YAZOO BACKWATER AREA REFORMULATION

MAIN REPORT

OCTOBER 2007

SYLLABUS
YAZOO BACKWATER AREA REFORMULATION

The U.S. Army Corps of Engineers, Vicksburg District (Vicksburg District), is reformulating the remaining unconstructed features of the Yazoo Backwater Project Area in the Yazoo Basin, Mississippi. An array of nonstructural, structural, and combination alternatives emphasizing increased urban flood protection, reduced agricultural intensification, and fewer adverse environmental impacts has been evaluated. This report presents the results of studies that evaluate the feasibility of alternatives to address the flooding problems and meet the environmental and economic objectives of the area.

Flooding problems in the Yazoo Backwater Study Area are significant. Approximately 630,000 acres are subject to inundation by the 100-year flood event of which approximately 316,000 acres are cleared.

The recommended plan for the Yazoo Backwater Area consists of a 14,000-cfs pump station with a pump-on operation elevation of 87.0 feet, NGVD, at the Steele Bayou structure; perpetual easements from willing sellers and reforestation/conservation measures on up to 55,600 acres of agricultural land primarily at or below the pump elevation (1 year base condition frequency level at the Steele Bayou structure); and modified operations of the Steele Bayou structure to maintain water level elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. This plan reduces the number of residential and nonresidential structures impacted by flooding by 68.5 percent and reduces flood damages for all damage categories by 75.2 percent. Returns to agricultural interests are increased while at the same time, the recommended plan provides significant environmental benefits to the area. While this plan allows the 1-year flood plain or 216,000 acres to flood prior to pump station operation, it does lower the 100-year flood event by 4 to 4.5 feet.

Accomplishments of the recommended plan include:

a. Meets OMB study directives.

   (1) Greater levels of flood protection for urban areas.

   (2) Reduced levels of agricultural intensification.

   (3) Reduced adverse impacts on the environment.

b. Requires perpetual easements from willing sellers only.

c. Maintains private ownership of reforested lands.

d. Includes reforestation/conservation features as a Federal cost.

e. Reforestation will increase 1-year fish spawning habitats.

f. Provides for a net gain in wetland functions.

g. Raises water levels during low flow season, thereby improving standing stock and production of many fish species.

h. Restores habitat for the threatened Louisiana black bear and the endangered plant, pondberry.

i. Includes a Memorandum of Agreement between the Vicksburg District and the U.S. Fish and Wildlife Service (FWS) for the establishment of two new pondberry colonies within the study area.

j. Reduces forest fragmentation within study area.

k. Restores habitat which has transcontinental significance for Neotropical forest breeding birds and migratory shorebirds.

l. Restores waterfowl habitat to one of seven priority conservation areas within the United States under the North American Waterfowl Management Plan.

m. Provides for increased organic matter, which is the basis of the food chain in this heterotrophic system.

n. Reduces sediment and nutrient loading to receiving streams, thereby improving water quality.

o. Improves recreational opportunities within the study area.

In summary, conclusions are that the features of the recommended plan are economically and environmentally sustainable, at an estimated Federal cost of $220.1 million. The annual costs are $15.1 million with annual benefits of $21.3 million with a benefit-cost ratio of 1.5, including employment benefits. The plan is the most balanced, implementable approach, and meets the economic and environmental needs of the basin. Reforestation/conservation features on up to 55,600 acres, primarily at or below the 1-year flood plain as a nonstructural flood damage reduction feature, is a multibenefit approach to addressing the needs and opportunities in the study area. Based on impact methodologies that address both habitat quantity and quality,

the alternative results in a 11.2 percent increase in terrestrial resources, 19.5 percent increase in wetland resources, a 52.8 percent increase in waterfowl forage habitat value, 30.3 percent increase in aquatic spawning resources, and 8.0 percent increase in aquatic rearing resources. Mitigation to offset adverse environmental impacts is included within the nonstructural component of the recommended plan.

Implementation of the recommended plan, along with operation and maintenance requirements, will be the responsibility of the Federal government. The project sponsor--Board of Mississippi Levee Commissioners--will perform minor maintenance on the completed project.

A project summary brochure has been prepared to give a reviewer an overview of the project and the studies conducted. A DVD video is also included in the project summary brochure to help the reviewer understand the problems and needs of the study area and how the recommended plan would operate. The Main Report and Final Supplemental Environmental Impact Statement summarize the economic, environmental, and engineering evaluations conducted, the various arrays of alternatives, and the selection of a recommended plan. Technical appendixes are included, allowing the reviewer more detailed information of how the evaluations were conducted. See the Table of Contents in the Main Report for a complete listing of technical appendixes.

In summary, the recommended plan provides for a balanced approach to the economic development and environmental needs of the area.

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a/ Also includes a Final Supplemental Environmental Impact Statement.

LIST OF APPENDIXES

YAZOO BACKWATER AREA REFORMULATION

MAIN REPORT

STUDY AUTHORITY

1. The Yazoo Basin, Yazoo Backwater, Mississippi, Project was authorized by the Flood Control Act (FCA) of 18 August 1941 (House Document (HD) 359/77/1, as amended by the Acts of 22 December 1944 and 27 October 1965 (HD 308/88/2) and the Water Resources Development Act of 1986 and 1996. Authorized flood control features include levees, associated drainage channels, pump stations, and floodgates. The Yazoo Backwater Area is divided into five subbasins: (a) the Satartia Area, (b) the Satartia Extension Area, (c) the Rocky Bayou area, (d) the Carter Area, and (e) the Yazoo Area. The area locations and the authorized flood control features are shown on Plate 4-1.

2. Flood protection for the entire Yazoo Backwater Area was authorized by Section 3 of the FCA of 18 August 1941, which was a compromise between Mississippi and Louisiana Congressional delegation for increasing the flooding in the Yazoo Backwater Area due to the abandonment of the Eudora Floodway and raising the levee heights along the Mississippi River. The act states in part:

> "(b) The project for flood control of the Yazoo River shall be as authorized by the Flood Control Act approved June 15, 1936, as amended, by Section 2 of the Act approved June 28, 1938, except that the Chief of Engineers may, in his discretion, from time to time, substitute therefore combinations of reservoirs, levees, and channel improvements; and except that the extension of the authorized project and improvements contemplated in Plan C of the report of March 7, 1941, of the Mississippi River Commission is authorized."

STUDY GUIDANCE

3. The Yazoo Basin, Yazoo Backwater Project, Mississippi, Reformulation Study is being conducted by the U.S. Army Corps of Engineers, Vicksburg District, in partial response to directives from the Assistant Secretary of the Army (Civil Works) and the Director of Civil Works in January 1989 and February 1990 requesting the Vicksburg District reformulate the project and identify, display, and evaluate the alternatives. This guidance was also included in a directive from the Office of Management and Budget (OMB) contained in the Fiscal Year 1991 Budget Passback and reads as follows:

"Yazoo Basin Study (MS): The mark includes the requested funding for a restudy of the Yazoo Basin Project. However, in response to the request for review and redesign of the project by the Governor of Mississippi, a reformulation report shall be prepared to identify, display, and evaluate alternative plans for 1) greater levels of flood protection for urban areas; 2) reduced levels of agricultural intensification; and 3) reduced adverse impacts of the environment. The scope of the reformulation should encompass alternative reservoir operations, and flood damage reduction alternatives for the Yazoo Backwater Area in addition to the Yazoo Backwater Pump station. Methodology of the report shall be in accordance with the Principles and Guidelines, including full consideration of predominantly nonstructural and nontraditional measures. Compliance with the Fish and Wildlife Coordination Act and the National Environmental Policy Act shall be integrated with the preparation of the reformulation report. The reformulation report should be transmitted to OMB by the fourth quarter of FY 1991.

Consistent with existing Army guidance, no new contracts should be awarded until the reformulation report is approved by OMB."

4. At the time of this guidance, reformulation was limited to 2 years and one report. However, as time progressed, it was apparent that detailed studies would take more time and resources. It would require four phases and could not be completed by the fourth quarter of Fiscal Year 1991, and that in lieu of one report, four reports would be required. Even the first two phases--Upper Steele Bayou Project and Upper Yazoo Projects (UYP)--were not completed by the fourth quarter of Fiscal Year 1991. When these two phases were essentially completed, the next phase--Yazoo Backwater–was initiated in 1993. This phase has taken considerably more time and resources due to the amount of coordination undertaken and the number of alternatives evaluated. The final phase—the Yazoo Tributaries reformulation—will be initiated in FY 08.

STUDY PURPOSE AND SCOPE

5. This report is in partial response to the OMB directive. Four areas were identified for reformulation under the directive: Upper Steele Bayou Project, UYP, Yazoo Backwater Project, and Yazoo Tributaries Project. Reformulation reports for the Upper Steele Bayou Project and the UYP were completed in December 1992 and December 1993, respectively. Reformulated projects were developed that are economically justified and environmentally sustainable. The reformulation report for Upper Steele Bayou Project was approved by Headquarters, U.S. Army

Corps of Engineers (HQUSACE) in June 1993. The UYP report was approved by HQUSACE in June 1994. Construction on the Upper Steele Bayou Project is essentially complete while construction of the UYP is continuing. The UYP is scheduled for completion in FY 2015. Reformulation studies for the Yazoo Tributaries Project will be initiated in FY 08.

6. According to the OMB guidance, "the scope of the reformulation should encompass alternative reservoir operations and flood damage reduction alternatives for the Yazoo Backwater Area in addition to the Yazoo Backwater Pump station." This OMB guidance encompasses four projects as previously stated; however, only the UYP and the Yazoo Tributaries Project are influenced by reservoir operations. Reservoir operations were considered as part of the completed UYP at which time it was determined that the optimum operation had already been established but could not be maintained due to lack of channel capacity. Since reservoir operations have been addressed under the UYP, this will not be readdressed under the Yazoo Tributaries Reformulation Project. The guidance to consider flood damage reduction measures was followed in completing the UYP and Upper Steele Bayou reformulation as well as in the current Yazoo Backwater Reformulation Study.

7. The purpose of this Reformulation Study is to review the uncompleted features of the authorized Yazoo Backwater Project and determine if features are economically feasible and environmentally sustainable. This study will also examine if the uncompleted features are the best alternative for meeting the Yazoo Backwater Area's current and future flood damage reduction needs.

8. The Yazoo Backwater Area is located in west-central Mississippi immediately north of Vicksburg, Mississippi. The Yazoo Backwater Area contains about 1,074,000 acres and is the area that has historically been subject to flooding from backwater by the Mississippi River. The area is also subject to headwater flooding from the Yazoo River, Sunflower River, and Steele Bayou. The area is divided into five subareas: (a) the Satartia Area, 28,800 acres; (b) the Satartia Extension Area, 3,200 acres; (c) the Rocky Bayou Area, 14,080 acres; (d) the Carter Area, 102,400 acres; and (e) the Yazoo Area, 926,000 acres (see Plate 4-1). The Yazoo Area is the focus of this study and will be referred to as the Yazoo Backwater Project Area. The Yazoo Backwater Project Area is bounded on the west by the left descending bank of the mainline Mississippi River levee, on the east by the west bank levees of the Will M. Whittington Auxiliary channel and the connecting channel, and the Yazoo River on the south (926,000 acres). The Yazoo Backwater Study Area encompasses those lands within the 100-year flood frequency, approximately 630,000 acres.

9. This study is comprised of a main report (which includes the Final Supplemental Environmental Impact Statement (FSEIS)) and supporting documentation. The main report discusses existing conditions, problems and opportunities, plan formulation, evaluation of alternatives, public involvement, and presents the results of the reformulation study and the recommendation. The FSEIS addresses potential environmental impacts, cumulative impacts,

minimization and avoidance features and outlines compensatory requirements. The study's supporting documentation includes mitigation, Fish and Wildlife Coordination Act (FWCA) Report, Section 404(b)(1) evaluation, coordination, engineering investigations, economics, socioeconomics, real estate, environmental analyses, cultural resources, threatened and endangered species, water quality, and the Environmental Protection Agency's (EPA) Virginia Tech University Report. All supporting documentation is presented in 17 technical appendixes. The study has been prepared in accordance with Engineer Regulation 1105-2-100, "Planning Guidance Notebook" (22 April 2000), including the Economic and Environmental Principles for Water and Related Land Resource Implementation Studies (3 February 1983), and the Economic and Environmental Guidelines for Water and Related Land Resources Implementation Studies (10 March 1983), commonly referred to as the Principles and Guidelines.

THE REPORTING PROCESS

10. This study, which includes the FSEIS and appendixes, is in response to the referenced authorities and guidance. The report presents a project alternative that addresses the flooding problems and includes environmental features which help to restore some of the area to a forested condition.

11. The Vicksburg District furnished the Draft Report and Draft SEIS to Federal, state, and local agencies and the public for review in September 2000. Comments from the review of the Draft Report and Draft SEIS and from the public meeting, held on 9 November 2000, have been addressed with additional nonstructural alternatives evaluated, and the recommended alternative revised with updated information, which has resulted in this Final Report and FSEIS. This Final Report includes responses to comments received from the review of the Draft Report and Draft SEIS (Appendix 5). The Vicksburg District again will forward the Final Report and FSEIS to Federal, state, and local agencies and the public for final review and comment.

12. As a part of the public involvement process, the Vicksburg District will conduct a public review of the Final Report and FSEIS. The review period will be initiated the day the filing is placed in the Federal Register, a process performed by EPA. Approximately 30 days after the filing, the Vicksburg District will hold a public meeting to receive comments on the Final Report and FSEIS. The comment period will last an additional 30 days after the public meeting. After the comment period has expired, the Final Report, along with the comments received, will be submitted to the President, Mississippi River Commission (CEMRC). The President will sign the Record of Decision (ROD) and issue a Notice of Availability.

13. Upon release of the Final Report and FSEIS, the Vicksburg District will request water quality certification from the Mississippi Department of Environmental Quality (MDEQ). The MDEQ will also be soliciting input from the public as it relates to issues of this permit.

AUTHORIZED PROJECT

14. The 7 March 1941 report by CEMRC, which is printed in HD 359, 77th Congress, was prepared in response to resolutions by the Committee on Flood Control, House of Representatives, and the Committee on Commerce of the Senate, dated 2 August 1939 and 12 March 1940, respectively.

15. The FCA of 1941 authorized the extension of the east bank mainline Mississippi River levee, generally upstream along the west bank of the Yazoo River for a distance of about 54 miles to a connection in the vicinity of Yazoo City, Mississippi, with the Yazoo River levee feature of the Yazoo Basin Headwater Project. A structure was included at Little Sunflower River, and a combination of structures and pump stations at Big Sunflower River, Deer Creek, and Steele Bayou with a total pumping capacity of 14,000 cubic feet per second (cfs) were planned. The capacities of the three pump stations were to be 11,000, 700, and 2,300 cfs for the Big Sunflower River, Deer Creek, and Steele Bayou, respectively. By closing the structures and operating the pumps when the Yazoo River reaches elevation 80.0 feet, National Geodetic Vertical Datum (NGVD), the pumping capacity of 14,000 cfs would prevent the elevation of water ponding behind the structures from rising above 90.0 feet, NGVD, more often than once in 5 years (i.e., the 5-year frequency event with pumps would be elevation 90.0 feet or less). The Act also provided for the enlargement of 7 miles of levee in the Rocky Bayou Area, and the adjustment in the discretion of the Chief of Engineers of grades of existing levees on the east bank of the Yazoo River, all as contemplated in Plan C of the report of CEMRC, dated 7 March 1941. The Act provided that the Chief of Engineers should fix the grade of the extension levees so that their construction would give the maximum practicable protection to the Yazoo Backwater Area without jeopardizing the safety of the mainline Mississippi River levees.

16. The FCA of 1944 extended the project, at the discretion of the Chief of Engineers, to include 38 miles of levees on the east bank of the Yazoo River (the Satartia and Satartia Extension Areas).

17. The Committee on Public Works of the U.S. Senate on June 12, 1954, adopted a resolution calling on the Chief of Engineers to "examine and review the project for flood control of the Mississippi River in its alluvial valley . . . as authorized by the Flood Control Act approved May 15, 1928, as amended by subsequent Acts of Congress, as one comprehensive whole and in its entirety, and to submit at the earliest practicable date recommendations for any modifications that are advisable with respect to the project or any feature of the project." In response, and in accordance with instructions from the Chief of Engineers, the Vicksburg District created a

document that became Annex L to the Comprehensive Review. That Annex addressed the Yazoo Backwater Project, Mississippi, and put forward a plan to connect the Sunflower and Steele Bayou ponding areas by a channel.

18. As a result of the Comprehensive Review of the Mississippi River and Tributaries Project Report dated 6 April 1962 (HD 308/88/2), the Chief of Engineers modified the authorized plan for the backwater area to include a connecting channel between the Sunflower River and Steele Bayou, with all interior drainage evacuated through the Little Sunflower and Steele Bayou structures. The Chief of Engineers Report reads in part as follows:

> ". . . I believe that, at some future time, protection of some areas in the Yazoo Backwater by pumping may be warranted. Since the new plan developed by the Mississippi River Commission is proposed for construction under existing project authorization, selection of this plan does not affect those authorizations, which I consider sufficiently broad to permit selection of location and capacities of pump stations, or a combination of gravity and pumped drainage, as future developments dictate."

19. Included in the recommended alternative was the purchase in fee title of 70,000 acres of land in the ponding areas and the operation of the ponding areas to produce optimum flood control and fish and wildlife benefits. These modifications were recognized by the FCA of 1965.

20. A report on Muddy Bayou (Eagle Lake) was prepared in December 1969 in response to requests by the Warren County Board of Supervisors, the Mississippi Game and Fish Commission, and other local interests. The report presented results of studies to determine the impacts of completed and authorized flood control works on Eagle Lake and to determine the feasibility and advisability of providing structural features for fishery management practices and improvement of water quality in the lake. As a result, the Yazoo Backwater Project was modified to include the Muddy Bayou Structure under the discretionary authority of the Chief of Engineers. The water control structure was approved in 1970. The structure allows manipulation of lake levels for improvement of water quality and fishery resources and also provides incidental flood protection for properties along Eagle Lake. This structure was completed in 1978.

21. The 23 July 1976, Yazoo Basin, Yazoo Backwater Area, Fish and Wildlife Mitigation Plan report proposed the implementation of an increment of structural features to mitigate fish and wildlife losses resulting from the constructed flood control works in the backwater area. The report was submitted for early action under the authority of the Yazoo Basin Comprehensive Study. The features proposed in the report were limited to only those mitigation features that might be implemented without acquiring additional lands because of then current U.S. Army

Corps of Engineers (USACE) policy to use existing public lands. The alternative recommended the construction of nine greentree reservoirs and nine slough impoundments on lands of the Delta National Forest under the discretionary authority of the Chief of Engineers. The recommended improvements were approved by the Chief of Engineers on 3 December 1976. During preparation of Design Memorandum No. 15 entitled Fish and Wildlife Facilities, Structural Measures, Delta National Forest dated 19 April 1979, approved by CEMRC, 11 June 1979, and with concurrence of the U.S. Department of Agriculture (USDA) Forest Service, the nine greentree reservoirs were reduced to four and the nine slough control structures were reduced to five. Four of the slough control structures and one of the greentree reservoirs were eliminated due to unsuitable site conditions. Due to problems with the existing easement, one additional greentree reservoir was deleted. The Vicksburg District eliminated three of the reservoirs because the USDA Forest Service informally indicated that it did not want any more greentree reservoirs built in the Delta National Forest. Additionally, the District obtained approval by letter report dated 14 March 1979, approved by the Mississippi River Commission 6 March 1980, to construct a boat-launching ramp on the Little Sunflower River mitigating the loss of access caused by construction of the Little Sunflower River drainage structure. The USDA Forest Service agreed to operate and maintain the boat ramp in accordance with other features constructed in the Delta National Forest. Currently, the greentree reservoirs and the slough control structures are being operated by the USDA Forest Service, but are being maintained by the Vicksburg District. In summary, four greentree reservoirs, five slough control structures, and one boat ramp have been completed by the Vicksburg District. Prior to the construction of the greentree reservoirs by the Vicksburg District, the Mississippi Department of Wildlife, Fisheries and Parks (MDWFP) constructed one greentree reservoir and continues to manage it. In recent years, Ducks Unlimited constructed several water control structures within the Delta National Forest.

22. A reevaluation of the economic feasibility of the pump stations features of the backwater project was completed by the Vicksburg District in 1982. The results of the reevaluation are presented in the Yazoo Basin, Yazoo Backwater Area, The Yazoo Pump Project report dated July 1982 and revised November 1982.

23. The alternatives considered during the 1982 reevaluation study were:

a. Nonstructural features.

(1) Floodproofing.

(2) Permanent evacuation of flood plain.

(3) Acquisition.

b. Levee system along both sides of the Sunflower River.

c. Dual pump stations at the mouth of the Little Sunflower River and Steele Bayou.

d. Alternative pump sizes at Steele Bayou:

(1) 10,000 cfs

(2) 15,000 cfs

(3) 17,500 cfs

(4) 20,000 cfs

(5) 25,000 cfs

(6) 30,000 cfs

e. Alternate pumping criteria:

(1) Initiate pumping at 80.0 feet, NGVD, year-round.

(2) Initiate pumping at 80.0 feet, NGVD, during cropping season; initiate pumping at 85 feet, NGVD, 1 December to 1 March and allow ponding to occur as it would under existing conditions up to elevation 85.0 feet, NGVD, 1 December to 1 March.

(3) Initiate pumping at 80.0 feet, NGVD, during cropping season; initiate pumping at 85 feet, NGVD, 1 December to 15 March and induce ponding up to elevation 85.0 feet, NGVD, 1 December to 15 March.

(4) Initiate pumping at 80.0 feet, NGVD, during the cropping season and initiate pumping at 85.0 feet, NGVD, during 1 December to 15 March and induce ponding up to elevation 80.0, NGVD, 1 January to 15 April.

(5) Initiate pumping at 85.0 feet, NGVD, year-round.

(6) Initiate pumping at 83.0 feet, NGVD, during the cropping season and initiate pumping at 85.0 feet, NGVD, during 1 December to 1 March.

(7) Initiate pumping at 90.0 feet, NGVD, year-round.

24. The economic analyses were conducted at both the current interest rate at the time and the authorized interest rate of 2-1/2 percent. The designated National Economic Development (NED) Plan was a 25,000-cfs pump station at Steele Bayou with pumping initiated at 80.0 feet,

NGVD, during the cropping season and 85 feet, NGVD, during the period 1 December to 1 March. The NED Plan had a first cost of $210.9 million annual excess benefits of $18.7 million, and a benefit-cost ratio of 3.0. The designated Environmental Quality (EQ) Plan was a 15,000-cfs pump station at Steele Bayou with pumping initiated at 85.0 feet, NGVD, year round. The EQ Plan also included the acquisition of 30,000 acres of wooded lands. The first cost for the EQ Plan was $162.8 million. The excess benefits were $4.7 million and the benefit-cost ratio was 1.8. The alternative recommended as best meeting the area's flood control needs with minimal environmental impact was a 17,500-cfs pump station at Steele Bayou with pumping initiated at 80.0 feet, NGVD, during the cropping season and 85.0 feet, NGVD, during the period 1 December to 1 March. The recommended alternative had a first cost of $147.2 million, excess annual benefits of $15.4 million and a benefit-cost ratio of 3.3. At the then current interest rate of 7-5/8 percent, the recommended alternative became the NED Plan with excess annual benefits of $4.7 million and a benefit-cost ratio of 1.3. The recommended alternative also included the acquisition of perpetual easements on 6,500 acres of wooded lands or 6,000 acres in fee simple purchase or some combination of the 2 for the mitigation of potential environmental impacts from the Yazoo Area Pump Project.

25. The alternative recommended in the 1982 reevaluation was altered during OMB review. In December 1985, budgetary guidance from OMB directed that the work allowance for Fiscal Year 1986 should be used only to fully fund channel work and related real estate acquisition, to finance engineering and design for a pump station of approximately 10,000 cfs in lieu of the current 17,500 cfs, and to pay any outstanding commitments related to the current design.

26. Design documents completed include the following:

a. Pump and Driver Feasibility Study, May 1984.

b. Design Memorandum No. 18 - Site Selection, January 1985.

c. Channel Work Report, February 1985.

d. General Design Memorandum (GDM) No. 20, April 1985.

e. Supplement No. 1 to GDM No. 20, June 1987.

f. Design Memorandum No. 19 - Pump and Prime Mover, November 1988.

27. Technical Reports prepared by the U.S. Army Engineer Research and Development Center (ERDC) (formerly the U.S. Army Engineer Waterways Experiment Station) for the alternate pump station include the following:

a. Pump station Inflow-Discharge Hydraulics, Generalized Pump Sump Research Study, HL-88-2, February 1988.

b. Formed Suction Intake Approach Appurtenance Geometry, HL-90-1, and February 1990.

c. Yazoo Backwater Pump station Discharge Outlet, HL-90-4, May 1990.

28. The July 1982 reevaluation report for the Yazoo Area pump project and the July 1982 Fish and Wildlife Mitigation Report for the Yazoo Area pump project and Yazoo Area and Satartia Area Backwater Levee Projects contained recommendations for both fee title and easement acquisition of forested lands to compensate for impacts from the construction and operation of the 17,500-cfs pump station and levee features (see tabulation below). Both reports recommended that purchase can be accomplished under either easement or fee title or some combination of easement and fee title acquisition that satisfied the mitigation requirement. No mitigation land was purchased as a part of this mitigation report. Mitigation requirements for all the Yazoo Area and Satartia Area levees were reevaluated by the October 1989 report as discussed in paragraph 29, and the Yazoo Backwater pump project is being reevaluated under this report.

July 1982 Mitigation Acreage Summary		
Feature	Easement	Fee Title
Pump station	6,500	6,000
Levees	33,500	26,800
Total	40,000	32,800

SOURCE: July 1982 Fish and Wildlife Mitigation Report, Yazoo Area Pump Project and Yazoo Area and Satartia Area Backwater Levee Projects.

29. The Water Resources Development Act (WRDA) of 1986 authorized the acquisition of perpetual easements on 40,000 acres of woodlands for mitigation of project-induced fish and wildlife losses within the Yazoo Backwater Area as recommended by the Vicksburg District in the July 1982 Reevaluation Report. WRDA 1986 also changed the cost-sharing provisions of local interests for USACE projects nationwide. Under the new provisions, the local project sponsor would provide the lands, easements, rights-of-way, relocations and disposal areas for the project or 25 percent of the construction cost whichever is greater. These new provisions were applicable to all projects or separable elements thereof, on which construction was initiated after 30 April 1986. The Rocky Bayou features, the Carter Area features, and the uncompleted features for the Yazoo Area were all deemed to be separable elements of the Yazoo Basin Backwater Project, and therefore, subject to the new cost-sharing provisions.

30. In October 1989, the Vicksburg District prepared the Yazoo Backwater Area, Mississippi, Yazoo Basin, Mississippi, Mitigation Plan report. The report presented a proposal to implement mitigation through compensation for terrestrial wildlife losses that resulted from the construction and operation of the Yazoo Area and Satartia Area Backwater Levee Projects. Potential environmental impacts for the Yazoo Area pump station feature were not considered. Alternatives considered included:

a. Development of existing public lands.

b. Fee title acquisition and management of wooded lands.

c. Perpetual land use easement acquisition of wooded lands.

d. Fee title acquisition of cleared lands with reforestation/regeneration.

Fee title acquisition of 8,400 acres of frequently flooded cleared lands with reforestation was selected as the best alternative for mitigating the wildlife losses in lieu of the mitigation plan approved by WRDA 1986. The report recommended the acquisition of lands from willing sellers and identified several properties that were currently available. The recommendation was implemented with the acquisition of the 8,800 acres of frequently flooded cleared lands referred to as the Lake George Property in 1990. However, the entire 8,800 acres included some existing levees, channels, and roads, and therefore, did not fully offset the required mitigation.

31. The WRDA of 1996, Section 102(a)(2) amended Section 103(e)(1) of WRDA 86 by defining physical construction as the date of construction contract award (25 March 1986 for the authorized backwater pump station). Since a contract on the pump station was awarded before April 30, 1986, this modification in effect changed local cooperation requirements for the pump station to those of the original authorized project.

STATUS OF OTHER PROJECTS

SATARTIA AREA

32. The Satartia Area is south of the town of Satartia, Mississippi, between the Yazoo River on the west and the hill line on the east. The area comprises 45 square miles including the town of Satartia. Protection of this area was completed in November 1976. Completed works include about 20 miles of loop levee tying into the hill line and a gravity structure with floodgate.

SATARTIA EXTENSION AREA

33. This area is south of the Satartia Area between the Yazoo River on the west and the hill line on the east. The area comprises only 5 square miles. Protection could be provided by a loop levee 8.2 miles long, tying to the hills. Drainage would be provided through a floodgate. No flood control features have been initiated at this time.

ROCKY BAYOU AREA

34. The Rocky Bayou Area is south of the city of Yazoo City, Mississippi, between the Yazoo River on the west and the hill line on the east. The area comprises about 22 square miles. The area is now afforded a fair degree of protection by a locally constructed levee which is deficient in both grade and section. Drainage is provided by a floodgate through this levee near its southern tie to the hills. Protection for this area, equal to that provided other areas in the Backwater Area, would be provided by enlarging the section, raising the levee grade, and replacing the existing floodgate. Two items of work have been accomplished. One item consisting of 3.0 miles of levee enlargement and the other consisting of 0.7 mile of levee enlargement and a small structure were completed in 1987. Enlargement of the 3 miles of the levee along the hill line was completed in conjunction with relocation work by the Mississippi Department of Transportation on Mississippi State Highway 3. No work on the remainder of the project features has been initiated.

CARTER AREA

35. The Carter Area contains about 160 square miles, approximately 102,000 acres, and is bounded by the Yazoo River on the east and the Will M. Whittington Auxiliary Channel on the west. The area begins just upstream of the confluence of the Big Sunflower and the Yazoo Rivers and extends northward to the latitude of Yazoo City. Yazoo Basin Headwater Project levees are located along the Will M. Whittington Auxiliary Channel and along the west bank of the Yazoo River upstream of Yazoo City. A large portion of the project area has been dedicated to manage natural resources. The FWS manages the 28,600-acre Panther Swamp National Wildlife Refuge (NWR) for fish and wildlife purposes, 20,300 acres of which are in the Carter Area. About 1,200 acres of the 8,800-acre Lake George Wildlife Wetland Restoration Project are within the Carter Area. Improvements authorized for this area consist of approximately 29 miles of levee and one major structure. No work has been initiated on this project.

36. Proposed flood control features include a levee along the west bank of the Yazoo River extending from the east bank levee of the Will M. Whittington Auxiliary Channel on the south to the intersection of the west bank Yazoo River headwater levee at Yazoo City. Interior drainage would be evacuated through a drainage structure at the southern end of the project area. No work on the flood control features has been initiated.

YAZOO AREA

37. The Yazoo Area is the focus of this study and will be referred to as the Yazoo Backwater Project Area. The Yazoo Backwater Project Area is located between the east bank mainline Mississippi River levee and the Will M. Whittington Auxiliary Channel. The area comprises about 926,000 acres. The Yazoo Backwater Study Area under consideration in this study is that part of the Yazoo Area inundated by the 100-year flood event and includes about 630,000 acres in parts of Humphreys, Issaquena, Sharkey, Warren, Washington, and Yazoo Counties in Mississippi and part of Madison Parish in Louisiana. The area extends north from Vicksburg, Mississippi, a distance of about 65 miles to the latitude of Belzoni, Mississippi. About 54 percent of the study area is cleared, 40 percent is in woodlands and 6 percent in water. Public wooded areas within or adjacent to the project area include (a) Delta National Forest (59,000 acres), (b) Yazoo NWR (10,200 acres), (c) Issaquena County Game Management Area (13,000 acres), (d) Twin Oaks Mitigation Area (5,800 acres), (e) Mahannah Mitigation Area (12,000 acres), (f) Panther Swamp NWR (28,600 acres), and (g) Lake George Wildlife Management Area (WMA) (8,800 acres). Big Sunflower and Little Sunflower Rivers, Deer Creek, and Steele Bayou flow through the area. The high ground along Deer Creek forms a natural divide between Steele Bayou and the Sunflower River Basins. About 80 percent of the drainage into the Yazoo Area is from the Sunflower River Basin.

38. Completed flood control works for the Yazoo Area include a levee system approximately 27 miles in length, extending from the south end of the east bank mainline Mississippi River levee generally upstream along the west bank of the Yazoo River to a connection with the west bank levee of the Will M. Whittington Auxiliary Channel. This levee system is complete to a grade of 107 feet, NGVD, and includes two structures (one with 19,000-cfs design discharge capacity at the mouth of Steele Bayou and one with 8,000-cfs design discharge capacity at the mouth of Little Sunflower River). A 15.2-mile-long channel was completed in 1978 from the Big Sunflower River to the Little Sunflower River and from there to Steele Bayou, connecting the Sunflower River and the Steele Bayou interior ponding areas. The levee feature was also completed in 1978. The Little Sunflower structure was completed in 1975. The Steele Bayou structure was completed in 1969. The Muddy Bayou control structure was completed in 1977.

The entrance and exit channel for the authorized pump station and cofferdam were completed in 1987 at a cost of about $2,500,000. As a part of the construction of the inlet and outlet channel, the Vicksburg District acquired 385.12 acres in fee title and 2.13 acres in perpetual easements. A major portion of this area has been maintained under a licensing agreement with the Board of Mississippi Levee Commissioners.

YAZOO BACKWATER LEVEE MITIGATION

39. The environmental impacts from the completed flood control features (levees, structures, and connecting channel) of the Yazoo Basin, Backwater Area Project have been partially mitigated. The completion of the Muddy Bayou Structure in 1978 mitigated the projected backwater project impacts to the fishery resources. To mitigate the terrestrial losses resulting from the constructed levees, structures, and connecting channel, four greentree reservoirs and five slough control structures have been constructed on the Delta National Forest lands, along with the acquisition and reforestation of 8,800 acres of frequently flooded cleared lands (Lake George WMA), was completed in 1998. Due to the timing of the acquisition of the Lake George WMA (1990) in relationship to when the terrestrial losses occurred in the construction of the Yazoo Backwater levees (1978) and reviewing those areas within Lake George WMA that could not be reforested, the Vicksburg District in consultation with the FWS agreed to reevaluate the compensatory mitigation requirements for the Yazoo Area and Satartia Area Backwater Levee Projects as a part of this reformulation of the Yazoo Backwater Area. This analysis is included in Appendix 1.

WILL M. WHITTINGTON
AUXILIARY CHANNEL

40. The Will M. Whittington Auxiliary Channel, completed in 1962, is an integral part of the flood control plan for the Yazoo Basin allowing a major portion of the floodflow in the Yazoo River near Silver City, Mississippi, to flow down the channel and reenter the Yazoo River near the mouth of the Big Sunflower River. This leveed floodway splits the flows of the Yazoo River providing reduction in flood stages on the Yazoo River. Constructed works consist of 30.8 miles of channel work, 61.3 miles of levees, and associated landside channel work and weirs.

MISSISSIPPI RIVER LEVEES

41. The Mississippi River Levees project was authorized by the FCA of 15 May 1928, as modified and amended in subsequent Acts of 23 April 1934, 15 June 1936, 18 August 1941, 24 July 1946, and 27 October 1965. The Mississippi River levees prevent inundation of the alluvial valley of the lower Mississippi River which begins at Cape Girardeau, Missouri, and gently slopes to the Gulf of Mexico. The main stem levees protect a number of major cities and

towns as well as highly developed industrial areas and very valuable farmlands, including wildlife habitats of woodlands and marshes. The Mississippi River levees protect the alluvial valley against the Project Design Flood (PDF) by confining flow to the leveed channel except where it enters natural backwater areas or is diverted purposely into floodway areas.

42. After the devastating 1927 flood, Congress passed the 1928 Flood Control Act (FCA). This act included a cutoff and channel realignment program, which was initiated in 1932, for the middle section of the Mississippi River. By 1941 this program was beginning to show benefits which included an increased channel carrying capacity and lower river stages. Features for the Yazoo Backwater Area were authorized by the FCA of 1941 and represented a major compromise between the States of Arkansas, Louisiana, and Mississippi. The Arkansas and Louisiana congressional delegations wanted the Boeuf and Eudora Floodways on the west bank of the Mississippi River closed. The Mississippi congressional delegation wanted the floodways to remain open. Closing the floodways would put an additional 700,000 cubic feet per second (cfs) of floodwater flow back into the Mississippi River during the PDF. This additional flood flow would raise stages of the Mississippi River at Vicksburg by 5 to 6 feet and induce more flooding in the Yazoo Backwater Area. As a compromise to the closing of the floodways, Congress authorized an increase in the height of the Mississippi River levees and provided for flood protection to the Yazoo Backwater Area through a combination of levees, associated drainage channels, floodgates, and pump stations. The FCA of 1941 authorized three pump stations with a combined pump capacity of 14,000 cfs. To date, the Backwater levee, three structures, and the connecting channel have been completed. By constructing the connecting channel, one pump station with a combined capacity of 14,000 cfs could be constructed in lieu of the three authorized pump stations with the same total capacity. The observed benefits from the cutoff and channel realignment program may have played a role in changes authorized by the FCA of 1941. However, recent hydrologic studies conducted as part of this study reveal that these benefits have largely been reversed and peak stages on the Mississippi River at Vicksburg gage are returning to the levels observed prior to the channel cutoff and realignment program. Therefore, the Yazoo Backwater Area is subject to higher flood stages than those that Congress attempted to address in the 1941 FCA.

43. A major Mississippi River flood in 1973 led to the development of the Refined 1973 MR&T Project Flood Flowline which enabled levee deficiencies along the main stem levees to be identified. An EIS was prepared in 1976 which identified the deficiencies in the levees and the environmental impacts of the additional work. A reevaluation of the project was completed in 1998 on the remaining work along with a Supplement to the final EIS. This report documented that of the 460.4 miles of levee in the Vicksburg District, 216.8 miles need to be enlarged and raised to grade with placement of approximately 57.4 miles of seepage control features. Of these amounts, 69.4 miles of levee enlargement and approximately 30 miles

of associated seepage control are required in Mississippi generally in the area south of Greenville, Mississippi. This work is ongoing. During high stages on the Mississippi River, seepage enters into the Backwater Area from beneath the Mississippi River levee. Although the Vicksburg District cannot prevent the seepage, it is managing it by the construction of relief wells and seepage berms to protect the integrity of the Mississippi River levee.

BIG SUNFLOWER RIVER

44. The Big Sunflower River Basin project was first authorized by the FCA of 22 December 1944 and subsequently amended by the FCAs of 24 July 1946 and 17 May 1950. These Acts provided for channel improvement for flood damage reduction in the alluvial valley of the Mississippi River.

45. The primary purpose of the Big Sunflower River Basin project was to alleviate flooding in the basin through channel improvements on the Big Sunflower, Little Sunflower, Hushpuckena, and Quiver Rivers and their tributaries, and on Hull Brake-Mill Creek Canal, Bogue Phalia, Ditchlow Bayou, Deer Creek, and Steele Bayou. The authorized channel improvement works were incorporated into the MR&T Project by the FCA of 24 July 1946. The 1946 Act also altered the project to include upstream and downstream extensions as required. The FCA of 1950 modified local sponsor cooperation requirements by changing project right-of-way requirements from a non-Federal to Federal expense. The FCA of 23 October 1962 authorized improvements to Gin and Muddy Bayous in the Quiver River Basin. Additional work in the Steele Bayou area and water control structures in nine lakes for fish and wildlife purposes was authorized by the FCA of 27 October 1965. Expanded flood damage reduction work in Steele Bayou, Main Canal, and Black Bayou was approved by Congressional Public Works Committees on 15 and 17 December 1970.

Project History

46. The Big Sunflower River Basin project area encompasses approximately 4,200 square miles of alluvial flood plain (delta). The area is drained primarily by Steele Bayou, Deer Creek, Bogue Phalia, and the Quiver, Big Sunflower and Little Sunflower Rivers and their tributaries. The original Big Sunflower River Basin project provided for flood damage reduction and runoff improvements on 663.5 miles of rivers and streams within the Big Sunflower River Basin. Construction features within the Big Sunflower River Basin began in 1947 and were completed by 1968.

47. Approximately 194 miles of the Big Sunflower River were modified as authorized by the 1944, 1946, and 1950 FCAs. Modifications to Dowling Bayou and other tributaries of the Big Sunflower River were made under the same authority. Project works on the Big Sunflower River were completed in 1968. On the Little Sunflower River, channel modification work on

21.6 miles was completed in 1959. Most of the channel improvement works on the Big Sunflower and Little Sunflower consisted of clearing and snagging. Channel work on the Bogue Phalia involved clearing and snagging, limited channel enlargement, and channel cutoff work, all of which were completed by 1964. A summary of historical channel maintenance work within the lower Big Sunflower River Basin is given in Table 1.

BIG SUNFLOWER RIVER
MAINTENANCE PROJECT

48. Since completion of the original work in the 1960s on the Big Sunflower River Basin, the Board of Mississippi Levee Commissioners and Yazoo-Mississippi Delta Levee Board have been responsible for minor maintenance such as vegetation control, removal of drift material, and removal of sedimentation at the mouth of small tributaries. However, these local sponsors are not responsible for major maintenance.

49. In recent years, extensive annual flooding has occurred in the Big Sunflower River Basin. Numerous complaints from local sponsors, flood control interests, residents, and landowners were received by the Vicksburg District. Concerns were expressed that the project was not operating as intended and the District was asked to investigate the situation. Channel surveys and other engineering data collected indicated the Big Sunflower River and tributaries south of Highway 82 lost design capacity due to sedimentation and vegetation in the channels.

