YAZOO PUMP PROJECT
YAZOO BACKWATER AREA
MISSISSIPPI

REEVALUATION REPORT

APPENDIX D

GEOLOGY AND SOILS

PREPARED BY
THE UNITED STATES ARMY
VICKSBURG DISTRICT, CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

REEVALUATION REPORT
YAZOO AREA PUMP PROJECT
YAZOO BACKWATER AREA, MISSISSIPPI

APPENDIX D

GEOLOGY AND SOILS

Table of Contents

Table of Contents (Cont)

LIST OF PLATES

REEVALUATION REPORT
YAZOO AREA PUMP PROJECT
YAZOO BACKWATER AREA, MISSISSIPPI

APPENDIX D

GEOLOGY AND SOILS

GEOLOGY

GENERAL

Physiography

1. The two proposed pumping plant sites (see Plates D-1 and D-2) are located in the Yazoo Basin, a physiographic subprovince of the Mississippi Alluvial Valley, which is a province of the Central Gulf Coastal Plain. Approximately 6 miles to the east of the sites is the eastern boundary of the Mississippi Alluvial Valley, formed by the Bluff Hills, a distinct ridge of Tertiary deposits capped by Pleistocene loess. The Mississippi Alluvial Valley extends about 80 miles to the west, where Tertiary outcrops form the western boundary known as the Western Hills.

Topography

2. Topographically the area is a large, low, flat flood plain that contains oxbow lakes, swales, backswamps, and meander scars abandoned by the ancient Ohio, Mississippi, and smaller rivers. Natural ground surface elevations range from a high of 100 feet, National Geodetic Vertical Datum (NGVD), to a low of 70 feet, with a relief greater than 10 feet being rare. Manmade levees form the highest land, with a top elevation of 107 feet, NGVD.

Lithology and Stratigraphy

3. Alluvial sediments in the Mississippi River Valley can be subdivided into two distinct but unequal units: a fine-grained topstratum that is further identified by an environment of deposition and a substratum composed of fine sands that grade downward into coarser sands and gravels. The substratum is generally underlain by Tertiary clays or sands (see Plates D-3 and D-4).

4. Levee auger borings completed in 1947 and 1961 (see Plate D-5) and geologic literature indicate that the point bar topstratum at the lower site is 25 to 35 feet thick and consists of 3 to 10 feet of clay (CH) underlain by about 10 feet of silt (ML), which is underlain by silty sand (SP-SM). Pervious substratum sands and gravels should be encountered near elevation 52 and extend down to the top of Tertiary near elevation -60.

5. Levee rotary borings made in 1963 (see Plate D-6) and geologic literature for the vicinity of the proposed upper pump site location reveal an abandoned course topstratum that is approximately 35 to 45 feet thick and consists of clay (CH-CL) containing some wood lenses and pieces. This is underlain by pervious substratum sands and gravels that extend from near elevation 52 to the top of Tertiary near elevation -30.

6. It should be noted that the abandoned channel clays terminate within a short distance northwestward of the levee borings, and point bar sediments are present throughout the remainder of the site area. Therefore, considerably different soil conditions could exist within a short distance at the upper site. Tertiary beneath both the lower and upper pump sites is the Yazoo clay, a massive impervious plastic clay.

Structure and Tectonics

7. The structure of the area is controlled by the north-south trending Mississippi Embayment, a structural trough in which the Mississippi River is entrenched, and the east-west trending Gulf Coastal Geosyncline with its axis across southern Louisiana. As a result of these two features, the regional dip of the strata is 30 to 60 feet per mile toward the southeast.

8. A regional fracture pattern of northeast-southwest and northwest-southeast trending lineaments has been postulated for the Mississippi Embayment. Approximately 4 miles northeast of Vicksburg, a fault known as the Bliss Creek Fault has been mapped. It is not known whether or not this fault is present for a significant distance into the alluvial valley or, if it is present, its exact location.

9. A straight line projection, which is not considered the best method, would place the possible fault location approximately 1 mile northeast of the lower pump study site. The Bliss Creek Fault occurred during Tertiary time and has been inactive during historic time. If present in the alluvial valley, this fault would be covered by at least 100 feet of alluvial sediments. Therefore, Bliss Creek Fault is not considered a threat to the proposed location of the lower pump.

Earthquake Data

10. The area encompassed by the proposed project is classified in Zone 1 (slight possibility of minor damage) by the Seismic Risk Map of the United States published in 1969 by the National Oceanic and Atmospheric Administration. A review of the seismic history of the area indicates that the Zone 1 classification is appropriate in view of the fact that earthquake activity affecting

the project area has been infrequent and of low intensity. ER 1110-1-1806 recommends a seismic coefficient of 0.025g for structures located in Seismic Risk Zone 1.

11. Available records indicate that no seismic activity exceeding Modified Mercalli Intensity VI has occurred within over 150 miles of the project area during modern times. No earthquakes have been positively located within approximately 80 miles of the project area during modern times, except for unconfirmed reports of an earthquake which occurred near Vicksburg, Mississippi, in 1941. This event, the seismic origin of which is unconfirmed, has been assigned a Maximum Modified Mercalli Intensity of III and was apparently felt over only a very limited area. The possibility of well-designed structures at the project site sustaining damage as a result of earthquake is considered remote.

Groundwater Conditions

12. Groundwater levels should range from within 1 to 2 feet of the ground surface to within 15 feet of the surface. Where only clays are penetrated, the water fluctuation will be minor and slow. Variations in the water level in the permeable point bar fine sands will be influenced by river stages and seasonal rainfall and therefore will be greater and much more rapid. Impervious Tertiary (Yazoo Formation) clays underlie both sites; thus, high hydrostatic pressures are not expected to be a problem.

Economic Minerals

13. No economically valuable minerals are known to exist in the proposed project areas except for sand-clay-gravel deposits.

Construction Materials

14. The Vicksburg District records for the area within a 50-mile radius of the proposed pumping station sites show 13 producing commercial sand and gravel companies that have been tested by the Corps and one company that has not been tested. Each company produces material of acceptable quality and quantity for the proposed project. Riprap would have to be trucked from northeast Mississippi, northwest Alabama, or central Arkansas, or barged from quarries with access to the Mississippi River. Barged riprap would probably be stockpiled at Vicksburg and trucked to the work areas.

ENGINEERING CONSIDERATIONS

15. Data from old levee borings and geologic literature indicate that the pumping station at the lower site would be constructed on point bar silts (ML) and fine sands (SP-SM). However, to design necessary features such as underseepage controls and/or piling, new borings will be necessary to determine the exact location of the structure and the existing subsurface conditions.

16. Data from old levee borings and geologic literature also indicate that the pumping station at the upper site could be located in abandoned channel clay

deposits or in point bar sediments that are shown adjacent to the levee area. New borings will be required to determine the exact location of the structure and the soil conditions present so that necessary design features can be planned.

CONCLUSIONS

17. There are no apparent geologic conditions that would prohibit the construction of a pumping station at the two proposed sites.

SOILS

SCOPE OF STUDIES

18. Soil studies consisted of a review of borings from the Yazoo Backwater Levee, Steele Bayou Drainage Structure, and Little Sunflower River Drainage Structure. It should be noted that the borings in the immediate area of the proposed sites are highly scattered and general in nature. Consequently, the following discussion of slopes, underseepage, structure foundations, etc., are based on past experience with similar soils.

SOIL CHARACTERISTICS

Excavation Slopes

19. Excavation slopes will range from 1V on 2H to 1V on 3H for the lower site, which is located on point bar deposits. The upper site may require slopes of from 1V on 3H to 1V on 4H because of the deep plastic clay common to abandoned channel deposits.

Construction Unwatering

20. A high groundwater elevation and approximately 120 feet of substratum sand thickness will make construction unwatering at the lower site expensive. The upper site may require less unwatering because of the deeper clay; however, this cannot be determined until more information on the foundation soils and excavation grade is available. Deep wells will probably be the most economical method of unwatering both sites, but alternative methods such as well points or a slurry trench will need to be evaluated before a decision can be made.

Foundation

21. Foundation requirements cannot be determined until more information is available on structure configurations, loads, elevation of the base, and the soils at each site. In general, if the structure is founded on clay, it will require bearing piling to support the load. If the structure is founded on sands, the need for piling will depend on the density of the foundation sands, structure load, depth below the surface, and structure base dimensions.

Channel Slopes

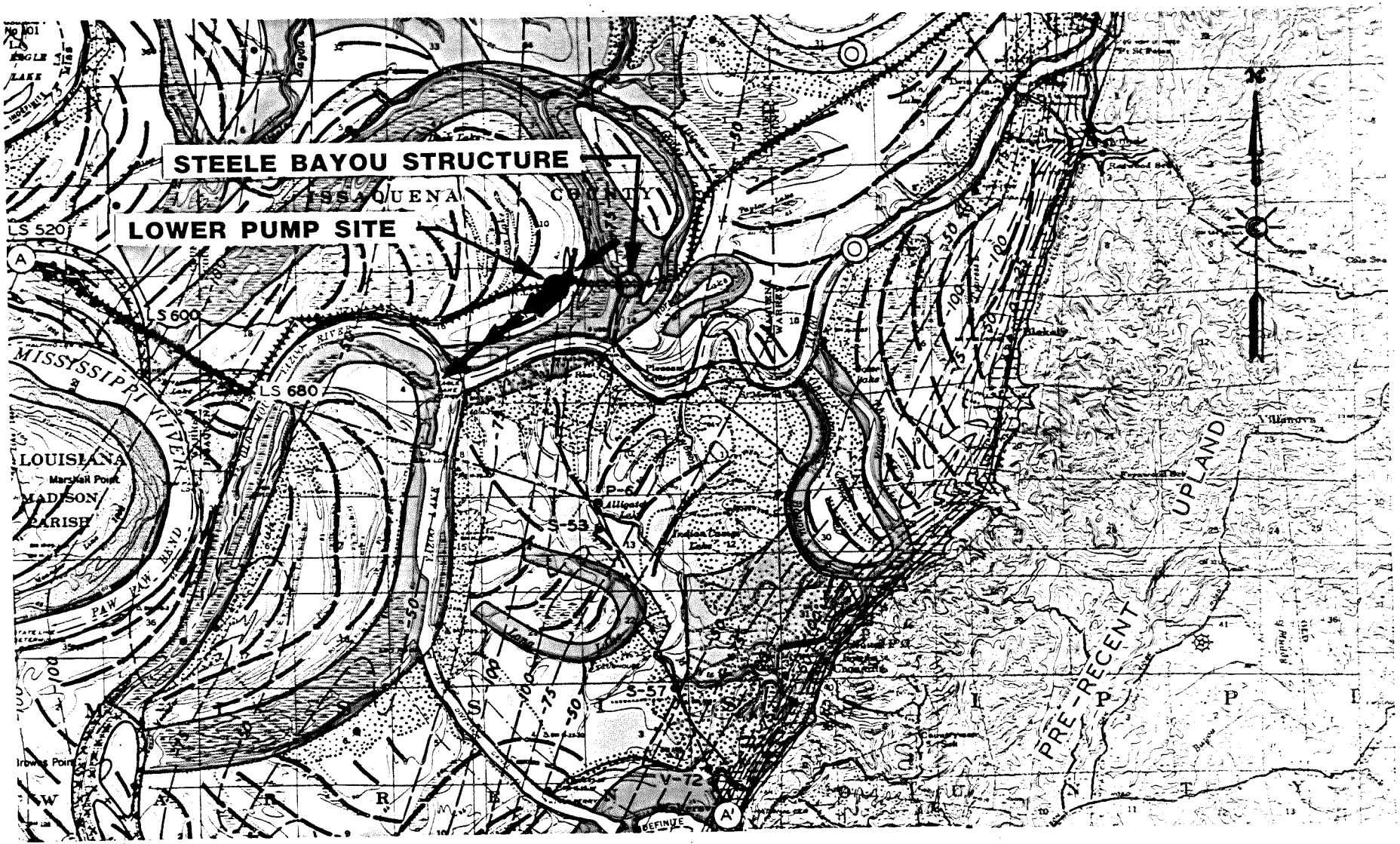
22. Inlet and outlet channels will be excavated in clays, silts, and fine sands. Grade will be well below the groundwater. Steady seepage will exist throughout both channels. Piping and sluff sides will probably cause minor problems in the unprotected reaches that are not covered with riprap. Estimated side slopes are 1V on 4H throughout.

Underseepage

23. Underseepage will possibly cause problems in the bottom of the inlet channel. The severity of the problem will depend on channel elevations, structure lengths, and differential heads between river and sump.

CONCLUSIONS

24. The limited amount of available soil information for the project area indicates the pumping stations could be built at either site. However, detailed boring programs would be required for both locations before a realistic evaluation can be made.



LEGEND

- ALLUVIAL APRON
- NATURAL LEVEE
- POINT BAR
- BACKSWAMP
- ABANDONED CHANNEL OR "CLAY PLUG"
- ABANDONED COURSE (M) MISSISSIPPI (O) OHIO, (S) SMALLER STREAMS
- PROBABLE POSITION OF ABANDONED COURSE REWORKED BY SUBSEQUENT MEANDERING OF A SMALLER STREAM
- DEPTH TO TERTIARY IN FEET MSL
- SELECTED MAJOR SWALES
- TREND OF MEANDERS
- INDEFINITE BOUNDARY
- ENGINEER BORINGS
- OTHER BORINGS
- BORINGS USED TO CONTOUR TERTIARY

NOTE: DASHED ARCUATE PATTERNS IN BACKSWAMP AREAS INDICATE RELATIVELY SHALLOW BACKSWAMP CLAYS OVERLYING ANCIENT MEANDER BELT DEPOSITS.

SCALE

Contour interval 5 and 20 feet changing on the 100 foot contour

PROPOSED PUMPING STATION

PROPOSED CHANNEL

LEVEE

YAZOO RIVER BASIN
YAZOO BACKWATER PROJECT
MISSISSIPPI
DESIGN MEMORANDUM NO. 16
YAZOO AREA - PUMP PROJECT
YAZOO PUMP STUDY

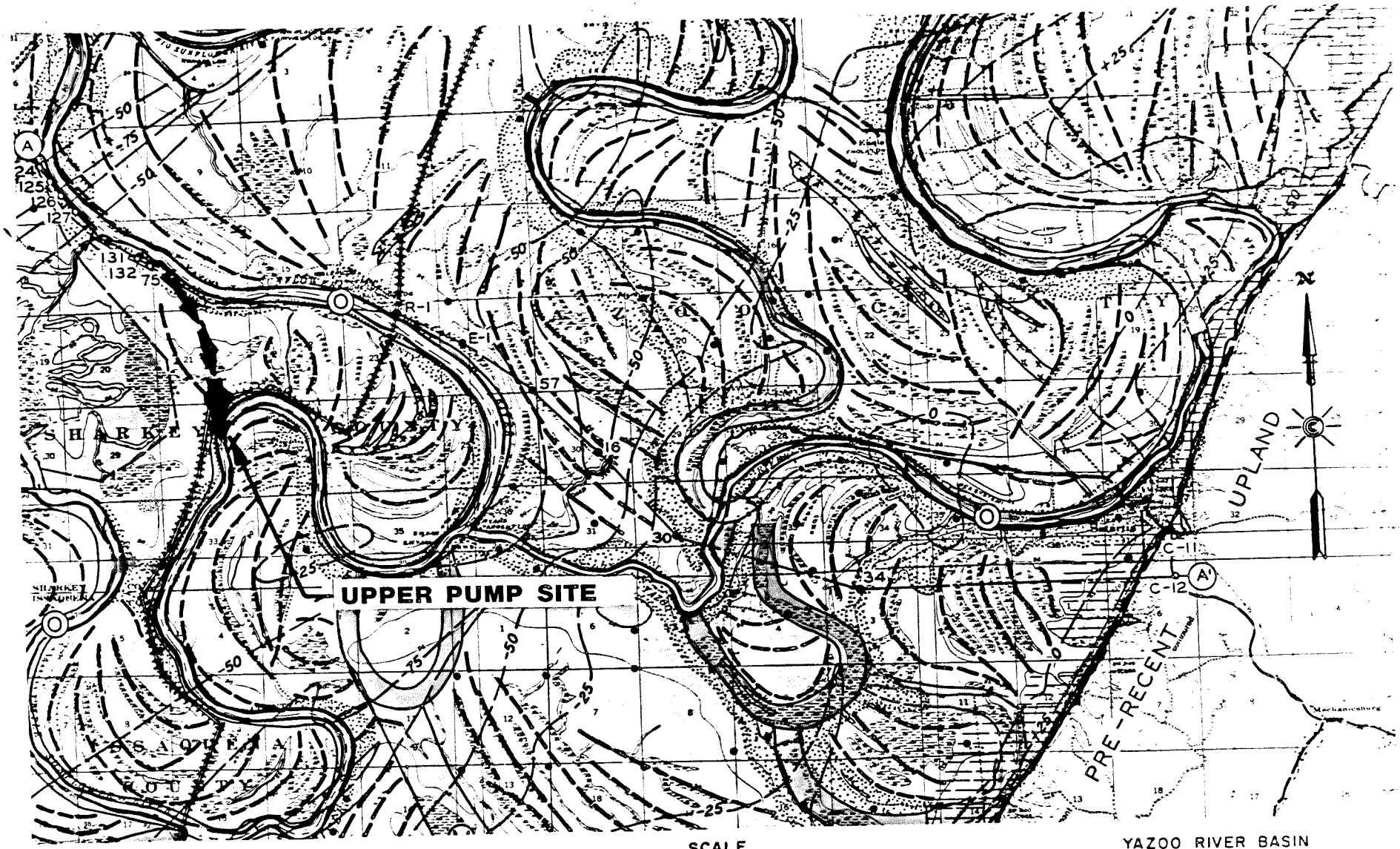
GEOLOGY

U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: 1981

FILE NO. Y-14-216

PLATE D-1



LEGEND

- ALLUVIAL APRON
- NATURAL LEVEE
- POINT BAR
- BACKSWAMP
- ABANDONED CHANNEL OR "CLAY PLUG"
- ABANDONED COURSE (M) MISSISSIPPI, (O) OHIO, (S) SMALLER STREAMS
- PROBABLE POSITION OF ABANDONED COURSE REWORKED BY SUBSEQUENT MEANDERING OF A SMALLER STREAM
- DEPTH TO TERTIARY IN FEET MSL
- SELECTED MAJOR SWALES
- TREND OF MEANDERS
- INDEFINITE BOUNDARY
- ENGINEER BORINGS
- OTHER BORINGS
- BORINGS USED TO CONTOUR TERTIARY

NOTE: DASHED ARCUATE PATTERNS IN BACKSWAMP AREAS INDICATE RELATIVELY SHALLOW BACKSWAMP CLAYS OVERLYING ANCIENT MEANDER BELT DEPOSITS.

SCALE

Contour Interval 5 feet

PROPOSED PUMPING STATION

PROPOSED CHANNEL

LEVEE

YAZOO RIVER BASIN
YAZOO BACKWATER PROJECT
MISSISSIPPI
PHASE I STUDY
DESIGN MEMORANDUM NO. 16
YAZOO AREA - PUMP PROJECT

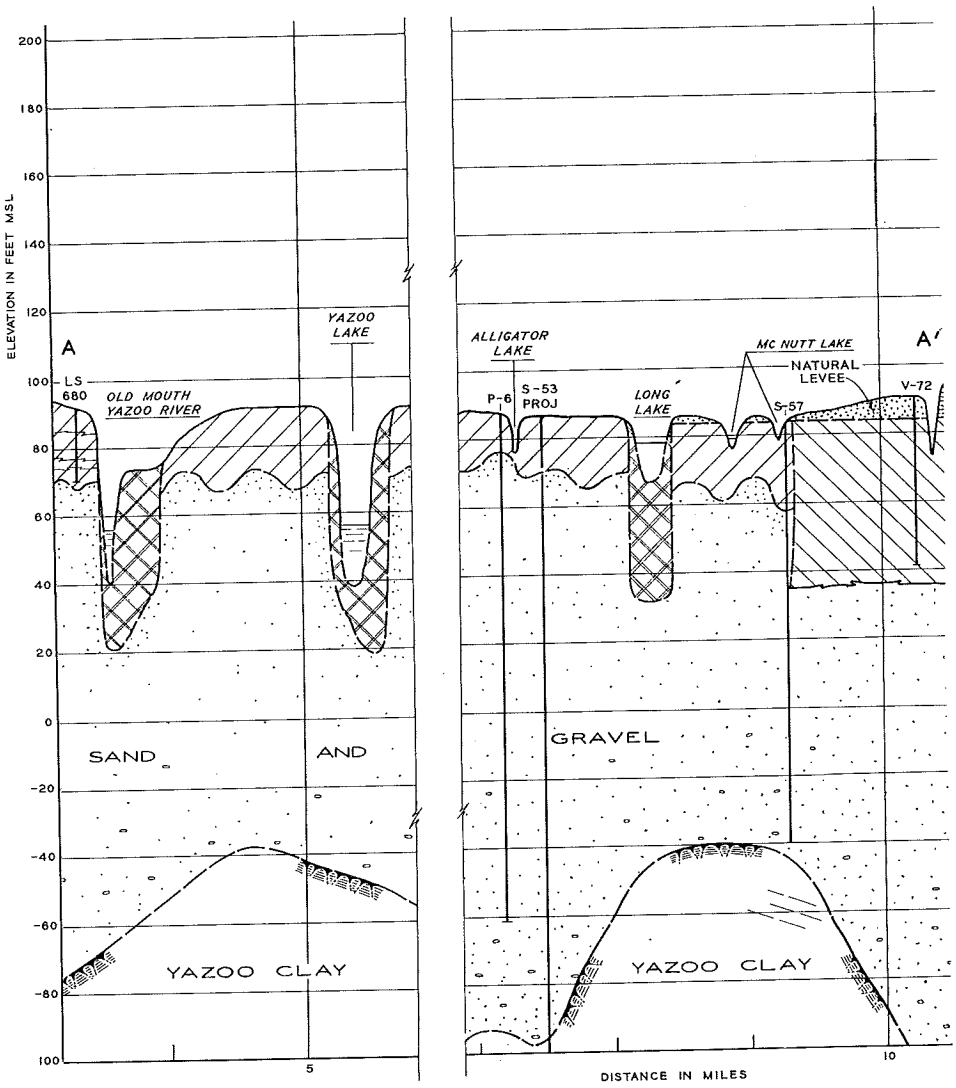
GEOLOGY

U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: 1981

FILE NO. Y-14-216

PLATE D-2



LEGEND

TOPSTRATUM

- ALLUVIAL APRON
- NATURAL LEVEE
- POINT BAR
- BACKSWAMP
- ABANDONED CHANNEL OR "CLAY PLUG"
- ABANDONED COURSE

YAZOO RIVER BASIN, MISSISSIPPI
YAZOO BACKWATER PROJECT

PHASE 1 STUDY

DESIGN MEMORANDUM NO. 16

YAZOO AREA PUMP PROJECT

GEOLOGY

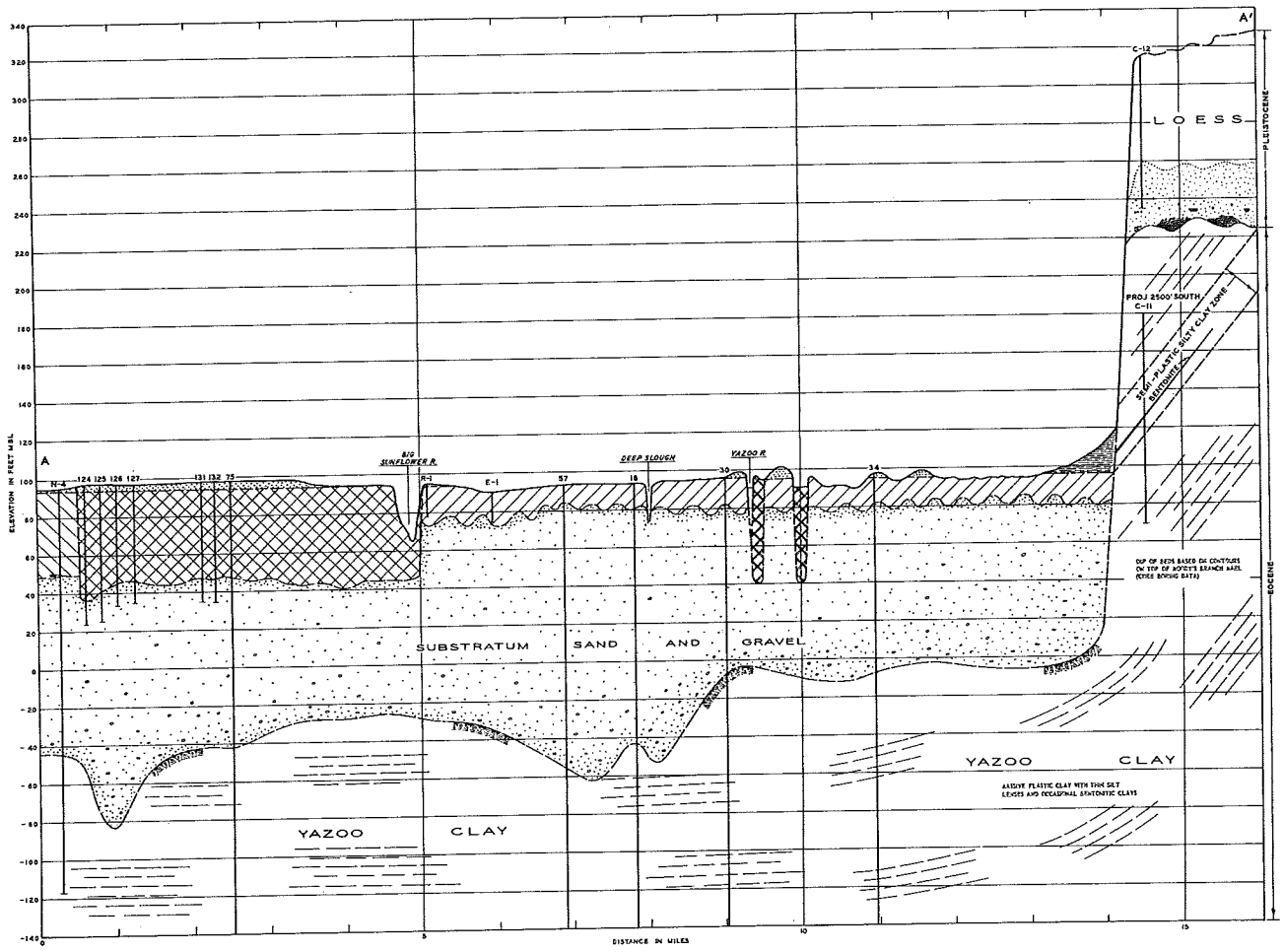
SECTION A-A' LOWER PUMP SITE

U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: 1981

FILE NO. Y-14-216

PLATE D-3



LEGEND

TOPSTRATUM
- ALLUVIAL APRON
- NATURAL LEVEE
- POINT BAR
- BACKSWAMP
- ABANDONED CHANNEL OR "CLAY PLUG"
- ABANDONED COURSE

PROJ - PROJECTED A SHORT DISTANCE INTO PROFILE

YAZOO RIVER BASIN, MISSISSIPPI
YAZOO BACKWATER PROJECT
PHASE I STUDY
DESIGN MEMORANDUM NO. 16

YAZOO AREA PUMP PROJECT

GEOLOGY

SECTION A-A' UPPER PUMP SITE

U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: 1981 FILE NO. Y-14-216

PLATE D-4

YAZOO PUMP PROJECT
YAZOO BACKWATER AREA
MISSISSIPPI

REEVALUATION REPORT

APPENDIX E

COSTS

PREPARED BY
THE UNITED STATES ARMY
VICKSBURG DISTRICT, CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

REEVALUATION REPORT
YAZOO AREA PUMP PROJECT
YAZOO BACKWATER AREA, MISSISSIPPI

APPENDIX E

COSTS

Table of Contents

LIST OF TABLES

REEVALUATION REPORT
YAZOO AREA PUMP PROJECT
YAZOO BACKWATER AREA, MISSISSIPPI

APPENDIX E - COSTS

GENERAL

1. This appendix contains a set of analyses of costs for several plans considered to provide additional flood control in the Yazoo Backwater area. The recommended plan includes a 17,500-cubic-foot-per-second pumping plant, necessary appurtenant channels and mitigation lands. Detailed cost estimates for the recommended plan are presented in Table E-1. Cost comparison estimates for alternative plans considered are summarized in Table E-2.

PLANS

RECOMMENDED PLAN (PLAN C,
17,500 CFS, WITH MITIGATION)

2. The recommended plan is based on a 17,500-cubic-foot-per-second pumping plant, necessary inlet and outlet channels and required mitigation. This plan will allow ponding of interior runoff to elevation 80.0 feet, NGVD, before pumping begins. The plan includes an operational modification to start pumping at 85.0 feet during the period 1 December - 1 March in order to reduce fish and wildlife losses. Mitigation will consist of acquisition of land use easements on 6,500 acres of woodland to assure that the land use will remain in bottom-land hardwoods, the purchase and development of 6,000 acres in fee (simple) title, or a combination of both. For the purpose of preparing cost estimates, land use easements were selected as the most likely alternative. Descriptions of the relocations of facilities required with the recommended plan are summarized in this appendix.

OTHER ALTERNATIVES CONSIDERED

3. The costs of other plans considered are shown in Table E-2 and the comparison of environmental costs of the NED plan, EQ plan, and recommended plan are shown in Table E-3.

COSTS

UNIT COSTS

4. Unit costs are based on similar work in the general area modified to conditions that exist in the Yazoo Backwater. Costs of various pumping stations were developed from the cost data, as discussed in paragraph 6 of this appendix. An allowance of 25 percent is included for contingencies for lands and damages, and 20 percent is included for contingencies for relocation and construction cost. Values of engineering and design and supervision and administration are based on anticipated needs for these items during a normal construction schedule. Costs are based on October 1980 price levels.

LANDS

5. Real estate appraisals were made using aerial mosaics and other available maps of the area. Field trips were made to inspect lands involved. The estimates are based on a study of sales and general knowledge of land values in the area and include requirements of Public Law 91-646. Various portions of the pump plant site are previously encumbered by Yazoo Backwater levee easements, Steele Bayou sump easements, and Steele Bayou channel improvement easements. Values for fee and easement acquisition for the pump plant vary as each portion is affected by the previous encumbrances, as indicated by the unit cost variousness within the lands and damages item shown in Table E-1.

PUMPING PLANT

6. Costs for pumping plants were based on data developed by the Bureau of Reclamation, Department of the Interior, and on data from pumping stations recently constructed or now under construction in the Lower Mississippi Valley Division, modified to local conditions.

CHANNELS

7. Cost estimates for channels include the cost of the inlet channels from Steele Bayou and the outlet channel from the pumping station to the Yazoo River. Quantitative estimates were computed using the channel dimensions obtained from the hydraulic data as discussed in Appendix C to this report. Unit costs for land clearing and turfing were developed as discussed in paragraph 4 of this appendix.

8. Excavation and disposal costs are based on the assumption that all excavated material will be deposited on the channel banks and the unit cost for excavation and disposal is applicable to either the dragline or dredge method of construction. Although the unit cost for dredge excavation is less than that for dragline excavation, the cost of disposal of material excavated by dredge would be higher since diked containment areas would be required. Therefore, the total unit cost is assumed to be the same for either construction method.

9. The disposition of excavated material and methods of construction will be studied in more detail in the design phase.

RELOCATIONS

10. Road and utility relocations required were determined from field investigations, quadrangles, and aerial mosaics. One bridge on State Highway 465 will require relocation. One county road, two powerlines, and three telephone lines will also require relocation.

OPERATION AND MAINTENANCE

11. Electric motors were selected for analysis in the Reevaluation Report, with power to be provided by the local utility company. Average annual energy costs are based on the average annual number of days that the various pumps are operated. Energy use during the remaining days, when pumps are not operated, is considered to be negligible as compared with the total annual energy costs. Operation and maintenance costs excluding energy costs are based on anticipated labor requirements, plant and channel repairs, engineering and design, inspection and evaluation, and supervision and administration. Annual operation and maintenance costs including energy costs and energy requirements for the various pumping alternatives considered are summarized in Table E-4.

12. The current annual power cost estimates are based upon information taken from Mississippi Power and Light Company's rate schedule C-18, dated 1 July 1980. The net monthly rate schedule as presented in this publication is basically as follows:

$2,750.00 for the first 1,000 kW or less of customer's demand
$2.70 per kW for all additional kW of customer's demand
$0.4618 per kWh for the first 435,000 kWh
$0.4428 per kWh for additional kWh up to 400 kWh per kW of customer's demand
$0.4288 per kWh for next 350,000 kWh
$0.4118 per kWh for all additional kWh
$0.30 per kilovar (kvar) of excess kvar

13. With the exception of Plan B, each alternative cost was calculated by applying the above rate schedule and using the following information for each alternative:

Power (kW) to operate the pumps
Average number of days pumps are operated
Annual energy requirements per month
Number of months per year where pumps are not operated

14. It was assumed that all energy usage will occur over the average number of days pumps are operated and no energy will be used during the off-season. However, large demand costs will still be incurred over this off-season period as determined from the rate schedule.

15. Each alternative for Plan B consists of two pumping stations of differing pumping capacities and expected days of operation. The same type of information used to calculate all other alternatives was used for each alternative in Plan B, except that the information was broken down into power (kW) and energy (kWh) per station. The costs were calculated per station per month and summed to give the total alternative annual cost.

TABLE E-1
COST ESTIMATE
RECOMMENDED PLAN - PLAN C, 17,500 CFS, WITH MITIGATION

Cost Account No.	Item	Quantity	Unit	Unit Cost ($)	Total Cost ($000)
01	Lands and Damages				
	Cleared land, fee[a/]	14	ac	330.0	4.6
	Woodland, fee[a/]	26	ac	330.0	8.6
	Woodland, easement[b/]	215	ac	550.0	118.2
	Woodland, easement[b/]	55	ac	0.0	0.0
	Woodland, easement[c/]	6,500	ac	350.0	2,275.0
	Contingencies				601.6
	Acquisition	9 [d/]	tracts	3,000.0	27.0
	PL 91-646 Title III				3.0
	Subtotal				3,038.0
02	Relocations				
	Bridge	1	job		805.0
	Road	1	job		55.0
	Powerlines	2	job		14.0
	Telephone lines	3	job		21.0
	Contingencies				179.0
	Subtotal				1,074.0
09	Channels and Canals				
	Excavation	3,394,293	cu yd	1.0	3,394.3
	Clearing-cleared lands	14	ac	200.0	2.8
	Clearing-woods	296	ac	750.0	222.0
	Turfing	186	ac	1,110.0	204.6
	Contingencies				764.7
	Subtotal				4,588.4
13	Pumping Plant				92,105.0
	Contingencies				18,421.0
	Subtotal				110,526.0
30	Engineering and Design				17,428.0
31	Supervision and Administration				13,361.0
TOTAL					150,015.4

a/ Lands associated with pumping plant.
b/ Easement acquired for channels, disposal sites, etc.
c/ Mitigation lands. (Easement approach was assumed for the purpose of estimating cost.)
d/ Includes 5 tracts of mitigation lands.

TABLE E-2
COMPARATIVE COST ANALYSIS
YAZOO AREA PUMP STUDY

Alternative	Cost Account Number/Item								
	01/Lands and Damages ($000)	02/Relocations ($000)	06/Fish and Wildlife Facilities ($000)	09/Channels and Canals ($000)	11/Levees ($000)	13/Pumping Plants ($000)	30/Engineering and Design ($000)	31/Supervision and Administration ($000)	Total ($000)
Plan A									
10,000 cfs	128.8	804.0	—	2,939.0	—	64,788.0	10,280.0	7,881.0	86,822.0
15,000 cfs	160.5	1,007.0	—	4,124.0	—	94,414.0	14,932.0	11,448.0	126,185.0
17,500 cfs	172.7	1,074.0	—	4,588.0	—	110,753.0	17,462.0	13,388.0	147,438.0
20,000 cfs	180.3	1,183.0	—	5,352.0	—	132,000.0	20,780.0	15,932.0	175,427.0
25,000 cfs (NED)	214.0	1,328.0	—	6,870.0	—	159,913.0	25,217.0	19,333.0	212,875.0
30,000 cfs	248.9	1,479.0	—	8,390.0	—	188,060.0	29,690.0	22,762.0	250,630.0
Plan B									
15,000 cfs (L) - 10,000 cfs (U)	437.2	1,792.0	—	8,697.0	—	176,268.0	21,164.0	21,592.0	238,000.0
10,000 cfs (L) - 15,000 cfs (U)	496.5	1,770.0	—	9,302.0	—	177,941.0	28,352.0	21,736.0	239,598.0
7,000 cfs (L) - 18,000 cfs (U)	542.1	1,836.0	—	9,892.0	—	178,306.0	28,505.0	21,854.0	240,935.0
Plan C									
10,000 cfs	128.8	804.0	—	2,939.0	—	63,946.0	10,153.0	7,784.0	85,755.0
15,000 cfs	160.5	1,007.0	—	4,124.0	—	93,988.0	14,868.0	11,399.0	125,546.0
17,500 cfs	172.7	1,074.0	—	4,588.0	—	110,526.0	17,428.0	13,361.0	147,150.0
17,500 cfs with mitigation[a/]	3,038.0	1,074.0	—	4,588.0	—	110,526.0	17,428.0	13,361.0	150,015.4
20,000 cfs	180.3	1,183.0	—	5,352.0	—	129,757.0	20,444.0	15,674.0	172,590.0
25,000 cfs	214.0	1,328.0	—	6,870.0	—	158,332.0	24,980.0	19,151.0	210,875.0
30,000 cfs	248.9	1,479.0	—	8,390.0	—	187,698.0	29,635.0	22,720.0	250,172.0
Plan D									
25,000 cfs	31,914.0	5,473.0	—	6,870.0	2,655.0	158,261.0	25,989.0	19,925.0	251,086.0
Plan E									
25,000 cfs	5,961.0	3,424.0	—	6,870.0	838.0	158,153.0	25,393.0	19,468.0	220,107.0
Plan F									
10,000 cfs	116.7	804.0	—	2,575.0	—	63,875.0	10,088.0	7,734.0	85,195.0
15,000 cfs	144.7	1,007.0	—	3,745.0	—	93,863.0	14,793.0	11,341.0	124,893.0
17,500 cfs	158.0	1,074.0	—	4,168.0	—	109,986.0	17,284.0	13,251.0	145,921.0
20,000 cfs	171.1	1,183.0	—	4,857.0	—	128,964.0	20,251.0	15,525.0	170,951.0
25,000 cfs	207.4	1,328.0	—	6,678.0	—	153,875.0	24,282.0	18,617.0	204,987.0
30,000 cfs	245.6	1,479.0	—	8,189.0	—	180,794.0	28,570.0	21,903.0	241,180.0
Plan G									
10,000 cfs	107.7	804.0	—	2,301.0	—	63,095.0	9,930.0	7,613.0	83,852.0
15,000 cfs	134.1	1,007.0	—	3,492.0	—	87,952.0	13,868.0	10,632.0	117,085.0
17,500 cfs	144.0	1,074.0	—	3,886.0	—	108,854.0	17,072.0	13,089.0	144,119.0
20,000 cfs	165.1	1,183.0	—	4,530.0	—	127,043.0	19,913.0	15,267.0	168,101.0
25,000 cfs	204.7	1,328.0	—	6,577.0	—	151,822.0	23,958.0	18,368.0	202,258.0
Plan H									
15,000 cfs (EQ)	29,869.0	1,007.0	12,660.0	3,492.0	—	87,952.0	15,767.0	12,088.0	162,834.0
Plan I									
10,000 cfs	97.8	804.0	—	1,976.0	—	61,607.0	9,658.0	7,404.0	81,549.0
15,000 cfs	122.2	1,007.0	—	3,112.0	—	86,022.0	13,521.0	10,366.0	114,151.0
20,000 cfs	153.9	1,183.0	—	4,503.0	—	124,361.0	19,507.0	14,955.0	164,663.0

(L) Lower ponding area.
(U) Upper ponding area.
a/ Recommended plan.

