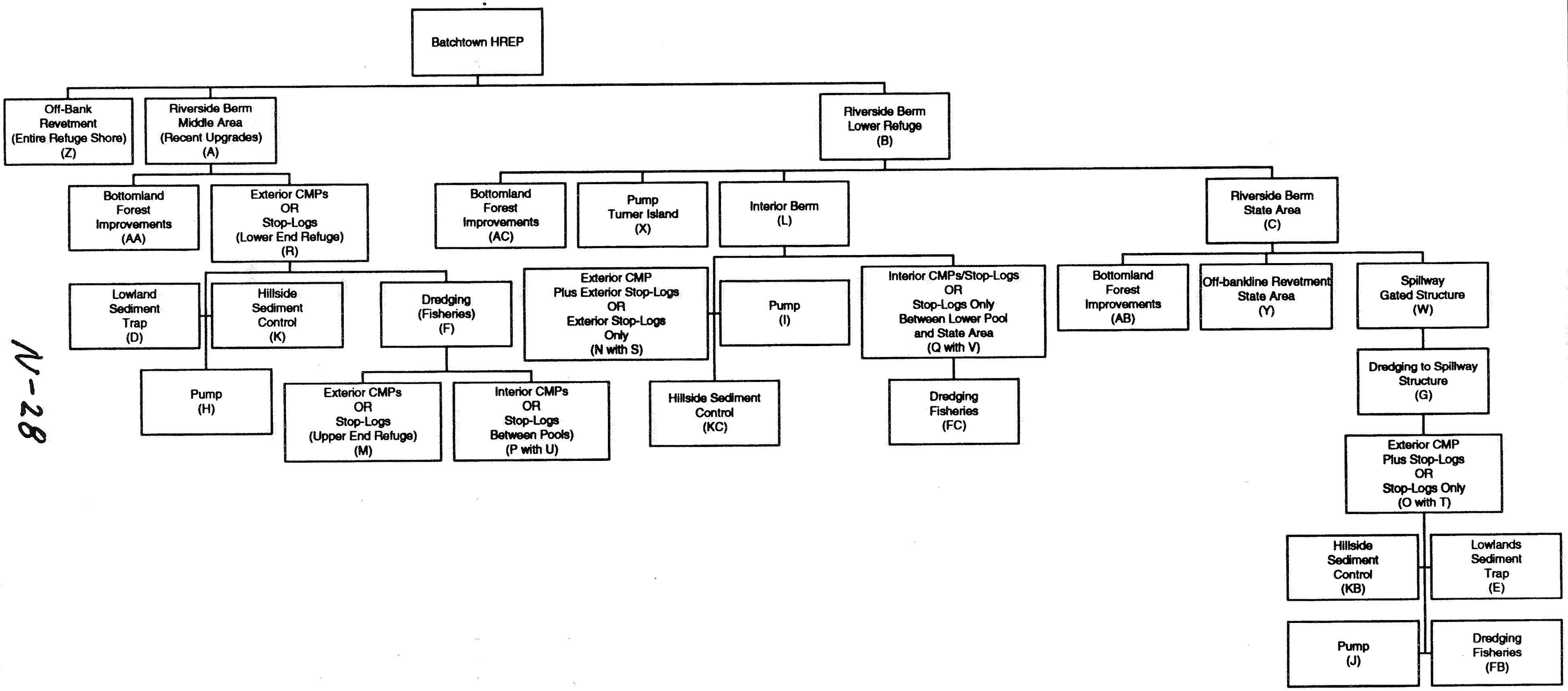
EXHIBIT N-2

MEASURES	X1	X2	X3	Y1	Y2	Z1
AA WILDLIFE	14	29	29	0	0	0
AA AQUATIC	0	0	0	0	0	0
AA MUSSEL	0	0	0	0	0	0
<u>YEAR</u>						
1998	(82,500)	(94,562)	(99,000)	(1,022,258)	(1,461,323)	(56,166)
1999	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2000	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2001	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2002	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2003	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2004	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2005	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2006	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2007	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2008	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2009	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2010	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2011	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2012	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2013	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2014	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2015	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2016	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2017	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2018	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2019	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2020	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2021	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2022	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2023	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2024	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2025	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2026	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2027	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2028	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2029	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2030	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2031	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2032	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2033	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2034	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2035	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2036	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2037	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2038	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2039	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2040	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2041	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2042	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2043	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2044	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2045	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2046	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
2047	(4,000)	(6,000)	(8,000)	(100)	(200)	(0)
PRESENT VALUE OF COST STREAM	(133,526.58)	(171,101.87)	(201,053.16)	(1,023,533.66)	(1,463,874.33)	(56,166.00)
AVG ANNUAL COST	(10,400.00)	(13,400.00)	(15,700.00)	(80,100.00)	(114,500.00)	(4,400.00)
AVG ANNUAL COST PER W-AAHU	(740.00)	(460.00)	(540.00)	(0.00)	(0.00)	(0.00)

EXHIBIT N-2

MEASURES	Z2	Z3	AA-1	AC-1	AB-1
AA WILDLIFE	0	0	0	0	0
AA AQUATIC	0	0	0	0	0
AA MUSSEL	0	0	0	0	0
<u>YEAR</u>					
1998	(213,411)	(460,499)	(65,850)	(21,950)	(87,800)
1999	(50)	(100)	(555)	(185)	(740)
2000	(50)	(100)	(555)	(185)	(740)
2001	(50)	(100)	(555)	(185)	(740)
2002	(50)	(100)	(555)	(185)	(740)
2003	(50)	(100)	(555)	(185)	(740)
2004	(50)	(100)	(555)	(185)	(740)
2005	(50)	(100)	(555)	(185)	(740)
2006	(50)	(100)	(555)	(185)	(740)
2007	(50)	(100)	(555)	(185)	(740)
2008	(50)	(100)	(555)	(185)	(740)
2009	(50)	(100)	(555)	(185)	(740)
2010	(50)	(100)	(555)	(185)	(740)
2011	(50)	(100)	(555)	(185)	(740)
2012	(50)	(100)	(555)	(185)	(740)
2013	(50)	(100)	(555)	(185)	(740)
2014	(50)	(100)	(555)	(185)	(740)
2015	(50)	(100)	(555)	(185)	(740)
2016	(50)	(100)	(555)	(185)	(740)
2017	(50)	(100)	(555)	(185)	(740)
2018	(50)	(100)	(555)	(185)	(740)
2019	(50)	(100)	(555)	(185)	(740)
2020	(50)	(100)	(555)	(185)	(740)
2021	(50)	(100)	(555)	(185)	(740)
2022	(50)	(100)	(555)	(185)	(740)
2023	(50)	(100)	(555)	(185)	(740)
2024	(50)	(100)	(555)	(185)	(740)
2025	(50)	(100)	(555)	(185)	(740)
2026	(50)	(100)	(555)	(185)	(740)
2027	(50)	(100)	(555)	(185)	(740)
2028	(50)	(100)	(555)	(185)	(740)
2029	(50)	(100)	(555)	(185)	(740)
2030	(50)	(100)	(555)	(185)	(740)
2031	(50)	(100)	(555)	(185)	(740)
2032	(50)	(100)	(555)	(185)	(740)
2033	(50)	(100)	(555)	(185)	(740)
2034	(50)	(100)	(555)	(185)	(740)
2035	(50)	(100)	(555)	(185)	(740)
2036	(50)	(100)	(555)	(185)	(740)
2037	(50)	(100)	(555)	(185)	(740)
2038	(50)	(100)	(555)	(185)	(740)
2039	(50)	(100)	(555)	(185)	(740)
2040	(50)	(100)	(555)	(185)	(740)
2041	(50)	(100)	(555)	(185)	(740)
2042	(50)	(100)	(555)	(185)	(740)
2043	(50)	(100)	(555)	(185)	(740)
2044	(50)	(100)	(555)	(185)	(740)
2045	(50)	(100)	(555)	(185)	(740)
2046	(50)	(100)	(555)	(185)	(740)
2047	(50)	(100)	(555)	(185)	(740)
PRESENT VALUE OF COST STREAM	(214,048.83)	(461,774.66)	(72,929.94)	(24,309.98)	(97,239.92)
AVG ANNUAL COST	(16,700.00)	(36,100.00)	(5,700.00)	(1,900.00)	(7,600.00)
AVG ANNUAL COST PER W-AAHU	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

EXHIBIT N-3



Batchtown HREP
Off-Bank Revetment (Entire Refuge Shore) (Z)
Riverside Berm Middle Area (Recent Upgrades) (A)
Riverside Berm Lower Refuge (B)
Bottomland Forest Improvements (AA)
Exterior CMPs OR Stop-Logs (Lower End Refuge) (R)
Bottomland Forest Improvements (AC)
Pump Turner Island (X)
Interior Berm (L)
Riverside Berm State Area (C)
Lowland Sediment Trap (D)
Hillside Sediment Control (K)
Dredging (Fisheries) (F)
Exterior CMP Plus Exterior Stop-Logs OR Exterior Stop-Logs Only (N with S)
Pump (I)
Interior CMPs/Stop-Logs OR Stop-Logs Only Between Lower Pool and State Area (Q with V)
Bottomland Forest Improvements (AB)
Off-bankline Revetment State Area (Y)
Spillway Gated Structure (W)
Pump (H)
Exterior CMPs OR Stop-Logs (Upper End Refuge) (M)
Interior CMPs OR Stop-Logs Between Pools) (P with U)
Hillside Sediment Control (KC)
Dredging Fisheries (FC)
Dredging to Spillway Structure (G)
Exterior CMP Plus Stop-Logs OR Stop-Logs Only (O with T)
Hillside Sediment Control (KB)
Lowlands Sediment Trap (E)
Pump (J)
Dredging Fisheries (FB)

EXHIBIT N-4

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	VG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU	AVG COST/ AAHU
1	1	0	0	0	0	0.00	0.00
1	2	96	19400	96	19400	202.08	202.08
1	3	136	31400	40	12000	300.00	230.88
2	1	291	33600	155	2200	14.19	115.46
3	1	312	36000	21	2400	114.29	115.38
4	1	323	37800	11	1800	163.64	117.03
2	2	387	53000	64	15200	237.50	136.95
3	2	408	55400	21	2400	114.29	135.78
4	2	419	57200	11	1800	163.64	136.52
2	3	427	65000	8	7800	975.00	152.22
3	3	448	67400	21	2400	114.29	150.45
4	3	459	69200	11	1800	163.64	150.76
5	2	473	75900	14	6700	478.57	160.47
5	3	513	87900	40	12000	300.00	171.35
6	3	542	101300	29	13400	462.07	186.90
7	3	548	104100	6	2800	466.67	189.96
8	3	576	119000	28	14900	532.14	206.60
9	3	599	131800	23	12800	556.52	220.03
5	4	619	213300	20	81500	4075.00	344.59
6	4	648	226700	29	13400	462.07	349.85
10	1	681	228400	33	1700	51.52	335.39
8	4	682	244400	1	16000	16000.00	358.36
10	2	777	247800	95	3400	35.79	318.92
10	3	817	259800	40	12000	300.00	317.99
11	2	863	309900	46	50100	1089.13	359.10
12	2	873	317700	10	7800	780.00	363.92
11	3	903	321900	30	4200	140.00	356.48
12	3	913	329700	10	7800	780.00	361.12
13	3	923	337500	10	7800	780.00	365.66
10	5	938	405700	15	68200	4546.67	432.52
11	4	1009	447300	71	41600	585.92	443.31
12	4	1019	455100	10	7800	780.00	446.61
13	4	1029	462900	10	7800	780.00	449.85
12	5	1034	475600	5	12700	2540.00	459.96
13	5	1044	483400	10	7800	780.00	463.03

EXHIBIT N-5

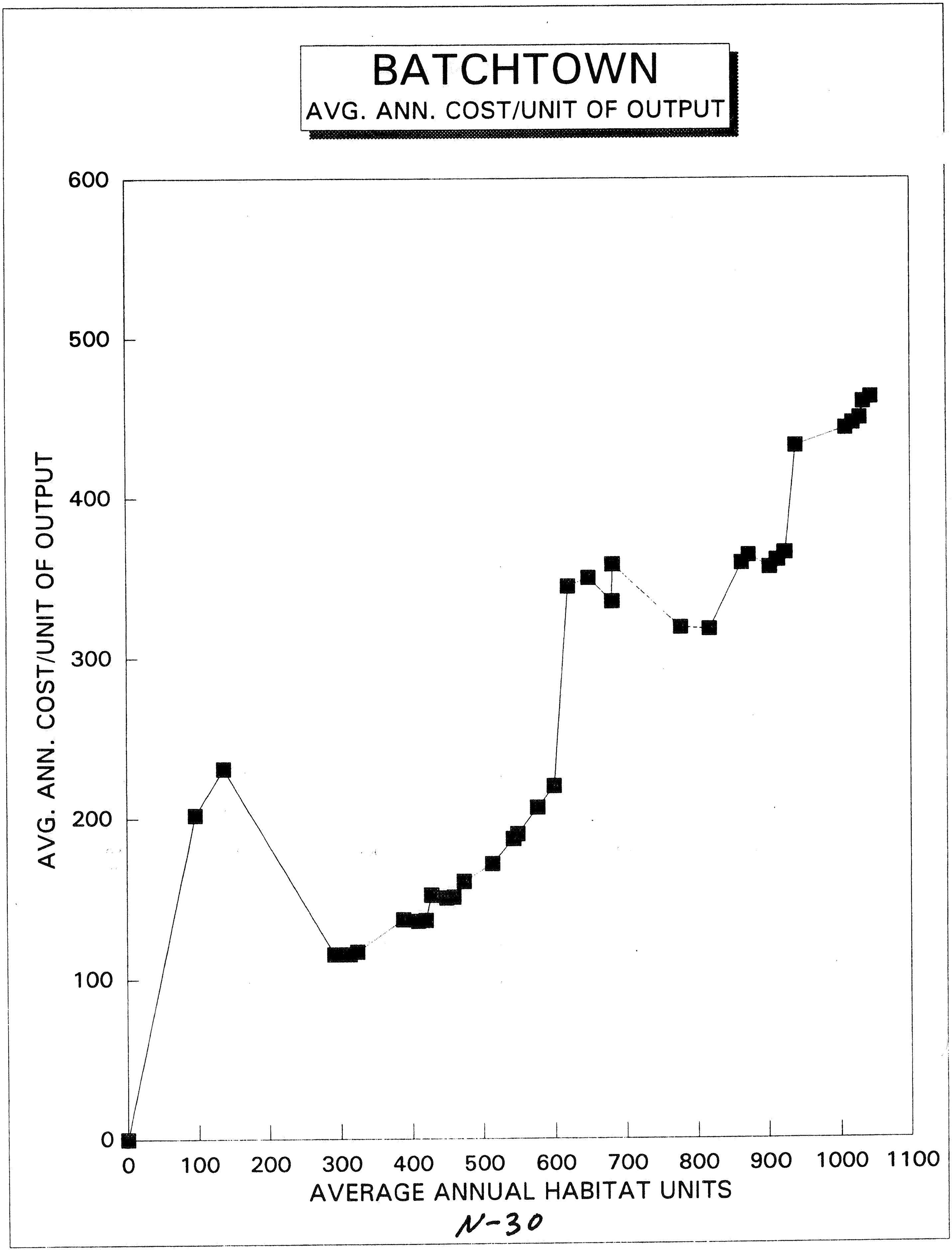
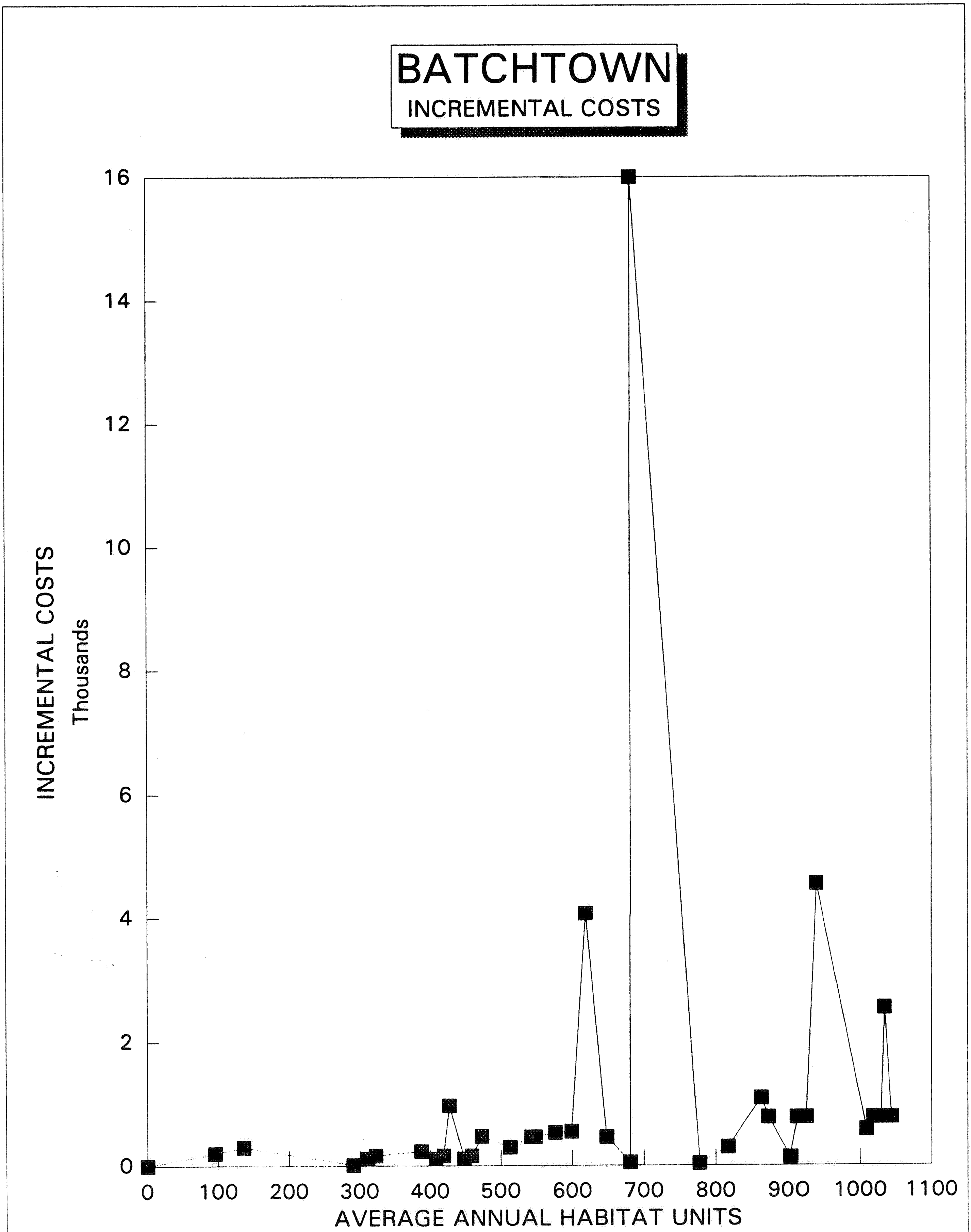

BATCHTOWN
AVG. ANN. COST/UNIT OF OUTPUT
AVG. ANN. COST/UNIT OF OUTPUT
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
800
900
1000
1100
AVERAGE ANNUAL HABITAT UNITS

EXHIBIT N-6



BATCHTOWN
INCREMENTAL COSTS
INCREMENTAL COSTS
Thousands
16
14
12
10
8
6
4
2
0
0
100
200
300
400
500
600
700
800
900
1000
1100
AVERAGE ANNUAL HABITAT UNITS

EXHIBIT N-7

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
1	1	0	0	0	0	0
1	2	96	19400	96	19400	202.08
1	3	136	31400	136	31400	230.88
2	1	291	33600	291	33600	115.46
3	1	312	36000	312	36000	115.38
4	1	323	37800	323	37800	117.03
2	2	387	53000	387	53000	136.95
3	2	408	55400	408	55400	135.78
4	2	419	57200	419	57200	136.52
2	3	427	65000	427	65000	152.22
3	3	448	67400	448	67400	150.45
4	3	459	69200	459	69200	150.76
5	2	473	75900	473	75900	160.47
5	3	513	87900	513	87900	171.35
6	3	542	101300	542	101300	186.90
7	3	548	104100	548	104100	189.96
8	3	576	119000	576	119000	206.60
9	3	599	131800	599	131800	220.03
5	4	619	213300	619	213300	344.59
6	4	648	226700	648	226700	349.85
10	1	681	228400	681	228400	335.39
8	4	682	244400	682	244400	358.36
10	2	777	247800	777	247800	318.92
10	3	817	259800	817	259800	317.99
11	2	863	309900	863	309900	359.10
12	2	873	317700	873	317700	363.92
11	3	903	321900	903	321900	356.48
12	3	913	329700	913	329700	361.12
13	3	923	337500	923	337500	365.66
10	5	938	405700	938	405700	432.52
11	4	1009	447300	1009	447300	443.31
12	4	1019	455100	1019	455100	446.61
13	4	1029	462900	1029	462900	449.85
12	5	1034	475600	1034	475600	459.96
13	5	1044	483400	1044	483400	463.03

1ST RECALCULATION

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
3	1	312	36000	0	0	0.00
4	1	323	37800	11	1800	163.64
2	2	387	53000	75	17000	226.67

3	2	408	55400	96	19400	202.08
4	2	419	57200	107	21200	198.13
2	3	427	65000	115	29000	252.17
3	3	448	67400	136	31400	230.88
4	3	459	69200	147	33200	225.85
5	2	473	75900	161	39900	247.83
5	3	513	87900	201	51900	258.21
6	3	542	101300	230	65300	283.91
7	3	548	104100	236	68100	288.56
8	3	576	119000	264	83000	314.39
9	3	599	131800	287	95800	333.80
5	4	619	213300	307	177300	577.52
6	4	648	226700	336	190700	567.56
10	1	681	228400	369	192400	521.41
8	4	682	244400	370	208400	563.24
10	2	777	247800	465	211800	455.48
10	3	817	259800	505	223800	443.17
11	2	863	309900	551	273900	497.10
12	2	873	317700	561	281700	502.14
11	3	903	321900	591	285900	483.76
12	3	913	329700	601	293700	488.69
13	3	923	337500	611	301500	493.45
10	5	938	405700	626	369700	590.58
11	4	1009	447300	697	411300	590.10
12	4	1019	455100	707	419100	592.79
13	4	1029	462900	717	426900	595.40
12	5	1034	475600	722	439600	608.86
13	5	1044	483400	732	447400	611.20

2ND RECALCULATION

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
4	1	323	37800	0	0	0.00
2	2	387	53000	64	15200	237.50
3	2	408	55400	85	17600	207.06
4	2	419	57200	96	19400	202.08
2	3	427	65000	104	27200	261.54
3	3	448	67400	125	29600	236.80
4	3	459	69200	136	31400	230.88
5	2	473	75900	150	38100	254.00
5	3	513	87900	190	50100	263.68
6	3	542	101300	219	63500	289.95
7	3	548	104100	225	66300	294.67
8	3	576	119000	253	81200	320.95
9	3	599	131800	276	94000	340.58
5	4	619	213300	296	175500	592.91

6	4	648	226700	325	188900	581.23
10	1	681	228400	358	190600	532.40
8	4	682	244400	359	206600	575.49
10	2	777	247800	454	210000	462.56
10	3	817	259800	494	222000	449.39
11	2	863	309900	540	272100	503.89
12	2	873	317700	550	279900	508.91
11	3	903	321900	580	284100	489.83
12	3	913	329700	590	291900	494.75
13	3	923	337500	600	299700	499.50
10	5	938	405700	615	367900	598.21
11	4	1009	447300	686	409500	596.94
12	4	1019	455100	696	417300	599.57
13	4	1029	462900	706	425100	602.12
12	5	1034	475600	711	437800	615.75
13	5	1044	483400	721	445600	618.03

3RD RECALCULATION

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
4	2	419	57200	0	0	0.00
2	3	427	65000	8	7800	975.00
3	3	448	67400	125	29600	236.80
4	3	459	69200	136	31400	230.88
5	2	473	75900	150	38100	254.00
5	3	513	87900	190	50100	263.68
6	3	542	101300	219	63500	289.95
7	3	548	104100	225	66300	294.67
8	3	576	119000	253	81200	320.95
9	3	599	131800	276	94000	340.58
5	4	619	213300	296	175500	592.91
6	4	648	226700	325	188900	581.23
10	1	681	228400	358	190600	532.40
8	4	682	244400	359	206600	575.49
10	2	777	247800	454	210000	462.56
10	3	817	259800	494	222000	449.39
11	2	863	309900	540	272100	503.89
12	2	873	317700	550	279900	508.91
11	3	903	321900	580	284100	489.83
12	3	913	329700	590	291900	494.75
13	3	923	337500	600	299700	499.50
10	5	938	405700	615	367900	598.21
11	4	1009	447300	686	409500	596.94
12	4	1019	455100	696	417300	599.57
13	4	1029	462900	706	425100	602.12
12	5	1034	475600	711	437800	615.75
13	5	1044	483400	721	445600	618.03

EXHIBIT N-7

4TH RECALCULATION

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
4	3	459	69200	0	0	0.00
5	2	473	75900	14	6700	478.57
5	3	513	87900	54	18700	346.30
6	3	542	101300	83	32100	386.75
7	3	548	104100	89	34900	392.13
8	3	576	119000	117	49800	425.64
9	3	599	131800	140	62600	447.14
5	4	619	213300	160	144100	900.63
6	4	648	226700	189	157500	833.33
10	1	681	228400	222	159200	717.12
8	4	682	244400	223	175200	785.65
10	2	777	247800	318	178600	561.64
10	3	817	259800	358	190600	532.40
11	2	863	309900	404	240700	595.79
12	2	873	317700	414	248500	600.24
11	3	903	321900	444	252700	569.14
12	3	913	329700	454	260500	573.79
13	3	923	337500	464	268300	578.23
10	5	938	405700	479	336500	702.51
11	4	1009	447300	550	378100	687.45
12	4	1019	455100	560	385900	689.11
13	4	1029	462900	570	393700	690.70
12	5	1034	475600	575	406400	706.78
13	5	1044	483400	585	414200	708.03

5TH RECALCULATION

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
5	3	513	87900	0	0	0.00
6	3	542	101300	29	13400	462.07
7	3	548	104100	35	16200	462.86
8	3	576	119000	63	31100	493.65
9	3	599	131800	86	43900	510.47
5	4	619	213300	106	125400	1183.02
6	4	648	226700	135	138800	1028.15
10	1	681	228400	168	140500	836.31
8	4	682	244400	169	156500	926.04
10	2	777	247800	264	159900	605.68
10	3	817	259800	304	171900	565.46
11	2	863	309900	350	222000	634.29
12	2	873	317700	360	229800	638.33

11	3	903	321900	390	234000	600.00
12	3	913	329700	400	241800	604.50
13	3	923	337500	410	249600	608.78
10	5	938	405700	425	317800	747.76
11	4	1009	447300	496	359400	724.60
12	4	1019	455100	506	367200	725.69
13	4	1029	462900	516	375000	726.74
12	5	1034	475600	521	387700	744.15
13	5	1044	483400	531	395500	744.82

6TH RECALCULATION

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
6	3	542	101300	0	0	0.00
7	3	548	104100	6	2800	466.67
8	3	576	119000	34	17700	520.59
9	3	599	131800	57	30500	535.09
5	4	619	213300	77	112000	1454.55
6	4	648	226700	106	125400	1183.02
10	1	681	228400	139	127100	914.39
8	4	682	244400	140	143100	1022.14
10	2	777	247800	235	146500	623.40
10	3	817	259800	275	158500	576.36
11	2	863	309900	321	208600	649.84
12	2	873	317700	331	216400	653.78
11	3	903	321900	361	220600	611.08
12	3	913	329700	371	228400	615.63
13	3	923	337500	381	236200	619.95
10	5	938	405700	396	304400	768.69
11	4	1009	447300	467	346000	740.90
12	4	1019	455100	477	353800	741.72
13	4	1029	462900	487	361600	742.51
12	5	1034	475600	492	374300	760.77
13	5	1044	483400	502	382100	761.16

7TH RECALCULATION

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
7	3	548	104100	0	0	0.00
8	3	576	119000	28	14900	532.14
9	3	599	131800	51	27700	543.14
5	4	619	213300	71	109200	1538.03
6	4	648	226700	100	122600	1226.00

EXHIBIT N-7

10	1	681	228400	133	124300	934.59
8	4	682	244400	134	140300	1047.01
10	2	777	247800	229	143700	627.51
10	3	817	259800	269	155700	578.81
11	2	863	309900	315	205800	653.33
12	2	873	317700	325	213600	657.23
11	3	903	321900	355	217800	613.52
12	3	913	329700	365	225600	618.08
13	3	923	337500	375	233400	622.40
10	5	938	405700	390	301600	773.33
11	4	1009	447300	461	343200	744.47
12	4	1019	455100	471	351000	745.22
13	4	1029	462900	481	358800	745.95
12	5	1034	475600	486	371500	764.40
13	5	1044	483400	496	379300	764.72

8TH RECALCULATION

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
8	3	576	119000	0	0	0.00
9	3	599	131800	23	12800	556.52
5	4	619	213300	43	94300	2193.02
6	4	648	226700	72	107700	1495.83
10	1	681	228400	105	109400	1041.90
8	4	682	244400	106	125400	1183.02
10	2	777	247800	201	128800	640.80
10	3	817	259800	241	140800	584.23
11	2	863	309900	287	190900	665.16
12	2	873	317700	297	198700	669.02
11	3	903	321900	327	202900	620.49
12	3	913	329700	337	210700	625.22
13	3	923	337500	347	218500	629.68
10	5	938	405700	362	286700	791.99
11	4	1009	447300	433	328300	758.20
12	4	1019	455100	443	336100	758.69
13	4	1029	462900	453	343900	759.16
12	5	1034	475600	458	356600	778.60
13	5	1044	483400	468	364400	778.63

EXHIBIT N-7

9TH RECALCULATION

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
9	3	599	131800	0	0	0.00
5	4	619	213300	20	81500	4075.00
6	4	648	226700	49	94900	1936.73
10	1	681	228400	82	96600	1178.05
8	4	682	244400	83	112600	1356.63
10	2	777	247800	178	116000	651.69
10	3	817	259800	218	128000	587.16
11	2	863	309900	264	178100	674.62
12	2	873	317700	274	185900	678.47
11	3	903	321900	304	190100	625.33
12	3	913	329700	314	197900	630.25
13	3	923	337500	324	205700	634.88
10	5	938	405700	339	273900	807.96
11	4	1009	447300	410	315500	769.51
12	4	1019	455100	420	323300	769.76
13	4	1029	462900	430	331100	770.00
12	5	1034	475600	435	343800	790.34
13	5	1044	483400	445	351600	790.11

10TH RECALCULATION

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
10	3	817	259800	0	0	0.00
11	2	863	309900	46	50100	1089.13
12	2	873	317700	56	57900	1033.93
11	3	903	321900	86	62100	722.09
12	3	913	329700	96	69900	728.13
13	3	923	337500	106	77700	733.02
10	5	938	405700	121	145900	1205.79
11	4	1009	447300	192	187500	976.56
12	4	1019	455100	202	195300	966.83
13	4	1029	462900	212	203100	958.02
12	5	1034	475600	217	215800	994.47
13	5	1044	483400	227	223600	985.02

EXHIBIT N-7

11TH RECALCULATION

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
11	3	903	321900	0	0	0.00
12	3	913	329700	10	7800	780.00
13	3	923	337500	20	15600	780.00
10	5	938	405700	35	83800	2394.29
11	4	1009	447300	106	125400	1183.02
12	4	1019	455100	116	133200	1148.28
13	4	1029	462900	126	141000	1119.05
12	5	1034	475600	131	153700	1173.28
13	5	1044	483400	141	161500	1145.39

12TH RECALCULATION

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
12	3	913	329700	0	0	0.00
13	3	923	337500	10	7800	780.00
10	5	938	405700	25	76000	3040.00
11	4	1009	447300	96	117600	1225.00
12	4	1019	455100	106	125400	1183.02
13	4	1029	462900	116	133200	1148.28
12	5	1034	475600	121	145900	1205.79
13	5	1044	483400	131	153700	1173.28

13TH RECALCULATION

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
13	3	923	337500	0	0	0.00
10	5	938	405700	15	68200	4546.67
11	4	1009	447300	86	109800	1276.74
12	4	1019	455100	96	117600	1225.00
13	4	1029	462900	106	125400	1183.02
12	5	1034	475600	111	138100	1244.14
13	5	1044	483400	121	145900	1205.79

EXHIBIT N-7

14TH RECALCULATION

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
13	4	1029	462900	0	0	0.00
12	5	1034	475600	5	12700	2540.00
13	5	1044	483400	15	20500	1366.67

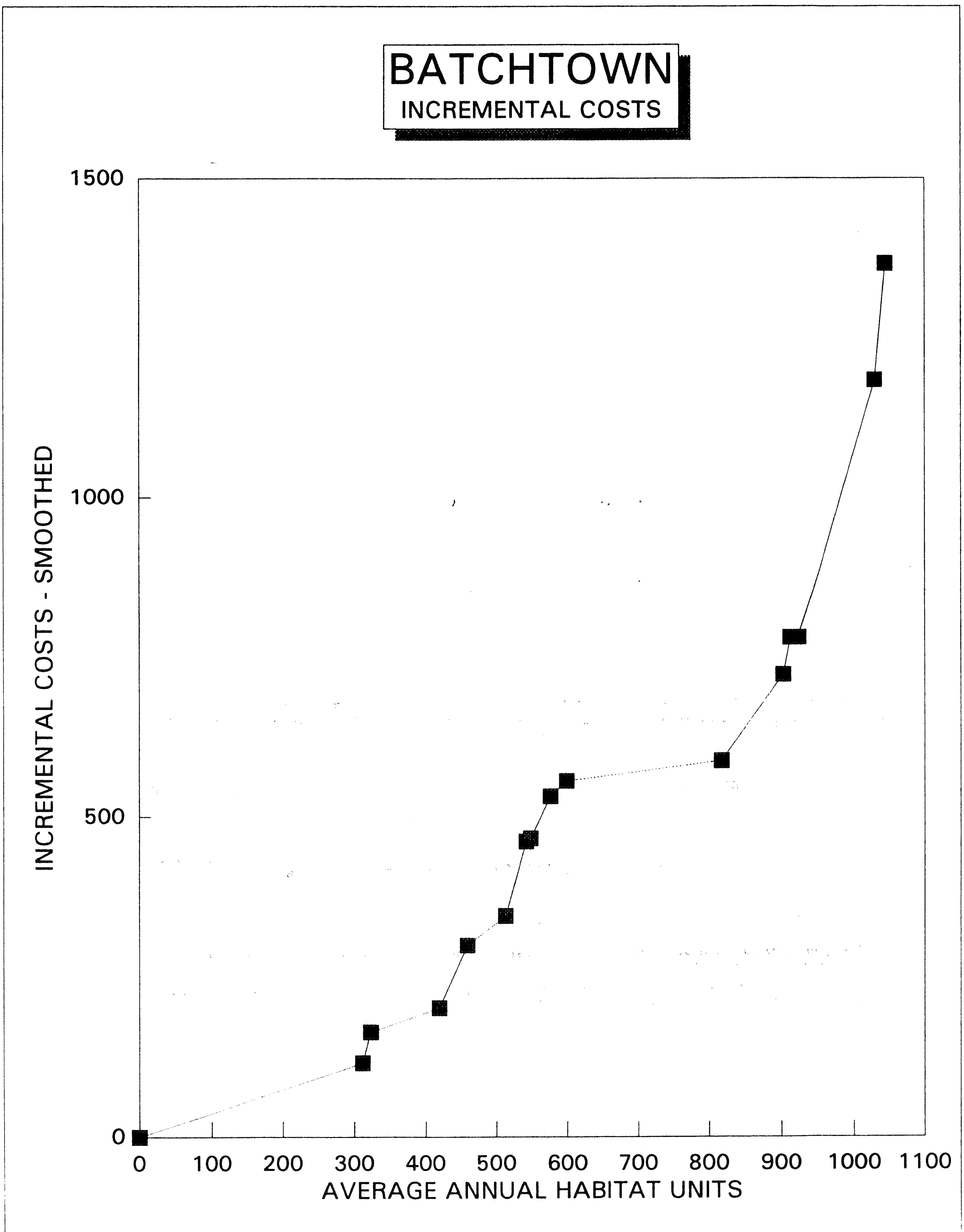
EXHIBIT N-8

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	MARG AAHUs	MARG COST	MARG COST/ MARG AAHU
1	1	0	0	0	0	0.00
3	1	312	36000	312	36000	115.38
4	1	323	37800	11	1800	163.64
4	2	419	57200	96	19400	202.08
4	3	459	69200	40	12000	300.00
5	3	513	87900	54	18700	346.30
6	3	542	101300	29	13400	462.07
7	3	548	104100	6	2800	466.67
8	3	576	119000	28	14900	532.14
9	3	599	131800	23	12800	556.52
10	3	817	259800	218	128000	587.16
11	3	903	321900	86	62100	722.09
12	3	913	329700	10	7800	780.00
13	3	923	337500	10	7800	780.00
13	4	1029	462900	106	125400	1183.02
13	5	1044	483400	15	20500	1366.67