50. To lessen the impact of flooding, channel maintenance is planned on approximately 133.1 miles of streams. This includes the removal of approximately 8.42 million cubic yards of material along 104.8 miles of channel and clearing and snagging on 28.3 miles of channel. After avoiding and minimizing environmental impacts to the maximum extent practical, this project requires the purchase and reforestation of 1,912 acres of frequently flooded agricultural land to mitigate the environmental impacts.

TABLE 1
HISTORICAL BIG SUNFLOWER RIVER BASIN
CHANNEL IMPROVEMENT WORK
YAZOO BACKWATER AREA REFORMULATION

Location	Construction Dates	Type of Maintenance	River Mile
Big Sunflower River	09/22/47-11/17/47	Clearing and snagging	0.00 - 11.36
Big Sunflower River	10/06/47-11/13/48	Clearing and snagging	11.36 - 19.22
Holly Bluff Cutoff	06/05/56-03/01/59	Cutoff and weir	19.22 - 33.5
Little Sunflower River	11/05/56-10/15/59	Clearing and grubbing	6.14 - 27.75
Big Sunflower River	09/01/58-11/22/59	Clearing and snagging	33.50 - 99.00
Bogue Phalia	07/18/58-08/14-59	Channel enlargement and realignment	8.50 - 20.87
Bogue Phalia	02/10/59-02/24/60	Channel enlargement and realignment	30.00 - 47.0
Big Sunflower River	11/14/60-07/02/63	Clearing and snagging	99.00 - 169.5
Bogue Phalia	09/01/61-09/29/62	Clearing and snagging	60.27 - 82.78
Big Sunflower River	03/12/62-06/02/62	Channel enlargement and cleanout	33.50 - 35.82
Bogue Phalia	08/24/62-05/21/63	Clearing/snagging, cleanout, cutoff and enlargement	0.00 - 8.50
Bogue Phalia	08/24/62-07/10/63	Clearing/snagging and cleanout	23.84 - 30.00
Big Sunflower River	08/28/62-11/12/62	Clearing and snagging	28.30 - 57.00
Big Sunflower River	08/13/62-11/12/62	Clearing and snagging	57.70 - 78.13
Big Sunflower River	08/26-63-06/06/64	2 cutoffs	86.50 - 92.00
Bogue Phalia Cutoff	06/21/64-08/01-64	Clearing and snagging	0.00 - 4.16
Dowling, Ditchlow, and Twin Lakes	09/14/64-08/05/65	Clearing/snagging & cleanout	0-7.88, 0 - 4.16, 0 - 2.0
Big Sunflower, Mill Creek	11/15/64-11/02/65	Clearing/snagging and cleanout	199.42 - 210.78, 0-7.0
Gin/Muddy Bayou	2/15/68	Clearing/snagging and cleanout	0.0 – 12.8
Steele Bayou	11/10/44	Clearing and snagging	00.00 – 30.45
Steele Bayou	6/05/51	Channel enlargement	30.45 – 33.50
Steele Bayou	10/21/51	Clearing/snagging and cleanout	33.50 – 40.50
Steele Bayou	10/22/51	Channel enlargement	40.50 – 42.30
Steele Bayou	2/05/54	Cutoff and clearing/snagging	42.50 – 50.50
Steele Bayou	2/02/60	Clearing/snagging and cleanout	55.06 – 65.97
Steele Bayou	3/03/67	Enlargement	10.10 – 11.40
Steele Bayou	10/10/67	Enlargement	11.40 – 23.30
Steele Bayou	11/16/76	Enlargement (Item 30-A)	23.30 – 37.10
Steele Bayou	3/21/78	Enlargement (Item 43 –A)	37.10 – 46.20
Steele Bayou	5/01/79	Enlargement (Item 49-A)	46.20 – 51.60
Steele Bayou	12/07/84	Enlargement (Item 55-A)	51.60 – 63.00
Steele Bayou	8/17/90	Enlargement (Item 66-A)	63.00 – 68.70
Steele Bayou	10/06/91	Associated with structure	56.00
Steele Bayou	Under construction	Enlargement (item 66-A)	63.00 – 68.70
Steele Bayou	Under construction	Enlargement (item 66-B)	68.70 – 71.00
Steele Bayou	7/31/90	Associated with structure	Swan Lake
Steele Bayou	3/28/91	Associated with structure	Swan Lake
Steele Bayou	3/28/91	Associated with structure	Swan Lake
Steele Bayou	7/01/91	Associated with structure	Swan Lake
Steele Bayou	7/17/91	Associated with structure	Swan Lake
Steele Bayou	4/29/94	Associated with structure	Swan Lake

51. Subsequent to preparation of the Big Sunflower River Maintenance Project Final Environmental Impact Statement, date July 1996, opposition to the project had been expressed by several environmental organizations. The ROD was signed by the President, CEMRC, Major General Robert B. Flowers on 31 March 1997 and the Mississippi Water Quality Certificate was issued on 26 March 1998. Design of the first item of work (Item 3) was completed in June 1998. A contract was awarded for the work on 15 September 1999 and was completed on 6 July 2000. Item 3 consisted of 7.2 miles of clearing and snagging on the Little Sunflower River.

52. This work required the purchase and reforestation of 38 acres of frequently flooded agricultural land to mitigate for the environmental impacts. While it is the policy of the Vicksburg District to be concurrent with mitigation by project, mitigation is not usually purchased for an individual item of work. However, 287 acres of mitigation was purchased in November 2001 to offset the environmental impacts. Prior to awarding any additional items of work, the State Water Quality Certificate was revoked on 19 April 2001 due to a court challenge that has halted work on that project.

53. The Vicksburg District completed a draft Environmental Assessment (EA) in February 2002 to evaluate the information since the 1996 SEIS. This EA resulted in the preparation of a supplement to the SEIS. The Vicksburg District is reworking the 1996 SEIS utilizing many of the models and data described in this study. It will also include new engineering design concept that are more environmentally acceptable. This change could impact the amount of material removed from the streams as well as the number of stream miles impacted as discussed in the above paragraph.

54. The supplement is being prepared and is scheduled for public review in 2008. No maintenance work can proceed until a new SEIS has been completed, the Mississippi State Water Quality Certificate has been issued, and the ROD has been signed.

STEELE BAYOU

55. The Steele Bayou project was authorized by the FCA of 1944 and is a feature of the MR&T, Big Sunflower unit of the Basin. Subsequent modifications to the 1944 FCA provided for additional channel enlargement on Steele Bayou, extension of the channel work to the Steele

Bayou tributaries, Main Canal and Black Bayou and the construction of features to facilitate waterfowl and water quality in and around the Yazoo NWR (reference the 1992 Main Report and Final Supplement No. 1 to the Revised Final Environmental Impact Statement Upper Steele Bayou Project, Mississippi). The work on Steele Bayou is essentially complete except for some additional channel construction around the Yazoo NWR and some additional water control structures being installed downstream of the Yazoo NWR. The waterfowl and water quality features have been completed except for establishment of the final levee grades within the refuge. Most of this work is scheduled to be completed by 2008. This project is separate from the Yazoo Backwater Project, which includes the Steele Bayou structure.

56. Work on Main Canal and Black Bayou was reformulated in 1992 under the same reformulation authorization used in the Yazoo Backwater Area. This reformulation effort resulted in 25.3 miles of channel enlargement to Main Canal and improvements to two laterals in Greenville, Mississippi, 6.3 miles of selective clearing and snagging, 30.2 miles of channel cleanout on Black Bayou, and installation of 5 weirs and 78 water control structures.

57. Environmental losses were minimized through project design; however, remaining losses were compensated by the acquisition and reforestation of 5,250 acres of frequently flooded agricultural lands. For detailed information, reference Appendix 1, 1992 Main Report, and Final Supplement No. 1 to the Revised Final Environmental Impact Statement Upper Steele Bayou Project, Mississippi. Construction of the improvements on Main Canal and Black Bayou was begun in 1992 and was completed in 2001. Mitigation lands were purchased concurrently with construction.

PROJECT AREA

LOCATION

58. The Yazoo Backwater Project Area, as depicted on Plate 4-1, lies in west-central Mississippi between the mainline Mississippi River east bank levee and the hill line on the east. The triangular shaped area extends northward about 65 miles to the latitude of Hollandale and Belzoni, Mississippi, and comprises about 1,446 square miles (926,000 acres). Big Sunflower and Little Sunflower Rivers, Deer Creek, and Steele Bayou flow through the project area. These streams have a total drainage area of 4,093 square miles of the alluvial valley of the Mississippi

River and include a major portion of the Mississippi Delta (Plate 4-21). The drainage area extends from the confluence of Steele Bayou with the Yazoo River north to the vicinity of Clarksdale, Mississippi, and has an average width of approximately 30 miles. The Mississippi Delta alluvial plain is generally flat with slopes averaging 0.3 to 0.9 foot per mile. Drainage areas of the four basins are shown in the following tabulation:

Stream	Drainage Area (square miles)
Big Sunflower River	2,832
Little Sunflower River	309
Deer Creek	200
Steele Bayou	752
Total	4,093

Interior drainage of the area is accomplished by structures at Little Sunflower River (upper ponding area) and Steele Bayou (lower ponding area). The Yazoo Backwater Study Area consists of all lands flooded by the 100-year frequency flood (630,000 acres).

CLIMATE

59. The climate of the Yazoo Backwater Area is primarily humid, subtropical with abundant precipitation. The summers are long and hot; the winters are short and mild. The average annual temperature is about 65 degrees F. Average monthly temperatures range from 44 degrees F in January to 82 degrees F in July and extremes range from about -10 degrees F to 110 degrees F. The normal length of the frost-free growing season is slightly longer than 9 months.

PRECIPITATION

60. The average annual rainfall over the Yazoo Backwater Area is approximately 51 inches. Normal monthly rainfall varies from 5.81 inches in March to 2.58 inches in October. However, severe rainfall, producing locally intense runoff, can occur at any time of the year. Snowfall occurs about once a year with an average of less than 2 inches.

PHYSIOGRAPHY

61. The project area lies in the alluvial valley of the Mississippi River. The topography is characterized by relatively flat, poorly drained land with slopes of 0.3 to 0.9 foot per mile. Elevations range from 120.0 to 75.0 feet, NGVD, from north to south.

62. The alluvial valley was formed during the early Pleistocene epoch, or glacial period, at which time the Mississippi River became deeply incised in the coastal plain. The river gradually filled the valley with deposits of sand, silt, clay, and gravel during the Quaternary period. The deposits generally grade from coarse to fine, proceeding from deep to shallow with a clay cap typically found on the slopes. This material has been reworked as streams have meandered throughout the area. Depositional features resulting from this activity include abandoned course, abandoned channel, point bar, backswamp, braided stream, and natural levee. The relationship of streams under investigation to these features is discussed in the more detail in Appendix 6.

PLAN FORMULATION

EXISTING CONDITIONS

Socioeconomic Setting

63. An economic base area was selected for this study to determine the existing economic conditions and project future economic conditions with or without a flood control project. The area chosen, Sharkey and Issaquena Counties, comprises 87 percent of the Yazoo Backwater Study Area's land. In addition to Sharkey and Issaquena Counties, smaller portions of Humphreys, Warren, Washington, and Yazoo Counties in Mississippi and Madison Parish in Louisiana are included in the Yazoo Backwater Study Area.

64. Because of the fertile soil and mild climate of the Mississippi Delta, agriculture (primarily cotton) became the economic mainstay for the region beginning in the early 1800s. This resulted in clearing and draining of the forested bottom lands to facilitate agricultural production. Currently, 53 percent of the Study Area is devoted to agriculture. Catfish production in past years was an important agricultural activity in the study area accounting for 4 percent of the farmland acres. However, production has decreased in recent years. Other nonurban lands, including forest lands, wetlands, water bodies, etc., represent approximately 42 percent of the Study Area with urban lands less than 1 percent.

65. Other natural resources in the Study Area include water, forests, and mineral resources. Surface water resources other than project rivers and their tributaries include numerous lakes, ponds, and wetland areas. Ground-water resources are dominated by the Mississippi River alluvial aquifer, a prolific water-bearing strata used for irrigation, catfish production, and municipal and industrial (M&I) supplies. Deeper aquifers are primarily reserved for M&I use. Forest resources are comprised of bottom-land hardwoods which support numerous wildlife species. While significant reductions in forested acreage have occurred in the last 50 years, the

recent trend has been an increase in bottom-land hardwoods through reforestation under the Conservation Reserve Program (CRP) and Wetland Reserve Program (WRP). Sufficient acreage remains to support several timber-related industries in the study area. Of minor importance are clays and oil and gas reserves.

66. Human and cultural resources for the economic base area can be identified in terms of population, housing, transportation, communication, and utilities. The population of the Yazoo Backwater Economic Base Area has decreased from 17,869 in 1950 to approximately 8,854, based on the latest U.S. Census conducted in 2000. However, when the estimated population for the portions of the other Mississippi counties that are within the project area are included (i.e., Humphreys, Warren, Washington, and Yazoo), total population estimates approach 20,000 based on U.S. Census data for the year 2000.

67. The largest population center located in the economic base study area is Rolling Fork, Mississippi. Among the smaller communities impacted by backwater flooding are Cary, Eagle Lake, Fitler, Holly Bluff, Louise, Mayersville, and Valley Park, Mississippi.

68. Following the same trends as total population patterns of the area, housing in the Yazoo Backwater Study Area has been decreasing. The number of permanent housing units in the Yazoo Backwater Economic Base Area has decreased from 5,506 in 1950 to 3,293 in 2000, or approximately a 40 percent decline, while the average number of persons per household decreased from 4.0 in 1950 to 3.1 in 2000.

69. Transportation facilities provide access throughout the project area in the form of highways. Rolling Fork serves as a transportation hub since the major highways converge in the city.

70. Economic conditions can be described by parameters such as labor force and employment, earnings and income, agricultural activity, and industrial and business activity. The civilian labor force; i.e., nonmilitary, ranged from 3,268 in 1980 to 3,386 in 2000. These numbers were accompanied by unemployment figures ranging from 7.7 to 14.3 percent during the same period. Industrial employment has traditionally centered on activities related to agriculture in the Yazoo Backwater area. In 2000, five industry groups accounted for the majority of total employment in the Yazoo Backwater area. These include government (21.2 percent), farms (22.5 percent), agricultural services (16.4 percent), retail and wholesale trade (13.6 percent), and manufacturing (11.9 percent). Total agricultural employment (includes farms and agricultural services) comprised 38.9 percent of total employment in 2000 and supports a major portion of the wholesale and retail trade.

71. Earnings and income patterns provide further insight into the area economy. Earnings from manufacturing activities, as well as the farm industry, have declined percentage-wise over the last decade yielding to agricultural services and Government as the major contributor to earnings in 2000 with 9.9 and 33 percent, respectively, of the total. Trade and services comprised 8.7 and

5.1 percent, respectively, of total earnings in 2000, compared to 17.4 percent for farm earnings. Earnings by county show Sharkey County with 88 percent of the total. Per capita income in 1999 for the Economic Base Area was approximately $10,695, which is an increase of 35 percent from 1979 (presented in 1996 dollars).

72. Agriculture continues to be of major importance to the area economy, although the trend is toward fewer farms with larger acreage. Based on county-level data from Sharkey and Issaquena Counties, the number of farms decreased from 2,036 in 1954 to 192 in 2002, while the average size increased from 140 to 2,913 acres during the same period (based on 2002 Census of Agriculture). Cropland represented 84.2 percent of total farmland in 2002. The value of farm products sold fluctuated with a high of $132.1 million in 1992. Principal field crops are soybeans, cotton, wheat, rice, and corn. Soybeans and cotton represent 38 and 29 percent, respectively, of the total harvested acreage in 2002.

73. The "sunbelt movement" of the 1970s resulted in the emergence of the services, trade, and manufacturing sectors which helped to stimulate the economy of the area by creating more industry and jobs. Manufacturing has contributed to the diversified industrial base of the Yazoo Basin. There were six manufacturing establishments in the area in 1992. Manufacturing ranked fourth in employment and value added by manufacture increased from $7.5 million in 1972 to $12.9 million in 1982. The number of establishments increased from 8 in 1972 to 10 in 1987 before decreasing to 6 in 1992. Manufacturing statistics since 1992 have been unavailable due to disclosure of confidential information.

74. Two agencies were established by Congress in recent years to assist in the economic development of the Delta--the Lower Mississippi Delta Development Commission (LMDDC) and the Delta Regional Authority.

75. Congress established the LMDDC in October 1988 to study and make recommendations regarding economic needs, problems, and opportunities in the Lower Mississippi Delta Region and develop a 10-year economic plan for the region in the Commission’s final report (May 1990). The study area encompassed all or parts of seven states and 308 counties and parishes. This area included all of Louisiana, Arkansas, and Mississippi; 29 counties in Missouri; and 16 in southern Illinois; 21 counties in western Kentucky; and 21 counties in western Tennessee. Recommendations were made regarding health, education, housing, community development, agriculture, public infrastructure, entrepreneurial development, and technology, business, and industrial development. The Commission also identified tourism, cultural resource preservation, and environmental protection as key elements to economic success in the region.

76. Included in the report to Congress was a stated goal "every Delta resident will have access to adequate water and sewer, fire protection, flood control, roads, streets, and bridges to improve the quality of life and provide for economic growth and development."

77. The Delta Regional Authority was a follow-on agency established by Congress in 2000 to assist 240 counties and parishes in 8 states (Alabama, Arkansas, Illinois, Kentucky, Louisiana, Mississippi, Missouri, and Tennessee). As a part of the Authority debate in the Subcommittee on Entergy and Water on 7 September 2000, Senator Cochran of Mississippi stated:

> "Although there are many very important needs in the Mississippi River Delta region which are unique to that area, better roads, educational enhancements, protection from floods, natural resource conservation, and equipment and instruction support for workforce training ought to be the primary focus of this funding.
>
> There are existing and proven delivery systems for these purposes which have the benefit of local planning and priority-setting by the people who reside in the Delta.
>
> Is it the intent of this committee that this founding [sic funding] be utilized in this way for these purposes?"

Senator Domenici responded:

> "Yes, Senator. In fact, it is the interest of the subcommittee to bring this Federal support to the Mississippi River Delta region in the most timely and cost-efficient manner. It is my understanding that much like in your own State of Mississippi, the other six states have similar delivery systems in place through their local community colleges, universities, departments of transportation, and water resource agencies that should be used as the primary vehicles through which these funds are properly administered to provide the greatest regional impact."

78. In 2000, Congress amended the Consolidated Farm and Rural Development Act to establish the Delta Regional Authority to:

a. Develop comprehensive and coordinated plans and programs, establish priorities, and approve grants for the economic development of the Mississippi Delta Region.

b. Provide for research, demonstration, investigation, assessment, and evaluation of such region's assets and needs.

c. Encourage the formation and capacity of local development districts and private investment in industrial, commercial, and other economic development projects.

d. Provide a forum for the consideration of problems and possible solutions of the region.

79. While the Delta Regional Authority has a mandate to help the citizens of the Delta, it is primarily in the areas of economic development and quality of life. While flood control is integrally tied to both, it was the intent of Congress that this should be delivered by existing water resource agencies.

Hydrologic Setting

80. The hydrology of the study area is affected by both internal and external sources. Both sources have been altered by features of the Mississippi River and Tributaries (MR&T) Project. The frequency and duration of flooding due to the Mississippi River have been reduced by the mainline levees and the channel cutoffs (external sources). The levees keep floodwaters of the Mississippi River out of the study area. The channel cutoffs lowered Mississippi River stages which in turn reduced backwater flooding. The maximum reduction of backwater flooding due to the channel cutoffs occurred in the 1950s. Aggradation of the Mississippi River channel bed has eliminated most of this reduction. Reservoirs constructed in the hill area of the Yazoo Basin and channel improvements to the Yazoo River also had an effect on stages within the Yazoo Backwater Area. The Yazoo Backwater Study Area has also benefited from other flood damage reduction features of the MR&T project that have been completed inside the study area (internal sources). These features are listed below and are shown on Plate 4-3. A more detailed description of the hydrologic setting is included in Appendix 6.

a. Yazoo Backwater levee extending from the end of the east bank mainline Mississippi River levee to the downstream end of the west side of the Will M. Whittington Channel levee along the Yazoo River.

b. Structures at Steele Bayou and the Little Sunflower River. These structures allow interior runoff to be released when the ponding area stages are higher than the river stages and prevent backwater flooding from the Mississippi and Yazoo Rivers when the river is higher than the ponding areas.

c. A 200-foot bottom width connecting channel between the Big Sunflower and Little Sunflower Rivers and an enlarged Little Sunflower River channel between this connecting channel and the Little Sunflower drainage structure.

d. A 200-foot bottom width connecting channel between the Little Sunflower River and Steele Bayou, which also intercepts Deer Creek flow.

e. A gated structure in Muddy Bayou which controls Eagle Lake inflows and outflows for environmental purposes.

f. The inlet-outlet channel and the cofferdam around the pump station site.

81. The mainline Mississippi River levees are designed to protect the alluvial valley from the Project Design Flood (PDF) by confining floodflows within the leveed floodway, except where it enters the backwater areas or is diverted intentionally into the floodway areas. The mainline levee system is comprised of levees, floodwalls, and various control structures. When major floods occur and the carrying capacity of the Mississippi River leveed channel is threatened, additional conveyance through the Bird's Point-New Madrid Floodway, and relief outlets through the Atchafalaya Basin, Morganza, and Bonnet Carre Floodways are utilized as well as the storage capacity of flat lowlands at the confluences of tributaries with the Mississippi River. These tributary areas are commonly referred to as "backwater areas." These areas are protected from lesser floods by backwater levee systems that are designed to be overtopped near the crest of the PDF in order to reduce the peak flow of the PDF and allow safe passage within the mainline levee system. The system design which utilizes backwater storage at appropriate times in the PDF hydrograph has significantly reduced the need for even higher mainline levees. The Yazoo Backwater levees are designed to overtop by the PDF.

82. Ponding of runoff from the Big Sunflower River, Little Sunflower River, Deer Creek, and Steele Bayou is provided by two ponding areas connected by a 200-foot bottom width channel. The lower ponding area, formerly referred to as the Steele Bayou ponding area, lies in the lower end of the Steele Bayou Basin while the upper ponding area, formerly called the Sunflower River ponding area, is located in the lower portion of the Little Sunflower River Basin (Plate 4-4).

83. The interior area is protected from high stages of the Mississippi and Yazoo Rivers by levees; however, the area is subject to flooding resulting from inflow into the ponding areas from Steele Bayou, Deer Creek, and Big and Little Sunflower Rivers. Under present conditions, the flooding in the Study Area primarily results from interior ponding behind the Yazoo Backwater levee when the Steele Bayou and Little Sunflower structures are closed due to high Mississippi River stages. The interior ponding areas consist primarily of agricultural and forested lands with several developed areas. Interior flooding begins at approximately 80.0 feet, NGVD.

84. During the rising and falling stages of a flood hydrograph, the water surface elevations in the upper ponding area are generally higher than the water surface elevations in the lower ponding area. This difference is due to slope through the connecting channel and head losses across bridges and overbank openings along Deer Creek ridge and the divide between the two areas. Near the peak of the flood event, there is little difference in water surface elevations between the two ponding areas.

85. The Muddy Bayou control structure was constructed as a means of controlling inflows to and discharge from Eagle Lake during nonflood conditions in order to enhance the lake's water quality. However, due to the topography surrounding the lake, flood protection is provided as well.

86. During flood conditions, the Muddy Bayou structure is opened to allow water to pass from the lower ponding area into Eagle Lake only if it becomes apparent that this line of protection will be overtopped (about elevation 96.0 feet, NGVD).

87. Eagle Lake was formed from an abandoned Mississippi River channel. Although being cutoff from the Mississippi River by the Mississippi River levee, Eagle Lake provides numerous recreational benefits with numerous permanent and recreational homes located there. Without the two low-level levees (privately owned) in conjunction with the Muddy Bayou control structure, the area would see significant backwater flooding.

88. The Steele Bayou structure is the principal drainage structure for the Yazoo Backwater Project. Any time the stage on the landside of the Steele Bayou and Little Sunflower structures is higher than the riverside and above 70.0 feet, NGVD, the gates are opened. With a rising river, the interior ponding areas are normally allowed to rise to an elevation of 75.0 feet, NGVD. The floodgates are closed when the river elevation is higher than the interior ponding levels. The Little Sunflower structure generally remains closed. It is opened during flood events when the riverside water surface elevation is less than the landside elevation and the Steele Bayou structure is closed.

89. The Steele Bayou structure is operated to control minimum water levels in the Steele Bayou and Little Sunflower ponding areas. The current operation plan calls for holding minimum water levels in the ponding areas between 68.5 feet, NGVD, and 70.0 feet, NGVD.

Environmental Setting

90. The Yazoo Backwater Study Area contains significant environmental resources. These resources are considered significant based on institutional, public, and technical recognition. Sources of institutional recognition include Public Laws, Executive Orders, rules and regulations, treaties, and other policy statements of the Federal Government. Significance based on public recognition means that some segment of the general public recognizes the importance of an environmental resource. Significance based on technical recognition means that the importance of an environmental resource is based on scientific or technical knowledge. Significant resources in the study area include bottom-land hardwood forests, wetlands, terrestrial and aquatic resources, waterfowl resources, wildlife refuges, game management areas, threatened and endangered species, cultural resources, rivers and oxbow lakes, and prime and unique farmland.

91. The significant resources have previously been described in various other reports. These were described in the FEIS, Flood Control, Mississippi River and Tributaries, Yazoo River Basin, Mississippi, filed with the Council on Environmental Quality (CEQ) on 29 December 1975. Extensive background information is also provided in the Environmental Inventory and Assessment, Yazoo River Basin, June 1980, prepared for the Vicksburg District by Howard, Needles, Tammen, and Bergendoff. This information has been updated through investigations undertaken in support of the Yazoo Basin Reformulation studies. These resources were also described in the Big Sunflower River Maintenance Supplement No. 2 to the FSEIS, July 1996. A description of these resources is presented in the accompanying FSEIS. Evaluations of the effects to significant resources mentioned above were conducted along with consideration of nonstructural, structural, and a combination of structural and nonstructural flood control features. The complete analyses of these resources are presented in the FSEIS and accompanying appendixes.

92. Preproject conditions as discussed above are the basis for evaluating overall changes to the environment. Agriculture dominated the rural economy which led to extensive land clearing and increased production of row crops such as cotton, corn, and soybeans. However, major stands of bottom-land hardwoods still remain in areas such as the Delta National Forest; Issaquena County Game Management Area; Yazoo and Panther Swamp NWRs; Mahannah, Twin Oaks, and Lake George mitigation areas; and Delta Wildlife and Forestry, along with various other smaller tracts. Forested areas, comprised primarily of bottom-land hardwoods, cover approximately 38 percent of the study area. Most of these remaining areas are rated high in commercial timber value and also wildlife value. These bottom-land hardwoods provide essential and highly productive habitat for whitetail deer, wild turkey, squirrels, raccoons, opossums, mink, cottontail and swamp rabbits, nesting and migratory waterfowl, herons, egrets, hawks, owls, and many species of nesting and wintering songbirds. Various species of turtles, snakes, and amphibians and the American alligator are native to the area. Tabular information on land use within the 100-year flood event for the Yazoo Backwater Study Area is presented in Table 2.

93. The Food Security Act of 1985 discourages the clearing of bottom-land hardwoods for agricultural purposes. Prior to this legislation, clearing of wooded tracts was a common practice influenced to a great extent by agricultural commodity prices. Also, Section 404 of the Clean Water Act has served as an additional deterrent to land clearing since a permit is required for impacts to wetlands.

TABLE 2
LAND USE BY REACH FOR THE 100-YEAR FLOOD EVENT a/
YAZOO BACKWATER AREA REFORMULATION

2005 Land Use Category	Unadjusted Acres			Adjusted Acres b/		
	Lower Ponding Area	Upper Ponding Area	Total	Lower Ponding Area	Upper Ponding Area	Total
Cotton	19,400	55,400	74,800	19,100	54,100	73,200
Soybeans	57,400	103,400	160,800	52,900	96,300	149,200
Corn	8,400	12,800	21,200	8,300	12,500	20,800
Rice	5,000	11,300	16,300	4,700	11,100	15,800
Total Crop	90,200	182,900	273,100	85,000	174,000	259,000
Herbaceous	19,100	20,300	39,400	16,800	17,200	34,000
Reforest	8,400	19,500	27,900	0	0	0
Total Non-Crop	27,500	39,800	67,300	16,800	17,200	34,000
Bare Soil	100	200	300	100	200	300
Bottom-land Hardwoods	87,200	145,800	233,000	64,900	54,500	119,400
Cypress	5,400	3,400	8,800	2,900	1,600	4,500
Total Forest	92,600	149,200	241,800	67,800	56,100	123,900
River	6,000	9,000	15,000	4,900	7,400	12,300
Lake	8,200	900	9,100	8,000	800	8,800
Total Water	14,200	9,900	24,100	12,900	8,200	21,100
Ponds	2,000	21,400	23,400	1,900	21,100	23,000
WMA				5,000	13,400	18,400
NWR				17,600	70,600	88,200
WRP				14,800	20,300	35,100
CRP				4,300	17,400	21,700
FmHome				400	4,900	5,300
Total Managed				42,100	126,600	168,700
Total	226,600	403,400	630,000	226,600	403,400	630,000

NOTE: WMA - Wildlife Management Area
NWR - National Wildlife Area
WRP - Wetland Reserve Program
CRP - Conservation Reserve Program
FmHome - Farmer Home Administration Lands

a/ Acres developed from FESM Model using 2005 land use data

b/ Adjusted Acres - the land use acres were adjusted by removing all lands managed by state and Federal agencies or under Federal farm programs.

94. Extensive studies were conducted by EPA, FWS, ERDC, and the Vicksburg District to determine base environmental conditions and are described in the following paragraphs. Detailed hydrologic data were required to complete the base conditions analysis. A Geographic Information System (GIS) was also used to determine land-cover type, reach boundaries, and facilitate the evaluation of economic data and project features.

95. To determine land use changes in the Final Report, 2005 satellite imagery was classified and incorporated into the GIS. (The 2000 Draft Report utilized 1988 land use.) This information indicates that approximately 242,000 acres of bottom-land hardwoods remain in the study area. Although much of this acreage is in public ownership, a significant amount remains in private ownership. Some of these bottom-land hardwoods are classified as wetlands and are protected by provisions of the Food Security Act of 1985. Approximately 70,000 acres of nonwetland bottom-land hardwoods are exempt from the Food Security Act, but the owners value these lands for wildlife and timber production. The remaining cleared lands are classified as "prior converted" cropland in accordance with the Food Security Act, and thus, have lost much of the functional wetland value as opposed to "farmed" wetlands which still exhibit some wetland characteristics even though cleared.

96. Base aquatic habitat conditions were determined by sampling streams, existing borrow areas, lakes, and flood plain habitats for juvenile and adult fishes (Appendix 11). Fifty-seven species of fish were identified, including flathead catfish, freshwater drum, gizzard shad, common carp, bigmouth buffalo, white crappie, gar, bowfin, bullheads, and sunfishes. The species collected represent those tolerant of degraded environments (e.g., high summer water temperature, high turbidity, and low dissolved oxygen[DO]). High turbidity and uniformly shallow water were found to be significant factors inhibiting species diversity. Spawning habitat was the highest in the fringe flood plain connecting to the inlet/outlet channel to the Steele Bayou structure and in the oxbow lakes contiguous with the Big Sunflower River or one of its tributaries. Overall, permanent water bodies on the flood plain provide higher habitat value to rearing fishes than cleared lands. Species richness of larval fish is low compared to other flood plain river systems with large tracts of contiguous bottom-land hardwoods. While some stratification was observed in the flood plain behind the Steele Bayou structure during the spring and early summer, mean DO ranged from 4 to 5 mg/L at all locations (MDEQ instantaneous DO standard is 4 mg/L).

97. The State of Mississippi lists many of the waters in the Yazoo Backwater Study Area as impaired for one or more parameters. The listed impairments include sediment, organic enrichment/low DO, nutrients, pesticides, pathogens, and biological impairment by unknown sources. Water quality studies in the Yazoo Backwater Study Area show that concentrations of

many surface water parameters are seasonal. Suspended sediment concentrations were observed to be highest during rainfall events in late winter and spring, while nitrogen and phosphorus concentrations were lowest during the summer months. The DO concentrations and water temperatures were occasionally outside their recommended ranges during the late summer months. The project should not have any adverse impact on water quality during summer months. This issue is discussed in detail in Appendix 16. Of the water quality parameters with State criteria, DO had the highest number of exceedances (24 percent) during the 15 years evaluated. The water temperature criterion was exceeded in only 4 percent of the samples, while the ammonia and pH criteria were exceeded in approximately 1 percent of the samples. Surface water pesticides concentrations show distinct seasonal patterns that corresponded to the type of crops grown in the watershed and the pesticides used on those crops. According to the USGS, the most frequently detected pesticides are those currently used in cotton, corn, soybean, and rice production. Although most of these current-use pesticides do not have established aquatic-life water quality criteria, most had concentrations in sub-part per billion amounts that were well below any acute toxicity levels. Overall, the highest pesticide concentrations occurred in the summer months, peaking in June and July.

98. Sediment samples were analyzed for legacy organochlorine pesticides. The most frequently detected pesticides were DDT and its metabolites, DDD and DDE. The total of the three, ∑DDT was found in 80 percent of the samples. These data were compared to EPA fresh water sediment criteria developed from bioassays to evaluate the probability of a compound in sediment being associated with adverse biological effects in sensitive aquatic invertebrates. Results of the data comparison show that 98 percent of the Yazoo Backwater Study Area sediments evaluated did not have ∑DDT at concentrations that could be associated with frequent biological effects in aquatic organisms. Toxicity tests confirm this assessment. When DDT is available to aquatic organisms, it can move up the food chain. Currently, streams and lakes in the Yazoo Backwater Project Area have fish consumption restrictions for the legacy use pesticides DDT and toxaphene for certain species and sizes of fish. Results from pesticides analysis of fish collected between 1993 and 2005 show that DDT was detected in more than 95 percent of the fish samples; however, concentrations in some streams seem to be decreasing. Sixty-eight percent of the fish collected between 1993 and 1999 exceeded the Mississippi fish consumption criterion of 1.0 mg/kg for DDT. Only 18 percent of the fish collected since 2000 exceeded the 1.0 mg/kg DDT fish consumption criterion.

99. Waterfowl studies in the 2000 Draft Report were conducted by FWS, and ERDC updated the Final Report using the same FWS model to determine base conditions and project impacts on waterfowl. Using food as an index of carrying capacity, the study area was evaluated to determine changes resulting from the proposed project. This area is an important wintering

waterfowl area comprised of large tracts of bottom-land hardwoods and agricultural fields. The area often floods during the winter and early spring to provide abundant foraging habitat for waterfowl. Forested wetlands fulfill special waterfowl habitat requirements not provided by open lands. These bottom-land hardwoods produce nutritious foods for waterfowl and provide secure roosting areas, cover during inclement weather, resting sites, protection from predators, and isolation for pair formation. Whereas much of the foraging and nutritional requirements can be met by flooded agricultural fields, a variety of habitats are needed to satisfy the life cycle requirements of wintering waterfowl. Eight species of waterfowl regularly utilize the bottom-land hardwood forests in the Mississippi flyway.

100. Historically, the Mississippi Alluvial Valley (MAV) served as a major wintering area for waterfowl. Waterfowl population numbers began to decline in 1960s as a direct result of extensive droughts and loss of nesting habitats in the prairie pothole region of North America, and the conversion of wintering area in the MAV to agricultural production. Recently, waterfowl populations have recovered to the long-term average primarily because of better breeding conditions (Appendix 12). According to FWS, the net effect of wetland conversion and drainage has been that under normal conditions, natural habitat is no longer sufficient to meet the needs of this number of wintering waterfowl and other migratory birds.

101. The FWS identified the endangered plant pondberry (*Lindera melissifolia*) and the threatened Louisiana black bear (*Ursus americanus luteolus*) as species that may occur in the study area. Pursuant to Section 7 of the Endangered Species Act, a final Biological Assessment (BA) for these species was sent to FWS on 5 December 2005 (Appendix 14). The BA determined that the project was not likely to adversely affect either species. The FWS did not concur with the determination that the project was not likely to adversely affect the pondberry. The FWS also indicated that additional informal consultation on the Louisiana black bear was required prior to determining whether the project was likely to adversely affect the Louisiana black bear. Although the BA concluded that the project was not likely to adversely affect pondberry, the Vicksburg District did request initiation of Section 7 formal consultation to ensure the project did not jeopardize the continued existence of pondberry. The FWS initiated Section 7 formal consultation for pondberry on 18 January 2006.

102. After additional consultation, FWS concurred with the Vicksburg District's determination that the project was not likely to adversely affect the Louisiana black bear (letter of 10 August 2006). The FWS provided its pondberry Biological Opinion (BO) 2 July 2007. The FWS concluded that the project was likely to adversely affect, but that the project would not jeopardize the continued existence of the endangered plant, pondberry.

103. To help conserve and recover the pondberry, the Vicksburg District has significant ongoing or planned activities designed to address data and recovery tasks contained in the FWS 1993 Pondberry Recovery Plan. In 2003, the Vicksburg District and the U.S. Department of Agriculture (USDA) Forest Service entered into a 7-year, $5 million interagency agreement to conduct extensive research on pondberry's biological and ecological requirements. In addition, in 2007, the Vicksburg District and FWS signed a Memorandum of Agreement to establish two new pondberry populations in the study area and conduct additional field experiments evaluating the effects on flooding, stand thinning, competition, and pathogens on pondberry.

104. A cultural resources survey for historic/archeological sites at the backwater pump station site has been conducted. No evidence of historic/archeological sites was discovered.

105. A literature and record search was conducted to ascertain whether any previously recorded or known prehistoric and historic cultural resources were located in or adjacent to the project study area. This search was also conducted to determine what types of cultural resources might be expected in the study area. The search recorded approximately 595 archeological sites within the study area along with 93 National Register of Historic Places (NRHP) eligible properties and numerous NRHP listed properties. This included all of the six counties/parishes involved in the Yazoo Backwater Study Area--Humphreys, Issaquena, Sharkey, Warren, Washington, and Yazoo Counties, Mississippi; and Madison Parish, Louisiana.

106. Wildlife-based recreation is an important part of the Yazoo Backwater Study Area culture. This includes both consumptive and nonconsumptive activities. Consumptive activities include hunting, trapping, fishing, etc. Nonconsumptive activities include photography, birdwatching, nature study, etc.

107. The Yazoo Backwater Study Area is one of four functional backwater flood plain complexes within the Lower Mississippi Valley, the Nation's largest flood plain, which are the "ecological engines" responsible for its renowned biological productivity. It is not surprising, then, that historically, the wetland habitats of the Yazoo Backwater Area supported an exceptional diversity and abundance of fish and wildlife resources.

108. Today, nearly 75 percent of the Lower Mississippi Valley's historic forest cover and 90 percent of its historic flood plain have been lost. Within the Yazoo Backwater Study Area, approximately 95,700 acres of backwater habitat in the 2-year flood plain are currently in agricultural production. As a result, many flood plain habitat restoration efforts have been implemented by Federal and state agencies, and private conservation organizations. For example, the Mississippi Alluvial Valley Migratory Bird Conservation Initiative designated the Yazoo Backwater Area as a high priority migratory bird conservation zone. In 1986, the North

American Waterfowl Management Plan recognized the role of the Nation's largest flood plain in conserving continental waterfowl populations by naming the Lower Mississippi Valley as one of seven priority conservation areas in the United States. Its value to Neotropical forest-breeding birds and migratory shorebirds returning from Central and South America wintering grounds also gives the Lower Mississippi Valley transcontinental significance. The Lower Mississippi Valley Joint Venture has established ecosystem-wide habitat restoration objectives for each of the three species groups targeted by the North American Waterfowl Management Plan, Partners in Flight, and the U.S. Shorebird Conservation Plan. Accomplishment of the habitat restoration goals set for the Yazoo Backwater Area also supports the long-range natural resource management objectives of the Lower Mississippi River Conservation Committee.

109. In concert with these plans, the Black Bear Conservation Committee has established the goal of reversing those factors that have brought about the steady decline of the Louisiana black bear (listed as threatened under the provisions of the Endangered Species Act). The primary factor in the decline of the Louisiana black bear has been the loss and fragmentation of large tracts of bottom-land hardwood habitat. The past decades have brought about significant bottom-land hardwood restoration in the Yazoo Backwater Project Area. This has been accomplished primarily through USDA programs and now with the potential of future restoration and the presence of several publicly owned tracts of bottom-land hardwoods. The area is being targeted for the establishment of a subpopulation of Louisiana black bear. Reforestation will result in additional large contiguous tracts of wooded habitats that would greatly enhance habitat value for the black bear and other bottom-land hardwood birds, ducks, and mammal species including Neotropical and migratory birds.

FUTURE WITHOUT-PROJECT CONDITIONS

110. While other Federal agencies have ongoing programs (such as WRP and CRP), which could affect the land use of the Yazoo Backwater Study Area. Each of these programs arise as part of distinct laws, with particular limits and conditions associated with the law or program. In the last few years, most of these programs have been relatively stable, both in acreage and funding. While a major expansion of these programs would have an effect on future conditions, there appears to be no interest by the local citizens, the Mississippi Legislature, or Congress to establish any new programs or to increase funding under an ongoing program whereby substantial changes in land use would occur. Therefore, the future without-project conditions are projected to be the same as what is observed in the study area today. The future without-project conditions serve as a baseline from which alternative improvements are evaluated.

Socioeconomic Setting

111. From a national perspective, socioeconomic trends are assumed to reflect reasonably full employment; the absence of natural disasters, wars, epidemics, etc.; long-term growth in output; and continued migration into the sunbelt states. Regionally, earnings and income should continue their current relatively slow growth, paralleling technological improvements in the agricultural sector.