TABLE E-3
COST ESTIMATE OF ENVIRONMENTAL FEATURES
COMPARISON OF PLANS
YAZOO AREA PUMP STUDY

Cost Account No.	Item	NED Plan [a/] ($)	EQ Plan ($000)	Recommended Plan ($000)
01	Lands and Damages	0	29,735.0	2,859.0
06	Fish and Wildlife Facilities	0	12,660.0	0
30	Engineering and Design	0	1,899.0	0
31	Supervision and Administration	0	1,456.0	0
	TOTAL	0	45,750.0	2,859.0

a/ A mitigation plan was not developed for this alternative; however, estimated mitigation cost would be approximately $3.0 million.

TABLE E-4
OPERATION AND MAINTENANCE COSTS
AND ENERGY REQUIREMENTS
YAZOO AREA PUMP STUDY

Alternative	Annual Operation and Maintenance Costs ($000)	Annual Energy Requirements (Million kWh)
Plan A		
10,000 cfs	536.1	7.2
15,000 cfs	949.5	14.1
17,500 cfs	1,118.8	17.1
20,000 cfs	1,206.1	19.4
25,000 cfs (NED)	1,464.2	22.6
30,000 cfs	1,550.7	23.9
Plan B (Two-Site)		
15,000 cfs (L) - 10,000 cfs (U)	1,648.7	26.2
10,000 cfs (L) - 15,000 cfs (U)	1,898.3	29.3
7,000 cfs (L) 18,000 cfs (U)	2,039.0	31.7
Plan C		
10,000 cfs	487.8	6.3
15,000 cfs	834.7	12.0
17,500 cfs (recommended)	1,021.0	14.9
20,000 cfs	1,117.4	16.5
25,000 cfs	1,319.3	19.7
30,000 cfs	1,425.2	21.4
Plan D		
25,000 cfs	990.1	14.1
Plan E		
25,000 cfs	1,026.6	14.6

TABLE E-4 (Cont)

Alternative	Annual Operation and Maintenance Costs ($000)	Annual Energy Requirements (Million kWh)
Plan F		
10,000 cfs	309.4	3.4
15,000 cfs	513.3	6.4
17,500 cfs	612.9	7.6
20,000 cfs	673.9	8.7
25,000 cfs	742.7	9.6
30,000 cfs	811.0	10.6
Plan G		
10,000 cfs	258.7	2.6
15,000 cfs	415.8	4.7
17,500 cfs	456.6	5.2
20,000 cfs	483.8	6.3
25,000 cfs	592.9	7.1
Plan H		
15,000 cfs (EQ)	415.8	4.7
Plan I		
10,000 cfs	162.0	0.9
15,000 cfs	266.4	1.7
20,000 cfs	335.4	2.3

(L) Lower ponding area.
(U) Upper ponding area.

YAZOO PUMP PROJECT
YAZOO BACKWATER AREA
MISSISSIPPI

REEVALUATION REPORT

APPENDIX F

ECONOMIC ANALYSIS

PREPARED BY
THE UNITED STATES ARMY
VICKSBURG DISTRICT, CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

[redacted]

[redacted]

[redacted]

REEVALUATION REPORT
YAZOO AREA PUMP PROJECT
YAZOO BACKWATER AREA, MISSISSIPPI

APPENDIX F
ECONOMIC ANALYSIS

Table of Contents

Table of Contents (Cont)

Table of Contents (Cont)

LIST OF TABLES

LIST OF TABLES (Cont)

LIST OF TABLES (Cont)

LIST OF PHOTOS

LIST OF PHOTOS (Cont)

LIST OF PLATES

REEVALUATION REPORT
YAZOO AREA PUMP PROJECT
YAZOO BACKWATER AREA, MISSISSIPPI

APPENDIX F
ECONOMIC ANALYSIS

INTRODUCTION

1. This appendix pertains to the economic evaluation of additional water resource improvements recommended for the Yazoo Backwater project area. Pertinent information contained herein consists of a description of the methodology used to determine the damages and benefits under existing and future conditions, the project costs, and the benefit-cost evaluation.

2. All data used in project evaluation are based on the most recent land use data, hydrologic conditions, and October 1980 price levels. Economic evaluation of the proposed improvements is based on a 50-year period of analysis, an authorized interest rate of 2-1/2 percent, and an estimated project completion date of 1989. Initial project benefits will accrue in 1990 (base year).

3. The frequency method of analysis was used to convert historical flooding to an average annual basis. Beneficial and adverse effects of the proposed water resource improvements on various components of the human and natural environment are discussed in Appendix B.

FLOOD DAMAGE EVALUATION

LAND USE

4. The project area (the area flooded by the 100-year flood) includes approximately 539,000 acres of land in the Yazoo Area of the Mississippi Delta. Of this total, about 74 percent is cleared and used for row crops, livestock production, and miscellaneous and idle uses. An estimated 26 percent of the area is in woodlands. Of the total woodland area, approximately 80,200 acres are located within the Delta National Forest, the Panther Swamp National Wildlife Refuge, the Yazoo National Wildlife Refuge, and Delta Wildlife and Forestry, Inc. (a privately owned corporation operated with the primary objective of providing hunting for its stockholders).

Area	Area Subject to Flooding		
	Cleared (acres)	Wooded (acres)	Total (acres)
Lower Ponding Area	148,000	52,000 a/	200,000
Upper Ponding Area	249,000	90,000 b/	339,000
TOTAL	397,000	142,000	539,000

a/ Includes 3,630 woodland acres within Yazoo National Wildlife Refuge.
b/ Includes 76,589 woodland acres within Delta National Forest, Delta Wildlife and Forestry, Inc., and Panther Swamp National Wildlife Refuge.

5. Field investigations were conducted to determine the extent and character of flooding and flood damages. "Without-project" reflects existing conditions in the project area; "with-project" reflects conditions with the recommended plan (Plan C, 17,500-cubic-foot-per-second pump, without mitigation) in operation.

6. Flood damage evaluation was accomplished by examination of current aerial photographic maps and hydrologic data, the chronological tabulation of floods of records, field survey data, and the use of applicable flood analysis curves. Flood analysis curves were prepared for the project area to provide an accurate means of converting various types of damages to an average annual basis. These curves depict the relationship between stage and area inundated; stage and frequency of occurrence; area inundated and frequency of occurrence; stage and damage; and damage and frequency of occurrence. A typical set of flood analysis curves is shown on Plate F-1.

7. Based on existing conditions from the flood analysis curves, 249,000 cleared acres in the upper sump area and 148,000 cleared acres in the lower sump area are subject to flooding from the 100-year frequency event (see Table F-1).

TABLE F-1
CLEARED AREA SUBJECT TO INUNDATION BY
SPECIFIC FREQUENCY FLOOD EVENT
EXISTING CONDITIONS
(Acres)

Flood Frequency	Upper Sump Area	Lower Sump Area	Total Area
1-Year	12,000	9,000	21,000
2-Year	25,000	21,000	46,000
5-Year	51,000	46,000	97,000
10-Year	100,000	71,000	171,000
20-Year	148,000	96,000	244,000
50-Year	209,000	126,000	335,000
100-Year	249,000	148,000	397,000

8. The flood damage evaluation is based on the period of economic analysis (1990-2039); i.e., the period beginning with the first full year of benefits and continuing through the economic life of the project, and includes existing damages. "Existing values" refers to activities affected by flooding in the year the analysis was conducted (1978).

9. Present and future flood damages were determined for the agricultural and nonagricultural sectors affected by flooding. Major flood damage occurs to agricultural properties (crops and noncrop items), rural properties, and public roads and bridges.

CROP DISTRIBUTION AND YIELDS

10. Present crop yields (flood-free) and land use estimates for the agriculture sector were obtained from personal interviews with farmowners, farm operators, and county agricultural workers. The field survey represented a 44 percent sample of the total cleared land subject to flooding in the lower ponding area and a 24 percent sample in the upper ponding area.

11. Estimates of future with- and without-project conditions were obtained from the above sources, taking into consideration the land resource base and characteristics of farmers involved. Other sources of information included the U. S. Census of Agriculture for Mississippi, the Crop Reporting Service, and the Soil Conservation Service of the U. S. Department of Agriculture.

12. Crop budgets for the various crops were developed using October 1980 Guideline 2 agricultural price standards. Data on agricultural land use, crop distribution, and crop yield in the lower and upper ponding areas are provided in Tables F-2 and F-3.

TABLE F-2
PRESENT LAND USE
CROP DISTRIBUTION AND YIELDS
(Lower Ponding Area)

Land Use	Percent Distribution [a/]	Average Flood-Free Yield Per Acre
Cotton	14	833 lb
Soybeans	71	29 bu
Rice	1	95 bu
Double-cropping:		
Soybeans	6	23 bu
Wheat	(6) [b/]	33 bu
Pasture	1	280 lb
Miscellaneous	7	--

[a/] Applicable to cropland acres.
[b/] Parentheses indicate double-cropping.

TABLE F-3
PRESENT LAND USE
CROP DISTRIBUTION AND YIELDS
(Upper Ponding Area)

Land Use	Percent Distribution [a/]	Average Flood-Free Yield Per Acre
Cotton	12	884 lb
Soybeans	78	26 bu
Rice	2	109 bu
Double-cropping:		
Soybeans	3	21 bu
Wheat	(3) [b/]	33 bu
Pasture	1	214 lb
Miscellaneous	4	--

[a/] Applicable to cropland acres.
[b/] Parentheses indicate double-cropping.

AGRICULTURAL CROP DAMAGE

13. Average annual crop damage for "present" conditions, without and with the recommended plan, was determined by multiplying the damage per cleared acre flooded by the average annual cleared acres flooded. Data and methodology used in crop damage computations are presented in the following paragraphs.

Average Damage Per Cleared Acre Flooded

14. Average agricultural crop damage per cleared acre flooded was calculated using the computer program "Computerized Agricultural Crop Flood Damage Assessment System" (CACFDAS) recently developed by the Department of Agricultural Economics of Mississippi State University. In addition to its teaching function, this department is one of the major research components of the Mississippi Agricultural and Forestry Experiment Station. Others involved in development of the program include specialists from the Delta Branch Experiment Station, Stoneville, Mississippi, and the Mississippi Cooperative Extension Service, Mississippi State, Mississippi. Participating scientists included agricultural economists, agricultural engineers, agronomists, plant geneticists, plant pathologists, plant physiologists, and soil and weed scientists.

15. CACFDAS is published in two volumes. Volume I contains the damage assessment procedures and the computerization of these procedures. Volume II contains the budgetary data for each of the crops analyzed. Copies of the program are available from the Vicksburg District.

16. CACFDAS was developed to calculate flood damages for approximately 30 crops. Two general levels of management were developed for the principal crops of rice, cotton, and soybeans--high management practices and typical management practices. In addition, a low management practice for soybeans was included for a late crop replanting alternative.

17. Data used in the budgets for high management practices represent input data on yields, production practices, and resource use rates provided by research scientists and extension specialists at experiment stations. These reflect the potential for each crop when producers use "best-known" or recommended practices.

18. Budgets reflecting typical management practices are based on information developed from a survey of 82 cooperating producers in the delta of Mississippi. This survey has been conducted annually since 1974 to provide information on production practices and performance rates of new equipment for the principal crops of cotton, soybeans, rice, wheat, corn, and grain sorghum. Typical management practices reflect current production practices and costs based on "usual input practices," which describe the practices most commonly used by these 82 producers. These are the budgets used in this analysis.

19. The program calculates flood damages by crops by analyzing daily flood events. The program also has the capability to calculate damage from multiple

flooding events in the same year on the same area. In addition, the program allows for specific crop replanting and/or crop substitution.

20. Calculation of agricultural crop flood damage is a complex process. This program is structured to compute flood damages based on the time of the flood event as related to sequence of agricultural operations that have occurred in the production process. Duration factors, expressed as the number of days required to cause damage, are developed for four stages of plant development from planting through harvest. These factors range from 1 to 10 days depending on the crop and the stage of plant development. Dates of normal planting, late planting, and last date of planting are also developed by crop. These dates are extremely important as they, in conjunction with the duration factors, are the base dates from which flood damage, crop replanting, crop substitution, and crop yield reduction data are derived.

21. Three cost vectors were developed in the crop budgets and are used to assess flood damages. These include production costs and fixed harvesting equipment costs; expected net returns to lands, management, and general farm overhead; and operation revenues consisting of realized gross value of the harvested crop. Major computer input requirements include crop distribution data, net and gross returns by crop, crop substitution data, daily flood duration data, and number of cleared acres flooded on a daily basis.

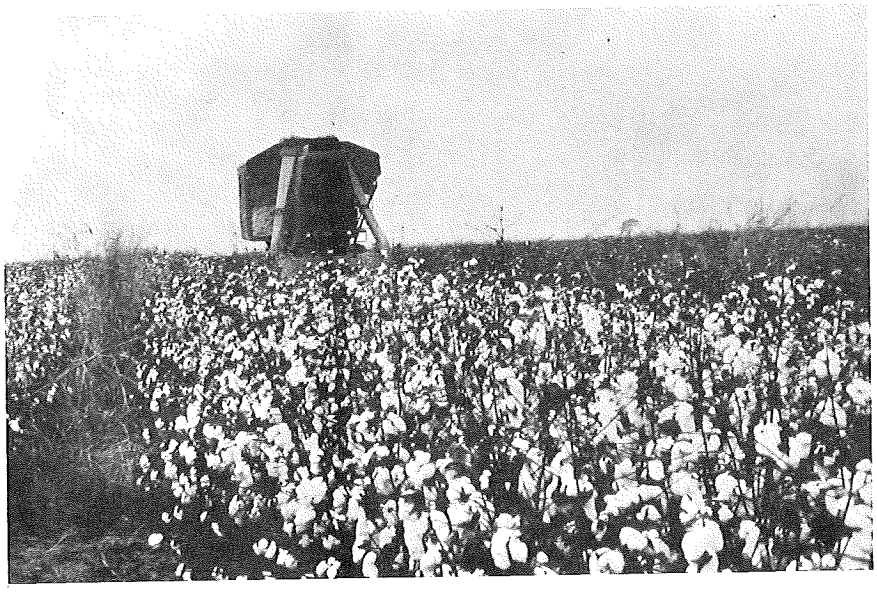
22. Land use crop data (crop distribution and yield data) were obtained from a random sample of landowners and operators within the project area. This sample survey includes the entire spectrum of cropping patterns for all elevations within the project area. Based on results of the agricultural crop damage program, using the survey data, damages per cleared acre flooded for without-project (1978) conditions are estimated at $31.64 for the lower ponding area and $33.56 for the upper ponding area. For with-project (1978) conditions, these damages per acre factors were determined to be $26.49 and $28.36, respectively.

Average Annual Cleared Acres Flooded

23. The average annual cleared acres flooded for with- and without-project conditions were derived from area-frequency curves developed by integration of stage-frequency and stage-area curves. Computation of the area under the area-frequency curves indicated that the average annual flood inundates 35,633 cleared acres in the lower ponding area and 47,515 cleared acres in the upper ponding area without the project, and 13,292 cleared acres in the lower ponding area and 18,206 cleared acres in the upper ponding area would be flooded with the project in operation. Additionally, Table F-4 presents the average annual cleared acres flooded by specific flood frequency stratification for comparison purposes.

PHOTOS 1 AND 2

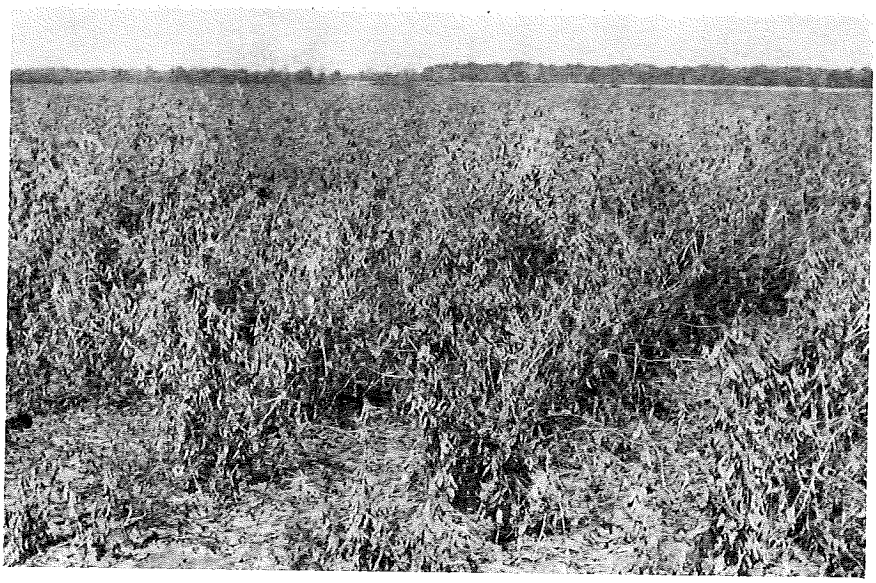
Low Yield Cotton - Late Planting
Due to Spring Flooding



High Yield Cotton - Planting on Optimum
Date with No Flooding

PHOTOS 3 AND 4

Low Yield Soybeans - Late Planting and Flood Damage



High Yield Soybeans - Optimum Planting Date as a Result of No Flooding

TABLE F-4
AVERAGE ANNUAL CLEARED ACRES SUBJECT TO INUNDATION
BY SPECIFIC FREQUENCY STRATIFICATION
EXISTING CONDITIONS
(Acres)

Flood Frequency Stratification	Upper Sump Area	Lower Sump Area	Total Area
0 - 5-Year	23,800	19,500	43,300
0 - 20-Year	37,400	29,500	66,900
5 - 20-Year	13,600	10,000	23,600
20 - 100-Year	10,100	6,100	16,200

Average Annual Crop Damage

24. Present average annual crop damages for without- and with-project conditions are presented below:

Item	Average Annual Crop Damages		
	Lower Sum ($)	Upper Sump ($)	Total Project Area ($)
Present damage			
Without project	1,127,000	1,595,000	2,722,000
With project	352,000	516,000	868,000

Future Values

25. Future food and fiber needs make continued productivity gains through knowledge and technology even more critical. According to USDA estimates, future productivity increases of approximately 1.5 percent per year are possible as public and private management generates sufficient productivity growth to meet world needs.

26. U. S. agricultural history reflects four distinct periods based on major sources of technological change: hand power, horse power, mechanical power, and science power. In each of the previous periods, as productivity reached or approached limits to growth from the dominant technology, a new major technology emerged and stimulated productivity to a higher growth curve. Substantial periods of time are often required from the commercial introduction of a new technology to its widespread adoption and implementation. As a result, USDA estimates reflect that yields will continue to increase through greater

use of basic technologies that now exist such as hybrid seed, more fertilizer, improved equipment, planting and cultivation practices, chemical developments, etc.

27. An example of this is the recent development of a new soybean variety called Braxton which could increase present acreage soybean production by 10 million bushels per year. Braxton provides yield increases of 9 to 10 percent over existing varieties, has excellent seed holding qualities, and is resistant to many diseases to which other varieties are susceptible. Another example of existing technology offering potential for significant increases in yields is in the area of planting and cultivation practices. Research reveals that removal of common cockleburs from soybeans during the first 6 weeks of the growing season prevents almost all of a 43 percent yield reduction that would have occurred otherwise. Similarly, recent research has been conducted on narrow-row cotton (requiring 14 inches rather than 40 inches) which benefits growers through increased yields per acre, earlier harvest dates, and improved pest management schemes. Increases in yields of up to 20 percent are attributed to this narrow-row cotton production technique.

28. In addition, scientists expect a new family of technologies to emerge, some of which are already appearing. Many analysts feel some of these have great potential and could propel agricultural productivity into a new growth spiral when they become commercially available. It is possible that an unprecedented growth could result from some of these emerging technologies. One area now in development which is expected to play a big role in the future is the field of photosynthesis enhancement. Others include bioregulators (which help producers to control ripening and other characteristics of fruits and vegetables to facilitate harvesting), water and fertilizer management, new pest control strategies, multiple and intensive cropping, reduced tillage, bioprocessing, new crop development, etc.

29. Thus, considerable potential does exist for dramatic increases in yields using current information and resources. Significant differences in production often exist between test-plot yields and on-farm yields. Therefore, one major element for increasing production is the transfer of expertise to the individual farmer. Some estimates indicate that cotton yields could be increased by 60 percent by more effective dissemination and use of information. The top 10 percent of U. S. farmers with the highest yields of major crops such as corn, wheat, soybeans, and cotton achieve yields 50 to 80 percent greater than average. Although all producers cannot reach these productivity levels, most can improve.

30. Science-based technology, unlike natural resources, is a manmade resource which can be continuously renewed through research and development. These advances will undoubtedly have dramatic impact upon productivity. However, adequate flood protection is critical to farmers within the study area if they are to be capable of utilizing the resources and technology available to them.

31. The factors discussed above indicate that technological improvements will continue and agricultural production will increase as in the past. The value

of farm products sold per acre harvested (in constant dollars) is a good indication of the historical increases in productivity for a specific area, and the extension of these trends into the future provides reasonable estimates of expected increases. Per acre harvested values were used to offset the impacts of including increased amounts of cleared acreages in the total value of all farm products sold.

32. The statistical reliability of the analysis was tested by comparison with Census of Agriculture data for Humphreys, Issaquena, Sharkey, and Yazoo Counties, Mississippi, for the years 1949, 1954, 1959, and 1964. The years 1969 and 1974 were not used in the analysis since area crop production in both years was not representative due to severe droughts in the project area during the growing season. The drought problems in 1974 were compounded by the flood problems in the spring, which caused crops to be planted later than normal. Since no major flood control works were completed during the period 1949 through 1964 in the 4-county area for which value of farm products sold was projected, no discernible flood control project-induced effects, such as additional land treatment, etc., were built into the trend line. Based on use of the "F" test, the projected data proved to be statistically significant at the 1 percent level of probability. The coefficient of determination was calculated to be .99. Historical and projected values of all farm products sold per acre harvested for selected years are shown in the following tabulation:

Year	Historical and Projected Value of Farm Products Sold Per Acre Harvested		
	Value/Acre (1972 Dollars)	Ratio of Increase (Over Prior Year)	(Over 1978)
1949	78.72	1.5795	N/A
1954	124.34	1.3729	N/A
1959	170.71	1.1556	N/A
1964	197.27	-0.5204	N/A
1969	94.61	1.3468	N/A
1974	127.42	2.4771	N/A
1978	315.63	1.3057	1.3057
1990	412.11	1.1951	1.5604
2000	492.52	1.1632	1.8152
2010	572.92	1.1404	2.0699
2020	653.33	1.1231	2.3247
2030	733.73	1.0986	2.5539
2039	806.09		

AGRICULTURAL NONCROP DAMAGE

33. Flood damages to farm property other than crops include damages to farm fences, farm buildings, farm roads, drainage ditches, etc.

Present Values

34. Present noncrop damage values were determined by developing a composite noncrop damage factor per acre and applying this factor to the average annual cleared acres flooded. The damage factor was determined by using aerial photographs, an analysis of the amount of each damageable item, field investigations, current cost data, verified percent damage estimates, and appropriate flood analysis curves. The average damage per cleared acre ($5.47) was multiplied by the average annual cleared acres flooded for without- and with-project conditions (see paragraph 23) to determine the present noncrop damages shown in the following tabulation.

Item	Average Annual Noncrop Damage		
	Lower Sump ($)	Upper Sump ($)	Total Project Area ($)
Present (1978) damage			
Without project	195,000	260,000	455,000
With project	73,000	99,000	172,000

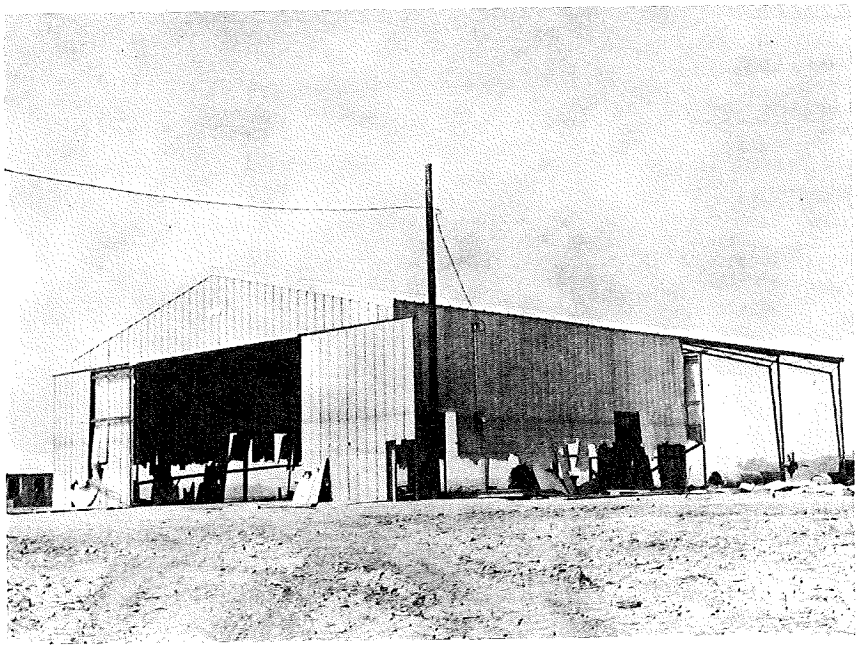
Future Values

35. Future increases in noncrop items or improvements are based on implementation of existing practices and technology as well as utilization of additional items that will be developed during the life of the project. Major strides have occurred in on-farm improvements during recent years. The extent to which these have been implemented is due to a variety of factors, one of which is the stage of development of the area. Much of the study area has been cleared and placed in agricultural production in the recent past, and the extent of noncrop development is relatively low as evidenced by the existing damage rate of $5.47 per acre. The increase in the development of noncrop items such as drainage ditches, improved farm roads, farm buildings, grain bins, etc., is generally a long-range goal of landowners.

36. A comprehensive study of 66 hydraulic reaches in the Vicksburg District was completed in 1980 by private A-E firms. It specifically addressed losses to machinery, supplies, fences, farm roads, and drainage ditches within the noncrop category. Per acre damages varied from a low of $0.55 to a maximum of $79.40 and averaged $19.69. The average is influenced by highly developed reaches where per acre damages of $20.00 or more are common as well as reaches with less development such as those presently in the study area.

PHOTOS 5 AND 6

Farm Property - Example of Private Expenditure to Relieve Flood Damage



Flood Damage to Metal Building - Wavewash and Metal Fatigue

37. Agricultural noncrop items such as land leveling, drainage ditches, etc., are directly related to growth in the crop production of the area. Farmers within the study area are progressive and have historically implemented practices and improvements to improve their operations. Improvements have included extensive noncrop items which represent major capital investments, a trend which is expected to continue. Therefore, the projection of noncrop damages based on a direct relationship with increases in crop damages provides reasonable estimates of future damages, and the damage rate of $13.97 per acre at the end of the projection period is well within reasonable limits.

DAMAGE TO RURAL
RESIDENTIAL PROPERTY

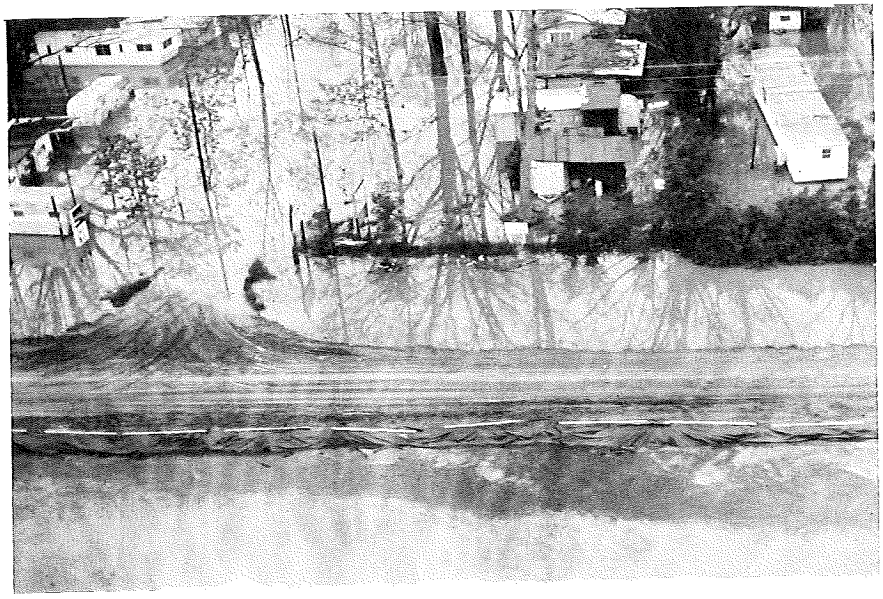
38. Flood damage to rural residential property was determined through the use of the computerized computational procedure developed by Vicksburg District personnel. The information required for this statistical procedure consists of elevations of various frequency floods and structural information, i.e., identification of the structure, elevation, value, description, and value of contents.

39. The tabulation below presents, by structure type, the estimated number of structures subject to flooding by the 100-year frequency flood under without- and with-project conditions. The number of structures subject to flooding will remain constant throughout the project life due to a projected negative population growth and the development constraints pursuant to the Flood Disaster Protection Act of 1973.

Property Type	No. of Structures Subject to Flooding	
	Without Project	With Project
Residential Dwelling		
Brick homes	144	68
Frame homes	479	103
Trailer homes	127	24
Commercial	37	1
Industrial	4	-
Recreational	244	35
Public	4	-
Semipublic	15	1

PHOTOS 7 AND 8

Flooding of Private Homes
Yazoo Backwater Area



Flooding of Recreational Property
Yazoo Backwater Area

Average Residential Structures and Content Values

40. The average values of existing rural residential structures (dwellings) and contents subject to flooding in the project area were determined based on recent real estate appraisals. The value of land was excluded in the determination of average structure values. Average value of residential structures and contents subject to flooding are expressed in 1980 current dollars and are presented in Tables F-5 and F-6 for without- and with-project conditions, respectively.

TABLE F-5
AVERAGE VALUE OF RESIDENTIAL STRUCTURES AND CONTENTS SUBJECT TO FLOODING
EXISTING AND FUTURE WITHOUT-PROJECT CONDITIONS [a/]

Classification	Structures	Average Value of Structures	Average Value of Contents	Average Value of Contents as a Percent of Structure Value
	(No.)	($)	($)	($)
Dwelling:				
Brick homes	144	40,609	16,244	40
Frame homes	479	11,206	4,482	40
Trailer homes	127	8,743	3,497	40

a/ The "affluence factor" (increases in average value of contents based on projected per capita income increases) is not applicable in rural areas.

TABLE F-6
AVERAGE VALUE OF RESIDENTIAL STRUCTURES AND CONTENTS SUBJECT TO FLOODING
EXISTING AND FUTURE WITH-PROJECT CONDITIONS a/

Classification	Structures	Average Value of Structures	Average Value of Contents	Average Value of Contents as a Percent of Structure Value
	(No.)	($)	($)	($)
Dwelling:				
Brick homes	68	41,944	16,778	40
Frame homes	103	12,329	4,932	40
Trailer homes	24	8,847	3,539	40

a/ The "affluence factor" (increases in average value of contents based on projected per capita income increases) is not applicable in rural areas.

Present Values

41. Average annual damages to rural residential properties within the project area include damage to residential dwellings and commercial, industrial, public, semipublic, and recreational properties. Of the total damages, 92 percent accrue to residential dwellings. Rural residential dwelling damages on a per unit basis for without- and with-project conditions are presented in the following tabulation. Unit flood damages were obtained by dividing the average annual flood damage (determined by frequency analysis) by the number of structures affected (see Tables F-5 and F-6). Unit flood damages will remain constant over the life of the project.

Property Type	Unit Flood Damages	
	Without Project ($)	With Project ($)
Residential:		
Brick homes	1,123	389
Frame homes	398	449
Trailer homes	353	262

Future Values

42. A negative population growth is projected for the project area throughout the life of the project; therefore, the assumption made in the analysis was that the number of structures would not change with or without the project. Some structures would be replaced with new units, maintaining approximately the same number in the project area. Pursuant to the Flood Disaster Protection Act of 1973 (PL 93-234), new structures to be located in the designated flood-prone areas of the "rural residential area" must meet established requirements to provide protection for the 100-year flood. Improvements to structures presently in the area and inflation rates are expected to maintain current value levels. No affluence factor was applicable; therefore, future without-project damage was assumed to be the same as the present data, expressed in 1980 dollars.

Total Rural Residential Flood Damages

43. Total rural residential flood damages were obtained using data on the estimated number of structure units (Tables F-5 and F-6) and unit flood damages (paragraph 41). The following tabulation presents data on the total annual rural residential flood damage for without- and with-project conditions. Flood damages remain constant over the project life due to the projected reduction in population growth, development constraints pursuant to the Flood Disaster Protection Act of 1973, and the rural characteristics of the project area.

Property Type	Annual Flood Damages	
	Without Project ($)	With Project ($)
Residential:		
Brick homes	162,000	26,000
Frame homes	190,000	47,000
Trailer homes	45,000	6,000
Commercial	6,000	1,000
Industrial	1,000	0
Recreational	22,000	2,000
Public	3,000	0
Semipublic	1,000	a/
Total	430,000	82,000

a/ Less than $500.

DAMAGE TO PUBLIC
ROADS AND BRIDGES

44. Public road and bridge damage estimates are based on field investigations, historical flood data obtained from local officials, and analysis of county highway maps with flood delineations noted.

Present Values

45. Data from the above sources and damage estimates per mile for asphalt and gravel roads were utilized to develop and verify stage-damage relationships. By integration of stage-damage and stage-frequency curves, a damage-frequency curve was developed. Measurement of the area under the damage-frequency curve yielded average present road and bridge damage estimates as presented in the following tabulation:

Item	Average Annual Road and Bridge Damage		
	Lower Sump ($)	Upper Sump ($)	Total Project Area ($)
Present (1978) damage			
Without project	71,000	210,000	281,000
With project	19,000	70,000	89,000

Future Values

46. Population projections indicate a decrease in project area population throughout the project life. Therefore, damage values for public roads and bridges were held constant throughout the project life.

TOTAL DAMAGE

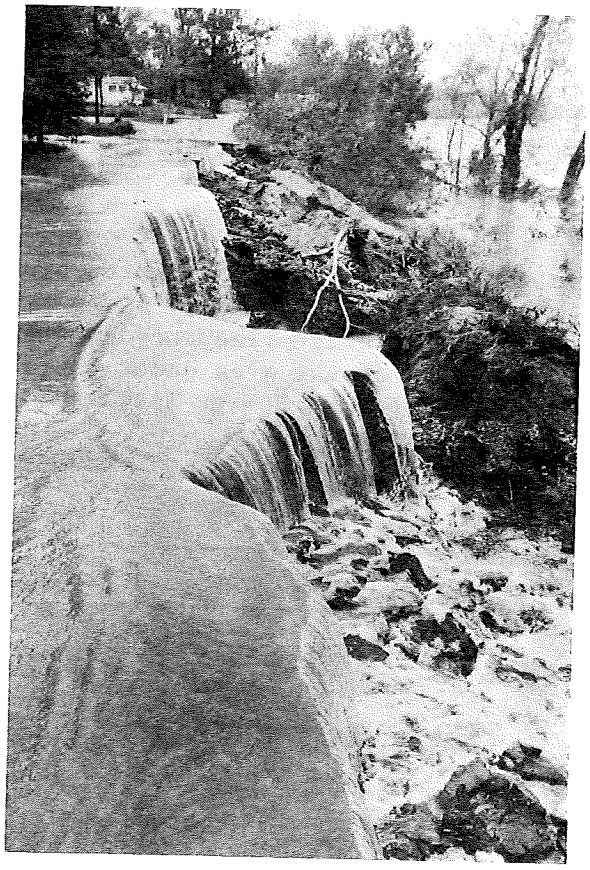
47. Total average annual flood damage to present development within the project area is estimated at $3.9 million under existing conditions (Table F-7). Of these damages, 70 percent occur to agricultural crops, 12 percent to agricultural noncrop properties, 11 percent to rural residential properties, and 7 percent to public roads and bridges.