EXHIBIT 8-A

PATH "B" IDEN. NUM	PATH "R" IDEN. NUM	AVG ANN AAHUs	AVG ANN COST	PLAN IDENTIFICATION NUMBERS B	X	L	I	N	KC	Q	C	W	G	O	E	KB	J	R	H	K	F	M	D
1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	312	36000	1	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
4	1	323	37800	3	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
4	2	419	57200	3	0	2	0	0	0	0	2	0	0	0	0	0	0	3	0	0	0	0	1
4	3	459	69200	3	0	2	0	0	0	0	2	0	0	0	0	0	0	3	1	0	0	0	1
5	3	513	87900	3	0	2	0	0	0	0	3	0	0	0	0	0	0	3	0	0	0	0	1
6	3	542	101300	3	2	2	0	0	0	0	3	0	0	0	0	0	0	3	1	0	0	0	1
7	3	548	104100	3	2	3	0	0	0	0	3	0	0	0	0	0	0	3	1	0	0	0	1
8	3	576	119000	3	2	3	2	0	0	0	3	0	0	0	0	0	0	3	1	0	0	0	1
9	3	599	131800	3	2	3	2	0	1	0	3	0	0	0	0	0	0	3	1	0	0	0	1
10	3	817	259800	3	2	3	2	0	1	0	3	2	1	4	1	1	0	3	1	0	0	0	1
11	3	903	321900	3	2	3	2	0	1	0	3	2	1	4	1	1	2	3	1	0	0	0	1
12	3	913	329700	3	2	3	2	0	1	2	3	2	1	4	1	1	2	3	1	0	0	0	1
12-A	3	913	329700	3	2	3	2	2	1	0	3	2	1	4	1	1	2	3	1	0	0	0	1
13	3	923	337500	3	2	3	2	2	1	2	3	2	1	4	1	1	2	3	1	0	0	0	1
13	4	1029	462900	3	2	3	2	2	1	2	3	2	1	4	1	1	2	3	1	0	1	3	1
13	5	1044	483400	3	2	3	2	2	1	2	3	2	1	4	1	1	2	3	1	1	1	3	1

EXHIBIT N-9



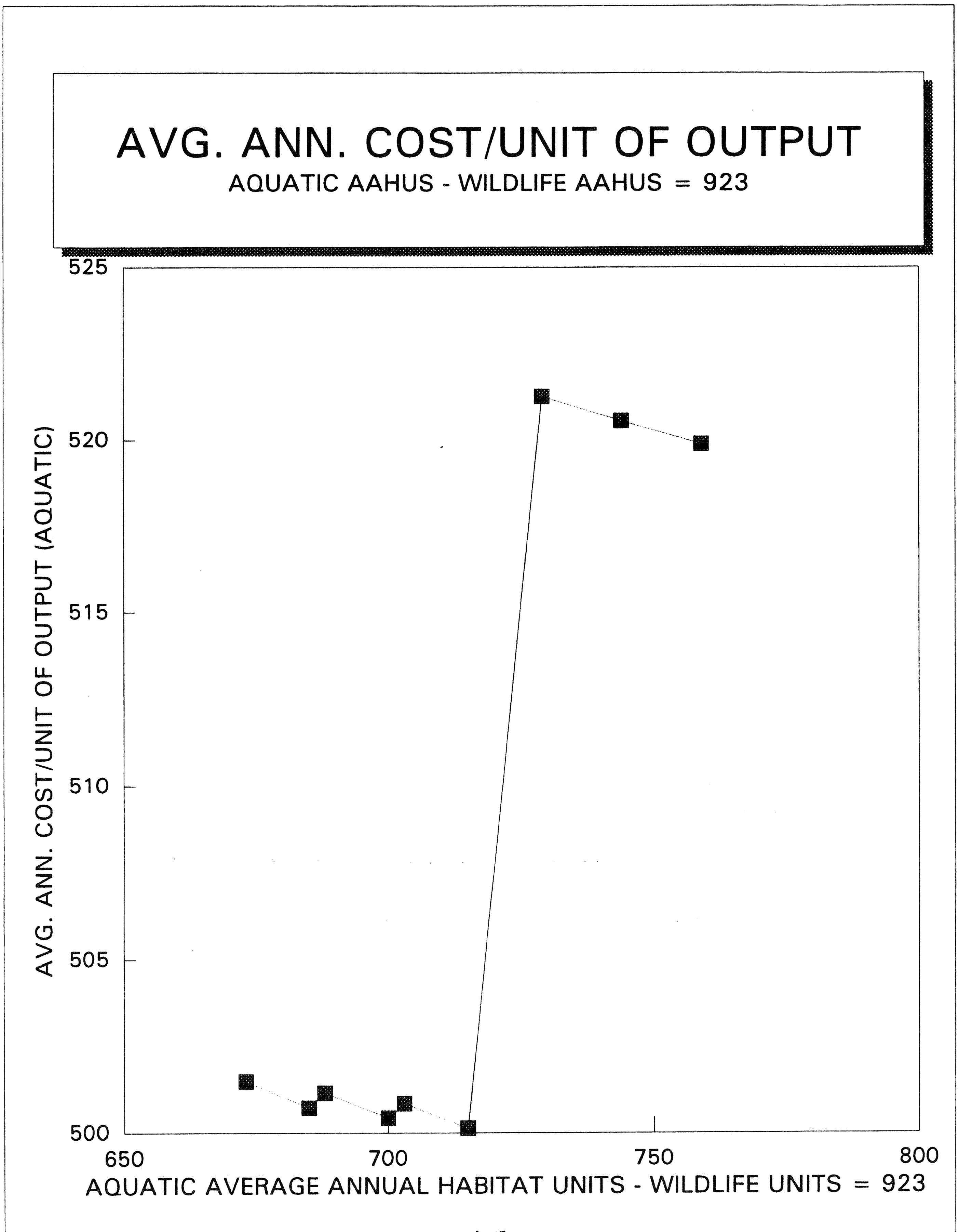
BATCHTOWN
INCREMENTAL COSTS
1500
1000
500
0
INCREMENTAL COSTS - SMOOTHED
0
100
200
300
400
500
600
700
800
900
1000
1100
AVERAGE ANNUAL HABITAT UNITS

EXHIBIT N-10

TOTAL W-AAHU	TOTAL A-AAHU	AVG ANN COST	MARG A-AAHU	MARG COST	MARG COST/ MARG A-AAHU	AVG COST/ A-AAHU	B	X	L	R	C	I	N	KC	Q	FC	W	G	O	KB	E	J	FB	D	K	H	F	M
923	673	337500	673	337500	501.49	501.49	3	2	3	3	3	2	2	1	2	0	2	1	4	1	1	2	0	1	0	1	0	0
923	685	343000	12	5500	458.33	500.73	3	1	3	3	3	2	2	1	2	0	2	1	4	1	1	2	0	1	1	1	0	0
923	688	344800	3	1800	600.00	501.16	3	2	3	3	3	2	2	1	2	0	2	1	4	1	1	2	1	1	0	1	0	0
923	700	350300	12	5500	458.33	500.43	3	1	3	3	3	2	2	1	2	1	2	1	4	1	1	2	0	1	1	1	0	0
923	703	352100	3	1800	600.00	500.85	3	2	3	3	3	2	2	1	2	1	2	1	4	1	1	2	1	1	0	1	0	0
923	715	357600	12	5500	458.33	500.14	3	1	3	3	3	2	2	1	2	1	2	1	4	1	1	2	1	1	1	1	0	0
923	729	380000	14	22400	1600.00	521.26	3	2	3	3	3	0	0	1	2	0	2	1	4	1	1	1	0	1	1	1	1	3
923	744	387300	15	7300	486.67	520.56	3	2	3	3	3	0	0	1	2	1	2	1	4	1	1	1	0	1	1	1	1	3
923	759	394600	15	7300	486.67	519.89	3	2	3	3	3	0	0	1	2	1	2	1	4	1	1	1	1	1	1	1	1	3

**PLEASE NOTE: THERE ARE ACTUALLY THREE PLANS WHICH PRODUCE THE SAME NUMBER OF A-AAHUS FOR THE SAME COSTS. THESE WILL BE INCLUDED IN THE FINAL INFORMATION. ONLY ONE OF EACH IS UTILIZED FOR ANALYSIS. PLANS ARE: 688, 700 AND 744 A-AAHU ABOVE.

EXHIBIT N-11



AVG. ANN. COST/UNIT OF OUTPUT
AQUATIC AAHUS - WILDLIFE AAHUS = 923
525
520
515
510
505
500
650
700
750
800
AVG. ANN. COST/UNIT OF OUTPUT (AQUATIC)
AQUATIC AVERAGE ANNUAL HABITAT UNITS - WILDLIFE UNITS = 923

EXHIBIT N-12

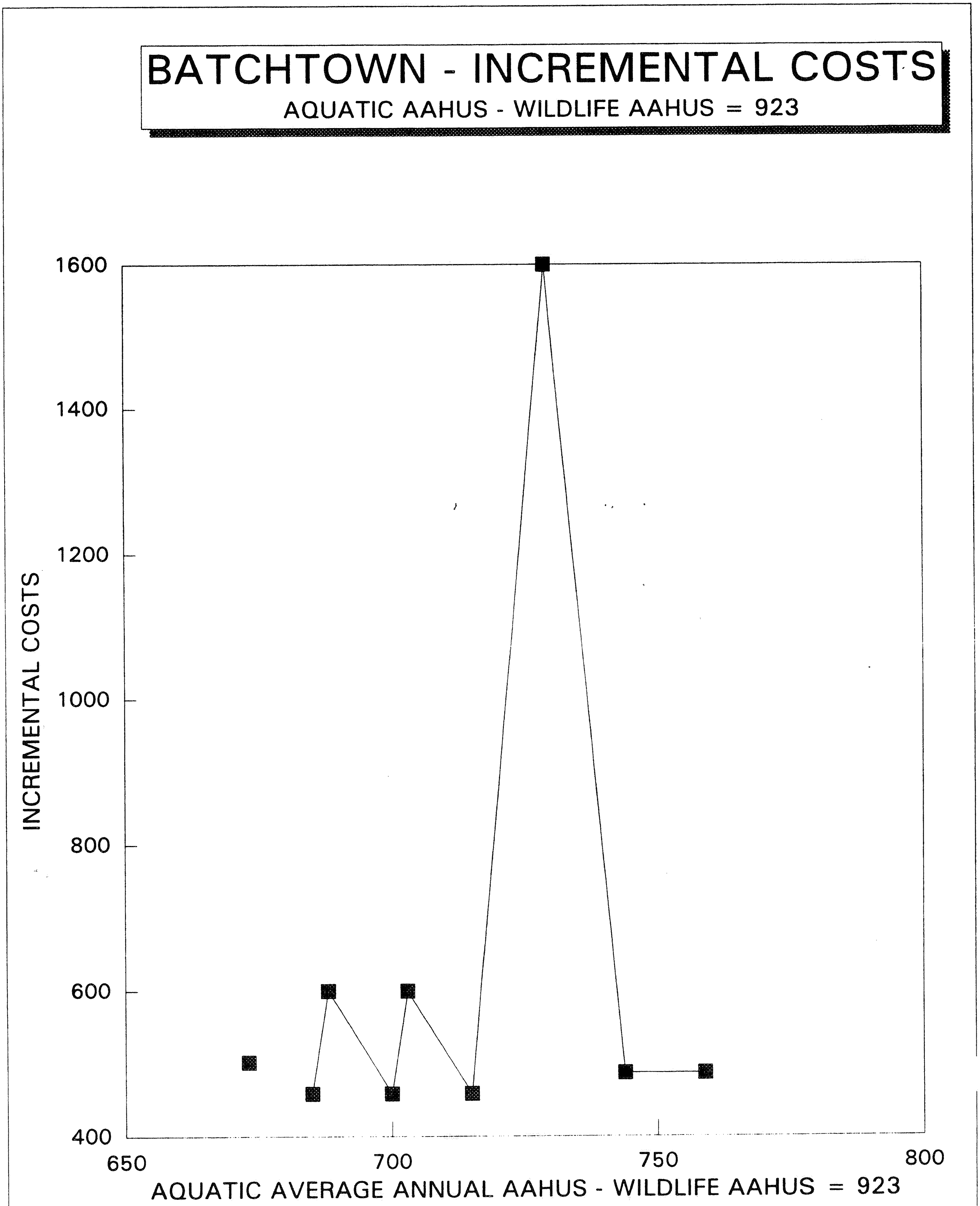

BATCHTOWN - INCREMENTAL COSTS
AQUATIC AAHUS - WILDLIFE AAHUS = 923
1600
1400
1200
1000
800
600
400
INCREMENTAL COSTS
650
700
750
800
AQUATIC AVERAGE ANNUAL AAHUS - WILDLIFE AAHUS = 923

EXHIBIT N-13

TOTAL W-AAHU	AVG ANN A-AAHU	AVG ANN COST	MARG A-AAHU	MARG COST	MARG COST/ MARG A-AAHU	B	X	L	R	C	I	N	KC	Q	FC	W	G	O	KB	E	J	FB	D	K	H	F	M
923	673	337500	673	337500	501.49	3	2	3	3	3	2	2	1	2	0	2	1	4	1	1	2	0	1	0	1	0	0
923	685	343000	12	5500	778.29	3	1	3	3	3	2	2	1	2	0	2	1	4	1	1	2	0	1	1	1	0	0
923	688	344800	15	7300	486.67	3	2	3	3	3	2	2	1	2	0	2	1	4	1	1	2	1	1	0	1	0	0
923	700	350300	27	12800	474.07	3	1	3	3	3	2	2	1	2	1	2	1	4	1	1	2	0	1	1	1	0	0
923	703	352100	30	14600	486.67	3	2	3	3	3	2	2	1	2	1	2	1	4	1	1	2	1	1	0	1	0	0
923	715	357600	42	20100	478.57	3	1	3	3	3	2	2	1	2	1	2	1	4	1	1	2	1	1	1	1	0	0
923	729	380000	56	42500	758.93	3	2	3	3	3	0	0	1	2	0	2	1	4	1	1	1	0	1	1	1	1	3
923	744	387300	71	49800	701.41	3	2	3	3	3	0	0	1	2	1	2	1	4	1	1	1	0	1	1	1	1	3
923	759	394600	86	57100	663.95	3	2	3	3	3	0	0	1	2	1	2	1	4	1	1	1	1	1	1	1	1	3

N-47

1ST RECALCULATION

TOTAL W-AAHU	AVG ANN A-AAHU	AVG ANN COST	MARG A-AAHU	MARG COST	MARG COST/ MARG A-AAHU	B	X	L	R	C	I	N	KC	Q	FC	W	G	O	KB	E	J	FB	D	K	H	F	M
923	700	350300	0	0	0.00	3	1	3	3	3	2	2	1	2	1	2	1	4	1	1	2	0	1	1	1	0	0
923	703	352100	3	1800	600.00	3	2	3	3	3	2	2	1	2	1	2	1	4	1	1	2	1	1	0	1	0	0
923	715	357600	15	7300	486.67	3	1	3	3	3	2	2	1	2	1	2	1	4	1	1	2	1	1	1	1	0	0
923	729	380000	29	29700	1024.14	3	2	3	3	3	0	0	1	2	0	2	1	4	1	1	1	0	1	1	1	1	3
923	744	387300	44	37000	840.91	3	2	3	3	3	0	0	1	2	1	2	1	4	1	1	1	0	1	1	1	1	3
923	759	394600	59	44300	750.85	3	2	3	3	3	0	0	1	2	1	2	1	4	1	1	1	1	1	1	1	1	3

EXHIBIT N-13

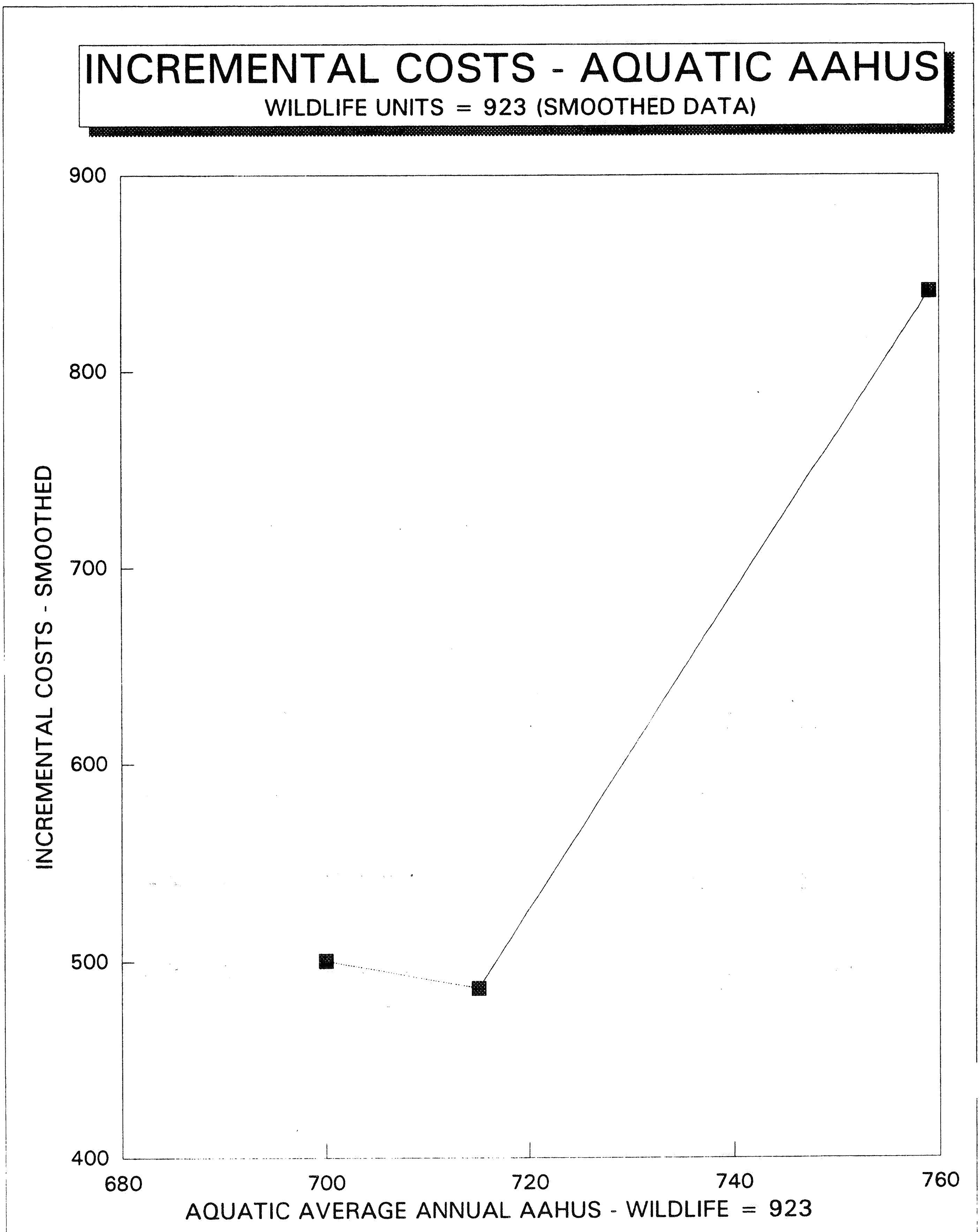
2ND RECALCULATION

TOTAL W-AAHU	AVG ANN A-AAHU	AVG ANN COST	MARG A-AAHU	MARG COST	MARG COST/ MARG A-AAHU	B	X	L	R	C	I	N	KC	Q	FC	W	G	O	KB	E	J	FB	D	K	H	F	M
923	715	357600	0	0	0.00	3	1	3	3	3	2	2	1	2	1	2	1	4	1	1	2	1	1	1	1	0	0
923	729	380000	14	22400	1600.00	3	2	3	3	3	0	0	1	2	0	2	1	4	1	1	1	0	1	1	1	1	3
923	744	387300	29	29700	1024.14	3	2	3	3	3	0	0	1	2	1	2	1	4	1	1	1	0	1	1	1	1	3
923	759	394600	44	37000	840.91	3	2	3	3	3	0	0	1	2	1	2	1	4	1	1	1	1	1	1	1	1	3

EXHIBIT N-14

TOTAL W-AAHU	TOTAL A-AAHU	AVG ANN COST	MARG A-AAHU	MARG COST	MARG COST/ MARG A-AAHU	B	X	L	R	C	I	N	KC	Q	FC	W	G	O	KB	E	J	FB	D	K	H	F	M
923	700	350300	700	350300	500.43	3	1	3	3	3	2	2	1	2	1	2	1	4	1	1	2	0	1	1	1	0	0
923	700	350300	0	0	500.43	3	1	3	3	3	2	2	1	2	0	2	1	4	1	1	2	1	1	1	1	0	0
923	715	357600	15	7300	486.67	3	1	3	3	3	2	2	1	2	1	2	1	4	1	1	2	1	1	1	1	0	0
923	759	394600	44	37000	840.91	3	2	3	3	3	0	0	1	2	1	2	1	4	1	1	1	1	1	1	1	1	3

EXHIBIT N-15


INCREMENTAL COSTS - AQUATIC AAHUS
WILDLIFE UNITS = 923 (SMOOTHED DATA)
INCREMENTAL COSTS - SMOOTHED
900
800
700
600
500
400
680
700
720
740
760
AQUATIC AVERAGE ANNUAL AAHUS - WILDLIFE = 923

Appendix O - Hillside Sediment Control Plan and Resource Plan

United States Department of Agriculture
Soil Conservation Service
P.O. Box 516
101 French St.
Hardin, IL 62047
(618)576-2723

To: Dave Kirkpatrick
Planning Division
U.S. Army Corps of Engineers
1222 Spruce St.
St. Louis, MO 63103-2833

November 15, 1994

Dear Dave,

Enclosed is a draft copy of the Batchtown EMP Hillside Sediment Control proposal with 4 different options. The hillside part of this project is very beneficial to the conservation of all natural resources. Ecosystem planning also provides upland wildlife benefits that should be considered. I prepared this draft based on previous and current data available in this office. I am sending copies out for review by experts. I will revise as needed and keep you current.

I feel that the options I have presented are flexible enough to cover many aspects of erosion control., The flexibility of these options will also make them adaptable and appealing to landowners. I am enclosing the diskette with my spreadsheets on them. They were done on a DOS machine with LOTUS 123, probably version 2.1. A list of the print ranges is attached, with the borders already set. The BFORM.WK1 spreadsheet is the exact same spreadsheet except it shows the formulas used in the BEMP$1.WK1.

Please call me with any questions. If you need to, we can schedule a meeting again. You may have heard, the Soil Conservation Service has been renamed the Natural Resource Conservation Service. While we are in transition, we will answer to either name.

Martha Sheppard

Martha Sheppard
District Conservationist

cc w/ enclosures: Roy Bailey, Roger Windhorn
cc w/out enclosures: Rick Macho

Batchtown EMP Hillside Sediment Reduction Plan

Need:

Sediment coming from the watershed area will continue to fill the Batchtown EMP area with 28,844 tons of soil per year (Opt.1 col. AC, AD) or a total of 1,442,189 tons of soil after 50 years. The main component in this sediment is dissolved soil particles, usually silty in texture. Silt particles lack the cohesiveness found in clay particles, which allows them to be easily loosened by water. The soils found in the Batchtown watershed area outlined in fig. 1 are dominantly silty textured, not just in the surface but frequently to a depth of 20 feet or more.(1) The potential for soil erosion is much higher in these soils than in soils that are underlain with clay or rock materials.

Deep, silty soils like these maintain cropland productivity despite loss of topsoil, so that erosive practices continue. Current conservation plans address soil erosion on cropland fields only, resulting in estimated soil losses for the watershed of 46,964 tons per year (Opt.1, col AA). These plans only address soil loss on a given tract, not sediment related damages that occur off sight. The topography ranges from 813 feet above sea level to normal pool at Winfield lock and dam of 434 feet(2). With almost 400 feet in drop from the highest point to the lowest point in the watershed over a distance of about 2 miles, eroded soil is able to quickly reach streams and travel to the river. Sediment delivery to the river is given as a percent of the gross erosion rates in Option 1 and ranges from 55 percent for sheet and rill erosion to 100 percent streambank erosion. All soil loss tonnages are based on air dried weights.

Options:

Four options are given for addressing upland erosion as it relates to the Batchtown EMP. Option 1 shows current erosion rates and is based on data prepared by Chris Borden in 1991. Based on status reviews conducted in the Batchtown watershed area, the data is still current. Option 1 also shows the expected results if no upland treatment is used.

All sub-watersheds shown in fig.0-1 should be included. Sub-watersheds 1,2, and 7 were dropped as being outside the impoundment area for the EMP. All other sub-watersheds contribute sediment to the EMP area. Not including a listed sub-watershed will lower participation rates, increase costs, and decrease overall effectiveness. Although all data is given by sub-watershed, the Natural Resource

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1 United States Department of Agriculture. 1989. Soil Survey of Calhoun County, Illinois. 6-7 pp, illus.

(2) US Geological Survey, Foley, Missouri-Illinois Quadrangle topographic map. 1975.

Conservation Service does not consider partial watershed planning an option in this situation.

Option 2 uses the EBA (Ecosystem Based Assistance) planning approach to control sheet and rill erosion and ephemeral erosion. EBA plans cover an entire tract of land but are actually prepared on a watershed basis, allowing for influences beyond property lines. Although NRCS and the SWCD primarily work with crop and forage land, other natural resource disciplines such as forestry, fisheries, wildlife, etc. contribute to make the plan address SWAPA+H (Soil, water, air, plants, animals + human) resources. These disciplines are compatible with sediment reduction and with input from the landowner, we get long term results.

The topography of this watershed gives us increased sediment delivery rates for sheet, rill, and ephemeral compared to the watershed of Swan Lake, also located in Calhoun County. Sheet, rill, and ephemeral erosion occur in mostly in cropland. Option 2 shows expected results if EBA plans and Cost-share items listed in figure 2 were used alone. An expected participation of 15% of the cropland is all that is expected based on a landowner interest survey in 1992. The EBA plans and incentives alone are not enough to encourage landowners to participate. Sheet, rill, and ephemeral erosion reductions will yield a 5.7% decrease in sediment delivered to the EMP impoundment. The cost of $100 per acres is based on the cost of EBA planning plus the one-time cost of application of low cost cultural practices. The cost is estimated at about $1.40 per ton sediment reduced. This option tries to stop dissolved soil particles from ever leaving the field or location they are in. The practices listed in figure 10, often referred to as "cultural practices" are effective in preventing erosion. The main emphasis of these practices is vegetation and other ground covers that slow the impact of rain drops and allow them to be absorbed into the soil. Each practice listed has specifications given in our Technical Guide, Section 4. Each practice is measurable and the unit of measure for recording it is given in parenthesis.

These practices are usually economical for landowners, but require a relatively high amount of technical and administrative assistance. The benefits must usually be explained and sometimes demonstrated to people who are unfamiliar with them. The landowners cost associated with them could be: somewhat specialized equipment, additional labor, additional seed, or the loss of a small area of cropland. Incentives for these practices can be paid based on the University of Illinois Cooperative Extension Service Guide to Custom Rates and Costs. These are also good practices to use as "in-kind" practices to make other practices more affordable to landowners.

In option 3 gully and streambank erosion are treated with structural practices that correct an individual erosion problem. These problem areas can be treated based on landowner sign-ups. Landowner surveys indicate that about

50% of the gully and streambank erosion would be treated with these incentives. A technical assistance amount of 8% is included in the cost. The average structure controls 28 tons of soil loss per year for a total sediment reduction over 50 years of 3.2 percent. Average cost per ton sediment reduced is $2.51. This option would be popular with landowners but its overall impact is minimal.

Whenever water comes together running off of fields it forms a concentrated flow. This concentrated flow is more powerful than a single raindrop and is able to move substantial amounts of soil. Once eroding soil reaches a concentrated flow area its sediment delivery rate is increased because the force carrying it will continue to carry until it reaches a place with still water, such as a major river or lake. As this soil is moved, the resulting trench is lower and receives more and more water. Even with the use of cultural practices, water still forms concentrated flow areas that need treatment. Gullies in this watershed usually average 28 tons of soil loss each year. Figure O-3 is a list of practices that commonly control gully erosion. Landowner costs are high because these practices usually require heavy equipment and operators. The technical assistance is less than with cultural practices because contractors that do the earthwork usually are familiar with using specifications and designs.

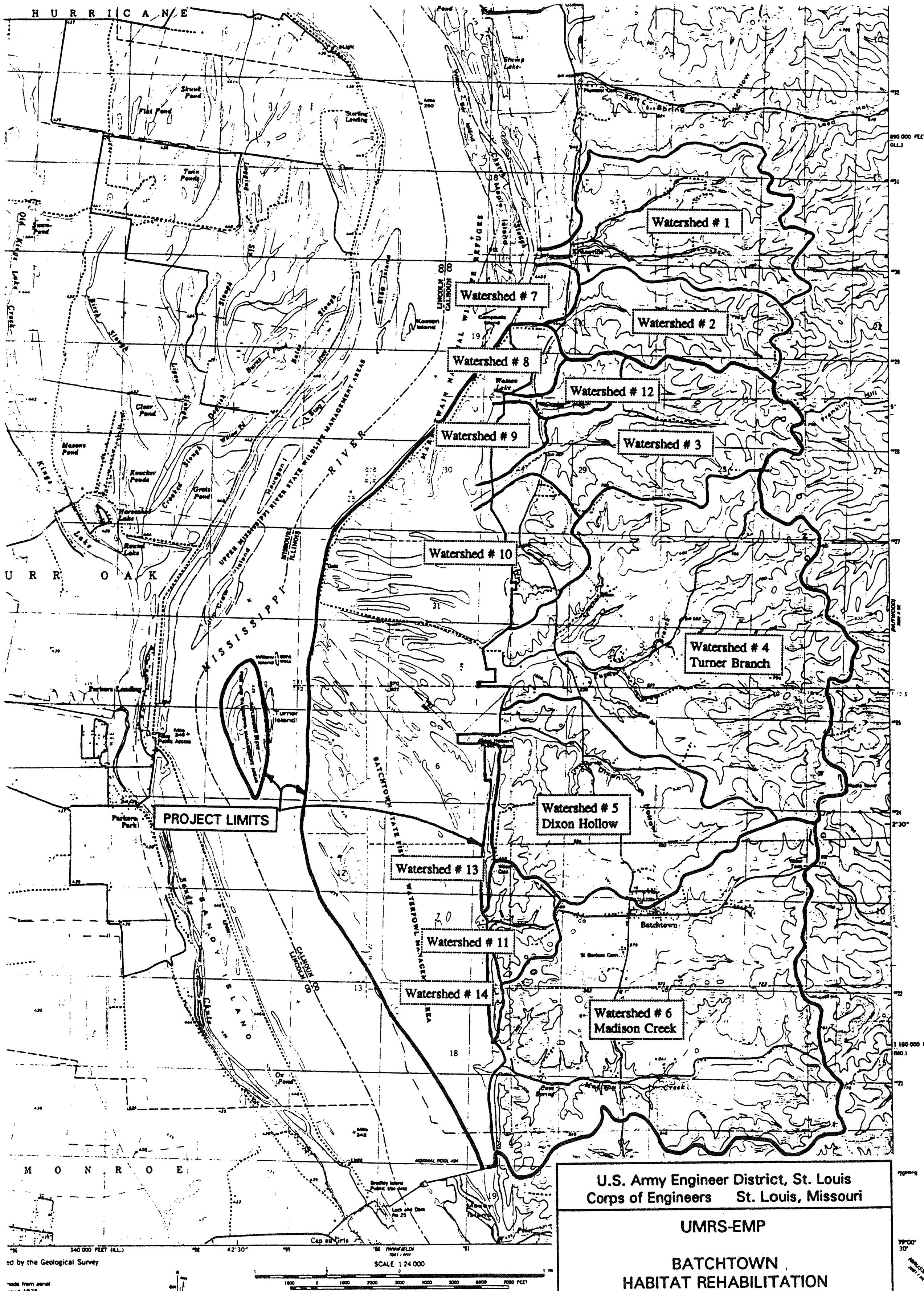
These practices effectively stop gullies, slow the discharge time, and allow sediment to settle out. Although they trap sediment, their usual purpose is to stop the gully and stabilize the grade so that water leaving them is slower and clearer. If these practices are used without the cultural practices, maintenance is high and they are less effective.

Streambank erosion is similar to gully erosion, except the bank that is eroding is usually depositional material that washed from the uplands at an earlier date but was stable there for some time. Streambanks can change quickly from stable to unstable. Upstream erosion treatments reduce the peak flow of a stream, so that stabilization projects are more easily done and last longer. Actual streambank stabilization practices are fairly cost effective once everyone involved has some experience.

Livestock and farmstead related erosion are also addressed with streambank erosion. The percent of a streams' linear footage that is eroding is increased by the number of livestock operations present in its watershed. The typical size of an active erosional face is 4'x0.5' in the Batchtown area. Practices that address only the stream are difficult to be accepted by landowners. However, when practices that provide alternatives for livestock water and waste management are included, they are more popular and just as effective on cost.

Option 4 combines the EBA planning and cultural practices used in option 2 with the structural practices used in option 3. The overall result is 60 percent landowner participation, resulting in an overall sediment reduction of 26 percent. The increased landowner participation in EBA planning results from the added incentive of cost-share on the structural practices. The overall cost of this option would be $504,385; the per ton sediment reduction would be $1.35. This option is the most cost effective and substantially reduces sedimentation to the EMP area.

Another option discussed but not included in landowner surveys would be a Conservation Reserve Program, modelled on the one offered by ASCS in the past. At a cost of about $950 per acre, cropland is retired from production for 10 years. ASCS has also offered a similar program known as the Wetland Reserve Program (WRP) that takes wetland cropland out of production permanently for a cost not to exceed $1200 per acre, using an easement.



U.S. Army Engineer District, St. Louis
Corps of Engineers St. Louis, Missouri

UMRS-EMP

BATCHTOWN
HABITAT REHABILITATION
AND ENHANCEMENT PROJECT

WATERSHEDS
UPLAND SEDIMENT CONTROL PROGRAM

FIGURE O-1

Figure O-2

Cultural practices that effectively address Sheet, Rill and Ephemeral Erosion

Conservation Cover (acre)	327
Conservation Cropping Sequence (acre)	328
Conservation Tillage (acre)	329
Contour Farming (acre)	330
Contour Orchard and other Fruit Area (acre)	331
Cover and Green Manure Crop (acre)	340
Critical Area Planting (acre)	342
Crop Residue Use (acre)	344
Livestock Exclusion (acre)	472
Mulching (acre)	484
Nutrient Management	590
Pasture and Hayland Management (acre)	510
Pasture and Hayland Planting (acre)	512
Pest Management	595
Prescribed Burning (acre)	338
Recreation Area Improvement (acre)	562
Stripcropping, Contour (acre)	585
Tree Planting (acre)	612
Trough or Tank (no)	614
Wildlife Food Plots (interim)	
Wildlife Upland Habitat Management (acre)	645
Wildlife Watering Facility (no)	648
Wildlife Wetland Habitat Management (acre)	644
Windbreak Renovation (acre)	650
Woodland Direct Seeding (acre)	652
Woodland Improved Harvesting (acre)	654
Woodland Improvement (acre)	666
Woodland Pruning (acre)	660
Wetland Restoration (state interim)	657

Figure O-3

Following is a list of practices that address concentrated flow areas.