112. Population in the Yazoo Backwater economic base study area (i.e., Issaquena and Sharkey Counties) was estimated to be 8,900 persons in 2000 and is projected to decrease to approximately 7,400 by the year 2050, representing a decline of approximately 17.0 percent. These projections are conditional forecasts based on extensions of past trends in the area adjusted to reflect changes in national, regional, and interregional conditions. Historical population statistics for the economic base study area show a 50.0 percent decline in the number of people from 1950 to 2000. These trends are expected to continue into the future, but at a slower rate of decrease. Conversely, the towns and communities in the economic base study area have either maintained their population numbers or have experienced slight increases over the past 50 years. These trends are also expected to continue into the future. Forecasts of employment indicate the workforce to remain near constant over the next 50 years based on historical trends. In regard to the other economic indicators, moderate increases are projected in earnings, value added by manufacturing, farm products sold, and the services, manufacturing, and trade industries in the economic base study area. A more detailed discussion of the projection methodology is presented in the Socioeconomic Profile, Appendix 8.

113. Current land use trends in the Yazoo Backwater project area are projected to continue. Agricultural production will remain stable, but industrial growth has the potential to increase due primarily to the available labor base that exists in the economic base study area. Rural land use will not change significantly, except for possible cropping patterns and technological changes in the agricultural sector. Reforestation of agricultural lands appeared to have peaked in 1999 and subsequently, very little reforestation has occurred since the two primary counties in the project area--Sharkey and Issaquena--have reached their caps under the USDA program.

114. Urbanized development exists and will be hindered in some circumstances and instances by lack of capital investment because of flood risks due to the absence of flood control features for the economic base study area. This situation leads to instability in earnings and employment, resulting in residents forced to accept substandard levels of living; i.e., income, housing, etc.

115. Many lands dedicated to agricultural use and public use lands will continue to be at risk of flooding without a flood control project. Lands successfully farmed for many years are at risk due to rising production costs and steady to decreasing commodity prices. The ability to recover from even occasional flooding depends on many factors beyond farm owners' and operators' control. These conditions will persist as farmers move into world market competition and lending institutions place more restrictions on agricultural financing. While there are increasing pressures on agriculture, significant shifts in land use are not likely unless there are major changes in agricultural policy. Although cropping patterns are expected to change from year to year over the life of the project (e.g., current shift from other crops to corn acreage due to biofuel production), total land in agricultural production is expected to remain relatively constant. Federal Farm Policy is reviewed by Congress every 4 to 5 years with the passage of a new Farm Bill. Farm Bills have generally resulted in some type of income assurance for farmers and in recent times, some type of conservation programs. These conservation programs often involve the farmer/landowner removing lands from production in return for a direct one time or annual payment from the Government. At the present time, any new Farm Bill will probably extend these two programs in some form. But since the WRP program is at or near current program limits in the two counties that make up the majority of the Study Area, relatively little change should result from any new Farm Bill. While programs such as those funded by the Delta Regional Authority and other state and Federal initiatives could improve socioeconomic conditions in the study area, there are no current, active programs that would result in a significant change in the community. The Vicksburg District anticipates that absent a major initiative or program, the without-project future conditions would be largely similar to current conditions.

Hydrologic Setting

116. When the Little Sunflower River and Steele Bayou structures are closed because of high stages on the Mississippi River, flooding or the threat of flooding, from ponding of interior drainage is the principal problem in the project area. Major problems that have resulted from frequent flooding include flood damages to agricultural crops, rural residential property, timber management, and public roads and bridges. Major floods have caused hardships and economic losses to residents of the area due to flooding of residential and nonresidential structures, disruption of sanitation facilities, lines of communications, and transportation. Without additional project construction in the Yazoo Backwater Area, future hydrologic conditions are not expected to change and significant periodic flood damages will continue. With the reforestation of agricultural lands under the CRP and WRP programs, water quality could improve as well as a reduction in the amount of sediment carried into streams.

Environmental Setting

117. As discussed previously, land clearing for agricultural development is being discouraged and has essentially stopped. Some of the remaining forested lands are classified as wetlands, and these are protected by "Swampbuster" provisions of the 1985 Farm Bill. Other nonwetland bottom-land hardwood areas are now considered to be more valuable than the cleared cropland by their owners and are not projected to be cleared because of the combination of their timber and recreational value. Timber harvesting will continue on both public and private lands in the project area. These harvested areas will either be allowed to regenerate or be replanted. In addition, current economic conditions are not conducive for conversion of bottom-land hardwoods to agricultural lands. Section 404 of the Clean Water Act also serves as a deterrent to land clearing. As the lands enrolled and reforested by the CRP and WRP programs develop, terrestrial and wetland resource values will increase. As bottom-land hardwoods grow and mature, additional recreation opportunities will become available. Should some of this reforestation take place around lakes, fishery resources would improve for that site as sediments are held on the land. According to USDA Farm Services Agency (FSA), Farm Bill policy caps WRP at 10 percent of the county total cropland acreage. CRP caps at 25 percent of the total county cropland acreage; however, WRP acreage is included in the 25 percent. The ceiling for WRP enrollment in Sharkey and Issaquena Counties has been reached, according to the FSA National website. Since CRP enrollment is not perpetual and is subject to revision with each Farm Bill, enrollment in this program should not impact long-term land use. County governments have expressed reservations on raising these ceilings due to the impact on the tax revenue. The conversion of agricultural land to forest land under these programs results in a significant reduction in property taxes for the counties. As the property taxes go down on this property, taxes on other property has to be raised to make up the shortfall. Based on local action to date and on recent congressional actions, future expansion of these programs is not likely. However, as a part of this project, the local sponsor, the Board of Mississippi Levee Commissioners, was instrumental in getting the Mississippi Legislature to pass a law to protect the counties from losing revenue on reforestation from this project. This law only allows easement lands for the Yazoo Backwater project to be assessed a fee equal to the loss of revenue resulting from the change of land use due to this project. This fee is a county option by each county Board of Supervisors in the study area and cannot exceed $4 per acre.

118. As stated previously, the bottom-land hardwoods and wetlands provide fish and wildlife habitat in the study area. The FWS categorizes bottom-land hardwoods as scarce in the region, and consequently considers them to be in Resource Category 2 of their mitigation policies requiring compensatory in-kind mitigation for adverse impacts to them. Other aquatic and waterfowl habitats are also considered to be in Resource Category 2 by FWS. While wildlife resources have generally declined in the study area with the clearing of bottom-land hardwoods during the 1950s, 1960s, and early 1970s, the additional agricultural lands that are flooded

during the winter months provide foraging habitat for waterfowl (Appendix 12). As more of this area has become dedicated to wildlife by the acquisition of large tracts by the Federal Government and farmers enrolling marginal lands in the USDA conservation programs, bottom-land hardwood and wetland resources have stabilized. Currently, there are two species in the study area that are on the Federal list for threatened and endangered species. These species are the threatened Louisiana black bear and the endangered plant, pondberry. With the reforestation of agricultural lands in the study area, habitat for these species is increasing.

PROBLEMS AND OPPORTUNITIES

119. As brought out during project scoping and other meetings, the problems of the Yazoo Backwater Area focus on the continuing flood damages to both rural and agricultural properties and the need to protect the small communities and towns of the study area. Progress has already been made in restoring environmental resources by the successful reforestation of some frequently flooded agricultural lands under USDA programs, but these programs have come at a great expense to local governments. It was also pointed out that additional opportunities existing whereby environmental resources (terrestrial, wetland, waterfowl, and aquatic) and water quality could be increased/improved even more, which in turn could lead to increased/enhanced recreational or ecotourism opportunities in the study area.

Problems

120. Flooding of urban and rural structures, as well as agricultural properties, constitutes a major problem to residents and could prevent future development of the study area. A definite need exists for the reduction of this flooding. Flood protection would benefit all sections of the economy, thereby contributing to the total well-being of area residents. An estimated 1,576 structures are affected by the 100-year flood. Approximately 316,000 acres of cleared agricultural lands of the total 630,000 acres are impacted by the 100-year frequency flood event. Average annual acres is determined by a statistical analysis of historic flood events and results in the cumulative probability of each of the flood events occurring in any given year and the associated number of acres flooded. There are approximately 148,000 cleared agricultural acres inundated on an average annual basis (reference Appendix 7 for additional discussion on flood damage calculations). Total annual flood damage is estimated at $19.9 million. Flood damages to nonagricultural properties which include urban structures, emergency costs, streets and public roads total $6.6 million annually. Damages to agricultural properties, including agricultural crops and noncrops, total $13.3 million per year. For a detailed description on computation of average annual acres, refer to Appendix 6.

121. Three important factors which affect flood losses to agricultural properties are time of year, duration, and frequency of flooding. Frequent or intermittent floods can occur any time of the year; however, flood records indicate that the majority of floods occur during the land preparation and spring planting months (March-June).

Opportunities

122. Terrestrial, wetland, aquatic and waterfowl resource functions have diminished in the study area with the clearing of bottom-land hardwoods during the 1950s, 1960s, and early 1970s. As more of this area has become dedicated to wildlife by the acquisition of large tracts by the Federal government and farmers enrolling marginal lands in the USDA conservation programs, these resources have not only stabilized, but are now increasing. These reforestation efforts are successfully converting agricultural land back to bottom-land hardwoods. As a part of this reformulation, increasing these resources under a nonstructural alternative was considered.

123. Water bodies in the Yazoo Backwater Study Area are considered to be impaired due to contamination from sediment, pesticides, and nutrients. Reforestation of agricultural land would be a component of any nonstructural alternative or any combination plan that includes nonstructural features. Reforestation would reduce the amount of pollutants in the aquatic system by stabilizing the soil and reducing erosion and by increasing the wetland functions that feature the removal of suspended sediment and pollutants from floodwater that enters these reforested wetlands.

124. Recreational opportunities have already increased in the study area with purchases by the Federal government of large tracts of bottom-land hardwoods and the reforestation of agricultural lands under USDA conservation programs. As a part of the reformulation, the opportunity exists to increase the amount of bottom-land hardwood available to both public and private interests.

PLANNING OBJECTIVES

125. Planning objectives were developed in accordance with ER 1100-2-100. Planning objectives stem from national, state, and local water and related land resource management needs specific to the Yazoo area of the Yazoo Backwater Area. These objectives have been developed

through problem analysis and a public involvement program and have provided the basis for formulation of alternatives, impact assessment, environmental design, evaluation and selection of a recommended alternative. The planning objectives, as directed by Congress, are as follows:

a. Reduce flood damage to urban and rural structures as well as agricultural properties resulting from prolonged flood stages on the Mississippi River when the Steele Bayou and Little Sunflower structures are closed and floodwaters pond landside of the structures.

b. Provide reduced levels of agricultural intensification.

c. Reduce adverse environmental impacts through design.

Consistent with USACE and the Vicksburg District policy, the project also has planning objective of:

d. Compensate 100 percent for unavoidable environmental impacts.

Based on coordination between the Vicksburg District and FWS during project planning, this project has an additional objective:

e. While the objectives of subparagraphs a through d above were utilized to address future problems and opportunities of the study area, an additional objective is to fulfill the mitigation requirement for the already completed Yazoo Area and Satartia Area Backwater Levee Projects, previously constructed features in the Yazoo Backwater Area. This objective is discussed in detail under the topic mitigation.

126. For purposes of comparing alternatives, the Vicksburg District utilized the first four objectives identified above as an appropriate summary description of project purpose and need. While the primary purpose of the project is flood damage reduction, these four objectives were balanced, consistent with NED, in screening and evaluating alternatives under NEPA.

PLANNING CONSIDERATIONS

127. Legislative and executive authorities specify the range of impacts to be assessed and have set forth the planning criteria that must be applied when evaluating alternatives.

128. A number of existing flood damage reduction features were considered in the Yazoo Backwater Reformulation study. The Vicksburg District's planning was consistent with the baseline physical characteristics of the study area, which include the previously constructed

levees, connecting channels, structures and the pump station site. The lowering of the damage elevation has been dictated by past economic activities in the basin. Reforestation of low-lying agricultural lands in recent years has served to raise this damage elevation.

FORMULATION AND EVALUATION CRITERIA

129. Alternatives were formulated and evaluated in accordance with various technical, economic, environmental, and socioeconomic criteria (ER 1105-2-100). When applied, these criteria provide the means for responding to the problems and needs of the area by selecting a plan in the best public interest consistent with other developments in the area and by developing an economically feasible solution. The guidance for conducting civil works planning studies requires the systematic development of alternatives that contribute to the Federal objective. Alternatives are formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability. Table 36, which summarizes the Principles and Guidelines evaluation criteria for final array of alternatives, is presented later in this Main Report.

130. Federal policy on multi-objective planning, derived from both legislative and executive authorities, establishes and defines the national objectives for water resources planning, specifies the range of impacts that must be assessed, and sets forth the conditions and criteria which must be applied when evaluating alternatives. Alternatives must be formulated considering benefits and costs, both tangible and intangible, and effects on the environment and social well-being of the community.

131. Plan formulation criteria include published regulations and principles adopted by the Water Resources Council and USACE regulations. Other criteria used are in compliance with the Principles and Guidelines, NEPA, Executive Orders 11988 and 11990, other appropriate engineering standards, regulations, guidelines, and guidance from OMB.

132. By letter, 21 August 1992, the Board of Mississippi Levee Commissioners indicated their willingness to participate as the local sponsor for the uncompleted Yazoo Backwater Project and requested that reformulation of the project be expedited. Based on the commitment of the Board

of Mississippi Levee Commissioners, reformulation studies were conducted for this uncompleted feature. Interests and objectives of the local sponsor are factors considered in evaluating the four criteria: completeness, effectiveness, efficiency, and acceptability.

Public Involvement and Consensus Building

133. The public was extensively involved during the reformulation study. A scoping meeting was held early in the study process (November 1993) in Rolling Fork, Mississippi. The purpose of the meeting was to solicit public assistance in identifying significant environmental resources within the study area that should be considered in the evaluation of alternatives. Following the scoping meeting, the Vicksburg District began the data gathering phase of the study and began to formulate an initial array of alternatives. In preparation of the Draft Report, public involvement continued while crop data were being gathered from farm agencies and local farmers along with other economic data. Environmental resources were evaluated by Habitat Evaluation Procedures teams which were comprised not only of Vicksburg District staff, but ERDC, FWS, and MDWFP.

134. Three public involvement workshops were held in May 1997 to solicit information regarding alternative nonstructural and/or environmental features. Participants included environmental organizations, the non-Federal sponsor (Board of Mississippi Levee Commissioners), local interests from the project area, and Federal and state agencies. A joint briefing—the Vicksburg District, EPA, and FWS--was held on 7 August 1997 as requested by the participants at the May 1997 public involvement workshop. The participants requested information be presented regarding the study history, study process, remaining activities, and data on the alternatives. Vicksburg District presented information regarding the study and provided a handout on alternatives. The data included descriptions of alternative features and preliminary cost estimates. The FWS briefed their perspective on the study, authorized project, and structural and nonstructural alternatives. After the briefing, the participants selected alternatives for more detailed evaluation.

135. In 1999 and 2000, a committee composed of project area residents, local elected officials, state-elected officials, state resource agencies, Federal resource agencies, and environmental organizations was established by the local non-Federal sponsor to reach consensus on a balanced plan to address the water resource problems in the project area. This Consensus Committee met several times and helped formulate alternatives to be evaluated, but several of the initial parties quit participating before completion of the 2000 Draft Report and DSEIS. These parties include the Audubon Society, Gulf Restoration Network, Mississippi Wildlife Federation, National Wildlife Federation, and the Sierra Club.

136. The Vicksburg District, Mississippi State University (MSU), and FWS participated in a study conducted by Dr. Leonard Shabman and Ms. Laura Zepp of Virginia Tech University (VT) under contract with EPA to evaluate costs and benefits associated with a nonstructural alternative for the Yazoo Backwater Area. Although the Vicksburg District, MSU, and FWS were listed as

participants in the study, the participation was limited to furnishing data to VT. The report entitled "An Approach for Evaluating Nonstructural Actions with Application to the Yazoo River (MS) Backwater Area," was reviewed and its findings coordinated by the EPA. The results of the study, referred to hereafter as the Shabman Report, were published on 7 February 2000, and a copy of the study was included in the 2000 Draft Report and is included in this Final Report. Information from the Shabman Report was used to formulate an alternative (Alternative 2C) evaluated in the Final Report and FSEIS.

137. Prior to release of the Draft Report and DSEIS, the staffs of CEMRC and the Vicksburg District coordinated extensively with the Regional Administration of EPA and FWS and their respective staffs in an effort to build consensus from a Federal agency perspective. No consensus was reached. Comments to the Draft Report and DSEIS were received from these agencies. Following receipt of these comments, the Vicksburg District reengaged the Regional Administration of EPA and their staff in an attempt to address their major areas of concern. The primary focus was on a revised wetland analysis. The FWS participated in several of these meetings with the Vicksburg District and EPA to resolve wetland concerns. Later, FWS was asked to enter into informal consultation on a threatened Louisiana black bear and into formal consultation on an endangered plant pondberry. This consultation resulted in several meetings with the Regional Director and/or his staff. A full discussion of these activities is included under the topic "Views of Local Sponsor and Other Agencies."

138. The major public and interagency meetings conducted during the reformulation study are outlined in Table 3. Additional information concerning these activities is included in Appendix 5.

TABLE 3
PUBLIC INVOLVEMENT CHRONOLOGY
YAZOO BACKWATER AREA REFORMULATION

Number	Event
1	Public Involvement Workshops (PIW) - May 97 (3)
2	EPA, FWS, CEMVK Briefing of PIW Participants - Aug 97
3	Vicksburg District (CEMVK)-EPA teleconference - May 98
4	CEMVK/CEMRC Status Briefing for EPA and FWS (Atlanta) - Sep 98
5	ASA(CW), EPA and FWS meeting (Washington) - Oct 98
6	EPA, FWS, and CEMVK staff meeting (Vicksburg) - Oct 98
7	CEMVK/CEMRC Briefing for EPA and FWS (Atlanta) - Dec 98
8	ASA(CW), CEMRC, EPA, and FWS (Atlanta) - Jan 99
9	Backwater Project presented to Congressman Bennie Thompson in Rolling Fork - Jan 99

TABLE 3 (Cont)

Number	Event
10	FWS Briefing for EPA, CEMVK, and CEMRC on FWS Plan (Vicksburg) – Feb 99
11	FWS Planning Aid Letter defining FWS Plan - Mar 99
12	First Consensus Committee Meeting in Greenville - Mar 99
13	Followup Consensus Committee Meetings (19 Apr 99, 11 May 99, 26 May 99, 22-24 Jun 99)
14	EPA Briefing for FWS, CEMVK, CEMRC on Shabman Report (Atlanta) - Jul 99
15	Consensus Committee Meeting (Raymond, MS) - Jul 99
16	FWS Planning Aid Report - Sep 99
17	Consensus Committee Meeting (Raymond, MS) - Sep 99
18	Consensus Committee Meeting (Raymond, MS) - Mar 00
19	Mississippi Levee Board Public Meeting (Rolling Fork, MS) - Mar 00
20	Review of Draft Report by resource agencies (Vicksburg, MS) - May 00
21	Transmitted Draft Report and Draft SEIS to public and resource agencies (Vicksburg, MS) – Sep 00
22	Public Meeting (Rolling Fork, MS) – Nov 00
23	Public Meeting hosted by Congressman Bennie Thompson (Mayersville, MS) – Dec 00
24	Chief of Engineers Environmental Advisory Board (Vicksburg, MS) – Oct 01
25	EPA Wetland Meetings (Vicksburg, Atlanta, Washington) – Aug 02 – Aug 06
26	Cooperating Agency Meetings (Vicksburg, MS) – Jul 03, Jul-Oct 05, Jul 06

139. A public meeting was held in Rolling Fork, Mississippi, on November 9, 2000. The purpose of this meeting was to receive comments and answer questions from the public on the Draft Report and Draft SEIS released in September 2000. The official comment period remained open for 60 days past the public meeting. Numerous comments, both pro and con, were received by the Vicksburg District. The complete set of comments and the Vicksburg District responses are provided in the Appendix 5.

140. Based on some of the comments received on the Draft Report and Draft SEIS, the Vicksburg District reengaged EPA to revise the Wetland Appendix using an EPA approved method to determine functional values and project-induced impacts. Numerous meetings were held with EPA from 2002 to 2005 when a revised Wetland Appendix, along with updated versions of the Aquatics, Waterfowl, Terrestrial, Water Quality, and Mitigation Appendixes, were distributed to the cooperating agencies for review and comment. Comments received from

this review were considered during the completion of the appendixes that are attached to this document. The cooperating agencies were EPA, FWS, USDA Forest Service, Natural Resources Conservation Service (NRCS), MDEQ, and MDWFP. The comments from the cooperating agencies, along with the Vicksburg District's responses, are included in Appendix 5. Additional discussion of coordination activities is included under the topic "Views of Local Sponsor and Other Agencies."

Technical Criteria

141. The following criteria were adopted in developing the alternatives:

a. The existing Yazoo Backwater levee and the Steele Bayou and Little Sunflower drainage structures and connecting channels will continue under current operation.

b. The rate of flows from the Steele Bayou and Sunflower River watersheds enter into the Backwater area's ponding area may be changed slightly if the conveyance capacity of the channels is modified by other projects; however, the same volume of flow from a storm event will arrive in the Backwater area.

c. During the nonflood season, the Muddy Bayou Control Structure will continue to be operated to provide the water levels in Eagle Lake established in cooperation with MDWFP.

d. The objective is to keep flood surfaces below elevation 96.0 feet, NGVD, so as to alleviate the need for opening the gates on the Muddy Bayou Control Structure and allowing Eagle Lake to flood. This would prevent the overtopping of Highway 465 and the inundation of 107 residential and nonresidential structures at Eagle Lake.

e. Alternatives developed should be consistent with provisions of the National Flood Insurance Program.

f. The economic life of the project is assumed to be 50 years.

g. The Yazoo Backwater Area project (1982) will be reformulated to identify, display, and evaluate alternatives which consider:

(1) Greater level of flood protection for the structures located in the Yazoo Backwater Study Area.

(2) Reduced level of agricultural intensification.

(3) Reduced adverse impacts on the environment.

h. The pump-on elevations utilized in the study were initially based on the 5-foot elevation contour intervals on U.S. Geological Survey (USGS) quadrangle maps (80.0, 85.0, and 90.0 feet, NGVD). Refinements to the elevations were later made utilizing satellite imagery and river gage data to depict elevations of environmental significance as determined by FWS, EPA, and the Vicksburg District. The following pump-on elevation criteria were used in the various alternative arrays.

Pump-On Elevation (feet, NGVD)	Pump-On Elevation Criteria
80.0	Elevation 80.0 feet, NGVD, was the damage elevation used in the 1982 Reevaluation report. Available contour data from USGS quadrangle maps. Elevation of water to be held during crop season 1 March through 1 December in 1982 Reevaluation Report.
85.0	Elevation 85.0 feet, NGVD, was based on the available contour data from the USGS quadrangle maps. Also, elevation that water would be allowed to rise to during winter waterfowl season 1 December through 1 March in 1982 Reevaluation report.
87.0	Elevation 87.0 feet, NGVD, is the base 1-year frequency flood elevation at the Steele Bayou structure.
88.5	Elevation 88.5 feet, NGVD, represents the 5 percent duration wetland elevation at the Steele Bayou structure.
90.0	Elevation 90.0 feet, NGVD, based on the available contour data from USGS quadrangle maps.
91.0	Elevation 91.0 feet, NGVD, is the base 2-year frequency flood elevation at the Steele Bayou structure.
100.3	Elevation 100.3 feet, NGVD, is the base 100-year frequency flood elevation at the Steele Bayou structure.

Economic Criteria

142. Economic criteria for formulation of the alternatives in all of the arrays are summarized as follows:

a. The benefits and costs should be expressed in comparable terms as fully as possible. All evaluations of alternatives were based on October 2005 prices, an interest rate of 5-1/8 percent, and a 50-year period of analysis for flood control alternatives.

b. Each alternative considered in detail must be "justified" as total beneficial effects (monetary and nonmonetary) are equal to or exceed the total adverse effects (monetary and nonmonetary) associated with the objectives.

c. The maximization of net benefits should be determined in sizing a project; however, environmental quality and intangible considerations could dictate a project larger or smaller in size.

d. Project benefits should be based on analysis of with- and without-project conditions, using methodology described in USACE regulations and policies.

e. Benefit categories considered include both structural and nonstructural benefits. The structural benefits include agricultural crop and noncrop, structures, automobiles, roads, flood insurance, and emergency. The nonstructural benefits include the aforementioned crop and noncrop categories, but also include timber values and hunting leases.

Environmental Criteria

143. The following environmental criteria are applicable to the formulation and evaluation of alternatives.

a. Alternatives should be formulated to the maximum extent practicable to avoid and minimize impacts to environmental resources.

b. The environmental impacts of any proposed action should be evaluated. Any adverse environmental impacts, which could not be avoided, would be identified for compensation.

c. Unavoidable net environmental impacts will be mitigated concurrently with construction at 100 percent Federal cost.

d. Environmental losses that have remained from construction of the Yazoo Area and Satartia Area Backwater Levee Projects and the previous construction at the pump station site will be included in the Yazoo Backwater reformulation effort.

e. Environmental values are the same whether the land is acquired in fee title or encumbered with a perpetual conservation easement.

Socioeconomic Criteria

144. The following socioeconomic criteria are applicable in this study:

a. Laws and regulations require that consideration be given to evaluating and preserving historical, archeological, and other cultural resources.

b. Consideration should be given to safety, health, community cohesion, and social well-being.

c. Displacement of people by the floods and/or the project should be minimized to the extent possible. This includes displacement as a result of a nonstructural land use change.

d. Improvement of leisure activities and public facilities should be evaluated.

e. Effects of a project on regional development, including income, employment, business and industrial activity, population distribution, and desirable community growth, should be considered.

f. Executive Order 12898, 11 February 1994, "Federal Actions to Address Environmental Justice and Minority Populations and Low Income Populations," requires that Federal agencies consider and address the adverse environmental effects of proposed Federal projects on minority and low-income communities. In response to this directive, an analysis of environmental justice considerations is included in Appendix 8, Attachment 8A.

g. General public acceptance of potential alternatives should be determined by coordination with interested Federal and non-Federal agencies, various groups, and individuals by means of public meetings, field inspections, informal meetings, letters, and other public involvement procedures.

h. The alternatives should be implementable considering the present and potential constraints of the local sponsoring agency in regard to its structure, function, relationships, and associations in the study area.

ALTERNATIVES

GENERAL

145. Before describing the process and range of alternatives, this section explains the full range of features that could be utilized to meet the project purposes. The Vicksburg District considered alternatives that included nonstructural features, structural features, and combined nonstructural and structural features. Alternatives were formulated to minimize and/or avoid potential adverse project impacts on the environment and ensure identification of the NED or EQ Plans. These alternatives were developed and evaluated by an interdisciplinary team of planners representing disciplines such as engineering, hydrology, economics, and environmental. Each of the alternatives was developed through a multiobjective process to satisfy the specific needs identified in this report. Water management and mitigation features were evaluated to avoid, minimize, and compensate for unavoidable adverse environmental impacts. A "no-action" alternative was evaluated to display future conditions in the absence of a Federal project.

146. All practicable nonstructural features to reduce flood damages were considered during the screening of alternatives. While some were eliminated during early formulation of alternatives, others were evaluated in detail to determine if a combination of structural and nonstructural features would comprise the best solution for the overall study area.

147. Basically, two types of nonstructural features for flood protection exist--those which reduce existing damages and those which reimburse for existing damages and reduce future damage potential. Those nonstructural features which reduce damages are as follows:

a. Floodproofing by waterproofing of walls and openings in structures.

b. Raising structures in place.

c. Constructing walls or ring levees around structures.

d. Permanent flood plain evacuation.

(1) Relocate structures, contents, and residents to flood-free area.

(2) Relocate contents and residents and demolish structures. Provide replacement housing.

e. Flood forecasting and warning systems with temporary evacuation.

148. Nonstructural features which compensate or reimburse for existing damages and/or reduce future damages include:

a. Acquisition of flood-prone property by fee title or easement.

b. Flood plain regulation by zoning ordinances, regulations, and building codes.

c. Flood insurance.

d. Income Assurance Program – a nonstructural feature that would provide crop insurance premiums for the 50-year period of analysis. This is a one-time lump sum payment to those landowners in lieu of flood protection.

149. Residential, commercial, and public structures in the flood plain are primarily slab-on-grade construction. Raising such structures through normal jacking procedures is impractical; permanent flood plain evacuation was evaluated, but was not considered a viable alternative by the project sponsor or most residents of the study area. Flood forecasting and warning systems with temporary evacuation are in essence what are being utilized now and are not satisfactory because these methods reduce loss of life, but do not reduce property damage. Floods in this area are slow to occur with people having sufficient time to evacuate the area, but it could be months before the floodwaters recede and allow them to return to their structures.

150. Two types of easements were proposed--conservation and flowage--to compensate for existing damages and reduce future damages. Conservation easements were used to control future land use. Options under a conservation easement were (a) continue existing land use (wooded or open lands) while restricting future intensification of the land use and (b) reforestation of agricultural lands. A flowage easement is required when existing hydraulic conditions (depth, frequency, and/or duration of flooding) are adversely impacted by a proposed alternative/feature. The flowage easement feature would require additional authorization from Congress to implement. Landowner participation in conservation easements would be strictly on a willing seller basis. Flowage easements would be acquired by fee purchase with the use of condemnation in the event of nonagreement as to just compensation or incurable title problems. All easements would be perpetual in duration.

151. All six Mississippi counties and nine communities in the Lower Yazoo Basin are participants in the National Flood Insurance Program (NFIP). The unincorporated communities participate in NFIP through the local counties. This program allows property owners to purchase

flood insurance at subsidized rates and mandates the local government to adopt and enforce flood plain regulations that require all future development within the 100-year flood plain to be elevated above the 100-year flood elevation.

152. Structural features evaluated a pump station at Steele Bayou, a levee system along the Big and Little Sunflower Rivers and local protection projects; i.e., ring levees with pump stations to protect residential areas.

153. Approximately 80 percent of the drainage in the Yazoo Area is from the Sunflower River system. The Sunflower River and the Steele Bayou Basins were not directly connected until the construction of the connecting channel in 1978. Construction of levees along each side of the Sunflower River would restore the original division of drainage and result in reductions of flood stages in the Steele Bayou Basin. The connecting channel would have to be closed as part of the levee alternative. Under the levee alternative, drainage from the Sunflower River Basin would be evacuated through the existing Little Sunflower River structure. This structure would also be used to regulate low-water conditions for minimum ponding. A fixed overflow section would be required at the existing drainage structure to accommodate large streamflows. Drainage from the leveed area would be provided by landside collection ditches through gravity structures into the Sunflower River.

154. Local protection projects were evaluated for the towns of Rolling Fork, Eagle Lake, Cary, Holly Bluff, and Valley Park, Mississippi. Protection works usually consisted of ring levees, interior structures, and often a pump station to remove interior drainage.

INITIAL ARRAY

155. For the initial array in 1995, the Vicksburg District considered a range of nonstructural features. Table 4 provides the summary of the economic analysis of several nonstructural features for the four hydrologic reaches used in the 2000 Draft Report (the Sunflower subbasin was divided into three hydrologic reaches by the levees in the levee alternative. These reaches were used to evaluate all of the alternatives in the 2000 Draft Report and DSEIS. After the levee alternative was dropped from further consideration, only two hydrologic reaches were needed to analyze the hydrologic impacts of the project). Based on field observations by Vicksburg District economic and real estate personnel, structures were located in the field, marked and numbered on a map, and an approximate size and value determined. Then using a digital elevation model, the elevation of the structures was determined. Using the above data, hydrologic data, and computer models, the first cost, annual cost, annual benefits, and benefit-cost ratios were determined for the various nonstructural features. Table 4 was based on the structures that existed in the study area in 2000; dollar values are in 1996 dollars. Since that time, structural data were updated, refined, and reevaluated both in 2000 and 2005, results of which were utilized in the final array of alternatives, but not to update Table 4. The nonstructural analysis includes no projection as to future growth because while the population of Mississippi has increased over the past several decades, the counties of the lower

TABLE 4
ECONOMIC SUMMARY
OF NONSTRUCTURAL FEATURES BY PROJECT REACH a/
BASE (WITHOUT-PROJECT) CONDITIONS
YAZOO BACKWATER AREA REFORMULATION
(1996 Values)

Item/Reach	No. of Structures	First Cost ($000)	Annual Cost ($000)	Annual Benefit ($000)	Benefit-Cost Ratio
Reach 1 (Steele Bayou Basin)					
Floodproofing	545	9,317.0	728.9	127.4	0.17
Structure Raising	412	10,637.2	832.2	127.4	0.15
Small Walls	657	10,663.1	834.2	127.4	0.15
Relocation	412	20,024.6	1,566.5	100.9	0.06
Acquisition/Demolition	413	27,708.8	2,167.7	100.9	0.05
Reach 2 (Sunflower River Subbasin)					
Floodproofing	191	4,113.8	321.8	31.9	0.10
Structure Raising	149	4,219.2	330.1	31.9	0.10
Small Walls	205	4,122.5	322.5	31.9	0.10
Relocation	149	8,716.0	681.9	25.4	0.04
Acquisition/Demolition	149	11,291.4	883.3	25.4	0.03
Reach 3 (Sunflower River Subbasin)					
Floodproofing	75	985.3	77.1	13.7	0.18
Structure Raising	29	392.3	30.7	13.7	0.45
Small Walls	64	788.8	61.7	13.7	0.22
Relocation	29	701.5	54.9	12.8	0.23
Acquisition/Demolition	18	596.6	46.7	12.8	0.27
Reach 4 (Sunflower River Subbasin)					
Floodproofing	251	4,824.3	377.4	43.3	0.11
Structure Raising	142	3,450.2	369.9	43.3	0.16
Small Walls	260	5,027.6	393.3	43.3	0.11
Relocation	142	6,669.5	521.8	34.8	0.07
Acquisition/Demolition	139	7,885.1	616.9	34.8	0.06
Total For All Reaches					
Floodproofing	1,062	19,240.4	1,505.2	216.3	0.14
Structure Raising	732	18,698.9	1,462.9	216.3	0.15
Small Walls	1,186	20,602.0	1,611.7	216.3	0.13
Relocation	732	36,116.0	2,825.1	173.9	0.06
Acquisition/Demolition	719	47,481.9	3,714.6	173.9	0.05

a/ Nonstructural analysis conducted in 2000 based on 7-5/8 percent discount rate and no other project improvements in place, including structures in each reach.

Yazoo Basin have experienced very little growth. The populations of Sharkey and Issaquena Counties have been flat or slightly decreasing. As far as structures are concerned, there has been some increase in recreational and weekend homes in the area, as well as some new primary homes built in the Eagle Lake area. It is unlikely that the population of these counties will increase significantly under current economic conditions. As can be seen from the Table 4, none of the nonstructural features evaluated in the 2000 Draft Report for individual structures were feasible. However, nonstructural features to reduce future damage potential were considered in the next iteration of alternatives. These included conservation and flowage easements, structure raising, ring levees, and structure acquisition/demolition. These features are discussed in more detail in the following paragraphs, and the discussions associated with the final array of alternatives.

156. The initial array of alternatives was developed in 1995 to determine if a structural solution was economically feasible. Five alternative pump station capacities (10,500, 14,000, 17,500, 21,000, and 24,500 cfs with a year-round pump operation elevation of 80.0 feet, NGVD, at the Steele Bayou structure were evaluated. Pump station sizes were determined previously in the 1982 Backwater study and have been modeled by the U.S. Army Corps of Engineers, Portland District. A pump station is not one big pump, but a series of pumps. In general, the cost per cubic feet per second goes down as the pump size increases until reaching a size that physically cannot be constructed. In the case of the 14,000-cfs pump station, there are twelve 1,167-cfs pumps, each powered by its own motor. Pump sizes were determined by maximizing the pumping capacity that could be effectively manufactured by pump suppliers and the number of pumps that could be installed in each monolith. A Sunflower River levee alternative and local protection projects were also evaluated (Plate 4-5). Estimated compensatory mitigation costs were based on a preliminary aquatic impact analysis by ERDC, which was the resource that required the acquisition of the largest mitigation acreage when compared to other resources. An economic comparison of the alternatives is presented in Table 5. The costs of the pump stations shown in Table 5 reflect the use of electric motors to power the pumps. All the alternative pump station capacities and the Sunflower River levee alternative were economically feasible with a 14,000-cfs pump station providing the greatest excess of benefits over cost. The local protection plan was determined not to be economically feasible. Damages in the five areas were determined to be $433,000/year. These damages would only support a first cost of a plan of $6.3 million, and this assumes that all damages are alleviated. No structural features could be built around any of the areas for this amount. Therefore, no further economic analysis was conducted. A combination levee and pump station alternative was not further considered due to the fact that the levee would provide 100-year protection at a cost greater than any size pump station in the initial array. In addition, environmental losses would increase if both features were constructed. After determining that a 14,000-cfs pump station powered by electric motors provided the greatest excess benefits over cost, cost engineers evaluated this pump station size to

TABLE 5
ECONOMIC DATA FOR INITIAL ARRAY OF ALTERNATIVES a/
YAZOO BACKWATER AREA REFORMULATION

Benefits	Pump Station					Levee	Local Protection Projects c/
	10,500 cfs b/	14,000 cfs b/	17,500 cfs b/	21,000 cfs b/	24,500 cfs b/		
	Electric						
Agricultural Crop ($000)	11,400	13,500	14,600	15,300	15,700	10,400	
Agricultural Noncrop ($000)	2,380	2,800	3,040	3,180	3,280	2,000	
Catfish ($000)	337	362	404	442	467	325	
Structures ($000)	1,560	1,790	1,920	1,970	2,000	1,750	108
Road/Bridge ($000)	697	828	902	950	985	436	
Emergency ($000)	135	152	161	164	166	90	169
Flood Insurance ($000)	21	27	30	31	32	25	4
Automotive ($000)	11	13	14	14	14	13	14
Street ($000)	68	77	85	89	92	60	138
Total (Rounded) ($000)	16,600	19,500	21,200	22,100	22,700	15,100	433 d/
Costs							
Construction Cost ($000)	90,800	109,000	133,000	153,000	169,000	190,300 e/	
Mitigation Cost ($000)	18,700	22,600	23,100	26,700	30,600	12,600	
Total Construction Cost (Rounded) ($000)	110,000	131,000	156,000	179,000	200,000	203,000 e/	
Annual							
Amortization ($000)	9,510	11,400	13,600	15,600	17,300	12,700	
Operation and Maintenance ($000)	2,000	2,530	3,140	3,500	3,800	300	
Major Replacements ($000)	101	135	169	202	236	0	
Total Annual (Rounded) ($000)	11,600	14,100	16,900	19,300	21,400	13,500	
Excess Benefits (Rounded) ($000)	5,000	5,400	4,300	2,800	1,300	1,600	
Benefit-Cost Ratio (%)	1.4	1.4	1.3	1.2	1.1	1.1	

NOTE: Cost and benefit data rounded to three significant figures.

a/ Reflects 1995 benefits, costs, and 7-5/8 percent interest rate, 1988 land use.

b/ Assumes year-round pump operation at elevation 80 feet, NGVD.

c/ Local protection projects were evaluated at Rolling Fork, Eagle Lake, Cary, Holly Bluff, and Valley Park.

d/ This level of damages would support a first cost of $6,272,000. No project could be constructed for this cost; therefore, this alternative was dropped from further study.

e/ Based on staged levee construction.

determine the cost of a 14,000-cfs diesel-powered pump station. Results showed a savings when the pump station is powered by diesel engines over electric motors. These data are shown in Table 6.

157. Based on the information in the previous paragraph, only diesel-powered pump stations were evaluated in subsequent future arrays. The costs, benefits, interest rate, etc., utilized in Tables 5 and 6 reflect the price levels that were in existence in 1995. All of these pump station alternatives used 80.0 feet, NGVD, as the pump-on elevation. These tables were not updated to reflect 2005 price levels/benefits since they were utilized for screening purposes only. The relative difference in the alternatives would be the same regardless of the prices or interest rates utilized. Diesel engines are still the most economical.

SECOND ARRAY

158. The second array of alternatives was a modification of the first array based on the public involvement workshops held in 1997. Economic analyses were performed on concepts the participants requested to be considered. Cost data were based on a preliminary analysis and were refined if the alternative was carried forward into the next array. The alternatives are presented in Table 7, along with preliminary cost and environmental data. Table 7 reflects 1996 cost levels and was not updated to 2005 price levels because it was utilized for screening purposes only. The relative difference in the alternatives would be the same regardless of the prices or interest rate utilized. The acres of mitigation required to offset the remaining environmental losses were not updated using the revised environmental models presented in this Final Report nor were the acres available for reforestation updated to reflect 2005 land-use conditions. Nine nonstructural plans, 6 structural plans, and 13 plans combining both nonstructural and structural features were considered. The data were presented at the 7 August 1997 briefing to assist the public involvement participants in the selection of alternatives to be considered in the next iteration.