BENEFITS

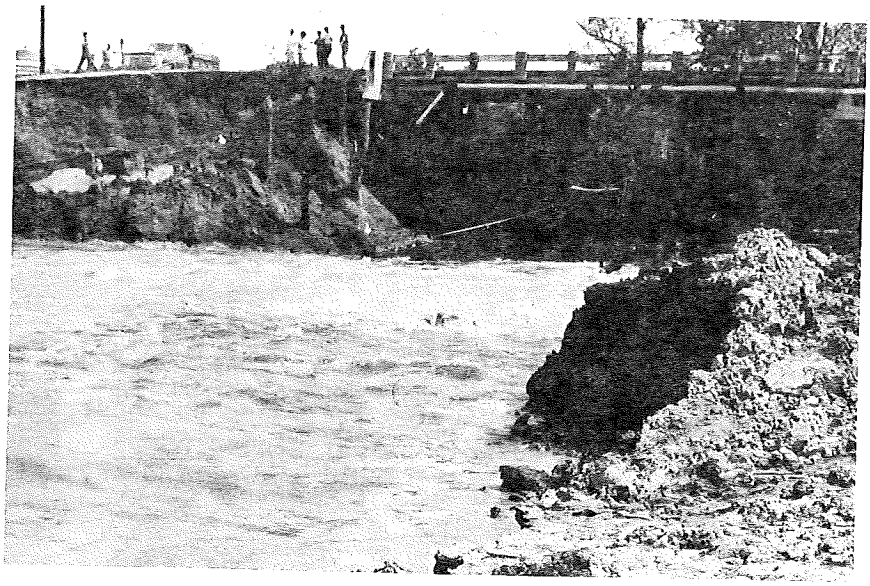
GENERAL

48. The benefits presented in this section are based on construction of the recommended plan (Plan C, 17,500-cubic-foot-per-second pump). Benefits are based on the period of economic analysis; i.e., the period beginning with the

PHOTOS 9 AND 10



Road Damage Due to Flooding
Yazoo Backwater Area



Flood Damage to Bridge
Yazoo Backwater Area

TABLE F-7
SUMMARY OF ESTIMATED AVERAGE ANNUAL FLOOD DAMAGES
PRESENT AND FUTURE VALUES, WITHOUT AND WITH PROJECT CONDITIONS [a/]

Item	Type of Damage						Total
	Agricultural			Nonagricultural			
	Crop [b/]	Noncrop [c/]	Subtotal	Rural Structural [d/]	Road and Bridge	Subtotal	
	($)	($)	($)	($)	($)	($)	($)
Present 1978 damage							
Without project	2,722,000	455,000	3,177,000	430,000	281,000	711,000	3,888,000
With project	868,000	172,000	1,040,000	82,000	89,000	171,000	1,211,000
Projected base year 1990 damage							
Without project	3,554,000	593,000	4,147,000	430,000	281,000	711,000	4,858,000
With project	1,134,000	225,000	1,359,000	82,000	89,000	171,000	1,530,000
Projected 2000 damage							
Without project	4,247,000	710,000	4,957,000	430,000	281,000	711,000	5,668,000
With project	1,355,000	268,000	1,623,000	82,000	89,000	171,000	1,794,000
Projected 2010 damage							
Without project	4,942,000	826,000	5,768,000	430,000	281,000	711,000	6,479,000
With project	1,576,000	313,000	1,889,000	82,000	89,000	171,000	2,060,000
Projected 2020 damage							
Without project	5,635,000	941,000	6,576,000	430,000	281,000	711,000	7,287,000
With project	1,798,000	356,000	2,154,000	82,000	89,000	171,000	2,325,000
Projected 2030 damage							
Without project	6,328,000	1,057,000	7,385,000	430,000	281,000	711,000	8,096,000
With project	2,019,000	401,000	2,420,000	82,000	89,000	171,000	2,591,000
Projected 2039 damage							
Without project	6,951,000	1,162,000	8,113,000	430,000	281,000	711,000	8,824,000
With project	2,218,000	440,000	2,658,000	82,000	89,000	171,000	2,829,000

a/ Undiscounted values, rounded to nearest thousand.
b/ Includes damages to all crops susceptible to flood damage.
c/ Includes damage to farm fences, drainage ditches, land leveling, farm roads, etc.
d/ Includes damages to residences, commercial establishments, industrial firms, public properties, semipublic structures, and recreational facilities.

estimated first full year of operation and continuing through the economic life of the project (1990-2039).

Validation of Benefit Evaluation

49. There are several methods for improving the credibility of benefit evaluation: sensitivity analysis, use of sampling techniques and statistical testing, quantifying variable relationships, assumptions and hypotheses, and probability of occurrence.

50. The sensitivity analysis is more applicable in urban areas where the economic feasibility is especially sensitive to a given variable or parameter. Since the economy of the project area is based primarily on the agricultural industry, the use of sensitivity analysis was not considered applicable.

51. The level of agricultural production and agricultural price levels used in the analysis for this study were developed to eliminate the cyclical fluctuation characteristic of the agricultural industry. Use of the sensitivity analysis would have necessitated consideration of varying production levels plus alternative assumptions on agricultural exports, allotment restrictions, etc.

52. Since the project area is relatively small, any alternative level of agricultural production would not significantly affect total United States agricultural production. Therefore, the benefit evaluation in this study was given additional credibility by the use of sampling techniques and statistical testing, assumptions, quantification of variable relationships, and probability of occurrence.

53. Sampling techniques were used to collect basic values used to determine damages to crop and noncrop items and roads and bridges. Rural residential damages were based on surveys of affected areas to determine number, type, and value of structures at selected elevations of flooding.

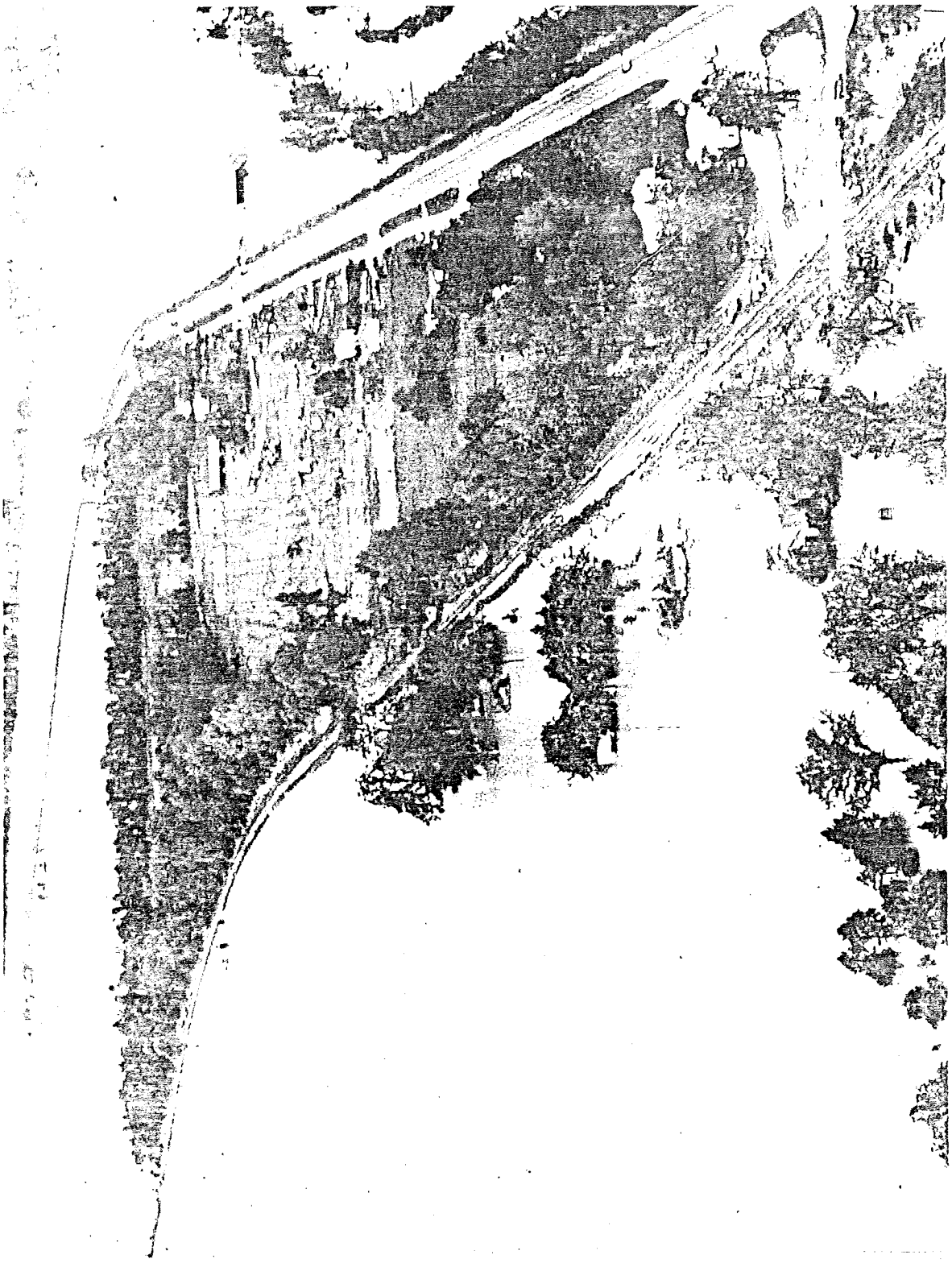
Benefit Categories

54. Flood control benefits are classified into two categories: inundation (flood damage reduction) and intensification. Inundation benefits consist of damage reduction to development expected to exist for present conditions at the beginning of project operation and the reduction of damage to additional development without project installation. Intensification benefits result from development potentials created by the project. These additional benefits will result from an intensification of farming operations and change in land use. Intensification benefits are measured in terms of increases in net returns to land.

Benefits by Sector

55. Future flood control benefits were determined for the agricultural and nonagricultural sectors affected by the recommended plan of improvement. Agricultural benefits within the project area consist of damage reduction to

PHOTO 11



Typical Flood Scene
Yazoo Backwater Area

crops and noncrop items, increased net returns to land from higher yield levels, and conversion of woodland to cropland. Benefits accruing to the nonagricultural sector result from damage reduction to affected rural residences and other nonagricultural properties in the project area and public roads and bridges.

56. All benefits were discounted to determine present worth and were amortized over the project life to determine average annual values for each category. Benefits are based on a 50-year development period, a project economic life of 50 years, and an authorized interest rate of 2-1/2 percent.

INUNDATION BENEFITS

57. Inundation benefits (flood damage reduction) were evaluated for agricultural crops, agricultural noncrop items, rural residences and other nonagricultural properties, and public roads and bridges.

Agricultural Crops

58. Flood damage reduction benefits to crops are based on the difference between annual flood damages for without-project conditions and the remaining damage with installation of the recommended plan (Table F-8). Calculation of present and future benefits is illustrated in Item 1 of Table F-8.

59. Computations indicate that the base year (1990) flood damage reduction benefits to crops would be $2.4 million. With the recommended plan, damages to crops would be reduced by 68 percent (Item 2). Discounting of agricultural crop benefits was accomplished utilizing the computer discounting program ECON. Benefits from flood damage reduction to crops would be $3.3 million annually.

Agricultural Noncrop Items

60. Benefits from flood damage reduction to agricultural noncrop items were determined by the same method used for agricultural crops. Total average annual benefits of $507,000 would accrue to the project area (Table F-9). Installation of the proposed works of improvement would provide an overall reduction of 62 percent in existing noncrop damages.

Rural Residential Property

61. Benefits from flood damage reduction to rural residences and other structures were obtained by determining the difference between projected without- and with-project conditions. Average annual flood damage reduction benefits to rural residential properties would be $346,000 and represent an 81 percent reduction in urban damage with installation of the recommended plan (Table F-10).

TABLE F-8
COMPUTATION OF BENEFITS FROM DAMAGE
REDUCTION TO AGRICULTURAL CROPS
WITH PROJECT
(Project Area)

Item	Damages Without Project ($)	Damages With Project ($)	Flood Damage Reduction Benefits ($)
1. Present and projected data			
Present value 1978 (current year)	2,722,000	868,000	1,854,000
Projected values			
1990 (base year)	3,554,000	1,134,000	2,420,000
2000	4,247,000	1,355,000	2,892,000
2010	4,942,000	1,576,000	3,366,000
2020	5,635,000	1,798,000	3,837,000
2030	6,328,000	2,019,000	4,309,000
2039	6,951,000	2,218,000	4,733,000

2. Degree of protection (ratio of reduction in flood damage to total damage).

Base year (1990) $2,420,000 ÷ $3,554,000 = 0.68

3. Total annual benefits

Average annual agricultural crop benefits = $3,340,000 a/

a/ Projected benefits are discounted over 50-year life of project using the authorized interest rate of 2-1/2 percent.

TABLE F-9
COMPUTATION OF BENEFITS FROM DAMAGE
REDUCTION TO AGRICULTURAL NONCROP ITEMS
WITH PROJECT
(Project Area)

Item	Damages Without Project[a/] ($)	Damages With Project[a/] ($)	Flood Damage Reduction Benefits ($)
1. Present and projected data			
Present value 1978 (current year)	455,000	172,000	283,000
Projected values			
1990 (base year)	593,000	225,000	368,000
2000	710,000	268,000	442,000
2010	826,000	313,000	513,000
2020	941,000	356,000	585,000
2030	1,057,000	401,000	656,000
2039	1,162,000	440,000	722,000

2. Degree of protection (ratio of reduction in flood damage to total damage).

Base year (1990) $368,000 ÷ $593,000 = 0.62

3. Total annual benefits

Average annual agricultural noncrop benefits[b/] = $507,000

a/ Damages shown are undiscounted values.
b/ Projected benefits are discounted over 50-year life of project using the authorized interest rate of 2-1/2 percent.

TABLE F-10
COMPUTATION OF BENEFITS FROM DAMAGE
REDUCTION TO RURAL RESIDENTIAL PROPERTIES
WITH PROJECT
(Project Area)

Item	Damages Without Project[a/] ($)	Damages With Project[a/] ($)	Flood Damage Reduction Benefits ($)
1. Present and projected data			
Present value 1978 (current year)	429,000	83,000	346,000
Projected values (1990-2039)	429,000[b/]	83,000[b/]	346,000[b/]
2. Degree of protection (ratio of reduction in flood damage to total damage).			
Base year (1990)	$346,000 ÷ $429,000 = 0.81		
3. Total annual benefits			
Average annual rural residential benefits[b/]	= $346,000		

a/ Damages shown are undiscounted values.
b/ Benefits were held constant over the life of the project.

Public Roads and Bridges

62. Benefits from flood damage reduction to roads and bridges were determined by subtracting with-project damages from without-project damages. Present values were held constant over the life of the project due to a projected negative population growth. Average annual benefits of $192,000 would result from reduction of flooding on public roads and bridges (Table F-11).

Inundation Reduction

63. Field surveys and historical trends within the project area indicate the conversion of woodlands to cropland will continue with or without project implementation. Inundation benefits will accrue on land to be cleared without project installation and are based on a per-acre benefit derived from crop and noncrop benefits on presently cleared land in the project area. Per-acre benefits were determined to be $6.06 for the lower ponding area and $4.97 for the upper ponding area (Table F-12).

64. Future benefit values were obtained by applying per-acre benefits to the estimated acreage to be cleared, and projecting these values by use of projected ratios of increase for value of farm products sold per acre harvested. With the recommended plan, the average annual benefits resulting from the reduction of flooding on lands cleared in the future without the project would be $238,000.

INTENSIFICATION BENEFITS

65. Intensification benefits are the increased effect of a water resources project plan on activities, enabling them to utilize the land more intensively, thereby increasing net returns. The reduction of flood risk allows farmers to intensify agricultural operations, producing higher yield levels, more profitable cropping distributions, and increased net returns.

66. Soil wetness is a major problem which often severely limits agricultural activities. Frequent flooding precludes drainage and other improvement activities necessary to reduce excessive soil wetness. This detrimental impact on drainage also extends to less frequently flooded areas. Failure to evacuate water from the more flood-prone areas prevents the effective drainage of higher areas, thus increasing soil wetness problems in these areas.

67. Due to the soil wetness problems caused by ineffective drainage systems and by the high risk of flooding, farmers are unable to plan and select highest yielding varieties or to plant on optimum dates. By planting recommended varieties at the appropriate time, increased yields will result from utilization of periods of more favorable plant growth, less insect pressure, favorable harvest conditions, and an increased number of days suitable for various crop production operations. Research performed at Mississippi State University during the period 1976-1979 indicates that the period 14-28 May is the optimum period for planting soybeans in the Yazoo area. Subsequent delays resulted in significantly decreased yields.

TABLE F-11
COMPUTATION OF BENEFITS FROM DAMAGE
REDUCTION TO PUBLIC ROADS AND BRIDGES
WITH PROJECT
(Project Area)

Item	Damages Without Project[a/] ($)	Damages With Project[a/] ($)	Flood Damage Reduction Benefits ($)
1. Present and projected data			
Present value 1978 (current year)	281,000	89,000	192,000
Projected values (1990-2039)	281,000[b/]	89,000[b/]	192,000[b/]
2. Degree of protection (ratio of reduction in flood damage to total damage).			
Base year (1990)	$192,000 ÷	$281,000 =	0.68
3. Total annual benefits			
Average annual road and bridge benefits[b/]		=	$192,000

a/ Damages shown are undiscounted values.
b/ Benefits were held constant over the life of the project.

TABLE F-12
COMPUTATION OF BENEFITS FROM REDUCTION OF FLOODING ON
LANDS TO BE CLEARED WITHOUT PROJECT

Item	Amount
1. Per acre benefit (1978):[a/]	
Lower Ponding Area	$6.06
Upper Ponding Area	$4.97

2. Projected benefits, period of analysis:

Year	Per Acre Benefit ($)	Acres To Be Cleared[b/] (Cumulative Acres)	Ratio of Increase[c/]	Value ($)
		Lower Ponding Area		
1990	6.06	11,570	1.3057	92,000
2000	6.06	16,970	1.5604	160,000
2010	6.06	18,170	1.8152	200,000
2020	6.06	19,370	2.0699	243,000
2030	6.06	20,470	2.3247	288,000
2039	6.06	21,470	2.5539	332,000
		Upper Ponding Area		
1990	4.97	3,046	1.3057	20,000
2000	4.97	4,546	1.5604	35,000
2010	4.97	4,846	1.8152	44,000
2020	4.97	5,146	2.0699	53,000
2030	4.97	5,446	2.3247	63,000
2039	4.97	5,746	2.5539	73,000

3. Total annual benefits:

Average annual future, without-project land clearing--inundation reduction benefits[d/]

Lower Ponding Area	=	$195,000
Upper Ponding Area	=	$ 43,000
Total	=	$238,000

a/ Crop and noncrop benefits (1978) ÷ cleared acres at 100-year frequency.
b/ See Appendix A, without project land use area data.
c/ Developed from tabulation, paragraph 32, as: value of farm products sold per acre harvested for respective year divided by similar 1978 value.
d/ Projected benefits were discounted using authorized interest rate of 2-1/2 percent and 50-year project life.

68. Due to the high risk and uncertainty associated with areas of frequent flooding, farmers are unable to properly plan their farming operation. Farmers generally make plans prior to the spring planting season and translate these plans into commitments with suppliers to purchase seeds, fertilizer, and chemicals as well as tractors, trucks, and other associated agricultural equipment. Financial needs are arranged through lending institutions based on anticipated crop types and activities considering flood risk and other elements.

69. The ever-present threat of flooding in the Yazoo Area places farmers in a situation where they are unable to determine the equipment or number of employees that will be needed or the seasonal crop varieties, herbicides, or insecticides to purchase. Thus, farmers in frequently flooded areas are severely limited in their ability to plan for the desired and most efficient operation.

70. Flooding conditions in the Yazoo Area render this area ideally suited for the accrual of intensification benefits. As stated previously, floods of varying degrees occur on an annual basis. Major floods have occurred 4 of the past 7 years with the largest occurring during 1973 in which 397,000 cleared acres would flood under present conditions. The 1973 flood lasted 9 months. Reduction of this flood threat would allow area farmers to construct more efficient drainage, select recommended varieties and plant crops on optimum dates, and more efficiently plan their operations. During field surveys and at the public meeting, farmers repeatedly stated that the frequent flooding was adversely affecting the planning and management of their operations.

Presently Cleared Lands

71. Benefits from increased yield levels on presently cleared lands are based on the increase in net productive value per acre resulting from intensified farming operations due to flood reductions provided by the project.

72. Increases in net productive value per acre are based on the differences in yield levels and crop distribution under without- and with-project conditions as shown in Tables F-13 and F-14. Extensive field surveys were conducted in the study area to determine without- and with-project flood-free land use and yield levels. Farmowners and/or operators representing 44 percent of the cleared lands in the lower sump and 24 percent in the upper sump were interviewed. These sample farms were randomly selected and included farms of various sizes, located throughout the project area, and covering the entire spectrum of flood zones. Increases in yield levels and modifications in cropping practices are based on personal interviews with a large number of area farmers (as discussed), consultations with agricultural workers, interviews with personnel of the Soil Conservation Service and the Agricultural Stabilization and Conservation Service, and the expertise of staff agronomists. The increase in net productive value per cleared acre after installation of the proposed plan of improvement is presented for the lower ponding area and for the upper ponding area (see Tables F-13 and F-14, respectively).

TABLE F-13
INCREASE IN NET PRODUCTIVE VALUE PER ACRE
UPPER SUMP
(Project Area)

Land Use	Price[a]	Without-Project						With-Project						Increase In Net Productive Value/Acre
		Percent Distribution	Average Yield/Acre[b]	Gross Value	Production Cost	Net Returns	Weighted Net Value	Percent Distribution	Average Yield/Acre	Gross Value	Production Cost	Net Returns	Weighted Net Value	
	($)			($)	($)	($)	($)			($)	($)	($)	($)	($)
Cotton (Lint)	.602 lb	12.0	884 lb	609.90	322.35	287.55	34.51	13.0	977 lb	674.06	334.76	339.30	40.72	6.21
(Seed)	111.52 ton													
Soybeans	6.53 bu	78.0	26 bu	169.78	67.32	102.46	79.92	65.0	35 bu	228.55	69.28	159.27	124.23	44.31
Rice	3.90 bu	2.0	109 bu	425.10	244.18	180.92	3.62	3.0	125 bu	487.50	250.31	237.19	4.24	1.12
Double-cropping:														
Soybeans	6.53 bu	3.0	21 bu	137.13	47.16	89.97	2.70	14.0	28 bu	182.84	49.00	133.84	4.02	1.32
Wheat	3.08 bu	(3.0)	33 bu	101.64	34.21	67.43	2.02	(14.0)	40 bu	123.20	35.32	87.88	12.30	10.25
Pasture	58.77 cwt/ beef	1.0	2.14 cwt/ beef	125.77	55.28	70.49	0.70	1.0	3.0 cwt/ beef	176.31	77.49	98.82	0.99	0.29
Misc & Idle	--	4.0	--	--	--	--	--	4.0	--	--	--	--	--	0
TOTAL		100.0					123.47	100.0					186.79	63.32
Less Cost of Land Treatment and Structural Measures							.00						-10.35	-10.35
NET PRODUCTIVE VALUE PER ACRE							123.47						176.44	52.97
ADJUSTED FOR DEGREE OF PROTECTION (.676 X $52.97)							0.00						0.00	35.81

a/ October 1980 Guideline Prices (G-2).
b/ Average flood-free yields.

TABLE F-14
INCREASE IN NET PRODUCTIVE VALUE PER ACRE
LOWER SUMP
(Project Area)

Land Use	Price[a]	Without-Project: Percent Distribution	Without-Project: Average Yield/Acre[b]	Without-Project: Gross Value	Without-Project: Production Cost	Without-Project: Net Returns	Without-Project: Weighted Net Value	With-Project: Percent Distribution	With-Project: Average Yield/Acre	With-Project: Gross Value	With-Project: Production Cost	With-Project: Net Returns	With-Project: Weighted Net Value	Increase in Net Productive Value/Acre
	($)			($)	($)	($)	($)			($)	($)	($)	($)	($)
Cotton (Lint) (Seed)	.602 lb 111.52 ton	14.0	833 lb	574.72	315.11	259.61	36.35	15.0	948 lb	654.06	330.93	323.13	48.47	12.12
Soybeans	6.53 bu	71.0	29 bu	189.37	67.96	121.41	86.20	56.0	38 bu	248.14	69.95	178.19	99.79	13.59
Rice	3.90 bu	1.0	95 bu	370.50	238.96	131.54	1.32	5.0	116 bu	452.40	246.84	205.56	10.28	8.96
Double-cropping:														
Soybeans	6.53 bu	6.0	23 bu	150.19	47.68	101.51	6.09	17.0	30 bu	195.90	49.54	146.36	24.88	18.79
Wheat	3.08 bu	(6.0)	33 bu	101.64	34.21	67.43	4.05	(17.0)	42 bu	129.36	35.66	93.70	15.93	11.88
Pasture	58.77 cwt/ beef	1.0	2.8 cwt/ beef	164.56	72.33	92.23	0.92	1.0	2.8 cwt/ beef	164.56	72.33	92.23	0.92	0.00
Misc & Idle	--	7.0	--	--	--	--	--	6.0	--	--	--	--	--	0
TOTAL		100.0					134.93	100.0					200.27	65.34
Less Cost of Land Treatment and Structural Measures							.00						-10.35	-10.35
NET PRODUCTIVE VALUE PER ACRE							134.93						189.92	54.99
ADJUSTED FOR DEGREE OF PROTECTION (.688 X $54.99)							0.00						0.00	37.83

a/ October 1980 Guideline Prices (G-2).
b/ Average flood-free yields.

73. Since the survey involved all the flood zones in the project area, the without- and with-project land use, yields, and budget data in Tables F-13 and F-14 represent averages for the entire 100-year flood plain. Therefore, the 9-bushel-per-acre increase in soybean yields (26 bushels per acre without project and 35 bushels with project) in the upper sump is average for the 100-year flood plain. The increase ranged from an average of 15 bushels per acre on the three surveys with the largest increases to no change on the three surveys with the smallest increases. This indicated that the less flood-prone areas may not incur any intensification while the areas that are frequently flooded will incur large amounts of intensification. Since the land use and yield levels shown in this study are averages for the 100-year flood plain, it would be appropriate to apply the increase in net productive value to all the cleared lands subject to flooding by the 100-year frequency flood. However, since most of the enumerative data reflected the area flooded by the 20-year frequency event as the area most impacted by the project (also see Table F-4), the area of consideration was limited to the area flooded by the 20-year frequency flood.

74. The with-project land use and yields compare favorably with the trends in areas with less severe flooding and are well within the capabilities of the soils of the Yazoo Area under current technology.

75. The with-project land use and yields presented in Tables F-13 and F-14 are based on complete protection of the area flooded by the 100-year frequency flood. Therefore, the increases in net productive value of $52.97 and $54.99 must be adjusted by the degree of protection provided by the project. This adjustment will yield increases in net productive value of $35.81 and $37.83 per acre for the upper sump and lower sump, respectively, for the recommended plan. These intensification benefits will accrue to the area as a result of the reduction in flooding and associated risk and uncertainty allowing farmers to implement land use modifications and improved production practices, conduct more timely operations, and increase the efficiency of existing and future land treatment measures.

76. The number of cleared acres flooded by a 20-year frequency event was multiplied by the increase in net productive value per acre to determine the annual benefits. These benefits were adjusted to account for the damages remaining with project installation, projected over the project economic life, and discounted by the degree of protection afforded by the project.

77. Average annual benefits of $15.7 million were derived utilizing the computer discounting program ECON that employs standard discounting and amortization procedures to project benefits. Table F-15 contains a detailed analysis of the calculation of the benefits for the project area.

Lands Projected To Be Cleared

78. Field surveys and historical trends indicate the conversion of woodlands to cropland will continue within the project area without project implementation (see Land Use, Appendix A). Due to periodic flooding on this land, less

TABLE F-15
COMPUTATION OF BENEFITS FROM INCREASED
YIELD LEVELS--PRESENTLY CLEARED LANDS
WITH PROJECT
(Project Area)

1. Calculation of annual, current year (1978) benefits:

a. Cleared acres under consideration (20-year frequency without project)

Lower Ponding Area	=	96,000
Upper Ponding Area	=	148,295

b. Net productive value per cleared acre:[a/]

(1) With-project conditions

Lower Ponding Area	=	$189.92
Upper Ponding Area	=	$176.44

(2) Without-project conditions

Lower Ponding Area	=	$134.93
Upper Ponding Area	=	$123.47

(3) Increase in net productive value

Lower Ponding Area	=	$54.99
Upper Ponding Area	=	$52.97

(4) Adjusted for degree of protection

Lower Ponding Area (.688[b/] X $54.99)	=	$37.83
Upper Ponding Area (.676[b/] X $52.97)	=	$35.81

c. Increase in productive value of area

Lower Ponding Area

$37.83 X 96,000 = $ 3,631,680

Upper Ponding Area

$35.81 X 148,295 = $ 5,310,444

TABLE F-15 (Cont)

d. Flood damage remaining:

(1) With-project conditions--with project yield levels

Lower Ponding Area

$37.96 X 13,292 = $504,564

Upper Ponding Area

$37.11 X 18,206 = $675,625

(2) With-project conditions--without project yield levels

Lower Ponding Area

$26.49 X 13,292 = $352,105

Upper Ponding Area

$28.36 X 18,206 = $516,322

(3) Increase in damages

Lower Ponding Area = $152,459
Upper Ponding Area = $159,303

(4) Adjusted for degree of protection

Lower Ponding Area (.688 b/ X $152,459) = $104,892
Upper Ponding Area (.676 b/ X $159,303) = $107,689

e. Benefits current year (1978)

Lower Ponding Area

$3,631,680 - $104,892 = $ 3,526,788

Upper Ponding Area

$5,310,444 - $107,689 = $ 5,202,751

TABLE F-15 (Cont)

2. Projected benefits, period of analysis:

Year	Amount ($)	Ratio of Increase c/	Projected Value ($)
		Lower Ponding Area	
1990	3,526,788	1.3057	4,605,000
2000	3,526,788	1.5604	5,503,000
2010	3,526,788	1.8152	6,402,000
2020	3,526,788	2.0699	7,300,000
2030	3,526,788	2.3247	8,199,000
2039	3,526,788	2.5539	9,007,000
		Upper Ponding Area	
1990	5,202,751	1.3057	6,793,000
2000	5,202,751	1.5604	8,118,000
2010	5,202,751	1.8152	9,444,000
2020	5,202,751	2.0699	10,769,000
2030	5,202,751	2.3247	12,095,000
2039	5,202,751	2.5539	13,287,000

3. Total annual benefits:

Average annual benefit from increased yield levels due to project implementation:

Lower Ponding Area	=	$ 6,355,000 d/
Upper Ponding Area	=	$ 9,375,000 d/
Total project area	=	$15,730,000 d/

a/ Obtained from Tables F-13 and F-14.
b/ Degree of protection afforded by project.
c/ Based on projected value of all farm products sold per acre harvested.
d/ Discounted using authorized interest rate of 2-1/2 percent for 50-year life of project.

intensified agricultural management practices as well as lower yield levels result. Installation of the project will result in a reduction of the periodic flooding; therefore, the application of better management practices will produce increased yield level benefits.

79. Benefits are limited to those lands to be cleared at and below the 20-year frequency flood without the project and are based on a per-acre amount derived from increased yield levels on lands presently cleared and intensified with the project. A per-acre benefit of $36.74 was determined for the lower ponding area and a value of $35.08 for the upper ponding area. These per-acre values were applied to the number of acres estimated to be cleared, and the product derived was projected by use of projected ratios of increase in the value of farm products sold per-acre harvested.

80. The recommended plan would result in average annual intensification benefits of $1,232,000 on lands projected to be cleared without project. Computation of these benefits is shown in Table F-16.

Conversion of Woodland to Cropland

81. Landowner attitudes and preferences involved in farm planning are based primarily on past observations and current market forecasts. In analyzing results of field survey studies, it was concluded that past observations were perhaps dictated by an observed data frequency curve (1953-1968) approximately 2 to 3 feet lower than the existing conditions' frequency curve (floodgate and levees complete) used in this study. If landowners were to consider the dry period as average conditions, farm outlooks would include unrealistic average conditions and net return projections.

82. The completion of the Yazoo Area levee in December 1977 is also viewed as an additional source of protection and even greater net returns. Without an adequate time period in which to reevaluate actual levels of flood protection, farm plans are perhaps based on a level of flood protection greater than that which actually exists.

83. In recognition of the above, an interdisciplinary task force was formed to develop specific alternative methods for projecting project-induced conversion of woodland to cropland within the project area. The task force study concluded that the most reasonably sound and supportable procedure for estimating project-induced land clearing for the project area was to professionally evaluate and incorporate available field survey data for a similar project.

84. The task force determined that, within the Lower Mississippi Valley, the Tensas-Cocodrie Pumping Plant Project, located in Concordia Parish, Louisiana, was most similar to the Yazoo Area Pump Study in terms of geographic location, history of development, current and historical land use, and historical flooding conditions.

TABLE F-16
COMPUTATION OF WITH-PROJECT BENEFITS FROM INTENSIFIED AGRICULTURAL MANAGEMENT PRACTICES ON LAND TO BE CLEARED WITHOUT PROJECT AND WITHOUT MITIGATION
(Project Area)

Item [a/]	Amount
1. Per acre benefit:	
Lower Ponding Area	$36.74
Upper Ponding Area	$35.08

2. Projected benefits, period of analysis:

Year	Per Acre Benefit ($)	Acres to Be Benefited [b/] (Cumulative Acres)	Ratio of Increase	Value ($)
		Lower Ponding Area		
1990	36.74	10,494	1.3057	503,000
2000	36.74	15,392	1.5604	882,000
2010	36.74	16,480	1.8152	1,099,000
2020	36.74	17,569	2.0699	1,336,000
2030	36.74	18,566	2.3247	1,586,000
2039	36.74	19,473	2.5539	1,827,000
		Upper Ponding Area		
1990	35.08	1,587	1.3057	73,000
2000	35.08	2,368	1.5604	130,000
2010	35.08	2,525	1.8152	161,000
2020	35.08	2,681	2.0699	195,000
2030	35.08	2,837	2.3249	231,000
2039	35.08	2,994	2.5539	268,000

3. Total annual benefits:

Average annual future without-project land clearing--intensification benefits:

Lower Ponding Area	=	$1,075,000 [c/]
Upper Ponding Area	=	$ 157,000 [c/]
Total	=	$1,232,000 [c/]

a/ Increased yield level benefits, 1978 (Item 1e, Table F-15) ÷ acreage benefited (Item 1a, Table F-15).

b/ Represents 90.7 and 52.1 percent of the lands projected to be cleared without-project in the lower and upper ponding areas, respectively. These percentages represent the properties of existing woodlands (1978) located at and below the 20-year frequency flood without-project.

c/ Benefits were discounted using authorized interest rate of 2-1/2 percent and a 50-year project life.

85. Construction of the Tensas-Cocodrie Area levee and associated drainage structures was essentially complete in 1953. This levee system currently provides 100-year protection from Mississippi and Red River backwater floods. Under existing conditions, drainage of the interior area is restricted during high stages on the Mississippi and Red Rivers. Within the lower portion of the Tensas-Cocodrie area, 169,000 acres are affected by flooding from a 100-year frequency flood. Vicksburg District studies completed in 1976 recommended construction of a pumping plant to reduce interior flood stages and flood damages.

86. Economic data supporting the Tensas-Cocodrie Pumping Plant Project included project-induced land clearing benefits. These benefits were based on field survey results which were considered reasonable due to the time that elapsed between completion of the levee system (1953) and the date of the field survey (1976).

87. Results of the Tensas-Cocodrie field study indicated that with complete flood protection, approximately 17 percent of all undedicated woodlands would be cleared. Since the recommended Tensas-Cocodrie Pumping Plant Project provided only a 72 percent degree of protection to woodlands, the 17 percent factor was reduced to 12.2 percent (17 X 0.72). The resulting 12.2 percent factor was applied to the total acreage of undedicated woodlands to provide an estimate of project-induced clearing.

88. Project-induced land clearing benefits for the Yazoo Area Pump Study were determined by use of the 17 percent factor as recommended by the task force and are based on the increase in net productive value per acre which would result from conversion of an acre of woodland to cropland (see Table F-17).

89. Induced clearing was assumed to occur over the project life (1990-2039). It is also assumed that the ratio of project-induced land clearing to without-project land clearing remains constant. Implementation of the recommended plan (without mitigation) is expected to result in the conversion of 3,400 acres of woodland to cropland over the project life, providing average annual benefits of $487,000. The procedure used to calculate land clearing benefits is presented in Table F-18.

TOTAL FLOOD CONTROL BENEFITS

90. Total annual flood control benefits of $22,072,000 are estimated to accrue from implementation of the recommended plan (without mitigation). Benefits are summarized in Table F-19.

REDEVELOPMENT

91. This section presents an evaluation of the economic impact on the project area as a result of construction of the recommended plan of improvement. The recommended plan would be constructed in Issaquena County, Mississippi. No redevelopment benefits were evaluated or included in the economic analysis

TABLE F-17

ESTIMATE OF INCREASE IN NET PRODUCTIVE VALUE RESULTING FROM CONVERTING AN ACRE OF WOODLAND TO CROPLAND WITHOUT MITIGATION

Item	Amount ($)
1. First costs for conversion:	
Clearing of land	250.00
Lateral drainage	56.00
Total first cost	306.00
2. Annual charges:	
Clearing	
Interest at 10.25 percent	25.62
Sinking fund (.00079) 50-year	.20
Lateral drainage	
Interest at 10.25 percent	5.74
Sinking fund (.06200) 10-year	3.47
Total charges for conversion	35.03
3. Present net productive timber value:	
Value of timber growth	16.00
Less maintenance and other costs	1.50
Present net productive timber value	14.50
4. Present net hunting lease value:	3.50

TABLE F-17 (Cont)

Item	Amount ($)	
5. Increase in net productive value:	Ponding Area	
	Lower	Upper
Net productive value of cropland	189.92 a/	176.44 b/
Less present net productive timber value	14.50	14.50
Less present net hunting lease value	3.50	3.50
Less annual charges for conversion	35.03	35.03
Adjusted net productive value	136.89	123.41

a/ Obtained from Table F-14.
b/ Obtained from Table F-13.