Diversion (ft)	362
Fencing (ft)	382
Field Border (ft)	386
Filter Strip (acre)	393
Fishpond Management (no)	399
Forest Land Erosion Control System (acre)	408
Grade Stabilization Structure (no)	410
Grassed Waterway or Outlet (acre)	412
Heavy Use Area Protection (acre)	561
Hedgerow Planting (ft)	422
Lined Waterway or Outlet (ft)	468
Pipeline (ft)	516
Pond (no)	378
Roof Runoff Management (no)	558
Sediment Basin (no)	350
Terrace (ft)	600
Underground Outlet (ft)	620
Vertical Drain (no)	630
Waste Utilization (acre)	633
Water and Sediment Control Basin (no)	638
Wetland Restoration (state interim)	657

Figure O-4

BATCHTOWN EMP UPLAND WATERSHED TREATMENT
Option 1: No upland watershed treatment

Present Erosion and Sedimentation Amounts in tons/acre/year:

WS #	Watershed Acres: Total Acres	Crop Acres	Pastur Acres	Wooded Acres	Pe 15 PP HI	Gross Sheet & Rill	Sed. Rate	Net Sheet & Rill	Gross Ephem.	Sed. Rate	Net Ephem.
A	C	D	E	F	HI	K	L	M	O	P	Q
3	834	44	132	658	**	2,240	64.0%	1,434	330	72.0%	238
4	2,346	384	577	1,385	**	9,109	55.0%	5,010	2,880	62.0%	1,786
5	1,060	111	332	617	**	3,562	64.0%	2,280	833	72.0%	599
6	2,404	868	868	668	**	14,356	55.0%	7,896	6,510	62.0%	4,036
8	154	47	16	91	**	794	64.0%	508	353	72.0%	254
9	110	66	0	44	**	880	64.0%	563	495	72.0%	356
10	281	71	12	198	**	1,284	64.0%	822	533	72.0%	383
11	214	7	65	142	**	563	64.0%	360	53	72.0%	38
12	121	8	70	43	**	392	64.0%	251	60	72.0%	43
13	63	0	11	52	**	137	64.0%	88	0	72.0%	0
14	44	0	16	28	**	104	64.0%	67	0	72.0%	0
Tot	7,631	1,606	2,099	3,926	**	33,421	62.4%	19,278	12,045	69.8%	7,733

WS #	Gross Gully	Sed. Rate	Net Gully	Stream Bank feet	% Act. Erod.	Stream bank tons/yr	Gross soil loss tons/yr	Net ann. Sediment Delivery	Net 50 y Sediment Delivery
A	S	T	U	W	X	Y	AA	AC	AD
3	112	95.0%	106	14,880	4.4%	59	2,741	1,837	91,82
4	455	85.0%	387	59,040	2.4%	128	12,376	7,310	365,49
5	178	95.0%	169	23,520	3.0%	64	4,564	3,112	155,58
6	675	85.0%	574	46,080	2.9%	120	21,440	12,626	631,30
8	40	95.0%	38			0	1,184	800	39,98
9	44	95.0%	42			0	1,417	961	48,07
10	64	95.0%	61	2,400	1.0%	2	1,877	1,268	63,41
11	28	95.0%	27	2,880	8.8%	23	642	448	22,38
12	20	95.0%	19	4,800	1.0%	4	471	317	15,85
13	7	95.0%	7			0	144	94	4,70
14	5	95.0%	5			0	109	72	3,57
Tot	1,628	93.2%	1,433	153,600	3.4%	400	46,964	28,844	1,442,18

Figure O-5

BATC

OptiOption 2: EBA plans to control Sheet, Rill, and Ephemeral Erosion on 15% of area.

WS #	Crop land at 12 t/a	Past. land 3 t/a	Wood land 2 t/a	With EBA Plans: crop land 5 t/a	gross sheet & rill	Net sheet & rill	With EBA Plans Ephemerol erosion: (S&R x Net. 0.625)	Ephem	
A	AG	AH	AI	AK	AL	AM	AP	AQ	AR
3	449	396	1316	33	2,194	1,404	301	217	
4	3917	1731	2770	288	8,706	4,788	2,628	1,629	
5	1132	996	1234	83	3,445	2,205	760	547	
6	8854	2604	1336	651	13,445	7,395	5,940	3,683	
8	479	48	182	35	745	477	322	232	
9	673	0	88	50	811	519	452	325	
10	724	36	396	53	1,209	774	486	350	
11	71	195	284	5	556	356	48	34	
12	82	210	86	6	384	246	55	39	
13	0	33	104	0	137	88	0	0	
14	0	48	56	0	104	67	0	0	
Tot	16381	6,297	7,852	1,205	31,735	18,317	10,991	7,057	0

WS #	Combined Costs: Cost Per Acre	Percent Acres Planned	Total Cost	Results: Gross Soil Loss	Net Sediment Delivered	50 year Sed. Total	Cost per Ton	Percent Sediment Reductio
A	AT	AU	AV	AX	AY	AZ	BB	F
3	$100.00	15%	$12,510.00	2,666	1,786	89,308	$4.97	2.7
4	$100.00	15%	$35,190.00	11,916	6,932	346,591	$1.86	5.2
5	$100.00	15%	$15,900.00	4,447	2,985	149,232	$2.50	4.1
6	$100.00	15%	$36,060.00	20,180	11,772	588,579	$0.84	6.8
8	$100.00	15%	$2,310.00	1,106	746	37,294	$0.86	6.7
9	$100.00	15%	$1,650.00	1,306	886	44,293	$0.44	7.9
10	$100.00	15%	$4,215.00	1,762	1,187	59,353	$1.04	6.4
11	$100.00	15%	$3,210.00	654	440	21,981	$8.01	1.8
12	$100.00	15%	$1,815.00	462	308	15,393	$3.96	2.9
13	$100.00	15%	$945.00	144	94	4,709	$0.00	0.0
14	$100.00	15%	$660.00	109	72	3,575	$0.00	0.0
Tot	$100.00	15%	$114,465.00	44,753	27,206	1,360,309	$1.40	5.7

Figure O-6

BATC

OptiOption 3: Structural Practices Applied to 50% of Gully and Streambank Erosion.

WS # A	Gully erosion control measures: 50% treated Gross Gully BI	Sed. Rate BJ	Net Gully BK	tons per struc. BM	cost per struc. BN	Total Cost BO	Streambank Erosi Linear feet treated BQ	Gross & Net Erosion BR	Streambank Costs Cost per lin. ft. BT	Cost to treat 50% BU	Total Cost BW	Results: Gross Soil Loss BY	Net Sediment Delivere BZ	50 year Sed. Total CA	Cost per Ton CC	Perce Sedim Reduc CD
3	56	95.0%	53	28	$3,200	$6,400	327	29	$10	$3,274	$9,673.60	2,655	1,754	87,693	$2.34	4.5%
4	228	85.0%	193	28	$3,200	$26,000	708	64	$10	$7,085	$33,084.80	12,280	7,053	352,634	$2.57	3.5%
5	89	95.0%	85	28	$3,200	$10,171	353	32	$10	$3,528	$13,699.43	4,515	2,995	149,769	$2.36	3.7%
6	338	85.0%	287	28	$3,200	$38,571	668	60	$10	$6,682	$45,253.03	21,264	12,279	613,950	$2.61	2.7%
8	20	95.0%	19	28	$3,200	$2,269	0	0	$10	$0	$2,268.57	1,166	781	39,041	$2.41	2.4%
9	22	95.0%	21	28	$3,200	$2,514	0	0	$10	$0	$2,514.29	1,397	941	47,025	$2.41	2.2%
10	32	95.0%	30	28	$3,200	$3,669	12	1	$10	$120	$3,788.57	1,850	1,237	61,837	$2.40	2.5%
11	14	95.0%	13	28	$3,200	$1,606	127	11	$10	$1,267	$2,872.91	641	423	21,144	$2.32	5.5%
12	10	95.0%	9	28	$3,200	$1,120	24	2	$10	$240	$1,360.00	464	306	15,278	$2.37	3.6%
13	3	95.0%	3	28	$3,200	$391	0	0	$10	$0	$391.43	140	91	4,547	$2.41	3.5%
14	3	95.0%	2	28	$3,200	$297	0	0	$10	$0	$297.14	107	69	3,452	$2.41	3.5%
Tot	814	93.2%	717	28	$3,200	$93,009	2,220	200	$10	$22,195	$115,204	46,480	27,927	1,396,369	$2.51	3.2%

Figure O-7

BATC

Optiption 4: Combination Approach, 60% cropland planned, 50% structural control of erosion.

WS # A	From Opt. 1 Cost Per Acre CG	% Acres EBA CH	Crop Not Plan Gross CI	Crop 60% Gross Loss CJ	Gross Sheet Rill CK	Net sheet/ Rill CL	Gross ephem CM	Net Ephem CN	S&R Ephem Total Cost CO	Stream-bank & gully Costs CQ	Total Cost CS	Gross Soil Loss CT	Net Soil Loss CU	50 year net CW	Cost Per Ton CX	Percent change CY
3	$85.00	60%	211	132	2,055	1,315	215	154	$42,534.00	$9,673.60	$52,207.60	2,355	1,552	77,622	$3.68	15%
4	$85.00	60%	1,843	1,152	7,496	4,123	1,872	1,161	$119,646.00	$33,084.80	$152,730.80	9,659	5,541	277,034	$1.73	24%
5	$85.00	60%	533	333	3,096	1,981	541	390	$54,060.00	$13,699.43	$67,759.43	3,758	2,487	124,361	$2.17	20%
6	$85.00	60%	4,166	2,604	10,710	5,891	4,232	2,624	$122,604.00	$45,253.03	$167,857.03	15,340	8,861	443,063	$0.89	30%
8	$85.00	60%	226	141	597	382	229	165	$7,854.00	$2,268.57	$10,122.57	846	566	28,283	$0.87	29%
9	$85.00	60%	317	198	603	386	322	232	$5,610.00	$2,514.29	$8,124.29	847	638	31,918	$0.50	34%
10	$85.00	60%	341	213	986	631	346	249	$14,331.00	$3,788.57	$18,119.57	1,365	812	45,585	$1.02	28%
11	$85.00	60%	34	21	534	342	34	25	$10,914.00	$2,872.91	$13,786.91	593	391	19,541	$4.85	13%
12	$85.00	60%	38	24	358	229	39	28	$6,171.00	$1,360.00	$7,531.00	409	269	13,446	$3.13	15%
13	$85.00	60%	0	0	137	88	0	0	$3,213.00	$391.43	$3,604.43	140	91	4,547	$22.16	3%
14	$85.00	60%	0	0	104	67	0	0	$2,244.00	$297.14	$2,541.14	107	69	3,452	$20.58	3%
Tot	$85.00	60%	7,709	4,818	26,676	15,434	7,829	5,027	$389,181.00	$115,203.77	$504,384.77	35,519	21,377	1,068,851	$1.35	26%

Conservation practices blanket and protect the land.

Challenges Ahead

Illinois farmers are applying conservation and environmental practices to their land at record rates.

They are protecting water resources by scouting fields for pests, establishing buffer zones of vegetation along streams and creeks and storing animal manure until conditions are right for field application.

They are saving soil by leaving more residues on crop fields, building terraces, and farming on the contour.

Farmers have accepted the challenge of protecting our natural resources and continue to educate themselves about new technologies and techniques as they are developed.

Consider this book as another tool to help you meet the conservation and environmental challenges ahead. Select practices which will help you balance the needs of the environment with your own economic needs and the needs of the hundreds of people you help feed every year.

Use the human resources available to you as well. Technical staff from several federal and state agencies as well as agribusiness specialists and private crop consultants, will help you protect your land and water.

Printed on recycled paper using soy based inks

 September 1993

U.S. GOVERNMENT PRINTING OFFICE 1993 546-416

Conservation Choices

Your guide to 30 conservation and environmental farming practices

U.S. Department of Agriculture
Soil Conservation Service
Champaign, Illinois

Encl O-2

About this guide

This guide features 30 different conservation and environmental farming practices. It explains how each practice works and how it helps improve a farm, lists items to think about when considering each practice, gives some information on SCS technical standards, and talks about maintenance needs.

Each practice will work most effectively in combination with others as part of a total resource management system.

Five symbols are used throughout the book to show the benefits of each practice featured in the guide. Explanations of the symbols are listed below.

Benefit symbols

This practice helps reduce soil erosion and sediment runoff, or may add organic matter to the soil.

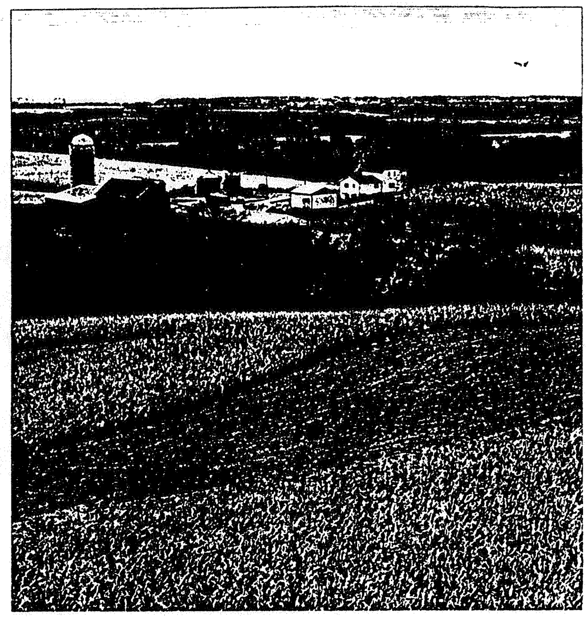
Help protect or improve water quality with this practice.

Use this practice to increase profits by reducing costs, increasing production or both.

You're thinking of wildlife by providing habitat or food sources with this practice.

This practice helps improve air quality by reducing odor and other problems.

To provide more information about planning for and protecting all the farm's resources, the Soil Conservation Service has produced this book. Cooperators in this and other education materials include: National Pork Producers Council; Region 7, Environmental Protection Agency through a grant to the Iowa Department of Natural Resources; Iowa Association of Soil and Water Conservation District Commissioners; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship.



About total resource management

The key to a successful total resource management system is careful, complete planning.

Like the pieces of a jigsaw puzzle, each practice fits together with others to complete a picture. But anybody who has spent a rainy Sunday afternoon piecing together a jigsaw puzzle knows it takes patience, organization and teamwork.

When designing a total resource management plan you need to consider all the resources on your farm. Take an inventory; think about every field, pasture, pond, stream, and wooded area. Then consider which soil conservation, water quality, wildlife habitat and energy conservation practices would contribute to an environmentally and economically sound farm.

Some of the most profitable practices, like pest or nutrient management take little or no financial investment and may have the highest impact on water quality.

For example, scouting crops, selecting pest control alternatives and targeting control in problem areas can cut expenses and improve water quality.

The planning process may seem overwhelming, but that is where teamwork can help.

There are federal, state and local agencies available to help you plan, implement and maintain your total resource management system. You might also consider using a private crop consultant.

Make use of the technical experts to choose sound environmental, conservation and profitable practices for your farm.

Total resource management checklist: some basic questions

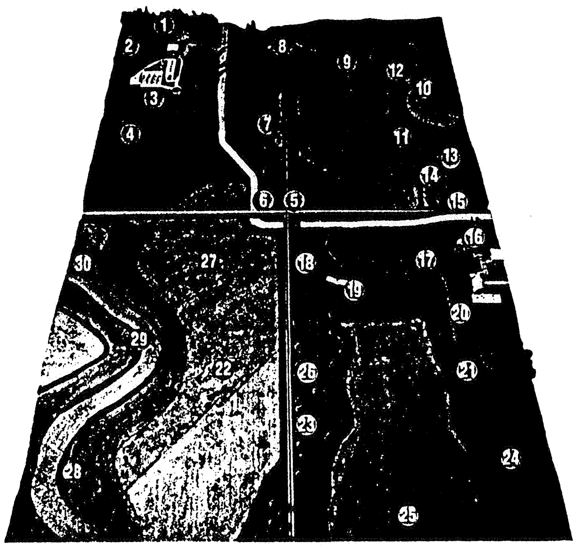
- ✓ What are the natural resources on my farm?
- ✓ What are the crops to be grown?
- ✓ Have I minimized runoff?
- ✓ Am I using crop rotations to reduce disease and pest problems?
- ✓ What type of wildlife would I like on my farm?
- ✓ Does any practice interfere with or cancel out another practice?
- ✓ Can I use wetlands or filter strips to filter nutrients from runoff water?
- ✓ Am I making the best use of animal manure as nutrients for plants?

0-14

Conservation Choices

The practices numbered below contribute to a well-rounded conservation and environmental farm. This photo shows many of the options available.

Use this booklet to identify the practices you might add to your farm. Then review each practice to see whether it could work with other practices to better protect your soil and water.



30 conservation and environmental choices

1. Woodland management
2. Planned grazing system
3. Manure storage
4. Farm pond
5. Wildlife upland habitat
6. Wildlife food plot
7. Filter strip
8. Grade control structure
9. Critical area planting
10. Contour stripcropping
11. Diversion
12. Grassed waterway
13. Contour buffer strip
14. Contour farming
15. Field border
16. Well protection
17. Windbreak
18. Pasture planting
19. Stream protection
20. Manure testing
21. Tree planting
22. Crop residue management
23. Wetland enhancement
24. Crop rotation
25. Nutrient management
26. Wetland
27. Pest management
28. Water and sediment control basin
29. Terrace
30. Cover crop

1 Woodland management...improving the quality and quantity of woodland growing stock and maintaining ground cover and litter for soil and water conservation.

How it works

Existing woodland or other suitable land is dedicated to timber production. Livestock is excluded. Optimum tree populations are determined by the kinds of trees planted and their adaptability to your soils. Existing trees or newly planted trees are thinned, pruned and harvested to maintain desired production. Twigs, limbs and other debris are not removed, maintaining ground cover, reducing soil erosion and providing wildlife habitat. As trees mature they are harvested, and replacements are established.

How it helps

- Adds income to your farm.
- Adds beauty to your farm.
- Ground cover provides wildlife habitat, reduces soil erosion and improves water quality.

Planning ahead

- Do you need this land for livestock or crops?
- Are the trees you harvest going to be a marketable product?
- Can the soil support the type of trees and product you want?

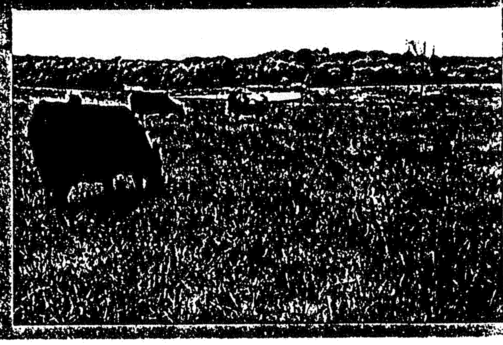
Tech notes

- Plant trees that are suitable to your soils.
- Protect from grazing.
- Cut undesirable trees and shrubs that are competing with desired species for sunlight and moisture.
- Thin hardwood stands to a 12-foot spacing before trees are 5 inches in diameter at a 4 to 5 foot height.
- Thin conifer stands to a 10-foot spacing before trees are 5 inches in diameter at a 4 to 5 foot height.
- Do not cut vines unless they are interfering with trees with a high commercial value. Vines provide valuable cover for wildlife.

Maintenance

- Control weeds, brush and competing plants by mowing, spraying or cutting.
- Mow vegetative growth around new plantings until they are 3 to 4 feet high.
- Periodically check for rodent, insect or disease damage.

2 Planned grazing system...planting forage and using grazing rotations to maximize production and reduce sediment and nutrient runoff. Consider food, water and herd size.



How it works

Pasture is divided into two or more pastures or paddocks with fencing. Cattle are moved from paddock to paddock on a pre-arranged schedule based on forage availability and livestock nutrition needs.

How it helps

- Improves vegetative cover, reducing erosion and improving water quality.
- Increases harvest efficiency and helps ensure adequate forage throughout the grazing season.
- Increases forage quality and production which helps increase feed efficiency and can improve profits.
- Rotating also evenly distributes manure nutrient resources.

Planning ahead

- Is there enough water of good quality available in all pastures to meet the needs of your livestock?
- Is the mix of grass and legumes adequate for your herd and soil types?
- Will your pasture meet the nutrient needs of your cattle?
- Have you considered management alternatives for periods of low forage production?

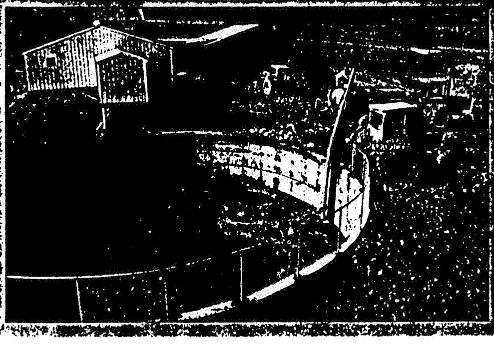
Tech notes

- Plan your rotation so the same paddocks will not be grazed the same time year after year.
- Plan rest periods so each pasture (paddock) will have adequate time to recover during the growing season to promote plant growth.
- All livestock must be removed from pastures while they are being rested.

Maintenance

- Keep fencing secure.
- Some paddocks may need to be mowed or hayed during heavy growth periods.
- Remove pasture water systems during winter if necessary, and reinstall them in the spring.
- If herd size changes dramatically, update rotation schedule, paddock numbers and paddock size.
- Apply fertilizer and nutrients according to soil tests.

3 Manure storage...structure that protects water bodies from manure runoff by storing manure until conditions are appropriate for field application.



How it works

The type of manure storage structure you would use depends upon your livestock operation, animal waste management system and planned field application. Several options exist including an earthen storage pond, above or below ground tank, pit underneath a confinement facility or a sheltered concrete slab area. Manure can be pumped, scraped and hauled, pushed or flushed into your storage structure. The structure's purpose is to safely contain the manure and keep nutrient loss and pollution of downstream water bodies to a minimum by preventing runoff.

How it helps

- Protects water quality, by preventing runoff from feedlots.
- Cuts fertilizer costs and reduces nutrient losses.
- Allows for field application when conditions are right.

Planning ahead

- Is the structure planned for the proper location considering the landscape, potential odor problems, visibility, aesthetic value and compatibility with existing farm buildings?
- Will the structure store manure in a form you have the equipment to handle?
- Are there buffer zones of vegetation around the structure to filter any runoff and to improve appearance?
- Is the structure the right size to handle the amount of manure produced by your livestock during the planned storage period?

Tech notes

- Storage period should be determined by manure use schedule. Plan to empty at least twice a year.
- If manure is stored as a solid, it should be protected from precipitation.
- Runoff from land surrounding livestock facilities should be diverted from storage structures.
- Structures should be fenced for livestock and human safety.
- Ramps built for handling equipment should meet safety standards.

Maintenance

- Watch for any leaks or seepage and make repairs.
- Repair any damaged fences immediately.

4 Farm pond...a pool of water formed by a dam or pit, to supply water for livestock, recreation and wildlife, and to control gully erosion.

How it works

A typical farm pond is formed by building a dam across an existing gully or low lying area. Earth for the dam is dug out above the dam with heavy machinery to form a bowl. Generally the ponded area fills with water within a year. An overflow pipe is installed through the dam to control the water level and allow water to spill through the dam without causing erosion.

How it helps

- Prevents soil erosion and protects water quality by collecting and storing runoff water.
- Provides water for livestock, fish and wildlife, and recreational opportunities.
- Adds value and beauty to a farm or farmstead.
- Provides a water supply for emergencies.

Planning ahead

- Are adequate soil conservation measures installed near the proposed pond site to protect it from filling with sediment?
- Is there a dependable source of clean water to fill the pond?
- Will the pond store enough water for proposed uses—i.e. livestock, wildlife and recreation?
- Is the soil at the proposed site capable of holding water?

Tech notes

- Provide for a natural or constructed spillway.
- If the dam is for a fish pond, the pool should have at least $^1/_2$ acre of surface area and be at least 8 feet deep.
- The landowner should secure necessary permits or easements.
- Divert runoff from feedlots, barnyards and septic tanks if the pond is used for drinking water, livestock, wildlife or recreation.
- Clear all trees and shrubs within at least 30 feet of the dam's spillway and embankment.
- Generally for every surface acre of pond there should be at least 10 acres of drainage area.

Maintenance

- Keep outlet free of debris.
- Keep burrowing animals, trees and shrubs off the dam.
- Maintain grass cover on the dam.

5 Wildlife upland habitat...creating, maintaining or improving food and cover for upland wildlife.

How it works

Planting trees, shrubs and other vegetation that provide cover and food will attract wildlife to an area. The type of habitat provided will determine the kind and numbers of wildlife attracted.

How it helps

- Ground cover helps reduce soil erosion, adds organic matter to the soil, filters runoff and increases infiltration.
- It can add value to your farmstead.
- Planned wildlife habitat provides food and cover for wildlife.

Planning ahead

- Will your planned habitat attract the type of wildlife you want?
- Is a particular piece of land better suited for upland habitat than for livestock or crops?
- Do you plan to allow hunting?
- Are there any endangered or threatened species in your area you could help protect?
- How close do you want the habitat area to your farmstead?

Tech notes

- Plant the wildlife area with a vegetative cover of grass, trees or shrubs.
- Exclude livestock.
- To attract a specific wildlife species, choose cover and habitat for that species.
- Create a diverse habitat to attract a wider variety of wildlife.
- Consult with an SCS biologist or local DNR officer for the recommended wildlife populations for the upland habitat area planned for your farm.
- Include a food plot if possible.
- Encourage shrub growth between woodlands and grasslands.
- Include bird houses and feeding stations in habitat areas.
- Plant fruit and nut bearing trees or shrubs to the windward side of a woodland habitat area.

Maintenance

- Prescribed burning may be necessary to regenerate growth and eliminate undesirable species.
- Use weed management to maintain desirable plant and animal species.
- Replant vegetation and trees if habitat area is damaged by disease or poor weather.

6 Wildlife food plot...establishing a variety of plants that furnish food for wildlife.

How it works

Food plots may be established either within an existing crop field or in a separate location. You may simply leave four rows of corn standing after harvest to provide food for wildlife over the winter. Or you may plant a small plot elsewhere. These plots help wildlife through the winter when food supplies are in short supply.

How it helps

- Standing crops with unharvested grain give food to wildlife that may otherwise not be accessible after heavy snows or ice.
- A food plot helps maintain wildlife on your farm by providing food.

Planning ahead

- Will the crop you plan to plant or leave standing in the field attract the wildlife you want?
- Is there adequate cover and water near the food plot to support wildlife?
- Are you endangering wildlife by placing the food plot too close to high traffic areas?

Tech notes

- Planting dates range from March 1 to June 15 depending on the crop.
- Food plots should be planted on the least erosive areas of the selected field.
- Fall seedbed preparation is not allowed.
- Plots on slopes steeper than 5% must be planted on the contour.
- A plot can be planted on the same area each year as long as soil loss does not exceed acceptable limits.
- Accepted crops include: corn, sorghum, oats, barley, wheat, sunflower, buckwheat, millet, partridge pea and soybeans.
- Soybeans and sunflowers can not be used in Conservation Reserve Program food plots.
- Reduced till or no-till planting is encouraged.

Maintenance

- Exclude livestock.
- Don't control weeds with herbicides unless noxious weeds persist. If herbicides are needed, spot spray. Avoid using herbicides that would endanger adjacent seedings.

7 Filter strip...a strip of grass, trees or shrubs that filters runoff and removes contaminants before they reach water bodies or water sources such as wells.

How it works

Strips of grass, trees and/or shrubs slow water flow and cause contaminants like sediment, chemicals and nutrients to collect in vegetation. Collected nutrients and chemicals are used by the vegetation, rather than entering water supplies. Filtered water then enters water bodies.

How it helps

- Grass, trees and shrubs provide cover for small birds and animals.
- Ground cover reduces soil erosion.
- The vegetative strip moves rowcrop operations farther from a stream.
- Vegetation prevents contaminants from entering water bodies, protecting water quality.

Planning ahead

- Are adequate soil conservation measures installed above filter strips?
- Are plants adapted to your soil types?
- Have you selected the correct species of vegetation for the control you need? For example, are you establishing the filter strip around a sinkhole, to control runoff from a feedlot or to filter runoff from cropland?

Tech notes

- Filter strips are most effective on slopes of 5% or less.
- Filter strips for cropland must be at least 15 feet wide. Steeper slopes require wider strips.

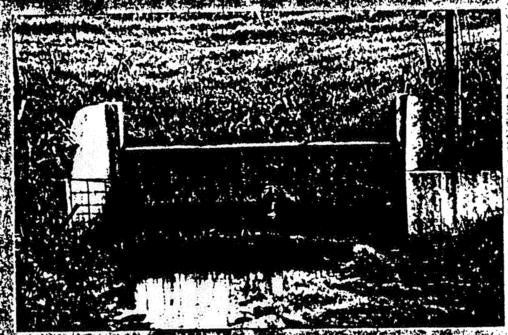
% Slope	Minimum width
0-10	15 feet
10-20	20 feet
20-30	25 feet

- A minimum 50 foot width is required for filter strips on forest land.
- Do not use a filter strip as a roadway.
- Filter strips will be less effective under snow or during frozen conditions.
- Avoid drift when applying herbicides on surrounding cropland.
- Controlled grazing may be allowed if filter strips are dry and firm.

Maintenance

- Repair rills and small channels that may have developed.
- Control grazing if livestock have access to filter strips.

8 Grade control structure...earthen, wooden, concrete or other structure built across a drainageway to prevent gully erosion.



How it works

A dam, embankment or other structure built across a grassed waterway or existing gully controls and reduces water flow. The structure drops water from one stabilized grade to another and prevents overfall gullies from advancing up a slope.

How it helps

- Grade control structures are often used at the outlet of a grassed waterway to stabilize the waterway outlet, preventing gully erosion.
- Grassed, non-eroding waterways made possible with a grade control structure give better water quality, can be crossed with equipment, and look better than non-stabilized gullies.
- If it is planned to store water, a grade control structure may provide a water source and habitat for wildlife.

Planning ahead

- Are adequate conservation practices installed above the structure to prevent sedimentation?
- Is the planned location in the proper place to achieve the level of control you want?

Tech notes

- Ask SCS for design and construction specifications.
- Obtain any necessary easements or permits.
- Remove all trees and shrubs within 30 feet of the structure.
- Clear debris approximately 50 feet downstream from the spillway outlet.

Maintenance

- Keep burrowing animals off of earthen structures.
- Repair any cracks in concrete.
- Keep outlets free of debris.

9 Critical area planting...planting grass or other vegetation to protect a badly eroding area from soil erosion.

How it works

Grass, legumes, trees or shrubs are established in small, isolated areas of excessive erosion. The vegetation provides surface cover to stop the raindrop splash and slow water flow.

How it helps

- It reduces soil erosion.
- A vegetated area improves water quality by reducing the amount of sediment, nutrients and chemicals running off farmland.
- Protects areas such as dams, terrace backslopes or gullied areas when vegetation may be difficult to establish.
- Vegetation can be planted to provide small areas of nesting cover for birds and small animals.

Planning ahead

- Will protection provided by the critical area planting be adequate?
- Are proper soil conservation practices installed above the planting area?
- Will you want to provide wildlife cover?
- Can the area be stabilized with other conservation methods?

Tech notes

- Protect the area from erosion with annual grasses until permanent cover is established.
- Apply lime and fertilizer, if needed, in the top three inches of the soil before planting.
- Use proper rates and recommended seeding dates.
- Severely eroded areas may need a nurse crop like oats. Seed oats at a rate of 1 to 1½ bushels per acre. Mow oats before they head out if possible. Mow high to avoid clipping the permanent seeding.
- Areas disturbed during construction or barren slopes 4:1 or steeper should be mulched to provide temporary protection before seeding.
- Mulches include grass, hay, grain straw and shredded cornstalks.

Maintenance

- Allow no grazing the year after planting and prevent overgrazing after permanent cover is established. Fence if needed.
- Permanently exclude livestock from extremely steep slopes.
- Native or warm season grasses can benefit from periodic burning, which stimulates growth by reducing and removing competing plant growth.

10 Contour stripcropping...crop rotation and contouring combined in equal-width strips of corn or soybeans planted on the contour and alternated with strips of oats, grass or legumes.

How it works

Crops are arranged so that a strip of meadow or small grain is alternated with a strip of row crop. Not more than half a field can be planted to row crops. Meadow slows runoff, increases infiltration, traps sediment and provides surface cover. Ridges formed by contoured rows slow water flow which reduces erosion. Rotating the strips from corn to legumes allows nutrient-needy crops to benefit from the nitrogen added to the soil by legumes. This practice combines the beneficial effects of contouring and crop rotation.

How it helps

- Contour stripcropping reduces soil erosion and protects water quality.
- Contour stripcropping may help reduce fertilizer costs.

Planning ahead

- How many acres of row crops do you need?
- Does your crop rotation allow for alternating row crops with small grains and forages?
- Will herbicide carryover be a problem?

Tech notes

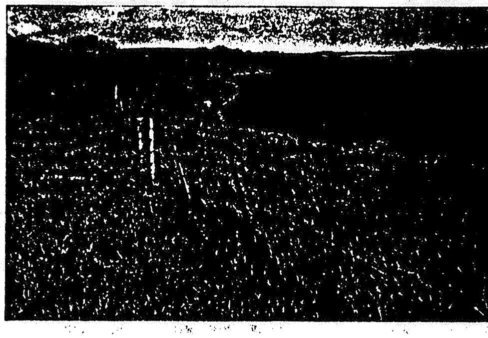
- Row crop strips need to be nearly the same width as small grains or meadow. A 10% variance is allowed.
- Plant grass or legume field borders instead of end rows and establish waterways as part of your stripcropping system.
- Key lines used for laying out strips should not exceed a 2% slope; except within 100 feet of an outlet, when the grade can be 3%.
- Strip widths may be adjusted downward to accommodate your equipment width for even rounds.
- Stripcropping is not as effective if crop strips become too wide, especially on steep slopes. Use the following table to plan maximum widths:

% Slope	Crop strip width
1 - 2	130 feet
3 - 8	100 feet
9 - 16	80 feet
17 - 20	60 feet
21 - 25	50 feet

Maintenance

- Keep strip widths consistent from year to year.
- If a meadow crop fails or is winter killed, SCS can help you make adjustments in your rotation schedule.

11 Diversion...earthen embankment similar to a terrace that directs runoff water from a specific area.



How it works

A diversion is much like a terrace, but its purpose is to direct or divert runoff water from an area. A diversion is often built at the base of a slope to divert runoff away from bottom lands. A diversion may also be used to divert runoff flows away from a feedlot, or to collect and direct water to a pond.

How it helps

- Reduces soil erosion on lowlands by catching runoff water and preventing it from reaching farmland below.
- Vegetation in the diversion channel filters runoff water, improving water quality.
- Vegetation provides cover for small birds and animals.
- Allows better crop growth on bottomland soils.

Planning ahead

- Are there proper soil conservation measures installed to prevent the diversion from filling with sediment?
- Is the outlet planned in a location which will not cause erosion?
- Is the diversion and outlet large enough to handle the runoff amount for that location?

Tech notes

- Diversions cannot substitute for terraces used for erosion control.
- Diversions must be built to carry at least the peak amount of runoff generated by a 10-year, 24-hour storm.
- Minimum top width for a diversion ridge is four feet.
- Each diversion must have an outlet. A grassed waterway, grade stabilization structure, or underground outlet is acceptable.
- Establish vegetative outlets before a diversion is constructed.
- Diversions should not be built in high sediment producing areas unless other conservation measures are installed too.

Maintenance

- Keep outlet clear of debris.
- Keep burrowing animals out of the diversion.
- Maintain vegetative cover on the diversion ridge.
- Install filter strips above the diversion channel to trap sediment and protect the diversion, if needed.
- Fertilize as needed.

12 Grassed waterway...shaping and establishing grass in a natural drainageway to prevent gullies from forming.

How it works

A natural drainageway is graded and shaped to form a smooth, bowl-shaped channel. This area is seeded to sod-forming grasses. Runoff water that flows down the drainageway flows across the grass rather than tearing away soil and forming a larger gully. An outlet is often installed at the base of the drainageway to stabilize the waterway and prevent a new gully from forming.

How it helps

- Grass cover protects the drainageway from gully erosion.
- Vegetation may act as a filter, absorbing some of the chemicals and nutrients in runoff water.
- Vegetation provides cover for small birds and animals.

Planning ahead

- Is major land reshaping needed?
- Is there a proper outlet for surface runoff at the bottom of the waterway?
- Are soil conservation measures installed to prevent siltation?
- Will tile drainage be necessary to establish vegetation in the waterway?

Tech notes

- A waterway should be deep enough and wide enough to carry the peak runoff from a 10-year frequency, 24-hour storm. Check SCS design charts.
- Plant seed at recommended time and rates. Place seed about $\frac{1}{4}$ to $\frac{1}{2}$ inch deep. Plant across the area or in a figure 8 pattern to reduce erosion.
- A nurse crop, temporary cover or mulching may be necessary until permanent cover is established.

Maintenance

- Lift implements out of the ground and shut off spray equipment when crossing.
- Don't use the waterway as a roadway.
- Fertilize as needed.
- Mow periodically, but wait until July 15 so young birds have a chance to leave the nest.
- Maintain the width of the grass area when tilling surrounding fields.
- Avoid planting end rows along the waterway. This prevents a new gully forming on the outside edges of the waterway.

13 Contour buffer strip...strips of grass or legumes in a contoured field, which help trap sediment and nutrients. Similar to stripcropping, but with narrower grass or legume strips.