159. The nonstructural alternatives included conservation easements on open and forested lands and flowage easements for water management. Conservation easements were used to (a) preserve the existing woodlands in the study area, (b) reestablish forest on open lands below the elevations of 85.0 feet, NGVD (approximately 0.7-year frequency flood event at the Steele Bayou structure), and elevation 90 feet, NGVD (slightly less than the 2-year frequency flood event), at the Steele Bayou structure, (c) compensate owners of open lands who would experience continued flooding, and (d) reduce agricultural flood damage. Flowage easements were used for water management during the winter waterfowl season. The addition of a winter waterfowl water management feature is justified considering that waterfowl resources are considered significant by institutional, public, and technical criteria. Restoring important waterfowl habitat to one of the seven priority conservation (Yazoo Basin) areas with the United States is an initiative of the North America Waterfowl Management Plan which was signed by

TABLE 6
ECONOMIC DATA FOR ELECTRIC VERSUS DIESEL-POWERED PUMP STATION a/
INITIAL ARRAY OF ALTERNATIVES
YAZOO BACKWATER AREA REFORMULATION

Benefits	14,000 cfs	
	Electric b/	Diesel b/
Agricultural Crop ($000)	13,500	13,500
Agricultural Noncrop ($000)	2,800	2,800
Catfish ($000)	362	362
Structures ($000)	1,790	1,790
Road/Bridge ($000)	828	828
Emergency ($000)	152	152
Flood Insurance ($000)	27	27
Automotive ($000)	13	13
Street ($000)	77	77
Total (Rounded) ($000)	19,500	19,500
Costs		
Construction Cost ($000)	109,000	102,000
Mitigation Cost ($000)	22,600	22,600
Total Construction Cost (Rounded) ($000)	131,000	124,000
Annual		
Amortization ($000)	11,400	10,800
Operation and Maintenance ($000)	2,530	1,290
Major Replacements ($000)	135	126
Total Annual (Rounded) ($000)	14,100	12,200
Excess Benefits (Rounded) ($000)	5,400	7,300
Benefit-Cost Ratio (%)	1.4	1.6

NOTE: Cost and benefit data rounded to two significant figures.

a/ Reflects 1995 benefits, costs, and interest rate; 1988 land use.

b/ Assumes year-round pump operation at elevation 80 feet, NGVD.

the United States, Canada, and Mexico in 1986 and 1994, respectively. Winter waterfowl water would be provided by closing the gates of the Steele Bayou structure from 1 December to 1 March to induce ponding of interior/landside flows to water stage elevations of 80.0 and 85.0 feet, NGVD, at the Steele Bayou structure.

160. The following assumptions were used to formulate the nonstructural alternatives for the second array.

a. Conservation easements.

(1) Easement taken on cleared and/or wooded lands below a given elevation as shown in Table 7. Current land use either retained or reforested depending on elevation.

(2) No public access.

(3) Normal silvicultural practices would be allowed on woodlands.

(4) Future flood damage reduction foregone.

(5) Government has no right to induce flooding.

(6) All encumbrances would be perpetual.

(7) Structures would not be relocated unless affected by water management.

(8) All woodlands would be preserved with restrictions preventing conversion to more intensive use.

(9) Reforestation of cleared lands would be a 100 percent Federal cost.

(10) Operation of Little Sunflower and Steele Bayou structures would continue under current operational guidelines.

(11) All agricultural easements would contain restrictions preventing conversion to more intensive use.

b. Flowage easement for water management modifications.

(1) Operation of Steele Bayou and Little Sunflower structures would be modified to manage water during the period 1 December to 1 March using internal (Deer Creek, Steele Bayou, and Sunflower Rivers) and external (Yazoo and Mississippi Rivers) sources.

(2) Easements would be taken on cleared and wooded lands at or below a given elevation as shown in Table 7.

(3) Residential structures would be relocated if affected by water management.

(4) All encumbrances would be perpetual.

(5) Existing land use under the easements would not be allowed to intensify.

161. The structural alternatives included the pump station (five alternative pump station capacities) and the Sunflower River levee. Estimated compensatory mitigation requirements were included. Pumping would be initiated at elevation 85.0 feet, NGVD, in the 1 December to 1 March timeframe, but the remainder of the year pump operation would be initiated at elevation 80.0 feet, NGVD, at the Steele Bayou structure.

162. The alternatives combining both nonstructural and structural features included a 14,000-cfs pump station in combination with conservation and flowage easements. Conservation easement elevations were set at elevations 85.0 and 90.0 feet, NGVD, at the Steele Bayou structure. Flowage easement elevations were set at elevations 80.0 and 85.0 feet, NGVD, at the Steele Bayou structure for water management--induced ponding of water for winter waterfowl. The 14,000-cfs pump station would be operated to reduce flood damages above the conservation easement elevations.

163. The total cost for the nonstructural alternatives ranged from $217 to $295.8 million (1996 cost data). The least costly alternative was Alternative 1 which included conservation easements to preserve all existing wooded lands within the study area and conservation easements on open lands to compensate landowners for continued flooding. The most costly alternative (Alternative 9) included (a) conservation easements to preserve all existing wooded lands within the study area, (b) conservation easements to reestablish forest on open lands below elevation 90.0 feet, NGVD, at the Steele Bayou structure, (c) conservation easements on open lands above elevation 90.0 feet, NGVD, at the Steele Bayou structure to compensate landowners for continued flooding, and (d) flowage easements for water management (during the winter waterfowl season (1 December to 1 March) on lands below elevation 85.0 feet, NGVD, at the Steele Bayou structure.

164. The total costs for the alternatives with combined features ranged from $151 to $239 million (1996 cost data). The least costly alternative (Alternative 10) included (a) 14,000-cfs pump station to reduce flooding above elevation 85.0 feet, NGVD, at the Steele Bayou structure, (b) conservation easements to preserve existing wooded lands below elevation 85.0 feet, NGVD, at the Steele Bayou structure, and (c) conservation easements to compensate landowners of open land below elevation 85.0 feet, NGVD, at the Steele Bayou structure for continued flooding. The most expensive alternative (Alternative 21) included (a) 14,000-cfs pump station to reduce flooding above elevation 90.0 feet, NGVD, at the Steele Bayou structure,

TABLE 7
SECOND ARRAY OF ALTERNATIVES[a]/
YAZOO BACKWATER AREA REFORMULATION

Alternative	Easements			Easements	Reforestation	Mitigation	Structural	Total	Pump Station	Acres of Mitigation
	Conservation Easements on Woodlands	Reforestation/Open Lands	Flowage/Water Management [b]/	($ Million)						
NONSTRUCTURAL										
1	Preserved below 100.3 feet	Use Retained below 100.3 feet	N/A	217.0			N/A	217.0	N/A	
2	Preserved below 100.3 feet	Use Retained below 100.3 feet	Below 80.0 feet	235.3	0		N/A	235.3	N/A	
3	Preserved below 100.3 feet	Use Retained below 100.3 feet	Below 85.0 feet	253.2	0		N/A	253.2	N/A	
4	Preserved below 100.3 feet	Reforested below 85.0 feet	N/A	232.1	8.1		N/A	240.2	N/A	
5	Preserved below 100.3 feet	Reforested below 85.0 feet	Below 80.0 feet	255.0	8.1		N/A	263.1	N/A	
6	Preserved below 100.3 feet	Reforested below 85.0 feet	Below 85.0 feet	257.0	8.1		N/A	265.1	N/A	
7	Preserved below 100.3 feet	Reforested below 90.0 feet	N/A	246.5	15.7		N/A	262.2	N/A	
8	Preserved below 100.3 feet	Reforested below 90.0 feet	Below 80.0 feet	269.3	15.7		N/A	285.0	N/A	
9	Preserved below 100.3 feet	Reforested below 90.0 feet	Below 85.0 feet	280.1	15.7		N/A	295.8	N/A	
COMBINATION NONSTRUCTURAL-STRUCTURAL										
10	Preserved below 85.0 feet	Use Retained below 85.0 feet	N/A	48.9	0		102	150.9	14,000 cfs [c]/	
11	Preserved below 85.0 feet	Use Retained below 85.0 feet	Below 80.0 feet	59.2	0		102	161.2	14,000 cfs [c]/	
12	Preserved below 85.0 feet	Use Retained below 85.0 feet	Below 85.0 feet	75.1	0		102	177.1	14,000 cfs [c]/	
13	Preserved below 85.0 feet	Reforested below 85.0 feet	N/A	59.7	8.1		102	169.8	14,000 cfs [c]/	
14	Preserved below 85.0 feet	Reforested below 85.0 feet	Below 80.0 feet	68.9	8.1		102	179.0	14,000 cfs [c]/	
15	Preserved below 85.0 feet	Reforested below 85.0 feet	Below 85.0 feet	78.9	8.1		102	189.0	14,000 cfs [c]/	
16	Preserved below 90.0 feet	Use Retained below90.0 feet	N/A	82.5	0		102	184.5	14,000 cfs [c]/	
17	Preserved below 90.0 feet	Use Retained below90.0 feet	Below 80.0 feet	87.7	0		102	189.7	14,000 cfs [c]/	
18	Preserved below 90.0 feet	Use Retained below90.0 feet	Below 85.0 feet	103.6	0		102	205.6	14,000 cfs [c]/	
19	Preserved below 90.0 feet	Reforested below 90.0 feet	N/A	104.6	15.7		102	222.3	14,000 cfs [c]/	
20	Preserved below 90.0 feet	Reforested below 90.0 feet	Below 80.0 feet	111.8	15.7		102	229.5	14,000 cfs [c]/	
21	Preserved below 90.0 feet	Reforested below 90.0 feet	Below 85.0 feet	121.6	15.7		102	239.3	14,000 cfs [c]/	
22	Preserved below 100.3 feet	N/A	N/A	69.1		22.6	102	193.7	14,000 cfs [c]/	18,500
STRUCTURAL										
23	N/A	N/A	N/A			18.7	85	103.7	10,500 cfs [d]/	15,000
24	N/A	N/A	N/A			22.6	102	124.6	14,000 cfs [d]/	18,500
25	N/A	N/A	N/A			23.1	124	147.1	17,500 cfs [d]/	19,000
26	N/A	N/A	N/A			26.7	145	171.7	21,000 cfs [d]/	22,000
27	N/A	N/A	N/A			30.6	158	188.6	24,500 cfs [d]/	25,000
28	N/A	N/A	N/A			12.6	177	189.6	N/A	10,000

[a]/ Reflects 1996 cost data; 1988 land use.
[b]/ 1 December to 1 March.
[c]/ A 14,000-cfs pump station would be operated to reduce flood damages above easement elevations.
[d]/ Initiate pumping at elevation 85 feet, NGVD, during 1 December to 1 March; initiate pumping at elevation 80 feet, NGVD, during cropping season.

Notes:
Alternatives 1 through 9 are Nonstructural.
Alternatives 10 through 22 are Combination.
Alternatives 23 through 27 are standard plans, including a pump station while Alternative 28 is a structural levee plan along the Sunflower River.

(b) conservation easements to preserve existing wooded lands below elevation 90.0 feet, NGVD, at the Steele Bayou structure, (c) conservation easements to reestablish forest on open lands below elevation 90.0 feet, NGVD, at the Steele Bayou structure, and (d) flowage easements for water management during the winter waterfowl season on lands below elevation 85.0 feet, NGVD, at the Steele Bayou structure.

165. The total costs for the structural alternatives ranged from $104 to $190 million (1996 cost data). The least costly alternative was Alternative 22 (10,500-cfs pump station). The most expensive alternative was Alternative 27 (levee alternative).

166. Of the 28 alternatives, two nonstructural alternatives (Alternatives 1 and 7), all the alternatives with combined features, and three structural alternatives (Alternatives 24, 25, and 28) were selected at the 7 August 1997 briefing for more detailed analysis. The Board of Mississippi Levee Commissioners requested that a 17,500-cfs pump station also be evaluated in combination with nonstructural features.

THIRD ARRAY

167. The third array of alternatives is presented in Table 8. The third array includes all the alternatives developed through the public involvement workshops that were conducted by the Vicksburg District in August 1998. This information was presented to the consensus committee in March 1999. Table 8 includes 2 nonstructural alternatives; 12 combination alternatives utilizing a 14,000-cfs pump station and 12 combination alternatives utilizing a 17,500-cfs pump station; a 14,000-cfs pump station structural alternative; a 17,500-cfs pump station structural alternative; a levee alternative along the Big Sunflower River; and an alternative utilizing a 14,000-cfs pump station while preserving all existing woodlands below elevation 100.3 feet, NGVD. An economic comparison of the alternatives is presented in Table 8. Table 8 reflects 1998 cost levels and was not updated to 2005 price levels because it was utilized for screening purposes only. The relative difference in the alternatives would be the same regardless of price or interest rate utilized. The acres of mitigation required to offset the remaining environmental losses were not updated using the revised environmental models presented in this Final Report nor were the acres available for reforestation updated to reflect 2005 land-use conditions. Neither of the nonstructural alternatives was economically feasible. Five of the alternatives with combined features were economically justified--three with a 14,000-cfs pump station and two with a 17,500-cfs pump station. The combined alternative with the greatest excess of benefits over cost was Alternative 6, which included (a) a 14,000-cfs pump station with a pump operation elevation of 85.0 feet, NGVD, and (b) conservation easements to preserve existing woodlands below elevation 85.0 feet, NGVD, at the Steele Bayou structure. Two of the structural alternatives were economically feasible. The alternative with the greatest excess of benefits over costs was a structural alternative (Alternative 27), a 14,000-cfs pump station with a pump operation elevation of 80.0 feet, NGVD, during the cropping season (1 March-1 December) and

TABLE 8
THIRD ARRAY a/
YAZOO BACKWATER AREA REFORMULATION

Alternative	Construction Cost											Average Annual Costs	Average Annual Benefit	Excess Benefits
	Easements				Reforestation		Environmental Impacts	Mitigation Cost	Structural Modification	Pump Station	Total			
	Conservation Woodlands	Reforestation Open Lands b/	Flowage/ Water Management	Total										
				($ Million)	Acres	($ Million)	(HU)	($ Million)	($ Million)	($ Million)	($ Million)	($000)	($000)	($000)
NONSTRUCTURAL ALTERNATIVES														
1	Preserve below 100.3	Use retained	N/A	261.4	0	0	0	0	0	0	261	19,238	0	-19,238
2	Preserve below 100.3	Reforest below 90.0	N/A	307.8	101,800	14.3	80,070	0	0	0	330	24,265	-4,452	-28,717
COMBINATION ALTERNATIVES - 14,000 CFS PUMP b/														
3	Preserve below 85.0	Use retained below 85.0	N/A	42.1	0	0	-49,151	31.3	0	120	193	16,365	16,242	**-123**
4	Preserve below 85.0	Use retained below 85.0	Below 80.0 c/	63.5	0	0	-41,104	26.2	0.35	120	210	17,548	16,242	-1,306
5	Preserve below 85.0	Use retained below 85.0	Below 85.0 d/	81.7	0	0	-41,200	26.2	0.35	120	228	18,890	16,242	-2,648
6	Preserve below 85.0	Reforest below 85.0	N/A	56.0	53,000	7.4	10,608	0	0	120	187	15,574	16,900	**1,326**
7	Preserve below 85.0	Reforest below 85.0	Below 80.0 c/	70.2	53,000	7.4	21,533	0	0.35	120	202	16,654	16,900	**246**
8	Preserve below 85.0	Reforest below 85.0	Below 85.0 d/	81.7	53,000	7.4	21,390	0	0.35	120	213	17,503	16,900	-603
9	Preserve below 90.0	Use retained below 90.0	N/A	85.2	0	0	-30,927	19.1	0	120	224	18,522	13,387	-5,135
10	Preserve below 90.0	Use retained below 90.0	Below 80.0 c/	102	0	0	-9,232	5.8	0.35	120	228	18,675	13,387	-5,288
11	Preserve below 90.0	Use retained below 90.0	Below 85.0 d/	117	0	0	-9,223	5.8	0.35	120	243	19,783	13,387	-6,396
12	Preserve below 90.0	Reforest below 90.0	N/A	135	101,800	14.3	36,022	0	0	120	276	22,155	13,883	-8,272
13	Preserve below 90.0	Reforest below 90.0	Below 80.0 c/	139	101,800	14.3	66,607	0	0.35	120	280	22,466	13,883	-8,583
14	Preserve below 90.0	Reforest below 90.0	Below 85.0 d/	141	101,800	14.3	66,616	0	0.35	120	282	22,615	13,883	-8,732
COMBINATION ALTERNATIVES - 17,500 CFS PUMP b/														
15	Preserve below 85.0	Use retained below 85.0	N/A	42.1	0	0	-53,614	34.2	0	143	219	18,562	18,052	**-510**
16	Preserve below 85.0	Use retained below 85.0	Below 80.0 c/	63.5	0	0	-45,832	29.2	0.35	143	236	19,756	18,052	-1,704
17	Preserve below 85.0	Use retained below 85.0	Below 85.0 d/	81.7	0	0	-45,828	29.2	0.35	143	254	21,097	18,052	-3,045
18	Preserve below 85.0	Reforest below 85.0	N/A	56.0	53,000	7.4	3,932	0	0	143	210	17,532	18,159	**627**
19	Preserve below 85.0	Reforest below 85.0	Below 80.0 c/	70.2	53,000	7.4	14,414	0	0.35	143	225	18,612	18,159	-453
20	Preserve below 90.0	Reforest below 85.0	Below 85.0 d/	81.7	53,000	7.4	14,417	0	0.35	143	236	19,461	18,159	-1,302
21	Preserve below 90.0	Use retained below 90.0	N/A	85.2	0	0	-35,692	22.8	0	143	251	20,783	14,794	-5,989
22	Preserve below 90.0	Use retained below 90.0	Below 80.0 c/	102	0	0	-11,473	7.3	0.35	143	253	20,763	14,794	-5,969
23	Preserve below 90.0	Use retained below 90.0	Below 85.0 d/	117	0	0	-11,469	7.2	0.35	143	268	21,855	14,794	-7,061
24	Preserve below 90.0	Reforest below 90.0	N/A	135	101,800	14.3	29,534	0	0	143	299	24,113	14,917	-9,196
25	Preserve below 90.0	Reforest below 90.0	Below 80.0 c/	139	101,800	14.3	63,519	0	0.35	143	303	24,424	14,917	-9,507
26	Preserve below 90.0	Reforest below 90.0	Below 85.0 d/	141	101,800	14.3	63,523	0	0.35	143	305	24,573	14,917	-9,656
STRUCTURAL ALTERNATIVES b/														
27 (14K P) e/	N/A	N/A	N/A	0	0	0	-63,743	40.5	0	120	161	13,990	17,539	**3,549**
28 (17.5K P) e/	N/A	N/A	N/A	0	0	0	-75,884	48.2	0	143	191	16,636	19,664	**3,028**
29 (LEV) f/	N/A	N/A	N/A	0	0	0	-30,081	19.1	0	215	234	19,552	15,102	**-4,450**
30 (14K P)	Preserve below 100.3	N/A	N/A	73.3	0	0	-63,743	39.4	0	120	233	19,348	17,539	-1,809

a/ Reflects 1998 costs, benefits, and interest rate; 1988 land use.

b/ Pump station would be operated to provide flood damage reduction for cleared lands above the easement elevation.

c/ 1 December - 1 March.

d/ Elevation 80.0 feet, NGVD, 1 December - 1 January and 15 February - 1 March; elevation 85.0 feet, NGVD, 1 January - 15 February.

e/ Pump station would be operated to provide flood damage reduction for cleared lands above elevation 80 feet except during 1 December - 1 March when pump station would be operated at elevation 85 feet, NGVD.

f/ Does not reflect cost of pump station but of the levee.

a pump operation elevation of 85.0 feet, NGVD, during the waterfowl season (1 December-1 March) with compensatory mitigation. The 17,500-cfs pump station with a pump operation elevation of 80.0 feet, NGVD, during the cropping season and elevation 85.0 feet, NGVD, during the waterfowl season with compensatory mitigation was economically feasible.

168. After a review of the third array by the consensus committee and the Vicksburg District, flowage easements for water management were eliminated. There was not sufficient interior flow during 1 December to 1 March to consistently achieve an elevation between 80.0 and 85.0 feet, NGVD. Although there was sufficient interior flow to achieve an elevation of 80.0 feet, NGVD, the feature was not considered to be cost effective. The habitat units and associated total cost are presented in Table 9.

169. Also, conservation easements to preserve woodlands were retained only in Alternative 7 at the request of FWS. This feature was eliminated from other alternatives because it added cost with relatively little or no economic or environmental benefit. There was little evidence that existing bottom-land hardwoods are under threat of destruction. The Vicksburg District believes that sufficient laws and policies are available to prevent any substantial conversion of bottom-land hardwoods and this was agreed to by the Consensus Committee. Therefore, the costs for the easements for the conservation of woodland were dropped from further consideration.

170. The 17,500-cfs pump station was dropped from further consideration due to concerns expressed by the consensus committee and results of a Vicksburg District analysis which found excess benefits to be greater for the 14,000-cfs pump station when compared to the 17,500-cfs pump station. Only the 14,000-cfs pump station was carried into the fourth and final arrays (Plate 4-6).

FOURTH ARRAY OF ALTERNATIVES (2000 DRAFT REPORT)

171. The fourth array of alternatives resulted from the evaluations of previous arrays, a consensus building public involvement process and the combined utilization of satellite scenes, river gage stations, and GIS technology. Previously, planning efforts centered around utilization of the USGS quadrangle maps which are generally shown on 5-foot contours. With the advance in GIS technology, several satellite scenes could be ordered that showed levels of flooding at the various river elevations in the study area. This provides a planner a more accurate picture of the area impacted under preproject conditions. In addition, computer modeling had progressed such that postproject maps of the impacted area could be simulated and verified for each alternative. During the consensus building process, resource agencies requested the Vicksburg District utilize this technology to utilize pump-on/off elevations that were significant to environmental resources. For example, elevation 87.0 feet, NGVD, at the Steele Bayou structure

TABLE 9

PRELIMINARY AQUATIC SPAWNING RESOURCE SUMMARY a/

YAZOO BACKWATER AREA REFORMULATION

			Alternative	Impact	Reforest	Total	Mitigation	Mitgation	Mitigation O&M	Impact/ Reforest Ratio	Break Even Easement Reforestation	Break Even Reforestation Cost
				Habitat Units			Acres	$			Acres	$
			No-Action	200,553	0	200,553	0	0	0	0.00	0	
Ease. < 100.3			Alternative 1	0	0	0	0	0	0	0.00	0	
Easements < 90			Alternative 2	0	70,531	70,531	0	0	0	0.00	0	
14,000 Pump	Easements < 85	No	Alternative 3	-49,235	0	-49,235	21,041	32,549,856	315,609	0.00	0	
		80	Alternative 4	-41,170	0	-41,170	17,594	27,218,127	263,912	0.00	0	
		85	Alternative 5	-41,267	0	-41,267	17,636	27,282,316	264,534	0.00	0	
		No	Alternative 6	-49,235	59,759	10,524	0	0	0	0.82	43,650	34,920,365
		80	Alternative 7	-41,170	62,637	21,467	0	0	0	0.66	34,823	27,858,793
		85	Alternative 8	-41,267	62,593	21,325	0	0	0	0.66	34,930	27,944,244
	Easements < 90	No	Alternative 9	-20,090	0	-20,090	8,585	13,281,556	128,780	0.00	0	
		80	Alternative 10	-9,242	0	-9,242	3,950	6,110,319	59,247	0.00	0	
		85	Alternative 11	-9,234	0	-9,234	3,946	6,104,400	59,189	0.00	0	
		No	Alternative 12	-20,090	71,810	51,720	0	0	0	0.28	28,471	11,857,689
		80	Alternative 13	-9,242	75,839	66,597	0	0	0	0.12	12,402	5,165,418
		85	Alternative 14	-9,234	75,842	66,609	0	0	0	0.12	12,390	5,160,206
17,500 Pump	Easements < 85	No	Alternative 15	-53,709	0	-53,709	22,953	35,507,643	344,289	0.00	0	
		80	Alternative 16	-45,910	0	-45,910	19,620	30,351,858	294,297	0.00	0	
		85	Alternative 17	-45,907	0	-45,907	19,618	30,349,567	294,275	0.00	0	
		No	Alternative 18	-53,709	57,544	3,835	0	0	0	0.93	49,450	39,560,066
		80	Alternative 19	-45,910	60,246	14,336	0	0	0	0.76	40,374	32,299,052
		85	Alternative 20	-45,907	60,247	14,340	0	0	0	0.76	40,370	32,296,388
	Easements < 90	No	Alternative 21	-22,333	0	-22,333	9,544	14,764,565	143,160	0.00	0	
		80	Alternative 22	-11,487	0	-11,487	4,909	7,594,383	73,637	0.00	0	
		85	Alternative 23	-11,484	0	-11,484	4,908	7,592,092	73,614	0.00	0	
		No	Alternative 24	-22,333	70,988	48,655	0	0	0	0.31	32,016	13,334,359
		80	Alternative 25	-11,487	74,992	63,505	0	0	0	0.15	15,589	6,492,502
		85	Alternative 26	-11,484	74,993	63,509	0	0	0	0.15	15,584	6,490,507
14000			Alternative 27	-63,859	0	-63,859	27,290	42,217,952	409,353	0.00	0	
17500			Alternative 28	-76,022	0	-76,022	32,488	50,258,960	487,320	0.00	0	
Levee			Alternative 29	-30,081	0	-30,081	12,855	19,886,883	192,827	0.00	0	
14000 Preserve			Alternative 30	-63,859	0	-63,859	27,290	42,217,952	409,353	0.00	0	

a/ Reflects 1988 land use and draft environmental appendixes.

was the 1-year frequency flood elevation; elevation 88.5 feet, NGVD, is the 5 percent duration elevation; and elevation 91.0 feet, NGVD, is the 2-year frequency flood elevation. In addition, the change in the operation of the Steele Bayou structure to maintain water elevations between 68.5 and 70.0 feet, NGVD, to an elevation between 70.0 and 73.0 feet, NGVD, during low-flow conditions, was a result of the consensus building process.

172. The EPA funded Dr. Leonard Shabman of Virginia Tech University to evaluate nonstructural flood damage reduction initiatives in the Yazoo Backwater Area.

173. The Shabman Report evaluated the following initiatives:

a. Adopt existing economic analysis protocols for evaluating nonstructural alternatives.

b. Demonstrate the analytical protocol with an evaluation of nonstructural actions for the Yazoo River backwater.

c. Describe an implementation plan that would provide incentives for landowners' adoption of nonstructural actions.

d. Review Vicksburg District preliminary estimates of agricultural benefits for a pump.

174. The Vicksburg District was briefed on the Shabman Report on 11 February 2000 and later received a copy for review. The Vicksburg District reviewed the report as it related to the planning objectives and to determine if it adhered to current policies and guidance. The Vicksburg District also evaluated whether the report recommendations warranted further review as a reasonable alternative. Several of the Shabman Report objectives were similar to the Vicksburg District objectives. A major difference was that the Shabman Report recommendations only affect a portion of those lands and properties below the 2-year frequency flood elevation while the Vicksburg District plans provided benefits to those lands and properties up to the 100-year frequency flood elevation.

175. In summary, the Shabman Report identified 3 findings and 12 implications which are discussed in more detail in Appendix 17 and summarized in the following paragraphs.

176. Based on the Vicksburg District's understanding of the Shabman Report, which recommended a nonstructural alternative that included voluntary reforestation of approximately 70 percent of the 2-year frequency flood event (88,000 acres—1988 land use), an income assurance program for farms outside the 2-year flood plain, and relocation or the utilization of local flood protection features for a limited number of structures. This plan was not

economically justified without counting benefits from carbon sequestration and nutrient load reduction. To be used, economic markets for these two categories must be found to exist and be predictable. Also, these benefit categories must be extended to all Federal water resource projects where reforestation is combined with a nonstructural approach. It was the Vicksburg District that concluded these benefit categories had been overstated based on information received by the Vicksburg District (K. Pennington, 1999, "Relationship Between Surface Water Sediment Concentration, Total Phosphorus, and Total Kjeldahl Nitrogen in Mississippi Delta Streams," Proceedings of the 29th Mississippi Water Resources Conference). In addition, the Shabman Report failed to account for all the costs involved. For example, the cost of acquiring 88,000 acres (1988 land use) proposed by Dr. Shabman was not quantified. The Shabman Report projected that approximately 40,000 acres would be enrolled in WRP and CRP (therefore, paid for by USDA funds, rather than project funds). Dr. Shabman did not account for the costs of administration to acquire and reforest these lands, provide the income assurance program to those lands above the 2-year flood plain, elevate roadways, and relocate any structures. The Vicksburg District's detailed review of the Shabman Plan is included in Appendix 17. Due to the above-listed reasons and because this plan does not meet the overall objectives of the study, the Vicksburg District concluded that the Shabman Plan was not a reasonable alternative. The full Shabman Report was included as an appendix in the Draft Report and circulated for public comment.

177. Project features carried into the fourth array alternatives included (a) a pump station to provide flood damage reduction benefits above the pump operation elevation, (b) conservation easements from willing sellers with reestablishment of forest on open land below the pump operation elevation to prevent existing flood damages by converting the land to a use more compatible to frequent flooding, (c) conservation easements from willing sellers to preserve forest land below the pump operation elevation of 91.0 feet, NGVD (requested by FWS), at the Steele Bayou structure, (d) compensatory mitigation for unavoidable environmental impacts and (e) modification of the operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-flow conditions. This allows for more permanent water in the existing channels and provides additional environmental habitat. This feature has no cost associated with it, but provides a positive environmental gain for the area. Seven alternatives are included in the fourth array. Included in the array is the no-action alternative, a nonstructural alternative, a structural alternative, and four combinations of structural and nonstructural alternatives. Several of these alternatives were modified by further discussions with the consensus committee from what was shown in Array 3. Alternatives were developed relating pump-on elevation to flood frequency. Elevation 87.0 feet, NGVD, at the Steele Bayou structure represents the 1-year frequency flood event while elevation 91.0 feet, NGVD, represents the 2-year frequency flood event at the Steele Bayou structure. Elevation 88.5 feet, NGVD, at the Steele Bayou structure represents the elevation of Federally-defined wetlands (5 percent duration) as determined by backwater flooding analyses. Alternatives have been developed that utilize these elevations for pump station operation.

178. The alternatives carried into the fourth array are:

a. Alternative 1. No action.

b. Alternative 2 - nonstructural alternative. No pump station with conservation easements from willing sellers on 212,600 acres of open land, below the 100-year elevation of 100.3 feet, NGVD, with reestablishment of forest on 107,000 acres of open land below elevation 91.0 feet, NGVD, which is the 2-year frequency flood event, and modified operation of Steele Bayou structure to maintain water levels between 70.0 to 73.0 feet, NGVD, elevations during low-water periods.

c. Alternative 3. The 14,000-cfs pump station with pump operation elevation of 80.0 feet, NGVD (1 March-1 December), at the Steele Bayou structure and elevation 85.0 feet, NGVD (1 December-1 March); acquisition and reestablishment of forest on 27,435 acres for mitigation and modified operation of Steele Bayou structure to maintain water levels between 70.0 to 73.0 feet, NGVD, elevations during low-water periods.

d. Alternative 4. The 14,000-cfs pump station with a year-round pump operation elevation of 85.0 feet, NGVD, at Steele Bayou; conservation easements from willing sellers and reestablishment of forest on 40,600 acres of open land below the pump elevation; and modified operation of Steele Bayou structure to maintain water levels between 70.0 to 73.0 feet, NGVD, elevations during low-water periods.

e. Alternative 5. The 14,000-cfs pump station with a year-round pump operation elevation of 87.0 feet, NGVD, at Steele Bayou; conservation easements from willing sellers; and reestablishment of forest on 62,500 acres of open land below the pump elevation, modified operation of Steele Bayou structure to maintain water levels between 70.0 to 73.0 feet, NGVD, elevations during low-water periods.

f. Alternative 6. The 14,000-cfs pump station with a year-round pump operation elevation of 88.5 feet, NGVD, at Steele Bayou; conservation easements from willing sellers; and reestablishment of forest on 77,300 acres of open land below the pump elevation; modified operation of Steele Bayou structure to maintain water levels between 70 to 73 feet, NGVD, elevations during low-water periods and to reintroduce flows from the Mississippi River up to elevation 87.0 feet, NGVD, at Steele Bayou structure (1-year frequency flood event).

g. Alternative 7. The 14,000-cfs pump station with a year-round pump operation elevation of 91.0 feet, NGVD, at Steele Bayou; conservation easements from willing sellers; reestablishment of forest on 107,000 acres of open land below the 91.0 feet, NGVD, elevation; conservation easements on 91,600 acres of existing woodlands below elevation 91.0 feet, NGVD (requested by FWS); modified operation of Steele Bayou structure to maintain water levels between 70.0 to 73.0 feet, NGVD, elevations during low-water periods and to reintroduce flows from the Mississippi River up to elevation 87.0 feet, NGVD, at the Steele Bayou structure (1-year frequency flood event).

179. Table 10 summarizes the economic analysis of the fourth array based on 2000 price levels, 6-5/8 percent interest rate, and 1988 land use. As shown, Alternative 3, the structural alternative, along with the combination Alternatives 4-6, are economically justified.

TABLE 10
SUMMARY, ECONOMIC ANALYSIS (FOURTH ARRAY) (2000 DRAFT REPORT)
FIRST COSTS, ANNUAL COSTS, ANNUAL BENEFITS,
EXCESS BENEFITS OVER COST, AND BENEFIT-COST RATIO
YAZOO BACKWATER AREA REFORMULATION

Item	Alternatives (Fourth Array)					
	2	3	4	5	6	7
Costs ($000)						
First Cost a/b/	291,001	153,710	154,732	181,595	196,274	274,654
Structural	--	115,233	140,391	134,978	127,913	120,383
Nonstructural	291,001	--	14,341	46,617	68,461	154,271
Interest During Construction	27,731	14,648	14,740	17,305	18,704	26,173
Structural	--	14,648	13,374	12,863	12,180	11,472
Nonstructural	27,731	--	1,366	4,442	6,524	14,701
Mitigation	--	38,477	--	--	--	--
Gross Investment	318,732	168,358	169,472	198,900	214,981	300,827
Structural	--	129,881	153,765	147,841	140,093	131,855
Nonstructural	318,732	--	15,707	51,059	74,985	168,972
Annual Cost a/b/c/ ($000)						
Structural						
Amortization	--	11,623	10,616	10,207	9,665	9,103
O&M Project	--	812	812	812	812	812
O&M Energy	--	379	253	183	142	76
O&M Mitigation	--	334	--	--	--	--
Pump Replacement	--	154	154	154	154	154
Nonstructural						
Amortization	22,005	--	1,085	3,525	5,177	11,666
Total Annual Costs a/b/c/	22,005	13,302	12,920	14,881	15,950	21,811
Structural	--	13,302	11,835	11,356	10,773	10,145
Nonstructural	22,005	--	1,085	3,525	5,177	11,666

TABLE 10 (Cont)

Item	Alternatives (Fourth Array)					
	2	3	4	5	6	7
Annual Benefits c/ ($000)						
Structural						
Agricultural Crop	--	12,934	10,085	9,763	8,708	6,274
Agricultural Noncrop	--	2,705	2,579	2,241	2,159	1,770
Structures	--	1,967	1,935	1,871	1,788	1,639
Road and Bridge	--	883	863	828	802	766
Urban Streets	--	90	89	83	80	66
Emergency Cost	--	170	168	158	152	126
Federal Insurance Administration	--	31	31	30	29	25
Catfish	--	383	377	365	352	319
Total Structural	--	19,163	16,127	15,339	14,070	10,985
Nonstructural						
Agricultural Crop	380	--	1,027	1,162	854	380
Timber/Hunting Leases	2,488	--	608	936	1,158	2,488
Total Nonstructural	2,868	--	1,635	2,098	2,012	2,868
Employment						
Structural	--	438	417	376	351	395
Nonstructural	841	--	43	130	188	384
Total Employment	841	438	460	506	539	683
Annual Benefits (All Benefit Categories) ($000)						
Structural	--	19,601	16,544	15,715	14,421	11,380
Nonstructural	2,410	--	1,678	2,228	2,200	3,252
Total Annual Benefits (All Benefit Categories) ($000)	2,410	19,601	18,222	17,943	16,621	14,536
Annual Benefits (With Employment Excluded) ($000)						
Structural	--	19,163	16,127	15,339	14,070	10,985
Nonstructural	1,569	--	1,635	2,098	2,012	2,868
Total Annual Benefits (With Employment Excluded) ($000)	1,569	19,163	17,762	17,437	16,082	13,853
Excess Benefits Over Cost (All Benefit Categories) ($000)	(19,595)	6,299	5,302	3,063	670	(7,181)
Excess Benefits (With Employment Excluded) ($000)	(20,436)	5,861	4,842	2,557	131	(7,960)
Benefit-Cost Ratio (All Benefit Categories)	0.11	1.47	1.41	1.23	1.07	0.67
Benefit-Cost Ratio (With Employment Excluded)	0.07	1.44	1.37	1.19	1.03	.64

a/ February 2000 price levels.

b/ Includes costs for mitigation for Alternative 3; Alternatives 2 and 4-7 include conservation easement and reforestation costs (1988 land use).

c/ Annualized using 50-year project life 6-5/8 percent Federal discount rate.

180. Tables 11 and 12 summarized the environmental analysis of the alternatives carried into the fourth array. Table 11 presents the analyses in terms of average annual habitat units (AAHU), functional capacity units (FCU), and duck-use-days (DUD) by alternative while Table 12 presents the net change in each resource category by alternative. Additional information is included in Appendixes 10–13.

181. The fourth array was the final array shown in the 2000 Draft Report and serves as a basis for the final array of alternatives.

FINAL ARRAY OF ALTERNATIVES (2007 FINAL REPORT)

182. Based on comments received on the 2000 Draft Report and DSEIS, ten alternatives are included in the final array. Included in the final array are the no-action alternative, four nonstructural alternatives, a structural alternative, and four combination alternatives utilizing both structural and nonstructural features. Alternatives were developed utilizing the elevation of hydrologic events. Elevation 87.0 feet, NGVD, at the Steele Bayou structure represents the 1-year frequency flood event while elevation 91.0 feet, NGVD, is the 2-year frequency flood event. Elevation 88.5 feet, NGVD, represents the upper limit of backwater sustained wetlands at the Steele Bayou structure. Alternatives were developed that utilize these elevations for pump operation. Project features carried into the final array alternatives included (a) a pump station to provide flood damage reduction benefits above the pump operation elevation, (b) perpetual easements from willing sellers with reestablishment of forest/conservation features on open land primarily below the pump operation elevation to reduce flood damages by converting the land to a use more compatible to frequent flooding, (c) perpetual easements from willing sellers to preserve forest land primarily below the pump operation elevation of 91.0 feet, NGVD (requested by FWS), and (d) compensatory mitigation for unavoidable environmental impacts, (e) ring levees, (f) floodproofing or relocating structures below 100-year flood plain, (g) income assurances, (h) restore connectivity with the Yazoo and Mississippi Rivers for the 1-year frequency flood plain, and (i) modification of operation of the Steele Bayou structure during low-water periods.

183. A number of changes and updates have occurred since the release of the Draft Report and Draft SEIS. These changes are highlighted below:

a. Land use data were updated from 1988 to 2005. The Vicksburg District's updated land use revealed that some of the low-lying agricultural lands were reforested under USDA conservation programs during these years. This change affected the economic and environmental analyses, and there is less acreage available for reforestation under the nonstructural flood damage reduction feature.

TABLE 11
ENVIRONMENTAL GAINS AND LOSSES
FOURTH ARRAY
YAZOO BACKWATER AREA REFORMULATION
(2000 Draft Report) (1988 Land Use)

Alternative	Terrestrial (AAHU)			Wetland (FCU)			Waterfowl (DUD)			Aquatics Spawning (AAHU) a/			Aquatics Rearing (AAHU)		
	Structural Effects		Nonstructural Effects	Structural Effects		Nonstructural Effects	Structural Effects		Nonstructural Effects	Structural Effects		Nonstructural Effects	Structural Effects		Nonstructural Effects
	Construction	Hydrologic	Reforestation	Construction	Hydrologic	Reforestation	Construction	Hydrologic	Reforestation	Construction	Hydrologic	Reforestation	Construction	Hydrologic	Reforestation
2	0	0	175,542	0	0	77,919	0	0	-824,505	0	0	80,072	0	0	41,730
3	-108	-6,572	0	-463	-52,788	0	-2,166	-188,934	0	-142	-63,744	0	-44	-42,913	0
4	-108	-3,832	78,473	-463	-39,469	63,227	-2,166	-184,086	-750,357	-142	-49,151	59,759	-44	-31,571	31,853
5	-108	-2,896	110,678	-463	-18,579	70,562	-2,166	-80,438	-790,828	-142	-29,919	67,489	-44	-15,905	36,556
6	-108	1,183	133,912	-463	22,072	83,318	-2,166	326,326	-958,177	-142	-12,659	74,555	-44	-2,679	40,394
7	-108	3,721	177,715	-463	30,824	92,362	-2,166	362,462	-973,220	-142	2,802	81,200	-44	+5,327	43,146

NOTE: Construction effects are those that result from the actual construction site; hydraulic effects are those that result from operation of the structural features; and reforestation effects are those that result from reforesting agricultural lands.

+ indicates a gain in environmental resources.
- indicates a loss in environmental resources.

a/ Flood plain spawning had the greater impacts than rearing habitat value and was used to determine compensatory mitigation and the minimum threshold of reforestation required under plans with negative effects.

TABLE 12
NET ENVIRONMENTAL GAINS AND LOSSES
FOURTH ARRAY
YAZOO BACKWATER AREA REFORMULATION
(2000 DRAFT REPORT)
(1988 LAND USE)

Alternative	Terrestrial (AAHUs)	Wetland (FCUs)	Waterfowl (DUDs)	Aquatics Spawning (AAHUs)	Aquatics Rearing (AAHUs)
2	175,542	77,919	-824,505	80,072	41,730
3	-6,680	-53,251	-191,100	-63,886	-42,957
4	74,533	23,295	-936,609	10,466	238
5	107,674	51,523	-873,432	37,425	20,607
6	134,987	104,928	-634,017	61,754	37,671
7	181,328	122,722	-612,924	83,860	48,429

NOTE: Although reforestation results in a loss of waterfowl foraging habitat for all plans, there are other important waterfowl requirements that are met with reforestation (loafing, pair bonding, etc.) and that are notably absent in agricultural fields.