TABLE F-18
COMPUTATION OF BENEFITS FROM CONVERSION OF
WOODLAND TO CROPLAND
RECOMMENDED PLAN (WITHOUT MITIGATION)

1. Total wooded acres under consideration (remaining nondedicated woodlands at 100-year frequency (year 1990) less construction clearing):

Lower Ponding Area (36,800 acres[a/] - 296 acres) = 36,504

Upper Ponding Area (9,900 acres[a/] - 0 acres) = 9,900

2. Estimated amount of project-induced conversion of woodland to cropland:

Lower Ponding Area (36,504 X .17[b/] X .436[c/]) = 2,700

Upper Ponding Area (9,900 X .17[b/] X .414[c/]) = 700

3. Projected timing of project-induced conversion of woodland to cropland:

Year	Lower Ponding Area[d/] (Cumulative Acres)	Upper Ponding Area[d/] (Cumulative Acres)
1990	0	0
2000	1,500	400
2010	1,800	500
2020	2,100	600
2030	2,400	700
2039	2,700	700

4. Increase in net productive value per acre cleared under flood-free conditions:

Lower Ponding Area = $136.89[e/]

Upper Ponding Area = $123.41[e/]

5. Calculation of annual, current year (1978) and projected benefits:

Year	Cumulative Acres by Year		Increase in Net Produtive Value Per Acre Cleared ($)		Increased Productive Value of Area ($)	Flood Damage Remaining Per Acre Flooded[f/] ($)		Acres Flooded on Area Cleared[g/]		Flood Damage Remaining on Area Cleared ($)	Current Year (1978) Benefits (Increased Value Less Damage Remaining) ($)		Ratio of Increase		Projected Value ($)
Lower Ponding Area:															
1990	0	X	136.89	=	0	37.96	X	0	=	0	0	X	1.3057	=	0
2000	1,500	X	136.89	=	205,335	37.96	X	478	=	18,145	187,190	X	1.5604	=	292,000
2010	1,800	X	136.89	=	246,402	37.96	X	574	=	21,789	224,613	X	1.8152	=	408,000
2020	2,100	X	136.89	=	287,469	37.96	X	670	=	25,433	262,036	X	2.0699	=	542,000
2030	2,400	X	136.89	=	328,536	37.96	X	765	=	29,039	299,497	X	2.3247	=	696,000
2039	2,700	X	136.89	=	369,603	37.96	X	861	=	32,684	336,919	X	2.5539	=	860,000
Upper Ponding Area:															
1990	0	X	123.41	=	0	37.11	X	0	=	0	0	X	1.3057	=	0
2000	400	X	123.41	=	49,364	37.11	X	69	=	46,803	46,803	X	1.5604	=	73,000
2010	500	X	123.41	=	61,705	37.11	X	86	=	58,514	58,514	X	1.8152	=	106,000
2020	600	X	123.41	=	74,046	37.11	X	103	=	70,224	70,224	X	2.0699	=	145,000
2030	700	X	123.41	=	86,387	37.11	X	120	=	81,934	81,934	X	2.3247	=	190,000
2039	700	X	123.41	=	86,387	37.11	X	120	=	81,934	81,934	X	2.5539	=	209,000

6. Total annual benefits:

Average annual benefits from project-induced conversion of woodland to cropland:

Lower Ponding Area = $386,000[h/]

Upper Ponding Area = $101,000[h/]

Total Project Area = $487,000[h/]

a/ See Appendix A, without project land use data.
b/ Estimated percentage of induced clearing assuming complete flood protection. Developed based on similar area studies.
c/ Percent reduction in average annual wooded acres flooded with project in operation.
d/ Based on projected rates of clearing projected for without-project conditions.
e/ Obtained from Table F-17.
f/ Agricultural crop flood damage per acre flooded, with-project yield levels, with-project conditions.
g/ Average annual nondedicated woodlands flooded with project divided by total nondedicated woodlands in area multiplied by cumulative acres cleared.
h/ Discounted using authorized interest rate of 2-1/2 percent for the 50-year project economic life.

TABLE F-19
SUMMARY OF AVERAGE ANNUAL FLOOD CONTROL BENEFITS
RECOMMENDED PLAN (WITHOUT MITIGATION)

Benefit Category	Undiscounted Benefits							Total Average Annual Discounted Benefits[a]
	Current Year 1978	Base Year 1990	2000	2010	2020	2030	2039	
	($000)	($000)	($000)	($000)	($000)	($000)	($000)	($000)
Flood Control								
Agricultural								
Inundation								
Crop[b]	1,854	2,420	2,892	3,366	3,837	4,309	4,733	3,340
Noncrop[c]	283	368	442	513	585	656	722	507
Future without project cleared land[d]	0	112	195	244	296	351	405	238
Subtotal	2,137	2,900	3,529	4,123	4,718	5,316	5,860	4,085
Intensification								
Increased yield levels- presently cleared land[e]	8,730	11,398	13,621	15,846	18,069	20,294	22,294	15,730
Increased yield levels-future without project cleared land[f]	0	576	1,012	1,260	1,531	1,817	2,095	1,232
Conversion of woodland to cropland[g]	0	0	365	514	687	886	1,069	487
Subtotal	8,730	11,974	14,998	17,620	20,287	22,997	25,458	17,449

TABLE F-19 (Cont)

Benefit Category	Undiscounted Benefits							Total Average Annual Discounted Benefits[a/]
	Current Year 1978	Base Year 1990	2000	2010	2020	2030	2039	
	($000)	($000)	($000)	($000)	($000)	($000)	($000)	($000)
Nonagricultural								
Inundation								
Rural residential[h/]	346	346	346	346	346	346	346	346
Road and bridge[i/]	192	192	192	192	192	192	192	192
Subtotal	538	538	538	538	538	538	538	538
Total Flood Control Benefits	11,405	15,412	19,065	22,281	25,606	28,851	31,856	22,072

a/ Benefits were calculated using the authorized interest rate of 2-1/2 percent and a project economic life of 50 years.
b/ Obtained from Table F-8.
c/ Obtained from Table F-9.
d/ Obtained from Table F-12.
e/ Obtained from Table F-15.
f/ Obtained from Table F-16.
g/ Obtained from Table F-18.
h/ Obtained from Table F-10.
i/ Obtained from Table F-11.

since the onsite construction activity is not within a "designated area" as defined by current evaluation guidelines.

Economic Effects

92. The initial investment of construction funds will create new jobs and income flows, and thereby directly reduce unemployment in the construction industry within Issaquena County and the general labor market area. In addition, incomes of individuals in associated industries (manufacturing, retail and wholesale trade, etc.) will be increased indirectly due to the interrelationship and interdependence of these industries.

Effects on Labor Market

93. During the 5-year construction period of the project, 54,300 average annual man-days of work will be generated, and an estimated 928 construction jobs (113 skilled, 716 semiskilled, and 99 unskilled) and 150 supervisory and administrative jobs will be created. Labor requirements can be met from available labor in the market area. Currently, there are approximately 5,000 unemployed persons within the labor market area who would be available for work. Of the total number of unemployed males, there are an estimated 1,000 skilled, 2,400 semiskilled, and 1,600 unskilled workers.

EFFECTS ON FISH AND WILDLIFE RESOURCES

94. This section presents a discussion of the recommended plan of mitigation and the assumptions used to evaluate the effects of the project on fish and wildlife resources of the project area.

Adverse Effects

95. The recommended plan (without mitigation) will have an adverse effect on the fish and wildlife resources by reducing existing fish and wildlife habitat on project-affected lands. The adverse project effects were evaluated in monetary and nonmonetary terms for use in project formulation and justification.

96. The man-day participation in various fish and wildlife activities was evaluated under with- and without-project conditions. Fish and wildlife losses were based on the range of values contained in the Water Resources Council's Principles and Standards for Planning Water and Related Land Resources.

97. Results of the evaluation show the annual losses to be approximately $95,000.

Beneficial Effects

98. In order to mitigate for the adverse impacts on wildlife resources from implementation of the proposed pumping plant, the recommended plan includes the preservation of 6,500 acres of bottom-land hardwoods in perpetual land use easements or 6,000 acres in fee (simple) title, or some combination of the two. Additional woodland purchases are required to mitigate for the adverse impacts on wildlife resources from implementation of the completed backwater levee projects in conjunction with the above pumping plant mitigation requirements. Specific woodland purchase requirements are presented in the Yazoo Area Pump Project and Yazoo Area and Satartia Area Backwater Levee Projects Fish and Wildlife Mitigation Plan. (For the purpose of the economic analysis, all mitigation requirements are assumed to be accomplished by purchase of perpetual land use easements.)

99. As a result of the land acquisition for mitigation purposes, the project-induced woodland clearing as a result of implementation of the recommended pump plan would be 900 acres. An additional 300 acres of woodlands are required for pump project rights-of-way. The recommended mitigation plan along with mitigation for the completed levee projects and the completed Yazoo Backwater mitigation features (Muddy Bayou Structure at Eagle Lake and construction of greentree reservoirs and slough control structures) offsets all fish and wildlife losses resulting from both the recommended pump project and the completed backwater levee projects.

TOTAL BENEFITS

100. The area to be benefited from proposed improvements in the Yazoo Area consists of 539,000 total acres of which 397,000 are cleared and is located in Humphreys, Issaquena, Sharkey, Warren, Washington, and Yazoo Counties, Mississippi, and part of Madison Parish, Louisiana. There are approximately 1,150 farms in the project area with an average size of approximately 350 acres. In addition, there are approximately 450 individual nonfarm ownerships in the project area. The entire economy of the area and the social well-being of area residents are directly related to agriculture. The Yazoo Area Pump Project will have major beneficial impacts upon all of the people in the area, as it will affect almost every aspect of their lives. Due to the scope, diversity, and character of project effects as well as the large number of farms in the area, windfall benefits (to include intensification) of an unconscionable magnitude will not accrue to limited special interests. Total benefits accruing to each plan alternative evaluated in detail are summarized in Table F-20.

101. Flood control benefits will result from flood damage reduction to agricultural crop and noncrop items, public roads and bridges, rural residential properties, and a general intensification of agricultural activities due to the reduction in financial risks.

102. The degree of protection (ratio of reduction in flood damages to total damages) provided by the project is an indicator of project effectiveness.

TABLE F-20
BENEFIT SUMMARY BY CATEGORY, ALL PLANS
(2-1/2 Percent Interest Rate, 50-Year Project Economic Life)
($000)

Alternative	Present Cleared Land					Future Without Project Cleared Land		Project Induced Land Clearing	Total Primary Benefits
	Inundation				Intensification Increased Yield Level	Inundation	Intensification		
	Crop	Noncrop	Road and Bridge	Rural Residential					
Plan A									
10,000 cfs	2,201	339	129	252	10,250	142	703	289	14,305
15,000 cfs	3,018	478	176	327	14,145	213	1,082	463	19,902
17,500 cfs	3,430	547	198	349	16,234	247	1,277	543	22,825
20,000 cfs	3,794	588	220	373	17,992	275	1,429	676	25,347
25,000 cfs	4,223	640	241	388	20,117	314	1,651	736	28,310
30,000 cfs	4,380	657	246	390	20,911	326	1,731	771	29,412
Plan B									
15 - 10,000 cfs [a/]	4,387	689	254	397	21,005	310	1,619	791	29,452
10 - 15,000 cfs [a/]	4,396	708	260	407	21,066	306	1,585	805	29,933
7 - 18,000 cfs [a/]	4,387	714	262	408	21,035	304	1,571	802	29,483
Plan C									
10,000 cfs	2,187	323	125	252	10,109	140	690	281	14,107
15,000 cfs	2,939	443	171	324	13,706	205	1,044	415	19,247
17,500 cfs	3,340	507	192	346	15,730	238	1,232	487	22,072
With mitigation [b/]	3,340	507	192	346	15,730	177	914	140	21,346
20,000 cfs	3,720	543	211	370	17,583	268	1,398	568	24,661
25,000 cfs	4,204	600	233	385	19,986	308	1,637	648	28,001
30,000 cfs	4,362	614	238	387	20,778	323	1,718	720	29,140
Plan D									
(Hold 85 feet)	3,655	431	234	427 [c/]	17,429	266	1,465	511	24,418
Plan E									
(Hold 80 feet)	3,777	565	222	425 [d/]	17,920	280	1,474	636	25,299
Plan F									
10,000 cfs	1,508	237	102	236	6,418	94	417	164	9,176
15,000 cfs	2,194	351	151	311	9,436	146	664	277	13,530
17,500 cfs	2,493	402	170	332	10,829	170	784	325	15,505
20,000 cfs	2,766	437	188	358	12,076	190	885	384	17,284
25,000 cfs	3,291	483	209	374	14,283	240	1,138	454	20,472
30,000 cfs	3,430	494	214	378	14,900	251	1,194	470	21,331
Plan G									
10,000 cfs	988	185	85	220	4,547	57	258	109	6,449
15,000 cfs	1,696	303	140	299	7,852	110	525	214	11,139
17,500 cfs	1,927	347	157	319	9,012	128	620	251	12,761
20,000 cfs	2,172	386	176	347	10,211	144	701	300	14,437
25,000 cfs	2,625	437	200	368	12,324	185	923	364	17,426
Plan H									
(EQ Plan)	1,696	303	140	299	7,852	85	408	76	10,899
Plan I									
10,000 cfs	594	99	39	177	2,723	34	146	34	3,846
15,000 cfs	898	162	69	254	4,110	56	259	60	5,868
20,000 cfs	1,097	190	79	290	5,048	70	333	78	7,185

[a/] The first number indicates the pump capacity in the lower ponding area; the second number indicates the pump capacity in the upper ponding area.
[b/] Recommended Plan.
[c/] Includes $43,000 for relocation benefits.
[d/] Includes $12,000 for relocation benefits.

With project installation, the degree of protection for agricultural crops, agricultural noncrop items, roads and bridges, and rural residential properties is 68, 62, 68, and 81 percent, respectively.

COSTS

FIRST COSTS

103. Project first costs are based on October 1980 price levels and are presented in Table F-21 for the detailed structural plans considered. All first costs are Federal costs and consist of the estimated construction costs for Corps of Engineers works of improvement. A contingency allowance of 20 percent is included in the cost estimates. Detailed cost information is contained in Appendix E.

ANNUAL COSTS

104. Estimated annual costs are based on a project economic life of 50 years. Annual interest and sinking fund costs are based on an authorized interest rate of 2-1/2 percent. Other annual cost items include operation and maintenance; losses of net returns to lands affected by project installation; fish and wildlife; and timber losses. Annual costs are summarized in Table F-21.

ECONOMIC JUSTIFICATION

105. All plans were evaluated to determine the plan providing the greatest benefits relative to costs. Project first costs, annual benefits, annual costs, excess benefits over costs, and benefit-cost ratios for the plans of improvement studied in detail are presented in Table F-22.

106. An array of pump capacities was considered for each alternative. The excess benefits over costs for the plans considered ranged from $1,311,000 (Plan I, 15,000-cubic-foot-per-second pump) to $18,671,000 (Plan A, 25,000-cubic-foot-per-second pump). Comparison of total average annual benefits to the total annual costs indicates that all plans evaluated are economically justified. The recommended plan (Plan C, 17,500-cubic-foot-per-second pump, with mitigation), with a benefit-cost ratio of 3.2, provides excess benefits over costs of $14,713,000 when applying the authorized interest rate of 2-1/2 percent. When the current interest rate of 7-5/8 percent is used, the benefit-cost ratio of 1.3 provides excess benefits over costs of $4,077,000. Plan C, 17,500-cubic-foot-per-second pump (without mitigation), has a benefit-cost ratio of 3.3 and provides excess benefits over costs of $15,441,000 using the 2-1/2 percent interest rate.

TABLE F-21
FIRST COSTS AND ANNUAL COSTS
REPRESENTATIVE PUMP SIZE FOR ALL PLANS [a/]
(2-1/2 Percent Interest Rate, 50-Year Project Life)

Item	Plan A 25,000 cfs ($000)	Plan B 10-15,000 cfs ($000)	Plan C 17,500 cfs ($000)	Plan C with Mitigation [b/] ($000)	Plan C with Mitigation [c/] ($000)	Plan C 25,000 cfs ($000)	Plan D Hold 85 Feet ($000)	Plan E Hold 80 Feet ($000)	Plan F 25,000 cfs ($000)	Plan G 25,000 cfs ($000)	Plan H (EQ) ($000)	Plan I 15,000 cfs ($000)
First Costs												
First Cost	212,900	239,600	147,200	150,000	150,000	210,900	251,100	220,100	205,000	202,300	162,800	114,200
Interest During Construction (5 years)	13,306	14,975	9,200	9,196 [d/]	28,049 [d/]	13,181	13,713 [e/]	13,397 [f/]	12,813	12,644	8,317 [g/]	7,138
Net Investment	226,206	254,575	156,400	156,337 [d/]	175,190 [d/]	224,081	264,813	233,497	217,813	214,944	171,117	121,338
Annual Costs												
Interest (.02500)	5,655	6,364	3,910	3,908	13,358	5,602	6,620	5,837	5,445	5,374	4,278	3,033
Sinking Fund (.01026)	2,321	2,612	1,605	1,604	347	2,299	2,717	2,396	2,235	2,205	1,756	1,245
Mitigation	--	--	--	100	224	--	--	--	--	--	--	--
Operation and Maintenance	1,464	1,898	1,021	1,021	1,021	1,319	990	1,027	743	593	416	266
Induced Damages	--	4	--	--	--	--	--	--	--	--	--	--
Fish and Wildlife Losses (Net)	199	218	95	0	0	120	74	108	90	79	-253	13
Total	9,639	11,096	6,631	6,633	14,950	9,340	10,401	9,368	8,513	8,251	6,197	4,557

a/ All cost data based on October 1980 price levels.
b/ Recommended Plan.
c/ Based on interest rate of 7-5/8 percent.
d/ Based on first cost less ($2,859,000), the cost of fish and wildlife lands.
e/ Based on first cost less ($31,700,000), the cost of fish and wildlife lands.
f/ Based on first cost less ($5,747,000), the cost of fish and wildlife lands.
g/ Based on first cost less ($29,735,000), the cost of fish and wildlife lands.

TABLE F-22
FIRST COSTS, ANNUAL BENEFITS, ANNUAL COSTS,
EXCESS BENEFITS OVER COSTS, AND BENEFIT-COST RATIOS

Plan	First Cost[a] ($000)	Annual Benefits ($000)	Annual Cost[b] ($000)	Excess Benefits Over Costs ($000)	Benefit-Cost Ratio
Plan A 25,000 cfs	212,900	28,310	9,639	18,671	2.9
Plan B 10-15,000 cfs	239,600	29,533	11,096 [c]	18,437	2.7
Plan C 17,500 cfs	147,200	22,072	6,631	15,441	3.3
Plan C 17,500 cfs with mitigation [d]	150,000	21,346	6,633	14,713	3.2
Plan C 17,500 cfs with mitigation [e]	150,000	19,027	14,950	4,077	1.3
Plan C 25,000 cfs	210,900	28,001	9,340	18,661	3.0
Plan D (Hold 85 Feet)	251,100	24,418	10,401	14,017	2.3
Plan E (Hold 80 Feet)	220,100	25,299	9,368	15,931	2.7
Plan F 25,000 cfs	205,000	20,472	8,513	11,959	2.4
Plan G 25,000 cfs	202,300	17,426	8,251	9,175	2.1
Plan H (EQ Plan)	162,800	10,859	6,197	4,662	1.8
Plan I 15,000 cfs	114,200	5,868	4,557	1,311	1.3

a/ Based on October 1980 price levels.
b/ Annual costs obtained from Table F-21.
c/ Includes $4,000 induced damages along Yazoo River.
d/ Recommended Plan.
e/ Based on interest rate of 7-5/8 percent.

ADDITIONAL ANALYSES

107. In addition to the standard economic analysis, other analyses and several specific checks were made, including existing development analysis, break-even years, internal rate of return, discount rate, and value per structure.

EXISTING DEVELOPMENT ANALYSIS

108. Evaluation of the plans of improvement, using the "existing development" analysis, indicates that existing development benefits (current year, 1978 benefits) do not justify the recommended plan, nor any of the other alternative plans considered. Using the existing development analysis, excess benefits over costs are negative for all plans. Data used in the existing development analysis are presented in Table F-23.

BREAK-EVEN YEARS

109. The break-even year analysis included two separate checks: (1) the project year in which undiscounted benefits first exceed annual costs, and (2) the project year in which discounted benefits exceed annual costs, assuming no further increases in benefits. Results of the break-even year analysis indicate 1990 would be the first year in which undiscounted and discounted benefits exceed annual costs.

INTERNAL RATE OF RETURN

110. The internal rate of return or the rate of interest at which annual benefits equal annual costs over the period of analysis (i.e., benefit-cost ratio equals 1.0) is 9 percent.

DISCOUNT RATE

111. The authorized Federal discount rate of 2-1/2 percent was used in project evaluation. The current Federal discount rate of 7-5/8 percent was also used for calculations of the recommended plan.

VALUE PER STRUCTURE

112. The value per structure check (ER 1105-2-351) is not applicable for this study.

TABLE F-23
EXISTING DEVELOPMENT BENEFITS
ALL PLANS CONSIDERED

(1) Plan	(2) Existing Development Benefits [a] ($000)	(3) Annual Costs [b] ($000)	(4) Excess Benefits Over Costs ($000)	(5) Benefit-Cost Ratio [c]
Plan A 25,000 cfs	3,329	9,639	-6,310	0.3
Plan B 10-15,000 cfs	3,500	11,096 [d]	-7,596	0.3
Plan C 17,500 cfs	2,675	6,631	-3,956	0.4
Plan C with mitigation [e]	2,675	6,633	-3,958	0.4
Plan C 25,000 cfs	3,285	9,340	-6,055	0.3
Plan D (Hold 85 Feet)	2,956	10,401	-7,445	0.3
Plan E (Hold 80 Feet)	3,057	9,368	-6,311	0.3
Plan F 25,000 cfs	2,677	8,513	-5,836	0.3
Plan G 25,000 cfs	2,269	8,251	-5,982	0.3
Plan H EQ Plan	1,549	6,197	-4,648	0.2
Plan I 15,000 cfs	913	4,557	-3,644	0.2

a/ Benefits to activities affected by flooding in the year 1978. Includes all inundation benefits (i.e., flood damage reduction to existing crop, non-crop, rural residential, and road and bridge development). Benefit values are presented for the year 1978 and are undiscounted (see Table F-19).
b/ Annual costs were obtained from Table F-21.
c/ Calculated using benefits in column 2 and costs in column 3.
d/ Includes $4,000 induced damages along Yazoo River.
e/ Recommended Plan.

YAZOO PUMP PROJECT
YAZOO BACKWATER AREA
MISSISSIPPI

REEVALUATION REPORT

APPENDIX G

ENVIRONMENTAL ANALYSIS

PREPARED BY
THE UNITED STATES ARMY
VICKSBURG DISTRICT, CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

REEVALUATION REPORT
YAZOO AREA PUMP PROJECT
YAZOO BACKWATER AREA, MISSISSIPPI

APPENDIX G
ENVIRONMENTAL ANALYSIS

Table of Contents

Table of Contents (Cont)

Table of Contents (Cont)

LIST OF TABLES

LIST OF ATTACHMENTS

REEVALUATION REPORT
YAZOO AREA PUMP PROJECT
YAZOO BACKWATER AREA, MISSISSIPPI

APPENDIX G
ENVIRONMENTAL ANALYSIS

ENVIRONMENTAL SETTING WITHOUT THE PROJECT

WATER RESOURCES

WATER AREAS AND FLOODING

1. The project area contains 21,938 acres of water area, as shown in the following tabulation. The lower ponding area includes 12,794 acres of the water area and the upper ponding area contains 9,144 acres.

Item	Acres Flooded, 100-Year Flood Elevation		
	Lower Sump	Upper Sump	Total
Water bodies	9,400	5,300	14,700
Streams	3,394	3,844	7,238
Wooded swamp (baldcypress-tupelo gum)	12,800	8,700	21,500
Wooded wetlands (overcup oak-bitter pecan)	5,100	3,600	8,700
Forested land	34,100	77,200	111,300
Agricultural land	148,000	249,500	397,500

2. The lower ponding area has a 1-year flood elevation of 84.8 feet, National Geodetic Vertical Datum (NGVD), and the upper ponding area has a 1-year flood elevation of 85.8 feet, NGVD. Table G-1 presents data on the number of acres flooded under with- and without-project conditions at the 1-, 3-, and 5-year frequency elevations.

3. In the upper ponding area, the 1-year frequency flood inundates 9,000 acres of forested land, 2,500 acres of wooded swamp, 3,600 acres of wooded wetlands, and 11,700 acres of cleared land. In the lower ponding area, the 1-year flood inundates 2,700 acres of forested land, 2,800 acres of wooded swamp, 5,100 acres of wooded wetlands, and 8,900 acres of cleared land. Interior ponding is intermittent and the acreage inundated varies depending on hydrologic conditions associated with the elevations of the Mississippi River and interior runoff.

GROUNDWATER

4. Groundwater in the Yazoo Backwater Area is seasonally variable, and the quantity depends upon local climatic and geologic conditions. The aquifers of the area include the Mississippi River Valley aquifer, the Cockfield Formation, and the Sparta Formation. The latter two aquifers have the potential to supply sufficient quantities of potable water for domestic and many industrial purposes. Water quality of the Mississippi River Valley aquifer is usually poor because of low pH and excessive iron and carbon dioxide content.

SURFACE WATER QUALITY

5. Surface water quality in the project area is largely affected by the intensified agricultural effort in the area. Industrialization in the area is limited and is not considered to be a major source of water quality influence, except in cases of individual spills of toxic materials.

6. A major nonpoint source of pollution affecting the aquatic environment of the project area is suspended sediment. Extensive land preparation and cultivation and erosion occurring on agricultural lands in the project area is the primary source of the pollutant. The sediment, composed of soil particles and organic debris, becomes suspended in agricultural runoff and is carried to area streams and lakes.

7. High levels of turbidity occur in nearly all streams and lakes, with the associated problems of reduced light penetration and primary productivity, interference with respiration of aquatic organisms, damage to sensitive tissue, silting over of nesting sites, smothering of eggs, and alteration of habitat for benthic flora and fauna.

8. The use of agricultural pesticides in the Delta has considerable impact on the biological environment of the project area. Pesticide residues have been found in tissue, water, and mud samples. In many cases, pesticide levels in lakes and rivers evaluated have been high enough to be suspected of interfering with the productivity of biota in the area, particularly animals high in the aquatic food chain such as game fish and herons. In high enough concentrations, pesticides can also reduce the numbers of aquatic food organisms, and at sublethal levels can adversely affect growth, reproduction, and behavior of higher animals which ingest pesticide-contaminated organisms.

9. Water quality studies have been conducted within the project area by Mississippi State University, the Mississippi Department of Wildlife Conservation, and an architect-engineer firm, Howard, Needles, Tammen, and Bergendoff (HNTB).

10. Pesticide contamination was found in all fish sampled by Mississippi State University. In May 1976, carp were found dead and dying in the Little Sunflower River, and subsequent analysis of one fish (collected alive) revealed a toxaphene concentration of 45 ppm. In August 1976, redfin minnows were collected at the same location, and subsequent analysis revealed 9.1 ppm toxaphene, 3.7 ppm 1,1-dichloro-2,2-bis (p-chlorophenyl) ethylene (DDE), and 1.3 ppm 1,1-dichloro-2,2-bis (p-chlorophenyl) ethane (DDD). Small bluegill collected from Barge Lake had concentrations of 0.73 ppm toxaphene, 0.38 ppm DDE, and 0.29 ppm DDD.

11. In 1980, HNTB completed an environmental inventory contract study of the Yazoo Basin for the Vicksburg District. Data collected by HNTB represent a monthly analysis of overall water quality, pesticides, and heavy metals over a 1-year period. Seven of the sample stations occurred within and adjacent to the project area. Pesticide concentrations were determined for mud samples, water samples, and tissue of various aquatic and terrestrial organisms. Mud and water samples were analyzed to determine heavy metals concentrations.

12. Pesticide analysis of mud and water samples revealed that aldrin, chlordane, lindane, t-DDT, and DDD were the most prevalent chemicals occurring within the project area. These pesticides were prevalent in the mud samples, but almost nondetectable in the majority of the water samples. Highest concentrations of these pesticides occurred in samples that were taken from sites that represent lentic environments, whereas the flowing water sample sites contained relatively low concentrations, where detectable at all.

13. Analysis of tissue identified aldrin, chlordane, lindane, heptachlor epoxide, endrin, dieldrin, and DDT derivatives (pp, DDT, t-DDT, DDD, DDE) as the most prevalent pesticides occurring in the samples analyzed. The majority of the occurring pesticide concentrations were detected in aquatic organisms, with very few terrestrial samples containing pesticide concentrations at any level.

14. The majority of the heavy metal concentrations were detected in the mud samples analyzed. In both mud and water samples, copper, zinc, and mercury were the most prevalent metals. Samples collected by HNTB within the basin indicated mercury concentrations in excess of the EPA recommended criterion for freshwater aquatic life and wildlife (0.05 u/1). The stations sampled ranged from 0.2 to 0.7 u/1 of mercury.

15. Present mercury concentrations indicate that a low level mercury pollution problem exists and may be widespread in the waters of the Yazoo River drainage basin. Further monitoring and study of this situation is needed to assess the nature and extent of this potential problem, particularly since there is no known point source of mercury within the project area.

16. Pesticide analyses conducted by both MSU and HNTB indicate that pesticides detected in tissue and water are above the allowable limit of EPA. Considering the adherence of pesticides to soil particles and the fact that the majority of the mud samples represent contamination, the continual entrance of pesticides into the aquatic system will further degrade the quality of the environment.

AQUATIC RESOURCES

17. Streams of the study area are typically slow and meandering. These streams have silt bottoms and are stable in regard to bank erosion and bedload movement. From the standpoint of biological communities, streams which contain small lakes or wooded brakes are often very productive. The stream areas that are wooded contain tupelogum and baldcypress in the overstory, and swamp privet, water elm, and black willow in the understory. Many species of animals, birds, reptiles, amphibians, and fish live, feed, and spawn in and near these wooded areas.

18. The Delta streams were once excellent habitat for a variety of fish species. Excellent sport fisheries of bass, crappie, and bream were sustained by good water quality, protective cover, and abundant food. The habitat productivity of these streams has been reduced, however, and they now support limited numbers of bass, bluegill and crappie, and moderate populations of buffalo, carp, and other tolerant species (Table G-2).

19. Most major Delta streams are now surrounded by open expanses of soybean and cotton fields and have high turbidity due to the suspension of silt. Turbidity in some Delta streams is constant, while in others the problem diminishes during short periods of drought. Heavy and often poorly managed use of fertilizers, herbicides, and pesticides has also contributed to poor water quality of Delta streams.

20. The Delta has many natural lakes, most of them oxbow cutoffs created by sluggish, meandering streams. Many of the lakes have baldcypress and mixed hardwood-willow shorelines and are important as winter feeding, resting and roosting areas for migratory waterfowl and as year-round habitat for wood ducks. Fishery resources in most of the lakes were once considered excellent but have steadily declined as a result of increasing inflow of poor quality runoff water from nearby agricultural fields.

SOIL RESOURCES

21. Alluvial soils and an abundance of water are valuable mineral resources in the Yazoo River drainage basin. Of these, the most important are the nearly level alluvial soils found on the Yazoo Delta flood plain. Delta soils, even though of deposition origin, are not uniform and vary widely in composition, structure, fertility, and agricultural capability. Many of these soils are intensively utilized for agricultural production; however, some are used for hardwood forest production.

22. Alluvial sediments deposited by the Mississippi River are the principal parent material of Delta soils. These alluvial sediments can be several hundred feet in depth, with upper portions consisting of sands, silts and clays, while the lower strata consist primarily of sands and gravels. Most of this alluvial material originated in the upper Mississippi River basin, where sedimentary rocks were the principal parent material.

23. The variety of material from the Mississippi River has caused a wide range in alluvial soil textures. Historically, when the Mississippi River overflowed its channel and floodwaters spread out over the flood plain, the first sediments to settle were the coarse gravels and sands. These materials dropped out parallel to or near the main channel and formed low ridges commonly referred to as natural levees.

24. Beyond the natural levees in the slackwater area, floodwaters spread more slowly, and finer sediments such as silts and sands dropped out of suspension. The finest sediments (clays and organic matter) settled out only when the flood had passed and floodwaters were left standing in low-lying depressions. Original alluvial deposits have been greatly modified by subsequent intrabasin meandering of the Mississippi River and its tributary system.

FOREST RESOURCES

25. The forests of the project area are primarily bottom-land hardwoods and vary considerably in composition and density. Conditions of the forested areas depend mainly on ownership, past and present silvicultural practices, and local site quality.

26. The highly fertile Delta soils support vigorous growths of hardwood forests consisting of many species adaptable to varying and complex soil and moisture conditions. The better drained natural levees and ridges which have loamy or sandy clay soils support primarily a water oak-sweetgum timber type. Extensive flats of slightly lower elevation, with tighter clay soils, are occupied by hackberry, elm, ash, and Nuttall oak.

27. Lower-lying backwater areas support an overcup oak-water hickory type. Wet lake margins, sloughs, and swamps support cypress, tupelogum, willow, and water elm. Most of the forest remaining in the project-affected area is comprised of overcup oak-bitter pecan and cutover cypress, willow and water elm timber types.

28. The lower ponding area contains 52,000 acres of forested land, and the upper ponding area contains 89,500 acres of forested land. Conditions are such that the average board feet volume per acre represents approximately 3,250 feet per acre for both ponding areas. Assuming that these areas are representative forest types within the project area, these lands represent a commercial value averaging approximately $325 per acre.

29. The timber resources in the project area provide commercial products for three woodyards, one pulpmill, and eight sawmills, industries which represent a significant input to the economy of the project area.

VEGETATIVE AND WILDLIFE COMMUNITIES

Bottom-land Hardwoods

30. A number of bottom-land hardwood subtypes are distinguishable based on soil type, drainage characteristics, and species composition. These subtypes include river edge forests, forests of basins and flats, and forests of natural levees and bottom-land ridges. The distinguishing features and wildlife habitat values of the bottom-land hardwood subtypes are discussed in the following paragraphs.

31. River edge forests occur along the banks and shores of streams and rivers throughout the Yazoo River drainage basin in areas subject to periodic disturbances from flooding, scouring, or deposition or sediments. Black willow and baldcypress are found closest to the stream channel, while higher and less frequently flooded bank areas support a more diverse assortment of trees. Common streambank tree species include cottonwood, bitter pecan, hackberry, box elder, American sycamore, American elm, red maple, and sweetgum.

32. Bottom-land hardwood forests of basins and flats are characteristically poorly drained and subject to periodic overflow during high water conditions. Most of these forests are associated with backswamp areas and low-lying areas between natural levees and other depositional surface features. Soils consist generally of heavy, poorly drained clays of low to moderate fertility.

33. Common tree species of the basin and flat forests include bitter pecan, overcup oak, Nuttall oak, green ash, sweetgum, hackberry, and elm. The understory is often sparse, but woody climbers such as wild grape, trumpet creeper, rattan vine, poison ivy, and other native vines are present.

34. Forests of basins and flats provide important wetland habitat for wintering waterfowl, provided there is a prolonged period of overflow during the winter season. Important species using these areas are mallard, wood duck, black duck, and other dabbling species which feed on acorns in the shallow waters. Game species which use basin and flat forests include squirrel, raccoon, swamp rabbit, white-tailed deer, and wild turkey. Snakes, turtles, and amphibians also find abundant habitat in these forests.

35. Bottom-land hardwood forests of natural levees, bottom-land ridges, and low terraces are characterized by infrequent flooding and high natural productivity. The soils are generally well-drained sandy loams of high fertility. Forests on this land provide excellent wildlife habitat but are also highly suitable for agriculture due to high natural fertility. As a result, most of this land has been converted to farmland.

36. Forests of low terraces that are moderately well drained support a number of mast-producing hardwoods which make up a significant portion of the overstory. Common tree species include water oak, cherrybark oak, willow oak, Nuttall oak, sweetgum, American elm, and hackberry. The understory is often well developed with such species as deciduous holly, Japanese honeysuckle, hawthorns, and other species.

37. Well-drained bottom-land hardwoods provide excellent habitat for important game species including swamp rabbit, white-tailed deer, squirrel, raccoon, and turkey. The abundance of mast-producing trees and well developed understory provide food cover for numerous other wildlife species as well.

Wetland Habitat

38. Wetlands in the project area can be classified in general as wooded swamps (cypress-tupelogum) and wooded wetlands (overcup oak-bitter pecan) that are propagated as a result of a flooding frequency sufficient to maintain a species composition indicative of a wetland.

39. Within the project area, the following species are normally used in delineating wetlands: baldcypress, tupelogum, black willow, water locust, green ash, red maple, bitter pecan, overcup oak, buttonbush, water elm, and swamp privet.

40. The project area contains 21,500 acres of wooded swamp and 8,700 acres of wooded wetlands. There are 5,300 acres of wooded swamp below the 1-year flood elevation and 16,200 acres above the 1-year flood frequency. The upper ponding area has 3,600 acres of wooded wetlands and the lower ponding area contains 5,100 acres of wooded wetlands. The total acreage of wooded wetlands occurs below 83 feet, NGVD.

41. Wooded swamps are forested areas characterized by saturated soils and standing water. Only during extended periods of drought are these areas devoid of surface water. Wooded swamps are typically found along the margins

of sluggish meandering streams, in shallow lake basins, and in low swales and sloughs within bottom-land hardwood flats. In the Delta region, wooded swamps are commonly known as "brakes" and are most often associated with oxbow lakes and abandoned stream channels.

42. The principal tree species of wooded swamps are cypress and tupelogum. Other less predominant associates of wooded swamps include water elm, Drummond red maple, swamp privet, green ash, and buttonbush. The understory is typically poorly developed or absent because of frequent or permanent standing surface water conditions.

43. Wooded swamps provide valuable habitat for furbearers, resident and wintering waterfowl, songbirds, shorebirds, wading birds, and various other wildlife species including deer, turkey, and swamp rabbit. These swamps are highly desirable nesting and roosting habitat for wood ducks. Important furbearing animals which use wooded swamps include raccoon, mink, nutria, river otter, muskrat, and beaver. Food is limited for foraging animals in wooded swamps due to the general absence of hard mast-producing trees and understory, although acorns often wash in from surrounding hardwood forests during high water periods.

44. Wooded wetlands are forested areas characterized by poorly drained soils subject to prolonged periods of annual overflow during the winter season. Dominant tree species are bitter pecan and overcup oak, which are adapted to a seasonal flooding regime. Important species dependent on these areas are resident and migratory waterfowl, squirrels, raccoons, and white-tailed deer. The wooded wetlands delineation corresponds to an elevation of 83 feet, NGVD, and below.

FEDERAL, STATE, AND
PRIVATE FORESTED AREAS

45. The remaining large woodland tracts of the Yazoo Delta are found primarily within the project area of the Yazoo River Backwater and include several wetland areas and cypress brakes which mark abandoned Mississippi and Ohio River channel courses.

46. The 59,000-acre Delta National Forest in Sharkey County and adjacent forests in the lower Big and Little Sunflower Rivers and Steele Bayou areas are the largest remaining forested areas. These forest lands and the 10,210-acre Yazoo National Wildlife Refuge (NWR) provide the best remaining wildlife habitat. Within the Yazoo NWR is Swan Lake, an abandoned oxbow lake which is used primarily for nature-oriented recreation and as a refuge for waterfowl. The Delta National Forest is one of the most productive hardwood and wildlife habitats in the alluvial valley of the Mississippi River and provides excellent hunting, fishing, camping, and various other recreational opportunities to the general public. Within the Delta National Forest, three areas are considered to be virgin timber stands: a sweetgum stand (40 acres), an overcup oak-water hickory stand (40 acres), and a green ash-sugarberry stand

(60 acres). Trees in these areas may reach or exceed 200 to 250 years of age. The sweetgum area is located on an alligator clay ridge at approximately 95 feet, NGVD, and is seldom flooded. The overcup oak-water hickory and green ash-sugarberry stands are located on Sharkey Clay flats. Under present conditions, the overcup oak-water hickory area floods on a 2-year frequency and the green ash-sugarberry area floods on a 5-year frequency.