How it works

A series of grass strips are placed across the slope on a contour. The alternating strips of grass or other permanent vegetation slow runoff flow, trap sediment from the crop strips above, and increase water infiltration. Because the buffer strip is established on the contour, runoff flows evenly across the entire surface of the grass strip, reducing sheet and rill erosion.

How it helps

- Vegetation provides cover and habitat for small birds and animals.
- The strips reduce erosion by slowing water flow and increasing water infiltration.
- By reducing siltation and filtering nutrients and chemicals from runoff, grass strips improve water quality.

Planning ahead

- Have you decided whether you want parallel crop strips or parallel buffer strips?
- Are other conservation measures such as crop residue management installed or planned to help reduce siltation of grass strips?
- Will planned acres in row crops meet your production objectives?

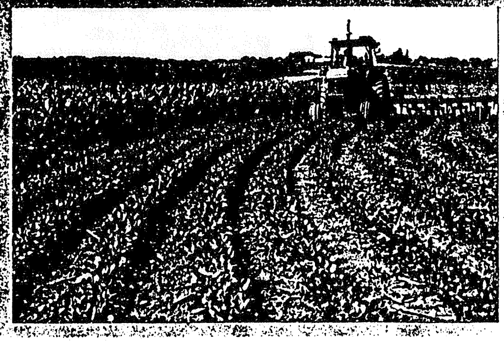
Tech notes

- Buffer strips must be at least 15 feet wide.
- Either crop strips or grass strips may be parallel. Parallel crop strips are easier to farm with no point rows, but that results in less of the slope in row crops.
- Grass buffer strips commonly make up 20% to 30% of the slope.

Maintenance

- Control weeds and brush in grass filter strips.
- Delay mowing until July 15 to help ground-nesting birds.
- Keep vegetation tall in spring and early summer to help slow runoff flow.
- Fertilize as needed.
- The buffer strip may be moved up or down the slope to help re-establish vegetation or for other maintenance needs.

14 Contour farming...farming with row patterns nearly level around the hill—not up and down hill.



How it works

Crop row ridges built by tilling and planting on the contour create hundreds of small dams. These ridges or dams slow water flow and increase infiltration which reduces erosion.

How it helps

- Contouring can reduce soil erosion by as much as 50% from up and down hill farming.
- By reducing sediment and runoff, and increasing water infiltration, contouring promotes better water quality.

Planning ahead

- Will more than one key contour line be needed because of steep or irregular slopes?
- Are terraces or stripcropping needed for steeper slopes?
- Are field borders needed to replace end rows in the contouring system to control sheet and rill erosion?

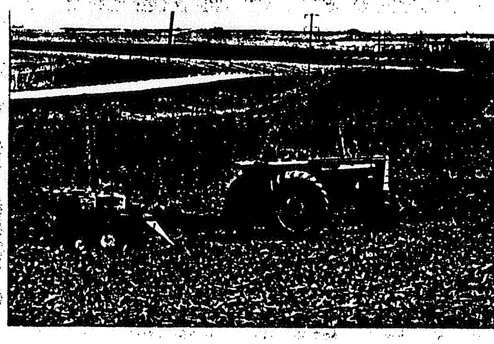
Tech notes

- Establish a key line around the hill by using a hand level or contour gauge.
- Contour key line grade should not exceed 2% except within 100 feet of an outlet. In that case, the grade can be a 3% slope.
- Perform all tillage and planting operations parallel to the key contour line.
- Contouring is less effective in preventing soil erosion on steeper or longer slopes.
- Replace end rows with field borders to reduce erosion.

Maintenance

- Use grassed waterways in areas where runoff is concentrated to prevent gully erosion.
- Contoured rows should enter the grassed area of waterways on the level, but should direct water into the grass.
- To avoid having to lay out new key contour lines every year, establish a narrow permanent strip of grass along each key contour line.

15 Field border...a strip of grass or legumes at the edge of a field used in place of end rows.



How it works

Strips of perennial vegetation are established at the outside edges of a field where excessive sheet and rill erosion is occurring. The grass or legume strips replace crop end rows, which would be planted up and down hill and be highly erosive. Field borders are sometimes referred to as picture frames of grass, and are used with contour farming, terrace, buffer strip and contour stripcropping systems.

The grass or legume in the strip protects steep field edges from soil erosion, and provides turning and travel lanes around the field.

How it helps

- Vegetative cover reduces sheet and rill erosion by slowing water flow.
- Vegetation filters runoff to improve water quality.
- Grass and legume strips may be harvested in some cases and are easier to turn on than end rows.
- Vegetation provides cover and habitat for small birds and animals.

Planning ahead

- Will the width be wide enough to turn your equipment?
- Can that land qualify for set aside?

Tech notes

- Borders must be at least 16 feet wide, or wide enough for your equipment.
- To qualify for ACR set aside, field borders need to be at least 33 feet wide.
- Borders need to be seeded or left in place when a meadow field is plowed.
- Seed with perennial grasses, legumes or a mixture of the two.
- Seed cool season grasses between March 1 and May 15 or during late summer seeding period, August 1 to September 15. Plant warm season grasses between April 1 and June 1.

Maintenance

- Delay mowing field borders until July 15 to allow time for young nesting birds to leave their nests.
- Reseed as necessary to maintain desired cover.
- Shut off farm chemical sprayers when turning on a field border, and insist custom chemical applicators do the same.
- Maintain nutrient levels. If vegetative cover declines, apply 30 lbs. nitrogen, 20 lbs. phosphate and 20 lbs. potash per acre.

16 Well protection...changing farming practices which occur on or near the farmstead in order to reduce the risk of contamination of water sources—mainly the well.

How it works

The way you handle materials that could contaminate a water supply, and the distance of possible contaminants from a well or other water source, can have a dramatic effect on the quality of drinking water on the farm. For instance if you typically mix pesticides near the well, your chances of drinking water contamination from pesticides escalates. To protect your well, take an inventory of farming practices like pesticide mixing and container washing and disposal. Then assess the risk of contamination and make necessary changes.

How it helps

- Modifications in farming operations may improve your efficiency and reduce operation or production costs.
- Soil conservation practices may be necessary to divert runoff from the well area.

Planning ahead

- Are necessary soil erosion practices in place?
- Have you taken an inventory of the operations you complete at or near the farmstead well?
- Have you properly closed and sealed all abandoned wells near the farmstead?
- Where is your well in relation to any feedlots and pesticide and herbicide spraying, storage and mixing?

Tech notes

- Mix farm chemicals and rinse containers a minimum of 100 feet from the well.
- Apply pesticides on days with minimal wind to prevent chemical drift into farmsteads.
- Use a device in the hose when filling a sprayer tank to be sure chemicals will not siphon back to the well.

Maintenance

- Keep an emergency chemical spill kit handy.
- Maintain any filter strips surrounding the farmstead or wellhead.
- Repair wellhead casing as needed.
- Repair any cracks in concrete pads used for chemical mixing, loading or container washing.

17 Windbreak...rows of trees and shrubs that protect areas from wind and provide food and cover for wildlife.

How it works

Multiple rows of coniferous trees or a combination of coniferous and deciduous trees are planted to protect a farmstead or feedlot from wind and snow. One or two rows of shrubs are also often planted. The established windbreak slows wind on the downwind side of the windbreak for a distance of 10 times the height of the trees. The tree rows also act like a snow fence, trapping snow within the windbreak. Field windbreaks can also be planted to reduce wind speed in open fields.

How it helps

- A windbreak reduces wind erosion, conserves energy, reduces heating bills and beautifies a farmstead.
- Trees serve as a sound barrier and muffle road noise.
- Trees and shrubs provide food and cover for wildlife.
- Improved livestock weight gains can be expected when livestock are protected from winter winds and snow.

Planning ahead

- Have you planned enough space for summer air circulation, travel lanes or gardens?
- Will the mature windbreak cast a shadow over the driveway or nearby road, prolonging icy conditions?
- Will trees in the windbreak attract the desired wildlife species?
- Will the position of the mature windbreak cause a visibility hazard for drivers or dump snow where it's not wanted?

Tech notes

- Preferred planting time is after winter thaw and before May 15.
- Plant on at least the north and west sides of the area to be protected; extend rows 50 feet beyond that area.
- Don't plant trees on the south or east side of a road. At mature height the trees will cast a shadow and prolong icy road conditions.
- Keep plantings 20 to 30 feet away from phone or utility lines.
- Plant trees according to spacing recommendations for the species.

Maintenance

- Control competing vegetation with tillage or herbicides before planting and for the first three years after planting.
- Fence livestock out.
- Inspect regularly to help control damage.

18 Pasture planting...planting grass and legumes to reduce soil erosion and improve production.

How it works

Drill or broadcast adapted grass or legumes into a low-producing pasture or a steep, eroding cropland field.

How it helps

- Heavy grass cover slows water flow, reducing soil erosion.
- Good pastures protect water quality by filtering runoff water and increasing infiltration.
- Lush pastures give cover and habitat for wildlife.
- As plants recycle and roots die, organic matter in the soil is improved.

Planning ahead

- Are selected species suited to your soil types?
- Have you chosen species that will help you reduce the use of pesticides and herbicides?
- Have you chosen species that will meet the needs of your livestock?

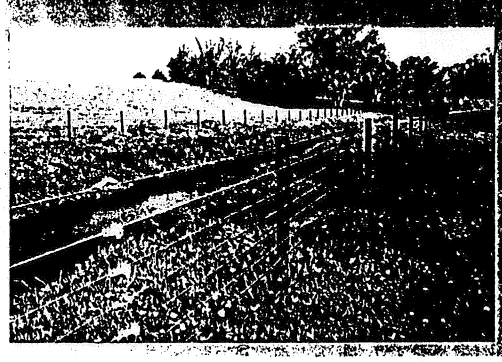
Tech notes

- Do not mix warm and cool season grasses in the same pasture.
- Selected grass and legumes should be compatible with the planned management.
- When only two grass species are selected, they should make up equal proportions of the seeding mixture.
- Add legumes to improve forage quality and extend the grazing season.
- Drill seed uniformly to a depth of $^1/_4$ to $^1/_2$ inch.
- Leave residues and till on the contour.
- If erosion is a problem, leave at least 30% residue cover after planting.
- Plant a nurse crop on steeper slopes or where weeds are a problem to get a good stand. SCS recommends seeding oats at 1 to $1^1/_2$ bu/acre as a nurse crop.
- Graze or closely chop pastures before reseeding. Apply a burndown herbicide.

Maintenance

- Wait until pasture is well established to graze.
- Mow weeds when they reach a height of 6-8 inches. Control persistent weeds with herbicides.
- Fertilize as needed.

19 Stream protection...protecting a stream by excluding livestock and by establishing buffer zones of vegetation to filter runoff.



How it works

Grass, riprap and gabions are installed along the edges of a stream to buffer the banks from heavy stream flow and reduce erosion. Fencing prevents cattle from trampling banks, destroying vegetation and stirring up sediment in the streambed. A buffer zone of vegetation along the streambank filters runoff and may also absorb excess nutrients and chemicals.

How it helps

- Streambanks are covered with rocks, grass, trees or other cover to reduce erosion.
- Better water quality results from reducing amounts of nutrients, chemicals, animal waste and sediment entering the stream.
- Buffer zones provide cover and habitat for birds and small animals.

Planning ahead

- Have you planned to install an off-stream water system for livestock or limited livestock access to the stream?
- Are proper soil conservation measures installed in the stream watershed to prevent siltation of buffer zones and streambed?
- Will a stream crossing be needed for livestock?

Tech notes

- Fence livestock out of the stream.
- Smooth streambanks to provide an adequate seedbed for vegetation.
- The vegetation area along streambanks should be between 15 and 25 feet wide.
- Remove fallen trees, stumps and debris that might cause turbulence in the stream.
- Remove trees and brush that adversely affect the growth of desirable bank vegetation.

Maintenance

- Keep fences repaired.
- Avoid damaging buffer zones with herbicides from surrounding cropland.
- Remove off-stream watering systems in the winter if necessary, and reinstall in the spring.

20 Manure testing...sampling and testing manure to determine nutrient content. This promotes proper nutrient application to fields.

How it works

Taking a representative sample from stored manure and sending it to an approved lab for analysis to determine nutrient content is the first step in a manure management system. This data is used to match application rates to plant nutrient needs and soil test data.

How it helps

- Manure testing and proper application to the land can reduce crop input costs.
- Preventing over-application of manure to crop fields results in improved water quality.

Planning ahead

- What form of manure do you plan to apply?
- Have you calibrated your spreader to apply the volume of manure called for according to plant needs and nutrient value of manure?
- Have you reduced commercial fertilizer use after accounting for nutrients supplied by manure?
- Will you hire someone or take manure samples yourself?
- Do you plan to take soil samples to help determine how manure can be used most effectively?
- Have you allowed sufficient time for the laboratory to process your manure sample and return the results to you?

Tech notes

- Take a representative sample from your storage structure.
- Apply manure as soon as possible after receiving analysis data.

Maintenance

- Retest manure storage every time storage structure is emptied or after making major changes in livestock feeding or bedding methods.

21 Tree planting...establishing trees in areas adapted to woodlands.

How it works

A variety of desired tree species, either seedlings or seeds, are planted mechanically or by hand in under-stocked woodlands or open fields. Tree species are matched with soil types and selected to prevent soil erosion, increase income, or boost productivity of existing woodland.

How it helps

- Improving stands of woodlands can increase profits.
- Ground cover created by trees and associated debris protects soil from rill and sheet erosion.
- Ground cover also protects water quality by filtering excess nutrients and chemicals from surface runoff and increasing infiltration rates.
- Healthy, well-managed woodlands provide long-term wildlife habitat.

Planning ahead

- Is the soil suitable for producing wood crops?
- Is the soil suitable for the tree species you have selected?
- Is there a market for the species you want to plant?
- Do you need this land for crops or livestock?

Tech notes

- Remove brush and till the strips of pasture or sod where trees will be planted the fall before planting.
- Complete spring planting by May 15. Fall planting should begin between September 1-15.
- Standard forest planting spacings are 6' x 6', at a rate of 1,210 trees per acre; 6' x 7', 1,037 trees per acre; 6' x 8', 908 trees per acre.
- Tree seedlings should be planted within seven days of their arrival.
- Keep roots moist during planting.
- Place the root crown at ground surface or one inch below.
- Remove all air pockets when planting seedlings.
- The hole prepared for the seedling should have enough room for the roots to spread completely out.

Maintenance

- Mow vegetative growth around trees until the trees are 3 to 4 feet high.
- Use herbicides to control competing vegetation.
- Check periodically for rodent, disease or insect damage.
- Replant, if necessary, to achieve a desired stand.

22 Crop residue management...leaving last year's crop residue on the soil surface by limiting tillage. Includes no-till, mulch till and ridge till.

How it works

Leaving last year's crop residue on the surface before and during planting operations provides cover for the soil at a critical time of the year. The residue is left on the surface by reducing tillage operations and turning the soil less. Pieces of crop residue shield soil particles from rain and wind until plants can produce a protective canopy.

How it helps

- Ground cover prevents soil erosion and protects water quality.
- Residue improves soil tilth and adds organic matter to the soil as it decomposes.
- Fewer trips and less tillage reduces soil compaction.
- Time, energy and labor savings are possible with fewer tillage trips.

Planning ahead

- Will your crop produce enough residue?
- Is crop residue management part of a planned system of conservation measures?
- Do you have the needed equipment?

Tech notes

- Planning for residue cover begins at harvest. Ensure ample residues are spread evenly over the field by the combine.
- Reduce the number of unnecessary tillage passes. Every tillage pass buries more crop residue.
- Use straight points and sweeps on chisel plows instead of twisted points. Twisted points can bury 20% more residue.
- Set tillage tools to work at shallower levels.

Measuring crop residues

You can estimate residue levels by using a line that has 50 or 100 equally divided marks. Stretch the line diagonally across crop rows. Count the number of marks that have residue under the leading edge when looking from directly above the mark. Walk the entire length of the rope. The total number of marks with residue under them is the percent residue cover. If the line has only 50 marks, multiply your count by two. Repeat this three to five times in a representative area of the field.

D-24

23 Wetland enhancement...installing practices such as dikes in existing wetlands to manage water levels and improve habitat.

How it works

Most wetland enhancement work includes small structures built to add water or regulate water levels in an existing wetland. Subsurface and surface drains and tiles are plugged. Concrete and earthen structures—usually dikes or embankments— are built to trap water. These practices maintain a predetermined water level in an existing wetland. Adjustable outlets allow the landowner to fluctuate the water level during different seasons. Enhancement also includes planting native wetland vegetation if plant populations need to be supplemented.

How it helps

- Wetlands filter nutrients, chemicals and sediment before water infiltrates into ground water supplies.
- Wetlands provide habitat for waterfowl and many other species of wildlife.
- Wetlands add beauty and value to a farm.

Planning ahead

- Will soil hold water?
- Is there an adequate water supply?
- Is there adequate upland wildlife habitat available?
- What wildlife do you want to attract?
- Will plugging drains or breaking tile lines to enhance the wetland have adverse effects on other parts of your farm, or a neighboring farm?

Tech notes

- Remove trees and brush from embankments and the vegetative spillway area.
- Protective vegetative cover should be established on exposed surfaces of embankments and spillways.
- Obtain any necessary permits.
- Keep livestock from the area, unless it is included in a planned grazing management plan.
- Dikes and levees should meet SCS or US Army Corps of Engineers standards.

Maintenance

- You may need to replant some wetland vegetation until a good stand is established.
- Keep burrowing animals out of earthen structures. Control beavers and muskrats.
- Keep intakes clean and outlet free of debris.
- Inspect pipe structures and repair any damages.

24 Crop rotation...changing the crops grown in a field, usually year by year.

How it works

Crops are changed year by year in a planned sequence. Crop rotation is a common practice on sloping soils because of its potential for soil saving. Rotation also reduces fertilizer needs, because alfalfa and other legumes replace some of the nitrogen corn and other grain crops remove.

How it helps

- Pesticide costs may be reduced by naturally breaking the cycles of weeds, insects and diseases.
- Grass and legumes in a rotation protect water quality by preventing excess nutrients or chemicals from entering water supplies.
- Meadow or small grains cut soil erosion dramatically.
- Crop rotations add diversity to an operation.

Planning ahead

- Will rotations meet crop base needs for set aside?
- Do you have use for other crops?

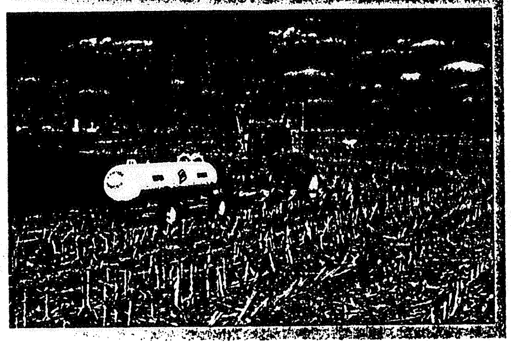
Tech notes

- Crops must be suited to your soils.
- Design crop rotations to meet the residue needs of your crop residue management plans.
- Rotations that include small grains or meadow provide better erosion control.
- Small grains and meadow can always be used to replace any row crop or low residue crop to gain better erosion control.
- Corn (grains) can always be used to replace soybeans or any other low residue crop in the rotation to gain better erosion control.
- For crop rotations which include hay (meadow) the rotation can be lengthened by maintaining the existing hay stand for additional years.

Maintenance

- Switch crops to maintain perennials in the rotation, if necessary.
- Consider herbicide carry over to avoid crop failures.

25 Nutrient management...applying the correct amount and form of plant nutrients for optimum yield and minimum impact on water quality.



How it works

After taking a soil test, setting realistic yield goals, and taking credit for contributions from previous years' crops and manure applications, crop nutrient needs are determined. Nutrients are then applied at the proper time by the proper application method. Nutrient sources include animal manure, sludge, and commercial fertilizers. These steps reduce the potential for nutrients to go unused and wash or infiltrate into water supplies.

How it helps

- Sound nutrient management reduces input costs and protects water quality, by preventing over-application of commercial fertilizers and animal manure.
- Correct manure and sludge application on all fields can improve soil tilth and organic matter.

Planning ahead

- Have you tested your soil and livestock manure for their nutrient levels?
- Are organic wastes or sludge available for you to use?
- Have you determined realistic yield goals?
- Are proper soil conservation measures installed?
- Have you accounted for nitrogen credits produced by legume crops?

Tech notes

- Choose best application method. Use broadcast, starter, surface band or injection.
- Use the late spring nitrogen test when appropriate when corn plants are between 6 to 12 inches tall.
- Refrain from applying commercial nitrogen in the fall except if N is associated with P application.
- Avoid applying manure on frozen or snow-covered ground if possible.

Maintenance

- Test soils once every three years according to Extension recommendations.
- Analyze manure and other organic waste for nutrient content before field application.
- Establish a winter cover crop if there's a possibility of nitrogen leaching because of poor crop yield.

26 Wetland...marsh-type area with saturated soils and water-loving plants. Wetlands provide wildlife habitat and serve as natural filters for agricultural runoff.

How it works

Natural wetlands— swamps, bogs, sloughs, potholes and marshes— occur in every state in the Nation and vary widely in size, shape and type. Sloughs, potholes and marshes in low-lying areas are most common in Iowa. A wetland may have standing water year-round or may hold surface water for only part of the year.

How it helps

The many values of wetlands are only recently being fully understood and appreciated. Among the benefits of wetlands are:

- Wetlands can provide natural pollution control. They remove nutrients, pesticides and bacteria from surface waters and can act as efficient, low cost sewage and animal waste treatment practices.
- Wetlands filter and collect sediment from runoff water.
- Because wetlands slow overland flow and store runoff water, they reduce both soil erosion and flooding downstream.
- Many wetlands release water slowly into the ground which recharges groundwater supplies.
- All of America's ducks and geese depend on wetlands for breeding, nesting, and feeding habitat. More than 5,000 plant species, 190 species of amphibians, and one-third of all native bird species are supported by wetlands.
- The ecological diversity of wetlands can offer one of the most beautiful and aesthetically pleasing features of a farm.

Planning ahead

- Goose nests, wood duck boxes, and other protection for water fowl and habitat for adjoining uplands may be added to enhance the wildlife and recreational value of a wetland.

Maintenance

- Mostly it's best to leave wetlands alone. They can be enhanced, however, by adding plants or water to a relatively dry wetland.

27 Pest management...evaluating and using a tailored pest management system to reduce crop and environmental damages. Scouting is done to identify insects, weeds and diseases.

How it works

Crops are scouted to determine type of pests—insects, weeds and diseases—and the stage of development. The potential damage of the pest is then weighed against the cost of control. Finally, if pest control is economical, all alternatives are evaluated based on cost, results, and environmental impact. Precaution is taken to keep any chemicals from leaving the field by leaching, runoff or drift.

How it helps

- Scouting and spot treatment for only those pests that are threatening can save money.
- Using fewer chemicals improves water quality.
- Specific treatments for specific pests on specific areas of a field prevents over-treatment of pests.

Planning ahead

- Which soils on your farm are likely to leach pesticides?
- Did you establish filter strips along streams?
- Did you consider pest control alternatives?
- Did you use records of crops and pest control for reference?
- Did you rotate crops to reduce the chance of pest problems?

Tech notes

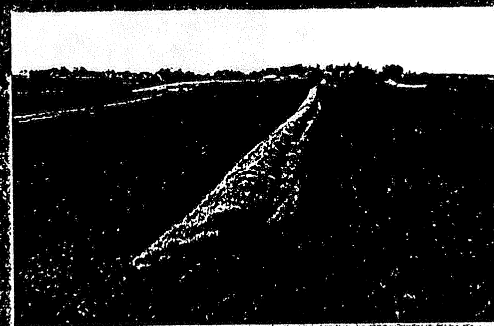
Following are guidelines to follow for applying and mixing pesticides:

- Complete a pesticide risk assessment of potential environmental damage from leaching or runoff. Consider this information when selecting a pesticide.
- Wear protective clothing when applying pesticides.
- Mix and load pesticides in an area that won't contaminate water supplies; and prevent back siphoning.
- Triple rinse containers before disposal. Burn paper bags.
- Apply pesticides during periods of minimal potential for drift or runoff.
- Use the lowest application rate practical and rotate pesticides.
- Use spot treatment or banding when possible in areas of concentrated pest populations.
- Use proper erosion control.

Maintenance

- Continue scouting to best identify pests and control methods.
- Keep records to track costs and chemical application.
- Calibrate spray equipment.

28 Water and sediment control basin...a short earthen dam built across a drainageway where a terrace is impractical; usually part of a terrace system.



How it works

An embankment is built across a depressional area of concentrated water runoff to act similar to a terrace. It traps sediment and water running off farmland above the structure, preventing it from reaching farmland below.

How it helps

- Basins improve water quality by trapping sediment on uplands and preventing it from reaching water bodies.
- Structures reduce gully erosion by controlling water flow within a drainage area.
- Grass cover may provide habitat for wildlife.

Planning ahead

- Will basins be part of an existing terrace system?
- Is the site too steep for the basin to work properly or be economically feasible?
- Can adequate outlets be provided?

Tech notes

- The uncontrolled area draining into the basin must not exceed 50 acres.
- Build the basin large enough to control the runoff from a 10-year storm without overtopping.
- Install a tile or infiltration outlet.
- Use fill material free of sod, roots, frozen materials and stones larger than 6 inches in diameter. It should also have correct moisture content for adequate compaction.
- Spacing for water and sediment control basins depends on the land slope, tillage and management system. Consult SCS for recommended spacing.

Maintenance

- Reseed and fertilize as needed to maintain vegetative cover.
- Check the basin after each large storm, and make any needed repairs.

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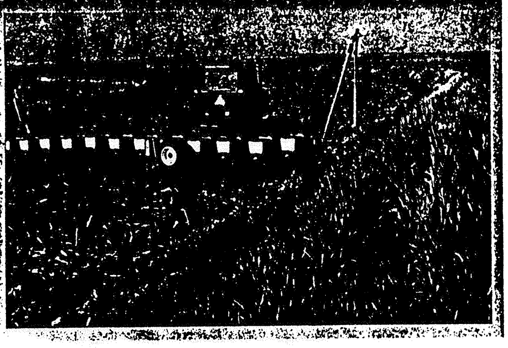
29 Terrace...an earthen embankment around a hillside that stops water flow and stores it or guides it safely off a field.



How it works

Terraces break long slopes into shorter ones. They usually follow the contour. As water makes its way down a hill, terraces serve as small dams to intercept water and guide it to an outlet.

There are two basic types of terraces—storage terraces and gradient terraces. Storage terraces collect water and store it until it can infiltrate into the ground or be released through a stable outlet.

Gradient terraces are designed as a channel to slow runoff water and carry it to a stable outlet like a grassed waterway.

How it helps

- Both water quality and soil quality are improved.
- Terraces with grass on front or backslopes can provide nesting habitat.

Planning ahead

- Will other conservation practices be used in conjunction with terraces to prevent sedimentation?

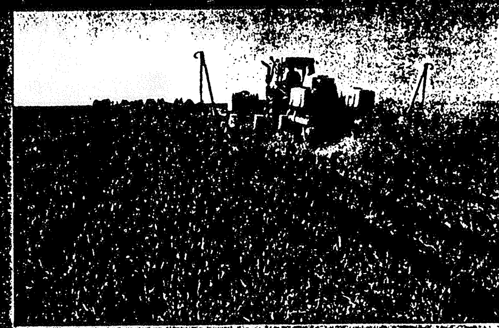
Tech notes

- Chisel the parts of the terrace that will be farmed to loosen compacted soil.
- Fertilize and seed according to SCS recommendations.
- Grassed backslope terraces have a farmable frontslope with a 2:1 backslope (2 foot horizontal to every 1 foot of vertical drop.)
- Narrow base terraces have 2:1 slopes on both the frontslope and backslope.
- Broadbase terraces should not be built on slopes greater than 8%. Farmable slopes should not be steeper than 5:1.
- Terraces are designed to control runoff from a 10-year storm.

Maintenance

- Avoid farming too close to intakes.
- Remove sediment build-up in the channel to maintain the required water-holding capacity.
- Repair sections of embankment which have eroded or have excessive settlement.
- Fill settled or eroded areas in the tile trench.
- Repair or replace damaged intakes.
- Remove sediment build-up and trash from around the intake.
- Control rodents or burrowing animals, weeds, brush and trees.
- Reseed and fertilize as needed to maintain good vegetation.

30 Cover crop...a close-growing crop that temporarily protects the soil when crop residues are not adequate.



How it works

Crops including cereal rye, oats and winter wheat are planted to temporarily protect the ground from wind and water erosion during times when cropland isn't adequately protected against soil erosion.

How it helps

- Cover crops keep ground covered, add organic matter to the soil, trap nutrients, improve soil tilth and reduce weed competition.

Planning ahead

- Do you have a seeding method that won't harm standing crops?
- Are adequate soil conservation measures installed?

Tech notes

- Cover crops are most often recommended when low residue producing crops such as soybeans or corn silage are grown on erodible land.
- Cover crops need 30-40 days of good growth before the first hard frost. Seeding after harvest will normally not allow cover crops to grow large enough to survive the winter.
- Seed from the end of August until mid-September.
- Cover crops may be air seeded prior to harvesting soybeans and other crops, or seeded conventionally after silage harvest.
- Many crops can be used for cover crops. Cereal rye is common.
- Kill cover crops in the spring. Mowing or herbicide application is acceptable. Tillage is not recommended because it will bury residue. Early kill is important to reduce the risk of depleting moisture needed for the grain crop.
- Follow the SCS recommended seeding rates for the cover crop you select:

Crop	lb./ac.
Oats	70
Cereal rye	90
Winter wheat	90
Alfalfa	12
Sweet clover	12
Red clover	10
Crownvetch	5
Sudan grass	25
Hairy vetch	30

- Legume cover crops add nitrogen to the soil, providing a low-cost fertilizer for grain crops.

Maintenance

- Cover crops are a short term practice and are not expected to last after initial establishment.
- Restrict grazing if necessary.

Wildlife Habitat Appraisal (WHAG) of
Batchtown Upland Watersheds

Background

A Wildlife Habitat Appraisal (WHAG) of the Batchtown project upland watersheds was conducted on 19 June 1995 for the purpose of evaluating the cost effectiveness and habitat benefits of an upland sediment control program. Upland wildlife benefits of this measure needed to be evaluated and have not been considered elsewhere in this report. The procedure is described in Appendix B, Subsection I, Item 1. HSI values for predominant broad habitat classifications were determined. Habitat types were cropland, grassland (pasture land) and upland hardwoods. Indicator species selected were bobwhite quail, fox squirrel and indigo bunting. Target years selected were year 0 (existing conditions), year 2 (early post-implementation) and year 50 of project life.

The draft Hillside Sediment Control proposal prepared by the Hardin County Natural Resource Conservation Service (Encl. O-1), utilizing the conservation and environmental farming practices identified in Encl. O-2, served as the basis for evaluation of the various habitats over the life of the project. Although the indicator species selected differ from those used in the Batchtown project WHAG, the cost per habitat unit generated can be used as a basis for comparison of the cost of project features, including upland and lowland sediment treatment measures. Also, although no attempt has been made to quantify these benefits, retention of sediment on the upland hillside is beneficial to the conservation of all natural resources.

The primary thrust of a hillside sediment control measure is just that, to control or retain sediment on the hillside. This measure encompasses a variety of practices that improve habitat conditions for wildlife, mainly by providing improved ground cover in all habitat types sampled. The WHAG team included representation from the USFWS, IDNR, NRCS and the Corps.

Assumptions

Certain assumptions were developed regarding existing and future conditions during the WHAG analysis. These assumptions are listed below.

1. The acreage of cropland in the watershed will decrease by approximately 10 percent over the next 50 years as marginal areas are removed from row crop or small grain production because they are not profitable to farm.

2. The acreage of grassland (pasture land) will decrease by approximately 10 percent over the next 50 years because some livestock operations will not be profitable and the land

Encl O-3

use will be changed.

3. The acreage of upland hardwoods will increase by approximately 20 percent over the next 50 years as cropland and pasture are converted or allowed to revert to forest.

4. There will be a continuation of the trend toward more conservation tillage and environmentally sound farming practices over the next 50 years because some of these practices are more economical than farming practices currently being used.

5. Landowner participation in the NCRS proposed upland treatment plan will be computed at 60 percent of the watershed acreage for the purpose of benefit analysis as projected in Encl
O-1.

6. There will be approximately a 26% reduction of hillside sediment resulting from the implementation of the NCRS proposed upland treatment plan.

<u>Results</u>

The WHAG analysis locations were selected by the WHAG team and were judged to be representative of the prevailing habitat conditions throughout the watersheds. One sample site was chosen for each of the most predominant habitat types of cropland, grassland (pasture land) and upland hardwoods. Future without project conditions were judged to be essentially the same as existing conditions except for the declines in acreage assumed above. Future with project conditions were based upon agricultural practices that could be implemented on cropland and grassland (pasture land) at the sample site if the landowner became a participant in the watershed treatment project. Future with project conditions for upland hardwoods were based upon treatment measures for forested land, such as timber stand improvement, that could be implemented at the sample site, again assuming that the landowner became a participant in the watershed treatment project.

Table O-1 shows the HSI values computed for each habitat type, with and without project and for existing, existing plus two years and 50 years hence.

Table O-2 provides a tabulated prediction for indicator species HSI's and habitat acreage changes expected for the project area over the next 50 years both with and without the project.

Table O-3 provides the calculated habitat units for each indicator species by habitat type both with and without the project.

Table O-1. Wildlife Habitat Suitability Indexes.

Species	Existing				Future Without				Future With*			
Habitat Type	cr	gr	cw	uh	cr	gr	cw	uh	cr	gr	cw	uh
Bobwhite Quail	.31	.67	0	.36	.31	.67	.23	.35	.48	.66	.23	.50
Fox Squirrel	--	--	0	.44	--	--	.26	.44	--	--	.26	.57
Indigo Bunting	--	LF	0	LF	--	LF	LF	LF	--	LF	LF	LF

Notes:

* - Computed HSI = Projected HSI x .6 + Existing HSI x .4 (Based upon 60% landowner participation [60% watershed acres for each habitat type] and 40% with no landowner participation [40% watershed acres for each habitat type] - applies to all HSI's in Future With column except cw.

cr = cropland
gr = grassland
cw = converted to woodland
uh = upland hardwoods
Indigo Bunting dropped from further calculations due to habitat Limiting Factors (LF).

Table O-2. Wildlife Habitat Acreages and HSI Values.

Future Without Project						
Year	1995		1997		2045	
HABITAT TYPE	Acres	HSI	Acres	HSI	Acres	HSI
Cropland	1606	.31 BQ	1600	.31 BQ	1445	.31 BQ
Grassland	2099	.67 BQ	2091	.67 BQ	1889	.67 BQ
Converted Woodland	0	0 BQ	16	.10 BQ	371	.23 BQ
		0 FS		.10 FS		.26 FS
Upland Hardwoods	3926	.36 BQ	3926	.36 BQ	3926	.35 BQ
		.44 FS		.44 FS		.44 FS
Future With Project						
Cropland w/p	964	.31 BQ	960	.33 BQ	867	.59 BQ
Cropland wo/p	642	.31 BQ	640	.31 BQ	578	.31 BQ
Total	1606	.31 BQw	1600	.32 BQw	1445	.48 BQw
Grassland w/p	1259	.67 BQ	1255	.74 BQ	1133	.65 BQ
Grassland wo/p	840	.67 BQ	836	.67 BQ	756	.67 BQ
Total	2099	.67 BQw	2091	.71 BQw	1889	.66 BQw
Converted Woodland	0	0 BQ	16	.10 BQ	371	.23 BQ*
		0 FS		.10 FS		.26 FS*
Upland Hardwood w/p	2356	.60 BQ	2356	.60 BQ	2356	.60 BQ
		.44 FS		.66 FS		.66 FS
Upland Hardwood wo/p	1570	.36 BQ	1570	.36 BQ	1570	.36 BQ
		.44 FS		.44 FS		.44 FS
Total	3926	.36 BQw	3926	.50 BQw	3926	.50 BQw
		.44 FSw		.57 FSw		.57 FSw

Notes:
* = Average over 50 years - 50% of difference of .1 to 50 year projected HSI.
w = Weighted HSI - 60% computed w/p + 40% computed wo/p.
BQ = Bobwhite Quail
FS = Fox Squirrel
w/p = With Project
wo/p = Without Project

Table O-3. Calculated Habitat Units.