AAHU – Average Annual Habitat Units
FCU – Functional Capacity Units
DUD – Duck-Use Days

b. A wetland reanalysis was completed which modeled the extent of wetlands sustained by backwater flooding with GIS. The functional values of wetlands were determined utilizing the HGM approach. The HGM approach was developed by ERDC in conjunction with EPA. This method measures eight wetland functions over a range of durations and land cover types. The HGM approach, when used with the Vicksburg District's Flood Event Simulation Model (FESM), allowed for a comparison of pre- and postproject changes to the Yazoo Backwater Area's wetlands. The FESM is a GIS model which was developed to simulate flooding using stage data and a digital elevation model (DEM).

c. In order to verify the Vicksburg District's offsite wetland delineation, EPA requested a statistically valid field testing of the results. To accomplish this, EPA wetland scientists utilized their Environmental Monitoring and Assessment Program (EMAP) to randomly choose 150+ sample sites within the study area for field testing. The goals of this sampling were to verify the Vicksburg District offsite wetland delineation, produce a statistically significant estimate of the project areas wetland acreage, and compare that acreage to the amount estimated by the Vicksburg District FESM model. In June 2003, interagency teams of scientists and engineers representing EPA, FWS, NRCS, and the Vicksburg District performed wetland determinations on the 150+ sampling sites. The wetland determinations were made using the 1987 Wetland Manual. Based on the results of the random field sampling, EPA estimated there are 216,600 acres of wetlands within the study area.

d. The Economic analysis was revised using an updated MSU report on crop production costs and yield data based on planting dates. Residential and nonresidential structure data were also updated.

e. The Water Quality analysis was updated to address total maximum daily loads (TMDL) and quantify project impacts using HGM.

f. A consulting firm, specializing in socioeconomic issues, prepared an environmental justice report.

g. The nonstructural feature was modified to allow up to 10 percent of the reforestation lands to be used for other conservation features. These features include the installation of water control structures, which will provide additional foraging habitat for waterfowl (Plate 4-16).

h. The date for securing the perpetual easements on the nonstructural feature was extended from 1 to 10 years after the pump station construction is complete.

i. Sufficient easements would be purchased prior to pump station operation to offset adverse impacts of the project.

j. Quantified the cumulative effects to terrestrial, wetlands, waterfowl, and aquatics from constructing both the Yazoo Backwater and the Big Sunflower River Maintenance Projects.

184. Other initiatives added include:

a. A 7-year, $4.9 million, pondberry study with USFS and FWS.

b. A 4 year, $1.0 million, suspended sediments/nutrient concentration study with USGS.

Both of these studies are ongoing at this time.

185. Formal consultation with FWS was conducted on the endangered plant, pondberry, as well as informal consultation on the threatened species Louisiana black bear.

186. The final array of alternatives is similar to the fourth array (2000 Draft Report), but with three variations of nonstructural approaches identified in the 2000 Draft Report and DSEIS. The EPA requested that additional nonstructural alternatives be evaluated in their review of the 2000 Draft Report, including an alternative similar to the plan outlined in the Shabman Report. Alternative 2A flood proofed the structures within the 100-year flood plain and provided income assurance to lands above elevation 88.5 feet, NGVD. Alternative 2B consisted of 14 ring levees, which would protect 88 percent of the structures in the 100-year flood plain. The parts of the Shabman Report which could be considered benefit categories utilizing USACE Principles and Guidelines were evaluated in Alternative 2C. Each of the above alternatives also had a nonstructural feature under which agricultural lands would be acquired and reforested.

187. In addition to the Shabman Report, EPA submitted another alternative to be considered for the area. This alternative was submitted to the Vicksburg District after the release of the Draft Report in September 2000. It will be discussed in the following paragraphs as part of the Final Report. The plan was entitled "The Lower Yazoo River Basin Economic and Environmental Initiative." The complete 5-page EPA report, along with Vicksburg District comments, are presented in Appendix 17.

188. The EPA's Lower Yazoo River Basin Economic and Environmental Initiative was estimated to cost approximately $170.0 million. It involved numerous state and Federal agencies, private industry, and nongovernment organizations in ongoing programs, but also recommended several new programs that would require congressional authorization and funding. The initiative was broken down into three priority areas and the costs associated with each. Priority 1 involved public health and safety at a cost of $55.0 million. Priority 2 involved flood plain protection and restoration and community economic development at a cost of $73.0 million. Priority 3 was economic development through nature-based tourism at a cost of $42.0 million. The final array of alternatives includes flood damage reduction features proposed in Priorities 1 (Flood protection of structures-houses/business/roads) and 2 (Conservations easements from willing sellers on 50,000 to 80,000 acres on the most frequently flooded lands

through targeted Emergency Wetland Reserve Program (NRCS)/Section 319 (EPA) initiatives). All remaining features in Priorities 1, 2, and 3 involve economic development and do not meet the study authority and objective of flood damage reduction. Thus, this plan as originally drafted by EPA was not carried through full alternatives analysis. The initiative is included in Appendix 17.

189. Since the release of EPA's document in September 2000, the Vicksburg District is not aware of any effort by EPA or others to go forward with this initiative. The EPA has not held any meetings or discussions with the state and Federal agencies who have primarily responsibilities in the areas that EPA desired to address in developing their initiative. In addition, Congress has not enacted any legislation or funded any of the initiatives beyond what the agencies were already funded to carry out.

190. The alternatives carried into the final array are described below, and all elevations are based on the elevation at the Steele Bayou structure. The operation of the Little Sunflower structure will not change with any of the alternatives.

[NOTE: Blocking Out. The reforestation/conservation features easement acquisition limits for the Yazoo Backwater Reformulation Study were established based upon flood frequency stage elevations. However, based upon sound real estate practices and guidance as found in USACE real estate regulations, blocking out will be utilized to address such items as access, the extent of severance damages, and avoidance of an uneconomic remainder. The blocking out will result in the acquisition of some lands outside a given flood event or elevation. The Vicksburg District Real Estate Division has vast experience in the acquisition of lands based upon elevation and typically uses a blocking factor of 30 percent. This figure was utilized for calculating the acreage to be acquired for the reforestation/conservation features easement in connection with the Yazoo Backwater Reformulation Study. The symbol "(b)" indicates a blocked acreage in the alternative descriptions listed below. Acreages are rounded to the nearest 100 acres and are based on 2005 land use.

Slope. Throughout the descriptions of the alternatives, the elevation at the Steele Bayou structure will be referenced regarding the acquisition of perpetual/flowage easements. These references do not imply an absolute elevation, but imply an elevation that rises as you move upstream from the structure. The rate of the rise or the slope of the surface can be found in Appendix 6 (Engineering), and it is based upon a hydrologic event, such as the 1-year frequency flood. The use of the elevation at the Steele Bayou structure establishes a standard point of reference for comparison of the alternatives.]

a. No Action.

Alternative 1. This is the no-action alternative. This action would not eliminate potential flood damages. Residential and nonresidential structures would continue to be affected by flooding, which economically impacts the area. Local, state, and Federal governments would continue to pay for flood-fighting efforts and repair of urban and rural roads, bridges, and other infrastructure. There will be no project impacts with the no-action alternative.

b. Nonstructural alternatives. The flowage easements and income assurance features of the nonstructural alternatives would require additional authorization from Congress to implement.

(1) Alternative 2. This alternative contains nonstructural and operational features which influence land-use patterns and activities. There is a no-pump station feature in Alternative 2. To be consistent with alternatives that include a pump station (i.e., some level of benefit across the study area), the nonstructural easements would provide flood damage reduction through reforestation or some degree of compensation across the entire study area. Reforestation of the 2-year flood plain (elevation 91.0 feet, NGVD, at the Steele Bayou structure) would provide flood damage reduction and remove impacts of agricultural practices on these lands. Compensation would be provided above elevation 91.0 feet, NGVD, at the Steele Bayou structure. Features include:

(a) Nonstructural.

1. Acquisition and reforestation/conservation features on up to 124,400 (b) acres of agricultural lands through perpetual easements from willing sellers only. Approximately 95,700 acres of cleared land are potentially available below elevation 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure), and the remaining acreage needed to reach up to the 124,400 acres would be acquired above elevation 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure). Up to10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to, (a) water management impoundments for waterfowl, wading birds, or other wildlife purposes; (b) food plots; (c) permanent openings maintained in early successional stages; (d) access trails, roads, and firebreaks; or (e) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches

used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches. The Vicksburg District will have the right to enforce the terms of the recorded conservation easements.

2. Acquisition of up to 197,600 acres of agricultural lands between elevations 91.0 and 100.3 feet, NGVD, at the Steele Bayou structure, through flowage easements. No agricultural intensification or other development would be allowed under the easement. Easements would be perpetual and from willing sellers only.

(b) Operational. Operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. No additional real estate is required for this feature.

(2) Alternative 2A. This alternative contains nonstructural features which influence land-use patterns and activities. There is a no-pump station feature in this alternative. Features include:

(a) Nonstructural.

1. Acquisition and reforestation/conservation features on up to 81,400 (b) acres of agricultural lands through perpetual easements from willing sellers only. Approximately 62,600 acres of cleared land are potentially available below elevation 88.5 feet, NGVD, at the Steele Bayou structure, and the remaining acreage needed to reach up to the 81,400 acres would be acquired between elevations 88.5 and 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure). Up to 10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to, (1) water management impoundments for waterfowl, wading birds, or other wildlife purposes; (2) food plots; (3) permanent openings maintained in early successional stages; (4) access trails, roads, and firebreaks; or (5) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches. The Vicksburg District will have the right to enforce the terms of the recorded conservation easements.

2. Flood proofing 1,363 structures in the 100-year flood plain.

3. Implementing an income assurance program that would be established for 235,000 acres of cropland above elevation 88.5 feet, NGVD.

(3) Alternative 2B. This alternative is a nonstructural alternative with a structural component. There is a no-pump station feature in this alternative. Features include:

(a) Nonstructural.

1. Acquisition and reforestation/conservation features on up to 26,400 (b) acres of agricultural lands through perpetual easements from willing sellers only. As a result of design and alignment of the 14 ring levees (see below), approximately 20,300 acres of cleared land are potentially available below elevation 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure), and outside the ring-leveed areas. Up to 10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to, (1) water management impoundments for waterfowl, wading birds, or other wildlife purposes; (2) food plots; (3) permanent openings maintained in early successional stages; (4) access trails, roads, and firebreaks; or (5) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches.

2. Relocate the remaining 194 structures not protected by the ring levees.

(b) Structural. Fourteen ring levees would be required with this alternative to provide 100-year protection to 88 percent of the structures in the Yazoo Backwater Study Area. Ring levees would require an accompanying infrastructure to evacuate precipitation from inside the ringed area and provide for operation of septic systems in saturated grounds. This would require water control structures, interior channels, road crossings, wastewater facilities, pumps, etc., in addition to the levees.

(4) Alternative 2C. This alternative is a nonstructural alternative that influences land-use patterns and activities. This alternative is based on the Shabman Report. There is a no-pump station feature in this alternative. Features include:

Nonstructural.

1. Acquisition and reforestation/conservation features on up to 114,400 (b) acres of agricultural lands through perpetual easements from willing sellers only. Approximately 95,700 acres of cleared land are potentially available below elevation 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure), and the remaining acreage needed to reach up to the 114,400 acres would be acquired above elevation 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure). Up to 10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to, (1) water management impoundments for waterfowl, wading birds, or other wildlife purposes; (2) food plots; (3) permanent openings maintained in early successional stages; (4) access trails, roads, and firebreaks; or (5) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches.

2. Implementing an income assurance program on 201,900 acres of cropland, which is all remaining cropland in the 100-year flood plain.

3. Relocation of all 1,576 structures damaged by a 100-year flood event.

c. Structural alternative. As part of the structural feature, pump-on elevations were selected to meet project purpose.

(1) Alternative 3. Features include:

(a) Structural. A 14,000-cubic-foot-per-second (cfs) pump station with a pumping elevation of 80.0 feet, NGVD, between 1 March and 31 October. Pumping elevation of 85.0 feet, NGVD, between 1 November and 28 February. This would allow retention of more water during the winter waterfowl season.

(b) Operational. Operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. No additional real estate is required for this feature.

d. Combined structural and nonstructural alternatives. As part of the structural feature, pump-on elevations were selected to meet project purpose.

(1) Alternative 4. Features include:

(a) Nonstructural. Acquisition and reforestation/conservation features on up to 37,200 (b) acres of agricultural lands through perpetual easements from willing sellers only. Approximately 28,600 acres of cleared land are potentially available below elevation 85.0 feet, NGVD, at the Steele Bayou structure, and the remaining acreage needed to reach up to the 37,200 acres would be acquired between elevations 85.0 and 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure). Up to 10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to (1) water management impoundments for waterfowl, wading birds, or other wildlife purposes; (2) food plots; (3) permanent openings maintained in early successional stages; (4) access trails, roads, and firebreaks; or (5) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches.

(b) Structural. A 14,000-cfs pump station with a year-round pumping elevation of 85.0 feet, NGVD.

(c) Operational. Operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. No additional real estate is required for this feature.

(2) Alternative 5. Features include:

(a) Nonstructural. Acquisition and reforestation/conservation features on up to 55,600 (b) acres of agricultural lands through perpetual easements from willing sellers only. Approximately 42,800 acres of cleared land are potentially available below elevation 87.0 feet, NGVD (1-year flood plain at the Steele Bayou structure), and the remaining acreage needed to reach up to the 55,600 acres would be acquired between elevations 87.0 and 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure). Up to 10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to (1) water management impoundments for waterfowl,

wading birds, or other wildlife purposes; (2) food plots; (3) permanent openings maintained in early successional stages; (4) access trails, roads, and firebreaks; or (5) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches.

(b) Structural. A 14,000-cfs pump station with a year-round pumping elevation of 87.0 feet, NGVD.

(c) Operational. Operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. No additional real estate is required for this feature.

(3) Alternative 6. Features include:

(a) Nonstructural. Acquisition and reforestation/conservation features on up to 81,400 (b) acres of agricultural lands through perpetual easements from willing sellers only. Approximately 62,600 acres of cleared land are potentially available below elevation 88.5 feet, NGVD, at the Steele Bayou structure, and the remaining acreage needed to reach up to the 81,400 acres would be acquired between elevations 88.5 and 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure). Up to 10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to (1) water management impoundments for waterfowl, wading birds, or other wildlife purposes; (2) food plots; (3) permanent openings maintained in early successional stages; (4) access trails, roads, and firebreaks; or (5) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches.

(b) Structural. A 14,000-cfs pump station with a year-round pumping elevation of 88.5 feet, NGVD.

(c) Operational.

1. Operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. No additional real estate is required for this feature.

2. Reintroduce flows from the Mississippi River up to a maximum elevation of 87.0 feet, NGVD (1-year frequency annual flood event), by leaving the Steele Bayou structure open.

(4) Alternative 7. Features include:

(a) Nonstructural.

1. Acquisition and reforestation/conservation features on up to 124,400 (b) acres of agricultural lands through perpetual easements from willing sellers only. Approximately 95,700 acres of cleared land are potentially available below elevation 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure), and the remaining acreage needed to reach up to the 124,400 acres would be acquired above elevation 91.0 feet, NGVD (2-year flood plain at the Steele Bayou structure). Up to 10 percent of an acquired property could be in conservation features other than reforestation. Conservation features are practices implemented and maintained solely for wildlife management purposes. Conservation features include, but are not necessarily limited to, (a) water management impoundments for waterfowl, wading birds, or other wildlife purposes; (b) food plots; (c) permanent openings maintained in early successional stages; (d) access trails, roads, and firebreaks; or (e) facilities and buildings necessary for property management (constructed above the 100-year flood plain elevation). While the Vicksburg District will provide the pipe for the waterfowl impoundment, landowners would be responsible for the cost of implementing and maintaining the waterfowl impoundment and any other conservation practices. Landowners also would be responsible for maintaining ditches used for agricultural operations on remaining portions of their properties or for agricultural operations on other properties dependent on those ditches.

2. Conservation easements on 81,800 acres of forested lands below elevation 91.0 feet, NGVD. Easements would be perpetual and from willing sellers only.

(b) Structural. A 14,000-cfs pump station with a year-round pumping elevation of 91.0 feet, NGVD.

(c) Operational.

1. Operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. No additional real estate is required for this feature.

2. Reintroduce flows from the Mississippi River up to a maximum elevation of 87.0 feet, NGVD (1-year frequency annual flood event), by leaving the Steele Bayou structure open.

EVALUATION OF ALTERNATIVES

191. As outlined in Engineer Regulation 1105-2-100, the criteria to evaluate alternatives include all significant resources, outputs and plan effects, contributions to the Federal objective and the study planning objective, compliance with environmental protection requirements, the Principles and Guidelines for evaluation (completeness, effectiveness, efficiency, and acceptability), and any other criteria deemed significant by participating stakeholders. These criteria were used in the evaluation process. A detailed evaluation of the alternatives is also presented in the FSEIS and the technical appendixes.

192. The evaluation process of the alternatives in the final array is discussed in the following section for the Yazoo Backwater Study Area. These alternatives include the no-action alternative (Alternative 1), the nonstructural alternatives (Alternatives 2, 2A, 2B, and 2C), the structural alternative (Alternative 3), and the combination alternatives (Alternatives 4 through 7 which include both structural and nonstructural features, along with operational changes to the Steele Bayou structure). The nonstructural alternatives consist of nonstructural features, such as reforestation and perpetual conservation easements, and include any alternative without a pump station located near the Steele Bayou structure. However, the features of Alternative 2B are the construction of ring levees with pumps and structures (a structural feature), Alternative 2B is

included with the nonstructural features because it does not include a pump station at the Steele Bayou structure. The structural and combination alternatives include a pump station at the Steele Bayou structure, reforestation/conservation features, and operational changes.

193. When the Little Sunflower River and Steele Bayou structures are closed because of high stages on the Mississippi River, flooding from ponding of interior drainage is the principal problem in the project area. However, the impoundment of floodwater is much less than it would be if the Yazoo Backwater levee was not in place. Major problems that have resulted from frequent flooding include flood damage to agricultural crops, rural residential property, commercial fisheries, timber management, and public roads and bridges. Major floods have caused undue hardships and economic losses to residents of the area due to flooding of residential and nonresidential structures, disruption of sanitation facilities, lines of communications, and transportation.

194. Three important factors which affect flood losses in the Yazoo Backwater Study Area are time of year, duration, and frequency of flooding. These factors not only significantly affect crop production on agricultural lands, but are also important to the ecological function in forested areas, lakes, streams, commercial fisheries, wildlife management areas (WMA), wetland areas, and rural residential areas. Frequent or intermittent floods can occur any time of the year. However, records indicate that the majority of floods occur during the months of March through June, which is typically the time land preparation and spring crop planting occurs.

195. Without the implementation of a flood damage reduction alternative (nonstructural, structural, or a combination), flood damages and losses will continue to be incurred by residents and properties within the Yazoo Backwater Study Area. Impacts include physical and financial losses from flood damages to residences, businesses, automobiles, contents to residential and nonresidential structures, and other personal property; physical damages to agriculture and related properties; economic opportunity losses (e.g., income, employment, new development, etc.); and the additional costs incurred by public services, emergency operations, and flood insurance administration during flood events. The implementation of a flood damage reduction plan would contribute to the overall health, safety, and welfare of the citizens in this segment of the Mississippi Delta by allowing them to continue their lives without interference or hazard from floodwaters; preventing flood losses to residential and nonresidential structures and personal property; and potentially stimulating economic activity in the region resulting from spin-off effects of jobs created by construction of the project.

196. While terrestrial, wetland, waterfowl, and aquatic resource functions diminished in the Yazoo Backwater Study Area due to the clearing of bottom-land hardwoods during the 1950s, 1960s, and early 1970s, these resources are now increasing due to the acquisition/reforestation of

large tracts of lands by the Federal Government and farmers enrolling lands in the USDA conservation programs. Water quality, while impaired by sediment, pesticides, and nutrients, has also seen improvement due to programs mentioned above. Recreational opportunities have also increased due to these programs. However, these environmental resources, water quality, and recreational opportunities would all benefit from additional reforestation. This reforestation would also benefit the threatened Louisiana black bear and the endangered plant pondberry.

NO ACTION - HYDROLOGIC ANALYSIS

197. The no action alternative was considered, but would not change the current conditions in the Yazoo Backwater study area. The time of year, duration, and frequency of flooding would be unchanged. There will be none of the project impacts (construction, hydrologic, or reforestation) with no action.

NONSTRUCTURAL ALTERNATIVES - HYDROLOGIC ANALYSIS

Alternative 2

198. Alternative 2 contains nonstructural features and an operational change to the Steele Bayou structure. The nonstructural feature would influence land use patterns and activities in the Yazoo Backwater Study Area. The reforestation feature of the structural and nonstructural alternatives will have a minimal impact on the base hydrologic condition. The operation plan of the Steele Bayou structure will be altered to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods in lieu of the current water elevations between 68.5 and 70.0 feet, NGVD. This operational change has a minimal effect on the base hydrologic condition since this rise of the water level is within the existing channels.

Alternative 2A

199. Alternative 2A contained only nonstructural features to influence land use patterns and activities. The nonstructural feature will have a minimal impact on the base hydrologic condition.

Alternative 2B

200. Alternative 2B is a nonstructural alternative with a structural component. The structural component consists of 14 ring levees with the necessary pumps and drainage structures to protect 88 percent of the residential and nonresidential structures and 255,000 acres of agricultural land within the Yazoo Backwater Study Area. The levees are designed to provide protection from a 100-year backwater flood. The remaining 12 percent of residential and nonresidential structures will be removed and approximately 61,000 acres of agricultural lands would flood more frequently and for longer durations.

Alternative 2C

201. Alternative 2C contains only nonstructural features to influence land use patterns and activities. The nonstructural feature will have a minimal impact on the base hydrologic condition.

STRUCTURAL ALTERNATIVE – HYDROLOGIC ANALYSIS

Alternative 3

202. Alternative 3 contains a 14,000-cfs pump station with a pumping elevation of 80.0 feet, NGVD, between 1 March and 31 October and a pumping elevation of 85.0 feet, NGVD, between 1 November and 28 February. This structural feature, with the 80.0-foot, NGVD, pumping elevation, has the greatest effect of any of the alternatives on reducing the duration and extent of flood events. The structural feature reduces the 10-year flood event by 6 feet in the Steele Bayou ponding area and by 5.3 feet in the Big Sunflower River ponding area. This reduces the acres flooded by a 10-year flood event by 180,728 acres (37.0 percent) out of a total of 488,149 acres. The 100-year flood event is reduced by 4.9 and 4.7 feet in the Steele Bayou and Big Sunflower River ponding areas, respectively. Alternative 3 would reduce the extent of the 100-year flood by 176,647 acres (28.0 percent), and 1,041 of the 1,576 structures would be provided protection from the 100-year flood. The operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods has a minimal effect on the hydrologic analysis since the elevated water levels would be within existing channels. There is no nonstructural feature in Alternative 3.

COMBINATION ALTERNATIVES –
HYDROLOGIC ANALYSIS

203. All the combination alternatives contain a structural feature (14,000-cfs pump station), a nonstructural feature (reforestation), and an operational change to the Steele Bayou structure (maintaining water elevations between 70.0 and 73.0 feet, NGVD, in lieu of maintaining water elevations between 68.5 and 70.0 feet, NGVD). The operational change provides an additional 3 feet of water depth in Steele Bayou and Big Sunflower River channels. This increase in ponded water provided a net increase of 1,384 acres of waterfowl foraging habitat and 2,353 acres of aquatic rearing habitat, without implementation of the structural feature.

Alternative 4

204. The structural feature has the same size pump station as Alternative 3 (14,000 cfs), but the pumping elevation has changed to a year-round 85.0 feet, NGVD. Raising the pumping elevation to 85.0 feet, NGVD, reduces the flood damage reduction effectiveness of Alternative 4 compared to Alternative 3. The 10-year flood stages are reduced by 5.3 feet in the Steele Bayou ponding area and 5.0 feet in the Big Sunflower River ponding area. This reduces the 10-year flood extent by 167,115 acres (34.0 percent) out of the total 488,149 acres. The 100-year flood event is reduced by 4.9 and 4.3 feet in the Steele Bayou and Big Sunflower River ponding areas, respectively. Alternative 4 would reduce the extent of the 100-year flood by 169,631 acres (26.9 percent), and 978 of the 1,576 structures would be provided protection from the 100-year event.

Alternative 5

205. The structural feature has the same size pump station as with Alternatives 3 and 4, but the pumping elevation is raised to 87.0 feet, NGVD. Raising the pumping elevation reduces the flood damage reduction effectiveness of the alternative. The 10-year flood stages are reduced by 5.1 feet in the Steele Bayou ponding area and 4.8 feet in the Big Sunflower River ponding area. This reduces the 10-year flood extent by 161,051 acres (33.0 percent) out of the total 488,149 acres. The 100-year flood event is reduced by 4.6 and 3.9 feet in the Steele Bayou and Big Sunflower River ponding areas, respectively. Alternative 5 reduces the 100-year flood extent by 157,996 acres (25.1 percent), and 930 of the 1,576 structures would be provided protection from the 100-year event.

Alternative 6

206. Alternative 6 has two operational changes to the Steele Bayou structure. The first operational change utilizes the Steele Bayou structure to maintain water elevations at 70.0 and 73.0 feet, NGVD, and is shared with Alternatives 3-5. In addition, Alternative 6 would reintroduce water from the Mississippi River up to a maximum elevation of 87.0 feet, NGVD, by leaving the Steele Bayou structure open. This change reduces the storage of the combined Steele Bayou and Big Sunflower River ponding areas by 216,199 acres. This is the 1-year flood event. This operational change will affect the base hydrologic condition. The combination of the operational changes with the structural feature, a 14,000-cfs pump station with a pumping elevation of 88.5 feet, NGVD, further reduces the flood damage reduction effectiveness of this alternative. For the 10-year flood event, the flood stages are reduced using the structural feature by 4.5 feet in the Steele Bayou ponding area and 3.9 feet in the Big Sunflower River ponding area. This reduces the 10-year flood extent by 137,201 acres (28.1 percent) out of 488,149 acres. The 100-year flood event is reduced by 4.3 and 3.8 feet, NGVD, in the Steele Bayou and Big Sunflower River ponding areas, respectively. Alternative 6 reduces the 100-year flood extent by 151,548 acres (24.1 percent), and 826 of the 1,576 structures would be provided protection from the 100-year event.

Alternative 7

207. Alternative 7 has two operational changes to the Steele Bayou structure. The first operational change utilizes the Steele Bayou structure to maintain water elevations at 70.0 to 73.0 feet, NGVD, and is shared with Alternatives 3 through 6. The second change would reintroduce water from the Mississippi River up to a maximum elevation of 87.0 feet, NGVD, by leaving the Steele Bayou structure open. This operational change reduces the storage of the combined Steele Bayou and Big Sunflower River ponding areas by 216,199 acres. This is the 1-year flood event. This will affect the base hydrologic condition. The combination of the operational changes with the structural feature, a 14,000-cfs pump station with a pump elevation of 91.0 feet, NGVD, further reduces the flood damage reduction effectiveness of the project. For the 10-year flood event, the flood stages are reduced using the structural feature by 3.9 feet in the Steele Bayou ponding area and 3 feet in the Big Sunflower River ponding area. This reduces the 10-year flood extent by 111,416 acres (22.8 percent) out of the total 488,149 acres. The 100-year flood event is reduced by 4.3 and 3.6 feet, NGVD, in the Steele Bayou and Big Sunflower River ponding areas, respectively. Alternative 7 reduces the 100-year flood extent by 148,023 acres (23.5 percent), and 776 of the 1,576 structures would be provided protection from the 100-year event.

SUMMARY OF HYDROLOGIC EVALUATION OF ALTERNATIVES

208. Table 13 summarizes the stage-frequency and stage-area data for the structural (Alternative 3) and combination alternatives (Alternatives 4, 5, 6, and 7) in the final array. The structural feature provides considerable flood damage reduction benefits to both the agricultural lands and residential and nonresidential structures. However, as the pump-on elevation rises, the flood damage reduction benefits are reduced, and fewer acres are protected by the structural feature.

NO-ACTION ALTERNATIVE - ECONOMICS

209. The no-action alternative was considered in the evaluation of the Yazoo Backwater Project. The no-action alternative would not eliminate any of the flood damages the area has historically experienced. Existing Yazoo Backwater flood duration and frequency would continue to adversely affect residential and nonresidential structures. Flooding would also have adverse impacts on the standard of living for residents, interrupting daily practices and travel to work, school, and church. Financial losses from flood damages to residential and nonresidential structures, automobiles, and other personal property must be added to the losses due to lost economic opportunity resulting from flood events. Employment opportunities are limited because businesses and industries are reluctant to locate facilities in flood-prone areas. Local governments would bear the burden of continued expenses for flood-fighting efforts; the repair of public properties (e.g., roads, bridges, utilities, and other infrastructure); and the interruption of public services (e.g., sanitation, water treatment, electricity, and emergency services) caused by flooding.

210. Agricultural lands and associated properties would also continue to incur flood damages and operational losses during flood events. The threat from flooding can cause changes in agricultural practices and operational procedures (such as replanting and delaying planting past optimum planting times), which reduces crop yields and farm income. These interruptions have a multiplier effect on other agricultural-related industries prevalent in the rural agricultural communities of the Yazoo Backwater Study Area, which impact income and employment in these sectors.

211. Since no action would be taken with this alternative, flooding would continue at existing frequencies and durations, and it would have a “disproportionate” effect on the high number of minorities and low-income persons located in this region. In consideration of environmental

TABLE 13
STAGE-FREQUENCY AND STAGE-AREA DATA
YAZOO BACKWATER AREA REFORMULATION

Frequency Event	Base Conditions		Alternative (Final Array)									
			Alternative 3		Alternative 4		Alternative 5		Alternative 6		Alternative 7	
Year	Elevation	Acres	Elevation	Acres	Elevation	Acres	Elevation	Acres	Elevation	Acres	Elevation	Acres
Lower Ponding Area a/												
1	87.0	75,882	81.5	47,845	85.0	65,236	87.0	75,882	87.0	75,882	87.0	75,882
2	91.0	109,491	84.7	63,630	86.0	70,583	87.8	81,192	89.5	93,723	91.2	112,057
3	92.9	135,108	86.6	73,762	87.2	76,942	88.5	86,341	89.9	97,425	91.5	115,893
5	94.6	162,306	88.4	85,606	89.1	90,775	89.6	94,648	90.5	103,046	91.8	119,729
10	96.3	187,780	90.3	101,126	91.0	109,491	91.2	112,057	91.8	119,729	92.5	128,937
20	97.6	209,356	92.0	122,358	92.2	124,989	92.7	131,984	93.2	139,774	93.4	142,865
25	98.0	217,205	92.5	128,937	92.6	130,423	93.0	136,669	93.5	144,411	93.7	147,502
50	99.2	236,988	94.0	152,471	94.0	152,471	94.4	159,086	94.6	162,306	94.6	162,306
100	100.3	226,574	95.4	174,089	95.4	174,089	95.7	178,673	96.0	183,358	96.0	183,358
Upper Ponding Area b/												
1	87.8	140,317	83.2	73,747	85.9	109,140	87.8	140,317	87.8	140,317	87.8	140,317
2	91.6	208,044	86.8	123,543	87.3	131,856	88.9	162,872	90.0	181,981	91.8	211,543
3	93.4	240,407	88.3	150,092	89.0	165,002	89.7	176,887	90.8	194,435	92.0	215,041
5	95.0	268,727	89.9	180,283	90.2	185,095	90.7	192,879	91.5	206,295	92.7	227,624
10	96.8	300,369	91.5	206,295	91.8	211,543	92.0	215,041	92.9	231,219	93.8	247,796
20	98.1	325,661	92.8	229,422	93.2	236,712	93.5	242,254	94.0	251,491	94.6	261,833
25	98.5	334,125	93.3	238,559	93.5	242,254	93.8	247,796	94.4	258,385	94.8	265,280
50	99.5	355,946	94.3	256,662	94.8	265,280	95.1	270,481	95.3	273,989	95.5	277,497
100	100.3	403,413	95.6	279,251	96.0	286,267	96.4	293,318	96.5	295,081	96.7	298,606

NOTE: Elevation - feet, NGVD.

a/ Steele Bayou structure landside gage location.
b/ Little Sunflower structure landside gate location.

justice (EJ), this segment of the population is the most adversely impacted group located in the flood-prone Yazoo Backwater Study Area. There will be none of the project impacts (construction, hydrologic, or reforestation) with no action.

NONSTRUCTURAL ALTERNATIVES – ECONOMIC ANALYSIS

212. The agricultural benefits in the final array of alternatives were updated to include 2005 crop budgets and 2005 current normalized prices. The data for the urban analysis were also updated. An inventory of structures in the 100-year flood plain was completed in June 2000, and was updated in 2005. Based on these surveys, 2,813 structures were identified in the Yazoo Backwater Study Area including 2,320 residential and 493 nonresidential properties, which are 82 and 18 percent, respectively. However, it should be noted that although all of these structures are located in the Yazoo Backwater Study Area, not all of these are subject to flooding by a 100-year flood event. A total of 1,576 structures were identified to be subject to flooding in the 100-year flood plain including 1,294 residences (82 percent) and 282 nonresidential structures (18 percent). Most of the residential structures affected by flooding are located in Reach 2 (upper ponding Area) with approximately 69 percent of the structures flooded. Based on the latest structure inventory, 93 structures are impacted at the 2-year frequency flood elevation, tripling to 312 at the 5-year flood frequency. Moderate population increases in some communities (like Eagle Lake, for example) are offset by declines in other areas. This population trend is expected to continue over the 50-year projection period.

213. There are four nonstructural alternatives in the final array. Alternative 2, which was evaluated in the 2000 Draft Report, and three alternatives (2A, 2B, and 2C), which are variations of prior proposals, are included in the final array. While Alternative 2 has no features to assist homeowners, the three variations do have features to provide assistance to homeowners. Approximately 1,576 residential and nonresidential structures incur damages from the 100-year frequency flood. Several nonstructural options to protect these structures were identified and evaluated. Alternative 2A would floodproof residential and nonresidential structures in the 100-year flood plain. Alternative 2B would construct 14 ring levees to protect 88 percent of the structures and purchase and remove any structures outside of the ring levees. Alternative 2C would purchase and remove all structures in the 100-year flood plain. While Alternative 2B does include ring levees, a structural feature, it was considered a nonstructural alternative, for purposes of this study since it did not include a pump station at the Steele Bayou structure. All nonstructural alternatives contain a reforestation feature.

Environmental Justice Considerations

214. It was determined that the implementation of any nonstructural alternative would not have disproportionate impacts on minorities or low-income persons in the study area, in comparison to the other residents impacted by flooding. However, the minority and low-income sector of the population will experience the greatest difficulty since flooding continues with any of these alternatives. This segment of the population does not have the resources to recoup their losses. Based on the statistics presented in the EJ analysis, the minority population (Census 2000) and the poverty level (U.S. Census Bureau data 2004) comprised 68.8 percent and 31.3 percent, respectively, of the Yazoo Backwater Economic Base Area population for those years. The same statistics for the State of Mississippi for the same years are 38.6 and 17.9 percent, respectively. Detailed conclusions from the EJ evaluation of the Yazoo Backwater Study Area are presented in Appendix 8, Attachment 8A.

County Tax Considerations

215. While most of the nonstructural alternatives and the nonstructural component of the combination alternatives improve the quality of the environment, none of the alternatives address the impacts on county governments and their tax base. County governments receive less taxes per acre for forested lands than for agricultural lands. The reduced tax revenue affects county services such as schools, law enforcement, the construction of roads and bridges, etc. As the agricultural tax base shrinks, tax rates will have to go up on the remaining, agricultural lands or in other areas to pay for these services. As a result of the consensus building workshops, the issue of land use change on county tax structure was determined to be a major issue. To address this issue, the local sponsor working through other consensus building participants approached the Mississippi legislature to pass a law whereby any perpetual easements secured for this project could be assessed a fee equal to the loss in revenue from the change in land use. This fee is at the discretion of each county Board of Supervisors in the Yazoo Backwater Area and cannot exceed $4 per acre. This legislation was passed and signed by the Governor of Mississippi in 2000. The economic impacts from reforestation on county governments were not utilized in the analysis of the alternatives.

216. Although economic development impacts cannot be included in the NED analysis, they are worthy of being discussed as part of this report. As taxes rise, citizens often evaluate whether this increase is impacting their standard of living. If their standard is rising and future opportunities exist, then they will continue to reside in the area. However, if their standard of

living is falling with no hope of improvement, then people must move to better themselves and an out-migration could occur. Flooding can expedite this self analysis. This type of outmigration was seen after the 1927 flood.

Ecotourism Considerations

217. Some individuals and groups believe that the reestablishment of the bottom-land hardwoods in the area could bring about an ecotourism benefit that would surpass the benefits derived from agriculture. This was one of the initiatives in EPA's Lower Yazoo River Basin Economic and Environmental Initiatives. There are insufficient data available to accurately predict the benefits from ecotourism or to estimate the number of jobs that could be generated by the industry in the study area should a viable tourism industry develop. In addition, the area would have to change from an agriculture-based economy to a service-based economy. People would have to be retrained should this change occur. In addition, the local tax base could be affected if people leave the study area. Should a viable ecotourism business develop, then this could serve to offset this loss in sales taxes. However, flooding would impact the ecotourism business also. Since the release of the Draft Report and Draft SEIS in September 2000, there has been no widespread program to educate the local population or to generate ecotourism dollars. There are a few 1-day events such as the Great Delta Bear affair, which is held annually near Rolling Fork, Mississippi, and several Blues festivals in Greenville and Clarksdale. A multi-agency wildlife and environmental interpretive and education center is being studied for the south Delta, but these events, along with the other public areas in the study area, are not enough to generate a steady reliable income for citizens to depend on ecotourism.

Alternative 2

218. Alternative 2 utilizes perpetual easements to acquire agricultural lands for reforestation/ conservation features below elevation 91 feet, NGVD, and flowage easements on the agricultural lands above elevation 91 feet, NGVD, at the Steele Bayou structure from willing sellers. Since every acre within the 100-year flood plain receives some benefit from the structural and combination alternatives, every acre under the nonstructural alternatives should also receive benefits. Under Alternative 2, these benefits would be in the form of a payment to landowners to allow flooding on open lands between elevations 91.0 and 100.3 feet, NGVD, at the Steele Bayou structure and to acquire and reforest open lands below elevation 91.0 feet, NGVD, at the Steele Bayou structure. The amount of the payment would vary depending on the frequency and duration of flooding, land classification, recent cropping patterns, crop program base acres, and several other factors (i.e., less frequently flooded cropland would receive less money per acre than more frequently flooded lands). However, the most frequently flooded lands do not necessarily receive the highest payment due to the classification, cropping pattern, and lack of a

crop program base acreage. Using these factors, a composite price for land was developed across the study area. This part of the nonstructural feature only pays individuals to continue with the current land use. Therefore, reforestation is included on those lands below elevation 91.0 feet, NGVD, at the Steele Bayou structure which is the 2-year flood plain or 124,400 acres. The 2-year flood plain was chosen because these lands have the highest environmental resource values.

219. The economic analysis of Alternative 2 does not include the additional costs associated with flood losses such as: agricultural noncrop, and road damages, or the costs of floodproofing residential and nonresidential structures. These costs are required if the alternative is to be fully comparable to the structural and combination alternatives. Thus, without accounting for any additional costs that could be associated with these flood damages and impacts, the construction/operational costs for the implementation of Alternative 2 were determined to be substantial. Therefore, it was deemed unnecessary to calculate the costs of these other damage categories. Furthermore, several variations of this nonstructural alternative were evaluated in Array 3 (outlined in the 2000 Draft Report), and all were determined to be economically infeasible.

220. In addition to its high costs, Alternative 2 did not provide any features to protect structures (such as floodproofing or acquisition/buyout of residential or nonresidential structures) in the Yazoo Backwater Study Area. Flooding would continue to occur at current frequencies and durations and the residents would continue to be impacted by major flood events. Residential and nonresidential structures would continue to be damaged by flooding with the implementation of this alternative. Residents would be isolated or cut off due to flooded roads. Emergency services and school bus routes would be impacted, if not totally disrupted by floodwaters. Water supply and electric service would be interrupted. Sewage systems would not work in the prolonged saturated and flooded conditions. Residents in the impacted area would continue to be affected by flooding; however, there would be no disproportionate effect on the minority and low-income populations of the region in comparison to the impacts experienced by other residents. Thus, without including specific protection features for residential and nonresidential structures, Alternative 2 is ineffective in reducing the flood damage and the interruption to daily life encountered by the residents and, thus, is unacceptable to them.

221. Alternative 2 has a first cost of $430.5 million, a benefit-cost ratio of 0.6 to 1. This alternative is not economically justified and lacks local acceptability. Without features included to protect the residential and nonresidential structures, the implementation of this alternative was determined to have effects on all residents impacted by flooding. The minority and low-income populations in the region would not be compensated for damages like landowners who are paid to either reforest or to continue with their current land use.

Alternative 2A

222. Alternative 2A is a nonstructural alternative which uses easement acquisition and income assurance to influence the land-use patterns in the study area. This alternative was developed to protect the wetlands dependent on backwater flooding. It consists of easement acquisition with reforestation/conservation features on those lands below elevation 88.5 feet, NGVD, at the Steele Bayou structure, which is the elevation associated with the upper limit of wetlands sustained by backwater flooding, and implementation of an income assurance program on the remaining open lands above this elevation. All residential and nonstructural structures in the 100-year flood plain would be floodproofed.