47. In 1943, the Secretary of Agriculture established these areas for management as natural research areas to retain their virgin or unmodified conditions. Use of these areas by responsible scientists and educators is encouraged. General use is permitted to the extent that such use does not conflict with the purpose for which the areas were established.

48. Leroy Percy State Park (2,442 acres) is the only State recreation area in the Delta. Its primary nonconsumptive uses include such recreational pastimes as birdwatching, hiking, camping, swimming, and outdoor photography. Nonconsumptive uses such as these are becoming increasingly popular; however, little potential exists for additional trails, campgrounds, picnic areas, and nature-oriented programs in the project area due to the continuing loss of natural areas to land clearing and stream modification.

49. The Mississippi Department of Wildlife Conservation manages a 1,200-acre greentree area on the Delta National Forest and a 570-acre greentree area west of Rolling Fork. The Department also leases the Anderson-Tully Game Management Area which provides about 4,500 acres of public hunting lands, part of which border on the Mississippi River outside of the backwater area. The U. S. Forest Service currently operates a 1,760-acre greentree reservoir in the Delta National Forest.

50. Delta Wildlife and Forestry, Inc., is an extensive area of bottom-land hardwood forest, mostly within the project area, owned by a private corporation. The area contains 20,909 acres of land in Issaquena County directly south of the Delta National Forest. Of these holdings, 3,007 acres are cleared and leased for agricultural development; the remaining area is forested and is intensively managed for both timber and wildlife.

51. The major objective of the stockholders of Delta Wildlife and Forestry, Inc., is recreational use of the area. The corporation is considered to be dedicated to maintaining the area in its present condition. The area contains many natural lakes and associated wetland areas, and provides excellent alligator and waterfowl habitat. The area also supports excellent deer and turkey populations.

52. The U. S. Fish and Wildlife Service (FWS) recently acquired 13,585 acres of woodland and wetland habitat in the Panther Swamp area, approximately 4,500 acres of which are located in the project area east of Holly Bluff, Mississippi.

WILDLIFE RESOURCES

53. Wildlife habitat has been considerably reduced and modified by flood control and drainage improvements and extensive clearing throughout large portions of the basin. Nearly all of the original virgin bottom-land hardwood forests and extensive overflow habitat in the Delta have been altered.

54. Many portions of the Yazoo Delta are severely lacking in wildlife habitat. This is due primarily to the high percentage of land under cultivation and intensive farming practices. Extensive areas in the central and northern sections of the Yazoo Delta have been almost entirely cleared for agriculture and are conspicuously barren of woodlots, thickets, hedgerows, and other cover types which are supportive of wildlife populations.

55. The current farming practices of straight-row cropping, cultivation to the edges of streams and lakes, large-field monoculture, and other "clean farming" practices allow little habitat for wildlife. In addition, the widespread use of fertilizers and pesticides, together with heavy sediment loads washed into area streams and lakes from agricultural areas, has contributed greatly to the loss and degradation of aquatic and terrestrial wildlife habitat in the Delta.

56. Wildlife habitat value of agricultural lands depends on the cover type and method of farming. In the Delta lowlands, farming generally is highly mechanized, clean, and for the most part, agricultural fields are lacking in sufficient year-round cover and food to support significant wildlife populations.

57. Where sufficient water is present or winter flooding of lowland fields occurs, unplowed croplands provide good habitat for wintering waterfowl. Soybean fields, which provide a good food source that is attractive to deer, are heavily used during the fall season when suitable natural cover is found nearby. Blackbirds, various other field songbirds, field rodents, hawks, and other wildlife species use croplands, especially during the fall season before crops have been harvested and stubble has been plowed.

58. Drainage ditches that traverse many of the farmlands, particularly in the Delta region, provide wildlife habitat for a variety of marsh and wetland species. Many of these ditch areas are lined with brushy vegetation that provides food, cover, and nesting opportunities. The numerous levees in the Yazoo Delta are normally maintained in pasture. Field songbirds, field rodents, hawks, cattle egrets, and various other animals use pastured levee areas.

59. Frequent winter and early spring flooding of low-lying farmlands provides habitat for wintering waterfowl. Approximately 20,560 acres of cropland are flooded annually in the project area.

60. In sharp contrast to the above-described agricultural areas, the remaining forests and swamps of the Yazoo Delta provide excellent wildlife habitat, particularly for game species such as white-tailed deer, squirrel, cottontail rabbit, wild turkey, waterfowl and various furbearers. Large tracts of bottom-land hardwood forests remain in the southern quarter of the Yazoo Delta.

PLANT AND ANIMAL SPECIES

61. The diversity of habitat types found in the project area has generated a variety of flora and fauna. Species of plants and animals that are representative of the Yazoo Backwater Area are presented in the Final Environmental Impact Statement, Yazoo River Basin, Mississippi, which was filed with the Council on Environmental Quality on 29 December 1975.

62. Additional information on species habitat preferences and relative abundance is contained in an environmental inventory and assessment prepared for the Vicksburg District, Corps of Engineers, by the Department of Wildlife and Fisheries, Mississippi State University (1977).

THREATENED AND ENDANGERED SPECIES

63. In the Mississippi State study, of the eight species considered (American alligator, Bachman's warbler, bald eagle, Florida panther, Eskimo curlew, ivory-billed woodpecker, peregrine falcon, and red wolf), only the American alligator was reported to be a permanent resident of the project area. Stocking of alligators by the Mississippi Game and Fish Commission (now the Mississippi Department of Wildlife Conservation) has resulted in a well established population that is reproducing and expanding its range within the study area.

64. Formal consultations with FWS under Section 7 of the Endangered Species Act in regard to the American alligator and issuance of their Biological Opinion have determined that the project is not likely to jeopardize the continued existence of the American alligator. No determination of critical habitat for any species (habitat that is essential to the survival of a species) has been made in the Yazoo River Basin by the Department of the Interior (FWS).

65. The bald eagle was once a common winter resident throughout the area; however, the sightings have declined in recent years because of declining populations, primarily due to pesticides, illegal shootings, and habitat destruction. The bald eagle is now an infrequent winter visitor to the area.

CULTURAL RESOURCES

66. In accordance with the National Historic Preservation Act of 1966 (Public Law 89-665), National Environmental Policy Act of 1969 (Public Law 91-190), and Protection and Enhancement of the Cultural Environment (Executive Order 11593), a cultural resources reconnaissance of the project area was undertaken by Corps archeologists. A literature search and records review were accomplished to determine what resources are known to be located in the project area. One archeological site, 22IS522, is located in the general vicinity; however, the site is not in the direct impact area. No sites eligible for listing in the National Register of Historic Places are located within the study area. A preliminary field assessment of the pump station and approach channel did not reveal any cultural resources. Upon more detailed plans of this project an intensive field survey of the project will be accomplished.

ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

GENERAL

67. The intensive flood control program throughout the Yazoo Delta has changed the original Delta environment from an extensive wooded swamp, wooded wetland, and hardwood forest system to an intensively managed agricultural system.

68. Flood control activities throughout the Yazoo Basin have had considerable effect on the hydrology of the aquatic ecosystem, and farming practices have changed infiltration rates and runoff patterns. Extensive elimination of the forests has altered natural evapotranspiration rates with unknown impact on water table levels and flow conditions, particularly during low-flow seasons.

69. The construction and operation of the recommended pumping plan would serve to reduce the extent and duration of interior ponding within the project area during periods of backwater flooding on the Mississippi and Yazoo Rivers. Flood reduction in the benefited area would diminish the risk involved in farming these lands for the production of soybeans and other agricultural crops.

70. The reduction in flood hazard would encourage the application of more efficient and productive methods and equipment and the conversion of more woodlands and wetlands to agricultural uses at an accelerated rate, which would result in increased net economic returns for agricultural enterprises in

the area of maximum ponding. The installation of more extensive and efficient interior drainage facilities by local interest groups would be feasible. The methodology for quantifying the fish, wildlife, and forestry impacts of the project is shown in Attachment 1 to this appendix.

WATER QUALITY, ENERGY, NOISE, AND AIR QUALITY

71. Site preparation and construction activities may cause temporary noise impacts; however, the pumping plant would be electrically driven and, therefore, operation should be relatively quiet and unobjectional. Debris from site clearing would contribute a minor degree of temporary air pollution. The project would have adverse effects on the water quality of oxbow lakes and wetland systems by reducing the natural cycle of flushing and nutrient exchange; however, there would be little direct effect on physiochemical water quality parameters.

72. An indirect effect would be increased turbidity and pesticides in water bodies in the area, resulting from induced land clearing and intensified farming. However, considering the total land surface already cleared and farmed in the Yazoo Area, the induced land clearing and intensified farming will contribute a relatively minimal amount of additional sediment and pesticides although the localized effects may be more severe.

73. Operation of the pumping plant will require energy from electric generating plants driven by fossil fuels or nuclear power. In a year of average pumping, 14.9 million kilowatt hours of electricity will be required for the proposed pumping plant (Table G-3). If energy becomes a limited resource as a result of future conditions, pump generation would compound energy requirements for the project area.

FISHERY RESOURCES

74. Habitat conditions conducive to an abundance of aquatic resources in the area are directly associated with frequency and duration of overflow during the winter and spring months. Seasonal water level fluctuations result in higher productivity and greater harvests of both sport and commercial fishery resources. A reduction in the frequency and duration of flooding occasioned by the operation of the pumping plant would reduce the food resources for fish provided by the inundation of terrestrial habitat. The reduction in flooding would also diminish spawning and nursery areas and reduce the overall quality of the sport and commercial fishery throughout the interconnected system of backwater lakes, wetlands, and streams.

75. With the proposed pump plan, the sport fishing resource would undergo a reduction of approximately 7,333 man-days annually, and the loss in value of the annual harvest of commercial fishes would be approximately $31,700 (see Table G-4).

FOREST RESOURCES

76. Rights-of-way for the pumping plant and chanels would require 296 acres of woodland and 14 acres of cleared land. Pump site construction would require 26 acres of woodland and 14 acres of cleared land. Inlet and outlet channels would require the remaining 270 acres of forested land including 12 acres of wooded swamp. Project implementation would result in the clearing of 3,700 acres of forest lands (rights-of-way plus project-induced) including 300 acres of wooded swamp under without-mitigation conditions (Table G-5).

77. The impact of clearing and reducing the flooding of woodlands and wetlands would be a loss in the extent and productivity of habitat essential for survival and propagation of many wildlife species. There will be a reduction in tree growth as a result of reduced flooding, and a decline in forest products and related industries in the general area as a result of induced clearing of bottom-land hardwoods.

78. Conversion of forest land to cropland will result in a reduction of deer, squirrel, and other forest game and nongame populations. The reduction of opportunities for hunting, trapping and nature-oriented use as a direct result of project-induced land clearing and rights-of-way will result in a net annual loss of $36,600 (Table G-4). The quality of hunting will also be degraded since the loss of wildlife resources will aggravate competition for hunting areas. Private hunting opportunities will be reduced and the cost of the sport will be increased, a situation that has already become serious throughout the Delta region.

WETLAND HABITAT

79. The proposed project will indirectly affect the quality of wooded wetlands (8,700 acres), and wooded and shrub swamps (21,500 acres) by reducing or eliminating seasonal inundation of these wetland habitats.

80. The potential exists for direct impact on peripheral and supportive habitat adjacent to the major wetlands from reduced flooding and lowering of the existing water table as a result of project implementation. If this condition occurs, the likelihood of these areas being converted to agricultural land would be greatly increased. Removing and/or lowering the flooding frequency would promote the potential for the clearing or "edging" of these areas.

81. Clearing of these supportive or "buffer" habitats would tend to degrade the quality of wooded swamps and oxbow lakes. Removal of this vegetation would eliminate the filtering effect of these areas with regard to incoming turbidity and pesticides from field runoff. Increased turbidity would result in long-term impacts of siltation deposition, with the associated impacts of shortening the expected longevity of these wetlands. Unfiltered runoff would tend to increase the pesticide concentrations and reduce the overall quality of the existing aquatic environment.

82. Reduction and/or elimination of the annual flood cycle would tend to reduce the quality of wetlands with regard to the overall ecology of the community. Reduced flooding represents the potential to alter existing vegetative communities as well as the macro- and microhabitats of the seasonal flood lands. Alteration of these habitats would impact the existing vertebrates and nonvertebrate organisms, which in turn would impact the ecology of the food chain as well as individual vertebrate and nonvertebrate populations.

83. Reduced flooding over time presents the likelihood of altering vegetative species composition in situations where flooding is reduced sufficiently to alter the water regime. These changes would be long-term impacts and the immediate effects would not be noticeable.

84. Allowing flooding up to 85 feet, NGVD, from 1 December to 1 March, as with the proposed plan, would reduce the impact to existing wetlands; however, the long-term impact of continual reduction cannot be determined with certainty sufficient to state that the wetlands would not be adversely impacted on a long-term basis.

85. Implementation of the proposed pump plan (Plan C) would not reduce the duration of flooding on 6,100 acres of wooded wetlands and 3,300 acres of wooded swamp below the with-project 1-year flood. Approximately 2,600 acres of wooded wetlands and 1,900 acres of wooded swamp now flooding on a 1-year frequency would be flooded on only a 1.5- to 2-year frequency with the project. The project would not reduce the flooding frequency during the period 1 December to 1 March. The flood duration on this acreage will not be significantly affected by the recommended plan. The frequency and duration of backwater flooding on wetlands lying above 85 feet, NGVD, will be reduced somewhat.

86. Impacts related to the alleviation of flooding frequency and duration would be long-term impacts but cannot be easily determined. However, these impacts will occur and were recognized when evaluating the impacts associated with implementation of the proposed project. Most of the wetlands lying above the 5-year frequency flood are affected much more by rainfall runoff and stream channel overflow than by interior flooding.

DELTA NATIONAL FOREST AND
DELTA WILDLIFE AND FORESTRY, INC.

87. The operation of the pumping plant would substantially reduce the frequency and duration of flooding of these areas (see Table G-1). The quality and quantity of the commercial and sport fishery, wetlands, timber resources, and waterfowl hunting would be reduced as a result of reduction in flooding frequency and duration.

88. The virgin overcup oak-water hickory and green ash-sugarberry stands located within Delta National Forest will experience a reduction in frequency and duration of flooding. On the average (without project), the green ash area floods on about a 2-year frequency; with the project, it would flood on a 5- to 6-year frequency. Flooding of the overcup oak area will change from a 5-year frequency to an 18- to 20-year frequency. Elimination of periodic flooding would reduce tree growth, change site conditions, and allow encroachment by invader species. Modification of the ecosystem would not be readily apparent.

WILDLIFE RESOURCES

THREATENED AND ENDANGERED SPECIES

89. With the exception of the American alligator and the southern bald eagle, it is highly unlikely that any endangered animal species exist in the Yazoo Area. The loss and degradation of forest and wetland habitat that has occurred in the Yazoo Basin has virtually eliminated the presence of endangered wildlife species such as the Florida panther, red wolf, ivory-billed woodpecker, and Bachman's warbler.

90. No critical habitat for any species has been established by the Department of the Interior within the total Yazoo Delta. There are no active eagle nests in or near the area; however, eagles infrequently visit the area during migration. The American alligator is common in oxbow lakes and swamps and streams; however, the construction and operation of the proposed pumping plant is not likely to jeopardize the continued existence of this species.

WATERFOWL

91. Changes in water regime would have an important influence on migratory and resident waterfowl. During the course of fall and spring migration, waterfowl feed and rest in flooded woods and fields. Waterfowl begin to arrive in the project area during the early part of November and remain until the middle of March. The proposed pumping project would reduce by 54 percent the acres flooded by the 5-year flood frequency. However, during the period from 1 December through 1 March, water would be permitted to rise to 85 feet,

NGVD (1-year flood elevation is 84.8 feet, NGVD, and 85.8 feet, NGVD, in the lower and upper ponding areas, respectively), before pumping is initiated. This project function greatly reduces the impact to waterfowl and lowers the man-day loss to hunting by approximately 80 percent.

92. Project-induced losses of waterfowl represent a loss of 1,178 man-days annually. The cumulative impacts of increased clearing, intensified agricultural practices, and altered flood frequency would tend to impact migratory and resident waterfowl. Long-term cumulative impacts represent the potential impact of altering migration patterns, affecting the condition of waterfowl returning to the breeding grounds, and reducing the quality of existing nesting and brood habitat of resident waterfowl. These impacts would not be immediately evident, but the long-term potential impact does exist.

CULTURAL RESOURCES

93. In accordance with the National Historic Preservation Act of 1966 (Public Law 89-665), National Environmental Policy Act of 1969 (Public Law 91-190), and Protection and Enhancement of the Cultural Environment (Executive Order 11593), a cultural resources reconnaissance of the project area was undertaken by Corps archeologists. A literature search and records review were accomplished to determine what resources are known to be located in the project area. One archeological site, 22IS522, is located in the general vicinity; however, the site is not in the direct impact area. No sites eligible for listing in the National Register of Historic Places are located within the study area. A preliminary field assessment of the pump station and approach channel did not reveal any cultural resources. Upon more detailed plans of this project an intensive field survey of the project will be accomplished.

FISH AND WILDLIFE MITIGATION

94. Adverse project impacts on fish and wildlife resources have been quantified where possible and have been included in the annual costs for all plans evaluated. Mitigation measures designed to lessen these adverse project impacts would be required.

95. The overall project review and the development of mitigation measures have been coordinated fully with the Mississippi Department of Wildlife Conservation, the Fish and Wildlife Service, and other appropriate Federal agencies. The mitigation report which describes the proposed plan to mitigate the project-induced losses will accompany this report.

96. Losses of forests, wetlands, and associated fish and wildlife, and losses in productivity of natural alluvial valley lakes and wetlands are significant, considering the rapid depletion and increasing scarcity of wildlife resources

throughout the overall Yazoo Basin. The losses are irreplaceable and are costs to be considered in the trade-offs for water land development projects designed to achieve a desirable goal of more productive and intensive land use and greater economic returns.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

BOTTOM-LAND FORESTS AND FISH AND WILDLIFE HABITAT

97. Construction and operation of the proposed pump plant would result in accelerated clearing and conversion of a portion of the remaining privately owned bottom-land forests to agricultural use throughout the extensive low-lying backswamp ponding area. Economic studies of the project indicate that an induced loss of 3,700 acres of forest land, including 300 acres in rights-of-way, would be attributable to the proposed pump plan. This is a commitment of bottom-land forest wildlife habitat and a portion of the forest base which provides outdoor recreation and sustains commercial hardwood forest enterprises in the general area.

PERMANENT LOSS OF FORESTS

98. Once the bottom-land forests are cleared and the land is converted to agricultural use, it is unlikely that agriculture would be abandoned and the lands would be permitted to revert to a mixed hardwood forest condition with the environmental qualities and fish and wildlife habitat values afforded by the original bottom-land forest cover.

99. In accordance with reforestation practices now being accomplished by forest industries in some parts of the Lower Mississippi Alluvial Valley, possible newly reestablished forests are likely to be of a single, fast-growing species managed in accordance with even-aged, short rotation silvicultural practice designed to achieve maximum economic returns.

COMMITMENT OF OTHER RESOURCES

100. Mitigation measures can partially compensate for project-induced losses of fish and wildlife resources, but total replacement of lost fish and wildlife resources, in kind, is considered impossible. The material and labor associated with project construction will be irreversibly and irretrievably committed.

TABLE G-1
FLOODED ACREAGE IN THE YAZOO PUMP STUDY AREA
AT VARIOUS ELEVATIONS
(With- and Without-Project Conditions)

Location	Flood Frequency (years)	Without-Project Conditions 1978		Without-Project Conditions 1980[a/]		With-Project Conditions 1980[b/]	
		Acres Flooded	Elevation (feet)	Acres Flooded	Elevation (feet)	Acres Flooded	Elevation (feet)
Nondedicated Forest Lands (L)	5	34,300	92.0	30,760	92.0	11,800	85.4
	3	26,300	90.0	23.586	90.0	10,600	84.8
	1	10,600	84.8	9,506	84.8	4,620	80.6
Nondedicated Forest Lands (U)	5	3,715	93.2	2,847	93.2	2,076	87.8
	3	2,822	91.2	2,530	91.2	1,874	86.7
	1	1,792	85.8	1,607	85.8	922	82.7
Forest Lands (Delta National Forest)	5	54,425	93.2	54,425	93.2	21,000	87.8
	3	45,950	91.2	45,950	91.2	15,000	86.7
	1	11,080	85.8	11,080	85.8	3,020	82.7
Forest Lands (Delta Wildlife & Forestry)	5	13,250	93.2	13,250	93.2	3,555	87.8
	3	12,070	91.2	12,070	91.2	2,385	86.7
	1	1,680	85.8	1,680	85.8	445	82.7
Forest Lands (Panther Swamp)	5	2,930	93.2	2,930	93.2	809	87.8
	3	1,688	91.2	1,688	91.2	671	86.7
	1	578	85.8	578	85.8	353	82.7
Cleared Lands (L)	5	46,200	92.0	49,740	92.0	10,500	85.4
	3	32,000	90.0	34,714	90.0	8,900	84.8
	1	8,900	84.8	9,994	84.8	1,480	80.6
Cleared Lands (U)	5	50,670	93.2	51,538	93.2	18,500	87.8
	3	33,175	91.2	33,467	91.2	14,600	86.7
	1	11,660	85.8	11,435	85.8	3,990	82.7

L = Lower ponding area. U = Upper ponding area.

a/ Based on without-project land clearing of 11,570 acres (1978-1980) in the lower ponding area and without-project land clearing of 3,046 acres (1978-1980) in the upper ponding area, and assuming clearing will be distributed proportionately to the existing (1978) woodland distribution. Additional non-project induced land clearing is expected to occur after 1980 (see Appendix F).

b/ Excludes effects of project rights-of-way requirements of 377 acres.

TABLE G-2
LOCATION AND DIVERSITY OF FISH SPECIES COLLECTED

Species	Lower Panther Swamp	Lower Lake George	Steele Bayou-Sunflower Connecting Channel	Yazoo River	Long Lake	Greasy Bayou	Black Bayou	Halpino Lake	Total Occurrence
Lepisosteus oculatus	X	X	X	X	X	X	X	X	8
Lepisosteus platostomus		X		X					2
Amia calva	X					X			2
Dorosoma cepedianum	X	X	X	X	X		X	X	7
Dorosoma petenense				X				X	2
Cyprinus carpio	X	X	X	X	X	X	X	X	8
Notropis atherinoides			X	X			X		3
Notropis maculatus				X					1
Notropis venustus			X						1
Carpiodes carpio	X			X					2
Carpiodes cyprinus	X	X	X		X	X		X	6
Ictiobus bubalus	X	X	X		X	X		X	6
Ictiobus cyprinellus	X	X	X	X	X	X		X	7
Ictalurus furcatus				X					1
Ictalurus metas				X				X	2
Ictalurus natalis							X		1
Ictalurus punctatus				X					1
Pylodictis olivaris				X		X			2
Gambusia affinis		X							1
Labidesthes sicculus				X					1
Menidia audens								X	1
Morone chrysops				X				X	2
Lepomis gulosus						X			1
Lepomis macrochirus	X	X		X	X	X	X	X	7
Micropterus punctulatus								X	1
Micropterus salmoides					X	X		X	3
Pomoxis annularis		X		X	X	X	X		5
Pomoxis nigromaculatus	X							X	2
Aplodinotus grunniens	X			X				X	3
Total number of species	11	10	8	18	9	11	7	15	

Source: Environmental Inventory and Assessment of the Yazoo River Basin, prepared by Howard, Needles, Tammen, and Bergendoff, 1980.

TABLE G-3
COMPARISON OF PLANS
YAZOO AREA PUMP STUDY

Plan (Elevation and Flow)	First Costs[a] ($000)	Annual Costs ($000)	Operation and Maintenance Costs ($000)	Annual Benefits ($000)	Excess Benefits ($000)	Benefit-Cost Ratio	Reduction in Damages (%)	Energy Use (million kWh)	Induced Clearing[b] (acres)	Net Fish and Wildlife Losses ($000)
Plan A (80.0 feet)										
10,000 cfs	86,800	3,851	536	14,305	10,454	3.7	45	7.2	2,300	63
15,000 cfs[c]	126,200	5,801	950	19,902	14,101	3.4	62	14.1	3,700	123
17,500 cfs	147,400	6,787	1,119	22,825	16,038	3.4	68	17.0	4,200	146
20,000 cfs	175,400	7,949	1,206	25,347	17,398	3.2	77	19.4	4,800	172
25,000 cfs	212,900	9,639	1,464	28,310	18,671	2.9	86	22.6	5,400	199
30,000 cfs	250,600	11,142	1,551	29,412	18,270	2.6	89	23.9	5,600	202
Plan B (80.0 feet)										
15-10,000 cfs	238,000	10,782	1,649	29,452	18,670	2.7	89	27.0	5,700	215
10-15,000 cfs	239,600	11,096	1,898	29,533	18,437	2.7	90	30.3	5,900	218
7-18,000 cfs	241,000	11,287	2,039	29,483	18,196	2.6	90	32.8	5,900	219
Plan C (80.0 feet Modified)[d]										
10,000 cfs	85,800	3,760	488	14,107	10,347	3.8	45	6.3	2,200	58
15,000 cfs	125,500	5,620	835	19,247	13,627	3.4	60	12.0	3,200	83
17,500 cfs	147,200	6,631	1,021	22,072	15,441	3.3	68	14.9	3,700	95
17,500 cfs with mitigation[e]	150,000	6,633	1,021	21,346	14,713	3.2	68	14.9	1,200	0
20,000 cfs	172,600	7,691	1,117	24,661	16,970	3.2	77	16.5	4,300	107
25,000 cfs	210,900	9,340	1,319	28,001	18,661	3.0	86	19.7	4,800	120
30,000 cfs	250,200	10,926	1,425	29,140	18,214	2.7	89	21.4	5,100	128
Plan D (HOLD 85.0 feet)										
25,000 cfs	251,100	10,401	990	24,418	14,617	2.3	75		3,800	74

TABLE G-3 (Cont)

Plan (Elevation and Flow)	First Costs[a/] ($000)	Annual Costs ($000)	Operation and Maintenance Costs ($000)	Annual Benefits ($000)	Excess Benefits ($000)	Benefit-Cost Ratio	Reduction in Damages (%)	Energy Use (million kWh)	Induced Clearing[b/] (acres)	Net Fish and Wildlife Losses ($000)
Plan E (HOLD 80.0 feet)										
25,000 cfs	220,200	9,368	1,027	25,299	15,931	2.7	77		4,700	108
Plan F (83.0 feet)[d/]										
10,000 cfs	85,200	3,536	309	9,176	5,640	2.6	29	3.4	1,400	35
15,000 cfs	124,900	5,251	513	13,530	8,279	2.6	41	6.4	2,200	58
17,500 cfs	145,900	6,145	613	15,505	9,360	2.5	46	5.6	2,600	67
20,000 cfs	171,000	7,158	674	17,284	10,126	2.4	52	8.7	3,000	78
25,000 cfs	205,000	8,513	743	20,472	11,959	2.4	62	9.7	3,600	90
30,000 cfs	241,200	9,939	820	21,331	11,392	2.1	65	10.6	3,700	92
Plan G (85.0 feet)										
10,000 cfs	83,900	3,428	259	6,449	3,021	1.9	20	2.6	900	25
15,000 cfs	117,100	4,848	436	11,139	6,291	2.3	35	4.7	1,700	46
17,500 cfs	144,100	5,912	457	12,761	6,849	2.2	38	5.6	2,000	56
20,000 cfs	168,100	6,848	484	14,437	7,589	2.1	44	6.3	2,500	67
25,000 cfs	202,300	8,251	593	17,426	9,175	2.1	54	7.1	3,000	79
Plan H										
15,000 cfs	162,800	6,197	416	10,859	4,662	1.8	35	4.7	700	-253
Plan I (90.0 feet)										
10,000 cfs	81,500	3,223	162	3,846	623	1.2	12	0.9	400	8
15,000 cfs	114,200	4,557	266	5,868	1,311	1.3	18	1.7	700	13
20,000 cfs	164,700	6,522	335	7,185	663	1.1	22	2.3	800	17

a/ Does not include mitigation costs, but tentative mitigation costs increase this figure by less than 10 percent.
b/ Includes right-of-way.
c/ Approximates authorized plan.
d/ Pumping initiated at 85 feet, 1 December - 1 March.
e/ Recommended plan.

TABLE G-4
ENVIRONMENTAL LOSSES FOR ALTERNATIVES
YAZOO PUMP STUDY

Elevation and Pump Size	(1) Sport Fishery Loss ($)	(2) Commercial Fishery Loss ($)	(3) Furbearer Loss ($)	(4) Waterfowl Loss From Reduced Flooding ($)	(5) Forest Game and Wildlife Oriented Loss ($)	(6) Total Value Loss ($)	(7) Total Gain Cleared Land Value ($)	(8) Net Losses ($)	(9) Terrestrial Wildlife Losses ($)
Plan A									
10,000 cfs	11,500	20,800	10,500	7,600	13,800	64,200	1,000	63,200	31,900
15,000 cfs	17,100	31,200	13,500	41,800	21,300	124,900	1,600	123,300	76,600
17,500 cfs	19,000	34,800	14,300	55,700	24,400	148,200	1,800	146,400	94,400
20,000 cfs	21,200	38,800	15,200	71,300	27,800	174,300	2,000	172,300	114,300
25,000 cfs	23,300	42,800	16,200	88,000	31,400	201,700	2,300	199,400	135,600
30,000 cfs	24,000	44,000	16,400	88,000	32,200	204,600	2,300	202,300	136,600
Plan B									
15-10,000 cfs[a/]	25,500	46,900	18,300	92,000	34,500	217,200	2,500	214,700	144,800
10-15,000 cfs[a/]	26,400	48,600	18,400	92,000	34,800	220,200	2,500	217,700	145,200
7-18,000 cfs[a/]	26,600	49,000	18,500	92,000	35,300	221,400	2,600	218,800	145,800
Plan C									
10,000 cfs	27,300-11,700	21,200-21,200	10,900-10,400	6,067-2,600	32,126-13,500	59,400	2335-1,000	58,400	26,500-46,252
15,000 cfs	15,500	28,200	12,700	8,000	20,200	84,600	1,500	83,100	40,900
17,500 cfs	17,400	31,700	13,500	10,600	23,100	96,300	1,700	94,600	47,200
20,000 cfs	19,500	35,600	14,300	13,500	26,300	109,200	2,000	107,200	54,100
25,000 cfs	21,500	39,200	15,200	17,000	29,600	122,500	2,200	120,300	61,800
30,000 cfs	22,000	40,400	16,000	17,000	35,000	130,400	2,300	128,100	68,000
Plan D									
25,000 cfs	16,000	29,000	7,700	0	22,600	75,300	1,700	73,600	30,300
Plan E									
25,000 cfs	19,700	35,700	13,600	13,300	27,800	110,100	2,000	108,100	54,700

TABLE G-4 (Cont)

Elevation and Pump Size	(1) Sport Fishery Loss ($)	(2) Commercial Fishery Loss ($)	(3) Furbearer Loss ($)	(4) Waterfowl Loss From Reduced Flooding ($)	(5) Forest Game and Wildlife Oriented Loss ($)	(6) Total Value Loss ($)	(7) Total Gain Cleared Land Value ($)	(8) Net Losses ($)	(9) Terrestrial Wildlife Losses ($)
Plan F									
10,000 cfs	7,200	12,600	4,900	2,600	8,800	36,100	700	35,400	16,300
15,000 cfs	11,000	19,400	6,200	8,000	14,400	59,000	1,000	58,000	28,600
17,500 cfs	12,500	22,000	6,800	10,600	16,700	68,600	1,200	67,400	34,100
20,000 cfs	14,200	25,000	7,500	13,500	19,300	79,500	1,400	78,100	40,300
25,000 cfs	15,400	28,000	8,400	17,000	22,700	91,500	1,600	89,900	48,100
30,000 cfs	16,200	29,000	8,500	17,000	23,300	94,000	1,700	92,300	48,800
Plan G									
10,000 cfs	5,400	9,300	1,700	2,600	6,500	25,500	500	25,000	10,800
15,000 cfs	9,400	16,700	2,700	8,000	10,200	47,000	700	46,300	20,900
17,500 cfs	10,800	19,300	3,300	10,600	12,700	56,700	900	55,800	26,600
20,000 cfs	12,400	22,200	4,000	13,500	15,600	67,700	1,100	66,600	33,100
25,000 cfs	14,280	26,200	4,900	17,000	18,500	80,880	1,400	79,480	40,400
Plan H (EQ)									
15,000 cfs[a]	9,400[b]	16,700[b]	2,700[b]	8,000[b]	10,200[b]	-252,000[c]	700	-252,700[c]	-279,500[c]
Plan I									
10,000 cfs	2,000	3,000	800	0	3,200	9,000	200	8,800	4,000
15,000 cfs	2,800	5,000	1,200	0	4,400	13,400	300	13,100	5,600
20,000 cfs	3,800	6,000	1,600	0	6,000	17,400	400	17,000	7,600

a/ The first number indicates the pump capacity in the lower ponding area; the second number indicates the pump capacity in the upper ponding area.

b/ Losses excluding benefit resulting from the purchase of 30,000 acres of forested land.

c/ Net gain including benefit of $299,000 associated with purchase, preservation, development, and management of 30,000 acres of forested land.

TABLE G-5
FUTURE LAND CLEARING
WITH AND WITHOUT THE RECOMMENDED PLAN

Alternative	Acres Cleared					
	1978-1990	1990-2000	2000-2010	2010-2020	2020-2030	2030-2039
Future Without Project	14,600	6,900	1,500	1,500	1,400	1,300
Plan C, 17,500 cfs pump (Recommended Plan) a/	14,900 b/	8,800	1,900	1,900	1,800	1,600

Note: In 1978 there were 61,316 acres of woodland within the project area (excluding Delta National Forest and Delta Wildlife and Forestry, Inc.).

a/ Modification involves allowing natural flooding of lands below 85 feet during the period 1 December - 1 March.

b/ Includes 300 acres for rights-of-way.

ATTACHMENT 1
YAZOO AREA PUMP STUDY
METHODOLOGY FOR QUANTIFICATION OF FISH AND WILDLIFE LOSSES

1. Sport Fishing.

a. Assume 7 man-days/acre for lakes (1-year), 2 man-days/acre for streams (100-year), and 1 man-day/acre for wetlands (1-year).[a/]

b. Reduce this by a factor of 0.39 which is the percent reduction in total sport fish production when all flooding is eliminated (based on "Fish Populations of Mississippi River Oxbow Lakes in Louisiana," Lambou).

c. Further reduce the losses in lakes and streams by the percent reduction in total acres flooded, and reduce the wetlands by reduction in flooding of wooded acres.

d. Dollar value = Ac X MD/Ac X % reduction in flooding X 0.39 x $2.25.

e. Example: 80 foot, 10,000 cubic feet per second (Plan A).

EXISTING VALUE

	Lower Ponding Area		Upper Ponding Area	
Lakes	905 Ac X 7 MD ~~X 0.299 X 0.39~~ X $2.25 = ~~$ 1,662~~ 14,254		1,450 Ac X 7 MD X 0.420 X 0.39 X $2.25 = $ 3,741	= 22,838
Streams	3,394 Ac X 2 MD X 0.299 X 0.39 X $2.25 = ~~$ 1,781~~ 15,273		3,844 Ac X 2 MD X 0.420 X 0.39 X $2.25 = $ 2,833	17,298
Wetlands	2,800 Ac X 1 MD X 0.244 X 0.39 X $2.25 = ~~$ 600~~ 6300		2,500 Ac X 1 MD X 0.380 X 0.39 X $2.25 = $ 834	5625
Total Lower Ponding Area		~~$ 4,043~~ $35,827	Total Upper Ponding Area	~~$ 7,408~~ 45,761

TOTAL BOTH PONDING AREAS $11,451
USE $11,500

existing value = $81,588
+ 86,240
$ 167,828

good fish
CF
existing

2. Commercial Fishing.

a. Assume $10 per acre per year value for lakes, $5/Ac/yr for streams and wetlands.

b. Reduce this by a factor of 0.69 which is the percent reduction in total commercial fish production when all flooding is eliminated (based on "Fish Populations of Mississippi River Oxbow Lakes in Louisiana," Lambou).

c. Further reduce the losses in lakes and streams by the percent reduction in total acres flooded and reduce the wetlands by the reduction in flooding of wooded acres.

d. Dollar value = Ac X % reduction in flooding X 0.69 X $/Ac.

e. Example: 80 foot, 10,000 cubic feet per second (Plan A).

Lower Ponding Area								Upper Ponding Area							
Lakes	905 Ac	X	$10	X	0.299	X	0.69	= ~~$ 1,867~~	1,450 Ac	X	$10	X	0.420	X	0.69	= ~~$ 4,202~~
Streams	3,394 Ac	X	$5	X	0.299	X	0.69	= $ 3,501	3,844 Ac	X	$5	X	0.420	X	0.69	= $ 5,570
Wetlands	2,800 Ac	X	$5	X	0.244	X	0.69	= $ 2,357	2,500 Ac	X	$5	X	0.380	X	0.69	= $ 3,278
Total Lower Ponding Area								~~$ 7,725~~	Total Upper Ponding Area							$13,050

TOTAL BOTH PONDING AREAS $20,775

USE $20,800

3. Furbearer Losses.

a. Based on 1979 fur prices and furbearer populations per acre, a value/acre of $2.60 for wetland species and $2.14 for bottom-land hardwoods was developed.

b. A reduced flooding loss to furbearers was developed using the wooded acres in the 1-year flood reduced by each alternative.

c. Dollar loss per acre as a result of reduced flooding ($2.60 - 2.14 = $0.46).

d. Example: 80 foot, 10,000 cubic feet per second (Plan A).

Lower Ponding Area			Upper Ponding Area		
Condition	1-Year Flood	Acres Reduced	Condition	1-Year Flood	Acres Reduced
Existing	10,600		Existing	14,700	
80 foot, 10,000	5,600	5,000 Ac X $0.46 = $2,300	80 foot, 10,000	4,740	9,980 X $0.46 = $4,591

TOTAL LOSS TO REDUCED FLOODING $6,891

e. A furbearer loss to induced clearing was developed using $2.60/Ac for induced clearing of wetlands and $2.14/Ac for bottom-land hardwoods.