Habitat Unit Type	W/P	WO/P	Unit Change
Cropland - Bobwhite Quail			
Cumulative	29944.26	23648.66	+ 6295.6
Annualized	598.89	472.97	+ 125.9
Grassland - Bobwhite Quail			
Cumulative	68443.34	66805.70	+ 1637.64
Annualized	1368.87	1336.11	+ 32.75
Upland Hardwoods - Bobwhite Quail			
Cumulative	97600.36	70668.00	+26932.36
Annualized	1952.01	1413.36	+ 538.65
Upland Hardwoods - Fox Squirrel			
Cumulative	111380.62	86372.00	+25008.62
Annualized	2227.61	1727.44	+ 500.17
Converted to Forest - Bobwhite Quail			
Cumulative	2087.92	2087.92	0.00
Annualized	42.00	42.00	0.00
Converted to Forest - Fox Squirrel			
Cumulative	2355.04	2355.04	0.00
Annualized	47.10	47.10	0.00

SUMMARY OF ANNUALIZED HABITAT UNITS

Annualized Habitat Units - Bobwhite Quail

Cropland	+125.90
Grassland	+ 32.75
Upland Hardwoods	+538.65
Total	+697.3

Annualized Habitat Units - Fox Squirrel

Upland Hardwoods	+500.17
Total	+500.17

Grand Total	+1197.47

Resource Plan
Batchtown Watershed Project

Prepared By:

Batchtown Watershed
Resource Planning Committee

Assisted By:

Calhoun County Soil and Water
Conservation District
and
Natural Resources Conservation Service

April 1996 **DRAFT**

O-40

Encl O-4

GEOGRAPHICAL INFORMATION ON CALHOUN COUNTY:

Calhoun County is located in the west-central part of Illinois. The county has an area of 179,840 acres, or 281 square miles. In 1990 the population was 5,322 which was a decline of 9.3 percent since 1980. Hardin, the county seat, had a population of 1071. Hardin is the only major community in the county to experience growth between 1960 and 1990 (see Table 3).

The county is bordered on the north by Pike County, on the east by the Illinois River, and on the west and south by the Mississippi River (see Map 1). The upland soils are gently sloping to very steep and mainly formed on windblown silt, called loess. On bottomlands ajacent to rivers the soils are nearly level, and formed in alluvium.

Elevations in the county range from about 820 feet above sea level on the upland-dividing ridge to about 420 feet above sea level at the confluence of the Illinois and Mississippi Rivers.

Agriculture is the main industry in the county. The number of farms in the county has declined by 28 percent from 1969 through 1987 and the size of farms increased by 11.9 percent during the same time period (see Tables 1 and 2). The major crops are soybeans, corn and winter wheat. About 1,100 residents are engaged directly in some form of agriculture. Apple and peach orchards are also important, and cover about 850 acres. Orchards are rapidly declining because of the seasonal labor needs. Approximately 30 percent of the county is wooded.

Major employers in the county that are agriculturally based include The Farm Service Supply, Richter's Fertilizer, National Vinegar (Cider Mill), and Calhoun Lumber and Supply. Other major employers outside of the county are McDonnell-Douglas in St. Louis County, Olin Corporation in East Alton, Steel in Alton, and Capri Sun in Granite City, True Manufacturing in O'Fallon, MO, and Cope Plastics in Godfrey. It is not uncommon for a commuter in Calhoun County to drive over one hour one way to work each day. Additionally, the county has a history of high unemployment (see Table 4). Calhoun County is cold in the winter and hot and humid in the summer. Rains are generally well distributed throughout the year. Snow falls during the winter and adds to the accumulation of soil moisture by spring. Normal annual precipitation is adequate for all crops that are suited to the temperature and length of the growing season in the area.

Tornadoes and severe thunderstorms occur occasionally. They are usually of local extent and of short duration, and damage is normally isolated. Hailstorms sometimes occur during the warmer months.

Table 1
Farm Size
(acres)

	Illinois	Calhoun County
1969	242	184
1974	262	186
1978	282	194
1982	292	204
1987	321	206
1992	365	205

Source: Census of Agriculture

Table 2
Number of Farms

	Illinois	Percent Change	Calhoun County	Percent Change
1969	123,565	--	682	--
1974	111,049	-10.2	633	-7.2
1978	104,690	- 5.7	591	-6.6
1982	98,483	- 5.9	542	-8.3
1987	88,786	- 9.9	491	-9.5
1992	80,840	-8.9	502	+2.3

Source: Census of Agriculture

Table 3
Calhoun County
Population Trends
1960 -1990

	1960	1970	1980	1990	Percent Change 60-90
Calhoun County	5,933	5,675	5,867	5,322	-11.3
Batchtown	248	217	254	225	- 9.3
Brussels	201	191	161	125	-37.8
Hardin	1,040	1,035	1,107	1,071	2.9
Kampsville	453	439	423	399	-11.9

Source: Census of Agriculture

Table 4
Unemployment
1985 - 1990

	1985	1986	1987	1988	1989	1990
Calhoun County	20.6	19.8	15.2	15.0	15.3	14.1
Illinois	9.0	8.1	7.4	6.8	6.0	6.2
Nation	7.2	7.0	6.2	5.5	5.3	9.0

Source: Census of Agriculture

In winter the average temperature is 31 degree F, and the average monthly minimum temperature is 21 degrees. In summer the average temperature is 75 degrees, and the average monthly maximum temperature is 87 degrees.

The total annual precipitation is 35.5 inches. Of this, 21.9 inches or 62 percent, usually falls in April through September. The average seasonal snowfall is 21 inches. On the average, 28 days of the year have at least 1 inch of snow on the ground.

Committees

On March 26, 1996, a group of residents requested assistance from the Calhoun County Soil and Water Conservation District to assist in the development of a plan to address their concerns. The following are the planning committee members appointed by the District:

Bob Snyders
Rick Snyders
Matt Kamp
Dan Van Doren
John Frank
Bernie Hillen
Karl Swan
Keith Klocke
Hazel Murphy
Dale Mortland

The technical advisory committee appointed to assist the planning committee in developing the plan is as follows:

Jeff Pontnak	- Illinois Department of Natural Resources
Tom Wilson	- Illinois Department of Natural Resources
John Handle	- Illinois Department of Natural Resources
Dave Harper	- Illinois Department of Natural Resources
Mark Phipps	- Illinois Department of Natural Resources
Ross Adams	- U.S. Fish & Wildlife Service
K. L. Drews	- U.S. Fish & Wildlife Service
Joe Swan	- Calhoun Co. Soil & Water Conservation District
Martha Sheppard	- Natural Resources Conservation Service
Bill McCartney	- Two Rivers Resource & Conservation Development
Greg Franke	- Migratory Waterfowl Association

Resource Concerns

The first meeting of the Batchtown Planning Committee was in March 1996 with 40 people representing the Batchtown area present. During this meeting, the committee identified 28 concerns. At a later meeting, the committee discussed these concerns and selected the group's top six concerns. The planning committee's concerns are as follows:

Erosion	Ponds
Madison Creek	Dry Dams needed
Pasture Improvement	Wetlands for hunting

Erosion Soil erosion in the Batchtown Watershed is predominately sheet, rill, gully, and ephemeral gully erosion. Erosion for the Batchtown Watershed is shown in Table 5.

Table 5
Estimated Erosion

Type	Tons Per Year
Sheet and Rill	33,421
Ephemeral	12,045
Gully	1,628
Streambank	400
Total	**47,494**

APPENDIX P

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revised July 1996

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Appendix Q - Literature Cited

APPENDIX Q
DRAFT
LITERATURE CITED AND GENERAL REFERENCES

BATCHTOWN
HABITAT REHABILITATION AND ENHANCEMENT PROJECT

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Appendix R - Cumulative Impacts Assessment

APPENDIX R

CUMULATIVE IMPACT ASSESSMENT OF THE UMRS-EMP HABITAT REHABILITATION AND ENHANCEMENT PROGRAM

Prepared by the Planning Division,
St. Louis District, Corps of Engineers
August 1995

This document attempts to assess the readily quantifiable cumulative impacts of habitat projects implemented under the Habitat Rehabilitation and Enhancement component of the Environmental Management Program for the Upper Mississippi River System (UMRS). Cumulative impact is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time" (Council on Environmental Quality, 1987).

<u>Background</u>. The EMP program was authorized by the Water Resource Development Acts of 1986 and 1990, and involves the expenditure of $189.6 million over a 15-year period (1988-2002) for habitat rehabilitation and enhancement (EMP-HREP) projects on public lands that lie in and along the Mississippi River from St. Paul, Minnesota, to Cairo, Illinois, and several of its major tributaries, including the Minnesota and Illinois Rivers. The habitat projects are proposed by the states of Minnesota, Wisconsin, Iowa, Illinois, and Missouri and the U.S. Fish and Wildlife Service (FWS), developed and designed by interagency planning teams, and engineered and constructed by the Corps of Engineers (St. Paul, Rock Island, and St. Louis Districts). The Corps' North Central Division is responsible for administration of the EMP-HREP program.

Because the most pervasive environmental problem on the Upper Mississippi River System is sedimentation, most of the projects are designed to counteract side channel and backwater sedimentation. The project designs generally involve dredging and alteration of flow patterns with riverine structures, construction of enclosed levee systems with pumping facilities for water level control, or island construction.

<u>Existing NEPA documentation for EMP-HREP projects</u>. For every EMP-HREP project, a site-specific planning document is prepared which includes NEPA documentation. An environmental assessment (EA) is prepared to determine if an EIS is needed. Probable impacts of project alternatives on all significant physical, biological, cultural, social, and economic resources are described. Cumulative impacts are addressed, but often briefly.

A programmatic environmental impact assessment or EIS has not been prepared for the entire EMP-HREP program. Such a document would describe the existing Upper Mississippi River System (including existing habitat goals and objectives), habitat deficiencies, problems, or opportunities (both existing and future), alternative ways to address these deficiencies, problems, and opportunities, a recommended plan, and that plan's probable impacts on the system's resources. The focus of a programmatic document's assessment of cumulative impacts would not be site-specific but system-wide.

<u>Limitations/observations concerning this cumulative impact assessment</u>. Because of a number of factors, the scope and degree of detail contained in this assessment are limited.

1. Cumulative impacts on physical and biological resources within the UMRS will be addressed in this assessment. Effects on cultural, social, and economic resources, which are not the focus of the EMP-HREP program, are not addressed.

2. This assessment is based primarily upon EMP-HREP data maintained and provided by North Central Division. The data consists of a list of projects by status as of the end of 1994, as well as a summary of project outputs for each District. This information was used to prepare TABLES 1A-1C.

3. It was not possible to assess some cumulative impacts for all three Districts, because either the necessary information is not consolidated, or what is readily available is of limited usefulness. For example, the St. Louis District's collection of project planning reports for Rock Island and St. Paul projects, which include detailed information on site-specific impacts, is incomplete. Also, information collected systematically concerning EMP-HREP impacts is limited, and consists of the summary data maintained by North Central Division. There are inconsistencies in this data among the Districts. For example, the description or classification of habitats improved by EMP-HREP projects is not uniform. In contrast, the collection of administrative and budgetary data for the EMP-HREP program is standardized.

4. This assessment was prepared by the St. Louis District, with limited input from the St. Paul and Rock Island Districts. Full participation from all three Districts, although desirable, was not possible given other priorities.

5. The "past, present, and reasonably foreseeable future" EMP-HREP projects correspond to the three project status categories used in the tables in this assessment. Past projects are those already constructed (category A), present projects are those under construction (category B), and future projects are those awaiting approval or in the planning/design phase (category C).

6. The scope of this assessment is limited to the EMP-HREP program. A full assessment of cumulative impacts in the UMRS could very well include other Corps of Engineer programs, such as maintenance and operation of the navigation system,

management of Corps lands adjacent to the navigation project, and the permitting of construction activities in waters of the United States through the regulatory program, but this is not feasible at this time. Likewise, this assessment could include habitat management and restoration activities in the UMRS by others such as the FWS and states, but this too was not feasible.

7. The assessment of cumulative impacts is very compatible with an ecosystem approach to resource monitoring, project planning, and resource management. The ecosystem perspective is new to the Federal government and others, and implementation of this approach is still in its infancy.

8. This assessment will appear initially in the St. Louis District's Final Definite Project Report for the Calhoun Point EMP-HREP project, which is scheduled to be released in August 1995. The St. Louis District intends to include this assessment in all future planning reports for St. Louis EMP-HREP projects. This assessment will undergo periodic updates to reflect the change in status of projects. The District also intends to coordinate periodically with the Rock Island and St. Paul Districts to make further improvements in the description of cumulative impacts, and to include information on cultural, social, and economic impacts not covered in this initial evaluation.

Summary of projects. As of December 31, 1994, a total of 45 EMP-HREP projects in the St. Paul, Rock Island, and St. Louis Districts were either already constructed, under construction, or still in the planning or design phase. There are 21, 16, and 8 projects for the three Districts, respectively (TABLES 1A, 1B, and 1C). Two of St. Paul's projects are phased or divided into two parts, and these phases have been treated as separate project sites in this assessment. The Mississippi River Bank Stabilization project, which expands across pools 6 through 10 in the St. Paul District, was treated as one site because no details were available for each pool. Therefore, this assessment treats a total of 47 project sites.

The St. Paul District tends to have the smallest sites (average about 600 acres), and the Rock Island District the largest (average about 2,800 acres). Sites in the St. Louis District average about 1,700 acres (TABLE 2). However, sites in all three Districts range widely in size, from as small as 20 acres to as large as 7,700 acres. TABLE 2 shows the tendency within each District that sites already constructed (category A) are the smallest, sites under construction (category B) are intermediate in size, and sites awaiting approval or under development are the largest.

There are 72,079 acres of aquatic and terrestrial habitats within the 47 EMP-HREP project sites, for which habitat conditions are expected to improve. Of these floodplain habitats, the proportion of area affected by each District is 0.20 for St. Paul, 0.62 for Rock Island, and 0.19 for St. Louis (TABLES 1A, 1B, and 1C).

TABLE 3 presents total area within the study boundaries for each of St. Louis' EMP-HREP projects. This table is presented because adverse effects of these projects, such as loss of bottomland forest (discussed later in this assessment), cannot be addressed using the data in TABLES 1A-1C. Data in TABLE 3 present existing conditions by broad land use/land cover types. Note that the area improved at each of St. Louis' project sites, as shown in TABLE 1C, is a subset of the area in TABLE 3. Some St. Louis projects, such as Swan Lake and Batchtown, include features in adjacent upland areas for the control of soil erosion. These upland areas are not reflected in TABLE 3. Information summarizing existing conditions for St. Paul and Rock Island projects is not included in this assessment.

Cumulative impacts. Cumulative impacts addressed in this assessment include: habitats affected, target animal groups, distribution of project sites within the UMRS, proportion of UMRS floodplain affected by projects, bottomland forest affected, and effects of project levees.

Habitats affected. Over all, most habitats affected by EMP-HREP projects are aquatic. In the St. Paul District, almost all project sites consist of backwater slough, backwater lake, side channel, river lake, and marsh (TABLE 1A). Consequently, almost all acres affected at St. Paul's projects are aquatic. Over half the habitats and acres improved by the Rock Island and St. Louis Districts are aquatic, and include the same or similar types (TABLES 1B and 1C). About 45 percent of acres improved at St. Louis project sites are terrestrial, and consist of bottomland forest and cropland. A consolidated summary by habitat type is not possible because no standardized system to classify or describe these habitats was used by the three Districts. For example, impacts to "wetlands," whether forested or nonforested, are not easily identified.

Target animal groups. Animal species are typically chosen as the targets or recipients of intended habitat improvements. Waterfowl and fish have been the focus of many EMP-HREP projects, mainly because the public lands to which these projects are confined are already under management by state or Federal natural resource agencies. In many instances the primary management responsibilities of these agencies as mandated by law are focused upon waterfowl and fish, with waterfowl often times receiving a greater emphasis in practice. Threatened and endangered species such as the bald eagle usually are included in management directives also, as are migratory birds.

The waterfowl-fish dichotomy is reflected in TABLES 1A-1C. A count of the number of project sites targeted toward one group or the other shows an even balance between fish and waterfowl. Forty-four, or about 94 percent, of the 47 project sites include measures targeted toward improving habitat conditions for fish. Forty-three sites also have measures to improve habitat conditions for waterfowl. Animals other than waterfowl and fish have been the targets of project objectives. For example, TABLE 1C includes additional species that were included as targets at St. Louis projects. This information is not included in TABLES 1A and 1B for St. Paul and Rock Island.

The habitat analyses conducted by the St. Louis District for the Pharrs, Stump, Swan, Cuivre, Calhoun and Batchtown projects reflect a net positive gain in fisheries and wildlife habitat value. These analyses quantify the habitat benefit to target groups or species listed in TABLE 1C. Benefits are expressed in terms of habitat units, which are a unit of measure that combines the effects of changes in habitat quantity and quality. For these five projects, the cumulative impact to target fisheries groups or species (including mussels) is +2,024 average annual habitat units (AAHUs). For these same five projects, +3,206 AAHUs of habitat benefits will accrue to target wildlife species. Habitat benefits in terms of AAHUs were not computed for the Clarksville or Dresser projects because they predated the implementation of the habitat unit methodology. Similar data for the St. Paul and Rock Island Districts are not included.

Distribution of EMP-HREP project sites within the UMRS. TABLE 4 shows that EMP-HREP projects are distributed rather uniformly throughout the UMRS, but there are gaps in the system where projects are not located. The system as defined in this assessment (see TABLE 5) includes 847 miles of the Upper Mississippi River, 231 miles of the lower Illinois River, and 50 miles of the lower Minnesota River, for a total of 1,128 river miles. There are two project sites on the Minnesota River, five on the Illinois, and forty project sites on the Mississippi.

The most significant gap is the lower 201 miles of the Mississippi River, from Lock and Dam 26R at Alton, Illinois to Cairo. This reach includes pool 27 and the open river. The scarcity of existing public lands along this river segment is the main reason for the lack of EMP-HREP projects. Other gaps are to the north, and include pools 2-3, 12, 15, and 19-20 on the Mississippi. (From St. Paul to Alton - from mile 847 to mile 201 - there are 25 pools on the Upper Mississippi River, each one averaging about 26 river miles in length.) Like the open river, there are no projects in pool 2 because of a scarcity of public lands. The gap in pool 3 is due to the combination of a scarcity of Federal lands, and the current lack of interest by the Minnesota Department of Natural Resources to cost share EMP-HREP projects on a considerable amount of state-owned land. TABLE 4 also shows that the distribution of fish and waterfowl projects is similar, reflecting the fact that many project sites include measures for both major animal groups.

It is reasonable to expect that as EMP-HREP projects become more numerous and more closely distributed throughout the UMRS, synergistic effects will occur ("the whole is greater than the sum of its parts"). At the present time, there is no methodology available to quantify this anticipated effect.

Proportion of UMRS floodplain affected by EMP-HREP projects. The outline of the UMRS floodplain can be used as the boundary of the ecosystem in which EMP-HREP projects lie. TABLE 5 contrasts the 72,079 acres affected by habitat projects with the larger ecosystem, which covers about 3.3 million acres (or about 5,155 square miles). About two percent of the total UMRS floodplain, from bluff to bluff, has been or will be affected in terms of habitat improvements. Following Corps District boundaries, projects in the St. Paul and Rock Island Districts affect about three percent of the floodplain ecosystem, and St. Louis projects about one percent. If the floodplain ecosystem is broken down by broad land use/land cover types, then about six percent of all "natural" habitats (forest, nonforested wetland, water) in the entire ecosystem are affected. Within each District, six to nine percent of the "natural" habitats are affected. These data indicate that the EMP-HREP program has affected a small area within the larger ecosystem.

The 72,079 acres affected by all projects represent the area that can be readily quantified. It is likely that some areas outside of but adjacent to project sites will also improve as a result of their proximity. Aquatic habitats are probably more likely to receive such "side benefits" than terrestrial ones. Project boundaries within aquatic areas are more often delimited artificially or arbitrarily, and not tied to any discrete environmental gradient, unlike terrestrial project sites which can be represented by islands or blocks of bottomland forest surrounded by cropland, for example. Although there is no methodology available to quantify these additional areas, it is unlikely that the cumulative total would approach the magnitude of the area already quantified.

Bottomland forest. Of the St. Louis District's 16,265 acres of total EMP-HREP project areas (of which 13,430 acres were or will be improved), 7,066 acres or about 43 percent consist of bottomland forest (see TABLES 3 and 6). These 7,066 acres comprise about four percent of the forested UMRS floodplain in the St. Louis District (TABLE 5), which is a small proportion.

Seven percent of the 7,066 forested acres were or will be mechanically cleared to construct project features. Another 252 acres of bottomland forest will be cleared by other methods. These 734 acres represent about four-tenths of one percent of the forested UMRS floodplain in the St. Louis District. In contrast, 618 acres of tree plantings are proposed at St. Louis sites. About half of these plantings will consist of converting floodplain cropland to bottomland forest, and the other half will involve planting trees within forest killed by the flood of 1993. Overall, area of forest cleared exceeds area of tree planting by 116 acres, or about two percent of the preproject forested area within project boundaries. The 116 acre difference represents about six-hundredths of one percent of the total bottomland forest within St. Louis' UMRS floodplain.

TABLE 6 does not reflect tree species composition of bottomland forest cleared at project sites. This varies within and among project sites, and consequently the value to wildlife of cleared forest varies. It has been useful in the St. Louis District to differentiate between bottomland forest supporting hard mast tree species, such as oaks and pecan, from bottomland forest that does not. The latter areas typically support silver maple, willow, and cottonwood, and they are lower in elevation with reference to the river than areas with mast trees. A rough estimate of the proportion of forest supporting hard mast species that is or will be cleared versus total forest cleared at St. Louis EMP-HREP project areas is 40 percent.

Fragmentation of bottomland forest has or will occur at six St. Louis projects, chiefly as a result of clearing for construction of a riverside dike/levee. Forest fragmentation has been viewed as a chief factor associated with the decline of interior forest nesting birds, including Neotropical migrants. However, the fragmentation at St. Louis sites is minor because the long relatively narrow band of trees removed is not located within the middle of a block of forest, but typically parallel to the river, and set back about 100-200 feet from the riverbank. The width of clearing usually varies from 75 to 180 feet, depending upon whether borrow areas are sited adjacent to the levee or not. At Stump Lake, clearing width in some segments has reached up to 215 feet. Project plans to convert cropland to bottomland forest by tree planting at Cuivre, Calhoun, and Batchtown will over time increase the extent and continuity of floodplain forest.

The cumulative impact of St. Louis' habitat projects on bottomland forest is minor. In the St. Paul District, less than 5 acres of bottomland forest have been cleared or adversely affected by EMP-HREP projects. Quantitative data describing bottomland forest impacts for the Rock Island District are not included here.

Effects of project levees. The Clarksville, Dresser, Stump, Swan, Calhoun, and Batchtown projects in the St. Louis District all involve the construction of a low riverside dike/levee around the perimeter of the project area. This feature is typically built to the 3- or 4-year frequency flood elevation. The levee provides benefits to aquatic habitats in a variety of ways. It reduces the rate of sedimentation in the protected area, thus prolonging the life of existing backwater areas. By excluding minor flooding, interior water levels can be better managed, thereby increasing the predictability of providing food resources for wetland wildlife, such as migratory waterfowl and shorebirds. Also, low levees can protect young-of-the-year fish overwintering in backwater areas from the cold temperatures of winter floods, which can threaten survival. In the St. Louis District, about 7,350 acres of backwater lakes, backwater sloughs, side channels, and marshes are located behind such levees at these six project areas.

About 5,040 acres of bottomland forest and cropland are also located behind these low levees. Most of these areas lie below the elevation of the levee crown, but some are above it. Other than retarding the rate of sedimentation, the chief effect on the levee-protected terrestrial habitats is the creation of a slightly drier hydrologic regime, due to the prevention of minor flooding. Consequently, fewer small floods in EMP-HREP project areas may promote the natural regeneration of native oaks. In a survey of natural floodplain vegetation of pools 24-26, Klein et al. (1975) observed that pin oak was more often an important component of forested areas protected by agricultural levees than in unprotected forested areas. These agricultural levees generally provide 10 to 25-year protection.

An adverse impact of these low levees is that they isolate the floodplain from the river to some degree. These levees prevent the exchange of riverine fish and other aquatic organisms with backwater areas when river stages are below the levee's crown elevation. Likewise, they prevent the import of nutrients from the river into backwater and terrestrial areas, and the export of organic debris from these areas into the river. However, these processes still occur when the levee is overtopped by bigger floods. To minimize the adverse effect to fish movement, which is most critical during the spring and fall, open topped fish passage/water control structures will be constructed at Stump Lake, Swan Lake, Calhoun Point, and Batchtown to connect fisheries and some waterfowl management units with the river. These four areas envelop 6,770 acres of aquatic habitat. Whether all kinds of fish will use these structures is unknown at the present time, and will be revealed only after field monitoring studies have been completed.

The District has assessed the cumulative impact of low levees at the Swan, Stump, and Calhoun projects, located at the low end of the Alton pool on the Illinois River, on upstream and downstream water surface profiles. A HEC-2 analysis was performed on the Illinois and Mississippi Rivers for conditions with and without the low levees for floods ranging from a 2-year to a 500-year recurrence interval. No significant increases in water surface elevations were projected.

Summary. All EMP-HREP project areas are monitored before and after construction to determine if project goals and objectives are met. Goals and objectives are often stated in terms of anticipated improvements to habitat conditions and water quality, and reductions in rates of sedimentation. Monitoring evidence to date suggests that EMP-HREP projects are achieving their site-specific environmental objectives.

The EMP-HREP projects can be characterized as demonstrations, and are very limited in scope. The program is working only a fraction of the total habitat area of the UMRS. If all planned program activities turn out to be a failure (and there is no evidence to indicate that this will be the case), it would not represent an irreversible, catastrophic impact on the river's ecosystem.

The program can be viewed as a possible 15 year long precursor to any future large scale habitat alteration attempts on the river system. If the program is funded by Congress to proceed beyond the 15-year authorized limit, for a broader application of the more viable habitat restoration techniques, then a systemic assessment of specific UMRS habitat restoration needs, objectives, measures, and plans is appropriate. Such a systemic assessment would also serve as a long-term cumulative impact assessment. Whether these projects represent a system-wide balancing of resource needs is less critical now, due to the small impact of these projects on the system at large, but this issue will become more critical if major UMRS habitat project installations are authorized following the close of the current EMP-HREP demonstration program.

References Cited.

Council on Environmental Quality, 40 Code of Federal Regulations, Chapter V, Parts 1500-1508, July 1, 1987, U.S. Government Printing Office, Washington, D.C., pp. 929-971.

Klein, W. M., R. H. Daley, and J. Wedum. 1975. Environmental inventory and assessment of navigation pools 24, 25, and 26, Upper Mississippi and Lower Illinois Rivers; a vegetational study. Prepared by the Missouri Botanical Garden for the U. S. Army Engineer District, St. Louis. Contract Report Y-75-1, U. S. Army Engineer Waterways Experiment Station, Vicksburg. 140 pp.

Laustrup, M.S. and C. D. Lowenberg. 1994. Development of a systemic land cover/land use database for the Upper Mississippi River System derived from Landsat Thematic Mapper satellite data. National Biological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, May 1994. LTRMP 94-T001. 103 pp.

U.S. Army Corps of Engineers. 1995. Draft environmental resource inventory for the Upper Mississippi River, Lower Missouri River and major tributaries, prepared by Burns & McDonnell, Kansas City, Missouri, April 1995.

TABLE 1A. Habitat Benefits of UMRS-EMP Habitat Projects - St. Paul District (as of December 31, 1994).

PROJECT	POOL	BENEFITS		
		TARGET ANIMAL GROUPS	ACRES IMPROVED	HABITAT TYPE
A. CONSTRUCTION COMPLETED				
Indian Slough, WI	4	fish	122 75 15	backwater slough backwater lake side channel
Finger Lakes, MN	5	fish	113	backwater lake
Island 42, MN	5	fish	95	backwater slough
Lake Onalaska, WI	7	fish, waterfowl	300 15	river lake island nesting
Pool 8 Islands, WI	8	waterfowl, fish	1,000 15	river lake island nesting
Blackhawk Park, WI	9	fish	282	backwater slough
Cold Springs, WI	9	fish	35	backwater lake
Guttenberg Ponds, IA	11	waterfowl	35	marsh
Subtotal A.			2,102	
B. CONSTRUCTION UNDERWAY				
Spring Lake, WI	5	fish	50	backwater lake
Polander Lake, MN	5A	waterfowl, fish	1,200 5	backwater lake island nesting
Lansing Big Lake, IA	9	waterfowl, fish	150	backwater lake
Pool 9 Island, WI	9	waterfowl, fish	180	river lake
Bussey Lake, IA	10	fish, waterfowl	213 55	backwater lake marsh
Subtotal B.			1,853	
C. CONSTRUCTION OR APPROVAL PENDING/PLANNING AND DESIGN UNDERWAY IN FY 95				
Rice Lake, MN	Minnesota R.	waterfowl	170 70 40	backwater lake marsh bottomland forest
Long Meadow Lake, MN	Minnesota R.	waterfowl, fish	1,500	marsh
Peterson Lake, MN	4	fish, waterfowl	500	backwater lake
Spring Lake - Ph.2, WI	5	waterfowl	300	backwater lake

Trempealeau, MN	6	waterfowl, fish	3,500 700	marsh refuge lake
East Channel, WI/MN	8	fish	10 10	main channel bay bottomland forest
Pool 8 Islands - Ph.2, WI	8	fish, waterfowl	600	river lake
Pool Slough, IA/MN	9	waterfowl	700	marsh
Capoli Slough, WI	9	waterfowl	600	river lake
Mississippi River Bank, MN/WI/IA	6-10	waterfowl, fish	1,500	backwater lakes and sloughs
Subtotal C.			10,200	
TOTAL			499 2,680 35 5,860 2,806 15 700 1,500 50 10 14,155 total	backwater slough river lake island nesting marsh backwater lake side channel refuge lake back. lakes&sloughs bottomland forest main channel bay

TABLE 1B. Habitat Benefits of UMRS-EMP Habitat Projects - Rock Island District (as of December 31, 1994).

PROJECT	POOL	BENEFITS		
		TARGET ANIMAL GROUPS	ACRES IMPROVED	HABITAT TYPE
A. CONSTRUCTION COMPLETED				
Bertom/McCartney Lake, WI	11	fish, waterfowl, mussels	1,983	backwater complex
Browns Lake, IA	13	fish, waterfowl	450	backwater lakes
Andalusia Refuge, IL	16	waterfowl, fish	130	backwater slough
Big Timber, IA	17	fish, waterfowl	1,039	backwater complex
Monkey Chute, MO	21	fish	88	backwater slough
Bay Island, MO	22	waterfowl	650	forested wetland
Subtotal A.			4,340	
B. CONSTRUCTION UNDERWAY				
Potters Marsh, IL	13	fish, waterfowl	2,305	backwater slough, wetlands
Peoria Lake, IL	Peoria[1]	waterfowl, fish, mussels	2,782	riverine lake, forested wetlands, side channel
Lake Chautauqua, IL	La Grange[1]	waterfowl, fish	4,212	leveed lakes
Subtotal B.			9,299	
C. CONSTRUCTION OR APPROVAL PENDING/PLANNING AND DESIGN UNDERWAY IN FY 95				
Pool 11, WI	11	waterfowl, fish	7,701	open water
Spring Lake, IL	13	waterfowl, fish	3,560	leveed lake, wetland
Princeton, IA	14	waterfowl	1,190	leveed marsh complex
Lake Odessa, IA	17/18	waterfowl, fish	6,800	leveed backwater complex, forested wetlands
Gardner Division, IL	21	waterfowl, fish	6,000	backwater complex
Cottonwood, MO	21	fish, waterfowl	463	forested wetland, backwater slough
Banner Marsh, IL	La Grange[1]	waterfowl, fish	5,141	leveed wetland, backwater lake
Subtotal C.			30,855	
TOTAL			44,494 total	

[1] On the Illinois River.

TABLE 1C. Habitat Benefits of UMRS-EMP Habitat Projects - St. Louis District (as of December 31, 1994).

PROJECT	POOL	BENEFITS		
		TARGET ANIMAL GROUPS (OR SPECIES)[1]	ACRES IMPROVED	HABITAT TYPE
A. CONSTRUCTION COMPLETED				
Pharrs Island, MO[2]	24	riverine fish	210	backwater slough
Clarksville Refuge, MO	24	dabbling ducks	150	marsh
Dresser Island, MO	26	dabbling ducks, riverine fish	200 230 500	marsh side channel bottomland forest
Subtotal A.			1,290	
B. CONSTRUCTION UNDERWAY				
Stump Lake, IL	Alton[3]	dabbling ducks (mallard), large slackwater fish	970 130 1,370	backwater lake backwater slough bottomland forest
Swan Lake, IL	Alton[3]	dabbling ducks (mallard), diving ducks, large slackwater fish	3,100 570	backwater lake bottomland forest
Subtotal B.			6,140	
C. CONSTRUCTION OR APPROVAL PENDING/PLANNING AND DESIGN UNDERWAY IN FY 95				
Batchtown Management, IL	25	dabbling ducks (mallard, wood duck), diving ducks, Canada goose; large slackwater fish (smallmouth buffalo); mussels	400 1,700 900 220	side channel backwater slough bottomland forest cropland
Cuivre Island, MO	26	wetland wildlife (mallard, wood duck, least bittern, king rail); riverine fish (gizzard shad, channel catfish, carp, crappie)	530 160 30 110	bottomland forest side channel backwater slough cropland
Calhoun Point, IL	26	wetland wildlife (mallard, wood duck, Canada goose, green-backed heron, northern parula, prothonotary warbler); riverine fish (smallmouth buffalo, bluegill)	1,350 470 130	bottomland forest backwater slough cropland
Subtotal C.			6,000	
TOTAL			350 4,070 2,540 790 5,220 460 13,430 total	marsh backwater lake backwater slough side channel bottomland forest cropland

1 For all projects except Clarksville and Dresser, habitat units were computed for all target groups/species, and used as project outputs.
2 Phase 1 only (bullnose dike); phase 2 currently inactive (levee).
3 On the Illinois River.

TABLE 2. Summary of UMRS-EMP Habitat Project Sites (as of December 31, 1994).[1]

DISTRICT	VARIABLE [2]	PROJECT SITES (BY CATEGORY) [3]			
		A	B	C	TOTAL
St. Paul	number sites	8	5	10	23
	average area (acres)	263	371	1,020	615
	area range (acres)	35-1,015	50-1,205	20-4,200	20-4,200
Rock Island	number sites	6	3	7	16
	average area (acres)	723	3,100	4,408	2,781
	area range (acres)	88-1,983	2,305-4,212	463-7,701	88-7,701
St. Louis	number sites	3	2	3	8
	average area (acres)	430	3,070	2,000	1,679
	area range (acres)	150-930	2,470-3,670	830-3,220	150-3,220

[1] For phased projects, phases treated as separate sites.
[2] Area represents area improved (from TABLES 1A-1C).
[3] Project categories defined in TABLE 1.

TABLE 3. Preproject Land Cover/Land Use of Entire Project Area at UMRS-EMP Habitat Project Sites - St. Louis District (as of December 31, 1994).

PROJECT	LAND COVER/LAND USE OF ENTIRE PROJECT AREA (ACRES)[1]							
	Urban	Agriculture	Nonwetland Forest	Forested Wetland	Nonforested Wetland	Water	Barren[2]	TOTAL
A. CONSTRUCTION COMPLETED								
Pharrs Island	0	0	0	265	101	160	0	526
Clarksville Refuge	0	0	0	175	150	0	0	325
Dresser Island	0	0	50	450	200	240	0	940
Subtotal A.	0	0	50	890	451	400	0	1,791
B. CONSTRUCTION UNDERWAY								
Stump Lake	30	0	215	1,314	969	129	0	2,657
Swan Lake	0	538	0	942	500	2,603	0	4,583
Subtotal B.	30	538	215	2,256	1,469	2,732	0	7,240
C. CONSTRUCTION OR APPROVAL PENDING/PLANNING AND DESIGN UNDERWAY IN FY 95								
Batchtown Management	0	224	0	989	1,174	940	0	3,327
Cuivre Island	0	188	0	1,287	45	190	40	1,750
Calhoun Point	28	269	100	1,279	296	170	15	2,157
Subtotal C.	28	681	100	3,555	1,515	1,300	55	7,234
Total EMP	58	1,219	365	6,701	3,435	4,432	55	16,265

[1] Data obtained from each project's Definite Project Report, and represent preproject conditions, which vary in time by project (from mid-1980s to early 1990s). Forest acres do not reflect effect of 1993 flood.
[2] Barren denotes land with little or no vegetative cover, and consists mostly of sandy areas in and along the Mississippi and Illinois Rivers.