223. For Alternative 2A, floodproofing cost was computed for all structures where first-floor elevations (FFE) were within 1 foot of the 100-year flood elevation. The depth-damage curve utilized to compute flood damages begins computing damages at 2 feet below the FFE. Therefore, the number of structures damaged by a 100-year event (1,576) differs for the number of structures floodproofed (1,363). Although flood damages to residential and nonresidential structures would be prevented, the nonstructural feature of the project does not reduce the extent of flooding, and people and communities would still encounter disruptions in their daily operations, including interruptions in public services (e.g., school routes, sanitation, utilities, emergency services, etc.) and transportation problems (e.g., traversing flooded roads and/or taking alternate routes).

224. Alternative 2A would floodproof structures by "structure raising" all of the residential and nonresidential structures in the 100-year flood plain. This feature raises the structure above the floodwaters enough that the structure's FFE cannot be damaged by the 100-year flood event. Raising a structure is considered a viable alternative for most structures according to the Federal Emergency Management Agency (FEMA) as per Report No. 312, "Homeowner's Guide to Retrofitting: Six Ways to Protect Your House from Flooding" (June 1998). This floodproofing feature provides 1 foot of freeboard between the design flood event and the FFE of the structure. The cost of structure raising is estimated based on the construction material of each structure. Costs include extending the foundation and utilities and miscellaneous items such as sidewalks and driveways, but exclude the placement of new fill or concrete slab in a basement. The costs applied were on 1-foot intervals beginning at the 2-foot elevation (including freeboard). Costs for raising structures included an estimated payment of $25,000 per structure under Public Law 91-64. This payment consists of up to $22,500 for a housing differential payment and an additional $2,500 for incidental costs such as moving, storage, or temporary housing costs. Based on conservative estimates from the Vicksburg District Real Estate Division and the FEMA

Report, the cost per square foot of raising a structure from 1 to 2 feet above the FFE was estimated to be $21 for a frame with crawlspace/basement; $43 for a brick with crawlspace/basement; and $58 for both frame and brick on slabs. The cost of raising a mobile home 1 to 2 feet is $1,000. All values are expressed in October 2005 dollars. In addition, real estate estimates include a 25 percent contingency on nonstructural floodproofing costs.

225. Although this alternative floodproofs the residential and nonresidential structures, people would still have to traverse flooded roads to and from the major highways. Flooding would still interrupt the fabric of life in the communities. Although the income assurance program would aid the farmers whose land is flooded, the citizens whom he hires to assist in farming the land or live in the Yazoo Backwater Study Area and work elsewhere would still suffer economic impacts.

226. With features included in Alternative 2A to protect the residential and nonresidential structures, the implementation of this alternative was determined to have no "disproportionate" adverse effects on the minority or low-income population. However, implementation of Alternative 2A may not eliminate some of the indirect effects of flooding on the total population, such as loss of job opportunities, disruption of services, rerouting of traffic, and other inconveniences.

227. The alternative does not address the economic needs of the area or its citizens. Alternative 2A had a first cost of $377.8 million and a benefit-cost ratio of 0.8 to 1 and therefore, was not economically feasible and for reasons similar to Alternative 2, this alternative would not be economically justified.

Alternative 2B

228. Alternative 2B is considered a nonstructural alternative, but contains both structural and nonstructural components. The structural component consists of constructing 14 ring levees, pumps, and structures in the Yazoo Backwater Study Area to protect the majority of the impacted structures (i.e., 1,382 of the 1,576 structures, or 88.0 percent). The location of the ring levees for Alternative 2B are shown on Plate 4-15. The 194 structures not protected by the ring levees would be purchased and removed. The nonstructural component of Alternative 2B includes the acquisition of perpetual easements and reforestation/conservation features on agricultural lands below elevation 91.0 feet, NGVD, which is the 2-year event outside the ring levees.

229. While the construction of the ring levees protects most of the residential and nonresidential structures, this alternative also includes a feature to purchase and remove the 194 residential and nonresidential structures unprotected by the ring levees. According to FEMA Report No. 312, the purchase of property is considered an effective and feasible mitigation

option for residential and nonresidential structures whose estimated value is less than the costs of other floodproofing mitigation options or in cases in which other mitigation options are considered infeasible or undesirable. Buyout costs are based on estimated structure value plus an estimated land cost. Average structure values range from $29,000 for public buildings and warehouses to $46,000 for residential, commercial, and semipublic buildings in the Yazoo Backwater Study Area. These values represent average depreciated replacement values for type of each structure. In addition, a separate cost of $4,300 (in 2005 dollars) is added for each structure to account for demolition, debris removal, and landfill costs (including hazardous waste materials). Costs for buyouts also include an estimated relocation costs of $25,000 per structure that consists of a housing differential costs and incidental costs such as moving, storage, or temporary housing costs. It is anticipated that adequate replacement housing will be available within a 50-mile radius of the study area. This radius would include larger municipalities such as Greenville, Vicksburg, and Yazoo City, Mississippi. In addition, real estate estimates include a 25 percent contingency on nonstructural floodproofing costs.

230. While Alternative 2B protects 88 percent of the structures, flooding will still occur outside the ring levees. Residential and nonresidential structures will no longer be susceptible to flooding with implementation of this alternative, but roadways will still incur damages. Residents will be isolated by submerged roadways will also endure hardships from traveling flooded roads, traveling miles out of the way taking alternative routes, and/or having to use boats to get to their destinations. Disruptions would also occur to other daily operations, such as school bus routes, water supply, electric service, sewage systems, and emergency services, to list only a few. Safety hazards would also exist. Many of the affected residents have expressed opposition to the buyout option in this proposal.

231. With ring levees to protect most of the residential and nonresidential structures, the implementation of this alternative (which includes relocation features to remove residential and nonresidential structures not protected by the ring levees) was determined to have no "disproportionate" effects on the minority and low-income populations in the region. However, there may be other effects such as the disruption of services, rerouting of traffic, and other inconveniences that would impacts on all of the residents in the region.

232. Because of the amount of land required to construct the levees, pumps, and structures, this alternative is locally unacceptable. In addition to a first cost of $416.7 million, Alternative 2B had a benefit-cost ratio of 0.8 to 1 and was not economically justified.

Alternative 2C

233. Alternative 2C is similar to the alternative outlined in the Shabman Report, but utilizing USACE guidelines and recognized benefit categories. It involves the acquisition of easements and reforestation/conservation features on lands primarily below the 2-year flood plain; i.e.,

91.0 feet, NGVD, an income assurance program on the remaining cropland up to the 100-year flood frequency and the relocation of all structures in the 100-year flood plain. There will be economic impacts on the community that are not addressed by this alternative. Impacted individuals would have to move to another location, which may involve an increase in their cost of living. Transportation costs for the citizens would escalate due to having to travel back to their jobs or having to seek new employment outside the study area. The landowner/farmer would be adequately compensated through the income assurance feature for the flooding impacts.

234. The relocation feature of Alternative 2C involves the purchase, removal, and relocation of 1,576 residential and nonresidential structures in the flood plain. The evaluation is the same as with Alternative 2B above. Costs for buyouts also include an estimated relocation costs of $25,000 per structure that consists of a housing differential costs and incidental costs such as moving, storage, or temporary housing costs. In addition, real estate estimates include a 25 percent contingency on nonstructural floodproofing costs.

235. In consideration of EJ, the implementation of this alternative was also determined to have no disproportionate effects on the minority and low-income populations as compared to the rest of the population in the region. However, it could cause others hardships. By buying out or relocating the 1,576 structures, the minority or low-income residents could have to make a complete lifestyle change not only from relocating to a new area, but could result in a change in employment.

236. This alternative had a first cost of $480.1 million and was not economically feasible with a benefit-cost ratio of 0.7 to 1 and is not locally acceptable because of its impacts on the many citizens impacted by the acquisition and relocation of the 1,576 structures in the 100-year flood plain. Not only have many of the residents of the area indicated their desire to stay in their current location, but other residents have concerns over the impacts these relocations would have on the remaining businesses, churches, and schools.

STRUCTURAL ALTERNATIVE –
ECONOMIC ANALYSIS

Alternative 3

237. Alternative 3 is a structural alternative with compensatory mitigation. The structural feature of this alternative includes the 14,000-cfs pump station with a pump operation elevation of 80.0 feet, NGVD, during the cropping season and elevation 85.0 feet, NGVD, during the winter waterfowl season. Also included was the operational change to the Steele Bayou structure during low-water periods. This alternative would require the acquisition and

reforestation of 53,363 acres of open land for compensatory mitigation. This alternative provides the greatest flood damage reduction benefits to residential and nonresidential structures and the existing agricultural land. Alternative 3 had a first cost of $233.9 million and was economically justified with a benefit-cost ratio of 1.3 to 1 and meets the flood damage reduction objective.

238. Alternative 3 was determined to have no disproportionate impacts on minorities or low-income persons in the study area. However, the impoverished residents of the area would continue to experience hardships from residual flooding since flood damages would only be reduced, not eliminated, and it is more difficult for this sector of the community to recover from their losses.

COMBINATION ALTERNATIVES - ECONOMIC ANALYSIS

239. All the combination alternatives contain a structural feature (14,000-cfs pump station), a nonstructural feature (reforestation/conservation features), and an operational change to the Steele Bayou structure (maintaining water elevations between 70.0 and 73.0 feet, NGVD, in lieu of maintaining water elevations between 68.5 and 70.0 feet, NGVD, during low-water periods).

240. The combination alternatives offer varying degrees of relief from the backwater flooding and should help low-income and minority residents of the area. Alternatives 4 through 7 were determined to have no "disproportionate" impacts on minorities or low-income persons in comparison with the rest of the population in the region. However, since it is harder for minority and low-income persons to recover from their losses, this sector of the population will experience the most difficulty should residual flooding occur with any of these alternatives in place. In addition, other effects resulting from flooding may be experienced, such as the disruption of services, rerouting of traffic, and other inconveniences that would impacts on all of the residents in the region.

Alternative 4

241. Under Alternative 4, pumping would begin at elevation 85.0 feet, NGVD, at the Steele Bayou structure, with perpetual easements from willing sellers on approximately 37,200 acres of open land primarily at or below elevation 85.0 feet, NGVD, at the Steele Bayou structure. After acquisition, these easement lands will have reforestation/conservation features installed on them. This alternative had a first cost of $192.8 million and was economically justified with a benefit-cost ratio of 1.6 to 1.

Alternative 5

242. Under Alternative 5, pumping would begin at elevation 87.0 feet, NGVD, at the Steele Bayou structure with perpetual easements from willing sellers on approximately 55,600 acres of open land primarily at or below 87.0 feet, NGVD, at the Steele Bayou structure. These easement lands would also have reforestation/conservation features installed on them. This alternative had a first cost of $220.1 million and was economically justified with a benefit-cost ratio of 1.4 to 1.

Alternative 6

243. In addition to the modified operation of the Steele Bayou structure to raise low flow water levels, Alternative 6 allows for reintroduction of Mississippi River flows up to a maximum elevation of 87.0 feet, NGVD, at the Steele Bayou structure. Under Alternative 6, pumping would begin at elevation 88.5 feet, NGVD, at the Steele Bayou structure with perpetual easements from willing sellers on approximately 81,400 acres of open land primarily at or below 88.5 feet, NGVD, at the Steele Bayou structure. These easement lands would have reforestation/conservation features installed on them. This alternative had a first cost of $261.6 million and was economically justified with a benefit-cost ratio of 1.2 to 1.

Alternative 7

244. In addition to the operational change of the Steele Bayou structure to raise low-flow water levels, Alternative 7 allows for the reintroduction of Mississippi River flows up to a maximum elevation of 87.0 feet, NGVD, at the Steele Bayou structure. Under Alternative 7, pumping would begin at elevation 91.0 feet, NGVD, at the Steele Bayou structure with perpetual easements from willing sellers on approximately 124,400 acres of open land primarily at or below 91.0 feet, NGVD, at the Steele Bayou structure. These easement lands would have reforestation/conservation features installed on them. This alternative had a first cost of $383.3 million and was not economically justified with a benefit-cost ratio of 0.9 to 1.

SUMMARY OF ECONOMIC EVALUATION OF ALTERNATIVES

245. A summary of the economic analysis for all alternatives in the final array is displayed in Table 14. None of the four nonstructural alternatives (2, 2A, 2B, and 2C) were economically justified. The one structural alternative (Alternative 3) was economically justified and three of

TABLE 14
SUMMARY ECONOMIC ANALYSIS
YAZOO BACKWATER AREA REFORMULATION
(FINAL ARRAY OF ALTERNATIVES)

Item	Nonstructural Alternatives				Structural Alternative	Combined Structural and Nonstructural Alternatives			
	Alternative 2	Alternative 2A	Alternative 2B	Alternative 2C	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7
Benefits ($000)									
Structural									
Agricultural Crop	0	0	0	0	9,554	7,970	6,534	5,153	3,235
Agricultural Noncrop	0	0	0	0	4,019	3,164	2,328	1,825	1,063
Structures	0	0	0	0	2,769	2,461	2,154	1,984	1,546
Automobiles	0	0	0	0	369	338	298	276	222
Road and Bridge	0	0	0	0	711	602	443	375	274
FIA	0	0	0	0	165	155	147	129	120
Emergency Cost	0	0	0	0	132	118	104	95	73
Total Structural	0	0	0	0	17,719	14,808	12,008	9,837	6,533
Nonstructural									
Structures		4,416	4,416	4,416					
Automobiles		561	561	561					
Road and Bridge		0	1,102	0					
FIA		248	248	248					
Emergency Cost		206	206	206					
Agricultural Crop	7,010	5,595	8,943	6,896	2,745	3,300	4,615	5,595	7,010
Agricultural Noncrop	5,407	4,403	6,633	5,318	2,156	2,598	3,632	4,403	5,407
Timber Values	972	636	206	894	0	291	435	636	972
Hunting Leases	1,403	918	298	1,290	0	420	638	918	1,403
Total Nonstructural	14,792	16,983	22,613	19,829	4,901	6,609	9,320	11,552	14,792
Employment	181	118	1,656	166	1,195	1,061	1,088	1,125	1,188
Structural	0	0	0	0	1,007	1,007	1,007	1,007	1,007
Nonstructural	181	118	1,656	166	188	54	81	118	181
Total Benefits (Excluding Employment)	14,792	16,983	22,613	19,829	22,620	21,417	21,328	21,389	21,325
Total Benefits (Including Employment)	14,973	17,101	24,269	19,995	23,815	22,478	22,416	22,514	22,513

TABLE 14 (Cont)

Item	Nonstructural Alternatives				Structural Alternative	Combined Structural and Nonstructural Alternatives			
	Alternative 2	Alternative 2A	Alternative 2B	Alternative 2C	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7
Costs ($000)									
First Cost (Total Project)	430,544	377,812	416,746	480,105	233,865	192,802	220,094	261,651	383,267
Structural	0	0	0	0	147,163	147,163	147,163	147,163	147,163
Mitigation	0	0	0	0	86,702	29,268	15,496	5,065	4,994
Total Structural features	0	0	0	0	233,865	176,431	162,659	152,228	152,157
Nonstructural	430,544	377,812	383,339	480,105	0	16,371	57,435	109,423	231,110
Mitigation	0	0	33,407	0	0	0	0	0	0
Total Nonstructural features b/	430,544	377,812	416,746	480,105	0	16,371	57,435	109,423	231,110
Interest During Construction	1,920	1,256	17,581	1,766	12,687	11,261	11,545	11,943	12,607
Structural	0	0	0	0	12,687	10,687	10,687	10,687	10,687
Nonstructural	1,920	1,256	17,581	1,766	0	574	858	1,256	1,920
Benefits ($000)									
Gross Investment Costs	432,464	379,068	434,327	481,871	246,552	204,063	231,639	273,594	395,874
Structural	0	0	0	0	246,552	187,118	173,346	162,915	162,844
Nonstructural	432,464	379,068	434,327	481,871	0	16,945	58,293	110,679	233,030
Annual Costs									
Structural									
Amortization	0	0	0	0	8,814	8,814	8,814	8,814	8,814
Mitigation	0	0	0	0	4,953	1,634	865	283	279
O&M Pump Project	0	0	0	0	1,056	1,056	1,056	1,056	1,056
O&M Energy	0	0	0	0	1,155	771	557	433	232
Pump Replacement	0	0	0	0	393	393	393	393	393
O&M mitigation lands					1,657	54	21	c/	0
Nonstructural									
Amortization	24,148	21,166	22,387	26,907	0	946	3,255	6,180	13,012
Mitigation	0	0	1,865	0	0	0	0	0	0
O&M nonstructural	249	163	3,450	229	0	20	90	163	249
Total Annual Costs	24,397	21,329	27,702	27,136	18,028	13,688	15,051	17,322	24,035
Structural	0	0	0	0	18,028	12,722	11,706	10,979	10,774
Nonstructural	24,397	21,329	27,702	27,136	0	966	3,345	6,343	13,261
Total Benefits (Excluding Employment)	14,792	16,983	22,613	19,829	22,620	21,417	21,328	21,389	21,325
Structural	0	0	0	0	17,719	14,808	12,008	9,837	6,533
Nonstructural	14,792	16,983	22,613	19,829	4,901	6,609	9,320	11,552	14,792
Total Benefits (Including Employment)	14,973	17,101	24,269	19,995	23,815	22,478	22,416	22,514	22,513
Structural	0	0	0	0	18,726	15,815	13,015	10,844	7,540
Nonstructural	14,973	17,101	24,269	19,995	5,089	6,663	9,401	11,670	14,973

TABLE 14 (Cont)

Item	Nonstructural Alternatives				Structural Alternative	Combined Structural and Nonstructural Alternatives			
	Alternative 2	Alternative 2A	Alternative 2B	Alternative 2C	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7
Excess Benefits (Excluding Employment)	-9,605	-4,346	-5,089	-7,307	4,592	7,729	6,277	4,067	-2,710
Excess Benefits (Including Employment)	-9,424	-4,228	-3,433	-7,141	5,787	8,790	7,365	5,192	-1,522
B/C Ratio (Excluding Employment)	0.61	0.80	0.82	0.73	1.30	1.60	1.40	1.20	0.89
B/C Ratio (Including Employment)	0.61	0.80	0.88	0.74	1.30	1.60	1.50	1.30	0.94

a/ Benefits and costs annualized at the current Federal interest rate of 5-1/8 percent and a 50-year economic life. (2006 cost data, 2005 land use, 2005 crop budgets and normalized prices).

b/ Cost includes cost of easements, reforestation, and conservation measures above any compensatory mitigation.

c/ Less than $1,000 per year for O&M of the necessary 53 acres to obtain a net net loss.

the four combination alternatives (4, 5, and 6) were economically justified, while Alternative 7 was not justified. Alternative 4, with the most excess benefits over costs, was identified as the NED Plan. The excess benefits for Alternative 5 were 20.0 percent less than the NED Plan while Alternatives 3 and 6 were 60.0 and 53.0 percent less, respectively.

246. Table 14 also provides a breakdown of the benefits and costs along with the annual benefits and costs between the structural component and the nonstructural flood damage reduction feature for each of the alternatives. The costs shown for the nonstructural features include only those costs associated with acquiring the perpetual easements from willing sellers and the reforestation/conservation features on those lands above the compensatory mitigation requirements. The structural component includes the cost of the pump station, the compensatory mitigation required to offset the unavoidable environmental impacts from the construction of the pump station, the 1987 construction of the inlet and outlet channel, and the remaining compensatory mitigation for the Yazoo Backwater levee.

247. Table 15 provides a breakdown of the percentage of flood damages prevented by the structural and nonstructural components for each of the alternatives carried into the final array.

NO-ACTION ALTERNATIVE - ENVIRONMENTAL

248. The no-action alternative would have no effect on the existing environmental resources in the area. Water quality conditions would continue in its current state. While there were comments on the 2000 Draft Report that flood-prone land would be enrolled in USDA reforestation programs in the absence of a project, the fact remains that the program acreage limitation under WRP has been reached in Sharkey and Issaquena Counties. Although some acreage could still be enrolled in CRP, it is highly unlikely that this acreage would have an impact on the total reforested acres in the study area. In addition, lands not re-enrolled under CRP, could be cleared of vegetation and put back into crop production. According to FWS Biological Opinion, declines in the study area's pondberry population will continue without project implementation. There are data that indicate that the threatened Louisiana black bear is breeding in the study area and this trend is expected to continue.

249. Terrestrial, wetland, and aquatic resource values would increase due to fact that the recent reforestation via USDA programs will grow and mature. These values will periodically fluctuate as landowners harvest and regenerate individual tracts of mature bottom-land hardwoods. However, the overall terrestrial value in the study area should remain stable through time.

250. Waterfowl resources foraging values would decrease as these reforested lands mature since caloric values are less on these lands. However, according to FWS, these reforested acres will provide other important life cycle requirements to waterfowl.

TABLE 15
FLOOD DAMAGES PREVENTED BY
STRUCTURAL AND NONSTRUCTURAL FEATURES
FINAL ARRAY OF ALTERNATIVES
YAZOO BACKWATER AREA REFORMULATION
(Percentages)

Damage Category	Nonstructural Alternatives				Structural	Combination Structural and Nonstructural Alternatives			
	Alternative 2	Alternative 2A	Alternative 2B	Alternative 2C	Alternative 3 a/	Alternative 4	Alternative 5	Alternative 6	Alternative 7
Damage Prevented by Structural Features									
Crop	0	0	0	0	65.3	50.7	41.2	34.8	22.2
Noncrop	0	0	0	0	59.9	47.1	34.7	27.2	15.8
Roads	0	0	0	0	48.7	41.2	30.3	25.7	18.8
Urban b/	0	0	0	0	63.1	56.4	50.1	45.5	35.9
Subtotal c/	0	0	0	0	62.0	50.6	41.0	34.9	23.8
Damage Prevented by Nonstructural Features									
Crop	76.7	61.2	97.8	75.4	30.0	36.1	50.5	61.2	76.7
Noncrop	80.5	65.6	98.8 e/	79.2	32.1	38.7	54.1	65.6	80.5
Roads	0.0	0.0	75.5	0.0	0.0	0.0	0.0	0.0	0.0
Urban b/	0.0	100.0	100.0	100.0	0.0	0.0	0.0	0.0	0.0
Subtotal c/	51.6	68.4	97.1	77.6	20.4	24.5	34.3	41.5	51.6
Totals d/	51.6	68.4	97.1	77.6	82.4	75.1	75.2	76.4	75.4

a/ Alternative 3 includes 53,363 acres of mitigation acres which are required for a no-net loss. Flood damage reduction benefits associated with. these acres are shown under the nonstructural feature. Flood damage reduction occurs on these lands because they are taken out of crop production and planted into trees.

b/ Urban includes structural damages, Federal Insurance Administration costs, autos, and emergency costs.

c/ Subtotal damages prevented computed based on total damages prevented divided by existing damages for all damage categories.

d/ Total damage reduction for both structural and nonstructural components derived by adding subtotal for both components.

e/ Seventy-eight percent of this reduction is associated with lands protected by ring levees; remainder of reduction due to land removed from production and reforested.

251. Hunting opportunities have increased due to the reforestation undertaken via USDA programs and these opportunities will continue to increase as these trees grow and mature. Hunting of small game species such as rabbits and quail will eventually give way to squirrels as trees mature. Whitetail deer will inhabit and forage in both reforested and mature bottom-land hardwoods areas. Waterfowl hunting will continue in the established greentree reservoirs and in privately operated waterfowl areas. Fishing opportunities will increase as reforestation improves water quality within the Yazoo Backwater Study Area. No project impacts would occur to cultural resources under this plan. There will be no project impacts (construction, hydrologic, or reforestation) with no action alternative.

NONSTRUCTURAL ALTERNATIVES –
ENVIRONMENTAL ANALYSIS

252. All nonstructural alternatives contain a nonstructural feature that includes the acquisition of perpetual easements with reforestation/conservation features. This reforestation feature was modified from the fourth array of alternatives by the Vicksburg District to include other conservation features on up to 10 percent of the perpetual easement lands. Out of this 10 percent, MDWFP later requested the Vicksburg District consider 5 percent of the easements for waterfowl habitat by installing water control structures. Therefore, as part of the nonstructural feature, the Vicksburg District will furnish the water control structures for the landowners' installation. Reforestation of frequently flooded agricultural lands causes a loss of waterfowl habitat value because the caloric value of grain crops is higher than those found within bottom-land hardwoods. However the installation of the water control structures will increase waterfowl foraging habitat and waterfowl resource values. Reforestation, when combined with water control structures, produces a gain in waterfowl resource value. Reforestation provides a variety of life cycle requirements to waterfowl, and the loss of foraging habitat value is more than balanced by providing these requirements. The waterfowl model utilized in this study was developed by FWS and is based on the caloric intake of a duck per day.

253. Reforestation provides a gain in habitat value for terrestrial, wetland, aquatic spawning, and aquatic rearing resources. Reforestation would improve water quality in the area and increase hunting and fishing opportunities. The nonstructural feature will provide increased habitat for the threatened Louisiana black bear and the endangered plant, pondberry. No adverse impacts to cultural resources are anticipated with the nonstructural feature.

Alternative 2

254. Alternative 2 utilizes perpetual easements to acquire agricultural lands for reforestation/ conservation features below elevation 91.0 feet, NGVD, at the Steele Bayou structure and flowage easements on those lands above elevation 91.0 feet, NGVD, at the Steele Bayou

structure from willing sellers. The operation of the Steele Bayou structure would be modified to raise the water levels during low-flow periods. The nonstructural feature, along with the operational change to the Steele Bayou structure, creates a 25.0 percent increase in terrestrial resources, 150.6 percent increase in waterfowl resources, 47.2 percent increase in wetlands resources, 86.3 percent increase in aquatic spawning resources, and 31.6 percent increase in the aquatic rearing resources.

Alternative 2A

255. Alternative 2A acquires perpetual easements with reforestation/conservation features on up to 81,400 acres of agricultural lands, provides floodproofing for all structures in the 100-year flood plain, and an income assurance program on lands above elevation 91 feet, NGVD, at the Steele Bayou structure. Only the nonstructural features have an effect on environmental resources. The nonstructural feature showed a 16.3 percent increase in terrestrial resources, 84.8 percent increase in waterfowl resources, 30.9 percent increase in wetlands resources, 56.5 percent increase in aquatic spawning resources, and 19.7 percent increase in the aquatic rearing resources.

Alternative 2B

256. Alternative 2B acquires perpetual easements with reforestation/conservation features on up to 26,400 acres of agricultural lands, construction of 14 ring levees to protect residential structures, and purchase and removal residential structures not protected by the ring levees. In addition to the 26,400 acres of perpetual easements, this alternative requires 26,619 acres of reforestation for compensatory mitigation. While the reforestation under the nonstructural effects provides a habitat gain for terrestrial, wetland, aquatic spawning, and aquatic rearing resources, the structural effects show a loss of habitat values for all categories. This alternative shows a 3.3 percent increase in terrestrial resources, 31.5 percent decrease in waterfowl resources, 2.4 percent increase in wetlands resources, 27.0 percent decrease in aquatic spawning resources, and 32.6 percent decrease in the aquatic rearing resources.

Alternative 2C

257. Alternative 2C acquires perpetual easements with reforestation/conservation features on up to 114,400 acres of agricultural lands, provides income assurance for flood agricultural lands, and the acquisition and removal of structures in the 100-year flood plain. The acquisition and reforestation/ conservation feature is the only feature that affects the environmental resources in this alternative. The nonstructural feature increases terrestrial resources by 23.0 percent, waterfowl resources by 129.4 percent, wetlands resources by 43.4 percent, aquatic spawning resources by 78.8 percent, and aquatic rearing resources by 27.6 percent.

STRUCTURAL ALTERNATIVE –
ENVIRONMENTAL ANALYSIS

258. The construction site for the proposed Yazoo Backwater pump station lies to the west of the Steele Bayou structure and covers approximately 215.2 acres, excluding the existing levee, cofferdam, and Highway 465. The area includes 98.1 acres of wetland pasture, 20.4 acres of scrub-shrub wetlands, 39.2 acres of open water, and 57.5 acres of nonwetlands. The inlet and outlet channels (34 acres of open water) were constructed in 1987, but were never connected to Steele Bayou or the Yazoo River. Once completed, the inlet channel will provide 30.8 acres of permanent open water behind the pump station. The outlet channel will provide up to 19.2 acres of additional open water that fluctuate with the water level of the Yazoo River. Project construction will permanently convert approximately 5.6 acres of open water at the construction site to other uses. This includes up to 0.9 acre of Cypress Lake, located adjacent to Highway 465. The remaining 4.7 acres of open water are located within the cofferdam and adjacent to Highway 465. These shallow ponds are the result of the 1987 construction and are sustained by precipitation. The project will also convert approximately 38 acres of forested wetlands to other uses.

Alternative 3

259. Alternative 3 has a 14,000-cfs pump station with a pumping elevation of 80 feet, NGVD, between 1 March and 31 October and elevation 85 feet, NGVD, during the remainder of the year. It includes the modified operation of the Steele Bayou structure to maintain water elevations between 70.0 and 73.0 feet, NGVD, during low-water periods. Alternative 3 does not have a nonstructural feature. Compensatory mitigation would be required to offset the environmental losses. The modified operation of the Steele Bayou structure has positive waterfowl benefits. Reforestation, as a part of compensatory mitigation, could result in improvements to water quality in the study area. Hunting and fishing opportunities would increase with the compensatory mitigation. Alternative 3 results in no change in terrestrial resources, 1.1 percent decrease in waterfowl resources, 5 percent decrease in wetlands resources, 40.3 percent decrease in aquatic spawning resources, and 16.4 percent decrease in the aquatic rearing resources in the absence of compensatory mitigation. These decreases were due to the structural effect of construction and operation of the pump station.

COMBINATION ALTERNATIVES –
ENVIRONMENTAL ANALYSIS

260. All the combination alternatives contain a structural feature (14,000-cfs pump station), a nonstructural feature (reforestation and water control structures), and an operational change to the Steele Bayou structure (maintaining water elevations between 70.0 and 73.0 feet, NGVD, in lieu of maintaining water elevations between 68.5 and 70.0 feet, NGVD, during low-flow periods).

261. The structural effect from the construction of a pump station shows a loss to all environmental resource categories. The structural effect from the operation of the pump station provides an increase in terrestrial resources value, a decrease in wetland resources values, an increase in waterfowl resources values, and generally, a loss in aquatic spawning and aquatic rearing resource values. The operational change to the Steele Bayou structure, while not broken out separately, causes an increase in waterfowl and aquatic resource values for all structural alternatives.

262. The nonstructural feature includes the acquisition of perpetual easements with reforestation/conservation features. The reforestation feature was modified from the fourth array of alternatives by the Vicksburg District to include other conservation features on up to 10 percent of the perpetual easement lands. Out of this 10 percent, MDWFP requested that 5 percent be utilized for moist soil management for waterfowl by the installation of water control structures, thereby creating foraging habitat. Reforestation of frequently flooded agricultural lands causes a loss of waterfowl habitat value because the caloric value of grain crops is higher than those found within bottom-land hardwoods. However, by the installation of the water control structures to increase waterfowl foraging habitat, waterfowl resource value is regained. Reforestation, when combined with the water control structures, provides a gain in waterfowl resource value. Reforestation provides a variety of life cycle requirements to waterfowl and the loss of foraging habitat value is more than balanced by providing these requirements. The waterfowl model utilized in this study was developed by FWS and is based on the caloric intake of a duck per day.

Alternative 4

263. Under Alternative 4, pumping would begin at elevation 85.0 feet, NGVD, at the Steele Bayou structure, with perpetual easements from willing sellers on up to 37,200 acres of open lands primarily at or below elevation 85.0 feet, NGVD, at the Steele Bayou structure. Combining the structural and nonstructural features with the operation changes to the Steele

Bayou structure creates a 7.5 percent increase in terrestrial resources, 26.5 percent increase in waterfowl resources, 10.9 percent increase in wetlands resources, 4.7 percent increase in aquatic spawning resources, and 1.0 percent decrease in the aquatic rearing resources.

Alternative 5

264. Under Alternative 5, pumping would begin at elevation 87.0 feet, NGVD, at the Steele Bayou structure, with perpetual easements from willing sellers on up to 55,600 acres of open land primarily at or below elevation 87.0 feet, NGVD, at the Steele Bayou structure. Combining the structural and nonstructural features with the operation changes to the Steele Bayou structure creates an 11.2 percent increase in terrestrial resources, 52.8 percent increase in waterfowl resources, 19.5 percent increase in wetlands resources, 30.3 percent increase in aquatic spawning resources, and an 8.0 percent increase in the aquatic rearing resources.

Alternative 6

265. In addition to the operational change of the Steele Bayou structure to raise low-flow water levels, Alternative 6 allows for reintroduction of Mississippi River flows up to a maximum elevation of 87.0 feet, NGVD, at the Steele Bayou structure. Under Alternative 6, pumping would begin at elevation 88.5 feet, NGVD, at the Steele Bayou structure with perpetual easements from willing sellers on up to 81,400 acres of open land, primarily at or below elevation 88.5 feet, NGVD, at the Steele Bayou structure. Combining the structural and nonstructural features with the operation changes to the Steele Bayou structure creates a 16.4 percent increase in terrestrial resources, 94.8 percent increase in waterfowl resources, 29.8 percent increase in wetlands resources, 56.3 percent increase in aquatic spawning resources, and 18.6 percent increase in the aquatic rearing resources.

Alternative 7

266. In addition to the operational change of the Steele Bayou structure to raise low-flow water levels, Alternative 7 allows for reintroduction of Mississippi River flows up to a maximum elevation of 87.0 feet, NGVD, at the Steele Bayou structure. Under Alternative 7, pumping would begin at elevation 91.0 feet, NGVD, at the Steele Bayou structure with perpetual easements from willing sellers on up to 124,400 acres of open land, primarily at or below elevation 91.0 feet, NGVD, at the Steele Bayou structure. Combining the structural and nonstructural features with the operation changes to the Steele Bayou structure creates a 25.0 percent increase in terrestrial resources, 153.9 percent increase in waterfowl resources, 46.8 percent increase in wetlands resources, 93.1 percent increase in aquatic spawning resources, and 31.6 percent increase in the aquatic rearing resources.

SUMMARY OF ENVIRONMENTAL EVALUATION OF ALTERNATIVES

267. Tables 16 and 17 provide a breakdown of the environmental gains and losses in both habitat values and acres for the structural and nonstructural features for terrestrial, wetlands, waterfowl, and aquatic spawning and rearing habitats for each of the alternatives in the final array based on functional analyses. The structural feature was subdivided to show the impacts from actual construction and those hydrologic impacts caused by the operation of the structural feature. The waterfowl nonstructural features were also subdivided to show those impacts that occur due to reforestation and those impacts from the installation of water control structures, thereby creating waterfowl foraging habitat. Even without the increase in waterfowl foraging habitat, FWS has stated that the overall benefits to waterfowl from reforestation exceed any loss of foraging habitat. Table 18 provides a summary by environmental category and the percent change from the base habitat value for the alternative in the final array. A detailed breakdown of these environmental resources is provided in Appendix 1 and summarized in the FSEIS.

268. The ERDC fishery scientists (Appendix 11) concluded that spawning habitat is the controlling aquatic resource. Without successful spawning, year-class fish numbers would be reduced even if rearing habitat was optimum. In contrast to spawning, rearing fishes do not have specific hydrologic requirements other than a preference to slack-water or swift-water conditions depending on the species. Larval fish can exploit a variety of depths, and most species along the shoreline tend to move with fluctuating water levels without stranding or injury. Deeper, persistent water, inclusive of spawning sites, is exploited by larval fishes for food (plankton, benthos) as is shallow, transient water for rapid growth (i.e., warmer water temperatures elevate larval fish metabolism). For these reasons, spawning is the limiting life stage regulating population growth when changes in flood elevation and duration are altered due to flood control features. Therefore, the aquatic rearing habitat type was not carried forward in subsequent analyses due to the fact that without a successful spawn, rearing habitat would not be required.

269. As explained in Appendix 1, when the AAHUs are converted to acres, aquatic spawning habitat requires the greatest number of mitigation acres; i.e., the reforestation/conversation acres will generate a certain number of units for each resource function, and the function that requires the maximum number of acres is aquatic spawning. For that reason, aquatic spawning is the controlling resource for calculating mitigation. The mitigation acres needed to offset impacts to aquatic spawning will generate AAHUs for other resource categories that exceed the impacts to those resources.

TABLE 16
ENVIRONMENTAL GAINS AND LOSSES
YAZOO BACKWATER AREA REFORMULATION
FINAL ARRAY OF ALTERNATIVES
(2005 Land Use)

Alternative	Terrestrial (AAHU)			Wetland (FCU)			Waterfowl (DUD)				Aquatic Spawning (AAHU)			Aquatic Rearing (AAHU)		
	Structural Effect		Nonstructural Effect	Structural Effect		Nonstructural Effect	Structural Effect		Nonstructural Effect		Structural Effect		Nonstructural Effect	Structural Effect		Nonstructural Effect
	Construction	Hydrologic	Reforestation a/	Construction	Hydrologic	Reforestation a/	Construction	Hydrologic	Reforestation a/	Foraging b/	Construction	Hydrologic	Reforestation a/	Construction	Hydrologic	Reforestation a/
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	174,658	0	0	418,291	0	195,476	-526,574	3,116,220	0	0	16,684	0	1,352	26,870
2A	0	0	114,286	0	0	273,704	0	0	-471,171	2,039,070	0	0	10,917	0	0	17,582
2B	-9,892	-3,901	37,066	-16,732	-50,869	88,769	-290,768	-673,635	-279,754	661,320	-1,904	-6,864	3,541	-2,116	-32,742	5,702
2C	0	0	160,618	0	0	384,666	0	0	-471,171	2,865,720	0	0	15,343	0	0	24,710
3	-113	0	0	-240	-43,990	0	-2,166	-17,485	0	0	-27	-7,791	0	-30	-14,663	0
4	-113	239	52,229	-240	-28,132	125,084	-2,166	42,032	-482,318	931,860	-27	-4,049	4,989	-30	-8,825	8,035
5	-113	239	78,062	-240	-14,188	186,953	-2,166	77,973	-491,181	1,392,780	-27	-1,580	7,457	-30	-4,779	12,010
6	-113	361	114,286	-240	-9,300	273,704	-2,166	261,126	-543,808	2,039,070	-27	-1	10,917	-30	-910	17,582
7	-113	361	174,658	-240	-3,949	418,291	-2,166	281,591	-549,128	3,116,220	-27	1,353	16,684	-30	1,403	26,870

NOTE: Construction effects result from the actual construction site; hydrologic effects result from operation of the structural features; reforestation effects result from reforesting agricultural lands; and foraging effects result from installation of water control structures.

+ indicates a gain in environmental resources.
- indicates a loss in environmental resources.

a/ 90 percent of the reforestation acreage was used to estimate habitat value because up to 10 percent of the nonstructural feature could be used for other conservation purposes.
b/ Assumes 5 percent of the easement lands would be used for waterfowl foraging habitat.

TABLE 17
ACRES AFFECTED BY ALTERNATIVE
YAZOO BACKWATER AREA REFORMULATION
FINAL ARRAY OF ALTERNATIVES
(2005 Land Use)

Alternative	Terrestrial			Wetland			Waterfowl				Aquatic Spawning			Aquatic Rearing		
	Structural Effect		Nonstructural Effect	Structural Effect		Nonstructural Effect	Structural Effect		Nonstructural Effect		Structural Effect		Nonstructural Effect	Structural Effect		Nonstructural Effect
	Construction	Hydrologic	Reforestation	Construction	Hydrologic	Reforestation	Construction	Hydrologic	Reforestation c/	Foraging d/	Construction	Hydrologic e/	Reforestation e/	Construction	Hydrologic e/	Reforestation e/
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	124,400	0	0	124,400	0	1,384	1,940	6,220	0	0	40,299	0	2,353	64,902
2A	0	0	81,400	0	0	81,400	0	0	1,753	4,070	0	0	26,370	0	0	42,468
2B	-3,156	-11,985 a/	26,400	-3,156	92,104	26,400	-3,156	-4,766	1,106	1,320	-3,156	-14,347	8,552	-3,156	-57,002	13,773
2C	0	0	114,400	0	0	114,400	0	0	1,753	5,720	0	0	37,060	0	0	59,685
3	-38	0	0	-38	118,486	0	-38	-128	0	0	-38	-16,285	0	-38	-25,529	0
4	-38	430 b/	37,200	-38	101,115	37,200	-38	301	1,793	1,860	-38	-8,463	12,051	-38	-15,364	19,408
5	-38	430 b/	55,600	-38	66,945	55,600	-38	561	1,827	2,780	-38	-3,303	18,012	-38	-8,321	29,008
6	-38	1,460 a/	81,400	-38	48,066	81,400	-38	1,861	2,001	4,070	-38	-2	26,370	-38	-1,586	42,468
7	-38	1,460 a/	124,400	-38	28,408	124,400	-38	2,001	2,022	6,220	-38	2,828	40,299	-38	2,442	64,902

NOTE: Construction effects result from the actual construction site; hydrologic effects result from operation of the structural features; reforestation effects result from reforesting agricultural lands; and foraging effects result from installation of water control structures.

+ indicates a gain in acres.
- indicates a loss in acres.

a/ Combined wood duck and mink acres.
b/ Wood duck acres only.
c/ Represents only that portion of total number of acres reforested that contribute to waterfowl resources.
d/ Waterfowl foraging acres based on 5 percent of easement lands.
e/ Average flooded acres.