Lower Ponding Area		Upper Ponding Area	
Induced loss of bottom-land hardwoods[b/]	1,111 Ac X $2.14 = $2,378	Induced loss of bottom-land hardwoods	396 Ac X $2.14 = $847
Induced loss of wooded swamp	119 Ac X $2.60 = $ 309	Induced loss of wooded swamp	24 Ac X $2.60 = $ 62
Total Lower Ponding Area	$2,687	Total Upper Ponding Area	$909

TOTAL FURBEARER LOSS = $6,891 + $2,687 + $909 = $10,487

4. Waterfowl Losses to Reduced Flooding.

a. Assume 5-year flood, both cleared and wooded, is the area influencing waterfowl, migratory and resident.

b. Each acre of woods has 0.7 MD/yr at $9.00/MD or $6.30/Ac. Each acre of cleared land has 0.3 MD/Ac/yr or $2.70/Ac/yr.

c. The number of acres removed from the 5-year flood by each alternative X $6.30 (or $2.70) = waterfowl loss to reduced flooding. (Average acres flooded per day for the 28-year period of record from 1 December-15 January.)

d. Example: 80-foot, 10,000 cubic feet per second (Plan A).

Lower Ponding Area

	Wooded		Cleared	
Existing 80-foot, 10,000 cfs	10,520 × 6.30 = 66,276 9,914		Existing 80-foot 10,000 cfs	8,708 × 2.70 = 23,512 7,907
Acres reduced	606 Ac X $6.30 = $3,818		Acres reduced	801 Ac X $2.70 = $2,163

Upper Ponding Area

	Wooded		Cleared	
Existing 80-foot, 10,000 cfs	9,790 × 6.30 = 61,677 9,594		Existing 80-foot, 10,000 cfs	7,090 × 2.70 = 19,143 6,961
Acres reduced	196 Ac X $6.30 = $1,235		Acres reduced	129 Ac X $2.70 = $348
	TOTAL LOSS BOTH PONDING AREAS	$7,564		

existing $179,608

606
801
196
129
1732 acres = × 2,600
$7,600

592 acres
~600

5. Big Game, Small Game, Wildlife-Oriented Recreation.

a. Assume 0.62 MD and $5.58/Ac for big game. This was developed using deer and turkey hunting data from the Mississippi Bureau of Fisheries and Wildlife Mail Harvest Survey. A harvest potential of 1 deer per 30 acres with a hunter effort of 14.7 days per deer gave a 0.49 man-day per acre value for deer.

A harvest potential of 1 turkey per 60 acres with 7.8 hunter days per harvest gave a 0.13 man-day value for turkey.

0.49
0.13

0.62 = MD/Ac value for big game for bottom-land hardwood

b. Using a similar method, the following small game values were developed.

	Harvest Potential	Days Effort/One	MD/Ac
Rabbit	1/4 acres	0.56	0.14
Squirrel	1/2 acres	0.41	0.21
Raccoon	1/16 acres	0.76	0.05
			0.40 MD/Ac value for small game

Small game = 0.40 MD and $0.90/Ac bottom-land hardwood.

c. Wildlife-oriented recreation was given a value of 1 man-day and $2.25 per acre of bottom-land hardwood.

d. Similar methods were used to develop losses for wooded swamp.

Big Game = 0.2 man-day and $1.80 per acre value

Small Game = 0.1 man-day and $0.23 per acre value

Wildlife-oriented recreation = 1 man-day and $2.25 per acre value

e.

	Lower Ponding Area				Upper Ponding Area			
	Induced Acres				Induced Acres			
Bottom-land hardwoods	1,111 ac	X	$8.73	= $ 9,699	396 ac	X	$8.73	= $3,457
Wooded swamp	119 ac	X	$4.28	= $ 509	24 ac	X	$4.28	= $ 103
TOTAL LOSS BOTH PONDING AREAS					$13,768			

a/ Mississippi Bureau of Fisheries and Wildlife studies show average standing crop of sport fish of 57.9 lb/Ac in Wasp Lake. Assume 75 percent of these available size, 50 percent catchability, 3 lb/man-day caught.

57.9 X 0.75 ÷ 2 ÷ 3 = 7 MD/Ac/yr

b/ Annualized induced clearing acres plus rights-of-way.

c/ Reference: "Shallow-Water Impoundment Increases Soil Moisture and Growth of Hardwoods," Broadfoot.

5.25
21.00

DOLLAR VALUE PER ACRE PER YEAR[a/]
YAZOO AREA PUMP STUDY

Category	Bottom-land Hardwoods and Wooded Wetlands		Wooded Swamp		Cleared Land	
Big Game	13.02	5.58	4.20	1.80	.21	0.09
Small Game	2.10	0.90	.53	0.23	.68	0.29
Waterfowl		6.30		6.30	6.30	2.70
Wildlife-Oriented Recreation	5.25	2.25	5.25	2.25	.54	0.23
Furbearers[b/]	20.37	2.14	9.98	2.60	7.73	0.00
Total	5-yr and below - 17.17 Above 5-yr - 10.87[c/]		5-yr - 13.18 Above 5-yr - 6.88		5-yr - 3.31 Above 5-yr - 0.61	

a/ Dollar values based on Principles and Standards.
9.00/Day, Big Game and Waterfowl.
2.25/Day, Small Game and Fishing.

b/ Fur values based on 1979 fur values provided by Mississippi Fur Cooperative.

c/ Difference in 5-year above and below is availability of water for waterfowl utilization.

VALUE OF BOTTOM-LAND HARDWOODS
YAZOO DELTA 1976-1977
(MISSISSIPPI DEPARTMENT OF WILDLIFE CONSERVATION)

Species	Population	Harvest Potential	Days Hunted	Harvest	Success	Day Effort For One	MD/Ac	$ Value/ Ac	Cleared Land Value	
									MD Effort	$ Value
Deer	1/10 Ac	1/30 Ac								
Gun			155,800	11,503	1/13.5	13.5	.45			
Archery			26,345	816	32.3	32.3	1.08			
Primitive Gun			5,084	407	12.5	12.5	.42			
Total			187,229	12,726	14.7	14.7	.49	4.41	.01	.09
Turkey	1/20 Ac	1/60 Ac	22,785	2,917	7.8	7.8	.13/62	1.17		
Small Game										
Rabbit	1/2 Ac	1/4 Ac	144,657	258,246	1.79/1	.56	.14			
Squirrel	1/1 Ac	1/2 Ac	128,316	314,775	2.45/1	.41	.21			
Raccoon	1/4 Ac	1/16 Ac	29,519	38,678	1.31/1	.76	.05			
Total							.40	.90	.13	.29
Waterfowl	1/.105	1/.5	107,394	285,392	2.7/1	.37	.7 on 1-yr freq flood	6.30	.7	6.30
Wildlife-Oriented Recreation							1.00	2.25	.10	.23
Total							2.76	15.03	.94	6.91

YAZOO PUMP PROJECT
YAZOO BACKWATER AREA
MISSISSIPPI

REEVALUATION REPORT

APPENDIX H

INSTITUTIONAL ANALYSIS AND PUBLIC INVOLVEMENT

PREPARED BY
THE UNITED STATES ARMY
VICKSBURG DISTRICT, CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

REEVALUATION REPORT
YAZOO AREA PUMP PROJECT
YAZOO BACKWATER AREA, MISSSISSIPPI

APPENDIX H

INSTITUTIONAL ANALYSIS AND PUBLIC INVOLVEMENT

Table of Contents

Table of Contents (Cont)

LIST OF ATTACHMENTS

REEVALUATION REPORT
YAZOO AREA PUMP PROJECT
YAZOO BACKWATER AREA, MISSISSIPPI

APPENDIX H

INSTITUTIONAL ANALYSIS AND PUBLIC INVOLVEMENT

INSTITUTIONAL ANALYSIS

INTRODUCTION

1. An important part of an effective planning process is the participation of the public throughout the study. Such participation aids Corps planners in defining the study objectives and priorities. It develops channels through which ideas and information can be shared by all study participants. In order to determine the implementability of any alternative for a pumping station within the Yazoo Backwater Area, the existing institutions affected by such plans and their functional responsibilities must be identified. The interaction between these institutions and the Vicksburg District, Corps of Engineers, must then be determined.

FEDERAL AGENCIES

USDA SOIL CONSERVATION SERVICE (SCS)

2. The SCS was created to plan and implement a national program to conserve and develop soil and water resources. SCS programs are usually coordinated through local landowners and operators, area and regional planning agencies, and other local, state, and Federal governmental units. The state SCS is directed by a State Conservationist who operates from the central office in Jackson, Mississippi. SCS also maintains a river basin survey staff in Jackson under the direction of a staff leader. The state is divided into seven regional areas, each served by an area conservationist and a technical staff. Each of the area offices contains from 9 to 16 field offices which, like the area offices, normally are located in the county seat.

USDA FOREST SERVICE

3. The Forest Service has responsibility for a number of water-related forestry programs, most of which overlap in the area of environmental protection. The Service owns Delta National Forest, a 59,000-acre tract in the project area. The Service cooperates with state and local governments, agencies and organizations, forest industries, and private landowners in the protection, reforestation, management, and utilization of forested lands and associated lands vital for watershed protection.

4. Cooperative programs are carried out with state forestry agencies, SCS, and local water conservation districts. Programs include the Yazoo-Little Tallahatchie flood prevention project, which covers nearly 5 million acres in the Yazoo Basin.

5. The Service conducts basic research programs throughout the country, such as flood prevention, which complement other forestry programs. Among the Service's other programs are those with the objective of environmental improvement.

U. S. FISH AND WILDLIFE SERVICE (FWS)

6. The FWS is the agency of the Department of the Interior designated to coordinate with other agencies in fish and wildlife resource activities. Cooperation between the FWS and the Corps is in the form of an official agreement for the funding of Fish and Wildlife Coordination Act of 1958 activities. This agreement was established on 7 September 1977 and consists of general guidelines to be followed in negotiations for funding of FWS planning and study efforts on Corps water resource study and development programs. It also defines each organization's responsibilities in these negotiations. This agreement is reviewed annually as funding and study requirements change.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

7. The EPA was created to administer a national policy to encourage protection and understanding of the environment and to foster a natural harmony between man and the environment. EPA has a mandate to control and abate all forms of pollution through a comprehensive program in cooperation with other Federal, state, and local agencies.

8. Specific water programs include the following:

a. Development of water quality and effluent guidelines and standards.

b. Development of national programs and technical policies for water resources.

c. Regulation of pesticides and their use.

d. Monitoring of pesticide occurrence in humans, animals, wildlife and fish and their environment.

STATE AGENCIES

9. The following state agencies have coordinated with the Corps on this study.

DEPARTMENT OF NATURAL RESOURCES

10. The Department of Natural Resources is designated as the single state agency to receive and expend any Federal funds available for matters within the jurisdiction of the Department. Additionally, the Department is responsible for conserving, managing, developing, and protecting the natural resources of the State of Mississippi and coordinating all functions of the state government related to wildlife which fall under its jurisdiction. The Department of Natural Resources is responsible for coordinating the review of water resource reports with other state agencies. The duties of the Bureau of Pollution Control and the Bureau of Land and Water Resources are discussed below.

Bureau of Pollution Control

11. The Bureau of Pollution Control is responsible for setting the state air and water quality standards and for specifying the actions required to meet these standards. It is empowered to develop comprehensive programs for the prevention, control, and abatement of new or existing pollution of the air and waters of the state.

12. The Bureau of Pollution Control is charged with the duty of carrying out Sections 201, 208, and 303 of the Federal Water Pollution Control Act Amendments of 1972. The State Water Quality Management Continuing Process outlines the future studies and management of procedures to be followed by the State of Mississippi and its public agencies in regard to water quality and management. This process also formulates the level of detail required by Federal regulations and considers both point and nonpoint water pollution problems.

13. The Bureau has completed basin water quality management plans for the 10 drainage basins in Mississippi, including the Yazoo River Basin.

Bureau of Land and Water Resources

14. Bureau of Land and Water Resources, formerly the Board of Water Commissioners, is concerned with recreational, industrial, municipal, and agricultural water users. The Division's duties are to:

a. Cooperate with all persons and agencies interested in regulating and conserving the use of water.

b. Inventory the water resources of the state and gather such adequate data as may be required to administer their functions as required by law.

c. Administratively determine and establish the rights of all water users who make beneficial use of water.

d. Divide the state into water resource districts.

e. Exercise jurisdiction over all unappropriated waters and act on all applications for appropriate rights to any surface stream, lake, or watercourse of the state.

f. Act upon the application of any person desiring to build a dam or reservoir.

DEPARTMENT OF WILDLIFE CONSERVATION

15. This department is composed of the Bureau of Marine Resources and the Bureau of Fisheries and Wildlife, which were formed from consolidation of the Marine Conservation Commission, the Game and Fish Commission, and the Boat and Water Safety Commission.

Bureau of Fisheries and Wildlife

16. The Game and Fish Commission was created in 1932 by the state legislature for the purposes of conservation, propagation, and protection of game and fish. The Commission's duties were delegated to the Bureau of Fisheries and Wildlife, which now administers affairs concerning water and water resources.

17. The Bureau is primarily concerned with water quality as it affects the fish, game, and wildlife of the state. The powers and duties of the Bureau are to:

a. Fine violators who discharge industrial wastes into the streams of the state. The fines are to be used for the purpose of inspecting and supervising waste disposal and enforcing the provisions of the Mississippi Air and Water Pollution Control Act. The Bureau has also been granted the authority to enforce the collecting of fines.

b. Extend and consolidate lands or waters suitable for the purposes of hunting, fishing, and trapping.

c. Regulate commercial and sport fishing in any of the public waters in the state by such measures as issuing commercial fishing permits and passing sport fishing laws which establish catch limits and fishing license requirements.

d. Operate a fish hatchery to supply public streams, parks, or lakes in the state.

18. The Bureau has very limited powers of eminent domain. Its powers are restricted to specific projects, after approval by the legislature.

RESEARCH AND DEVELOPMENT CENTER

19. The Research and Development (R&D) Center was created by the legislature in 1964 in order to perform the following duties:

a. Reorganize and expand the research function of the state government.

b. Establish the organizational structure and a physical facility through which the state research needs could be analyzed, coordinated, and acted upon more effectively.

c. Coordinate and minimize duplication of effort and utilize the existing research capabilities in state agencies and institutions of higher learning to the fullest extent practicable.

d. Associate the state research agency more closely with the academic community without placing it within a single institution.

e. Support research with a more adequate professional staff, equipment, and quarters.

f. Provide a representative advisory group, the Mississippi Research and Development Council, to guide research policies and programs for the maximum benefit of the state by orientation of such policies and programs to economic development.

20. The Planning Division of the R&D Center was created in 1972 and is charged with preparing a comprehensive development plan for the state and providing planning assistance to political subdivisions within the state. It is in this area that the functions of the R&D Center would be applicable to the Yazoo River Basin study, since the planning staff of the R&D Center works closely with planning commissions and regional agencies of the state in the preparation of land use plans, capital improvement programs, etc., in relation to plans for water supply and usage of water resources.

21. The Planning and Community Development Division manages the Mississippi portion of the flood insurance program of the Federal Emergency Management Agency.

MISSISSIPPI LEVEE DISTRICT, BOARD
OF MISSISSIPPI LEVEE COMMISSIONERS

22. The Mississippi Levee District will serve as sponsor of the Yazoo Area Pump Project. The operations of the Levee District are financed through ad valorem taxes, privilege taxes on businesses operating within the District, and an acreage tax on raw land. In times of crises, the Board of Mississippi Levee Commissioners has adequate power to raise funds, employ labor, or take any step necessary to secure the District from floods. The chief responsibility of the Board is to cooperate with the Mississippi River Commission and the Corps of Engineers in protecting and maintaining the levees. Through membership in the Lower Mississippi Valley Flood Control Association and personal contact with Congress, the Board seeks favorable funding to effect flood control in the Mississippi Valley.

YAZOO-MISSISSIPPI DELTA
LEVEE DISTRICT

23. The Yazoo-Mississippi Delta Levee District was founded in February 1884, when the State Legislature approved "An Act to Incorporate the Board of Levee Commissioners for the Yazoo-Mississippi Delta." This act provided the District with power to sell bonds based upon an ad valorem tax of real and personal property. Today, the operations of the District are financed through ad valorem taxes, privilege taxes on businesses operating within the District, and an acreage tax on raw lands.

24. The taxing powers given to the Yazoo-Mississippi Delta Levee District are broad and inclusive and are sufficient to provide adequate funding for extensive maintenance and construction activities of the District.

25. A major function of the District is the effective maintenance of the Mississippi River levee from the Tennessee line to the northern boundary of Bolivar County, Mississippi. In implementing this objective, the District works closely with individual drainage districts within its geographic jurisdiction, SCS, and the Corps. The counties included within the District's jurisdiction include all of Tunica, Coahoma, Quitman, Sunflower, Leflore, and parts of De Soto, Tallahatchie, Humphreys, and Yazoo Counties.

PUBLIC INVOLVEMENT

INTRODUCTION

26. Public involvement is a continuous two-way communication process which involves the following tasks: (1) promoting full public understanding of the process and mechanisms through which solutions to water resource needs and problems will be derived by study participants; (2) keeping the public fully informed about the status and the findings of plan formulation and evaluation activities; (3) actively soliciting from concerned citizens their preferences regarding resource use and alternative development or management strategies, and other information and assistance relevant to plan formation, evaluation, and selection.

27. To this end, public meeting notices (Attachment 1) and information summaries (Attachments 2 and 3) were distributed to notify the public of the study progress and request comments. Other steps to be taken and coordination to be accomplished are detailed in the following sections.

COORDINATION WITH OTHER AGENCIES

28. Key Federal and state agencies have been kept informed of plan development during the course of the study. An initial coordination meeting was held on 26 February 1975. Representatives of the following agencies attended: Bureau of Outdoor Recreation of the Mississippi Park Commissioners, U. S. Forest Service, Environmental Protection Agency, U. S. Fish and Wildlife Service (FWS), Soil Conservation Service, Delta Council, Yazoo-Mississippi Delta Levee District, Mississippi Farm Bureau, and Board of Mississippi Levee Commissioners.

29. Formal meetings were held with the Board of Levee Commissioners in June and October 1980 and July 1981. In attendance at the October 1980 meeting were members of the Mississippi Congressional delegation and the Farm Bureau Federation. In January 1981 the Board of Mississippi Levee Commissioners adopted a resolution supporting Plan C. A copy of this resolution is provided as Attachment 4. On 5 March 1975 and 3 October 1980, meetings were held with representatives of the Mississippi Department of Wildlife Conservation. Additional contacts have been made with each of these agencies through correspondence and meetings during the course of the study.

30. Numerous informal meetings were held with FWS during 1978, 1979, 1980, and 1981 to transfer information and discuss alternatives. Meetings were held

with the Environmental Protection Agency in March 1980, February 1981, and April 1981. The March 1980 and April 1981 meetings included joint field trips with the FWS.

PUBLIC MEETINGS

31. A plan formulation stage public meeting was held in Vicksburg, Mississippi, on 10 July 1979. Developed plans and alternatives were presented to the public. Comments were solicited and evaluated in the plan selection process. A final public meeting was held in Rolling Fork, Mississippi, on 6 April 1982 to present the tentatively selected plan to the public.

PUBLIC VIEWS AND RESPONSES

Plan Formulation Public Meeting

32. The District received comments on the Yazoo Area Pump Study from 293 individuals plus 6 petitions containing 660 signatures during and after the July 1979 public meeting, as well as 9 resolutions prior to the public meeting. Most of the responses concerned the need for mitigation caused by the pumps. Approximately half of those responding objected to fee title acquisition of land for mitigation. The most preferred type of mitigation was through land use easements. Fee title acquisition from willing sellers was the next most preferred method of mitigation.

33. On the matter of the pumps, the consensus of opinion favored the building of pumps, with 88 percent in favor, 12 percent opposed. In summary, the public wants construction of a pumping plant to relieve flooding and desires that the selected plan consider the environment and include mitigation by land use easement and/or fee title acquisition from willing sellers only.

Final Public Meeting

34. Prior to, during, and after the final public meeting, comments were received from 180 individuals. Of those responding, approximately 94 percent favored the recommended pump project while only 6 percent opposed the installation of pumps. Of those responding regarding mitigation, approximately 72 percent opposed mitigation. If mitigation is authorized, approximately 78 percent favored easements for the life of the project.

35. Those attending the final public meeting and supporting implementation of the recommended plan included Honorable William Winter, Governor of Mississippi; Congressman David Bowen; and Mr. C. B. Newman, Speaker of the State House of Representatives. Statements from U. S. Senators Thad Cochran and

John C. Stennis and Congressman G. V. Montgomery were read supporting the pump project. A statement was also received from Congressman Trent Lott supporting the recommended pump plan.

36. Various agencies supporting the project included the Mississippi Levee Board, the Delta Council, and the Mississippi Farm Bureau Federation. Those agencies opposing implementation of the proposed project included U. S. Fish and Wildlife Service, the Environmental Defense Fund, the National Wildlife Federation, and the Mississippi Wildlife Federation.

COORDINATION OF THE REEVALUATION REPORT

REPORT DISTRIBUTION

37. The Reevaluation Report-Environmental Impact Statement on the Yazoo Area Pump Project was provided to the following Federal, state, and local agencies or interests for their review and comment in February 1982.

a. Federal agencies:

(1) Environmental Protection Agency

(2) Department of Agriculture

Economic Research Service

Soil Conservation Service

Forest Service

(3) Advisory Council on Historic Preservation

(4) Department of the Interior

Fish and Wildlife Service

(5) Department of Housing and Urban Development

(6) Department of Commerce

Economic Development Administration

National Oceanic and Atmospheric Administration

(7) Department of Transportation

Federal Highway Administration

(8) Department of Energy

(9) Council on Environmental Quality

b. State Agencies:

(1) Mississippi Department of Archives and History

(2) Mississippi Department of Wildlife Conservation

(3) Mississippi Department of Natural Resources

Bureau of Geology

Bureau of Pollution Control

(4) Mississippi Forestry Commission

(5) Mississippi State Highway Department

(6) Coordinator Federal-State Programs

Central Mississippi Planning and Development District

South Delta Mississippi Planning and Development District

c. Local Agencies or Institutions:

(1) Lower Mississippi Valley Flood Control Association

(2) Yazoo-Mississippi Levee District

(3) Board of Mississippi Levee Commissioners

d. Environmental Organizations:

(1) National Wildlife Federation

(2) Mississippi Wildlife Federation

(3) Mississippi Audubon Society

(4) Sierra Club (Delta Chapter)

(5) Environmental Defense Fund

(6) Wildlife Management Institute

(7) The Nature Conservancy

(8) Society of Wetland Scientists

(9) Mississippi Chapter of the Wildlife Society

(10) Delta Wildlife Council

(11) Delta Wildlife and Forestry, Inc.

e. Other Interests:

(1) Delta Council

(2) Mississippi Farm Bureau Federation

(3) River and Harbor Association of Mississippi

(4) Anderson-Tully Company

(5) Mississippi Forestry Association

(6) Mississippi Power and Light Company

COMMENTS AND RESPONSES

38. Copies of agency letters providing comments on the draft Reevaluation Report, along with Vicksburg District responses, are provided on the following pages.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

April 15, 1982

Colonel Samuel P. Collins, Jr.
District Engineer
U. S. Army Corps of Engineers
P. O. Box 60
Vicksburg, Mississippi 39180

ATTN: LMKPD-Y
P. O. Box 60, Vicksburg, MS 39180

Dear Colonel Collins:

In accordance with the U. S. Environmental Protection Agency's responsibilities under Section 309 of the Clean Air Act, we have reviewed the Draft Environmental Impact Statement for the Yazoo Area Pump Project (Yazoo Backwater Area), Mississippi. This Agency has no fundamental disagreement with the project's stated goals, and is sensitive to the need to reduce flooding and improve the quality of life within the Yazoo Basin. However, in this particular case, we have reservations concerning the use of the proposed measures to achieve these goals.

Our concerns about the proposal and mitigation measures to lessen the adverse impacts closely parallel those stated in the U. S. Fish & Wildlife Coordination Act Report (Appendix J). We are concerned that the largest percentage of the benefits afforded by flood protection benefits are derived from intensification/ expansion into flood susceptable lands. Implementation of the project as proposed will eliminate much of the existing, natural flood storage within the project area, thereby exacerbating flooding downstream; ultimately further degrade water quality through increases in suspended solids, pesticides, and fertilizers in the water column; retard the overbank flooding which presently allows natural processes to lessen the adverse impacts of these agricultural chemicals; and diminish fish and wildlife values.

USFWS has developed a very cogent argument regarding the intended thrust of the original and subsequent enabling legislation. (Part 2, Appendix J). While we agree with the major points of the USFWS report, there are a number of points in which we would like to amplify and/or add our own perspectives. These are outlined in the attached technical comments.

We also question whether the project meets current conservation policies. We agree with the Vicksburg District's observation that Section 404 of the Clean Water Act is not meant to protect wetlands from all forms of potential destruction. It is arguable, however, that the intent of this statute was to protect

wetlands from conversion in this particular instance. In this regard, the loss of these wetlands, as well as pronounced alterations to the chemical, physical, and biological parameters of the area, could better be assessed if the 404(b)(1) evaluation in Appendix K addressed the issues which are discussed in the attached technical comments.

Since the DEIS contains some excellent alternatives and/or elements thereof, we believe a less environmentally damaging design will meet the project's objectives. We have assigned a rating of ER-2, i.e., we have some significant environmental reservations to the selected alternative, but feel opportunities exist to reach a mutually acceptable accommodation.

In this regard, I and members of my staff look forward to working with you. Dr. Gerald Miller, EIS Review (FTS 257-7458), will serve as our point of contact.

Sincerely yours,

Howard D. Zeller
Assistant Regional Administrator
for Policy and Management

Enclosure:
Technical Comments

DETAILED COMMENTS

1. Since the original implementing legislation in 1941, there have been major changes in many facets of agriculture within the project area. For example, increases in the area cultivated, especially at the lower elevations, now result in significant recurrent damage to crops. The DEIS also noted that 27,000 additional acres are projected to be cleared even without the project. Given the attendent adverse environmental impacts of this project, we do not feel that the public interest is best served by the Federal government's participation in land use decisions of this nature. Similarly, in keeping with the intent of Executive Order 11988, Floodplain Management, the cause and effect relationship of this type action on setting a precedent for improvident land use patterns should not be overlooked.

2. In view of the adverse impacts this project will have on water quality and wetlands values, we share USFW's concern over why this facility is being pursued in its present design. It was stated in the DEIS that the project was not justifiable without intensification of farming; however, since these benefits were derived throughout the project area, not just the lands below elevation 90', this tact was deemed appropriate. Regardless of where these intensification benefits are located along the topographic gradient of the basin, they comprise the preponderance of the economic rationale of the project. Hence, while there is a clearly demonstrated need for some type of flood control in the Yazoo, this particular facility appears to be a drainage project with only incidental flood control aspects.

3. It is stated in the 404(b)(1) evaluation (Page K-2) that the height of the groundwater table in the vicinity of the pump facility is such that groundwater seepage into both the inlet and outlet channels will be constructed, where possible, to provide a fishery habitat after construction. If groundwater seepage is substantial, especially during low flow periods, and/or if high turbidity levels exist in the channels during flood periods, water quality in the channels may not be suitable to support a fish population. Hence, this may be a mitigation measure of limited utility.

4. The reason for discounting the adverse impacts of suspended particulate/turbidity determinations (Page K-5) are unclear. Higher turbidity levels and sediment loads occuring after project implementation will probably increase the frequency of maintenance dredging in the pump's inlet and outlet channel. The frequency and impact of such maintenance dredging are not discussed in the evaluation or accompanying text.

5. It is acknowledged on Page K-5, Section 2(c)2(f), that pesticides are present in the sediments within the project drainage area and possibly in the water column. During flood periods, one may expect a pesticide resuspension effect from the sediments into the water column. Water column pesticide levels thus may be elevated after the flood has subsided, potentially affecting nekton and aquatic food web relationships to a greater extent than would have occurred with some of the other alternatives.

6. Page K-6,d. Contaminant Determination -- This section should contain the rationale why there is no major concern about exceeding EPA's criteria for chemical constituents.

7. Page K-6,e. Aquatic Ecosystem and Organism Determinations -- Effects are given only for the immediate vicinity of the discharge zone rather than for the broader impacted area. We offer that the effects on plankton, benthos, nekton, and other elements of the aquatic food web effects within the project area are known to be significant and the proposed project will worsen the degree of perturbation.

8. Page K-7,g. Determination of Cumulative Effects on the Aquatic Ecosystem -- It is stated, "The addition of a minimal amount of pollutants to the existing poor water quality, as a result of the discharges discussed previously, should not have a significant adverse effect on the aquatic ecosystem." This reasoning has been used on other projects in the basin with the result that the cumulative effects are now significant. The fact that poor water quality presently exists is not sufficient justification for exacerbating the situation.

Response to U. S. Environmental Protection Agency Letter, 15 April 1982.

Comment 1.

One major change that has occurred since 1941 is the conversion of woodlands to agricultural usage. Based on a continuation of this trend, it has been estimated that approximately 27,000 additional acres will be cleared in the area during the next 50 years even without project implementation. Factors such as improved plant varieties, technological advancements, and farming methods make this possible. There are woodlands which will be specifically impacted by the project, and this provides the basis for the 900 acres of project-induced clearing associated with the recommended plan. Since the project-induced clearing represents less than 1 percent of the existing woodlands in the project area, this is not considered to be setting a precedent for improvident land use patterns.

Comment 2.

Damages to present development are estimated at almost $4 million annually. The most severe flood of the 1970's resulted in financial losses amounting to over $65 million and immeasurable personal trauma. The flood stage lasted almost 9 months. Other major floods of the last decade have similarly flooded hundreds of thousands of acres, caused enormous losses, and displaced hundreds of families.

The area which is approximately 74 percent cleared and developed contains 1,054 structures which are subject to flooding. In summary, the area has experienced frequent, catastropic flooding events. These are the conditions that led to this study and provide the basis for flood control being of enormous importance.

Comment 3.

Fishery habitat was not discussed or considered relative to the inlet and outlet channels.

Comment 4.

Project implementation is not expected to increase the frequency of maintenance dredging in any of the existing channels. Experience with pumping projects of similar nature located in the area has indicated that volumetric changes in inlet and outlet channels are insignificant and, therefore, no maintenance dredging is anticipated. In general, maintenance dredging is a concern only in delta streams which receive drainage from hill areas. The Yazoo Area streams do not receive any hill drainage.

Comment 5.

Interior ponding would occur with or without the project. Under existing conditions, resuspension occurs during periods when the floodgates are open as the flood recedes. Since the same volume of water must pass through the system under existing and "with-project" conditions and since this volume would be discharged over a longer period of time with the project, resuspension would be correspondingly reduced. In addition, since detention time of the ponding areas would be lessened by the project, less deposition would take place.

Comment 6.

Report has been revised as suggested.

Comment 7.

The 404 evaluation addresses the impacts associated with the deposition of fill material in the immediate vicinity of the construction area. Primary and secondary impacts associated with the operation of the proposed project are addressed in the EIS and Environmental Analysis Appendix.

Comment 8.

Currently there are 397,000 cleared acres and 142,000 wooded acres within the study area. Implementation of the recommended plan will result in an additional 900 acres of area woodlands being cleared. This acreage put into agricultural production represents a 0.2 percent increase in cleared acreage with associated sediments and pesticides. Some aspects of intensification should increase pollutants; however, many activities should reduce pollutants. Approximately 11 percent of the agricultural acreage will be double-cropped, with wheat being the primary winter cover under intensified agricultural operations. Preferred longer maturing varieties of soybeans and the use of improved minimum tillage practices should reduce sheet erosion. Less inundation of pesticide-treated soybeans and cotton and fewer second applications should reduce the quantity of the pollutants entering the aquatic environment. Some additional land leveling would tend to increase the volume of pollutants to receiving waters. The traditional practices of plowing under soybean and cotton stubble would tend to increase sediment runoff from some fields; however, the trend is slowly reversing due to the high price of diesel fuel and the increasing utilization of flooded soybean fields for duck hunting. In general, the net effect of the project would be the addition of a minimal amount of pollutants.

U.S. DEPARTMENT OF AGRICULTURE
ECONOMIC RESEARCH SERVICE
Natural Resource Economics Division
River Basin Branch
145 U. S. Post Office & Courts Bldg.
Little Rock, Arkansas 72201

April 15, 1982

Col. Samuel P. Collins, Jr.
District Engineer
Vicksburg, Corps of Engineers
P.O. Box 60
Vicksburg, Mississippi 39180

Dear Col. Collins:

I have reviewed the General Design Memorandum and Environmental Impact Statement for the Yazoo Area Pump Project. The Economic Research Service (ERS), of the U.S. Department of Agriculture (USDA) has assisted in several planning studies in this area in the past. In 1970, this agency, in conjunction with the Soil Conservation Service and the Forest Service, examined at the Corps' request, the economic effects of improved flood protection in the Yazoo-Sunflower Basin. Projections of land use and flood damages without and with the combined USDA and Corps' proposed projects were provided to the Corps. In 1973, we participated in the West Texas and Eastern New Mexico Water Import Study. In 1974, the Lower Mississippi Type I study was completed under the Corps' leadership and with assistance by USDA, including ERS, and several other federal and state agencies.

At present, the USDA has proposed a study to examine irrigation potentials and associated land treatment needs in the Mississippi portion of the Delta. This history of involvement in water resource planning in the Delta over just the past 15 years suggests that a review of the methods, assumptions and results of this proposal be compared with earlier studies in the region.

As I understand it, this project allows flooding to take place on 41,000 acres during the winter and early spring since pumping would not occur until water got above 85 feet elevation. After March 1, pumping would begin when flood water rose above 80 feet. This alternative is more environmentally acceptable than other alternatives. Purchase of easements on 33,400 acres and fee simple purchase of 5,400 acres of bottomland hardwoods would mitigate fish and wildlife damages. The benefit-cost ratio is 3.2 at 2 1/2 percent discount rate and 1.3 at 7 5/8 percent. The annual net benefits at 7 5/8 percent is $4,082,000. The annual rate of return on investment, which is somewhat independent of the discount rate (on investment costs) is 12.8 percent.

This review of the pump project examines the economic analysis as related to benefits with particular emphasis on agricultural production effects. It appears that three crucial assumptions were made in this analysis. First, the demands facing agricultural producers in this project area were assumed perfectly elastic, i.e., they could sell all extra crops produced at given prices. Second, technology was projected to increase agricultural productivity by 255 percent from 1978 to 2039. Third, more intensive use of agricultural inputs would increase net returns by about 40 percent over the without project (on acres flooded in the 20 year and less frequency intervals).

When considering the pump project in isolation, the simplifying assumption concerning the elasticity of demands facing agricultural procedures is not unreasonable. The USDA study in 1970, however, assumed that future demands facing agricultural producers in the Yazoo-Sunflower Basin were proportional to increased national demands. The technical expression of that assumption was that the demand facing agricultural producers in the area was perfectly elastic to the point that national demands (factored down to the area) were met; any production beyond this faced a perfectly inelastic demand schedule. That is, it was surplus to the national interest. With future yields projected to increase faster than demands, this assumption did not favor federally funded projects to abate agricultural flood damages.

In actuality, however, yields for the two major crops in this study area have not increased faster than national demands since 1965: thus surpluses facing the Nation in 1970 were reduced until the last two or three years. This suggests that the Corps' assumption of a perfectly elastic demand curve facing agricultural producers in the area may be as defensible as any other assumption that could be made.

The defense of this assumption however rests on the relationship between projected agricultural production requirements and yields per acre. If yields per acre rise slower than production requirement, flood damage abatement and intensification of resource use are needed. Thus, the second crucial assumption concerning yield increasing technology needs to be examined.

In the Lower Mississippi Type I study, yields on Delta soils over the 1970 to 2020 period were projected to increase 1.26 percent annually for soybeans and .85 percent for cotton. In the Yazoo pump project productivity was projected on the basis of increases in gross value of production from 1949 to 1964 (in constant dollars). This procedure did not account for the dampened trends in yields (in fact, decreases) since 1965. The annual percentage increase from 1970-2020 implied by the productivity index is 1.94 percent.

Based on the index in the Lower Mississippi Type I study, flood free soybean yields in 2020 would be 48.5 bushels per acre, and flood free cotton yields in 2020 would be 1,250 pounds per acre. Based on the productivity index used in the Yazoo pump project, flood free soybean yields in 2020 would be 67 bushels, and flood free cotton yields would be 2,000 pounds. The increase in the productivity index used by the Corps is about twice the increases in production requirements for cotton in this Lower Mississippi Region and in Water Resource Planning Area 4 which contains the Yazoo-Sunflower Delta. For soybeans, the productivity index is only about 13 percent higher than the requirements index (Appendix B, Economics, Lower Mississippi Comprehensive Study, 1974).

If yield projections can be inferred from the productivity index, as I have done, then the index appears high relative to recent trends - 1965 to 1978. Information based on recent trends also has to be discounted somewhat as they may be short-run aberrations. The index also appears high relative to projections of production requirements published in the Lower Mississippi Type I report in 1974--given the assumption that producers could sell all extra crops at given prices. While it is true that local production increases will have little effect on world prices, there is that nagging doubt that the extra production may not be in the national interest.

The productivity index is also used to project intensification benefits, which account for over 75 percent of total project benefits. Intensification benefits are based on improved yields (for example, a 10 percent increase in soybean yields); greater use of double cropping of soybeans and wheat; and less than proportional increases in production costs). The implied projected yields seem rather high. For instance, by 2039 cotton yields on acres being used more intensively would average 4.85 bales per acre in the lower sump, [883 x 1.13 (for intensification) x 2.5539(for technology)/500 (bale weight)] and 5.0 bales in the upper sump [884 x 1.10(for intensification) x 2.5539(for technology)/ (500 bale weight)]. Using the above approach soybean yields per acre would average 97 bushels in the lower sump and 90 bushels in the upper sump by 2039.

While these yields seem high in 1980, nobody really knows what yield increasing technology may bring. My opinion is that it would have been appropriate to test the sensitivity of alternative yield levels.

I appreciate the opportunity to review this report. The project would undoubtedly have value to local agricultural producers, and in the long run, may have national economic development benefits far in excess of the costs.

Sincerely,

Neil R Cook

NEIL R. COOK, Leader
Southeastern Section
River Basin Branch

cc: Gary Taylor, Chief
Billy Griffin, State Conservationist

Response to U. S. Department of Agriculture, Economic Research Service, Letter, 15 April 1982.