TABLE 4. Distribution of UMRS-EMP Habitat Project Sites within Upper Mississippi River System (as of December 31, 1994).[1]

RIVER SEGMENT OR POOL	NUMBER OF PROJECT SITES (BY TARGET ANIMAL GROUP)					
	FISH (BY PROJECT CATEGORY) [2]			WATERFOWL (BY PROJECT CATEGORY)		
	A	B	C	A	B	C
Minnesota River			1			2
2						
3						
4	1		1			1
5	2	1				1
5A		1			1	
6			2			2
7	1		1	1		1
8	1		3	1		2
9	2	2	1		2	3
10		1	1		1	1
11	1 [3]		1	2		1
12						
13	1	1	1	1	1	1
14						1
15						
16	1			1		
17	1		1	1		1
18			1			1
19						
20						
21	1		2			2
22				1		
24	1			1		
25			1 [3]			1
26	1		2	1		2
Peoria		1 [3]			1	
LaGrange		1	1		1	1
Alton		2			2	
27						
Open river						

[1] For phased projects, phases treated as separate sites.
[2] Project categories defined in TABLE 1.
[3] Fisheries project includes component for mussels.

TABLE 5. Land Use/Land Cover of UMRS-EMP Project Sites and UMRS Floodplain (as of December 31, 1994). [1]

AREA [2]	LAND USE/LAND COVER TYPE (ACRES)						
	URBAN	AGRICULTURE	FOREST	NONFORESTED WETLAND	WATER	BARREN	TOTAL
St. Paul District							
UMRS Floodplain [3]	54,980 (.11)	156,410 (.31)	66,330 (.13)	65,280 (.13)	154,690 (.31)	410 (<.01)	498,100
All EMP project sites			50	14,105			14,155
All EMP project sites/UMRS Floodplain			<.01	.06			.03
Rock Island District							
UMRS Floodplain [4]	87,260 (.06)	831,510 (.60)	198,420 (.14)	55,390 (.04)	238,140 (.17)	700 (<.01)	1,411,410
All EMP project sites			44,494				44,494
All EMP project sites/UMRS Floodplain			.09				.03
St. Louis District							
UMRS Floodplain [5]	83,630 (.06)	910,880 (.66)	179,210 (.13)	96,580 (.07)	114,160 (.08)	4,430 (<.01)	1,388,890
All EMP project sites		460	5,220	350	7,400		13,430
All EMP project sites/UMRS Floodplain		<.01	.03	<.01	.06		.01
All Districts							
UMRS Floodplain	225,870 (.07)	1,898,800 (.58)	443,960 (.13)	217,250 (.06)	506,990 (.15)	5,540 (<.01)	3,298,410
All EMP project sites		460	71,619				72,079
All EMP project sites/UMRS Floodplain		<.01	.06				.02

[1] Project sites represent area improved (from TABLES 1A-1C).

[2] UMRS data sources: COE (1995) and Laustrup and Lowenberg (1994). Data from COE (1995) represent a broad classification based on 1990-1992 satellite imagery, supplemented with National Wetland Inventory data for forested and nonforested wetlands. Data from Laustrup and Lowenberg (1994) based on 1989 imagery; used for Peoria and LaGrange pools only. Land use/land cover categories for COE (1995) and Laustrup and Lowenberg (1994) paired as follows: urban - urban/developed; agriculture - agriculture; forest - trees/brush; nonforested wetland - aquatic vegetation and grasses/forbs; water - open water; barren - sand. In each cell for UMRS floodplain, acres are followed by proportion of that land use/land cover type within the floodplain (within parentheses).

[3] Floodplain defined as area from bluff to bluff along the Mississippi River from St. Paul, Minnesota, to Guttenberg, Iowa (river miles 847 to 614), and along the lower 50 miles of the Minnesota River (from Henderson to St. Paul).

[4] Floodplain defined as area from bluff to bluff along the Mississippi River from Guttenberg, Iowa, to Hannibal, Missouri (river miles 614 to 301), and along the Illinois River for the Peoria and LaGrange pools (river miles 231 to 80).

[5] Floodplain defined as area along the Mississippi River from Hannibal, Missouri, to Cairo, Illinois (river miles 301 to 0), and along the Illinois River for the Alton pool (river miles 80 to 0).

TABLE 6. Impacts of UMRS-EMP Habitat Projects on Bottomland Forest - St. Louis District (as of December 31, 1994).

PROJECT	**Bottomland Forest (Acres)**							**Recommended Plan**	
	Pre-project[1]	**Clearing**[2]		**Tree Planting**[2]			**Net Change**	**Review of forest impacts**	**Accepted by FWS/EPA**
		Mechanical[3]	Other	Cleared Area	Cropland[4]	Forest[5]			
A. CONSTRUCTION COMPLETED									
Pharrs	265	0	0	0	0	0	0	no net change	yes
Clarksville	175	-32	0	0	0	0	-32	acre based; tradeoff	yes
Dresser	500	-67	0	0	0	0	-67	acre based; tradeoff	yes
Subtotal A.	940	-99	0	0	0	0	-99		
B. CONSTRUCTION UNDERWAY									
Stump	1,529	-101	0	+15	0	0	-86	habitat unit based; future with project > future without	yes
Swan	942	-106	-33[6]	0	0	+33	-106	habitat unit based; future with project > future without	yes
Subtotal B.	2,471	-207	-33	+15	0	+33	-192		
C. CONSTRUCTION OR APPROVAL PENDING/PLANNING AND DESIGN UNDERWAY IN FY 95									
Batchtown	989	--~75	-50[6]	0	0	+~150	+25	acre based	pending
Cuivre	1,287	-50	0	0	+110	+80	+140	acre based	yes
Calhoun	1,379	-51	-169[7]	0	+110	+120	+5	acre based	yes
Subtotal C.	3,655	-176	-219	0	+220	+350	+170		
Total EMP	7,066	-482	-252	+15	+220	+383	-116		

[1] Acres reflect all bottomland forest within project study areas, not just acres of forest improved (as in TABLE 1C). Effects of 1993 flood not reflected in preproject acres for project categories B and C.

[2] Over 50-year project life, and as described in each project's Definite Project Report.

[3] Mechanical clearing necessary to construct project features.

[4] Plant mast trees to restore cropland to bottomland forest.

[5] Plant mast trees in bottomland forest killed by 1993 flood.

[6] At Swan Lake, 33 acres of tree stand improvements (creation of small, scattered tree clearings) will be implemented, in which mast trees will be planted. Likewise, for Batchtown, such clearings and plantings are planned for about 50 acres.

[7] Kill young trees with herbicide that are encroaching into moist-soil management areas.

Appendix S - Estimated Real Estate Requirements

This appendix provides the real estate requirements for the Batchtown HREP.

The Draft DPR had recommended the acquisition of certain real estate interests vital to the construction and operation of the proposed project, specifically for the lowland sediment trap, USFWS Middle Pool. <u>However, as now contained in the Final DPR, the lowland sediment trap was redesigned so as to eliminate the need for any easement acquisitions</u>.

APPENDIX S: REAL ESTATE CONSIDERATIONS

BATCHTOWN HREP

Purpose. The purpose of this report is to recommend acquisition of real estate interests which will enable the construction, operation and maintenance of the Batchtown Project. This report is for planning purposes only. The final real property acquisition lines are subject to minor revision after approval.

Description of the Project. This project is centered in the Batchtown State Fish and Waterfowl Management Area which is located just upstream of Lock an Dam No. 25 and between river miles 242 and 248 on the Mississippi River and on the east, north and south by privately owned land. It is within the Illinois County of Calhoun and is approximately 1 mile west of the City of Batchtown.

This managed area contains approximately 3300 acres of land and 900 acres of water. It was acquired in fee simple title by the Corps of Engineers in the late 1930's and early 1940's for the Lock and Dam 25 navigation project.

The project consists of the construction of a series of riverside and interior levees, lowland sediment traps, hillside sediment control, water control structures, dredging and pumping. All project features will be entirely on Federal land with the exception of the hillside sediment control program which will remain on privately-owned land. There is a non-cost easement granted to the soil and water conservation district (SWCD) and the NRCS established in a cooperative agreement between the landowners and the SWCD for the inspection of these features.

Proposed Acquisition. All of the land needed for the construction, operation and maintenance of this project is either Federally owned or under the non-cost easement described above. Since this project will not require or impact privately owned lands it is not necessary to acquire any additional lands or easements.

Appendix T - Correspondence Pertaining to the Draft DPR

T-1 Questions/Comments on Batchtown HREP DPR received from USFWS on 22 Apr 96, with responses from Corps.

T-2 Written comments received from the public workshop held on 23 Apr 96. Corps' responses in italics.

T-3 Letter to U.S. rep. Richard Durbin from Partners for Wetlands, dated 29 Apr 96, (no Corps comments).

T-4 Comments on Batchtown Draft DPR received from Neil Booth, IDNR, dated 4/30/96.

T-5 Responses from Corps to Neil Booth's comments.

T-6 U.S. Dept. of the Interior, USFWS, Mark Twain National Wildlife Refuge, comments on Draft DPR, dated 3 May 96.

T-7 xx Jun 96, response letter from Corps to U.S. Dept. of the Interior, USFWS, Mark Twain National Wildlife Refuge, comments on Draft DPR, dated 3 May 96.

T-8 Response comments from NRCS to U.S. Dept. of the Interior, USFWS, Mark Twain National Wildlife Refuge, comments on Draft DPR, dated 3 May 96.

T-9 Comments received from the Illinois Waterfowlers Alliance, dated 8 May 96.

T-10 Corps' response to comments received from the Illinois Waterfowlers Alliance, dated 8 May 96.

T-11 Comments received from Jim Bensman, Sierra Club, Piasa Palisades Group, dated 8 May 96.

T-12 Response letter from Corps, dated 21 May 96, to Jim Bensman's, Sierra Club, Piasa Palisades Group, dated 8 May 96.

T-13 Comments received from Butch Atwood, IDNR, dated 15 May 96.

T-14 Responses to comments received from Butch Atwood, IDNR, dated xx Jul 96.

T-15 Comments received from Lower Mississippi Valley Division, U.S. Army Corps of Engineers, dated 21 May 96.

T-16 Corps' response to comments received from Lower Mississippi Valley Division, U.S. Army Corps of Engineers, dated 21 May 96.

T-17 Comments received from Jim Bensman, Sierra Club, Piasa Palisades Group, dated 22 May 96.

T-18 Response letter from Corps to Jim Bensman, Sierra Club, Piasa Palisades Group letter of 22 May 96.

Appendix T - Correspondence Pertaining to the Draft DPR (Continued)

T-19 Comments received from U.S. Dept. of the Interior, Office of Environmental Policy and Compliance, dated 23 May 96.
T-20 Corps' response to comments received from U.S. Dept. of the Interior, Office of Environmental Policy and Compliance, in letter dated 23 May 96.

T-21 Comments received from Sierra Club, Midwest Office, dated 31 May 96.
T-22 Response letter from Corps to Sierra Club, Midwest Office.

T-23 Comments received from Federal Emergency Management Agency, dated 17 Jun 96.
T-24 Responses to comments received from Federal Emergency Management Agency, dated 17 Jun 96.

rec'd 22 Apr 96
from USFWS
@ Brussell

Questions/Comments on Batchtown HREP DPR

2.A. Existing Islands

On page 7, has 224 acres cropland; 214 acres listed in Executive Summary. Moist soil unit acreage also incorrect. Correct to state: Middle Unit 46 acres crop
50 acres Moist Soil Unit
Lower Unit 127 acres crop

acreages to be checked/corrected

Also correct (5) on page 15, E.(3), on page 106, and Appendix C-2, II.a.-II.b.1, Appendix R-15. acreages to be checked/corrected

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On page 17, Section F, third paragraph, please further identify that millet is sown on State areas, as noted; not on any USFWS acres.

On page 27 in Section C., top paragraph, it indicates IDNR feels 7 foot minimum is needed for fish to safely overwinter... agreed, drawings changed to match

Refer to Plate 12. Typical Section Channel Excavation shows 434.0 elevation, with dredge to 429.0. At full pool, this only provides 5 feet of depth which is insufficient for overwintering. As you can see, this is insufficient depth. typical changed

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On page 33, in fish passage and control structure paragraph, it discusses materials. Aluminum would be cost prohibitive. Note added

See page 98, Table 11, last item "Boat Ramps": If cost cutting is required, this could be cut since it is a recreational component, not habitat. None recommended

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Pages 73-74: DPR states stoplog structures are concrete. However, costs are more similar to the reduced figure using steel (cost information from Pere Marquette EMP projects cost reduction meetings). This is being looked into

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Page 76-77, Items Y & Z: Revetment is no longer being discussed. (It may have come from earlier plans.) Map on page 82 depicts. Figure 14, p. 82 simply depicts measures. Not a recommended measure.

Page 79 Depiction of "K, Hillside Sediment Control". This is what we have in mind for the siltation basin. Dredge material could be used in construction. acknowledged

However, this is not used in all other maps.

Page 83-84 Clearing trees to plant trees on State area. This is also covered in the Public Notice. But this is incorrect and should be removed. Incorrect information is also on page 96, Items AA-1, AC-1, AB-1. Again in E.1. on page 106, this is addressed. Version is wrong

This was thoroughly discussed at Pere Marquette meeting. USFWS did <u>some</u> restoration as part of flood rehab. However, we are currently restoring hardwoods to retired agricultural fields, within and to the north of project area. Acreages are incorrect.

Page 89, Item F.1. Dredging description is correct. However, all maps depict it as not going all the way to the pump station. will be shown all of the way on Fig. 17

Page 90, H-1: This pump should be included. We thought we would fund it as part of 1993 Flood Rehab., but could not. The pump station is fine, and need not be replaced. Present pump cost is $20,000. (Estimate from Peerless Pumps in 12/95.)

Measure H-2 is being recommended
until estimated
cost [illegible]

T-1

Page 90, I-Z. Eliminate the following portion: "Add pad for, ... cut ditch to interior lake." NOTE: This should save enough money to cover pump in item H-1, above.) See also page C-7. Page 95, Item U-1: USFWS believes this is a needed component; we are not "satisfied" with deleting it. However, USFWS agreed to delete this due to requisite USCOE cost-cutting. Please change wording to denote this. ✓done ✓done

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Table 12, Costs and Outputs
Page 100 There is an increase cost of $111,000 on this page -- Items B-2, D-1, E-1.
checked, it appears to be ok

Page 101 M-3 and O-6: We question the cost of these concrete structures; I would think they would be much higher, especially on State area (where coffer dams, etc., might be needed). Higher than $4,000 and $938,000? It is a rough est, but good enough for alternate evaluation.

Page 104 C. Real Estate Requirements. Throughout this report, there is differing acreages of land acquisition. Here it is 41 acres. Public Notice states 83 acres. In Appendix S, it gives ~~40~~ 41 acres (~~to 44~~ 42.0 MSL). Page S-4 shows 440.0. Appendix C-5, Item II.b.(2)(d), states 83 acres.
changed to 41 correct was incorrect correct

We also need to know the needs for this size and location of the berm. As stated earlier, we thought it would be lower in floodplain.

Also, there are questions as to the elevations. In Appendix C-5, Item II.b.(2)(d), it gives required elevation as 441.0. On Plate 1, elevation of 439.0 is shown. This is also what is in the Public Notice. Was lowered ... because of easement problems

---

? Page 106 in Section E.(2) on page 106: The dredge channel is listed as 50-60 feet wide. However, the drawing on Plate 12 shows only 45 feet. Does the larger measurement refer to upper portion of cut, or bottom?

Page 107, Section E(4) and Plate 8: All CMP's were removed on State and Federal areas as part of cost cutting exercise. They are unnecessary since there are stop log structures at all those locations. They have been removed from plates and text reference.

Page 107, Section F: Please delete the sentence: "Cropland not affected by the project will continue to be planted in small grains." deleted

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Page 127, 16.A. Location: Regarding total acres, this says project went from 2,069 acres to 2327. However, on page 7, it lists 3,327 acres, in Section 2.A. all habitat acreages to be checked.

All acreages (of wetlands, forests, croplands, etc.) do not correspond to other report areas, Appendix C or Public Notice. all habitat acreages to be checked

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Page 131. Cost was initially $6,537,000. We made approximately $2.5 million in cost cuts, so what is project cost now? Will be reflected in Table 15 when MCACES is complete

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Plate 1
1) CMPs gone (no # on plate)
2) ✓ Our figures show that the two gated CMPs at site 2, are/is a 40" CMPage (Could denote site as pump station).
3) What is Legend Item 3? Is it at pump station? Does it refer to same CMPs as in my #2, above? delete
4) Legend Item 4. This is correct. However, in other places in report, this is not listed as "portable" pumpage
5) Items 17 and 18 on Turner Island. These items were approved to delete at the Pere Marquette meeting. (These are the only items the State was cutting.) was deleted from table 11 & 12

T-1

Plate 12 Typical Section Earthen Levee. Is this correct? Should the elevation on "Interior Side" be 429 (not 419) for the borrow area? Cost and quantity for using this for the levee should be re-evaluated. For this cost, should be able to get wider levee that would be beneficial to State. Also, borrow area width is not stated. Needs to be as needed for width and depth, perhaps with minimum/maximum.

Plate 12 Typical Section Overflow: Where is this? If overflow is at 434.0, and 434.0 is normal pool, how will this function? (Plate 12 Overflow is 1/2 ft. lower than nearby berm.)

Also in APPENDIX C-2 through C-3

Page C-4

1) Delete paragraph: "A 15 cfs pump will be located on the river and will allow flooding of the unit when it is not possible to flood by gravity flow."

2) Third paragraph refers to 36" CMP with gate. There is presently no gate. Also, regarding sediment basin, we envision a berm with overflow structure instead of CMP.

3) Item iii: Refers to "An 8-foot stop log structure..." The quantity should be two, not one. Also, refers to "Three, 8-foot stop log structures..." There are 4, not

Page C-5:

1) Item 2(e): We question use of clam shell dredging. Such a dredge may be too big to get in. Don't know if it will work. The area in USFWS Middle Pool, could be dried enough to use an excavator or other means.

2) Item 2(e): How can 25 acres (page C-14) of dredge material taken on both State and Federal areas, create 40 acres of islands on USFWS?

Page C-8, Section II.e.(1) and II.e(4): Fill in the "?".

Appendix L-4 Cost Analysis, Items L-1 and L-2: Raising the elevations of levee incrementally, the costs do not make sense. (There is lower cost on the highest levee option.)

T-1

Written comments received from the public workshop held on 23 Apr 96. Responses in italics.

MR. OLIVER SIMON
RR1 BOX 182
HARDIN, IL 62047

I WOULD LIKE TO SEE QUITE A FEW POT HOLES DUG IN THE AREA TO ENHANCE DUCK HABITAT AND PROVIDE EXTRA FISHING. *Dredging to create deeper holes is being considered.*

I WOULD HOPE THEY WOULD NOT DO ANYTHING TO TURNER ISLAND. JUST WATCH THE MONEY. *IDNR agreed to delete from the recommended plan the boat pullover and portable pump and drive unit on Turner Island for cost savings.*

THERE SHOULD BE SOME CONSIDERATION TO THE HARBOR ACCESS AT COCKRELL HOLLOW. *Currently, the boat dock at Cockrell Hollow is on Corps property, and is leased to a sporting club. The lease expires in May 1997. It is the Corps' intention to negotiate either a new lease, a license, or some other sort of management agreement such that Cockrell Hollow will continue to be available to public access and to allow duck hunters the use of the area through the waterfowl season.*

JERRY KLOCKE
RR1 BOX 13
BATCHTOWN, IL 62006

I WOULD LIKE TO SEE AN EASY WAY OUT TO THE RIVER FOR THE OLDER MEN 60/70 YEARS OF AGE. I'D LIKE TO SEE YOU PULL A BOAT OVER THE ROLLERS AT 60/70 YEARS OLD. *We have deliberated on this, and we welcome suggestions. The entrance road into the USFWS area is open part of the year. Cockrell Hollow will remain open. Boat passage will be allowed through the stop-log structures on the proposed exterior berm in the IDNR-managed area if the stop-log structures are open.*

I WOULD LIKE TO SEE THEM DREDGE THE DITCH OUT. I THINK THE WATER FLOW WOULD KEEP THE SEDIMENT OUT OF THE BETTER HUNTING AREA. *Some dredging is proposed for overwintering of fish and for improving access.*

WHEN THEY DREDGE THROUGH THE EIGHTIES, I HOPE IT IS GOING TO BE TAKEN OFF THE BACKS AND NOT LEFT IN FRONT OF THE BLINDS. *Comment noted. The dredge material may be used for the construction of the lowland sediment traps in the USFWS and the IDNR areas.*

IF SEDIMENT PROTECTION AREAS FILL UP, I HOPE THEY DIG IT OUT. *The operating budgets of the USFWS and IDNR will influence the* *extent of maintenance dredging of the two recommended lowland sediment traps.*

MR. HAROLD W. SWEARENGIN
1214 W. PONTOON ROAD
GRANITE CITY, IL 62040

THE PROJECT SHOULD PROCEED AS PER THE DRAFT DEFINITE PROJECT REPORT. *Thank you for the comment.*

MR. JON HERRMANN
PO BOX 186
BATCHTOWN, IL 62006

CONCERN TO RIPRAP ALL OF LEVEE. *Rip-rap is being designed for the exterior berm, and will be shown in the Final DPR.*

PLANT TREES IN AREA WHERE [THEY WERE] DESTROYED ONLY. *The USFWS and IDNR will employ forest habitat improvements to offset the loss of trees from the flood of '93, and in other areas where tree survivability should be high.*

HAVE RIVER BOAT RAMP ACCESS. [A BOAT] PULLOVER DOESN'T WORK FOR HUNTING AND FISHING BOATS. *A boat pullover can be made for flat-bottom boats or for those with a v-shaped hull. Additionally, access will be available through the stop-log structures when they are open.*

MR. DAN PLUESTER
220 SOUTH GATE
FREEBURG, IL 62243

TREE PLANTING: I DON'T WANT ANY TREES PLANTED ANYWHERE EXCEPT WHERE HARDWOOD WAS DAMAGED BY THE '93 FLOOD. *The USFWS and IDNR will employ forest habitat improvements to offset the loss of trees from the flood of '93, and in other areas where tree survivability should be high.*

WE NEED TO GET ALL OF THE BRUSH OUT OF THE BOTTOM AND PLANT HARDWOODS BEHIND 70'S, 30'S ETC. THE BRUSH NEEDS TO BE CLEARED OUT FIRST. *Consideration has to be given to the importance of brush and cover for habitat before deciding to clear it. This measure could be implemented separately from this project as part of the USFWS and IDNR's management of the area. Much of the brush may be impacted by improved water level management.*

CHRIS FRANKE
PO BOX 218

HARDIN, IL 62047

I AM AGAINST PLANTING HARDWOOD TREES ANYWHERE OTHER THAN THE WOODED AREAS DAMAGED BY THE '93 FLOOD. *The USFWS and IDNR will employ forest habitat improvements to offset the loss of trees from the flood of '93, and in other areas where tree survivability should be high.*

MR. RICHARD BIEKER
RR1 BOX 197
FIELDON, IL 62031

I PROPOSE THAT THE LEVEE SHOULD BE RIPRAPPED AT LEAST TO THE LOWER END OF TURNER ISLAND. *Rip-rap is being designed for the exterior berm, and will be shown in the Final DPR.*

IN AN OPEN RIVER (FLOOD), FOR EXAMPLE [DURING THE] FLOOD OF '93, A DIRT LEVEE WOULD NOT HOLD UP TO SUCH DESTRUCTIVE CURRENTS. *Most levees are not destroyed by overtopping. There will be an overflow structure in the proposed exterior berm at the IDNR-managed area to equalize interior and exterior water levels prior to overtopping at other locations.*

[NEED A] BOAT RAMP FOR RIVER ACCESS. *The addition of a boat ramp was considered (p. 97, Draft DPR). The roadway on the berm would be inadequate for two-way travel. An additional boat ramp would require the construction of a parking lot. There is no convenient way for land vehicles to access the exterior berm except through the entrance to the USFWS area--which already has a boat ramp. Additionally, access will be available through the stop-log structures when they are open.*

BERNIE JOHNES
RR1 BOX 15
BATCHTOWN, IL 62006

THE PROJECT IS MAKING GOOD PROGRESS AND SHOULD CONTINUE TO PROCEED AS SOON AS POSSIBLE FOR THE FUTURE OF THE RECREATION AREA, AS WELL AS TO PROVIDE FUTURE PLANS TO HELP CONTROL THE EROSION AND SILTATION PROBLEM WHICH IS OCCURRING ALL THE TIME. *Thanks for the comment.*

THE CALHOUN SCS OFFICE NEEDS TO BE INVOLVED IN THIS PROJECT AS ONE OF THE MAJOR PARTIES. *The NRCS developed the hillside sediment control plan and has made it an important component of this project.*

THERE HAS TO BE SOMETHING DONE AS SOON AS POSSIBLE FOR THE FUTURE OF THE AREA AND THE RIVER.
Thanks for the comment.

RICHARD SNYDERS
PO BOX 187
BATCHTOWN, IL 62006

I THINK THIS IS A VERY IMPORTANT PROJECT FOR THIS AREA. I ONLY WISH IT WAS DONE 20-YEARS AGO. *Thanks for the comment.*

I AM 38 YEARS OLD. WHEN I WAS IN MY EARLY TEENS OUR REFUGE HELD HUNDREDS OF THOUSANDS OF DUCKS AND THE FISHING WAS ALWAYS THERE. *Thanks for the comment.*

THE PLACE WHERE I USED TO DOCK MY BOAT AT TITUS HOLLOW IS NOW FILLED IN, AND WATER IS NOWHERE AROUND. *Thanks for the comment.*

I LIKE THE PROJECT AS A WHOLE. I AM GOING TO WORK WITH MARTHA SHEPPARD ON THE HILLSIDE EROSION, BECAUSE CATCHING THE SILT AND KEEPING IT OUT OF THE BOTTOM IS MY MAJOR CONCERN. *Thanks for the comment.*

THERE IS A MAJOR BOAT CHUTE ABOUT A HALF MILE DOWN [THE] 40s CHANNEL ON THE RIGHT, THAT CONNECTS THE 40s CHANNEL WITH THE PRIME HUNTING AREA. DREDGING OR DIGGING THIS OUT WILL HELP KEEP A STRONG CURRENT RUNNING THROUGH THE LAKE ALL THE WAY TO THE SPILLWAY. *Thanks for the comment.*

I WOULD LIKE TO MAKE SURE THAT WHEN DREDGING THROUGH DIXON POND, THE DIRT OR DREDGE MATERIALS ARE DISPOSED OF. THAT CUT IS BETWEEN TWO OF THE BEST DUCK BLINDS WE HAVE. *Thanks for the comment.*

I THINK DIGGING OUT THE REFUGE WILL HELP [THE] FISHING GREATLY. I THINK THE DEEPER WATER WILL HELP US TO HAVE GOOD FISHING YEAR-ROUND. *Thanks for the comment.*

I WOULD LIKE TO HAVE ACCESS TO THE RIVER WITH THIS NEWLY BUILT ROAD. I THINK WE SHOULD HAVE ACCESS YEAR-ROUND. *The only road being proposed is on top of the exterior berm. There will be no access to this road by land at the L&D No. 25 overflow structure; the only other access by land will be from the USFWS entrance road--where there is an existing boat ramp. Additionally, access will be available through the stop-log structures when they are open.*

I THINK REPLANTING TREES IS A GOOD THING, BUT THEY SHOULD PLANT THEM WHERE THEY HAVE A CHANCE TO GROW. THEY WON'T LIVE OUT THERE. JUST LOOK AT HIDDEN LAKE WHERE THEY HAVE PLANTED THEM MANY TIMES IN THE LAST SEVERAL YEARS. THERE ARE VERY FEW LEFT DESPITE WHAT THE [USFWS] MANAGER SAYS. *The USFWS and IDNR will employ forest habitat improvements to offset the loss of trees from the flood of '93, and in other areas where tree survivability should be high.*

I REALLY LIKE THIS WHOLE PROJECT. THANKS FOR LETTING US HAVE A SAY SO. *Thanks for the comment.*

MR. RANDOLPH COUGHLIN
RR4 BOX 210
JERSEYVILLE, IL 62052

AS WE SEE THE BATCHTOWN AREA NOW:

WE HAVE ONLY ONE ACCESS POINT TO PUT IN BOATS TO THE RIVER.

WE NEED AN ACCESS POINT TO THE RIVER CLOSE TO THE HUNTING AREA. THE ONLY PLACE LIES IN THE MARK TWAIN REFUGE AT BATCHTOWN. THE ROAD IS BUILT TO THE RAMP AND PARKING LOT, BUT THE ROAD IS CLOSED DURING THE HUNTING SEASON. *The availability of the USFWS's boat is related to the management of the refuge, and not an issue addressed by an HREP project. The addition of a boat ramp was considered (p. 97, Draft DPR). Access will be available through the stop-log structures when they are open.*

IT IS UNSAFE TO TRAVEL DOWN THE RIVER FROM REDS LANDING TO OUR HUNTING AREA. ONCE THE LEVEE IS BUILT WE WILL HAVE NO ACCESS TO THE RIVER. THIS ACCESS IN THE REFUGE IS VERY IMPORTANT TO EVERYONE CONCERNED. *There will be access if the proposed boat pullover is used, and access will be available through the stop-log structures when they are open.*

MS. AUGUST S. WALLENDORF
PO BOX 28
BATCHTOWN, IL 62006

MY CONCERNS ARE AS FOLLOWS:

THE WATER MUST BE SUFFICIENTLY MAINTAINED DURING WATERFOWL SEASON. *That is one of the project objectives, as depicted in the water management plans, Figures 18 and 19.*

HARDWOOD TREES SHOULD BE PLANTED ALONG THE OTHER BANKS OF THE BOTTOM ON THE SHORELINES. *Comment noted.*

IF THEY WANT THIS BOTTOM TO BE THE WAY IT WAS 30-YEARS AGO, THEY WOULD NOT PLANT ANY TREES, BECAUSE MOST OF THE TREES WERE CUT DOWN TO MAKE WAY FOR PROGRESS. *A 1991 Corps policy guidance letter defines the "restoration of fish and wildlife habitat resources" as returning these resources to a "modern historic condition." The goal of this EMP project is to rehabilitate and enhance wetland habitat by using acceptable and cost effective measures.*

I THINK THE LEVEE HEIGHT SHOULD BE RAISED TO HIGHER ELEVATION SO

THE WATER WILL COVER MORE SURFACE AREA. *Not exceeding the height of the overflow structure associated with L&D No. 25 was the primary constraint.*

ALSO, WE ARE GOING TO NEED AN ACCESS TO THE MAIN RIVER OR KEEP THE REFUGE ROAD OPEN. *Access to the main river will be by a boat pullover on the proposed berm, and access will be available through the stop-log structures when they are open.*

MR. NICK SIEMER
P.O. BOX 65
BATCHTOWN, IL 62006

THE PROJECT HAS MY SUPPORT. *Thanks for the comment.*

I WOULD LIKE TO SEE THE REFUGE ROAD AND BOAT RAMP OPEN YEAR-ROUND WITH AN ALTERNATIVE BOAT RAMP ON THE PROPOSED BERM. *The availability of the USFWS's boat ramp is related to the management of the refuge, and not an issue addressed by this project. The addition of a boat ramp was considered (p. 97, Draft DPR). The roadway on the berm would be inadequate for two-way travel. An additional boat ramp would require the construction of a parking lot. Access will be available through the stop-log structures when they are open.*

I AM CONCERNED ABOUT RIVER ACCESS. *Comment addressed above.*

I SEE NO NEED TO PLANT TREES IN THE HUNTING OR REFUGE AREA. *Thanks for the comment.*

THE YEAR I WAS BORN, MY DAD WAS ON A TREE CUTTING CREW, CLEARING THE AREA OF TREES. *Thanks for the comment.*

I HAVE SOME CONCERN ABOUT ACCESS TO "BIG HOLE" AREA BY BOAT. *By proposing a dredge cut we are attempting to provide and maintain fish passage and boat access to "Big Hole."*

Partners For Wetlands

P.O. Box 29 Alton, Illinois 62002

Honorable Richard J. Durbin
US Congressman, 20th Congressional District, Illinois
129 Cannon HOB
Washington, D.C. 20515

April 29, 1996

Dear Congressman Durbin,

At last the Draft Project Report (DPR) for the Batchtown Environmental Management Program (EMP) wetland restoration project is complete. A public meeting was held by the St. Louis District Corps of Engineers (COE) on April 23. Now the Draft Report will be proofed and a Final Draft sent to Washington for approval to begin the plans and specs stage.

<u>Now for the bad news!</u> Funding for the EMP program has never matched the time-line of the work being accomplished. For instance, early on in the program, the St. Louis District COE was receiving more dollars than what it could use; therefore, the extra dollars weren't spent. Now that we have four major projects in the construction mode, or close to it, the existing funds aren't enough to complete the projects as presently planned. To make matters worse, EMP has a sunset date of 2002. Even if we could wait for better budget years, (which I am not in favor of because we need to complete these projects rather than create a jobs' program), EMP would be over.

The St. Louis District COE has begun stripping features from the Swan Lake, Stump Lake, Batchtown, and Calhoun Point projects in order to cut costs and match the estimated budget. These cuts, however, aren't reflected in the DPR. For instance, $3 million have been pared from the Batchtown project already. I am satisfied that some of the cuts were understandable since the COE is known for over-engineering now and then. But now we are down to bare bones and further cost saving measures are sure to impact on the integrity of the project. We are too far down the road to success to let this happen.

It appears that there are several avenues that could be taken to remedy the problem and keep our projects whole. First, if we could get the existing unspent funds reallocated to the St. Louis District, we might be okay. Second, if EMP was awarded the full funding specified by the original legislation, we would be fixed. Last, if we had an extension of the project sunset date beyond the 2002 deadline in hopes of continued funding, we also would be in good shape.

Congressman Durbin, in regard to EMP, we have spent taxpayers' dollars wisely up to this point. Your strong support for hillside sediment treatment has set a precedent for future wetland rehab endeavors and made the projects in your district a yardstick for similar ecosystem management to be measured by. It would be an absolute insult to taxpayers and the environment not to see these EMP projects funded to a level that will ensure project integrity and completion.

Sincerely,

Greg Franke
Project Chairman PFW

cc: USFWS, Region #3 Project Leader
IDNR, Director
MWHI, President

To: Sharon Cottner 2 pages

T-3

ILLINOIS
DEPARTMENT OF
NATURAL
RESOURCES

MEMORANDUM

to:

from: Marvin Hubbell

date: Neil Booth

subject: 4/30/96

Batchtown Draft DPR

I offer the following comments on the subject report.

All dredging is identified as clam shell removal and side casting for disposal. In the case of the dredge cut on the north end of the State area I would like to offer some other options. This particular location is narrow and side casting in this area would just add to the congestion and eliminate more herbaceous wetlands. I would think due to the close proximity of the Titus Hollow lowland sediment trap part of this material could be utilized in the construction of the berm. Once the trap is constructed I would like to see it used as a hydrualic dredge spoil placement area for the rest of this cut.

I would like to see the Titus Hollow lowland sediment trap re-aligned so it does not include any of the open wetlands in this area. Where the south leg ties into the bluff I would recommend that it be moved north approximately 150 feet. If these open areas are enclosed by the sediment trap berm they would have an extremely short future. These open areas and herbaceous zones are the habitats we are trying hardest to preserve.

There should be a small jib crane installed at all stop log structures to facilitate the removal of the logs. There should be adequate room to turn a vehicle around at the structure locations. We will also need to have vehicle access over some of the structures so we can reach the rest of them.

I stress that there be substantial revetment on the extrior berm from the south end of the exposed land to the lock 25 overflow structure.

This is about all I have I felt we had a good turnout at the meeting and think we should see some good comments.

c Rick Messinger
Deck Major
Dave Harper
Butch Atwood
Mark Phipps
Tom Wilson

T-4

page 1/1

Responses from Corps to Neil Booths's comments.

Titus Hollow Lowland Sediment Trap

The District agrees that the dredge cut to Big Hole provides an opportunity to incorporate disposal material into the berm around the sediment trap and have less of an adverse impact on the herbaceous wetland. The District will pursue this objective through the design and specifications stage to the extent that it is possible without unduly increasing the cost of this measure. The District agrees that additional herbaceous wetlands can be preserved by moving the alignment of the berm 150 feet north as long as private property will not be impacted.

Stop Log Structures and Revetment

The design for the stop log structures includes a jib crane to facilitate the removal of stop logs. The design for the riverside berm along the state managed portion of the project provides for a substantial amount of revetment along the exterior of the berm.

PD-F

United States Department of the Interior

Fish and Wildlife Service
Mark Twain National Wildlife Refuge
1704 N. 24th Street
Quincy, Illinois 62301

Gave original to [illegible] 5/8/96

May 3, 1996

Mr. Owen D. Dutt
Chief, Planning Division
U. S. Army Corps of Engineers
St. Louis District
ATTN: CELMS-PD-F
1222 Spruce Street
St. Louis, MO 63103-2833

Dear Mr. Dutt:

We have reviewed the draft Definite Project Report (SL-8) with Integrated Environmental Assessment for the Batchtown Habitat Rehabilitation and Enhancement Project dated March 1996. This project is important for restoring and enhancing wetland habitat for migratory birds, wintering and spawning fish, mussels and other wildlife using the river corridor. The management strategy for the project will provide for fish access and survival of the mussel beds in the project area.