TABLE 18
NET ENVIRONMENTAL GAINS AND LOSSES
YAZOO BACKWATER AREA REFORMULATION

Alternative	Terrestrial		Wetlands		Waterfowl		Aquatic			
							Spawning		Rearing	
	(AAHU)	% Base	(FCU)	% Base	(DUD)	% Base	(AAHU)	% Base	(AAHU)	% Base
1 a/	699,592		885,296		1,849,741		19,337		89,414	
2	174,658	25.0	418,291	47.2	2,785,122	150.6	16,684	86.3	28,222	31.6
2A	114,286	16.3	273,704	30.9	1,567,899	84.8	10,917	56.5	17,582	19.7
2B	23,273	3.3	21,168	2.4	-582,837	-31.5	-5,227	-27.0	-29,156	-32.6
2C	160,618	23.0	384,666	43.4	2,394,549	129.4	15,343	78.8	24,710	27.6
3	-113	0.0	-44,230	-5.0	-19,651	-1.1	-7,818	-40.3	-14,693	-16.4
4	52,355	7.5	96,712	10.9	489,407	26.5	913	4.7	-820	-1.0
5	78,188	11.2	172,525	19.5	977,406	52.8	5,850	30.3	7,201	8.0
6	114,534	16.4	264,164	29.8	1,754,222	94.8	10,889	56.3	16,642	18.6
7	174,906	25.0	414,102	46.8	2,846,517	153.9	18,010	93.1	28,243	31.6

a/ Alternative 1 represents the baseline conditions in each category by which the relative change is measured on the remaining alternatives.

INCREMENTAL ENVIRONMENTAL ANALYSIS

270. A modified incremental environmental analysis was conducted to determine the most cost-effective alternative from an environmental benefit perspective for the Yazoo Backwater evaluation. This is a "modified" incremental environmental analysis because this analysis was conducted to demonstrate that a deviation from the NED Plan is warranted and in the best interest of the Nation in regard to implementing water resources improvements in the Yazoo Backwater Study Area.

271. Table 19 provides the incremental first costs, annual costs, NED benefits, and EQ benefits for Alternatives 4-6 for the nonstructural component only when compared to Alternative 4, the NED Plan.

272. The NED Plan is the optimum plan economically (i.e., the plan that maximizes net benefits by producing the greatest excess benefits over costs or net benefits). The EQ Plan is the environmental quality plan (i.e., the plan that protects the quality of the environmental resources such as fish and wildlife habitat, water quality, streamflow, cultural resources, and/or wetlands). In accordance with Engineer Regulation (ER) 1165-2-28 (30 April 1980), the EQ Plan "must enhance, preserve, or restore the environment of the study area." Other guidance can be found in ER 1105-2-100 and Policy Guidance letter No. 24 (USACE, 1991). While various alternatives may meet EQ criteria, the objective is to identify an alternative that satisfied EQ criteria and NED criteria in a maximum manner. A detailed breakdown of the incremental environmental analysis is shown in Appendix 7.

TABLE 19
INCREMENTAL ANALYSIS
NONSTRUCTURAL FEATURE ONLY
YAZOO BACKWATER AREA REFORMULATION

Item	Alternative 4 a/	Alternative 5 b/	Alternative 6 c/
First Costs ($000)	--	41,064	51,988
Annual Costs ($000)	--	2,379	2,998
NED Benefits (excluding employment) ($000)	--	-89	98
Excess Benefits	--	-1,452	-2,210
EQ Benefits d/e/			
Wetlands (FCUs)			
Total Wetlands	125,084	186,953	273,704
Incremental Change	--	61,869	86,751
Percent Change		49	46
Terrestrial (AAHUs)			
Total Terrestrial	52,229	78,062	114,286
Incremental Change	--	25,833	36,224
Percent Change		49	46
Waterfowl (DUDs)			
Total Waterfowl	449,542	901,599	1,495,262
Incremental Change	--	452,057	593,663
Percent Change		100	66
Aquatics (AAHUs)			
Total Spawning	4,989	7,457	10,917
Incremental Change	--	2,468	3,460
Percent Change		49	46

a/ Alternative 4 is the NED plan.
b/ Alternative 5 is compared to Alternative 4.
c/ Alternative 6 is compared to Alternative 5.
d/ Units represent the net gain provided by the nonstructural features (reforestation and water impoundments), but do not include units associated with acres necessary to obtain a no net loss and units associated with mitigation owed for previous construction works for the Yazoo Backwater system.
e/ EQ benefits taken from Table 16.

273. Table 20 displays the average annual cost for the nonstructural features for Alternatives 4, 5, and 6. Alternatives 5 and 6 are the two alternatives in the final array closest to the NED Plan (Alternative 4) and exhibit the "least" total average annual costs. For these plans, the average annual costs of nonstructural features ranged from a low of $966,000 with Alternative 4 to a high of $6.3 million with Alternative 6.

TABLE 20
AVERAGE ANNUAL NONSTRUCTURAL FEATURE COSTS BY HABITAT TYPE
AND ALTERNATIVE
YAZOO BACKWATER AREA REFORMULATION

Habitat Type	Environmental Benefits by Alternative								
	Alternative 4			Alternative 5			Alternative 6		
	Annual Costs a/b/ ($000)	Units c/	Cost Per Unit ($)	Annual Costs a/b/ ($000)	Units c/	Cost Per Unit ($)	Annual Costs a/b/ ($000)	Units c/	Cost Per Unit ($)
Wetlands (FCU)	966	96,712	9.99	3,345	172,525	19.39	6,343	264,164	24.01
Terrestrial (AAHU)	966	52,355	18.45	3,345	78,188	42.78	6,343	114,534	55.38
Waterfowl (DUD)	966	489,408	1.97	3,345	977,406	3.42	6,343	1,754,222	3.62
Spawning Aquatics (AAHU)	966	913	1,058.05	3,345	5,850	571.79	6,343	10,889	582.51

a/ Values presented in 2006 dollars, including all costs associated with the construction and operation of these alternatives, and annualized at the current Federal interest rate of 5-1/8 percent over a 50-year economic project life.
b/ Annual costs for the nonstructural component are shown in Table 14 and include the cost of land and reforestation, which applies to all environmental resource categories.
c/ Units were reduced from those shown in Table 16 to account for those needed to compensate for construction of the structural feature. This table only reflects those units attributable to the nonstructural feature.

274. The four resource functions that were analyzed in a quantitative manner--wetlands, terrestrial, waterfowl, and aquatic spawning--and their corresponding number of units are shown for each alternative in Table 20. Since units cannot be integrated between habitat types, outputs for each habitat type must be evaluated individually as well as compared with incremental benefits from the entire array of outputs. For example, with Alternative 4, the average cost per aquatic spawning AAHU was determined to be $1,058.05. This is calculated by dividing the average annual cost by AAHU for each environmental resource. For example, the incremental cost for aquatic spawning AAHUs for Alternative 4 is obtained by $966,000 ÷ 913 AAHUs. This same process was utilized to determine the average cost per unit by habitat type for all three alternatives. As a result, Alternative 5 was identified to produce more units at a lower cost per unit for aquatics AAHUs which is the resource requiring the most reforestation.

275. Table 21 provides the results of the incremental cost analysis, which illustrates the cost per unit increase between alternatives, and further substantiates the change from Alternative 4 to Alternative 5. The average annual nonstructural cost for Alternative 5 increased by $2,379,000 over Alternative 4's average annual costs (i.e., $3,345,000 for Alternative 5 less $966,000 for Alternative 4 from Table 20). Likewise, the average annual cost for the nonstructural features of Alternative 6 increased by $2,998,000 (i.e., $6,343,000 for Alternative 6 less $3,345,000 for Alternative 5 from Table 20). In order to determine the incremental units generated by Alternatives 5 and 6, the units shown in Table 20 need to be subtracted between Alternatives 4 and 5 and 5 and 6 to determine the number of incremental units for Table 21 in each of the environmental benefit categories; i.e., in Table 20, Alternative 4 generates 96,712 FCUs (wetland) and Alternative 5, 172,525 FCUs; subtracting these numbers gives 75,813 FCUs as shown in Table 21. The same procedure would be performed for each category under Alternative 5 and then the same procedure would be repeated for Alternatives 5 and 6.

TABLE 21
AVERAGE ANNUAL NONSTRUCTURAL INCREMENTAL COSTS
ABOVE THE NED PLAN
BY HABITAT TYPE AND BY SELECTED ALTERNATIVE
YAZOO BACKWATER AREA REFORMULATION

Habitat Type	Environmental Benefits by Alternative								
	Alternative 4 a/			Alternative 5 b/			Alternative 6 c/		
	Annual Costs d/ e/ ($000)	Units	Cost Per Unit ($)	Annual Costs d/ e/ ($000)	Units	Cost Per Unit ($)	Annual Costs d/ e/ ($000)	Units	Cost Per Unit ($)
Wetlands (FCU)	0	0	0	2,379	75,813	31.38	2,998	91,639	32.72
Terrestrial (AAHU)	0	0	0	2,379	25,833	92.09	2,998	36,346	82.49
Waterfowl (DUD)	0	0	0	2,379	487,998	4.88	2,998	776,816	3.86
Spawning Aquatics (AAHU)	0	0	0	2,379	4,937	481.87	2,998	5,039	594.96

a/ Alternative 4 is the NED Plan.
b/ Alternative 5 is compared to Alternative 4.
c/ Alternative 6 is compared to Alternative 5.
d/ Values presented in 2006 dollars, including all costs associated with the construction and operation of these alternatives, and annualized at the current Federal interest rate of 5-1/8 percent over a 50-year economic project life.
e/ Annual costs for the nonstructural component are shown in Table 14 and include the cost of land and reforestation, which applies to all environmental resource categories.

276. In regard to additional costs per unit, Alternative 5 produces 4,937 more in aquatics spawning AAHUs than Alternative 4 at an incremental cost of $481.87 per unit while Alternative 6 generates an additional 5,039 AAHUs, but at a much greater cost of $594.96 per unit. Implementation of Alternative 5 reduces the incremental cost of aquatics. Therefore, the alternative with the least cost per habitat unit for spawning is the best overall alternative.

SUMMARY OF HYDROLOGIC, ECONOMIC, AND ENVIRONMENTAL EVALUATIONS

277. Table 22 presents a comparison of the results of NED and EQ evaluations for Alternatives 4, 5, and 6. As shown, there is a reduction of excess benefits between Alternatives 4 and 5 of $1.4 million and an additional reduction of $2.2 million between Alternatives 5 and 6. Results of the benefit-cost analysis yield benefit cost ratios within close proximity 1.6 to 1 for Alternative 4, 1.4 to 1 for Alternative 5, and 1.3 to 1 for Alternative 6. Total average annual benefits were all in the $21.3 to $21.4 million range. Structural flood damages are reduced by 50.6, 41.0, and 34.9 percent for Alternatives 4, 5, and 6, respectively. Nonstructural flood damages are reduced by 24.5, 34.3, and 41.5 percent for Alternatives 4, 5, and 6, respectively. This was due to the fact that more land was being reforested under each alternative which removed these lands from future flood damages. When combining both the structural and nonstructural flood damage reductions, the total flood damage reductions were 75.1, 75.2, and 76.4 percent for Alternatives 4, 5, and 6, respectively. Alternative 4 reduces the acres impacted by the 10-year flood event by 34.0 percent and the 100-year flood event by 26.9 percent. Alternative 5 reduces the acres impacted by the 10-year flood event by 33.0 percent and the 100-year flood event 25.1 percent. Alternative 6 reduces the acres impacted by the 10-year flood event by 28.1 percent and the 100-year flood event by 24.1 percent.

TABLE 22
SUMMARY OF NED/EQ ANALYSIS
YAZOO BACKWATER AREA REFORMULATION

Item	Alternative 4	Alternative 5	Alternative 6
Results of the NED Analysis (Monetary Impacts) a/			
Average Annual Costs ($000)	13,688	15,051	17,322
Difference Between Alternatives ($000)	--	*+1,363*	+2,271
Average Annual Benefits ($000) b/	21,417	21,328	21,389
Difference Between Alternatives ($000)	--	*-89 c/*	+61
Benefits Cost Ratio	1.6	1.4	1.2
Difference Between Alternatives	--	*-.2*	-.2
Excess Benefits over Costs ($000)	7,729	6,277	4,067
Difference Between Alternatives ($000)	--	*-1,452*	-2,210
Total Flood Damage Reduction (FDR) (%)	75.1	75.2	76.4
Structural FDR (%)	50.6	41.0	34.9
Nonstructural Agricultural FDR (%)	24.5	34.3	41.5
Hydrologic Effects			
10-year Flood Reduction (%)	34.0	33.0	28.1
100-year Flood Reduction (%)	26.9	25.1	24.1
Results of the Incremental Analysis of Environmental Benefits (Nonmonetary Impacts in Units)			
Wetlands (FCUs)	96,712	172,525	264,164
Difference Between Alternatives	--	*+75,813* (78%)	+91,639 (53%)
Terrestrial (AAHUs)	52,355	78,188	114,534
Difference Between Alternatives	--	*+ 25,833 (49%)*	+36,346 (46%)
Waterfowl (DUDs)	489,408	977,406	1,754,222
Difference Between Alternatives	--	*+487,998 (100%)*	+776,816 (79%)
Spawning Aquatic (AAHUs)	913	5,850	10,889
Difference Between Alternatives	--	*+4,937 (541%)*	+5,039 (86%)

a/ Values presented in 2006 dollars, including all costs associated with the construction and operation of these alternatives, and annualized at the current Federal interest rate of 5-1/8 percent over a 50-year economic project life.

b/ Excludes employment benefits, but includes all other categories.

c/ Less than 0.5 percent difference.

278. Environmentally, Alternative 5 produces 541 percent more spawning aquatic AAHUs at approximately half the cost per unit when compared to Alternative 4 ($1,058.05 per unit versus $571.79 per unit) (see Table 20). Incrementally, the cost per spawning aquatic AAHU cost dropped from $1,058.05 per unit with Alternative 4 to $481.87 per unit with Alternative 5 (Table 21). Likewise, deviating to Alternative 6 caused the spawning aquatic AAHU cost per unit to increase from $481.87 with Alternative 5 to $594.96. This was a 23 percent increase in incremental cost over Alternative 5. As previously discussed, the spawning aquatic AAHUs are the controlling resource and thus, deviation for the NED Plan could be based solely on the economic incremental cost for this category. In the overall habitat comparison using all four resource categories, Alternative 5 produces 78, 49, 100, and 541 percent more units, respectively, for the Wetlands (FCU), Terrestrial (AAHU), Waterfowl (DUD), and Aquatic Spawning (AAHU) categories than Alternative 4 (Table 22). Alternative 6 produced 53, 46, 79, and 86 percent more units, respectively, for the Wetlands (FCU), Terrestrial (AAHU), Waterfowl (DUD), and Aquatic Spawning (AAHU) categories than Alternative 5 (Table 22). However, the average cost per unit increased for all four resource categories when deviating from Alternative 5 to 6 (Table 20). For the reasons stated previously, Alternative 5 was determined to be the NED/NEQ Plan because it produces more units at a lower average and incremental cost per unit (for the aquatic spawning category) than Alternative 4.

279. While Alternative 6 would reforest up to 81,400 acres primarily at or below elevation 88.5 feet, NGVD, at the Steele Bayou structure, it would cost $52.0 million more than Alternative 5 (Table 19). Annual costs for Alternative 6 increased $2.3 million over Alternative 5 while annual benefits would increase by $134,000. Therefore, based on the first costs and the environmental incremental analysis, Alternative 6 was eliminated from further consideration.

280. Alternative 5 would reforest up to 55,600 acres primarily at or below elevation 87.0 feet, NGVD, at the Steele Bayou structure. According to Table 19, Alternative 5 would cost $27.3 million more than Alternative 4. Annual costs for Alternative 5 increased by $1.4 million over Alternative 4 while annual benefits would decrease by $207,000. Alternative 4 would reforest up to 37,200 acres primarily at or below elevation 85.0 feet, NGVD, at the Steele Bayou structure. It would produce greater excess economic benefits than Alternative 5, but would not provide as many environmental benefits. Alternative 5 provides more environmental benefits for less cost through the flood damage reduction feature of reforestation/conservation features on up to 55,600 acres when compared to Alternative 4. Alternative 5 more completely addresses the environmental opportunities than Alternative 4 for the following reasons.

a. The structural component of Alternative 5 has no affect on the size of the 1-year flood plain elevation 87.0 feet, NGVD, at the Steele Bayou structure. The structural component of Alternative 4 affects the 1-year flood plain by 2 feet, reducing the 1-year flood plain from elevation 87.0 to 85.0 feet, NGVD, at the Steele Bayou structure. This equates to 12,532 acres.

b. The structural component of Alternative 4 affects 101,115 acres of Federally-defined wetlands (43,000 acres < 5 percent duration and 58,200 acres changed duration), as determined by backwater flooding, while the structural component of Alternative 5 affects 66,900 acres (26,300 acres < 5 percent duration and 40,600 acres changed duration).

c. As previously discussed, all conservation easements will be acquired using a blocking factor. In order to achieve the goal of acquiring the easements with the 1-year frequency flood plain, the blocking factor will require the acquisition of some land outside the 1-year flood frequency. Due to the Yazoo Backwater Study Area's hydrology, the Vicksburg District believes most of these blocks would be on those lands within the existing 2-year frequency flood plain. Table 23 provides the percentage of agricultural lands that would be reforested within the existing 2-year flood frequency and within the with-project 2-year flood frequency for Alternatives 4 and 5. Alternative 4 includes reforestation of up to 37,200 acres of cleared acres with this alternative. Likewise, Alternative 5 includes up to 55,600 acres of reforestation. Under existing conditions, there are approximately 95,700 acres of cleared lands within the 2-year flood plain. Under with-project conditions, the acres flooded at the 2-year frequency flood event are reduced to 38,300 acres for Alternative 4 and 56,428 acres for Alternative 5. Reforestation of 37,200 acres with Alternative 4 equates to 38.9 percent (37,200 ÷ 95,700) of the existing 2-year flood plain and 97.1 percent (37,200 ÷ 38,300) of the with-project 2-year flood plain. Using this same methodology, Alternative 5 would reforest 58.1 percent (55,600 ÷ 95,700) of the existing 2-year flood plain and 98.6 percent (55,600 ÷ 56,400) of the with-project 2-year flood plain.

TABLE 23
LANDS TO BE REFORESTED WITHIN THE 2-YEAR FREQUENCY FLOOD
(2005 Land Use)
YAZOO BACKWATER AREA REFORMULATION

Alternative	Without-Project 2-Year Frequency (Percentage)	With-Project 2-Year Frequency (Percentage)
Alternative 4 a/	38.9	97.1
Alternative 5 b/	58.1	98.6

a/ Includes reforestation of up to 37,200 acres of the existing cleared acres.
b/ Includes reforestation of up to 55,600 acres of the existing cleared acres.

d. Increasing the pumping elevation from 85.0 on Alternative 4 to elevation 87.0 feet, NGVD on Alternative 5 increases the probability of successful fish egg incubation by providing an additional 2 feet of spawning habitat in the Yazoo Backwater Study Area. This equates to 5,200 acres of spawning habitat. The fish-spawning model uses an 8-day duration as an average incubation period. The range is from 1 to 14 days. Increasing the size of the flood plain would benefit those fishes that are at the lower duration of the incubation range. More detailed explanation of the fish-spawning model is included in Appendix 11.

e. The shorter duration and higher frequency of inundation of Alternative 4 at elevation 85.0 feet, NGVD, at the Steele Bayou structure versus the 1-year flood plain (elevation 87.0 feet, NGVD, at the Steele Bayou structure of Alternative 5) results in more variability in forest flooding. Not reforesting lands between elevations 85.0 and 87.0 feet results in fewer future habitat values.

f. A greater area of inundation results in better connectivity between aquatic flood plain habitat types, particularly between agricultural lands and bottom-land hardwoods. This is especially important because the predation rate on larval fish is higher in agricultural lands. Better connectivity allows larval fish to disperse into the structural cover of bottom-land hardwoods.

g. Particulate organic matter, mainly leaf detritus from the flood plain forests, is the basis of the food chain in heterotrophic systems such as the Yazoo River and Lower Mississippi River. Reforestation of the hydrologically unchanged 1-year flood plain would result in a significant increase in export of particulate organic matter to the aquatic system, which would increase benthic invertebrate and zooplankton production.

h. The fish-carrying capacity of a river system is dependent in part on the habitat quantity and quality during annual low flow conditions. The increased low flow aquatic habitat provided with the operational feature could significantly increase standing stock and production for many fish species. Reforestation of the 1-year flood plain (versus elevation 85.0 feet, NGVD, at the Steele Bayou structure) would better ensure the supply of organic matter and fish food organisms to young-of-the-year fish necessary to support increased standing stock.

i. Water quality improvement would be greater with reforestation of the 1-year flood plain. A larger area would be removed from agricultural production, and therefore, greater decreases in suspended sediments and nutrients would occur.

j. Increasing the reforestation from elevation 85.0 feet, NGVD, flood plain to elevation 87.0 feet, NGVD, at the Steele Bayou structure (1-year flood plain) will result in additional larger contiguous tracts of wooded habitat, which would greatly increase habitat value for the Louisiana black bear and other bottom-land hardwood bird and mammal species, including Neotropical birds.

k. Although Alternatives 4 and 5 both allow for the installation of conservation features on up to 10 percent of the acres under the nonstructural component, Alternative 5 would have a greater positive impact on all resources because more acreage is involved in the nonstructural component.

l. Although additional reforestation results with Alternative 5 when compared to Alternative 4, this caused a greater loss of waterfowl foraging habitat. However, according to FWS, the overall benefit that results from reforestation far exceeds losses of foraging habitat.

m. Mitigation to offset adverse impacts is included within the reforestation/conservation perpetual easement acreage for Alternative 5 (and other alternatives). The Vicksburg District has committed to acquire the mitigation acreage prior to operation of the pump station. Also, the length of time to secure the perpetual easements under the nonstructural feature has been extended from 1 year after completion of the pump station to 10 years. This will allow sufficient time for the community to cycle through postproject flood experiences as well as two possible Farm Bill Amendments. Landowners also have been afforded an option to leave up to 10 percent of the perpetual easements in other conservation features including 5 percent for waterfowl with the Vicksburg District furnishing the water control structure for installation and operation by the landowners. This feature allows for a diversity of environmental resources.

281. Therefore, based on the above-stated reasons and a review of the data in Tables 13 through 23, the NED/EQ recommended plan is Alternative 5.

RECOMMENDED PLAN

GENERAL

282. Alternative 5, the sum of net NED and EQ benefits, offers the best balance between the two Federal objectives and therefore is the recommended plan.

283. Plan 5 is a comprehensive plan that combines both structural and nonstructural features, which provide flood damage reduction benefits for the entire project area (open lands and structures) while minimizing adverse effects and improving the environment. The pump station will provide protection for open lands and structures above the pump start elevation by reducing flood stages. Perpetual easements (willing sellers) with reforestation/conservation features will prevent existing flood damages on open land primarily below the pump start elevation. Perpetual easements from willing sellers would control future land use and remove the agricultural intensity on these lands. The reforestation/conservation easement would not only offset the adverse impacts of the pump station operation, but would also result in a net positive environmental gain of the study area. This plan offers the opportunity to both improve people's lives and improve the environment and therefore justifies the additional cost over Alternative 4. The plan conforms to the OMB directive to (a) provide greater levels of flood protection for the structures located in the Yazoo Backwater Study Area, (b) reduce levels of agricultural intensification, and (c) reduce adverse impacts on the environment, and it meets the planning objective.

284. On 15 March 2004, the Director of Civil Works asked the Assistant Secretary of the Army (Civil Works) (ASA(CW)) for a deviation from recommending Plan 4, the NED Plan. The letter stated "The added monetary flood damage reduction benefits combined with the significant nonmonetary ecological benefits makes Plan 5 far superior to the NED Plan." In a letter dated 16 May 2005, Mr. John Paul Woodley, ASA(CW), concurred that "Plan 5 is a superior plan when considering both monetary flood damage reduction benefits and nonmonetary ecological benefits associated with the nonstructural flood control portion of the plan. As such, Plan 5 complies with the Principles and Guidelines as it is the plan that reasonably maximizes net NED benefits, consistent with protecting the Nation's environment. Therefore, I find that the Chief of Engineers has the authority to implement Plan 5 and as such, a waiver of policy is not required." Based on this, the Vicksburg District did not pursue a deviation. The letters which document the above correspondence can be found in Appendix 5.

Hydrologic Impacts

285. For the recommended plan (Plan 5), the pump station would not affect annual baseline peak flood stages below the pumping elevation 87.0 feet, NGVD. The pump station would modify the backwater hydrology on approximately 66,900 acres of the 189,600 acres of Federally-defined wetlands (backwater hydrology) in the project area that are inundated or saturated to the surface for at least 5 percent of the growing season (14 days) in most years. This is a conservative estimate of impacts to wetlands based on the 5 percent duration instead of the 12.5 percent duration as outlined in the Wetland Delineation Manual. Of this acreage, 26,300 acres would fall below the 5 percent backwater flood duration and would no longer meet the Federal wetland definition. However, these acres will continue to experience backwater

flooding, but with a shorter annual duration. The remaining 40,600 acres of wetlands would experience a shorter duration of flooding, but would still meet the minimum hydrology requirements for Federal wetlands (5 percent annual duration). All of the impacted 66,900 acres will continue to experience rainfall, which could maintain their wetland hydrology, but the Vicksburg District has assumed that other sources play no role in maintaining wetland hydrology. Impacts to both of these groups of wetlands were considered in this analysis. See Appendix 10 for more detail concerning these impacts. Wetland functional values were determined by the HGM approach developed by EPA and ERDC scientists.

286. The pump station effect on annual baseline peak stages by frequency and reach is shown in Table 24. Plates 4-7 through 4-10 depict the base conditions and the recommended plan for the 1-, 2-, 10-, and 100-year frequency flood events. The 1-year frequency flood event remains the same with approximately 216,000 acres flooded both under the without- and with-project conditions (Plate 4-7). This is because the 1-year frequency flood event is elevation 87.0 feet, NGVD, which is the elevation at which pump operation would begin. The 2-year frequency flood event shows 317,500 acres flooded under without-project conditions and 244,000 acres flooded under the recommended plan (Plate 4-8). Table 24 shows a 3.2-foot reduction in stage in the lower ponding area and a 2.7-foot reduction in the upper ponding area for the 2-year frequency flood event. The 10-year frequency flood event shows 488,200 acres flooded under the without-project conditions and 327,100 acres flooded with the recommended plan (Plate 4-9). Table 24 shows the 10-year frequency flood event reductions of 5.1 and 4.8 feet at the lower and upper ponding areas, respectively. The 100-year frequency flood event shows 630,000 acres flooded under without-project conditions and 472,000 acres flooded with the recommended plan (Plate 4-10). Table 24 shows the 100-year frequency flood event reductions of 4.6 and 3.9 feet at the lower and upper ponding areas, respectively. Acres flooded by ponding area and flood frequency event for the recommended plan are also displayed in Table 13. The hydraulic impacts for the recommended plan were the same in the 2000 Draft Report as in the 2007 Final Report.

TABLE 24
RECOMMENDED PLAN STAGE-FREQUENCY REDUCTIONS
YAZOO BACKWATER AREA REFORMULATION

Frequency Years	Base Conditions Stages (ft)	Recommended Plan Stages (ft)	Stage Reductions (ft)
Lower Ponding Area (Reach 1)			
1	87.0	87.0	0.0
2	91.0	87.8	3.2
3	92.9	88.5	4.4
5	94.6	89.6	5.0
10	96.3	91.2	5.1
20	97.6	92.7	4.9
25	98.0	93.0	5.0
50	99.2	94.4	4.8
100	100.3	95.7	4.6
Upper Ponding Area (Reach 2)			
1	87.8	87.8	0.0
2	91.6	88.9	2.7
3	93.4	89.7	3.7
5	95.0	90.7	4.3
10	96.8	92.0	4.8
20	98.1	93.5	4.6
25	98.5	93.8	4.7
50	99.5	95.1	4.4
100	100.3	96.4	3.9

287. Currently, the gates of the Steele Bayou structure are operated to evacuate flows whenever landside and/or Mississippi River stages permit except during low-flow periods when the gates are operated to maintain elevations between 68.5 and 70.0 feet, NGVD, in adjacent water bodies. The operation modifications would maintain higher water elevations (70.0 to 73.0 feet, NGVD) in the adjacent water bodies during low-flow periods. The gates would still be operated so that when Mississippi River/Yazoo River stages are higher, the gates would be closed, preventing water from backing through the Steele Bayou structure. Once stages on the interior are forecasted to exceed elevation 87.0 feet, NGVD, pump station operation would be initiated. The Vicksburg District evaluated the impacts of higher water levels on DO during low-flow periods. Studies conducted by MSU indicated the increase in stages should not be a problem, but the Vicksburg District will monitor the DO following construction. This feature will be terminated if repeated problems occur due to higher stages.

288. From the routing results and rating curves, it is estimated that the maximum increase in peak stages with the 14,000-cfs pump, on the riverside of the pump station, would be approximately 0.25 foot for riverside conditions near the initial pump startup elevation of 87.0 feet, NGVD. At elevation 87.0 feet, NGVD, the water levels are below major damage levels for developed areas downstream of the pump station along the Yazoo and Mississippi Rivers. For example, for the start pump elevation of 87.0 feet, NGVD, on the riverside of the pump station and a comparable stage elevation of 40.77 feet, NGVD, on the Mississippi River at the Vicksburg gage (gage zero equals elevation 46.23 feet, NGVD), the flow is approximately 1.1 million cfs. The maximum discharge of 14,000 cfs from the pump station is approximately 1 percent of the total flow in the Mississippi River at the pump-start elevation of 87.0 feet, NGVD.

289. Table 25 provides the results of a hydraulic analysis of pump operation if the pump station had operated under the recommended plan between 1943 and 1997. Table 25 identifies yearly pump operation time periods, showing the pump-on and off elevations for each year's pumping period. The pump-on elevation is based on the Mississippi River stages and interior ponding stages. A close examination of the data shows that many years would require more than one period of pumping; however, several years would not require any pumping. The hydraulic analysis also indicates that several years with 1 or more days of water surface elevation measurements greater than 87.0 feet, NGVD, would have received no pumping at all. Over the 55-year historic record, the average yearly pumping period would have been 31 days. For all pump operation periods, Table 25 provides that pumping would have been initiated at elevations slightly above the recommended plan pump-on elevation of 87.0 feet, NGVD, at the Steele Bayou structure and that pumping would have ceased slightly above elevation 87.0 feet, NGVD, the pump-off elevation. The average pump-on elevation for the historic record was 87.5 feet, NGVD, with a maximum pump-on elevation of 90.7 feet, NGVD. The average pump-off elevation was 88.4 feet, NGVD, with a maximum pump-off elevation of 95.6 feet, NGVD, which occurred at the end of the 1973 flood. The pump station ceases operation when the downstream stages are lower than the upstream stages, whereby the Steele Bayou structure could be opened for discharge.

TABLE 25
RECOMMENDED PLAN YEARLY PUMPING DATA
YAZOO BACKWATER AREA REFORMULATION

YEAR	TOTAL DAYS PUMPED	CONTINUOUS FLOOD EVENTS PUMPED												DAYS ABOVE 87.0 FEET, NGVD, W/O PUMPING	YEAR
		PERIOD PUMPED	PUMP ON	PUMP OFF	PERIOD PUMPED	PUMP ON	PUMP OFF	PERIOD PUMPED	PUMP ON	PUMP OFF	PERIOD PUMPED	PUMP ON	PUMP OFF		
1943	21	4/3-4/14	87.3	87.5	6/15-6/23	87.1	87.1							1	1943
1944	43	3/30-4/6	87.3	89.4	4/21-5/24	90.7	91.8							21	1944
1945	87	3/7-5/13	87.3	91.4	5/29-6/5	88.8	87.4	6/29-7/9	87.1	87.3				18	1945
1946	26	1/18-2/1	87.7	90.3	2/22-3/4									4	1946
1947	23	4/22-5/14	87.3	87.3										1	1947
1948	59	3/1-3/19	87.4	89.1	3/30-5/8	87.6	87.5							4	1948
1949	76	1/23-3/23	87.3	87.3	4/2-4/17	87.7	88.1							4	1949
1950	72	1/17-3/17	87.4	90.4	4/12-4/23	87.5	87.3							13	1950
1951	55	3/7-3/30	87.1	87.4	4/8-5/8	87.4	87.4							2	1951
1952	51	2/14-2/26	87.2	87.4	4/2-5/9	87.2	87.4							4	1952
1953	0													0	1953
1954	0													0	1954
1955	15	3/28-4/11	87.5	89.2										6	1955
1956	0													4	1956
1957	8	4/28-5/5	87.3	87.4										1	1957
1958	12	5/13-5/24	87.9	89.4										7	1958
1959	0													0	1959
1960	0													0	1960
1961	51	3/17-4/13	87.5	89.1	5/16-6/7	87.2	87.3							15	1961
1962	50	3/16-5/4	87.2	87.4										1	1962
1963	10	4/5-4/14	87.1	87.2										1	1963
1964	12	3/27-4/7	87.3	87.3										2	1964
1965	6	4/27-5/2	87.1	87.2										1	1965
1966	0													0	1966
1967	0													0	1967
1968	10	4/10-4/19	87.3	87.9										2	1968
1969	19	2/14-2/26	87.3	87.4	5/1-5/6	87.3	87.3							2	1969
1970	21	5/4-5/24	87.4	87.4										1	1970
1971	13	3/8-3/20	87.2	87.5										2	1971
1972	16	5/9-5/15	87.2	87.4	12/23-12/31	87.3								2	1972
1973	116	1/1-1/17		88.7	2/2-2/26	87.5	87.7	3/20-6/1	87.8	95.6				31	1973
1974	66	1/10-2/21	87.3	91.3	3/31-4/4	87.2	87.3	6/10-6/27	87.5	88.7				22	1974
1975	87	2/12-2/22	87.3	87.6	3/2-4/25	87.5	89.3	5/5-5/25	87.4	87.8				8	1975
1976	0													0	1976
1977	0													0	1977
1978	0													0	1978
1979	70	3/14-5/22	87.2	90.3										7	1979
1980	29	3/29-4/26	87.7	91.0										9	1980
1981	0													0	1981
1982	19	4/11	87.2	87.2	12/14-12/31	87.3								2	1982
1983	78	1/1-1/14		90.6	4/18-6/16	87.2	89.8	12/14-12/17	87.6	87.9				10	1983
1984	65	4/7-6/10	87.2	87.2										1	1984
1985	18	3/22-4/2	87.1	87.3	4/13-4/18	87.2	87.2							7	1985
1986	0													0	1986
1987	5	3/13-3/17	87.3	87.5										2	1987
1988	1	1/8	87.3	87.3										2	1988
1989	28	3/3-3/24	87.3	87.3	4/16-4/21	87.2	87.2							2	1989
1990	56	2/12-3/9	87.4	88.7	3/24-4/2	87.6	87.5	5/30-6/17	87.2	87.3	12/31	87.3		7	1990
1991	44	1/1-2/1		88.9	2/27-2/28	88.2	88.6	3/5-3/7	89.8	90.2	4/16-4/22	87.4	89.2	48	1991
1992	0													0	1992
1993	53	4/8-5/30	87.3	90.5										6	1993
1994	101	2/12-5/23	87.4	87.4										1	1994
1995	27	6/4-6/30	87.1	87.0										1	1995
1996	26	6/3-6/28	87.1	87.1										1	1996
1997	37	3/9-4/14	87.4	88.9										4	1997
55 YRS	1682													290	55 YRS

AVERAGE # DAYS PUMPED PER YEAR= 31 DAYS
TOTAL # DAYS PUMPED = 1682 DAYS
TOTAL # CONTINUOUS PERIODS PUMPED = 68 PERIODS
AVERAGE PUMP ON ELEVATION = 87.5 feet NGVD
AVERAGE PUMP OFF ELEVATION = 88.4 feet NGVD
MINIMUM PUMP ON ELEVATION = 87.1 feet NGVD
MAXIMUM PUMP ON ELEVATION = 90.7 feet NGVD
MINIMUM PUMP OFF ELEVATION = 87.0 feet NGVD
MAXIMUM PUMP OFF ELEVATION = 95.6 feet NGVD

290. The data in Table 25 are useful to predict future impacts of pump operation to waterfowl. Based upon the hydraulic analysis, the pump station only operated during the waterfowl season in 15 of the 55 years period of record. The longest periods of pumping during the waterfowl season occurred during major flood events. Used as a predictor for future with-project impacts to waterfowl, the historic data in Table 25 show in most years the bulk of pump operation would occur during March and April which are not part of the waterfowl season. Should a 1-year frequency flood event occur during the waterfowl season, 216,000 acres will be flooded prior to pump operation. Plate 4-11 shows a map of the project area depicting those areas that would receive structure protection and those areas that would be allowed to continue to flood under the nonstructural feature of the recommended plan. The nonstructural area represents 216,000 acres that would be flooded prior to pump station operation. This includes the flooded greentree reservoirs, but not agricultural fields with water control structures that are managed for wintering waterfowl each year. Together, these flooded acres provide sufficient habitat for wintering waterfowl within the Yazoo Backwater Study Area.

291. For the Steele Bayou structure, the current minimum ponding area elevation during low-flow periods ranges between elevations 68.5 and 70 feet, NGVD. With the current operation plan, the structure was closed 3,475 out of 7,300 days (48 percent) from 1978 to 1997. Out of the 3,475 days the structure was closed, 71 percent of the time (2,452 days) was for environmental purposes (closed in the case of environmental purposes means the gates of the Steele Bayou structure were being manipulated to restrict outflows to maintain minimum depths in river channels). A revision to the current operational plan raises this minimum ponding elevation to between 70.0 and 73.0 feet, NGVD, was considered in the final array of alternatives. Under this revised operational plan, the structure would have been closed 5,017 out of 7,300 days (69 percent). Out of the 5,017 days the structure would have been closed, 80 percent of the time (3,994 days) would be for environmental purposes and 20 percent for flood damage reduction purposes (1,023 days). Out of the 1,023 days the structure would have been closed for flood damage reduction, 64 percent of the time (657 days), the pump station would have been pumping. This revised operational plan provided a net increase of 1,384 acres of waterfowl foraging habitat and 2,353 acres of aquatic rearing habitat, without implementation of the structural or nonstructural measures. Appendix 6 illustrates this relationship for the entire period-of-record hydrology.

Economic Impacts

292. Table 26 provides an economic comparison of Plan 5 as shown in the 2000 Draft Report and the 2007 Final Report. First costs increased in the Final Report from $181.6 million to $220.1 million. First costs are defined as those costs associated with construction, purchase of real estate (conservation easements), relocations, planning engineering and design, construction management, and contingencies. However, annual cost decreased primarily due to the fact that the interest rate decreased from 6-5/8 to 5-1/8. The interest rate utilized by Federal water

TABLE 26
COMPARISON OF ECONOMIC ANALYSIS FOR
RECOMMENDED PLANS
2000 DRAFT REPORT VS 2007 FINAL REPORT
YAZOO BACKWATER AREA REFORMULATION

Benefits ($000)	Plan 5 2000 Report (2000 Cost Data) (6-5/8 Percent)	Plan 5 2007 Report (2006 Cost Data) (5-1/8 Percent)
Structural		
Agricultural crop	11,639	6,534
Agricultural noncrop	2,241	2,328
Structures	2,256	2,154
Automobiles	0	298
Road and bridge	828	443
Urban streets	83	0
Emergency cost	158	104
FIA	30	147
Catfish	365	0
Total Structural	17,600	12,008
Nonstructural		
Agricultural crop	2,960	4,615
Agricultural noncrop	0	3,632
Timber values	936 a/	435
Hunting leases	- a/	638
Total Nonstructural	3,896	9,320
Employment		
Structural	376	1,007
Nonstructural	130	81
Total Employment	506	1,088
Total Annual Benefits ($000)		
Excluding employment	21,496	21,328
Including employment	22,002	22,416
First Cost	181,595	220,094
Structural	134,978	162,659
Nonstructural	46,617	57,435
Interest During Construction	17,305	11,545
Structural	12,863	10,687
Nonstructural	4,442	858
Gross Investment	198,900	231,639
Structural	147,841	173,346
Nonstructural	51,059	58,293
Annual Costs		
Structural		
Amortization	13,732	8,814
O&M project	812	1,056
O&M energy	183	557
O&M Mitigation		21
Pump replacement	154	393
Mitigation	0	865
Nonstructural		
Amortization	0	3,255
O&M project	0	90
Total Annual Costs	14,881	15,051

TABLE 26 (Cont)

Benefits ($000)	Plan 5 2000 Report (2000 Cost Data) (6-5/8 Percent)	Plan 5 2007 Report (2006 Cost Data) (5-1/8 Percent)
Excess Benefits		
Excluding employment	6,615	6,277
Including employment	7,121	7,365
Benefit-Cost Ratio (%)		
Excluding employment	1.4	1.4
Including employment	1.5	1.5

a/ Hunting leases and timber value categories were combined in 2000 Draft Report.

resource projects is determined in accordance with Section 80 of Public Law 93-251. The Vicksburg District obtains the rate from the U.S. Treasury Department which computes it as the average yield on interest-bearing marketable securities of the United States having 15 or more years to maturity and is effective as of 1 October of each year. Also according to the law, the rate may not be raised or lowered more than one quarter of one percentage point in any year. As expected, operation and maintenance (O&M) costs, along with pump replacement costs, increased. Annual benefits generally remained constant at $21.5 and $21.3 million in 2000 and 2007, respectively. Agricultural noncrop benefits increased for the nonstructural features because the 2000 Draft Report did not compute benefits for the nonstructural features. Noncrop damages accrue when fields, ditches, and farm equipment are damaged from flooding. Agricultural crop damage benefits increased from the Draft Report because the crop yields and crop production costs increased from 2000 to 2005. These crop yields and crop production costs were documented by MSU in the report that is included in Appendix 7, Attachment 7B. The benefit-cost ratio remained essentially unchanged at 1.4.