Projection factors used to reflect future conditions in the agricultural sector should include any increase in national demand along with any anticipated demand increases in world consumption, restricted by the desire and capability to purchase these goods from U. S. farmers, impacts of weather on production, increases in technology both from a commodity value viewpoint as well as additional commodity uses and production cost reduction improvements, and any other impacts. The use of the value of farm products sold per acre harvested incorporates and reflects the impact of these factors. Therefore, the index referred to as the productivity index actually incorporates substantially more than yield level changes. The use of per acre harvested values removes any impacts resulting from additional cleared land entering production. The historical values are also placed on a constant dollar level, removing inflationary trends.

USDA estimates reflect that yields will continue to increase through greater use of basic technologies that now exist, including hybrid seed, fertilization, new and improved equipment, planting and cultivation practices, and chemical developments.

According to USDA estimates, future productivity increases of approximately 1.5 percent per year are possible as public and private management generates sufficient productivity growth to meet world needs. Many analysts feel that future technologies have great potential and could propel agricultural productivity into a new and possibly unprecedented growth spiral when they become commercially available.

Therefore, considerable potential exists for dramatic increases in yields using current information and resources. The future increases are expected to result partly from these yield increases and partly from additional technological or other improvements in the forms of a more valuable product and increased marketability of the product including increased usage. An additional value will be increased net returns to producers in the form of reduced production costs with no resultant decrease in product quality. This means that the factor of 2.5539 on page F-11 reflects more than increases in yields.

The value of farm products sold per acre harvested (in constant dollars) therefore includes numerous elements (including yields) for a specific area, and the extension of these trends into the future provides reasonable estimates of expected benefits.

United States Department of Agriculture

Soil Conservation Service

1321 Federal Building
100 West Capitol Street
Jackson, MS 39269

April 19, 1982

Colonel Samuel P. Collins, Jr.
Vicksburg District, Corps of Engineers
P. O. Box 60
Vicksburg, MS 39180

Dear Colonel Collins:

We have reviewed the draft Phase I General Design Memorandum and Environmental Impact Statement and the draft Fish and Wildlife Mitigation Report for the Yazoo Area Pump Project dated March 1982.

Members of my staff attended the public meeting held in Rolling Fork on April 6, 1982, and have previously discussed this project with Corps personnel. We are in full support of the intent of the project and feel the overall benefits outweigh the adverse impacts. We also feel that both documents adequately cover both benefits and adverse impacts.

One item of concern of this agency, however, is the lack of discussion regarding prime farmlands. The large acreage to be protected would no doubt include considerable acres of prime farmlands. As a matter of fact, prime farmland acreage might be increased by installation of the project. We feel some discussion should be included in subsequent drafts of the report and could assist your staff in this regard.

We would appreciate receiving copies of further drafts and we appreciate the opportunity for review and comment of this draft.

Sincerely,

Billy C. Griffin
State Conservationist

Response to U. S. Department of Agriculture, Soil Conservation Service Letter, 19 April 1982.

Final report has been revised as suggested.

United States Department of the Interior

OFFICE OF ENVIRONMENTAL PROJECT REVIEW

Southeast Region / Suite 1384
Richard B. Russell Federal Building
75 Spring Street, S.W. / Atlanta, Ga. 30303

April 21, 1982

ER-82/412

Colonel Samuel P. Collins, Jr.
Commander and District Engineer
U.S. Army Engineer District, Vicksburg
Post Office Box 60
Vicksburg, Mississippi 39180

Dear Colonel Collins:

The following comments represent the views of the Department of Interior on the (I) Draft Phase I General Design Memorandum (GDM), (II) Environmental Impact Statement (EIS), (III) 404(b)(1) Evaluation, and (IV) Fish and Wildlife Mitigation Report for the Yazoo Area Pump Project, Humphreys, Issaquena, Sharkey, Warren, Washington, and Yazoo Counties, Mississippi, and Madison Parish, Louisiana.

Throughout the coordination process on this project, the Fish and Wildlife Service (FWS) has detailed several fundamental concerns with the approach to water resource planning embodied in the Yazoo Area Pump Project. These include inconsistencies with previous logic on the need to maintain flood storage and related benefits in backwater areas; inconsistencies with previous Congressional intent to dedicate the area below 90-feet msl for flood storage; contradictions to sound principles of floodplain management in general and E. O. 11988, "Floodplain Management" and E.O. 11990, "Protection of Wetlands" specifically; contradictions to the regulatory program created by Section 404 of the Clean Water Act; and the continuation of an approach to planning that "solves" the flood control problems of one area by moving them downstream to other areas.

For this reason, the FWS does not support implementation of the Yazoo Area Pump Project. However, the FWS and the Corps of Engineers are nearing agreement on a mitigation plan. Our comments on the Fish and Wildlife Mitigation Report reflect the FWS concern for a mitigation plan that has more latitude and flexibility as to the type of real estate interest acquired. Likewise, we have expressed our concern for adequate funding of the operation and maintenance costs of mitigation measures. Coordination between the FWS and the Vicksburg District that has occurred since the release of the Draft GDM and Mitigation Report appears to have resolved most of the differences. As indicated in the District's presentation at the April 6, 1982, public meeting, the Fish and Wildlife Mitigation Report will be amended to include

a request for authorization to acquire mitigation lands in either 100 percent perpetual easements (40,000 acres) or 100 percent fee simple title (32,800 acres) or a combination thereof. The emphasis is to be on easements, but fee title will not be excluded where "publicly acceptable." We are not recommending that the Corps relinquish any condemnation authorities relative to the seeking of the necessary easements; however, in the case of fee simple acquisition, we believe the effort should be based upon a willing seller proposition. The FWS believes this would be a workable and supportable program.

Because of the planning inconsistencies previously documented, the FWS does not support the implementation of the recommended plan. However, the FWS will not oppose the project assuming an acceptable mitigation plan remains as an integral project feature. If, as a result of the public review process, the mitigation plan is eliminated or substantially altered in the final GDM/EIS, the FWS would oppose the project and consider it a candidate for referral to the Council on Environmental Quality (CEQ). The possibility of CEQ referral has been discussed on numerous occasions in formal coordination meetings and in preliminary, revised preliminary, and draft Fish and Wildlife Coordination Act reports officially transmitted on April 1, 1980; August 19, 1980; June 4, 1981; and January 7, 1982.

I. PHASE I GDM

General Comments

Extensive coordination between the Corps and the FWS has occurred at the field level during the course of the Phase I GDM studies. The FWS has conducted field investigations in the study area, performed a Habitat Evaluation Procedures (HEP) evaluation, attended numerous project discussion meetings, and provided preliminary, revised preliminary, and draft Fish and Wildlife Coordination Act (FWCA) reports. The draft FWCA report is contained within the GDM as Appendix J and addresses in detail the issues and concerns of the FWS in relation to the proposed pumping plant project. As will be explained in the remainder of these comments, the FWS believes the Corps has not addressed these concerns and issues in a sufficient manner and has not accurately identified the environmental trade-offs inherent in project implementation. The following comments are arranged in the order of specific issues. For each, we will briefly reiterate our concerns, address the response of the Vicksburg District, and discuss unresolved issues of policy and position.

1) Intensification Policy

Throughout plan formulation, the FWS has consistently questioned the environmental trade-offs of a project that incurs extensive environmental impacts not for the purpose of preventing existing flood damages but for the purpose of expanding and intensifying flood susceptible development into a very flood-prone environment. Such is, in our opinion, in conflict with the intent of Executive Orders 11988 and 11990 and the current authorization relative to the area below 90-feet msl being a sump storage

area. The Vicksburg District's response has been that ". . . these intensification benefits have traditionally constituted the majority of benefits in most predominantly agricultural watersheds." On this latter point the FWS agrees.

The Lower Mississippi Valley (LMV) as a whole, and the Yazoo Delta specifically, have been developed only through the efforts of massive Federal flood control programs. The benefits used in justifying these flood control projects have been more from the expansion and intensification of development than from the protection of existing development. Projects justified on the basis of this intensification policy have resulted in tremendous economic benefits but not without large and oftentimes unnecessary environmental costs.

On the basis of this intensification policy, flood control has progressed through the Yazoo Delta for 40 years at a Federal cost of over $800 million. The Yazoo Delta now has one of the most elaborate flood control systems found anywhere in the United States. Unfortunately, it is an area largely devoid of its once extensive fish and wildlife resource base. In many instances, Mississippi's wildlife heritage has been destroyed, not to produce prime farmland, but to produce or protect marginal croplands.

The application of this intensification policy to the Yazoo Pump project is as follows:

1. Seventy-nine percent of all project benefits come from the expansion and/or intensification of agricultural development. Only 21 percent of the project benefits result from preventing flood damages.

2. This expansion and intensification would be occurring in the last area of the Yazoo Delta containing extensive fish and wildlife resources.

3. As will be discussed later in specific detail, most of this intensification would occur in an area previously dedicated to the sump storage of flood waters and, as such, we believe this is beyond the scope of the current authorization.

The concern of the FWS is that the application of the "traditional" policy of intensification to the Yazoo Pump Project contradicts (1) FWS efforts to protect nationally significant and increasingly scarce wetlands of the LMV; (2) legislative programs of the Clean Water Act; (3) the increased Federal emphasis on wetland protection embodied in Executive Order (E.O.) 11990; and (4) the increased Federal emphasis embodied in E.O. 11988 on discouraging floodplain development while preserving the natural beneficial values of floodplains.

2) Contradictions to Section 404 of the Clean Water Act

The project would affect extensive wetland areas subject to the regulatory jurisdiction of Section 404. The Environmental Protection Agency has determined that all forested areas in the Yazoo Area at or below 90-feet msl (approximately 77,000 acres) are, with minor exceptions, jurisdictional

wetlands. The contradictions between project planning and the Clean Water Act lie in the fact that the Yazoo Pump Project has been designed and justified for the purpose of expanding and intensifying agricultural development into this area of extensive wetlands. The application of the intensification policy will have a significant impact on regulatory wetlands in that ". . . the less flood-prone areas may not incur any intensification while the areas that are frequently flooded will incur large amounts of intensification." (p. F-46, GDM)

Included in the economic justification of the project is the project-induced conversion of 3,400 acres of forested wetlands to nonwetland land uses. The FWS does not believe that this project-induced conversion is consistent with the purpose and intent of the Clean Water Act. More specifically, the deposition of fill associated with this conversion has not been approved in accordance with the evaluations required by Section 404(b)(1).

The economic justification for the project also includes the benefits of intensified agricultural development on over 27,000 acres of forested wetlands which the Corps assumes will be cleared without the project. This assumption is valid only within the context of the inconsistencies of the 404 regulatory program.

Within the jurisdiction of the United States Court for the Western District of Louisiana (which lies as close as one mile to the project area), the Vicksburg District regulates the conversion of forested wetlands. Under this regulatory program, the intensification benefits claimed on the 27,000 acres of existing forested wetlands would be premature and would lack an acceptable level of certainty. Within the project area, however, the Vicksburg District does not regulate the conversion of forested wetlands "Since the District does not feel that land clearing per se involves discharges of dredged or fill material . . . ." (p. J-4) Thus, we have a situation in which "feelings" contradict the legal findings of a Federal Court in an immediately adjacent area.

These examples indicate that the destruction of wetlands is an integral feature of the Yazoo Pump Project. It must also be remembered that those wetlands remaining will have their hydrologic regime significantly altered. This destruction of wetland values is, however, more than an unavoidable adverse impact; it is a fundamental aspect of the purpose and justification for the project. It is for this reason that the FWS believes that the project contradicts the policy of wetland protection contained in Section 404 of the Clean Water Act.

3) Contradictions to E.O. 11990, Protection of Wetlands

E.O. 11990 is an example of the growing public concern for the conservation of the Nation's highly valuable and increasingly scarce wetlands. It directs Federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands and also to avoid new construction in wetlands unless there

is no practicable alternative and all practicable measures to minimize harm have been taken. As the previous discussion of intensification indicated, the significant destruction of wetlands associated with the project is not simply an unavoidable side effect to which there is no practicable alternative. It is an integral feature of the project's purpose and justification. The FWS believes that this planned and purposeful elimination of wetland values is not in keeping with the spirit and intent of E.O. 11990.

4) Contradictions to E.O. 11988, Floodplain Management

Based largely upon the project's requirement for intensified development in an area containing significant natural beneficial floodplain values, the FWS has maintained that the Yazoo Pump Project does not comply with the directives of E.O. 11988. The basic response of the Corps has been that "A real need has been identified for providing additional flood protection in the Yazoo Backwater Area." (p. J-2)

A need for flood control is not in and of itself a justification of compliance with the directives of E.O. 11988. The pertinent question is can this need be met with a project that is sensitive to the increased Federal emphasis of E.O. 11988 ". . . to avoid to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative."

According to Corps data, the present need for flood damage reduction does not justify the project. Based on the benefits that would accrue to existing development, the project would have a benefit cost (B/C) ratio of 0.4 (2 1/2 percent interest rate) (p. F-71). In achieving a favorable B/C ratio, a project has been designed that requires increased development in an area that will continue to be flood-prone. Such is, in our opinion, in conflict with both Executive Orders 11990 and 11988 and the current authorization. The principal "need" addressed by the project thus becomes one of accelerated floodplain development; and in the process, a project has been designed that promotes the occupancy of floodplains and results in the extensive destruction of natural beneficial floodplain values. It is on this basis that the Service believes the Yazoo Pump Project does not comply with E.O. 11988.

5) Contradictions to Authorized Sump Storage of Flood Waters

The previous discussion has emphasized the FWS's concerns relative to a project designed and justified on the basis of intensified floodplain, wetland development. The FWS believes that these concerns are particularly pertinent when viewed in the context that most of the intensified development will occur in an area previously dedicated by Congress to the sump storage of flood waters. The Flood Control Act of 1941 dedicated the area below 90-feet msl (approximately 125,000 acres) to sump storage and authorized a 14,000 cfs pumping plant to provide protection above 90-feet msl. However, no specific means of insuring this dedication was authorized. It was simply assumed that lands flooded more frequently

than once in five years were not suited to agriculture. At the time, there were approximately 2,600 acres of cleared land below the 90-foot contour. Largely within the past twenty years, however, clearing has steadily encroached into the sump until there are now approximately 59,000 acres of cleared land below 90-feet msl.

This area, referred to in the Phase I GDM as the Upper and Lower Ponding Areas, is the vortex of an extensive Federal drainage system that encompasses nearly 4,000 square miles. Flood susceptibility has subsequently increased, and the area is now inundated by floods of a 2-3 year frequency.

In that existing flood damages are not sufficient for economic justification, the Corps has now reanalyzed the sump storage function and its inherent values to fish and wildlife and wetlands, and designed a project to further this encroachment. In effect, previous encroachment is considered justification for continued encroachment.

The FWS acknowledges that a real estate program as a means of dedicating the area to sump storage was not a part of project authorization. The FWS position relative to the sump is, however, that deliberate, subsidized encroachment involves unacceptable environmental trade-offs and is not, in our view, consistent with current authorization. As has been indicated in previous coordination, the FWS is not opposed to a pumping plant designed and operated to reduce flooding on existing agricultural lands if measures are included to insure that further development into the Upper and Lower Ponding Areas does not occur. These measures would include the acquisition of minimal interest necessary to maintain the natural flood storage capabilities of the ponding areas.

The area of the Delta National Forest in Sharkey County discussed at the bottom of page G-14 and top of page G-15 is listed on the National Registry of Natural Landmarks and is called the Green-Ash-Overcup Oak-Sweetgum Research Natural Areas. This landmark is composed of three noncontiguous Federal research natural areas which are 80, 40, and 40 acres in size and is administered by the U.S. Forest Service. From the information provided, it appears that the project will completely change the character of this area over the long term by reducing the water levels in the landmark.

The areas listed are particularly outstanding resources of national significance which deserve special attention in planning and design of projects so that adverse impacts can be avoided. We recommend that additional measures be undertaken that will provide for the natural flow of water so that natural water levels will be maintained in the landmark.

We have a responsibility to report to the Congress threats to National Natural Landmarks and will appreciate correspondence from the Corps assessing any final damage anticipated to the landmark from the project.

Paul Love Park on Lake Washington and Leroy Persey State Park are two recreation areas which were acquired with Land and Water Conservation

fund monies and were built around the natural values of the areas in which they are located. The statement identifies Leroy Persey State Park and the recreational activities provided, but does not assess the effects of the project in this park. The statement does not identify Paul Love Park nor discuss impacts.

6) Specific Comments

Page D-5. Paragraph 13 would be more accurate if rewritten to state that no economically valuable minerals other than sand and gravel and clays are known to exist in the project area.

Page D-5. Paragraph 14 states that Corps records indicate nine producing commercial companies within a 50-mile radius of the proposed pumping station. A search of the Bureau of Mines Mineral Industry Location System revealed 11 sand and gravel pits within 50 miles in Mississippi alone; Louisiana data are not currently available. The statement should be rewritten to indicate a higher level of sand and gravel activity than that indicated.

II. ENVIRONMENTAL IMPACT STATEMENT (EIS)

7) General Comments

a) It appears to the FWS that the EIS is inadequate in several aspects. The most noticeable of these deficiencies is the general nature of statements and conclusion with very little documentation or explanation of the supporting rationale. For example, damages to the human environment as a result of flooding are discussed, as are the overall benefits of flooding upon the natural flora and fauna of the area, however, there is little explanation of the environmental trade-offs which result from the project. It is noted that, "The protection of the project area from flooding will have an adverse impact on the natural environment." The FWS agrees with this statement, but would like to see a more detailed explanation of these adverse impacts and the associated environmental trade-offs. It is our opinion that extensive environmental impacts would occur as a result of a project designed, not to prevent existing flood damages, but to expand and intensify agricultural production in the last remaining portion of the Yazoo Delta containing substantial fish and wildlife habitat. We do not feel that it is adequate for a construction agency to merely say that all impacts have been considered and adverse impacts have been avoided to the extent possible. These impacts and their consideration should be fully disclosed.

Of concern in any trade-off analysis is that the area "protected" by the pump project will, by design, be flooded by the Mississippi River Standard Project Flood. It is reasonable to assume that increased development inherent in the pump project would result in this flood having greater damages than would occur without the project. These impacts should be acknowledged and evaluated in the EIS.

b) Reference to "backwater flooding" in the EIS should be changed to headwater flooding or interior flooding. Backwater flooding was eliminated

in the project area, for all but the most extreme floods on the Mississippi River, upon completion of the Yazoo Area Levee in 1977.

c) It would appear the EIS considers as wetlands only (1) shrub and wooded swamps and (2) "wooded wetlands" (predominately overcup oak and bitter pecan). This is in direct conflict with the Environmental Protection Agency's special case wetland determination and the Corps' 404(b)(1) Evaluation which includes as jurisdictional wetlands all forested areas (with minor exceptions) below elevation 90-feet msl.

d) The project proposal will have little impact on mineral resources. However, for completeness, mention should be made of mineral resources in the Affected Environment section of the Draft Environmental Statement. If the impact on mineral resources is considered minimal, the draft should contain a statement to that effect.

Specific Comments

8) Page EIS-3. Fishery losses will not be minimized by initiation of pumping at 85-feet msl from December 1 to March 1, nor will compensation of fishery losses be achieved by acquisition of easements on 6,500 acres of forest lands.

9) Page EIS-4 (Section 404(b)(1) Evaluation). The FWS believes that the Section 404(b)(1) Evaluation is inadequate since the Corps has basically included only the impacts which would occur from deposition of fill material in wetlands associated with the actual construction area. The Evaluation should include impacts resulting from reduced flooding and the direct and indirect destruction of wetlands associated with the total project. Please refer to specific comments of the FWS, which addresses our concerns in relation to the Clean Water Act and the Section 404(b)(1) Evaluation, contained elsewhere in this review.

10) Pages EIS-4, 5, 6, and 9 (E. O. 11988 and 11990 and compliance with environmental requirements). The stated objective of E. O. 11988 is ". . . to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative . . . ." Contrary to this national objective, the selected plan would deliberately stimulate floodplain encroachment at the expense of the natural, beneficial values of floodplains. It is the position of the FWS that the selected plan does not comply with E. O. 11988 in that it requires for its economic justification the deliberate stimulation of flood susceptible land uses into a flood susceptible environment. Furthermore, due to reduced flooding of wetlands and project induced destruction of wetlands, we feel the project is inconsistent with Executive Order 11990 "Protection of Wetlands." Adequate justification is not contained in the EIS to indicate that Plans A, C, and H are in compliance with the National Environmental Policy Act, the Clean Water Act of 1977, Floodplain Management (E. O. 11988), or Protection of Wetlands (E. O. 11990). Please refer to specific comments of the FWS related to E. O. 11988, E. O. 11990, and the Clean Water Act contained in our evaluation of the GDM.

11) Pages EIS-15 and 16. It is stated that, "Plan F was eliminated from further study primarily because it provided considerably less flood protection than was desired." (Emphasis added) Plan F (with a 15,000 cfs pumping station), in the opinion of the FWS, is essentially the plan authorized by Congress, since it provides one-in-five-year flood protection to lands above 90-feet msl. Plan G was "eliminated because it had fewer excess benefits over costs and provides a low degree of protection" (Emphasis added). Plan G, with a 17,500 cfs pumping plant (and pumping initiated at 85-feet msl), also provides the protection authorized by Congress. Thus, it appears that the Corps believes a greater degree of protection is necessary than was authorized by Congress.

12) Page EIS-17. It is indicated that the effects of the no action alternative would be a continued deterioration of water quality due to turbid pesticide-laden runoff, which is a product of agriculture. It is the opinion of the FWS that water quality would deteriorate even more drastically with the advent of intensified agriculture brought about by the selected plan. We believe this should be addressed in the EIS.

13) Page EIS-28. It is stated that "The annual flood within the project area inundates . . . 2,100 acres of wooded and shrub swamp, 11,400 acres of wooded wetlands, and 12,100 acres of forested acres classified as nonwetlands." Since EPA has determined that all forested areas below 90-feet msl (with minor exceptions) are wetlands, and the 1-year frequency flood inundates to approximately 85-feet msl, the FWS questions where these 12,100 acres of nonwetlands are located.

It is apparent that the assessment in the EIS of wetland impacts is not consistent with and does not reflect the extent of wetlands as determined by EPA. Additionally, there is a discrepancy between the annual flooded acreage in this section as compared to the annually flooded acreage shown on Page EIS-32 (5,200 acres of wooded swamp, 8,700 acres of wooded wetlands, and 11,800 acres of nonwetland forested areas).

III. SECTION 404(b)(1) EVALUATION

General Comments

14) Previous comments on the Phase I GDM have discussed the contradictions that exist between plan formulation and Section 404 of the Clean Water Act. In view of these contradictions, the 404(b)(1) evaluation (Appendix K) contains significant and substantial inadequacies. These inadequacies stem from the fact that the evaluation addresses only the wetland impacts that would result from the deposition of fill during construction. However, the operation of the project to be placed upon that fill has far-reaching impacts upon wetlands. These impacts are neither recognized nor addressed in the 404 (b)(1) evaluation.

The benefits and the impacts of the Yazoo Pump Project are a function of project operation rather than construction. In fact, construction impacts to wetlands are relatively insignificant when compared to operational impacts. Until these latter impacts are recognized and evaluated under the guidelines of Section 404(b)(1) and a justifiable determination is

made that there are no other practical alternatives to such action, the FWS is of the position that the Yazoo Pump Project does not comply with the legal requirements of the Clean Water Act.

One of the major impacts of project operation would be the induced conversion of 3,700 acres of wetland to nonwetland uses. This conversion and the associated deposition of fill is a direct result of the project and should be considered as such and included in the 404(b)(1) evaluation. Likewise, the operation of the project would have substantial impacts on extensive wetland areas as a result of reduced flooding and major alterations of the hydrologic regime. With this in mind, the specific comments contained in this review will be related to the total impact of the project upon wetlands.

Specific Comments

15) Page K-4 (Water Chemistry). A project of this magnitude has the potential of significant effects on water chemistry.

16) Page K-4 (Water Clarity). Turbidity will definitely increase due to intensification of agriculture and associated increases in erosion rates. Experience has indicated that erosion rates on land converted to agriculture would, at a minimum, approach 5 tons per acre per year as compared to an average of 0.5 ton per acre for forested wetlands.

17) Page K-4 (Dissolved gas levels). The reduction of dissolved oxygen levels could certainly be significant based upon the current conditions and the expected increase in biological oxygen demand.

18) Page K-4 (Nutrients and Eutrophication). Intensified agriculture throughout the project area will substantially increase nutrients which are released into the water bodies of the area. The increase in nutrients will definitely increase the possibility of hyper-eutrophication which is becoming an increasing problem in the Yazoo Delta.

19) Page K-4 (Current patterns and circulation). Current patterns and flow will very definitely be changed should a 17,500 cfs pumping plant be put into operation.

20) Page K-4 (Velocity). There will be extensive currents and turbulence associated with a pumping plant of 17,500 cfs. Velocity, both upstream of the intakes and downstream of the discharges, will be substantial.

21) Page K-4 (Hydrologic Regime). The hydrologic regime of the area, although changed extensively by completed flood control features, will be significantly altered. The reduction of the hydrologic regime is the primary purpose of the pumping plant and is a major concern of the FWS.

22) Page K-5 (Normal water level fluctuations). There will be substantial water level fluctuations as a result of project implementation since the reduction of water levels is a basic objective of the pumping plant.

23) Page K-5 (Effects on chemical and physical properties of the water column). This section deals only with the immediate construction area and should be expanded to address the impacts associated with the entire project. Fishery resources are currently degraded as a result of previous flood control projects which have resulted in pesticide, turbidity, and sedimentation problems. Potential increases of these problems brought about by this project should be addressed.

24) Page K-6 (Suspension/filter feeders and sight feeders). Increases in suspended particulates and turbidity levels will definitely have an adverse effect upon suspension/filter feeders and sight feeders.

25) Page K-6 (Aquatic Ecosystems and Organism Determinations). This section should be expanded to cover the operational impacts of the project that would result from intensified agriculture (including 3,700 acres of induced clearing) and decreased water levels on 77,000 acres of regulatory wetlands. The FWS considers these impacts to be substantial and not consistent with the 404(b)(1) guidelines.

26) Page K-7 (Determination of Cumulative and Secondary Effects on the Aquatic Ecosystem). The cumulative and secondary effects of the entire project on the aquatic ecosystem should be analyzed. It is the opinion of the FWS that the effects would be significant.

27) Page K-8 (#7). The discharge of materials is not the only concern that should be addressed. The cumulative effects of the entire project upon wetlands should be evaluated and the significant adverse effects stated.

IV. FISH AND WILDLIFE MITIGATION REPORT

General Comments

The Corps and the FWS are in basic agreement upon requirements for mitigation of fish and wildlife losses associated with the Yazoo Area Pumping Plant and completed Yazoo Backwater Features. The issues of the FWS concerning plan formulation have been addressed in our comments on the GDM and will not be reiterated in this section. We do have certain concerns and recommendations, discussed under Specific Comments, which we believe should be incorporated into the final mitigation report to make it a more consistent and workable document.

Specific Comments

28) Page 60. It is our understanding that the annual operation, maintenance, and replacement costs of $41,000, which are addressed in the Recommendations are associated with the 5,400 acres to be acquired in fee title. Furthermore, we understand that the existing Mississippi River and Tributaries Project is to be modified to provide these funds at project expense.

29) Attachment 2 (In-Kind Mitigation). The FWS is in basic agreement with the methodology and calculations utilized to develop in-kind mitigation for migratory waterfowl. We do, however, have one major concern. The

in-kind mitigation concept in this report is based upon the assumption that approximately one-half of the greentree reservoirs and slough control structures located on Delta National Forest will be pumped or filled naturally every year. A very substantial increase in habitat units is obtained based upon this assumption. Therefore, since the losses to be mitigated are a result of the project, the operation and maintenance costs associated with pumping should be at project expense. Operation and maintenance costs are currently not at project expense and it is anticipated that the U.S. Forest Service will be required to provide the necessary funds. During the migratory waterfowl seasons in 1979-80 and 1980-81, the Corps utilized portable pump to introduce water into the completed greentree reservoirs with favorable results to waterfowl. During the waterfowl season 1981-82, the Corps chose not to initiate pumping, thereby rendering the greentree virtually useless as waterfowl habitat. It is the opinion of the FWS that to obtain valid habitat unit increases, the recommendations of this report should include provisions to obtain adequate funding at project expense to assure that at least one-half of the greentree reservoirs and slough control structures are pumped full of water each year. We believe, based upon the letter dated October 1, 1979, contained within the mitigation report, that the U.S. Forest Service also supports such a recommendation.

30) Page 53 (Paragraph 120). It is stated that the FWS requested that mitigation requirements be purchased in fee title. Also, the Syllabus contained in the report indicates that the FWS recommended 32,800 acres be purchased in fee title to compensate for fish and wildlife losses. Actually, the FWS has recommended that the Corps seek Congressional authorization to acquire 32,800 acres of forested wetlands in fee title or 40,000 acres in easements or a combination thereof to compensate for completed features and the selected plan.

Although fee title provides for unlimited control, unencumbered management, and assurances for public use, the FWS does believe that emphasis, in this case, should be placed on easements of mitigation lands. We are not, however, opposed to fee title acquisition. It should be pointed out that the easements being proposed to prevent conversion of forested lands to non-forest uses will maintain only the projected future without project habitat values and not necessarily the existing conditions. Furthermore, future management capability will not be present nor will the right to provide for public access. Habitat values could be lowered by detrimental trends in forest management which are not a result of the project and cannot be controlled by easements.

The Corps has determined that the best method to mitigate wildlife losses in the Yazoo Area would be a combination of fee title and easement purchase. The FWS agrees with these determinations, however, the recommendation for authorization is excessively restrictive since it limits fee title acquisition to a specific 5,400-acre tract. Also the concept does not allow for obtaining additional or less acreage in fee title. We are aware that the potential currently exists for additional purchase of lands in fee title on a willing vendor basis. This is not to infer that the FWS will at this time recommend the acquisition of specific tracts of land. The probability exists that land currently for sale may not

be available or that other suitable acreage will be placed on the market before initiation of the Corps' acquisition program. We believe that lands of suitable quality should be obtained wherever they occur throughout the Delta. We would encourage the acquisition of marginal croplands where it would aid in the Migratory Bird Land Acquisition Program or be in consonance with State Wildlife Management Area needs.

The FWS suggests that the Corps seek authorization to acquire the necessary acreage in 100 percent fee title or 100 percent easements or a combination of both. This would increase the flexibility of the authorization and would not limit the option to acquire either type of easement or a combination thereof. The option should be at the discretion of the Chief of Engineers in consultation with the Director of the Fish and Wildlife Service and the Director of the Mississippi Department of Wildlife Conservation to assure that the acquisition would complement, to the extent possible, the Migratory Bird Land Acquisition Program, the National Wildlife Refuge System, and State Wildlife Management Area needs.

Thank you for the opportunity to provide these comments.

Sincerely yours,

James H. Lee

Regional Environmental
Officer

Response to U. S. Department of the Interior, Office of Environmental Project Review, Letter, 21 April 1982

Comment 1.

Devastating floods of catastrophic consequences provide the impetus for considering flood control improvements to the area. The magnitude of this enormous flooding problem is reflected in discussions throughout the report. Flooding of hundreds of thousands of acres occurs in the area on a frequent basis and has occurred 4 times in the last 9 years. It is with this type of background that improvements for the area are being considered.

The project has been formulated to prevent flood damages. Benefits to expanded development (project-induced land clearing of 900 acres) are relatively insignificant and have no effect on project feasibility. There are only 900 acres of project-induced land clearing and 300 acres of right-of-way, while there are 142,000 acres of woodlands within the project area. Benefits to future expansion associated with the project thus comprise only about six-tenths of one percent of total benefits and, therefore, are essentially negligible.

The project justification includes anticipated growth that can reasonably be expected in the area based on past trends. However, over 99 percent of project benefits relate to presently developed lands. Also, certain features of intensification, such as winter double-cropping, offer potential environmental benefits to the area.

Areas that may presently appear to be marginal must be considered in the context of related factors. For example, land that may appear to be marginal may, in fact, be beneficial to the farmer who incorporates it with other farmlands to permit greater equipment utilization and other economies of scale. Also, elements such as plant varieties that mature more quickly often change the classification of lands from an economically marginal category to a more profitable one. This has occurred historically, as reflected in past development, and will continue to occur.

Federal flood control programs have provided major benefits to the Yazoo Basin, most of which are from prevention of flood damages, not intensification. Additional discussion concerning intensification is presented in Appendix F.

Comment 2.

Refer to response to EPA Comment 1.

Of the 27,000 acres of forest lands that will be cleared without the project, only a portion is considered to be wetlands. The elevation at which clearing will occur is not specified. The majority of these acres will probably be cleared at higher and drier locations, rather than in the more flood-prone areas.

The Vicksburg District policy is that land clearing is not subject to the provisions of Section 404 of the Clean Water Act. An estimated 900 acres of woodlands will be cleared for agricultural purposes as a result of the project, with another 300 acres required for rights-of-way. Again, only a small portion of these woodlands are expected to be 404 wetlands. Approximately 14,900 acres will have impaired wetlands functions from the seasonal reduction in flooding of these lands. Destruction of wetland values is not a fundamental aspect of the purpose and justification for the project.

Comment 3.

Reducing flood damages to agricultural lands in the project area from prolonged flood stages is an integral feature of the project's purpose and justification. Elimination of wetland values is not a planned and purposeful project objective. Although implementation of the proposed project will result in the clearing of a small portion of wetlands, the mitigation feature of this project will preserve a greater amount of wetlands that would be subject to clearing without the project. Some reduction of flooding of wetlands is unavoidable since cleared lands currently exist within the 1-year frequency flood elevation.

Comment 4.

No additional structural development or occupancy is projected for the project area as a result of implementation and operation of the pumping plant. Economic justification for the project does not include benefits for induced residential or industrial development nor does it require expansion of farming activities (land clearing).

Comment 5.

At the time of the initial study of the Yazoo Backwater Area, the project area contained only 2,650 acres of cleared lands below elevation 90. This was approximately 2 percent of the total 125,000 acres at that elevation. The Mississippi River Commission report, referenced in the 1941 Flood Control Act, stated that due to the small amount of cleared land below elevation 90 there does not seem to be much advantage in holding the sump to lower levels. There are now 59,000 acres of cleared land below elevation 90. Current investigations must recognize this development since they are conducted based upon existing conditions.

Although changes in land use patterns since the Flood Control Act of 1941 have dictated a need for pumps in the Yazoo Area, this project will have only a minimal impact on future land use patterns as discussed in responses to Comments 1 and 2.

The impacts to the Green Ash-Overcup Oak-Sweetgum Research Natural Areas are discussed in Appendix G. Measures to maintain existing water levels in these areas do not appear to be feasible; however, they will be considered further during detailed design.

Paul Love County Park and Leroy Percy State Park are both located on the outer limits of the project area. Since all but a small portion of these areas lies above the 100-year frequency flood, no impacts to either area would occur with implementation of the project.

Comment 6.

Paragraphs 13 and 14 of Appendix D have been revised as suggested.

Comment 7.

a. Detailed explanation and discussion of adverse impacts is given in the Environmental Effects section of the EIS and in the Environmental Analysis, Appendix G. Table G-4 shows for each plan the dollar losses to sport and commercial fishing, furbearers, waterfowl, and forest game which include deer, turkey, and squirrel. This table and related narrative present a trade-off comparison of each alternative plan. Since the recommended plan will increase the amount of agriculturally developed land by only about two-tenths of one percent, it is reasonable to assume that the total damages resulting from the Mississippi River Standard Project Flood would not be increased significantly.

b. "Backwater flooding" has been changed to interior flooding.

c. The EIS and Environmental Analysis appendix consider as wetlands (habitats) only wooded and shrub swamps and wooded wetlands. The EPA special case wetland determination of 90 feet, NGVD, applies to Section 404 of the Clean Water Act (Water Quality) and was used only in the Section 404(b)(1) evaluation.

d. The EIS has been revised as suggested.

Comment 8.

Studies by Mississippi State University indicate that inundation of terrestrial habitat provides an important terrestrial food resource that may help to maintain a better reproductive potential among fishes. The term "wildlife and fishery" was used synoptically. Technically, easement acquisition does not benefit fish directly. However, preservation of forest lands reduces sediment and pesticide runoff to receiving streams. An explanation of the fishery loss compensation is provided in the mitigation report.

Comment 9.

See response to EPA Comment 7.

Comment 10.

See responses to Comments 3 and 4.

Comment 11.

The evaluation and assessment of alternatives was based on existing conditions.

Comment 12.

Increased turbid and pesticide-laden runoff is addressed in Appendix G, Environmental Analysis. Also, see response to EPA Comment 8.

Comment 13.

See response to Comment 7c. The land use acreage discrepancy at the 1-year frequency flood has been corrected.

Comment 14.

See response to EPA Comment 7.

Comment 15.

The deposition of fill material on dry land and the subsequent revegetation of this material should have no significant adverse impact on water chemistry.

Comment 16.

See responses to Comment 12 and EPA Comment 7.

Comment 17.

Significant reduction of dissolved oxygen levels is not expected to occur as a result of construction deposition.

Comment 18.

See response to Comment 12.

Comment 19.

The evaluation indicated that these parameters would be altered.

Comment 20.

Engineering considerations for pumping plants of this magnitude require minimal turbulence and low velocity in the approach and outlet channels. The velocities in the inlet and outlet channel will be lower than velocities which presently occur in existing channels in the area.

Comment 21.

See response to EPA Comment 7.

Comment 22.

See response to EPA Comment 7.

Comment 23.

See response to EPA Comment 7.

Comment 24.

See response to EPA Comment 8.

There should be no significant increases in suspended particles and turbidity levels.

Comments 25-27.

See responses to Comment 2 and EPA Comment 7.

Comment 28.

Operation, maintenance, and replacement cost for the recommended mitigation plan will be incorporated as a part of the Mississippi River and Tributaries Project.

Comment 29.

The greentree reservoirs and slough control structures were approved based on an agreement, incorporated into the letter report to the President, Mississippi River Commission, dated 23 July 1976, entitled Yazoo Backwater Area Fish and Wildlife Mitigation Plan. As stated in this report, the construction of the project would be a Corps cost, and operation and maintenance would be a responsibility of the U. S. Forest Service.

A 25 February 1976 letter from the U. S. Forest Service contained confirmation of this agreement. Should a mutual understanding be made to alter this agreement, the Corps would then consider assuming responsibility for pumping the reservoirs.

Comment 30.

As reflected in the FWCA report and numerous coordination meetings, FWS recommended the fee (simple) title woodland purchase alternative as opposed to perpetual land use easements.