The Service supports the need for hillside sediment control to reduce sediment accumulation in the Batchtown wetlands. However, this represents an expansion of the project area and, therefore, additional consideration needs to be given to historic preservation and endangered species issues relative to the expanded project area and also feature changes within the original project area.

We strongly encourage additional evaluation of options for the lowland sediment trap, measure D-1. If situated as shown in Figure 12, page 79, the levee for the trap could be constructed with spoil from dredge cut measure F-1. Could this location for the levee eliminate the need for a flowage easement or acquisition of private land? The levee location as shown in Figure 17 may require purchase of an estimated 41 acres of private land. The Service is not funded for easement acquisition costs, and thus EMP project funds must be available for acquiring the easements and for Realty personnel negotiating for the easements. Since the Service lost $200,000 of EMP funding for administrative overhead, we have no other source of funds to cover these costs.

Alignment of the levee for the Dixon Hollow sediment trap, measure E-1, should be designed to minimize impacts on existing wetlands in the area. Over wintering habitat for fish requires a minimum depth of 7 feet. Therefore, segments of dredge cut measures F and G should be designed to provide 7 feet deep winter sanctuaries for fish. Figure 12 shows a cut of only 5 feet.

Access both to the Mississippi River and to the Batchtown hunting area is a sensitive and significant issue with local citizens. Although access structures do not provide habitat, they are essential for the public using the area and access opportunities must not be diminished as a result of the project. Boat pullovers and other access measures should be considered an essential part of the project (overall access will be considered in development of the Corps Riverlands Master Plan).

Apparently, a compatibility determination has not been made for this project. I will initiate the document for approval and provide a copy to you by June 30.

Thanks for the opportunity to comment on the Definite Project Report. We are looking forward to the fish and wildlife habitat improvements that this project will provide.

Sincerely,

Ross Adams

Ross Adams
EMP Coordinator

cc: Refuge Manager, Mark Twain NWR
Brussels District
UMR
ARD/GEO3
ARD/GEO2
RHPO
Fisheries (Marion)
ES (Marion)
RIFO

T-6

Response comments from Corps to U.S. Dept. of the Interior, USFWS, Mark Twain National Wildlife Refuge, comments on Draft DPR, dated 3 May 96.

para. 1. Thanks for the support.

para. 2. NRCS responded in T-8.

para. 3. The lowland sediment trap in the USFWS Middle Pool was redesigned by the NRCS (following an on-site meeting between the Corps, USFWS, and NRCS) in late July 1996 to eliminate the acquiring of any land or the taking of any easements.

para. 4. Realignment of lowland sediment trap in the USFWS Lower Pool noted. However, the scale of the drawings in DPR is not large enough to reflect the movement of the levee by 150 feet or so. Dredge cuts changed to 7 feet.

para. 5. Access to the main river will be by a boat pullover on the proposed berm, and access will be available through the stop-log structures when they are open.

para. 6. A refuge compatibility statement dated June 12, 1996, was received.

Response comments from NRCS to U.S. Dept. of the Interior, USFWS, Mark Twain National Wildlife Refuge, comments on Draft DPR, dated 3 May 96.

Historic preservation for the Hillside Sediment Control Program:

Archaeologist Sharron Santure is employed by NRCS to oversee the preservation of cultural resources. In May 1995 she held a 3 day training session at the Brussels Refuge Headquarters. This session, like those held elsewhere within the state, was to show employees how to use NRCS procedures to protect known sights or be able to identify unrecorded sights and protect them also. All field employees currently working with the Swan Lake Watershed have had this training. It is a required training for all NRCS and SWCD employees. At the Hardin Field Office, Joe Swan, Resource Conservationist, has served as our Cultural Resource Contact since 1993.

Since our office works on private property, the exact location and extent of practices is usually not known too far in advance. The normal procedure followed is: When an area is identified that will have a conservation practice constructed the enclosed form (see Appendix M, encl. M-2) is filled out and sent to Sharron.

Sharron has access to the Illinois State Museum's databases of known sights. She checks the location with the database, notifying us of any sights near the project area. If a sight is located near the proposed practice, Sharron visits the sight to determine what action should be taken next. She also serves as our contact person with the State Historic Preservation Office.

Endangered Species Plan for the Hillside Sediment Control Program:

Mark Phipps, IDNR Natural Heritage Biologist, is on our Technical Advisory Team. He has visited the watershed area with me. We discussed different approaches that could benefit endangered species and Mark has agreed to help us with a plan of action. No inventoried natural areas are present in the watershed. However, I think there may be some local interest and an educational program on endangered species would be well received. An environmental impact form is filled out by NRCS on all undertakings. Mark said that since we are dealing with small areas on private property and exact locations of structures are not determined very far in advance it would probably be best to work on a case by case basis. If Fish and Wildlife or the Corps has any specialist that would like to work with us on an endangered species plan, let's schedule something. We have a current county list of endangered and threatened species along with pictures and/or description of each as a reference for everyone working in the field.

P.O. Box 372
Tolono, IL 61880
May 8, 1996

U.S. Army Corps of Engineers
St. Louis District
Attn: CELM-PD-F (Kirkpatrick)
1222 Spruce St.
St. Louis, MO 63103-2833

Dear Sirs:

The Illinois Waterfowlers Alliance is very pleased with how you have uniquely and diversely developed the Batchtown Habitat Rehabilitation and Enhancement Project draft (DPR) when compared to other EMP projects.

For Illinois waterfowling sportsmen, river access is a very important concern. Access through the USF and Wildlife Service refuge to a boat ramp on the river would be quite beneficial. We believe the public would have little or no impact on the waterfowl use of the refuge by providing this access.

We feel that the hillside treatment part of this project is of great importance. Hillside conservation treatment to help manage soil erosion from entering the waterways is very crucial. Sportsmen feel there should be more hillside treatment consideration in all EMP projects.

The Alliance would question the need for the interior water control structure between the USFWS lower pool and the state managed area. There is no good reason for this structure when the area can be managed with the rest of the state managed area.

We greatly appreciate the opportunity to have input on such an important habitat rehabilitation and enhancement project. The sportsmen feel you have developed an outstanding plan for this Batchtown EMP project. Again, thanks for your interest and hard work.

Sincerely,

Richard Behrends

Richard Behrends
Illinois Waterfowlers Alliance

T-9

Corps' Response to Comments Received from the Illinois Waterfowlers Alliance, dated 8 May 96.

para. 1: Thanks for the support.

para. 2: Year-round river access through the USFWS entrance into the refuge has been an issue in many public comments. However, this is a refuge management issue that the USFWS has certainly considered--and will likely continue to discuss with the public--and is largely an issue separate from the scope of this project. Although the proposed exterior berm at the IDNR-managed area will impede open access to Pool 25 from Cockrell Hollow, access will be available by using a boat pullover and through the stop-log structures when they are open. The berm is an effective measure for meeting most of the project objectives, and has positive net benefits for habitat.

para. 3: Thanks for the support of the hillside sediment control program.

para. 4: The stop-log structure between the USFWS lower pool and the IDNR-managed area will allow fish and boat passage along a dredged channel leading to Big Hole.

PD-F

SIERRA CLUB-PIASA PALISADES GROUP

CONSERVATION CHAIRMAN

Gave original to Kirkpatrick 5/10/96

Owen Dutt
Chief, Planning Division
Army Corps of Engineers
1222 Spruce Street
St. Louis, MO 63103-2833
May 8, 1996

Dear Mr. Dutt:

Thank you for the extension of time for commenting on the Batchtown EMP project, which we oppose other than the work to keep the sediment out of the river. We will do the best we can in this short time frame. We believe an additional 60 days should be given. Corps regulations state the "EA is a brief document . . . the EA normally should not exceed 15 pages . . ." 33 CFR § 230.10. The Batchtown EA is over 100 pages and includes hundreds of pages of appendixes.

Sincerely,

Jim Bensman
117 North Shamrock ST APT #1
East Alton, IL 62024-1149
(618)259-3642, Fax also, Call First!
Internet: jbensman@ezl.com

May 21, 1996

Planning Division
Plan Formulation Branch

Mr. Jim Bensman
117 North Shamrock St., Apt. #1
East Alton, Illinois 62024-1149

Dear Mr. Bensman:

Thank you for your letter dated May 8, 1996. Your letter stated that "The Batchtown Environmental Assessment is over 100 pages and includes hundreds of pages of appendixes." Actually, that bound document that you received is the main report and technical appendices, and its length is in line with other Corps Habitat Rehabilitation and Enhancement Project (HREP) reports. Nor, is it entirely an Environmental Assessment (EA)--the EA is integrated primarily within the existing conditions, and future with and without conditions. Much of the main report addresses plan formulation and evaluation, and the appendices provide other necessary information for the decision making process.

If you have any questions please contact Mr. Dave Kirkpatrick at (314) 331-8492.

Sincerely,

/s/

OWEN D. DUTT
Chief, Planning Division

Marvin Hubbell

Butch Atwood

May 15, 1996

Batchtown HREP Draft DPR

Have reviewed the subject document, and Neil Booth (4/30/96) and Mark Phipps (4/23/96) memos and concur with all. The project should be built. The recommended plan is justifiable because it represents an honest attempt to integrate a diverse set of objectives into a project with the high degree of management flexibility needed to manage the complex of habitats and habitat needs of the biota of this unique area.

The draft DPR does a good job of describing existing conditions, resource problems and opportunities, evolution of the recommended plan and project benefits. There are, however, three outstanding issues that probably should be discussed in the DPR: sedimentation rate with and without project, the effects seasonal relocation of pool control point may have on project design and management, and effects the possible enhancements of Lock & Dam 25 may have on project design and management. Brief discussions of each of these items follows. Minor editorial comments are in an attachment to this memo.

Sedimentation Rate

Everyone agrees that the project site is a depositional area (point bar) due to its location on the inside of a bend. Regardless of what we do this area will, at some point in the future, convert to mostly terrestrial habitat and, its morphological appearance is likely to evolve into something very similar to its predam characteristics - forested wetland interspersed with wet meadows, backwater lakes and sloughs - but we'll leave that for the river engineers to predict and the river to decide.

The unresolved issue that's at the crux of the sedimentation rate problem appeared in a reply to a District WOTS request from WES (Memorandum for Record from William A. Thomas and Barry S. Payne dated 25 October 1991 [under 26 Nov 91 cover]), a copy of which is located in the draft DPR in Appendix D - Correspondence and Memos, Encl D-2. WES was tasked with comparing Plans A and B, "with respect to their effects on depositional patterns and the future welfare of the mussel bed in the project area". The issue

Page 18	under G.(4) Fish - It's guessing and too generic to say that fish spawning is "interrupted" when the pool is on tilt. Although a rather large proportion of the area is dewatered, about an equal proportion remains inundated, no doubt providing spawning habitat for a variety of fish species. Without definitive studies to prove otherwise, it would be more acceptable to say that spawning habitat may be reduced at maximum drawdown. Also add main channel to the last sentence of the 1st paragraph in this section. The literature cited section (Appendix Q) does not contain a reference corresponding to Sheehan, et al. 1990
Page 25	1st paragraph, 3rd sentence - Unsure what the phrase, "...,but still has depths of four to seven feet below the depth that is found at the entrance of the channel where it connects with the Mississippi River.", means. Please clarify.
Page 107	Chapter 12. F. Management - This may be a good place to discuss how seasonal relocation of Pool 25 water level control point may affect project management.
Plates	There's a discrepancy between Plates 1 and 8: concerning SITE 1. Plate 1 shows 1-8' wide stoplog structure while Plate 8 shows 1-42" CMP G. Plate 1 agrees with Figure 17. If Plate 8 is in error, SITE 1 needs to be added to the Stoplog Struct. Table in Plate 9.

in question is stated in paragraph 14., pertinent parts of which are quoted below.

> "Present hydraulic conditions could exist over the mussel bed until the storage prism for water is exhausted. With no action, Plan A, or Plan B, this storage prism will someday be exhausted. The rate of loss will be greater under Plan A than under Plan B. ... However, we believe that even Plan B places the mussel bed at increased risk of earlier demise than would occur without any levee construction within the storage prism of the Batchtown Project area."

Although the present recommended plan (Plan C-2) was not considered by the WES scientists, the point made in the above paragraph appears to be that any project involving levee construction will increase the sedimenation rate and thus increase the rate aquatic habitat converts to terrestrial. If this is likely the case, then the DPR should not imply that the HREP will prolong the 'life' of the project area. If it's not likely to be so, the DPR needs to reconcile the above statements.

Seasonal Relocation of Pool 25 Water Level Management Control Point

Reviewers of the DPR may be interested in knowing that there is a proposed 1135 project for Pool 25 that will change the way water levels are controlled and also in knowing how this change will affect the management of the Batchtown HREP (i.e. compare and contrast annual water level management scenarios with and without relocation of the control point).

Possible Enhancements of Lock & Dam 25 (Nav. Expansion)

If the Navigation Feasibility Studies justify and Congress approves an increase in navigation capacity on the Mississippi River and Illinois Waterway it's possible that a new second lock will be constructed at Lock & Dam 25. If the new lock displaces a water control gate, then a new replacement gate will have to be constructed. The design and placement of this gate could affect design and management parameters of the Batchtown HREP and should, therefore, be given some consideration in the DPR.

We note that USFWS-MISO(ES), in their draft Fish and Wildlife Coordination Act Report (page G-17 in draft DPR), recommended development and utilization of a micro-model to determine sedimentation patterns for this project . We strongly support this recommendation and believe such a model would not only be extremely useful for examining sedimentation and flow patterns within the project area, before and after HREP project implementation, but could also be very helpful in determining the effects and opportunities presented by seasonal relocation of water level control point and enhancements to Lock & Dam 25.

Use of the micro-model during the design and specifications phase of the HREP process could be helpful in determining the precise location of water control structures and overflows, and berm alignments. Most participants would agree that some of the existing features of the project area (i.e. the scouring that occurs throughout the area when the pool is in the tilted condition) should be preserved if at all possible. A micro-model may help us determine how these existing features work and how they can be maintained and possibly enhanced. It may also be useful in developing the most efficient and effective water level management plans, with and without dam point control for instance. In the longer run it may provide us with some guidance if, and when, enhancements are made to Lock and Dam 25.

Finally, we'd recommend the beneficial use of dredge material from channel maintenance activities whenever and wherever possible for constructing this project.

If you have any questions concerning these comments please call.

cc: Debbie Bruce
Bill Bertrand
Bob Schanzle
Rick Messinger
Neil Booth
Deck Major
Larry Cruse
Mark Phipps

bc: Joyce Collins
Gorden Farabee
Ken Lubinski
Rob Davinroy

Batchtown HREP Draft DPR editorial comments (Atwood)

Page 1 — 1st sentence - Replace <u>restoration</u> with either rehabilitation or enhancement or both, this is not a restoration project.

Page 11 — 2nd paragraph under E. - An interesting addition to the DPR would be an historical map showing this area during the pre-dam era (eg. 1881 COE map).

Page 13 — under E. (4) <u>Backwaters</u>. - Acreage total of 1900 for backwaters must be in error since water acreage for entire project area is 929.

Page 14 — second complete paragraph, 2nd sentence - A word of caution in stating that maximum tilted pool pool conditions pose major problems for fish. When standing on the wildlife viewing stand at Cockrell Hollow during maximum tilt, it's intuitively obvious that conditions for fish must be poor because water levels are so low. This intuition, however, may be caused by distortions in the conceptual lens through which we observe the physical area and try to assess the interactions of the dynamic components of the area. Two lines of fundamental evidence seem to indicate conditions for fish may not be so bad.

Potomologists have taught us that the tilted condition is actually the 'natural' river condition (i.e. similar to pre-dam conditions) while the pooled river is the altered condition. A quick look at a pre-dam era map clearly shows that the Batchtown area was predominantly floodplain containing a diverse mosaic of floodplain habitat types. A free flowing river is always on tilt.

Secondly, the largest proportion of the species in fish assemblages that inhabit the UMR are river fishes. They have evolved under conditions created by floodplain rivers and are, therefore, superbly adapted to the dynamic fluctuations of water and other resources typical of these systems.

There's some likelihood, then, that a river fish's 'view' of the habitat conditions when the pool is on tilt is not nearly as negative as our own. If habitat conditions do become unfavorable, fish can temporarily move to areas where more favorable conditions prevail. While max. drawdown may negatively impact the spawning success and overwintering conditions of some species some years there's no hard evidence to suggest these drawdown events "pose major problems for fish".

Page 17 — Delete 1st paragraph - it's a duplication of a paragraph from page 13 under E.(3).

Responses to comments received from Butch Atwood, IDNR, dated 15 May 96.

Sedimentation Rate

It is our understanding that a low riverside berm will keep out the frequent sediment-bearing low-flow floods from the Mississippi River, and that a hillside sediment control program will additionally reduce sediment input into the project area.

Proposed 1135-Pool 25

The proposed 1135 for the seasonal relocation of the water control point in the pool will be included as an appendix in the final DPR. Relocation of the water control point in the pool will not impact the proposed water control plan for the management of Batchtown. The plan would remain essentially as depicted in Figures 18 and 19 for the FWS pools and the state managed area, respectively.

Possible enhancements of Lock & Dam 25 (navigation expansion)

The following text was included in a version of the Draft DPR, but was evaluated during an internal review as being too speculative and was stricken from the report: Concurrent with this report, the U.S. Army Corps of Engineers is conducting a separate navigation feasibility study (Upper Mississippi River-Illinois Waterway System Navigation Study). If this navigation study determines that increased navigation capacity in the Mississippi River is warranted, one recommendation may be to add a second lock to the existing Lock and Dam No. 25. This could require replacing one or more tainter gates on the dam, and that could mean that an old tainter gate could be relocated into the Batchtown project area (adjacent to the Illinois shoreline) and used to provide additional flow through the state-managed area and over the dam/spillway.

Micro-model of the Batchtown Project

The District concurs that a micro-model of the project could be useful in determining sedimentation patterns in the project area and in determining precise locations of water control structures, overflows and berm alignments.

The Corps' Potomology Section estimates that a micro-model of Batchtown would cost about $60,000 and take 5 months to complete. Should EMP be reauthorized by Congress, funds may become available to develop such a model. Current funding levels do not appear adequate to address this need.

Editorial Comments

Page 1 - Comment noted.

Page 11 - Comment noted.

Page 13 - Comment noted, acreage figure will be revised.

Page 14 - Comment noted, second paragraph will be modified.

Page 17 - Comment noted, paragraph will be deleted.

Page 18 - Comment noted, section will be modified.
Comment noted, main channel will be added to spawning habitat.
Comment noted, reference will be added to Appendix Q.

Page 25 - Comment noted, sentence will be clarified.

Page 107 - Comment noted.

Kirkpatrick

CF Gates
6/3/96

CELMV-ET-P (CELMS-PD/5 Apr 96)(1105-2-10c) 1st End Mr. Arnold/
lr/601-634-5836
SUBJECT: Upper Mississippi River System - Environmental Management Program, Batchtown Habitat Rehabilitation and Enhancement Project, Illinois, Draft Report

CDR, Lower Mississippi Valley Division, Vicksburg, MS 39181-0080

21 MAY '96

FOR Commander, St. Louis District (ATTN: CELMS-PD)

The comments enclosed (encl 2)are provided for your consideration. Although we were not requested to perform a technical review of this project, we did note some issues related to technical matters as well as conceptual aspects of the project. Note particularly Comment S under Specific Comments concerning the two proposed 54-inch pipes and gatewell structure. Our staff is available for discussion of these comments if needed. It is suggested that you include a response to these comments, as appropriate, in your Technical Review Package for the report.

FOR THE COMMANDER:

2 Encls
1. wd
2. added

JAMES R. HANCHEY
Director of Engineering and
Technical Services

CF: CENCD-PE

BATCHTOWN HABITAT REHABILITATION AND ENHANCEMENT PROJECT
CELMV Comments

1. General Comments

a. This report reflects the significant effort the district carried out to accommodate all the concerns various interests had with development of a project at the Batchtown site. It is commendable in this respect. However, the report is unclear with reference to the nature, cost, and justification of certain project features, such as the riverside berm, and it fails to achieve consistency when descriptions of the recommended plan are addressed in the different parts of the report and supporting documents. These concerns are addressed in more detail in the specific comments below.

b. The report contains no technical review package as specified by CELMV 23 Sept. '95 guidance on Quality Control and Quality Assurance. The status of preparation of the Quality Control Plan should be addressed.

c. Selection of inefficient measures as explained in Table 11 of the main report is not clear. Compelling reasons for deviation from the cost effective plan should be explained. For example, cost effective measure would not satisfy partner's flow requirements (measure O-6).

d. With the relatively large cost estimate for this project, there is concern about the ability of the Corps to implement it with our current budget situation. The ongoing budget review of all aspects of the EMP underscores this concern. It is also noted that much remains to be done in accomplishing detailed design for the project, which could lead to even higher costs. Consideration should be given to how the project might be phased, or possibly reduced in scope, taking these points into consideration.

e. The report should be reviewed by the SLD Potamologist to ensure compatibility with pool regulation.

f. In Appendix S, it should be stated that the local sponsor will be responsible for the right-of-way and an assessment of local sponsors' land acquisition experience and ability to acquire should be included. The section should also contain a statement whether facilities will have to be relocated. Included also should be a preliminary attorney's investigation of compensability and information as to how this affects land acquisition and costs, if facilities are involved. The section should also contain a statement concerning potential HTRW lands.

g. It is our general policy to have Regulatory Branch to determine the extent of jurisdiction under the Clean Water Act, Waters of the U. S., including wetlands. They should either write or review the Section 404 (b) (1) evaluation. If this is not the case, you should coordinate with that office.

2. Specific Comments

a. Pages 13 and 17. Flow velocity is discussed here and possibly elsewhere in terms of c.f.s.

b. Page 21, next to last paragraph and elsewhere. Due to addition of new project elements after initial field surveys for cultural resources were made, the proposed project has not been fully evaluated for these resources and possible impacts, nor has it been fully coordinated with the Illinois State Historic Preservation Officer. It does not, therefore, comply with the legal and policy mandates for dealing with these resources.

c. Pages 22 and 23. It would add greatly to the credibility of the report if some documentation for the basis of the future without project assumptions were provided. Reference to published literature or expert opinion is needed.

d. Page 60, second paragraph, first line, last word. This should read "Natural" and not "National".

e. Page 61, next to last paragraph, line five. "1986" should be "1996".

f. Table 11. A number of measures include the terms "initially Included." This is confusing because these measures are still included in the recommended plan. Remove the term initially.

g. Page 96, measure AB-1. No quantification of habitat outputs from this measure was carried out as required.

h. Page 97, measures Z-1, Z-2, Z-3. The 404(b)(1) evaluation and public notice indicate these measures would be a part of the recommended plan. It is apparent that the 404 evaluation does not address the currently recommended plan. This discrepancy should be addressed.

i. Page 104, Real Estate Requirements, 4th paragraph, first line, last word. "with" should be "within". In the last paragraph, there should be an explanation of why no land will be acquired for Hillside Sediment Control Measure.

j. Page 105, sixth paragraph. No indication is provided that Sect. 401 water quality certification will be forthcoming. Additionally, the Sect. 404 evaluation that will serve as the basis for evaluation of water quality issues does not accurately reflect the proposed project.

k. Page 106, top three lines. It is unclear where borrow for the riverside berm will come from. Here, the report indicates it will come from the river but the 404 evaluation and Plate 1 show a series of borrow pits alongside the berm on the non-river side. Additionally, the 404 evaluation indicates that some 60 plus acres of bottomland hardwood forest will be destroyed to create borrow pits, which is contrary to what is stated here.

l. Page 107, next to last paragraph, second sentence. The report does little to convince the reader that fish ingress and egress will be successful since stop logs would only be removed when the river and management units are at the same level, a situation where no flow will occur. Since many fish move in response to currents, the plan may actually reduce opportunities for fish to move into the area under management. Monitoring of fish movement under the conditions outlined should be made a part of this plan, as should monitoring of winter use of the "big hole" area. Additionally, the report should discuss operation of the stop log structures under conditions when the river is frequently fluctuating in stage. It is unclear how stop logs will be operated under such conditions.

m. Page 111, first full paragraph at top. Project features not in compliance with cultural resources requirements are outlined here.

n. Page 113, Table 13. This table indicates a significant impact to wetlands and aquatic habitat. This may indicate that the proposed plan should be more fully evaluated with an EIS.

o. Page 114, Table 14. Several items here should be listed as achieving only partial compliance. These are the Archaeological and Historic Preservation Act, the Clean Water Act, and the National Historic Preservation Act. Additionally, footnote 2 implies that the Corps will grant a permit to itself. This is incorrect and should be changed to avoid confusing the public and contributing to another incident such as the recent one involving Jim Bensmen and the Stump Lake project.

p. Page 116, item I. Whether or not the project will have significant beneficial effects should also be stated.

q. Page 122. A discussion of need to monitor fish movement and overwintering fish would greatly enhance this section.

r. Para 19, page 130. The technical review sign-off sheet should be completed.

s. Plates 1 and 11. An alternative to constructing the two 54-inch-diameter pipes with a concrete gatewell structure through the overflow dike for the dam should be developed. This structure has the potential to create problems in maintaining the navigation pool, and if accomplished, must be constructed and maintained with extreme care. For instance, seepage has not yet been addressed and is likely to require additional control measures. The pipes would pass through existing sheet piling, the present and future condition of which is unknown. Stability of and effective connection to the existing cells must be maintained. The cofferdam must serve as the dam during construction and as presently shown is inadequate in height. The cofferdam must be constructed such that flow will go over the overflow dike without damaging the cofferdam and without entering the excavation in an uncontrolled manner and breaching the dam. The permanent embankment and preformed scour hole are of significant size and must function properly. In summary, this structure involves potential risks to the navigation project and requires additional evaluation.

t. Page B-44, item (5) at top. The assumption provided is probably invalid. Documentation for its validity is needed if such if available.

u. Page C-8, item e.(2). This section is inconsistent with the description of the proposed project in the main report as it indicates a major adverse impact to bottomland hardwoods.

v. Appendix F, Paras 1 and 4.c. It is doubtful that compacted fills can be practically and economically constructed in some of the areas proposed due to the presence of water and soft foundation materials. These conditions as well as potential strain incompatibility of the embankment and foundation materials should be evaluated in detailed design.

w. Appendix L. The cost shown for the embankment, \$2.75/CY, appears low considering that some, if not most of the material, will need to be placed by floating plant. This unit cost should be checked.

x. Appendix S, page 3. This discussion should reflect acquisition costs -- 5 ownerships X \$8,000 = \$40,000.

y. Appendix S, page 2. The estate is non-standard in view of the deviations and requires approval by CERE-A. Further, the designated representative of the U.S. Fish and Wildlife Service should be used instead of "the project manager responsible for O&M." Also, the word "in" appearing in line 29 of the estate should be "or."

Corps' response to comments received from Lower Mississippi Valley Division, U.S. Army Corps of Engineers, dated 21 May 96.

1.a. Several comments have focused in on the necessity to provide justification for the riverside berm through the CEICA process. However, a threshold height for the riverside berm for the IDNR-managed generates substantial AAHUs, and per the dependency chart, Figure 13, all other measures in the IDNR-managed area depend upon the existence of a berm. The height is primarily determined by constraints: keep it as low as possible to achieve the purpose, do not exceed the height of the L&D No. 25 overflow structure nor the general ground or berm heights for the USFWS Lower Pool, and taper its height down at the lower end, and provide for an overflow portion.

1.b. A quality control and technical review chapter has been included. The draft DPR was substantially completed by the time that Division review was terminated. This report was the first instance of in-house technical review for the Planning Division, St. Louis District. Guidance is still evolving.

1.c. The Final DPR attempts to clarify selection of inefficient measures.

1.d. The project has been reduced in scope in order to garner cost savings; for instance, CMPs have been eliminated, the USFWS independently performed the levee work in the Middle Pool, the lowland sediment trap was redesigned to eliminate easements.

1.e. The measures have been coordinated with the Potomology Section by the team's hydraulic engineer.

1.f. Requirements for easements have been eliminated.

1.g. A joint application was coordinated with the Regulatory Branch, and made with the Illinois Department of Natural Resources, Technical Analysis & Permit Unit, Office of Water Resources, for permitting and review pursuant to the Rivers, Lakes and Streams Act, provisions of the Fish and Wildlife Coordination Act, Section 401 of the Clean Water Act, and other authorities, and with the Illinois Environmental Protection Agency for the water quality certification pursuant to Section 401 of the Clean Water Act.

2.a. Corrected.

2.b. Noted.

2.c. Noted.

2.d. Corrected.

2.e. Corrected.

2.f. Term removed.

2.g. No AAHUs were calculated because this measure is intended to mitigate for loss of habitat due to the Flood of 1993.

2.h. A review of Appendix C, 404(b)(1) evaluation, and the April 23, 1996 public notice did not indicate that the recommended plan contains measure Z-1, Z-2, or Z-3. Although these measures were highly touted by a separate "Avoid and Minimize" study, it was quickly determined for this study that off-bankline revetment was expensive and yielded little habitat benefits. The CEICA process upheld this obvious situation.

2.i. The RE appendix will be modified to state that: the features of the hillside sediment control program will remain on privately-owned land, that there is a non-cost easement granted to the soil and water conservation district (SWCD) and the NRCS established in a cooperative agreement between the landowners and the SWCD for the inspection of these features.

2.j. A joint application was coordinated with the Regulatory Branch, and made with the Illinois Department of Natural Resources, Technical Analysis & Permit Unit, Office of Water Resources, for permitting and review pursuant to the Rivers, Lakes and Streams Act, provisions of the Fish and Wildlife Coordination Act, Section 401 of the Clean Water Act, and other authorities, and with the Illinois Environmental Protection Agency (IEPA) for the water quality certification pursuant to Section 401 of the Clean Water Act on June 10, 1996. Review by IEPA is underway, and a determination is expected by August 2, 1996. The 404 evaluation has been corrected.

2.k. Noted, corrected.

2.l. Alternate 2 (C-2) in Enclosure D-5, page 11 of 13 shows that the greatest velocity through the State area (through stop-log structures and CMPs (for which the CMPs were later replaced with additional stop-log structures)) for that alternate is during open flow between the river and the interior of the State area. The USFWS and IDNR will attempt to manage per the water management plans (Figures 18 and 19). Day-to-day management may vary following actual practice. Potential variations may be one reason why some have suggested micro-modelling the project area.

2.m. Noted.

2.n. Noted.

2.o. Noted.

2.p. Noted.

2.q. Noted.

2.r. Sign-off sheet is being included in the quality control and technical review chapter.

2.s. Concur. Appendix F, Geotechnical Considerations, identifies some of these issues as requiring additional studies. The remaining issues raised in this comment which are not identified in the report will also require additional studies.

2.t. Noted.

2.u. Noted.

2.v. Concur.

During May 1996, pool 25 underwent a maximum drawdown in anticipation of increased flows. This drawdown revealed the land located upstream of the overflow section at the Illinois bluff. At normal pool elevations, the water is only 2.0 to 2.5 feet deep.

At that time, Geotechnical engineers from LMSED-GF visited the site and ran vane shear tests on the upper 24-inches of the deposits. The deposits are very soft, CH material. It is likely that this material will need to be removed to a depth of about 3.0 feet before the upstream cofferdam is constructed.

2.w. Spot checks in the MCACES shows fill from the $3 to $7 range per C.Y.

2.x. The need for easements has been eliminated.

2.y. Being addressed by the RE IPT member.

SIERRA CLUB-PIASA PALISADES GROUP
CONSERVATION CHAIRMAN

Colonel Thomas Suermann
District Engineer
US Army Corps of Engineers
1222 Spruce St.
St. Louis, MO 63103-2833

May 22, 1996

Dear Colonel Suermann:

Thank you for the opportunity to comment on the Batchtown Habitat Rehabilitation and Enhancement Project (HREP). We oppose this project, other than the soil retention portion. The project is a waste of our tax-dollars. The Corps needs to go back to the drawing board and propose a project that will convent government farmed land into wildlife habitat, purchase areas to convert to wildlife habitat, and employ measures to keep Calhoun County's sediment out of the river. The Corps should also explore the alternative of modifying the operation of L&D 25.

While we appreciate the short extension of time provided by Owen Dutt, it has not been adequate. The Piasa Palisades Group and I request an extension of time to comment on the project. The EA is larger than many EISs. We have not been able to adequately review the document. Therefore, we have not been able to adequately comment on the project. There are many issues we would like to make additional comments on.

REQUEST FOR A PUBLIC HEARING

We also request a Public Hearing. A Public Hearing is needed to discuss the impacts of the project. The Corps has provided no where near enough time to comment on the hundreds of pages of analysis for this project. A public hearing is also needed to explore the cumulative effects of all the EMP projects and flood work done on the Mark Twain National Wildlife Refuge. Colonel Suermann refuses to answer our letters, therefore, a hearing is needed to prevent the Colonel from ignoring the public he is supposed to be serving. The Corps has steadfastly refused to address the concerns we have raised about the St. Louis District's EMP projects. A hearing is needed to publicly air these concerns about the Batchtown and other EMP projects. Many of the sections of the analysis, particularly the wildlife models is incomprehensible. We request the Saint Louis District obey the Corps Regulations related to public hearings.

AN EIS IS REQUIRED

NEPA requires all federal agencies to prepare Environmental Impact Statements (EIS) on "major Federal actions significantly affecting the quality of the human environment." 42 USC §4332(2)(C).

"If substantial questions are raised regarding whether the proposed action 'may' have a significant effect upon the human environment, the agency must prepare an EIS." *Foundation for North American Wild Sheep v. Department of Agriculture*, 681 F.2d 1172, 1178 (9th Cir. 1982). If there are, "substantial questions as to whether [the proposed action] will have significant cumulative environmental effects . . . the [federal agency] is required to prepare an EIS analyzing such effects" *Thomas v. Peterson*, 753 F.2d 754 (9th Cir. 1982).

An EIS is required because 1) the project will have individually significant effects, 2) the EMP program has cumulative significant effects, and 3) the Batchtown, Swan Lake, Stump Lake, Calhoun Point, and the flood damage work done on the Mark Twain National Wildlife Refuge have significant cumulative effects.

The Corps' NEPA Regulation identifies "feasibility reports for the authorization and construction of major projects" as a class of actions normally requiring an EIS. 33 CFR § 230.6. Additionally, the Corps' regulations state the "EA is a brief document . . . the EA normally should not exceed 15 pages . . ." 33 CFR § 230.10. The Batchtown EA is over 100 pages long. The CEQ 40 Most Asked Questions state:

> Agencies should avoid preparing lengthy EAs except in unusual cases, where a proposal is so complex that a concise document cannot meet the goals of Section 1508.9 and where it is extremely difficult to determine whether the proposal could have significant environmental effects. In most cases, however, a lengthy EA indicates that an EIS is needed.
> Question 36b.

This gives further weight to the need to prepare an EIS.

INDIANA BAT

The Biological Assessment's (BA) analysis of the Federally Endangered Indiana bat is inadequate. The BA analysis needs to consider all the recent research and the draft update of the Recovery Plan for the Indiana bat.[1] The ESA requires the ACOE to use "the best scientific and

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[1] Calhan III, Edward, "Indiana bat Summer Habitat Requirements" Masters Thesis, University of Missouri, May 1993. (Calhan, 1993.)

Gardner, J. E., Garner, J. D., and Hofman, J. E. 1991. "Summer roost selection and roosting behavior of Myotis sodalis (Indiana bat) in Illinois." Unpublished Report, Illinois Natural History Survey, Champaign, Illinois. (Gardner 1991.)

Clawson, Richard L., "Report on the Status of Priority 1 Indiana bat Hibernacula, 1995."

Kurta, Allen, and Kimberly Williams "Roosting Habitat, Microclimate, and Behavior of the Endangered Indiana Bat (Myotis sodalis) in Southern Michigan." Eastern Michigan University, October 1, 1992.

(continued...)

commercial data available" in fulfilling their Section 7 obligations. The draft updated recovery plan states:

> Tree removal, either for harvest or land clearing, has been the most direct, known threat to Indiana bat summer roosts. Destruction or alteration of forest habitat could have serious impacts on Indiana bat populations Any harvest method that removes standing, dead trees that are potential Indiana roosts could be harmful.
> Recovery Plan at 19.

The project will clear forests for levees which will destroy bat habitat. The proposals to log the area under the guise of habitat improvement will also destroy bat habitat. The flood killed many tress. These trees provide potential roosts for the bats. The BA needs to consider these impacts.

BALD EAGLE

The Biological Assessment fails to mention or address summer (i.e., nesting) use. In recent years, bald eagles nested on an island near Grafton (less than 10 miles from project area). There are currently eagles nesting along the Illinois River across from a tavern (less than 15 miles from the project area). Additionally, eagles nest in several places in southern Illinois and Missouri. The project area is clearly potential nesting habitat. It may also be providing feeding habitat for the eagles nesting near Hardin. Yet neither the BA nor EA mention this fact.

MIGRATORY BIRD TREATY ACT

The Migratory Bird Treaty Act (16 USC § 703) prohibits the killing of migratory birds or their nest or eggs. If tree cutting is allowed during the nesting season, deaths will result (when a tree is cut down, birds will be killed). Therefore, cutting cannot be allowed during the nesting season. The Chief Judge for the Southern District of Illinois recently ruled cutting trees during the nesting season violated the MBTA. See, *Sierra Club v. U.S.D.A.*, Civil No. 94-CV-4061-JPG (So. Dist. Ill. September 25, 1995). (The project area is in the Southern District of Illinois. Therefore, Judge Gilbert's ruling is applicable to the project.) See, also *Sierra Club v. Martin*, Civil No. 1:96-CV-926-FMH (No. Dist. GA. May 8, 1996). (Enjoined eight timber sales due to violations of the MBTA.) Thus, the Corps must place a restriction prohibiting the cutting of trees during the nesting season.

ALTERNATIVES

NEPA requires Federal agencies to "study, develop, and describe appropriate alternatives to recommended courses of actions in any proposal." 42 USC § 4332(2)(e). This requirement has been held to be the "linchpin" or "heart" of the entire NEPA process. *Moroe County Conservation Council v. Volpe*, 472 F.2d 693, 697, (2nd Cir. 1972). The 404 Regulations state: "No discharge of dredge or filled material shall be permitted if there is a practical alternative to the proposed discharge which would have less adverse impacts on the aquatic ecosystem . . ." 40 CFR § 230.10. Even though the Sierra Club has raised the alternatives of converting cornfields into wetlands and acquiring new land to create

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[1](...continued)

Rommé, Russell C., Karen Tyrel, & Virgil Brack, Jr., "Literature Summary and Habitat Suitability Index Model, Components of Summer Habitat for the Indiana bat, *Myotis sodalis*" March 20, 1995 new habitat, these alternatives were not considered. The alternative of modifying the operation of L&D 25 to control the water levels was not considered.

ADVERSE EFFECTS

General ACOE regulations require:

> The benefits which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable determinants.
> 33 CFR § 320.4

The analysis, however, fails to address negative impacts. In spite of the Sierra Club raising the issue over and over again, the Corps continues to violate NEPA by failing to consider the off-site impacts. The CEQ Regulations require the Corps to consider "indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable." 40 CFR § 1508.8. If sediment is kept out of the project area, it does not magically disappear. The sediment must go somewhere else. It will fill in some other wetland. The analysis must balance this against the claimed benefit of keeping the sediment out of the Batchtown area. Additionally, the analysis does not address the negative impacts to species the project is not intended to benifit.

HEP ANALYSIS

The HEP wildlife analysis cannot be understood by an average person. Instead of informing the public, the analysis hides the effects with confusion. The analysis presents tables of confusing data. The analysis does not explain in "plain language" what impacts will occur. No one understands HSI and AAHU. The ACOE should translate these tables into a format that people can understand.

CUMULATIVE EFFECTS

The cumulative effects analysis is completely inadequate. The cumulative effects of the USFWS flood rehabilitation work is not mentioned or addressed. Much of the data is out of data. Some of the data is inaccurate. For example, it is claimed that some of the clearing at Stump Lake reached up to 215 feet. When it reached much more than this. Since much more trees were cut at Stump Lake (and given away to loggers, including huge pecan trees) the analysis needs to consider all this additional clearing. Since it happened at Stump Lake, it is also likely to occur elsewhere. The analysis, therefore, needs to consider this. The analysis also considers the ACOE's logging plans as benefits, when in fact these should be counted as negative impacts.

Thank you for the opportunity to comment. Please do not waste our tax dollars on this project.

Sincerely,

Jm

Jim Bensman
117 North Shamrock ST APT #1
East Alton, IL 62024-1149
(618)259-3642, Fax also, Call First!
Internet: jbensman@ezl.com

Response letter from Corps to Jim Bensman, Sierra Club, Piasa Palisades Group letter of 22 May 96.

#13-re: Request for Extension of Comment Period

The District provided an extension of the comment period and considered comments received during the revision of the Draft DPR. Consequentlly, the District felt that adequate time had been provided for comment and a formal extension of 60 days was not needed.

#14-re: Request for Public Hearing

The District Engineer has not normally been in attendance at public meetings for the other HREP's and consequently was not present at the Batchtown public meeting. He has been kept fully informed of the concerns raised at the meeting and of the concerns raised during the comment period of the draft DPR review. The District continued to use the less formal (one on one) meeting format used for other HREPs. This format allows for better public understanding of the project and associated issues and gives an opportunity for a better exchange of information between District staff and the public. The District believes that the public meeting on the Batchtown Project acheived the intended purpose.

#15-re: An EIS is Required

The HREPs can be characterized as demonstration projects, limited in scope, and impacting only a small amount of the total habitat area of the UMRS. A cumulative impact assessment overview is included in Appendix R. The District does not agree that this constitutes a "major Federal action significantly affecting the quality of the human environment." Congressional action to extend the program beyond current authorization would require a systematic strategy to restore UMRS habitat. This would include an evaluation of UMRS habitat needs, objectives, restoration measures and plans. A systemic assessment of this type would also serve as a long-term, cumulative impact assessment.

The Batchtown Project yeilds significant environmental benefits exclusive of obvious cumulative adverse affects. The District does not agree that an EIS is warranted.

#16-re: Indiana Bat BA is Inadequate

The District concurs with this comment and will update the BA analysis of the Indiana bat.

#17-re: Bald Eagle BA is Inadequate

The District concurs with this comment and will update the BA analysis for the bald eagle.

#18-re: Migratory Bird Treaty Act

The District concurs with this comment and will place a restriction prohibiting the cutting of trees during the nesting season.

#19-re: Alternatives

A number of alternatives for the project were considered and are discussed in Chapter 7. Additional alternatives were considered early in the scoping process and discarded because they were not felt to be viable or were against policies related to EMP as a whole. Such was the case with the consideration of purchasing new land and creating new wetland habitat as part of the Batchtown project. Land acquisition is not generally considered a viable component of EMP, and all of the land within the original project boundary for Batchtown was already in public ownership. Evolution of the project through the planning process identified a parcel of land that might require acquisition depending upon the siting of the lowland sediment trap in the FWS Middle Pool. This parcel would not be acquired to convert cropland to wetland, but would entail temporary flooding not to exceed 48 hours and silt deposition as a result of run-off detention.

The alternative of modifying the operation of Lock and Dam 25 was considered and is being pursued by the District separate from the Batchtown EMP project as a possible 1135 project. Water level management in Pool 25 will not solve the most prevalent problem in the project area, that of siltation. Without the riverside berm in place to slow or prevent inundation of the area during low level, high water events, siltation in the project area will continue to degrade the wetland habitat. Modification of the current water control plan for the pool would only partially address the problem of water level fluctuations in the project area and would be less reliable than under the proposed project.

#20-re: Adverse Effects

The Batchtown HREP will reduce sedimentation at that site if constructed according to the DPR. Of course this does not mean that the sediment will just disappear. The District assumes that river navigation will continue as will farming on the uplands, thus, sedimentation will continue into the future. Protection of the Batchtown area is a trade-off, the sediment that would accumulate in this area will accumulate elsewhere. The Batchtown project was selected because the area has high fish and wildlife value and is worthy of protection and restoration. The sediment deflected downstream is not likely to affect an area having as much fish and wildlife value as Batchtown.

The analysis does address the negative impacts of the project on some species (See Table B-2). One of the most important benefits of the project, however, is that it will improve habitat diversity. This improvement will result in greater species diversity and thus will have a positive impact on a greater number of species than will be impacted negetively. The District believes that the project benefits greatly exceed the adverse impacts.

#21-re: HEP Analysis

The habitat evaluation prodecures used in the DPR (WHAG, AHAG) are more easily used and understood than the HEP methodology upon which they are based. The information included in the technical appendices is technical or specialized, consequently not everyone will grasp the information contained in these sections. Biologists familiar with WHAG and AHAG analyses find these methods valuable in the planning process because comparisons between terrestrial and aquatic species can be made and subsequent decisions based on projected gains in habitat quality and/or quantity. There has not been any attempt to mask information or confuse readers in the presentation of data in the tables. The numbers are those actually derived from the calculations and upon which decisions have been made.

#22-re: Cumulative Effects

See response to comment #1.

Dfacty
PD-F

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
Custom House, Room 244
200 Chestnut Street
Philadelphia, Pennsylvania 19106-2904

IN REPLY REFER TO:

May 23, 1996

ER-96/251

Colonel Thomas C. Suermann
District Engineer
U.S. Army Corps of Engineers
St. Louis District
1222 Spruce Street
St. Louis, Missouri 63103-2833

Dear Colonel Suermann:

The Department of the Interior (Department) has reviewed the draft Definite Project Report (DPR) with Integrated Environmental Assessment and unsigned Finding Of No Significant Impact, dated March 1996, for the Batchtown Habitat Rehabilitation and Enhancement Project (HREP) located just upstream of Lock and Dam No. 25 on the Mississippi River in Calhoun County, Illinois. The project area is contained within the Mark Twain National Wildlife Refuge and is managed by the U.S. Fish and Wildlife Service (Service) and the Illinois Department of Natural Resources. We offer the following comments and recommendations for your consideration.

GENERAL COMMENTS

The DPR is generally adequate in its analysis of the potential impacts and benefits to fish and wildlife resources produced by the proposed action. The DPR also adequately describes the various reasonable alternatives to the proposed project. However, the DPR is inconsistent in some of the information presented. In addition, the cumulative impact assessment (Appendix R) is inadequate in describing the impact on the environment which may result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions.

SPECIFIC COMMENTS

<u>Fish and Wildlife Resources</u>

The DPR presents an evaluation of the hillside and lowland sediment control measures. These measures have been incorporated into the project plans and the Corps of Engineers (Corps) is expected to fund the hillside sediment control component with available funds. Incorporation of these measures will greatly improve the ability to achieve project objectives. One inconsistency in the document involves the construction of the lowland sediment trap in the Middle Pool. Tables 9 (page 63) and 11 (page 88) state that this structure will pond water on 83 acres of private farmland. However, pages 104 and S-1 state that approximately 40 acres of private land will be impacted.

Regardless of the amount of private land affected, the Service does not have the funding to acquire the necessary easements or for Realty personnel to negotiate for the easements. To address this problem, we encourage additional evaluation of options for the location of the lowland sediment trap. It appears that if the berm for the trap is constructed as shown in Figure 12 (page 79), the need for a flowage easement or acquisition of private land could be eliminated. In addition, this location would facilitate the use of dredge spoil material for berm construction. Should impacts to private land be unavoidable, Environmental Management Program (EMP) funds must be available for acquiring the easements and for Service Realty personnel to negotiate for the easements.

Bottomland forest habitat improvement has been discussed as a measure available to meet the project objectives. This measure would involve creating clearings of one to two acres in areas that have experienced significant tree mortality as a result of flooding in 1993. The cleared areas would be planted with species of hard-mast producing trees. Specifically, the project plans indicate that such improvements will occur on approximately 100 acres of state-managed land. It is further indicated that the construction of the riverside berm should reduce flooding within the project area and allow for increased survival of the tree plantings. However, the riverside berm is not designed to hold back moderate to severe flooding, such as that which has been experienced several times since 1990, and the Service is concerned that the survival of the tree seedlings may be much more problematic than acknowledged in the project plans. To address this uncertainty, we recommend that clearing be minimized and that tree plantings be interspersed among the existing dead standing trees, where possible. If some areas must be cleared and acceptable survival rates of planted species cannot be achieved initially or with possible replanting, the clearings should be allowed to regenerate naturally.

In recent discussions, reforestation of agricultural fields was presented as an alternative measure for forest improvement. This measure should also be addressed in the DPR. The Service has actively pursued a program of reforestation of agricultural fields and will continue with these efforts.

The DPR states that it is unlikely that a performance evaluation will be conducted on this project because construction of the project is not scheduled to be completed before the year 2001 and the EMP is only authorized through the year 2002. Given the complexity of this proposed project and the habitat within the project area, it is vital that a post-construction performance evaluation be conducted in order to determine if project objectives are achieved.

This performance evaluation is particularly important in two areas. Many of the measures incorporated in the project plans are aimed at maintaining the mussel bed and the important aquatic habitat in the Batchtown area. Monitoring is vital in order to determine the success of meeting this project objective. In addition, the overall success of this project to achieve the goals for fish and wildlife is dependent upon the proposed water level management plans. It is imperative that the water level management regimes be monitored and evaluated to ensure fish and wildlife habitat goals are achieved.

Federal Threatened and Endangered Species

The Service has reviewed the Biological Assessment prepared for this project to address Federal listed threatened and endangered species. Based upon the information provided, the Service concurred that the proposed action is not likely to adversely affect any threatened or endangered species. The threatened and endangered species section on page 109 of the DPR should be corrected to reflect the threatened status of the bald eagle and the decurrent false aster.

Fish and Wildlife Coordination Act

The Service is responsible under the authority of the Fish and Wildlife Coordination Act, as amended, for review and comment on the fish and wildlife resource impacts that would result from land and water resource development projects. The Batchtown HREP will impact approximately 61.5 acres of bottomland forest and four acres of non-forested wetland due to construction. Mechanical dredging will deepen about 25 acres of shallow water wetlands. Disposal sites for mechanically dredged sediment will directly affect about 13 acres of farmed wetland and about 50 acres of non-forested wetland.

Although these impacts to wetland resources are significant, the Service believes that the proposed project will serve to enhance and improve the remaining habitat for fish and wildlife. In particular, the amount of sedimentation occurring in the Batchtown area will be appreciably reduced, thus improving the quality and quantity of aquatic habitat. The habitat enhancement measures are estimated to provide a net gain of 932 Average Annual Habitat Units (AAHUs) for wildlife, 746 AAHUs for fishes, and 56 AAHUs for mussels. As such, the proposed project will result in an overall net benefit to fish and wildlife resources.

National Environmental Policy Act

As mentioned previously, the cumulative impact assessment in Appendix R is inadequate. The utilization of AAHUs is an inappropriate measure of cumulative impacts. The development of AAHUs is project specific and based on project specific assumptions. Given this, these numbers are not comparable between projects or in total. A more suitable assessment of impacts should be based on measurements such as acres of habitat restored/created versus destroyed, reduction in sedimentation rates and affect on upstream and downstream water surface profiles. These measures were discussed in the assessment, but differences between Corps Districts complicate measurements and comparisons.

A cumulative impact assessment of Habitat Rehabilitation and Enhancement Projects of the Upper Mississippi River-Environmental Management Program should be developed as a document separate from the Batchtown DPR. More information is clearly needed and efforts should be taken to reduce the various limitations in order for an adequate document to be prepared.

SUMMARY COMMENTS

The Department finds the proposed Batchtown HREP environmentally acceptable, provided our comments about location of the lowland sediment trap, tree clearing and planting survival, and project performance evaluation are satisfactorily addressed before finalizing project plans.

For further coordination on fish and wildlife resource matters and more detailed discussion of the Service concerns, please contact Mr. Ross Adams, EMP Coordinator, Mark Twain National Wildlife Refuge, 1704 N. 24th St., Quincy, Illinois 62301, Telephone: (217) 224-8580; or Ms. Joyce Collins, Fish and Wildlife Service, RR3, Box 328, Marion, Illinois 62959, Telephone: (618) 997-5491.

Thank you for the opportunity to provide comments.

Sincerely,

Don Henne

Don Henne
Regional Environmental Officer

Comments received from U.S. Dept. of the Interior, Office of Environmental Policy and Compliance, dated 23 May 96.

#1-re: General Comments-Cumulative Impact Assessment

Appendix R is not intended to be an in-depth assessment of the EMP program and the impacts individually and cumulatively of all projects to the Upper Mississippi River system. The information provided in the appendix is intended to provide an overview of the program to date. A report is being prepared for Congress that will provide a review of the EMP program and the cumulative impacts on the Upper Mississippi River system. The report is to be provided to Congress in 1997 and will contain much more detail and scientific information than is possible in the Batchtown DPR.

#2-re: Lowland Sediment Trap-Middle Pool

The inconsistency in the number of private acres impacted by the lowland sediment trap will be resolved in the final DPR. Location of the levee will be the key feature as it regards private land and impacts to bottomland hardwoods. Locating the sediment trap adjacent to the aquatic habitat in the Middle Pool would provide an opportunity to incorporate material from the dredging measure into the levee. However, this may have a negative impact on the bottomland forest adjacent to and encompassed by the sediment trap. The design of the sediment trap will be such that impounded water can be removed within 48 hours. However, much of the sediment will remain and will have a negative impact on the bottomland forest over the long term. A better solution would be to impound water and sediment in an area where no forest is present. The District is investigating the issue of acquiring land to properly site the sediment trap and avoid impacts to the bottomland forest.

#3-re: Bottomland Forest Habitat Improvement

The approximately 100 acres of bottomland forest habitat improvement will be concentrated on the land areas of higher elevation within the state-managed portion of the project. Some of these sites are not subject to frequent flooding because of elevation. There is an opportunity to re-establish hard mast producing tree species on these higher lands. Two acre clearings may not be made in most areas since much of the forest that has died as a result of the flood of 1993 is interspersed with other, living trees. Any tree planting that occurs outside of cleared areas will be dispersed among the living and dead standing trees. Some areas will be left to regenerate naturally.

#4-re: Reforestation of Agricultural Fields

A discussion of the FWS efforts to convert agricultural fields to forest and the applicability of this practice in remaining fields at the site will be included in the final DPR.

#5-re: Performance Evaluation

The District concurs that a post-construction performance evaluation of the project is important. However, funding through the EMP may not be available unless reauthorized by Congress. Post-construction evaluation of the project measures will be dependent upon the availability of funding within the District, unless undertaken by the project sponsor.

#6-re: Federal Threatened and Endangered Species

The final DPR will be corrected to reflect the threatened status of the bald eagle and decurrent false aster. Other comments noted.

#7-re: Fish and Wildlife Coordination Act

Comments noted.

SIERRA CLUB
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May 31, 1996

Mr. Owen Dutt:
Chief, Planning Division
Corps of Engineers, St. Louis District
1222 Spruce St.
St. Louis, MO 63101

Dear Mr. Dutt:

This letter constitutes the comments of the Sierra Club on the Draft Definite Project Report With Integrated Environmental Assessment ("DPR/EA") for the Batchtown Habitat Rehabilitation and Enhancement Project, and related Section 10 and Section 404 compliance documentation, dated March 1996.

The Sierra Club represents more than 550,000 members nationwide, including over 20,000 who live in the State of Illinois and who comprise the Club's Illinois Chapter. Many members of the Sierra Club from Illinois and nearby states benefit from and use the resources found in the Upper Mississippi River System (UMRS).

DESCRIPTION OF THE PROJECT WITHIN THE CONTEXT OF THE EMP.

Batchtown is a 3,327 acre waterfowl management area located just upstream of Lock & Dam 25 on the Illinois side of the Mississippi River, in Calhoun County. It consists mostly of undeveloped bottomland forest, backwater lakes, wetlands, and cropland within the floodplain of the Mississippi River. The land is managed in part by the U.S. Fish and Wildlife Service and in part by the Illinois Department of Natural Resources to produce waterfowl and to preserve the bottomland forest ecosystem.

The water level in most of the bottomland forest of Batchtown was raised when Lock and Dam 25 was constructed in 1938, making the area part of Pool 25. The water levels are regulated by the operation of the gates at the lock and dam. A series of low levees are present along part of the project, but flooding of the area is common.

The purpose of the Habitat Rehabilitation and Enhancement Project (HREP) is primarily to enhance the management potential for "production" of waterfowl by building a series of dikes and levees, and secondarily to improve the habitat value for fish and mussel species by dredging and reducing sedimentation of the backwater lakes. The proposed new dikes and levees are designed to prevent the lower summer floods from inundating the area while allowing the higher floods to overtop the levees. The project is part of the Upper Mississippi River System Environmental Management Program (EMP,) as authorized by Section 1103 of the Water Resources Development Act of 1986.

The Sierra Club was one of the earliest proponents of the EMP, having supported its passage in 1986 and pushed for full funding in every fiscal cycle since then. We are in complete agreement with the Corps, the U. S. Fish and Wildlife Service, and the Illinois Department of Natural Resources that preservation and restoration of habitat on the Mississippi River System is a vital need. It is clear, however, that we have disagreements on how this should be accomplished within the context of the EMP.

The Congressional intent behind the EMP was to establish a two-pronged effort to devise long-term solutions to the environmental impacts of the nine-foot channel project. The Long Term Resource Monitoring Program (LTRMP) was to provide basic data on the dynamics of the system. The HREP program was provide cutting-edge field tests to see how these and other data and theories could lead to real solutions. The Sierra Club has always advocated that both parts of the EMP fit into a vision that the future Mississippi River ecosystem will be built to the greatest extent possible on the natural processes of river hydraulics and sediment transport, interaction between main channels and backwaters, periodic floodplain inundation, and so forth.

Some of the HREPs that the Corps and its partners have developed have met these criteria and have been supported by the Sierra Club. However, HREP proposals that create habitat using well established techniques that operate in defiance of natural processes -- for example through the use of dikes, levees and pumps -- can only be considered to be appropriate if they (and only they) can address a specific emergency, such as a species in real danger of extinction.

GENERAL COMMENTS ON BATCHTOWN AND SIMILAR PROJECTS

It would appear to us that the Batchtown Proposal fails to meet the criteria the Sierra Club has advocated for HREP projects. There is nothing innovative about this type of moist soil vegetation release project, and it can hardly be said to improve interactive connectivity with the River ecosystem.

Within about 20 miles of this proposal are two nearly identical projects under construction (Stump Lake and Swan Lake) and one other that has been proposed (Calhoun Point.) Somewhat farther downstream is a completed project of a very similar nature, (Dresser Island.) Farther upstream on the Illinois River is

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another nearly identical project proposal (Rice Lake,) and a second that is very different in its configuration but is designed to meet the same objectives (Banner Marsh.)

Each of these projects has been designed and justified as if the others did not exist. Not only has the Corps failed to consider the cumulative impacts of these projects, as it is required to do by law, **it has failed to even address the question of cumulative utility.** Is there in fact any point to spending millions of dollars on all of these Band-aid projects that have nothing to do with the long-term sustainability of the Upper Mississippi River ecosystem, primarily in order to steer the fall migration patterns of a handful of common to super-abundant waterfowl species: blue-winged teal, mallards, and Canada geese?

The Batchtown Project must also be kept in perspective within the HREP program as a whole. The entire EMP budget has been under attack, and outyear projections are grim. The present projected cost of Batchtown is nearly $7.4 million. The entire projected EMP budget **including LTRMP** for FY 99 -- the year in which the Batchtown plans and specs are scheduled to be completed and the project advertised for bids -- is $8.7 million.

These numbers speak for themselves. While the Sierra Club continues to support full funding for the EMP, the outcome is problematical. Even at full program funding the Sierra Club has reservations about this project, as outlined here, but for Batchtown to proceed in light of current budget projections is unthinkable.

There is a further level of analysis that must be undertaken before large amounts of money are spent on more of these nearly identical projects. Each assumes that every condition on the River that contributes to the problem is going to remain immutable: that we will always have a sediment problem that is identical to the situation that prevails at present, that floodplain availability for sediment deposition will never be other than it is now, that there will never be changes in water release or level regimens. This set of static assumptions makes Band-aid thinking almost inevitable, but it is fundamentally inadequate to solving River problems and results in endless parallel Corps studies and projects that never pursue the obvious relations to each other: HREP studies, the Floodplain Management Assessment, the Summit, the studies undertaken in conjunction with the Navigation Expansion Project, annual navigation O & M studies, and on and on. The same agency conducts all these activities, each with functional blinders that disable any chance to learn from the others, and each typically is divided into three largely uncoordinated, geographically disjunct, segments as each Corps District goes its own way.

For example, when we raised the argument in our response to the DPR for the Calhoun Point HREP project that upstream watershed management should be studied as a more fundamental and desirable

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solution to excessive sedimentation in Mississippi River backwaters than the proposed HREP, it was dismissed with the comment that since such watershed management would cost over $1 billion it was obviously not a cost effective alternative. Assuming that this response was not a dry witticism, it highlights the compartmentalized thinking of the Corps.

SPECIFIC COMMENTS ON BATCHTOWN

As discussed above, a portion of our criticism of the Batchtown Project is generic: we take a dim view of this incessant accumulation of nearly identical projects, which are based on static and inadequate assumptions, and have not been studied for either their cumulative impacts or utility. They are a squandering of EMP resources that are badly needed elsewhere even in a condition of full program funding.

Leaving this general criticism aside, there are a number of specific points that can be made about Batchtown.

First, we are pleased that the project was modified to a degree to increase the non-waterfowl benefits, namely to those of fish and bottom invertebrates.

Second, we congratulate the Corps in including a soil conservation/land use component to the project.

At the same time, it seems to us that there are a number of alternatives to the project that have not been presented, and that might accomplish many of the objectives at lower cost.

First, selective deepwater dredging. This might be a viable alternative that could be combined with regular maintenance dredging to restore lost water depths to the site's backwater fisheries habitat. This measure could be accomplished separate from the riverside dike/levee project to improve fish and mussel habitat.

Second, increased attention to watershed erosion control. While the Corps is to be commended for adopting some limited upland watershed sedimentation management schemes, it fails to fully develop this as a strategy for control of sedimentation. The draft indicates sedimentation deposition is credited 85% versus 15% for river-borne versus hillside. These calculations were made from examination of a series of aerial photos of the supposed hillside depositional areas.

However, there are no data presented on the sediment budget for the rivers, when sediment is delivered to the bottom-land areas of the project area, or an evaluation of the sources of the sediments. An examination of the adjacent landside area to Batchtown reveals that much of the land is used for livestock production with minimal crops. No plans were presented in the draft for working with the landowners to control the common practice of animals being allowed to graze within upland gully and stream-bed areas. Since much sediment is likely carried in runoff from these sources, and likely carries with it high levels of fecal coliform contamination, further research is needed at this site to evaluate sources of sedimentation and associated water quality problems.

Corps personnel have admitted that the 85-15 calculation is essentially a best guess, and that it might be closer to 70-30. Other experts with whom we have spoken have suggested that lacking more sophisticated monitoring one might as well guess 15-85. All of this suggests to us that the land use component of the project -- which was essentially an afterthought forced on the Corps by other agencies -- needs a good deal more beefing up.

Third, water level manipulations. It is our understanding that the Corps is in the process of undertaking a "Section 1135" study, looking at the feasibility of changes in Pool 25 water management strategies. Preliminary analyses in other parts of the Upper Mississippi River System have indicated that relatively minor adjustments in periodic pool levels, undertaken with minimal if any impact to commercial navigation, could have profound beneficial impacts on backwater areas affected by excessive sediment deposition.

If it is in fact the case that this Pool 25 study is underway within the St. Louis District, and that it was not considered as an alternative -- either in part or in whole -- to the Batchtown HREP, this is a nearly incredible example of the "blinders" phenomenon discussed above. Here we apparently have the same office studying the same geographical area for the same physical and biological effects, and the one effort has not been allowed to influence the other. Not only is this counter to common sense, but it is a clear violation of NEPA.

Moreover, it is well known that the Navigation Expansion Project will recommend major modifications at Lock and Dam 25. An alternative to the HREP which must be considered are supplemental elements of construction or control that could be undertaken as part of Lock and Dam 25 modification.

RECOMMENDATIONS

The Sierra Club recommends that the Corps proceed with the soil conservation/land management portion of the Batchtown project. Not only will this have a beneficial effect, but it should serve to verify or modify the Corps' estimate of the proportionality of the sources of sediment. If it turns out, as some believe, that the Corps has greatly underestimated the share of sediment that originates in the adjacent watershed, that determination will obviously affect future project planning.

We also have no objection to proceeding with the improvement of the aquatic habitat through dredging, if the Fish and Wildlife Service and the Illinois Department of Natural Resources feel that such activity is urgently needed. (We would base our acceptance of this dredging -- as we have on similar projects in the past -- on a showing that it can be undertaken without toxic effects from churning up the lead shot that is currently buried in the sediments.)

The Corps should withhold a final decision on the balance of the project pending:

-- an assessment of alternatives, particularly the alternative of accomplishing many of the same purposes through alterations in the management of Lock and Dam 25;

-- a overall assessment of the regional need for moist soil vegetative regeneration acreage for migratory waterfowl and other species, and an assessment of the cumulative impacts of these projects;

-- a more dynamic reassessment of the factors that lead to the problem that this type of HREP seeks to address, including a consideration of alternative hydrological, sediment control and floodplain management practices;

-- and a review of the budgetary constraints that seem likely to affect the EMP program in the next few years.

Thank you very much for taking these views into consideration.

Sincerely yours,

Mark Deorkrem

Mark Deorkrem
Mississippi River Task Force

Wayne Freeman

Wayne Freeman
Piasa Palisades Group

Albert Ettinger

Albert Ettinger
Conservation Chair
Illinois Chapter

Jonathan P. Ela

Jonathan P. Ela
Mississippi River Specialist
Midwest Office

Response to comments received from Sierra Club, Midwest Office, dated 31 May 96.

Selective Deepwater Dredging

Dredging and maintenance dredging in the backwater, in addition to being extremely expensive, is a short term measure that could provide some immediate benefits to fish by providing access to overwintering areas. However, without the addition of the perimeter berm the problem of silt accumulation from the river is not being addressed. The use of dredging in the backwater, in conjunction with the perimeter berm provides greater long term benefits than dredging alone. The perimeter berm with the associated water control capability also provides the opportunity to dewater the area and solidify flocculent bottom substrates, thus providing the opportunity to reestablish emergent and submergent aquatic macrophytes as a result of the firmer rooting medium. These plants are beneficial to fish, wildlife and a variety of invertebrates. The dredging proposed in the project will have little benefit to mussels, because the proposed areas are silt deposition areas and, as such, are not mussel habitat nor will they facilitate flow over the mussel bed except during periods of high water, when flow over the bed is not a problem.

Watershed Erosion Control

Appendix O of the Batchtown DPR addresses watershed erosion control of the watersheds feeding the proposed project area. The plan presented has options that include sediment control measures for both tilled and untilled lands. Streambank erosion is specifically dealt with on page O-4 and is a component of the proposed sediment reduction plan.

The calculation that 85% of the silt is river borne and 15% from hillside is somewhat more than just a "best guess." These figures relate to the average number of tons of sediment that are calculated to be deposited within the project area annually from each source. The methodology used in these determinations is essentially the same as for other EMP projects within the District. As such, this determination is felt to be the best that can be achieved at this time given the available funding resources, and should be sufficient for planning purposes.

Pool 25-1135 vs. Batchtown HREP

The implication that the Pool 25 water control management initiative and the Batchtown HREP were developed unilaterally is incorrect. The Pool 25 Natural Resources Management Committee (a group consisting of federal and state biologists, engineers and land managers) has been the impetus behind an effort to experiment with different water level regimes in Pools 24,25 and 26. While the fluctuation of water levels appears to have positive affects on the natural resources of pool 25, it will not fully address the two largest problems affecting the Batchtown Project area. These are siltation and dewatering during drawdown conditions in the pool. The Committee concurs with the Corps that the Batchtown Project should proceed, whether or not water level manipulation for environmental benefits becomes a reality.

Dam #25 Modifications

Elements of construction or control that could be undertaken as part of Lock and Dam 25 modifications would not address the siltation problem in the Batchtown Project area, nor would dam modifications insure that the water management regime would not dewater the area during periods of high flow.

Federal Emergency Management Agency
Region V
175 West Jackson Blvd., 4th Floor
Chicago, IL 60604-2698

June 7, 1996

U.S. Army Corps of Engineers
St. Louis District
ATTN: CELMS-PD-F (Kirkpatrick)
1222 Spruce Street
St. Louis, Missouri 63103-2833

SUBJECT: Batchtown Habitat Rehabilitation and Enhancement Project Draft Definite Project Report (DPR) with Integrated Environmental Assessment (EA), Calhoun County, Illinois

Dear Colonel:

Thank you for sending us a review copy of the above-referenced document. We have a few comments.

1) The DPR and EA make no mention of the Special Flood Hazard Area (SFHA) as mapped by this agency for the purposes of the National Flood Insurance Program (NFIP).

2) The DPR and EA make no mention of the proposed project's impact on the base flood elevation or floodplain delineation on the Calhoun County Flood Insurance Rate Map. The report discusses water level fluctuations but does not discuss any possible impacts on the regulatory flood elevation.

3) The DPR and EA make no mention of the need to obtain state and local floodplain development permits for the proposed action. Both Illinois Department of Natural Resources and Calhoun County floodplain permits will be necessary for this project. We encourage the Corps of Engineers to obtain state and local permits in the identified flood hazard area.

4) The DPR and EA make no mention of the proposed action's compliance with Executive Order 11988, Floodplain Management.

Thank you for the opportunity to comment. If you have any questions, please call David Schein, Senior Program Specialist, on 312-408-5539.

Sincerely,

Janet M. Odeshoo

Janet M. Odeshoo
Director, Mitigation Division

cc: David R. Boyce, P.E., IDNR/OWR

Responses to comments received from Federal Emergency Management Agency, dated 17 Jun 96.

1) The project area is Federal property acquired for the navigation project, and now is a National Wildlife Refuge. There are only a few residential buildings (on leased land) within the project boundaries. In appendix E, Table E-5, Effect of Batchtown Levee on Upstream Water Surface, indicates that there will be no increase in depth over existing conditions for a 100-year flood by the recommended plan. This table has been corrected for the Final DPR: the correct berm heights have been used in the HEC calculations (the berm's initially greater height was used in the HEC calculation for the Draft DPR), and several Manning's N-values were changed (although this did not have a significant effect).

2) See 1) above.

3) A joint application was coordinated with the Corps' Regulatory Branch, and made with the Illinois Department of Natural Resources, Technical Analysis & Permit Unit, Office of Water Resources, for permitting and review pursuant to the Rivers, Lakes and Streams Act, provisions of the Fish and Wildlife Coordination Act, Section 401 of the Clean Water Act, and other authorities, and with the Illinois Environmental Protection Agency (IEPA) for the water quality certification pursuant to Section 401 of the Clean Water Act on June 10, 1996. Review by IEPA is underway, and a determination is expected by August 2, 1996. Upon review by IDNR, Calhoun County official (Rita Kraushaar, 618-576-2733) will review and coordinate local permiting.

4) In the plan formulation for this Habitat Rehabilitation and Enhancement Project, the Water Resources Council's eight-step process for addressing the basic requirements of Executive Order 11988 (Floodplain Management) was followed:

Step 1. Determine if a proposed action is in the base floodplain. Yes. The recommended plan, and all structural alternative plans (except for the Hillside Sediment Control features) are in the base floodplain of the Mississippi River.

Step 2. Provide for public review. Following NEPA and FWCA guidelines, the Draft DPR with integrated Environmental Assessment (EA) and draft FONSI was submitted for a 30-day review, and was widely distributed to Federal, state, and local agencies, interested organizations and individuals. The Final DPR includes review comments and response letters.

Step 3. Identify and evaluate practicable alternatives to locating in the *base floodplain.* The DPR identified and evaluated all measures available and acceptable for EMP projects, and included the somewhat non-traditional Hillside Sediment Control measures.

Step 4. Identify the impacts of the proposed action. Impacts have been identified in the DPR within the integrated EA, and under the "FUTURE WITH PROJECT CONDITIONS" section, and in Appendix R, Cumulative Impacts Assessment.

Step 5. Minimize threats to life and property and to natural and beneficial floodplain values. Restore and preserve natural and beneficial floodplain values. The recommended project will have no threats to life and property. The recommended plan is by design an attempt to enhance and rehabilitate habitat in the floodplain.

Step 6. Reevaluate alternatives. There have been many evaluations, reevaluations, and modifications to the plan because of review comments.

Step 7. Issue findings and a public explanation. The Draft DPR with integrated Environmental Assessment (EA) and draft FONSI was submitted for a 30-day review, and was widely distributed to Federal, state, and local agencies, interested organizations and individuals. The Final DPR includes review comments and response letters. The DPR documents a problem-solving method leading to a recommendation. The DPR includes documentation towards receiving a 401 permit from the State of Illinois, and a 404 permit from the U.S. Army Corps of Engineers.

Step 8. Implement the action. The DPR includes a recommendation to serve as a decision document for project approval. Following approval of the DPR, plans and specifications will be developed, leading to construction.