Recommendations in the final report have been revised to allow flexibility in authorization and do not limit the options of acquisition.

United States Department of Agriculture
Forest Service
National Forests in Mississippi
100 W.Capitol St.,Suite 1141
Jackson, MS 39269

Reply to: 1950

Date: April 26, 1982

Col. Samuel P. Collins, Jr., District Engineer
U. S. Army Engineer District
Attn: LMKPD-Y
P. O. Box 60
Vicksburg, MS 39180

Dear Colonel Collins:

Here are our comments regarding the draft Phase I for the Yazoo Area Pump Project.

1) -- (Fish & Wildlife Mitigation Report) Paragraph 96, Page 40 mentions that "the Forest Service provided no identification of any additional potential measures for additional development of these areas". This is in conflict with my 10/1/79 letter in which we recommended two mitigation measures. The letter is appended to the draft report.

2) -- While the Delta National Forest receives periodic natural flooding, we would object to any activity that will alter the water table or the use of the Forest for flood water storage.

Sincerely,

B. F. FINISON
Forest Supervisor

Response to U. S. Forest Service Letter, 26 April 1982.

Comment 1.

The mitigation report has been rewritten to reflect that no interest was indicated by appropriate agencies for any additional greentree reservoirs and slough control structures in the publicly owned areas of the basin. The measures suggested by USFS in the 1 October 1979 letter were considered in the mitigation analysis.

Comment 2.

The recommended pump plan would not increase the use of the forest for floodwater storage. Some reduction in flood frequencies will occur on forest lands above elevation 80 feet, NGVD, during the period 1 March to 30 November and on lands above elevation 85 feet throughout the year. The effects of the project on flood stages are discussed in Appendix C.

STATE OF MISSISSIPPI

OFFICE OF THE GOVERNOR
POST OFFICE BOX 139
JACKSON, MISSISSIPPI 39205

WILLIAM F. WINTER
GOVERNOR

May 12, 1982

Colonel Samuel P. Collins, Jr.
District Engineer
Vicksburg District, CE
Vicksburg, Mississippi 39180

Dear Colonel Collins:

The purpose of this letter is to respond to your request of February 26, 1982, asking State comments on the draft Phase I General Design Memorandum (GDM) and Environmental Impact Statement (EIS) as well as the draft Fish and Wildlife Mitigation Report for the Yazoo Area Pump Project.

As Chief Executive of the State, I provided you my personal views at the public hearing at Rolling Fork, Mississippi, on April 6, 1982. I have also had those State agencies with responsibilities in the project area review the project documents, and now offer the following State comments.

The Yazoo Area Pump project has long been awaited by the people of Mississippi, not only those with land in the backwater area who suffer the effects of backwater flooding, but by the State as a whole who see this as an opportunity to improve economic vitality.

It is distressing to all of us that the project will result in the loss of more of the State's dwindling wildlife habitat. Nevertheless, the beneficial effects to local, regional and national interests are so substantial that they far outweigh the adverse effects. Therefore, the State of Mississippi concurs that Project Plan C be approved for construction.

1) With respect to the Wildlife Mitigation Plan, I and all State agencies feel very strongly that only such land as is absolutely essential be removed from private ownership. I recommend that easements be utilized rather than fee simple acquisitions except as prohibited by federal law. This would include such land as is necessary for efficient project operations as well as any wildlife mitigation acquisitions that may be authorized by the Congress.

2) I further recommend that such easements be acquired only for the life of the project. Many unknowns, in all probability, will come into focus during the life of the project, and it would be in the public interest that easements terminate when no longer required for project purposes.

I urge you to make every effort to initiate construction of the Yazoo Pump Project as soon as possible. Damage occurring due to backwater flooding are well documented in the General Design Memorandum and Environmental Impact Statement. It is important to the economic well-being of the State, as well as to the personal well-being of those living in the area, that this protection be provided as soon as possible.

Enclosed for your information is a copy of the comments from various State agencies. I appreciate the opportunity to comment.

Sincerely,

WILLIAM F. WINTER
GOVERNOR

WFW:gjp

Enclosure

MISSISSIPPI FORESTRY COMMISSION

SOUTHERN HARDWOOD

SOUTHERN PINE

April 8, 1982

File: 119.9

Mr. Charlie L. Blalock
Executive Director
Mississippi Department of Natural Resources
P.O. Box 20305
Jackson, Mississippi 39209

Re: Yazoo Area Pump Project,
Yazoo Basin, Mississippi

Dear Mr. Blalock:

The Mississippi Forestry Commission has always been concerned with wildlife benefits accruing from proper forest management of our forests for multiple uses.

However, we oppose the use of mitigation as a remedy to offset losses of wildlife and its habitat resulting from installation of flood control projects. Our reasons are similar to those already expressed in past public hearings on this project. Also, mitigation is just another method of appeasing one or more publics at the expense of another public - the landowner.

The mitigation by "perpetual land use land purchase" alternative recommended over "fee (simple) purchase" is a cheaper and easier "out" for the Corps of Engineers. Certainly most landowners would probably rather accept the alternative than lose their lands forever.

3) Because so many publics often attend public hearings, it is difficult to really know the true feelings of all the landowners whose lands might be mitigated. We recommend that a formal ballot or election be held for these landowners in order to determine whether they want: (1) mitigation by fee (simple) purchase, (2) mitigation by perpetual land use land purchase, (3) if they are accepting (2) merely as an alternative to retaining some ownership and control of their lands and (4) no mitigation of any kind.

The results of the ballot should be made a part of Corps of Engineers' report to Congress so that Congress will know the

true feelings of the landowners about mitigation of their lands.

Sincerely,

Richard C. Allen
State Forester

MISSISSIPPI STATE HIGHWAY DEPARTMENT
Third District

J. T. Santmyer, Jr.
District Engineer

P. O. Box 630
Yazoo City, Mississippi 39194

March 26, 1982

Mr. Charlie L. Blalock
Executive Director
Mississippi Department of Natural Resources
P. O. Box 20305
Jackson, MS 39209

Dear Mr. Blalock:

Mr. John Tabb has referred the draft of the general design memorandum and environmental impact statement on the Corps of Engineers' Water Resource Pump Project for the Yazoo area to this office for our review and comments.

4) We have reviewed these documents and have determined that the proposed pumping station will lessen the chances of damage to our highways by reducing the duration and elevation of future floods. We have a few highways that are inundated by unusually high flood elevations and the pumping station will eliminate this. Also, it will reduce the saturation of embankments when they are subjected to high water elevations for long periods of time.

We believe this should adequately indicate our position as to the pumping station construction. If we can be of further assistance, please let us know.

Sincerely yours,

J. T. SANTMYER, JR.
DISTRICT ENGINEER

JTS,Jr-ss

CC: Mr. John R. Tabb

Response to State of Mississippi (Governor William Winter) Letter, 12 May 1982.

Comment 1.

At the time the draft report was distributed for review and the information summaries were mailed, our plans were to acquire the majority of mitigation lands in land use easements as discussed. However, as a result of higher level review of the report, we were directed to revise our recommendations so as not to preclude either the fee or the easement option of acquisition. The basis for this decision stems from the fact that present conditions may change dramatically prior to the time land acquisition is initiated. For example, although the majority of landowners presently may be agreeable to selling only an easement interest, some landowners may want to sell their entire ownership by the time of actual acquisition. If we did not have the authority to acquire in fee, we would not have the flexibility to adjust to possible changed conditions at the time of acquisition. Based on this new guidance, the proposed mitigation plan will provide the flexibility to acquire by either fee title or land use easements or some combination of the two. However, when and where appropriate, easements will be taken in lieu of fee acquisition.

Comment 2.

Consideration was given to the possibility of acquiring easements for the project life rather than perpetuity. This option was not recommended for meeting mitigation needs since the majority of the losses associated with the projects would be permanent. For example, the woodlands that were cleared to build the levees and channels resulted in permanent losses to wildlife habitat. Also, projects of this type are normally operated as long as the need and justification for the project exist. If at some time in the future it is determined that the project is no longer needed, the need for retaining easements on lands acquired for mitigation of project-induced losses could be reevaluated.

Comment 3.

Since the Yazoo Area Pump Project affects many more people than just those whose lands might be acquired for mitigation, it would be improper to poll a select group as suggested. Local interests had the opportunity at public meetings and in response to public information brochures to provide their views and opinions on mitigation.

Comment 4.

Comment noted.

Comment 5.

See response to Department of the Interior Comment 5.

Comment 6.

Comment noted.

Comment 7.

Recommendations in the final report have been revised to allow flexibility in authorization so as not to preclude fee title acquisition.

Comment 8.

It is expected that purchase of mitigation lands would be handled primarily on a willing seller basis. However, due to the constantly decreasing woodland base in the project area and the magnitude of the required acreage, it is possible that purchases from willing sellers only will not accomplish total mitigation needs. Therefore, condemnation of private property may be necessary to fulfill total mitigation needs.

Comment 9.

Report has been revised as suggested.

ENVIRONMENTAL DEFENSE FUND

April 12, 1982

Colonel Samuel P. Collins, Jr.
District Engineer
Corps of Engineers
Vicksburg District
P.O. Box 60
Vicksburg, Mississippi 39180

Re: Yazoo Area Pump Project

Dear Colonel Collins:

Enclosed is a copy of the written statement which we have prepared commenting on the Draft Phase I General Design Memorandum and Environmental Impact Statement for the Yazoo Area Pump Project, Yazoo Basin, Mississippi. In addition, we enclose a copy of the statement we prepared for the July 1979 hearing. We would request that that statement also be included as part of our comments at this time.

At the hearing in Rolling Fork, Mississippi, Tuesday evening, April 6th, many of the speakers commented on various aspects of the proposed mitigation plan. In one respect you are to be complimented for having incorporated into the Phase I General Design Memorandum and EIS any kind of a meaningful mitigation plan. Such action is rather unusual. A lot of the comments about the mitigation proposal, however, may reflect a lack of understanding about some of the details of that proposal. It would be very helpful for you to clarify what the terms and conditions of that proposal are.

1) Some of the speakers at the hearing commented that it was basically unfair to develop a mitigation proposal based exclusively on lands that are still wooded and primarily owned by timber companies or hunting clubs. I have been advised that some of the acreage that would be included in the mitigation program for inclusion in the National Wildlife Refuge is presently cleared land. If this is so, it seems to me that this should be clearly stated. In any case, the mitigation plan should include acquisition of leared land below the 90 foot msl contour. Furthermore, it is also my impression that the mitigation program would purchase lands in fee simple or by way of easement only from willing sellers. Is this the case? If so, it seems to me that it would go a long way towards rebutting many of the stated concerns.

444 Park Avenue South New York, New York 10016 212·686·4191
OFFICES IN: NEW YORK, NY (NATIONAL HEADQUARTERS); WASHINGTON, DC; BERKELEY, CA; DENVER, CO

2) The terms of any conservation easement are absolutely critical. In our view, they should be at least as stringent as those proposed by the U.S. Fish and Wildlife Service in their Fish and Wildlife Coordination Report. Several speakers also advocated that the duration of the easements be limited to the so-called "life of the project." Although we do not concur, any accommodation in this regard should clarify what the "life of the project" means. For economic analysis purposes, the Corps utilizes a 50 or 100 year time period. However, the project may be maintained long beyond that period of time. Indeed, it is hard to believe that the major features of the Mississippi River and Tributaries Project, including the backwater levees in the Yazoo River Basin, will not be maintained unless and until nature dictates otherwise. Certainly, the duration of the easements should extend at least as long as the Congress or the pertinent states maintain those major features of the Mississippi River and Tributaries Project. If the time comes when the backwater levees in the Yazoo River Basin are no longer maintained, and are gradually worn down by natural forces, the water regime that may reestablish itself may make the continuation of the easements a moot issue.

3) Even with these comments, as we have made clear in our oral and written statements, we do not consider the mitigation program to be adequate. An adequate mitigation program would be one as I described where the Corps of Engineers would be prepared to require, by fee simple or conservation easements, cleared or forested lands in the Basin which could not be profitably farmed due to flooding problems. The bulk of such land, we believe, would be below the 90 foot contour. In this respect, in our written statement, we request that you furnish us with information disaggregating the flood reduction and land intensification benefits for the lands below the 90 foot contour and above that contour. Although some willing sellers for cleared or forested lands above the 90 foot contour might come forward, we coubt that many would.

4) Finally, the 404(b) evaluation in Appendix K is woefully deficient. The evaluation at K-6 in Paragraph 2(e)(5)(b) (special aquatic site effects - wetlands) points out that 2000 acres of wetlands will be cleared as a result of this project and that 17,900 acres will be adversely affected as a result of hydrologic modification. (In addition, we believe that all anticipated clearing - some 27,000 acres of wetlands - stems from the failure of the Vicksburg District to enforce the Avoyelles Sportsmens League v. Alexander decisions plus anticipation of this project.

Yet, the rest of the evaluation fails to deal with and evaluate is massive wetland loss. It should do so, as should the GDM/ EIS.

Yours very truly,

James T. B. Tripp
Counsel

JTBT/mlr
Enclosure

cc: Charles Baxter
U.S. Fish and Wildlife Service
Vicksburg, Mississippi

ENVIRONMENTAL DEFENSE FUND

April 6, 1982

STATEMENT OF THE
ENVIRONMENTAL DEFENSE FUND, INC.
ON THE
YAZOO AREA PUMP PROJECT

by: James T. B. Tripp

We have received a copy of the Yazoo Area Pump Project, Draft Phase I GDM-EIS, U. S. Army, Corps of Engineers, Vicksburg District, the Corps' Fish and Wildlife Mitigation Report (March, 1982) and the Fish and Wildlife Coordination Act Report of the U. S. Fish and Wildlife Service. Based on our review of those documents, we have serious reservations about the pump project on economic and environmental grounds. In this respect, our views have not changed materially since our comments of July 6, 1979. We attach a copy of those comments and include them as part of this statement.

This project is the ultimate in technological redundancy. The alleged flood control need for the pumps project results solely from man-made structures which presently exists in the Yazoo River Basin. This project also represents the continuation of an approach to water and soil management in the Lower Mississippi River Valley which has dominated Corps of Engineers thinking for 100 years. The underlying assumptions are that all bottomland hardwood wetlands in the Mississippi River backwater areas not within a national forest or wildlife refuge should be cleared for agricultural use and that there is a benefit to such conversion. The question is never asked whether a river basin, or the entire Mississippi River Valley or the Nation, would benefit more from a mix of cropland and forested wetlands. It is further assumed in floodplain areas

444 Park Avenue South New York, New York 10016 ☎ 212•686•4191
OFFICES IN: NEW YORK, NY (NATIONAL HEADQUARTERS); WASHINGTON, DC; BERKELEY, CA; DENVER, CO

that flood control is to be accomplished by construction of levees and acceleration of drainage and that this hydrologic modification will increase flood stages downstream or upstream but that such costs may be properly borne by someone else. Finally, it is assumed that the Federal government, with taxes paid by the American public, will pay for this flood control program.

5) All of these assumptions today are being questioned and, indeed, should be questioned. The capital cost of this project is $149,894,000. Who is to pay that sum? The Federal government--the U. S. taxpayer. Why should they? If this project is such an enormous "benefit" to owners of land in the Yazoo River Area, why should not they pay for it? Logically, absent the enormous Federal subsidies, they might well conclude that they had some better use of their money. So does the Nation. The Congress is struggling to control and reduce the unprecedented U. S. budget deficits projected for the next five years. Why, in the fact of these hard fiscal facts, should the Federal government pump $150 million in the Yazoo Basin pumps? Fortunately, the Reagan Administration is beginning to question this philosophy of Federal largesse. We can only support that effort and wish to have this new policy applied here.

6) The Corps advises us that the project interest rate used in economic analysis is 2½ percent per annum. Isn't it ludicrous in 1982 to use such an interest rate when the prime banking rate is above 16%? Wouldn't the landowners in the Yazoo River Basin properly question any investment program, in which they had a stake, which was premised on a 2½ percent per annum interest rate? Are they prepared to condone this slight of hand only because it is not their money? So, in this project, the landowners of the Basin are to

use someone else's money to transfer what they perceive as a flooding problem somewhere else.

7) It should also be pointed out that this project will impose some added stress on the levee system elsewhere in the Lower Mississippi Valley flood control system. Flood stages at Vicksburg will increase a few inches. The increase elsewhere will be smaller but real. Thus, the cost of maintaining this Valley's extraordinary, complex, and costly flood control systems will increase. In its Phase I GDM, the Corps has not identified or calculated this cost.

8) It could be argued that the Federal government should construct this project to bail out landowners in the southern portion of the Yazoo Basin who are victims of the existing flood control structure; that the pumps are designed to remove waters from their land which would naturally drain off but for the backwater levee system. To some degree, these lower Basin landowners may be victims, just as landowners downstream in the Valley will be victimized if the pumps are constructed. However, the Corps' hydrologic evidence is that the lower Basin landowners are still better off with the backwater levees in place even without the pumps than with no backwater levees. If the two options were (1) no backwater levees or (2) backwater levees without the pumps, how many landowners would vote for (1)?

9) The Corps of Engineers will undoubtedly counter, joined by some Basin landowners, that Congress has authorized the construction of these pumps as part of the Yazoo River Basin flood control program of the Mississippi River and Tributaries project. Thus, reasons the Corps, it must build the project. But, in this case,

that response is inadequate. In House Document 359 and other reports, the Congress made it clear that all lands through the Lower Mississippi Valley cannot receive the same level of flood control. The Congress has recognized that some low-lying backwater areas must serve as flood storage areas. Within the Yazoo River Basin, the Congress has specifically recognized that those areas below 90 feet msl should serve this function and should not in turn be drained or provided flood protection. This area at or below 90 feet msl is approximately 136,000 acres.

10) In designing the pumps project, the Corps has disregarded this project concept. Rather than designate the 136,000-acre land area below 90 feet msl for flood storage, it has converted the pump project into a scheme which will provide flood control for this very area. The project as designed in the Phase I GDM therefore directly violates the Congressional Yazoo Basin flood control concept and therefore the authorization. Not only are the pumps unlawfully designed to provide flood control for this"sump" area but a substantial portion of the project benefits are based on intensification of cropland use within this area. Based on House Document 359, land use intensification within the Basin land areas below the 90 foot msl contour is not an appropriate benefit. All such benefits should be eliminated. If they are, we doubt that the Tentatively Selected Plan would have a benefit cost ratio greater than one. The pump project should accordingly not be built.

11) The pump project, as presently designed, in the process of providing drainage below the 90-foot msl contour, will also have the unfortunate affect of accelerating the clearing of over 30,000 acres of bottomland hardwood wetlands, not in Federal ownership, remaining in this low-lying area and their conversion to cropland. Although the Corps maintains that over 27,000 acres

would be cleared without the project, we cannot accept this figure. These wetlands should be subject to Corps jurisdiction under the Clean Water Act (see GDM Attachment 1 for Section 404 wetlands). Further, the fact that landowners would clear 27,000 acres of wetlands primarily below the 90 foot msl contour without the project (if we accept the Corps' contention) is evidence that the pumps project is not necessary to support crop production.

12) The continued loss of these low-lying Yazoo Basin bottomland hardwoods constitutes a massive ecological loss for the Basin. These 30,000 acres represent such a small fraction of overall Basin acreage. Their loss means a reduction in ecological diversity, cultural distinctiveness, and fish and wildlife habitat. This loss means the further disappearance of the Basin's natural and historical heritage. Furthermore, the combination of the continued conversion of these wetlands and the pumps will mean a further deterioration of water quality downstream. The water drainage off cleared floodplain land in the Basin carries large loads of sediment and pesticides. The result is highly contominated water quality. U. S. Fish and Wildlife Service Fishery Research Lab analyses record very high concentrations of agricultural pestides in fish tissue--so high that FDA action levels and state standards are routinely violated. For this reason, we expect that the water discharged through the pumps will violate water quality standards. The pumps would therefore not qualify for a NPDES permit pursuant to Section 404 of the Clean Water Act.

13) What soil and water management strategy should therefore be pursued in the lower Yazoo Basin? The objectives should be (1) retention of all remaining bottomland hardwood wetlands, (2) reforestation of cleared low-lying areas which need the pumps to be commerically viable, (3) substantial reduction in soil erosion rates and pesticide loads into waters of to Basin, and (4) significant improvement in water quality so as the sustain healthy fish and wildlife populations where natural habitat could support such life. The achievement of this objective in the 136,000-acre area below the 90 foot msl contour would provide some overall economic, social, aesthetic, and cultural diversity for the Basin as a whole. Any further drainage and land clearing would reduce this diversity.

14) How is this strategy to be realized? The pumps should not be built. Instead, the Corps of Engineers should design a "non-structural" flood control program for the lower Basin which would entail a prohibition on further clearing of wetlands below the 90 foot msl contour with fee simple or conservation easement purchase. In addition, landowners who own land cleared before this date would have the option of selling that land or conservation easements to the Corps of Engineers. Subject to such easements, all lands subject to this program would naturally be reforested. Landowners could timber these reforested lands and sell hunting leases but not farm the land. This program, if properly designed, would utilize the wet, low-lying areas below 90 foot msl for the primary function envisioned by Congress for flood storage.

15) The GDM/DEIS does not disaggregate flood protection and land intensification benefits of Plan C - 17,500 above and below the 90 foot msl contour (We would request that the Corps furnish us with this information.) Plate 6, which depicts the extent of the 3-year frequency flood with and without the project, compared to Attachment 1 (Section 404 wetlands, i.e., lands before the 90 foot msl contour), indicates that frequent floods, e.g., those occurring on a one, two, three, or perhaps five-year recurrence interval, are concentrated below the 90 foot msl contour. The 100 year annual flood, which is represented by the 1973 flood (GDM Plate 10) covers perhaps 539,000 acres, more or less, but the recurrence interval of a flood which covers most of the Yazoo Area floodplain is very long. In addition, GDM Table C-3 at C-34 indicates that the Tentatively Selected Plan will not significantly reduce the duration of major floods, like the 1973 flood. Furthermore, Table F-23 makes it clear that existing development benefits are small and do not justify the Tentatively Selected Plan. Finally, the GDM at F-46 states that most of the intensification benefits (which comprise almost 80% of all project benefits) occur in the wet areas, i.e., below the 90 foot msl contour. We interpret all of this information to mean that most of the benefits, i.e., 80 to 90% or more, accrue to the 136,000 acres below the 90 foot contour. Thus, a program of willing seller fee simple/conservation easement acquisition of privately held lands within the 136,000-acre area below the 90 foot contour could achieve virtually all of the legitimate benefits of the project at less cost.

16) This program would also have enormous soil erosion control, water quality and fish and wildlife benefits. These retained and restored wetlands would filter agricultural runoff, trapping sediments and breaking down biodegradable pesticides and herbicides. This low-lying area would therefore provide fishing and hunting grounds for the entire Basin. This program would also avoid the additional stresses on the MR&T levee system which the Corps' Tentatively Selected Plan will generate.

17) Finally, we expect that this program of wetland protection and restoration will be cost-effective. We would expect that the willing seller/fee simple/ easement acquisition program which we have described could be implemented at less cost than the Corps' pump project. Certainly, all of the privately held land below the 90 foot msl contour could be prucahsed for less than the Tentatively Selected Plan's capital cost. In addition, such a wetland protection program would be virtually maintenance-free and energy-free. The pump project will require the expenditure of some 14.9 million kilowatt hours of electrical energy per year (GDM Table B-8 and B-47). This wetland retention/ restoration program would require none. The annual maintenance costs of the pump project will be $1.5 million per year. The annual costs of the lower Basin wetland retention/restoration program would be close to zero. This program could also serve as belatedly but needed mitigation for the Yazoo backwater levee flood control project.

18) This wetland retention/restoration program would be a true EQ Plan. The EIS and GDM are deficient in that the do not identify and evaluate such an alternative flood control program. The Vicksburg District should pursue this alternative investment strategy immediately.

COMMENTS OF THE ENVIRONMENTAL DEFENSE FUND, INC.
ON THE YAZOO BACKWATER PROJECT, YAZOO PUMP STUDY

by: James T.B. Tripp

July 6, 1979

1. Introduction - Summary

We have reviewed various documents describing the Corps of Engineer's Yazoo Basin flood control project and the Yazoo backwater project Yazoo pump study. For reasons which we set forth below, we (a) oppose the pump project as proposed by the Corps of Engineers, (b) support complete implementation of a full fish and wildlife mitigation program for the flood control project described in the Corps' 1975 EIS prior to any work on the pump project, (c) support initiation of water quality management programs in the Basin to comply with water quality requirements of the 1977 Clean Water Act and other federal and state laws, and (d) request identification and consideration in detail of alternatives of non-structural, restoration management plans for the Basin as required by NEPA, the Principles and Standards and Executive Orders 11988 and 11990.

2. Existing Conditions in the Yazoo Basin

In order to evaluate impacts of the pump project and alternatives which should be fully investigated, we must have informa-

tion about existing environmental conditions in the Basin. Two facts stand out -- (a) much of the natural habitat of the Basin which used to support a diverse and rich faunal and floral community has been lost and replaced by cleared agricultural land producing food and fiber and (b) water quality is poor.

a. On-going loss of habitat

The Yazoo Mississippi River Delta was once a vast forested wetland basin covered by approximately 4 million acres of bottomland hardwood forests. It was a highly productive fish and wildlife area filled with streams, rivers, lakes and bayous of high water quality. The U.S. Fish and Wildlife Service estimates that less than 500,000 acres of the original bottomland hardwood forests remain. The other acreage has been cleared, drained and converted for agricultural use, a trend which has accelerated in recent years. As of 1975, about 77% of the Yazoo backwater area was cleared as compared to 40% in 1959. Furthermore, of the 1,200,000 acres of bottomland hardwood forests which remained in the Basin in 1970, about 60% have been cleared since that time. Thus, approximately 80% of this vast basin has already been committed to agricultural use.

While this massive land conversion has resulted in production of immense quantities of food and fibre, in particular cotton and soybeans, on the rich alluvial soils of the Basin, it has resulted in enormous external diseconomies. These include loss of flood storage capacity, increases in downstream flood peaks, decreases in water quality and loss of fish and wildlife nursery, spawning and breeding habitats.

b. Deteriorating water quality

Information on existing surface water quality is contained in the final EIS Flood Control, Mississippi River and Tributaries Yazoo River Basins, Mississippi (Sept. 1975) prepared by the Vicksburg District ("1975 EIS") at pages 46-52, including Tables 3 and 4. It is evident that existing water quality as of 1975 in the Basin was not good, particularly as reflected in Table 3. Nitrate levels were high, averaging for all survey points around 0.8 mg/l, with a maximum value of 1.9 mg/l at the Big Sunflower River. Phosphate levels were also elevated. The measurements given are 0.17, 0.21 and 0.37 phosphate in mg/l. Finally, turbidity levels measured in JTU were also high, ranging from 80 to 313. The 1975 EIS also indicates that the heavy pesticide concentrations in agriculturally related runoff in the basin are being bioaccumulated in fish tissue, sediments and the water column. These figures are frightening.

With respect to water quality, the Mississippi River and Tributary Yazoo River Basin, Mississippi Plan of Study (Vicksburg District, Dec. 1977) provides as follows at p. 60, paragraph 115: -

> "Water quality in the study area, particularly in the Delta, is not of high quality, but is presently sufficient to support existing fish life and other aquatic organisms. However, based on average observed levels of physical, chemical and pesticide quantities,many water bodies in the delta appear to be near threshhold conditions for life support of aquatic biota. Levels that are dissolved oxygen, turbidity, and pesticides are particularly critical. Some species, such as rough fishes, can tolerate poor quality water and survive under considerably adverse conditions."

The water quality data in the EIS, therefore, indicate that the water quality in the Basin is already polluted and stressed.

3. The existing Yazoo Basin flood control project -- its impacts on habitat and mitigation

The pump project is a structural appendage to the Yazoo Basin flood control project described in the Corps' 1975 EIS. In order to evaluate the pump project and consider the proper scope of its EIS, in particular the alternatives to be investigated, we must look at the impacts of this on-going, massive flood control program in the Basin. Presumptively, the pump project will aggravate the already severe impacts of the flood control backwater levee project on habitat loss and water quality deterioration, with resulting direct and indirect increases in fish and wildlife losses -- losses which have never been mitigated. The flood control program described in the 1975 EIS consists of a series of reservoirs, channelization and levees designed to control backwater flooding in the basin from the Mississippi River and to accelerate drainage of floodwaters from the basin. Levees which control backwater flooding of the basin at the same time obviously inhibit drainage from land inside of those levees. Interior water at the present time is released through the Yazoo backwater levee via two structures located at Steele Bayou and the Little Sunflower River, except during high stages in the Mississippi River when these structures are closed to prevent backwater flooding. When the structures are closed, water within the levee can not drain out and therefore builds up. The Corps is therefore planning to build the largest pumping plant ever constructed, to our knowledge in the world, to pump this interior water over the levee.

Undeniably, the construction and operation of the Yazoo River backwater level and other features of the flood control project

have directly destroyed and will destroy substantial amounts of bottomland hardwood forests and have induced and facilitated private drainage and clearing of additional tens of thousands of acres. To date, construction of the Yazoo Basin Flood Control Project has resulted in the installation of some 1308 miles of stream channelization with some 540 miles still proposed. In addition, of the total of 652 miles of levees planned, more than half or 325 miles are in place. The flood control project works have caused or will cause a direct loss of 44,600 acres of woodlands (plus 25,200 acres of cleared land). The 1975 EIS further indicates that the project will induce further clearing and drainage of 270,500 acres of bottomland hardwoods for agricultural production. The loss of this bottomland forest resource then exceeds 315,000 acres, over and above loss of hundreds of miles of stream habitat. The Flood Control, Mississippi River and Tributaries Yazoo Basin, Yazoo Backwater Area, Fish and Wildlife Mitigation Plan (July 1976) prepared by the Vicksburg District Corps of Engineers at pp. 4-5 thus correctly recognizes the linkage between Corps flood control projects in the Basin and land clearing. Much of the decline in fish and wildlife habitat is due to "the conversion of forestlands to agricultural production, much of which followed installation of the existing flood control and drainage works." Despite this fact, these enormous fish and wildlife losses have never been mitigated or compensated through a comprehensive mitigation program, in direct violation of the 1958 Fish and Wildlife Coordination Act.

To date, the U.S. Fish and Wildlife Service has requested

194,900 acres of bottomland hardwoods to be acquired in fee title with wildlife easements on 63,600 acres by way of mitigation, in addition to structural mitigation. To date, the Corps of Engineers has basically included only less than 20% of that request in its project planning with the result that acquisition of some 39,000 acres has been authorized by Congress. To date, in addition to two greentree reservoirs, only 15,383 acres have been acquired in fee title. This is both deplorable and a blatant violation of the Fish and Wildlife Coordination Act and NEPA.

We should indicate that these recommendations of the Fish and Wildlife Service fall far short of the requirements of the U.S. Fish and Wildlife Coordination Act for several reasons. First, there is no way in which the protection, through purchase or otherwise, of 194,900 acres of bottomland hardwood forests, can compensate for the direct and induced loss of 315,000 acres of bottomland hardwoods plus destruction of more than 1000 miles of stream habitat. Although the Fish and Wildlife Service has recommended a mitigation plan for the flood control project which violates the FWCA, the Corps' near total failure to seek approval for and implement even that inadequate plan of compensation is deplorable and represents a blatant disregard of Congressionally mandated water resource planning requirements.

Second, the Fish and Wildlife Service mitigation plan fails to provide any compensation for fish and wildlife losses due to adverse hydrologic modifications and water quality deterioration resulting from the project. It is therefore appropriate to look at those impacts both as a critique of the present and any future

mitigation plan for the Basin and as a guide to impacts of the pump project which must be closely analyzed.

4. Hydrologic impacts

It should be apparent that both the flood control project described in the 1975 EIS and the backwater pump will have major downstream hydrologic effects. In describing the hydrologic impacts of the reservoirs, channelization and backwater levees, the September 1975 EIS Summary states:

> "The project accelerates flood runoff, decreases amount and duration of flood overflow, reduces agricultural and urban damages, and allows greater intensification of agricultural activities." (p. i).

At the same time, the authorized plan of work for the Yazoo Basin when completed will "provide protection against headwater floods of streams in the basin, will give protection against backwater flooding from the Mississippi River, and will provide major runoff improvement for the alluvial valley."

Page 97 of the 1975 EIS indicates that, upon completion of the Yazoo River Basin Project, the Headwater feature will protect 1,209,000 acres against overflow, substantially benefit 203,000 acres and provide various communities with flood protection. In addition channel modifications in the Big Sunflower River and its tributaries will protect 195,000 acres against the design flood and an additional 395,000 acres will be benefitted as a result of improved drainage conditions. In view of these project purposes, it would reasonably be anticipated that it would have major downstream hydrologic effects.

The adverse hydrological effects of the entire flood control program were qualitatively noted in the 1975 EIS. For example,

the 1975 EIS at p. 98 states:

> "The reduction of available, undeveloped flood water storage areas in the Delta has increased the need for downstream flood control work. The loss of natural overflow in areas has also reduced groundwater recharge area with subsequent possible impact on the potential capacity of overflow areas to recharge streamflow during low flow periods."

Although the main body of the 1975 EIS contains no quantitative information about downstream hydrologic impacts, in response to a comment in the EIS, the Corps indicates as follows: (p. 133) -

> "Completion of the Yazoo Basin Project, both Headwater and Backwater projects, would cause an increased stage of about 1 foot on the Mississippi River at Vicksburg. The increased stage will dissipate below Vicksburg and no measurable increase would occur at Natchez, Mississippi, or below."

Needless to say, it is not explained how an additional one foot of stage at Vicksburg would simply dissipate since the water must go somewhere. Despite this fact, no effort was made to determine the cost of compensating for this increased stage at Vicksburg. One measure of damages would be the cost of raising the levee at Vicksburg and downstream by an additional foot.

The 1975 EIS also described qualitatively additional impacts of the flood control project on erosion and sediment deposition. For example, at pp. 98-99, para. 403(b), the EIS states:

> "b. Implementation of the authorized flood control project in the Yazoo Basin has had, and will have, direct, or first-order, impacts on the rates and amounts of sediment erosion and deposition as a consequence of increased channel velocities, containment of floodflows within channels, modification of channel bed equilibrium, and vegetation removal along channels for project maintenance purposes. The Yazoo River Basin Project will also have indirect, or second-order, influences on erosion through project-

> induced land clearing and improved flood plain runoff from lateral canals, off-project drains and other drainage features connected to the Federal project by local interests. Lands cleared as a result of project protection are subjected to accelerated soil erosion from rainfall on the bare soil and subsequent increased runoff of the entrained soil particles by way of the local interest drainage improvement. Soil erosion from cleared agricultural lands in the Yazoo Basin is a serious problem. Robinson (1971) pointed out that sediment yields from agricultural lands along the lower Mississippi River are from 5 to 13 tons per acre per year."

5. Water quality impacts of the flood control project

As we indicated above, existing water quality conditions in the Basin as of 1975 were bad. The 1975 EIS indicates that the flood control backwater level project will cause severe additional degradation of water quality. For example, it describes those impacts qualitatively at para. 4.04(b), p. 99:

> "b. Impacts on water quality, as a direct consequence of the Basin project, result primarily from modifications of channels and resultant change in flow regimes. Channel works, as previously mentioned, increase flow velocity with corresponding increases in erosion of channel beds, thereby increasing the turbidity level of the water body. Channel works often entail removal of streambank vegetation which exposes bank sediments to accelerated velocities, also causing increased erosion and turbidity. This removal of streambank vegetation allows greater solar insolation to reach the water surface and consequently will cause higher average water temperatures in the stream. Other direct project impacts on water quality result from actual construction activities where channel or bank materials are disturbed during channel enlargement or clearing and snagging operations. These works will put sediments, organic matter, and often entrailed pollutants into suspension or solution to be carried downstream. Any increase of organic material in the stream system will increase local biochemical oxygen demand and correspondingly

> decrease dissolved oxygen levels. Increased turbidity from channel works decreases light penetration through the water column but also absorbs heat energy, possibly increased by removal of vegetation overhang, thereby raising water temperatures. Increased water temperature reduces the quantity of oxygen by oxidation demand. Consequently, the total assimilative capacity of the stream for absorbing wastes, either natural or from farm, municipal or industrial sources, is decreased."

Para. 4.04(d), p. 100, of the 1975 EIS continues in pertinent part:

> "d. In addition to these direct, or first order, impacts on water quality in the Yazoo Basin from the authorized project, a number of indirect, or projected-induced, impacts are possible. Land clearing in the Basin, and especially in the Delta, will expose raw soils to precipitation and floodflows. Soil eroded from these lands will be carried into Basin waterways, thereby lowering water quality as a result of increased turbidity. Both newly cleared lands and the greater degree of protection for already developed lands will generate additional amounts of pesticides and fertilizers that will find their way to Basin waterways through runoff."

Similar comments are included in para. 5.03, p. 122, of the 1975 EIS.

Unfortunately, it is evident that little effort has been made to quantify downstream adverse impacts on water quality. In response to an EDF comment about the effect of the project on organic chemical and pesticide waste loads in the Mississippi River downstream and the importance for the EIS to quantify those impacts, the EIS at page 133 notes that "studies have not been made to determine how the project will affect water quality in the Mississippi River." Indeed, no quantitative, state-of-the-art modeling studies have been done, to our knowledge, to analyze water quality impacts, though massive, in the Basin as well.

The water quality conditions and water quality impacts of the project are so severe we can only wonder why the U.S. Environmental

Protection Agency or the Mississippi Water Quality Control Agency has not taken action under Section 404 or 208 of the Clean Water Act or other provision of law to rectify the situation. In addition, the pesticide concentrations in fish tissue would seem to cry out for action by EPA or the Food and Drug Administration. Yet, inaction pervades the scene in deference to American agriculture.

6. Anticipated impacts of the pump project

19) It is clear that the flood control project has had severe adverse effects on bottomland hardwood resources and hydrological, erosion and water quality conditions in the Basin. Except for its control of project-induced flooding behind the backwater level, the pump project will only exacerbate this deteriorating environment. By pumping water over the levee during high water backwater flooding conditions, the project can only raise downstream flood peaks still further. The New England Division Corps of Engineers has quantitatively developed downstream flood control benefits from its program of protecting, through acquisition, some 8,000 acres of wetlands in the Middle and Upper Charles River Basin as part of its Charles River Watershed project. This analysis indicates that the Corps can and should quantify downstream flooding costs induced by the pump project, over and above those of the flood control project, through direct estimates of damages or additional compensatory downstream flood works.

20) The pump project will induce destruction of bottomland hardwoods, unless the Corps adopts precautionary measures -- measures which it has shown no sign of taking. Of the 190,000 acres of