293. Table 26 also provides an increase in gross investment between the Draft and Final Reports. Gross investment increased from $198.9 to $231.6 million. Gross investment is defined as the total project first cost plus interest during construction. While not shown in Table 26, the fully funded cost estimate for the recommended plan is $251.9 million. This is shown in the cost estimate tables within Appendix 6 and represents the first cost of the project plus contingencies and escalation (inflation) over the life of the project (50 years).

294. For those acres on which perpetual easements were acquired under the nonstructural feature, it was assumed that no future flood damages would occur under the with-project analysis. Flood damage reduction benefits occurred on these perpetual easement lands because under existing conditions, these lands were in crop production and when flooding occurred during the growing season, damages occurred to the crops grown on these lands. Plate 4-12 depicts the land use for the base 100-year frequency. Under with-project conditions, the land use changed on these lands from agricultural crop to reforestation/ conservation features and thus, it was assumed no flood damage would occur in the future on these lands. Flood damage reduction benefits occurred on these lands due to the conversion from agricultural to reforestation/conservation features, not changes in hydrology associated with operation of the pump station. No other flood reduction benefits were calculated on these lands.

Environmental Impacts

295. The construction of the pump station will result in the loss of 38 acres of bottom-land hardwoods or 113 AAHUs of terrestrial habitat value and 5.6 acres of open water, which had no impact on terrestrial water-dependent species. The change in hydrology from the operation of the pump station will result in a gain of 239 AAHUs. The nonstructural features of the

recommended plan, the perpetual easements from willing sellers for reforestation/ conservation features on up to 55,600 acres of frequently flooded agricultural lands will result in a gain of 78,062 AAHUs. Therefore, there is a total gain of 78,188 AAHUs or 11.2 percent increase to the terrestrial resource with the project (see Appendix 13 for details).

296. The construction of the pump station will result in the loss of 38 acres of bottom-land hardwoods or 240 FCUs of wetland habitat values. In addition, 5.6 acres of open water will be impacted. However, these impacts have been accounted for and will be mitigated in the 519 acres for previous construction at pump station site (see Appendix 1). The change in hydrology from the operation of the pump station results in a loss of 14,188 FCUs. The nonstructural feature, the reforestation/conservation features on up to 55,600 acres of frequently flooded agricultural land, will result in an increase of 186,953 FCUs. Therefore, the recommended plan has a 19.5 percent or 172,525 FCU increase in wetland resources. (See Appendix 10 for details.)

297. The construction of the pump station will result in the loss of 38 acres of bottom-land hardwoods or a loss of 27 AAHUs of aquatic spawning habitat values and 5.6 acres of open water, which is not connected to the flood plain and therefore, has no aquatic spawning value. The change in hydrology due to the operation of the pump station resulted in a loss of 1,580 AAHUs. The reforestation/conservation features on up to 55,600 acres of frequently flooded agricultural lands will result in a gain of 7,457 AAHUs. Therefore, the recommended plan has a 30.3 percent or 5,850-AAHU increase in flood plain spawning habitat value. (See Appendix 11 for details.)

298. The construction of the pump station will result in a loss of 38 acres of bottom-land hardwoods or a loss of 30 AAHUs of aquatic rearing habitat values and 5.6 acres of open water, which is not connected to the flood plain and therefore, has no aquatic rearing value. The change in hydrology from the operation of the pump station resulted in a loss of 4,779 AAHUs on various habitats. The reforestation/conservation features on up to 55,600 acres of frequently flooded agricultural lands will result in a gain of 12,010 AAHUs. Therefore, the recommended plan has an 8.0 percent or 7,201-AAHU increase in flood plain rearing habitat value. (See Appendix 11 for details.)

299. Waterfowl foraging habitat losses are the result of loss of habitat and a reduction in flooding. The construction of the pump station will result in a loss on 38 acres of bottom-land hardwoods or a loss of 2,166 duck-use days (DUD) of waterfowl habitat values and 5.6 acres of open water, which has no foraging habitat value. The change in hydrology from the operation of the pump station results in a gain of 77,973 DUDs. The perpetual easements from willing sellers and reforestation of up to 55,600 acres of frequently flooded agricultural land results in a loss of 491,181 DUDs. However, by the installation of the water control structures, an additional

1,392,780 DUDs would be gained. The total impact of the recommended plan on waterfowl is a gain of 52.8 percent or 977,406 DUD in waterfowl habitat value (see Appendix 12 for more details).

300. Table 27 summarizes the structural and nonstructural impacts for the recommended plan.

301. The water quality of water bodies adjacent to the pump station site will be temporarily affected by increases in turbidity during construction. Impacts will be minimized by stormwater protection measures required by both the Vicksburg District and the State of Mississippi. When completed, the pump station will operate in a manner that will leave sufficient water depth and duration for sediments suspended in the water column to resettle naturally. Reforestation/ conservation measures on up to 55,600 acres of cleared agricultural land will improve water quality in two ways—removing these lands from agricultural production will reduce erosion and reduce concentrations of sediment, pesticides, and nutrients in stormwater runoff. Reforestation of frequently flooded land would also increase the removal of these materials from floodwaters as the newly planted forests mature (Appendix 16).

302. Table 28 provides a comparison of the environmental gains and losses from the Draft Report and the Final Report for the recommended plan. Changes in land use, the wetland methodology, and the inclusion of conservation features resulted in the most significant changes between the Draft and Final Reports. Based on 2005 land use, only 42,800 acres of agricultural lands are available in the 1-year flood plain. Changes in land use between 1988 to 2005 showed an increase in reforestation due to Federal programs. The difference between the 2000 Draft Report and the 2007 Final Report 1-year flood plain acreage is due to the conversion of agricultural lands to forest. Most of this land use change had occurred prior to 2000, but was not reflected in the 2000 Draft Report. The 2000 Draft Report utilized 1988 land uses. Therefore, instead of the nonstructural component being up to 62,500 acres, it is now up to 55,600 acres with the application of a 30 percent blocking factor for real estate acquisition. The reforestation of agricultural lands constitutes the nonstructural flood damage reduction component of this plan rather than a traditional structural approach. The wetland analysis was completely reworked, and the functional assessment now utilizes HGM. The HGM was developed by ERDC utilizing funds provided by EPA. Waterfowl impacts changed from a net loss to a net gain of foraging value by the installation of small water control structures which impound rainfall for waterfowl (conservation features) in conjunction with the reforestation easements. The waterfowl impoundments were not included in the 2000 waterfowl analysis. The Vicksburg District added this feature at the request of MDWFP. By allowing conservation features on up to 10 percent of the perpetual easement lands, the reforestation value for all resources categories was recalculated to reflect only 90 percent of the habitat value (Appendix 1). Aquatic impacts changed because of refinement to average flooded acres impacted and updated land use. While the difference in functional units seems large, the difference in acreage needed to restore those AAHUs (comparing 2000 and 2007) is less dramatic. The amount of reforestation necessary to

TABLE 27
STRUCTURAL AND NONSTRUCTURAL EFFECTS
RECOMMENDED PLAN
YAZOO BACKWATER AREA REFORMULATION

Effect	Terrestrial		Waterfowl		Wetlands		Aquatic Spawning		Aquatic Rearing	
	AAHUs	% Base a/	DUDs	% Base a/	FCUs	% Base a/	AAHUs	% Base a/	AAHUs	% Base a/
Baseline	699,529	-	1,849,741	-	885,296	-	19,337	-	89,414	-
Structural										
Construction	-113	0	-2,166	-0.1	-240	0	-27	-0.1	-30	0
Hydrologic	239	0	77,973	4.2	-14,188	-1.6	-1,580	-8.2	-4,779	-5.4
Total Structural	126	0	75,807	4.1	-14,428	-1.6	-1,607	-8.3	-4,809	-5.4
Nonstructural										
Reforestation	78,062	11.2	-491,181	-26.6	186,953	21.1	7,457	38.6	12,010	13.4
Foraging	N/A	N/A	1,392,780	75.3	N/A	N/A	N/A	N/A	N/A	N/A
Total Nonstructural	78,062	11.2	901,599	48.7	186,953	21.1	7,457	38.6	12,010	13.4
TOTAL	78,188	11.2	977,406	52.8	172,525	19.5	5,850	30.3	7,201	8.0

NOTE: + indicates a gain in environmental resources.
- indicates a loss in environmental resources.

a/ % Change where comparing total to baseline.

offset impacts to the resources was 12,980 and 10,662 acres for the Draft Report and Final Report, respectively (see below for discussion on mitigation). In order to facilitate review, this Final Report includes the Draft (2000) and final technical appendixes for terrestrial, wetlands, waterfowl, and aquatics. (See section "Mitigation" for more discussion.)

TABLE 28
ENVIRONMENTAL GAINS AND LOSSES
RECOMMENDED PLAN a/
DRAFT VERSUS FINAL REPORTS
YAZOO BACKWATER AREA REFORMULATION

Resource	2000 Draft Report	% Base g/	2007 Final Report	% Base g/
Terrestrial AAHUs b/	107,674	17.4	78,188	11.2
Wetland FCUs c/	51,520	23.5	172,525	19.5
Waterfowl DUDs d/	-873,432	-42.1	977,406	52.8
Aquatic Spawning AAHUs e/f/	37,428	18.7	5,850	30.3
Aquatic Rearing AAHUs e/	20,607	14.6	7,201	8.0

a/ Reforestation acres have changed from up to 62,500 in the 2000 Draft Report to up to 55,600 in the 2007 Final Report.
b/ Terrestrial impacts changed due to change in land use from 1988 to 2005.
c/ Wetlands impacts changed due to the adoption of the HGM methodology (at the request of the EPA), the change in land use, and 10 percent reduction in reforestation.
d/ Waterfowl impacts change due to a reduction in acreage to be reforested, the installation of conservation features on up to 10 percent of perpetual easement lands, 10 percent reduction in reforestation, and a change in land use.
e/ Aquatic spawning and rearing impacts changed due to the land use, the model by which average flooded acres were calculated and a 10 percent reduction in reforestation.
f/ Flood plain spawning habitat values had greater impacts over rearing habitat values and were utilized to determine the minimum threshold of reforestation (reference Appendix 1) required.
g/ Percent change from base conditions when compared to the recommended plan. The Draft Report was based on 1988 land use and certain environmental models. The Final Report was based on 2005 land use, and several environmental models were replaced/updated and inclusion of conservation features on up to 10 percent of the perpetual easements.

303. The FWS identified the endangered plant pondberry (*Lindera melissifolia*) and the threatened Louisiana black bear (*Ursus americanus luteolus*) as species that may occur in the study area. Pursuant to Section 7 of the Endangered Species Act, a final BA for these species was sent to FWS on 5 December 2005 (Appendix 14). The BA determined that the project was not likely to adversely affect either species. The FWS did not concur with the determination that the project was not likely to adversely affect the pondberry. The FWS also indicated that additional informal consultation was required prior to determining whether the project was likely to adversely affect the Louisiana black bear. Although the BA concluded that the project was

not likely to adversely affect pondberry, the Vicksburg District did request initiation of Section 7 formal consultation to ensure the project did not jeopardize the continued existence of pondberry. The FWS initiated Section 7 formal consultation for pondberry on 18 January 2006.

304. After additional informal consultation on the Louisiana black bear, FWS concurred with the Vicksburg District's determination that the project was not likely to adversely affect the Louisiana black bear (letter of 10 August 2006. Between January 2006 and the receipt of the BO from FWS on 2 July 2007, the Vicksburg District was involved in extensive coordination and data analysis with FWS in order to evaluate potential effects of the project to pondberry. The FWS concluded that the project was likely to adversely affect, but that the project would not jeopardize the continued existence of the endangered plant, pondberry.

305. To help conserve and recover the pondberry, the Vicksburg District has significant ongoing or planned activities designed to address data and recovery tasks contained in the FWS 1993 Pondberry Recovery Plan. In 2003, the Vicksburg District, FWS, and the USDA Forest Service entered into a 7-year, $5 million interagency agreement to conduct extensive research on pondberry's biological and ecological requirements. In addition, in 2007, the Vicksburg District and FWS signed a Memorandum of Agreement to establish two new pondberry populations in the project area and conduct additional field experiments evaluating the effects on flooding, stand thinning, competition, and pathogens on pondberry.

306. A preliminary assessment for hazardous, toxic, and radioactive waste (HTRW) was conducted at the pump station site. No indication of any HTRW contamination was found. HTRW evaluations will be conducted on up to 55,600 acres of perpetual easement land prior to purchase of an easement. Should a site be found, the appropriate remedial treatment will have to be undertaken by the landowner prior to purchase of the easement.

307. A literature and record search was conducted to ascertain whether any previously recorded or known prehistoric and historic cultural resources were located in or adjacent to the project study area. This search was also conducted to determine what types of cultural resources might be expected in the study area. The search recorded 595 archeological sites within the study area along with 93 National Register of Historic Places (NRHP) eligible properties and numerous NRHP listed properties. This included all of the seven counties/parishes involved in the study area--Humphreys, Issaquena, Sharkey, Warren, Washington, and Yazoo Counties in Mississippi and Madison Parish, Louisiana.

308. No prehistoric or historic cultural sites were located at the site of the pump station. If, however, NRHP eligible properties are identified in the project rights-of-way or area of potential effect, the effects of the project to the resources will be assessed, and efforts will be taken to avoid or mitigate appropriately for any adverse effects. A cultural resources survey will be conducted on those lands offered for perpetual easements. On those lands in which a perpetual easement is secured for the nonstructural feature, the easement will be purchased and prior to

reforestation and/or the installation of the conservation features, a cultural resource survey will be undertaken. Sites will be evaluated and documented. If a significant site is located in the vicinity of a conservation feature, the Vicksburg District will work with the landowner to relocate the conservation feature.

MITIGATION

309. Mitigation was required for Alternatives 2B and 3-6 (Appendix 1 provides information on methodologies and detailed analyses). Alternative 3 contained no nonstructural flood damage reduction feature to offset environmental losses. Alternative 2B is considered a nonstructural alternative although it includes ring levees, pumps, and structures and acquisition of lands below the 2-year flood plain. Compensatory mitigation, beyond that provided by the nonstructural feature, is required to achieve no net loss of environmental resources on Alternative 2B. The cost of the compensatory mitigation has been included in the first cost for Alternatives 2B and 3. The remaining Alternatives 4-7 include sufficient lands under the nonstructural flood damage reduction feature to more than offset any adverse effects from the pump station construction and operation. Alternatives 2A and 2C have no negative environmental impacts, only environmental gains due to reforestation. No pump station operation will occur before mitigation acreage is acquired. For the recommended plan, the Vicksburg District is committed to the fee title acquisition and reforestation of lands should insufficient perpetual easement lands become available to mitigate for the unavoidable losses from construction and operation of the pump station (i.e., the minimum threshold).

310. Table 29 provides the mitigation/minimum threshold requirement to offset impacts from construction and hydrologic changes associated with the ring levees under Alternative 2B. Table 29 also presents the impacts from the pump station construction and operation under Alternatives 3-7.

TABLE 29
COMPARISON OF NONSTRUCTURAL REFORESTATION
AND MITIGATION/MINIMUM THRESHOLD
FINAL ARRAY OF ALTERNATIVES
YAZOO BACKWATER AREA REFORMULATION

Alternative	Nonstructural Reforestation (acres)	Mitigation/Minimum Threshold (acres) a/
1	0	0
2	124,400	0
2A	81,400	0
2B	26,400	53,019
2C	114,400	0
3	0	53,363
4	37,200	27,230
5	55,600	10,662
6	81,400	66
7	124,400	0

a/ Number of acres to reforest to achieve a no-net loss of aquatic spawning resource values. Achieving this threshold would produce a net gain in the other resource categories.

311. In addition to any compensatory mitigation/minimum threshold outlined in this report due to construction and operation of the Yazoo Backwater project, the Vicksburg District agreed with the Mississippi field office of FWS to review mitigation required for the previously constructed Yazoo Area and Satartia Area Backwater Levee Projects. The Vicksburg District proceeded with the mitigation of this project by the acquisition and reforestation of the Lake George WMA. The FWS' position was that the Vicksburg District had failed to account for the difference between the time of construction and the time of the acquisition and for those areas within Lake George that could not be reforested. The Vicksburg District agreed to reevaluate and mitigate for these losses, if necessary, under the Yazoo Backwater reformulation study effort. Based on this reanalysis, an additional 3,848 acres of reforestation will be needed to offset the loss from the Yazoo Area and Satartia Area Backwater Levee Projects (Appendix 1).

312. Also included in this mitigation review is the environmental impact resulting from the construction of the inlet and outlet channel and the construction of the cofferdam at the pump station site. This work, completed in 1987, involved the clearing of 215.2 acres of bottom-land hardwoods. The compensatory mitigation required for this conversion is 519 acres, which does include the difference in the time of the loss and the time of acquisition of the easements and subsequent reforestation. The environmental impacts from the Yazoo Area and Satartia Area Backwater Levee Projects and previous construction at the pump station site will be offset by the purchase of perpetual easements from willing sellers as part of the recommended plan. Land acquired by perpetual easements from willing sellers or purchased in fee title provides the same environmental benefits. The first perpetual easements purchased will be used to offset the unmitigated impacts from the Yazoo Area and Satartia Area Backwater Levee Projects and the previous work at the pump station site. As additional easements are purchased, those will be used to offset impacts from construction of the pump station and finally to remove those remaining flood damages below elevation 87.0 feet, NGVD.

313. The perpetual easements from willing sellers attributable to the nonstructural feature for the various alternatives are:

Alternative 4 - 5,603 acres
Alternative 5 - 40,571 acres
Alternative 6 - 76,967 acres
Alternative 7 – 120,033 acres

These acres are calculated by deducting the mitigation requirements for the structural feature and the Yazoo Area and Satartia Area Backwater Levee Projects. For example, for the recommended plan:

Mitigation requirements for 14,000-cfs pump station at elevation 87 feet	10,603 acres
Mitigation requirements for impacts to 38 acres at pump station site	59 acres
Mitigation requirements for past work at the pump station site	519 acres
Mitigation requirements for past work on the Yazoo Area and Satartia Area Backwater Levee Projects	3,848 acres
Total Mitigation Required to achieve no-net loss of Environmental resources	15,029 acres
Perpetual easements from willing sellers attributable to nonstructural feature	40,571 acres
Perpetual easements from willing sellers	55,600 acres

314. Whereas in the Draft Report, offers for easement purchase would remain open for 1 year; in this Final Report, offers for easement purchase (up to the full 55,600 acres) will remain open for 10 years after completion of pump station construction. The Vicksburg District will therefore have the 4-year construction period plus 10 additional years to acquire these easements.

315. The 15,029 acres will be acquired before pump station operation. The guaranteed minimum reforestation of 15,029 acres will provide 100 percent compensation for all environmental impacts including (a) the current Yazoo Backwater Project, (b) past construction at the Yazoo Backwater pump site in 1986, and (c) the remaining mitigation owed for construction of the Yazoo Area and Satartia Area Backwater Levee Projects. This minimum guaranteed acreage will be acquired prior to pump operation. While the Vicksburg District is committed to acquiring up to the 55,600 acres, the recommended plan with this minimum reforestation does provide for an increase in environmental resources. The guaranteed minimum reforestation produces a no net loss of aquatic spawning habitat value and provides a 2.1 percent increase in terrestrial habitat value, a 1.4 percent increase in waterfowl habitat value, and a 2.4 percent increase in wetland habitat value.

316. In the event that the Vicksburg District is unable to secure enough perpetual conservation easements to achieve a no net loss of environmental resource value, prior to initial pump operation (15,029 acres), then the difference between the minimum threshold and the amount of perpetual easements already acquired from willing sellers will be purchased in fee title from willing sellers. The Vicksburg District will first seek suitable lands in the Yazoo Backwater Area, then the Yazoo-Mississippi Delta; however, if sufficient lands are unavailable, then the Vicksburg District will look to other areas in the Mississippi Alluvial Valley. Acquisition and reforestation/conservation features on frequently flooded agriculture lands for compensatory mitigation should not adversely affect any threatened or endangered species. Tracts acquired through fee title will have to be of sufficient size to allow for management or adjacent to state wildlife management areas or national wildlife refuges. Reforestation/ conservation features will occur after acquisition. Management of any compensatory mitigation will be turned over to other state or Federal agencies that do this type of management. Management funding will be a part of any compensatory mitigation acquisition. The offer to acquire the remaining perpetual easements for the nonstructural feature within the Yazoo Backwater Study Area will remain open for 10 years after the completion of pump station.

COMPARISON OF EPA AND USACE RECOMMENDED PLAN WETLAND ANALYSES

317. The Vicksburg District wetland analysis (calculations and assumptions) consistently overestimated the existing areal extent and project impacts to wetlands (e.g., all lands with a minimum 5 percent backwater flood duration were classified as wetlands). Appendix 10 documents the conservative assumptions and calculations used in the analysis. However, the extent of wetlands by the Vicksburg District estimates was 27,000 acres less than that of EPA's EMAP method. The Vicksburg District estimated the wetlands were 189,600 acres and EPA estimated there were 216,600 acres. The EPA estimated total wetlands in the study area, regardless of the source of hydrology. The Vicksburg District estimated only those wetlands in the study area that were inundated for 5 percent or more of the growing season by backwater flooding. While the Vicksburg District methodology captures some wetlands that are inundated from sources other than backwater flooding, it is designed to focus on the source of the hydrology. Thus the Vicksburg District methodology is not designed to estimate all of the wetlands, such as the areas of wetlands that could be sustained by the 51 inches of annual rainfall.

318. The Vicksburg District used the HGM approach to determine the functional value of impacted wetlands. This analysis is fully discussed in Appendix 10, and the offsetting mitigation for wetland impacts is discussed in the Appendix 1. As explained in Appendix 1, the mitigation to fully offset the wetland impacts for the recommended plan will require the reforestation of approximately 3,800 acres. In order to show how this would compare to the EPA wetland

acreage, the Vicksburg District used a 90 percent confidence range on its duration elevations and computed both the impacted acreage and functional values of the wetlands in the 90 percent confidence range. The results of the analysis are shown in Table 30 and represent only the hydrologic impacts from the operation of the pump station.

TABLE 30
WETLAND CONFIDENCE RANGE
RECOMMENDED PLAN a/
YAZOO BACKWATER AREA REFORMULATION

Item	Lower 90 Percent Confidence	Recommended Plan	Upper 90 Percent Confidence
Wetland Acres	150,000	189,600	229,000
Change in Acres (<5%) b/	12,900	26,300	44,600
Change in Acres (>5%) c/	39,900	40,700	50,600
No Change in Acres	97,100	122,600	133,800
Base FCUs (total)	759,500	885,300	1,144,600
Change in FCUs (<5%)	-6,600	-10,800	-24,500
Change in FCUs (>5%)	-4,700	-3,600	-5,400
Total Loss in FCUs	-11,300	-14,400	-29,900
Mitigation Acres	3,000	3,800	8,000

a/ Represents only the structural feature of Plan 5.
b/ Acres which were within the 5 percent duration, but are no longer within the 5 percent.
c/ Acres which remained above 5 percent duration, but changed duration.

319. The Vicksburg District's 90 percent confidence range (150,000 to 229,000 acres) encompasses EPA's EMAP estimate of 216,600 acres of wetlands. The tabulation provides that even if the Vicksburg District assumed that the upper limit of estimated wetland acres (229,000) was used to estimate impacts, the mitigation needed to offset such impacts would be 7,893 acres of reforested lands. As explained in Appendix 1, the aquatic spawning habitat, not the wetlands, was the controlling resource for determining mitigation, as offsetting the impacts to this resource required the largest single number of acres of reforestation (10,662). As a result, even if the Vicksburg District used the larger estimate of wetland impacts, the total 10,662 acres of mitigation provided by the project would offset those wetland impacts.

COMPARISON OF THE 1982 AND 2007 RECOMMENDED PLANS

320. The 2007 recommended plan is a reformulation of the July 1982 recommended plan. As described in this Report, the current recommended plan is a 14,000-cfs diesel pump station, with a year-round pump elevation of 87.0 feet, NGVD, at the Steele Bayou structure. The location is

the same in both recommended plans. The nonstructural flood damage reduction features include perpetual easements from willing sellers and reforestation/ conservation features on up to 55,600 acres of open land primarily at or below the pumping elevation. Also included is the modification of the operation of the Steele Bayou drainage structure to maintain water in adjacent water bodies between elevations 70.0 and 73.0 feet, NGVD, during low-water periods. The first cost of this plan is $220.1 million with an annual cost of $15.1 million and annual O&M cost of $2.1 million. This plan provides a 92 percent reduction in agricultural flood damages and 53 percent reduction of damages to urban and rural structures. The benefit-cost ratio for the recommended plan using the current interest rate of 5-1/8 percent is 1.4.

321. The previously recommended plan (July 1982 Final Report and Final EIS) consisted of a 17,500-cfs electric pump station, with pumping initiated at elevation 80.0 feet, NGVD, 1 March through 1 December, and at 85.0 feet, NGVD, from 1 December to 1 March. Mitigation for the project consisted of the purchase of 6,500 acres of woodlands in land use easements or 6,000 acres in fee title or some combination of easement and fee title. This mitigation would have offset the construction and operation impacts of the pump station. The first cost of this plan shown in the 1982 report was $150.0 million with an annual cost of $15.0 million and an O&M cost of $1.0 million. This plan had a 69 percent reduction in base flood damages. The benefit-cost ratio shown in the 1982 report using the then current interest rate of 7-5/8 percent was 1.4.

322. An alternative similar to the previously recommended plan (Alternative 28) (17,500 cfs) was evaluated in Array 3. Although it was economically feasible, it was screened out before the Fourth Array (2000 Draft Report) because benefits maximized with the 14,000-cfs pump station. Preliminary costs, based on 1998 cost levels and 1988 land use, showed the cost of that pump station to be $143 million with a mitigation cost of $34 million for a total cost of $177 million. The annual O&M for the pump station was estimated at $1.2 million and $334,000 for the mitigation lands.

323. Table 31 provides a comparison of the reduction in stages of the previously recommended plan (1982) versus the currently recommended plan (2007).

324. While the previously recommended plan fully compensated for environment impacts with compensatory mitigation, the use of the nonstructural flood damage reduction feature in the currently recommended plan achieves a net gain in all four environmental resource categories. While reforestation under the recommended plan initially resulted in a loss of waterfowl foraging value, the installation of water control structures up to 5 percent of the total conservation easement acres provides a net increase to waterfowl. Important waterfowl habitat requirements are met with both reforestation/ conservation features that are absent in agricultural fields. According to FWS, the overall benefit from reforestation far exceeds the loss of foraging habitat.

Under the currently recommended plan, the nonstructural flood damage reduction feature allows for the purchase of perpetual easements from willing sellers and reforestation/ conservation features on up to 55,600 acres primarily at or below the 87.0-foot, NGVD, pumping elevation.

TABLE 31
2007 YAZOO BACKWATER REPORT VERSUS
1982 YAZOO BACKWATER REPORT
RECOMMENDED PLANS
STAGE-FREQUENCY DEPARTURES
YAZOO BACKWATER AREA REFORMULATION

Frequency Years	2007 Report Recommended Plan 14,000-cfs Pump Station Elevation (ft)	1982 Report a/ Recommended Plan 17,500-cfs Pump Station Elevation (ft)	Difference (ft)
Lower Ponding Area			
1	87.0	81.3	5.7
2	87.8	82.7	5.1
3	88.5	84.9	3.6
5	89.6	86.5	3.1
10	91.2	88.7	2.5
20	92.7	90.3	2.4
25	93.0	90.8	2.2
50	94.4	92.5	1.9
100	95.7	94.0	1.7
Upper Ponding Area b/			
1	87.8	83.0	4.8
2	88.9	85.7	3.2
3	89.7	86.9	2.8
5	90.7	88.4	2.3
10	92.0	90.1	1.9
20	93.5	91.6	1.9
25	93.8	92.1	1.7
50	95.1	93.3	1.8
100	96.4	94.3	2.1

a/ Updated to 1943-1997 period of record (Alternative 28, Array 3).
b/ In the Final Report, the upper ponding area consisted of combining all three reaches.

325. In addition, Table 32 compares the cost of the previously authorized project (1982) to the recommended plan (2007) cost to the latest approved incremental project cost estimate (PB-3), effective 1 October 2006. The PB-3 is the project cost estimate prepared for the President's Budget Request, which is then submitted to Congress.

TABLE 32
COMPARISON OF PB-3 COST ESTIMATE OF PREVIOUSLY AUTHORIZED PLAN TO RECOMMENDED PLAN
YAZOO BACKWATER AREA REFORMULATION
OCTOBER 2006

Feature	Item	Previously Authorized Plan ($000)	Recommended Plan ($000)	Difference ± ($000)
1.01	Lands and damages	60,427	61,221	794
1.02	Relocations	1,690	3,538	1,848
1.06	Fish and wildlife facilities	10,937	9,663	-1,274
1.09	Channels and canals	5,424	5,004	-420
1.11	Levees and floodwalls	1,097	1,142	45
1.13	Pump station	96,976	107,566	10,590
1.19	Buildings, grounds, and utilities	1,256	1,720	464
1.20	Permanent operation equipment	749	1,367	618
1.31	Planning engineering and design	23,263	20,903	-2,360
1.31	Construction management	7,181	7,969	788
Total	Yazoo Backwater Pumps 14,000 cfs	209,000 a/	220,093 a/	11,093

a/ Does not include sunk cost for purchasing the land at the pump station site nor the construction at the site which was completed in 1987.

DESIGN AND CONSTRUCTION CONSIDERATION

326. If Plan 5 is the recommended plan by the ROD, then construction could be initiated as early as 2008 and could be physically complete by the year 2012. Design of the pump station will be based on the current technical guidelines and any additional engineering or surveys that may be necessary. Coordination of the design and construction of both pump station and utility relocations will be accomplished to reduce any further loss of bottom-land hardwoods, Federally-defined wetlands, and known significant cultural resources to the maximum extent practicable. The pump station construction area has been surveyed for impacts to environmental, endangered species, and cultural resources. The environmental impacts of the recommended plan will be fully offset by the proposed acquisition of perpetual easements and reforestation/ conservation features on up to 10,662 acres of land from willing sellers primarily at or below elevation 87.0 feet, NGVD, at the Steele Bayou structure. The pump station site was surveyed for significant cultural resources and HTRW sites and none were found.

327. Some design has already occurred due to advanced direction and funding from Congress. Site plans are shown on Plates 4-13 and 4-14. This has resulted in the development of plans to perform additional earthwork at the pump station site, construct a maintenance facility at the pump station site, and requisition the pumps and motors. These items of work may proceed, provided the ROD that is approved supports the recommended plan and additional funding is made available. The final design phase includes the pump station, which cannot be finalized until a pump manufacturer is selected due to the fact each pump manufacturer has different requirements for their respective pumps and motors. The relocation of the Highway 465 road and bridge/culverts will be accomplished by the Vicksburg District in cooperation with the Mississippi Department of Transportation.

328. The 14,000-cfs pump station is comprised of 12 pumps at 1,167 cfs each and 12 diesel motors with a pump-on/off elevation of 87.0 feet, NGVD. The diesel engines would require at a minimum 2,575 horsepower. In order to provide the proper margin of safety, the discharge pump station maximum elevation was set at 106.0 feet, NGVD. With a maximum design static head of 20 feet and a pipe discharge elevation of 106.0 feet, NGVD, the minimum pumping elevation is 86.0 feet, NGVD. This design allows for the pump station to operate efficiently and without damage to an elevation no lower than 86.0 feet, NGVD. Any operation below elevation 86.0 feet, NGVD, is outside the design requirements and could damage the diesel engines and/or pumps.

329. The remaining channel excavation on the inlet and outlet channel will be accomplished in the final construction contract after the Highway 465 bridge/culverts has been constructed. This work will be accomplished by dragline and excavated material will be hauled to the disposal sites. Any sedimentation that has occurred in the completed inlet and outlet channel work will also have to be removed by either dragline or dredge and moved to the disposal sites. Preloading of the construction site with borrow material will occur by off-road hauling equipment from a borrow area located within the existing pump station right-of-way. Structure excavation will be accomplished by dragline and placed in the disposal sites/borrow areas, located onsite. Suitable material from the above listed excavation will be used to backfill around the pump station, to build the connecting levee to the pump station, and may also be used to construct the Highway 465 approach to the relocated bridge/culverts.

330. Minor work around the Steele Bayou and Little Sunflower structures is anticipated. Relief wells will be installed to relieve the uplift pressure with the raising of the minimum water elevations from between 68.5 to 70.0 feet, NGVD, to elevations between 70.0 to 73.0 feet, NGVD. This work will be relatively minor and will be accomplished concurrently with work on the pump station.

331. Several criteria for the nonstructural flood damage reduction feature will have to be documented prior to the purchase of the perpetual easements and eventual reforestation/ conservation features. The Vicksburg District will prepare a Real Estate Design Memorandum by which the estimated values of the easement on those lands offered by willing sellers are approved by higher authority. An HTRW survey will be conducted prior to purchase of any easement. A cultural resources survey may or may not occur prior to purchase; however, a cultural resources survey will occur prior to reforestation/conservation features. Once all these criteria are satisfied, Real Estate Division will begin negotiations with the landowner as to the price to be paid for the perpetual easement. As a part of these negotiations, a conservation plan will be developed, whereby the landowner will delineate those areas where he desires conservation features in lieu of reforestation. When the easement is secured, lands will be evaluated to determine the most suitable species of trees for that particular site. A team comprised of the landowner, Vicksburg District, and state and Federal agencies will be assembled to evaluate the best restoration features for each site based on soil type, flooding regimes, and landowner management objectives. Seeds and/or seedlings will be ordered from nurseries and planted by the Vicksburg District generally in the late fall and winter. Water control structures will be sized, ordered, and delivered to the landowners for installation. It will be the responsibility of the landowner to secure any required permits. The Vicksburg District will monitor to ensure that any water control structure furnished to a landowner is installed. Tree survival will be monitored visually by the Vicksburg District to ensure success in the early years. After successful establishment, monitoring of both the reforestation and water control structures will be conducted by remote sensing techniques with occasional onsite inspections. Planting of the perpetual easement lands, and purchase of water control structures, will be accomplished as rapidly as funding, manpower, seedlings, and structures are available, but should be complete within 24 months of acquisition of the perpetual easements.

332. If Plan 5 is the recommended plan by the ROD, then the process of securing the perpetual easements could be initiated as early as 2008. Purchasing of the easements will be undertaken as quickly as the real estate process can be completed and as funds become available. The first easements purchased will be used to offset those remaining environmental losses from the construction of the Yazoo Area and Satartia Area Backwater Levee Projects and the previous work at the pump station site. Representatives from the Vicksburg District and the local FWS office agreed in 1998 that the mitigation plan for the Yazoo Area and Satartia Area Backwater Levee Projects did not account for the time differential of the environmental loss versus the mitigation acquisition. It also did not take into account those areas on the Lake George mitigation tract that were unable to be reforested. The Vicksburg District agreed to reanalyze the mitigation required for the Yazoo Area and Satartia Area Backwater Levee Projects under this study.

333. Under the recommended plan, the Vicksburg District has committed to the purchase of perpetual easements from willing sellers on up to 55,600 acres of agricultural lands in the study area.. As previously stated, the purchase of easements will begin as soon as the Record of Decision is signed and the real estate work is completed. Some funding has already been made available by Congress to start this phase concurrently with the construction work at the pump station site. The purchase of the perpetual easements will run concurrently with the design and construction of the pump station, and continue after the pump station is completed. Prior to operation of the pump station, the Vicksburg District will purchase all the easements necessary to fully offset the compensatory mitigation requirements for the Yazoo Area and Satartia Area Backwater Levee Projects, the previous work around the pump station site, the new work around the pump station site, and the hydrologic impacts from the pump station. The acreage required to offset these losses is 15,029 acres. In order to secure as many of the remaining 55,600 acres of perpetual easements, the Vicksburg District will continue to seek and purchase easements from willing sellers for 10 years after the completion of the pump station. Should the District be unsuccessful in securing enough perpetual easements to cover environmental losses from the pump station, the previous work at the pump station site, the remaining losses from the timing of the mitigation for the Yazoo Area and Satartia Area Backwater Levee Projects, and unforested areas within Lake George mitigation tract, then the difference between the amount of perpetual easements and the required compensatory mitigation will be purchased in fee title from willing sellers. This purchase in fee would first consider lands in the Yazoo Backwater Study Area, then in the Yazoo-Mississippi Delta. If sufficient agricultural lands are still not available, then the Vicksburg District would look elsewhere in the Mississippi Alluvial Valley. These fee lands would be reforested and eventually turned over to a state or Federal agency to manage.

OPERATION AND MAINTENANCE REQUIREMENTS

334. The Vicksburg District will be responsible for 100 percent of the O&M of the Yazoo Backwater Area Pump Station. The local sponsor will be responsible for the minor maintenance of the inlet and outlet channels. This consists of spraying or removal of woody growth from the channel. Some siltation in the inlet and outlet channels is anticipated and removal would be the responsibility of the Vicksburg District. During periods when the pumps are not in operation and river stages are at moderate levels (between elevations 80.0 and 87.0 feet, NGVD), some minor sedimentation is expected to occur in the approach to the inlet channel of the pump station and in the outlet channel near the confluence with the Yazoo River. While sedimentation is not expected to be of any major concern, the control of growth in the deposited areas will need to be pursued possibly on an annual basis. It is likely that removal of sediment accumulations (averaging about 1 foot in depth over the extent of the channels) may be necessary once or twice in the life of the project. Material deposited in the outlet channel of the Yazoo River may be returned to the Yazoo River without any significant impacts. Material deposited in the inlet channel will likely be placed in disposal areas/previously used borrow areas adjacent to the pump station.

335. The pumping cost for the recommended plan was based on an average of 31 days pumped per year, which would utilize approximately 286,000 gallons of diesel fuel. Based on July 2006 fuel quotes, fuel costs were estimated at $1.94 per gallon, which yields a fuel cost of approximately $557,000 annually. The pump station operation and maintenance cost was estimated at $1.1 million annually.

336. Structural maintenance of the pump station's major components is expected at year 35 into the 50-year economic project life. This maintenance cost is estimated to be $40.5 million. The net present value of this cost was $393,000 annually. The major replacement would involve the renovation or replacement of the diesel engines, axial flow pump, speed reducer, backstop device, and high and low speed couplings.

337. Once constructed, the pump station would be operated according to an operations manual. This operation manual would have to account for several factors. One factor is that the diesel-driven pumps cannot be instantaneously turned on nor simultaneously started. Not all the pumps will be utilized every time stages were predicted to exceed elevation 87.0 feet, NGVD. Other factors that will have to be addressed are the forecast of inflows due to Mississippi River conditions, interior conditions (stages and ground conditions) and forecasted flooded and weather conditions. Specific refinements to the pump station operation sequence will be developed as part of the water control plan for the project. The recommended plan pumping units and pump station layout are designed for a nominal pump-on elevation of 87.0 feet, NGVD. To provide for a margin of safety, the pump station is designed to operate efficiently and without damage down to elevation 86.0 feet, NGVD. Operating the pump station below elevation 86.0 feet, NGVD, is outside the design requirements for the pumping units and would damage the diesel engines and/or pumps. A more detailed description of the pump operation is provided in Appendix 6.

338. No Federal onsite O&M will be required on the 55,600 acres of perpetual easement lands. An annual cost of $2 per acre per year for monitoring the land use on the 55,600 acres using remote-sensing methods is included in the project O&M costs. The landowner will be responsible for maintaining the property consistent with conservation purposes as outlined in the easement. As stated earlier, these lands are presently open; and once an easement is secured, a team will determine the best practice for that tract and then the reforestation/conservation features will be initiated. The Vicksburg District will visually monitor these tracts after the initial reforestation/conservation features are installed, but once reforestation is determined to be successful and the water control structures are installed, only occasional visual on-the-ground monitoring will be conducted. The District will primarily use remote-sensing techniques to monitor the land use of these tracts. Should this monitoring indicate a violation in the terms of

the easement, the Vicksburg District can take the necessary action to regain voluntary compliance with the terms of the agreement or use legal actions, if necessary. However, if the Vicksburg District is unsuccessful in securing enough perpetual easements to cover the environmental losses from the pump station, the construction of the Yazoo Area and Satartia Area Backwater Levee Projects, the unforested areas on the Lake George mitigation tract, and the prior work, then the Vicksburg District will purchase in fee title those lands above what has been offered for easements. The O&M costs for the management of these compensatory mitigation lands will be funded by the Vicksburg District. The annual costs will be based on how many acres had to be purchased in fee. The O&M will be prorated based on the acres purchased times the O&M costs shown in Appendix 1.

SUMMARY OF ECONOMIC, ENVIRONMENTAL AND OTHER SOCIAL EFFECTS

339. Table 33 provides the total first costs, annual costs, annual benefits, excess benefits, and benefit-cost ratio for the recommended plan under both the current interest rate (2007) and the authorized rate. The FY 06 discount (interest) rate was 5-1/8 which was when the analysis was conducted and coincides with the October 2006 price levels utilized. The Federal discount rate utilized in project evaluation of Civil Works projects is set each fiscal year and published in an Economic Guidance Memorandum (EGM) by HQUSACE, Director of Civil Works, using interest rates from the U.S. Treasury Department. This is in accordance with Principles and Guidelines (Section 1.4.11) and Section 80 of Public Law 23-251. The 2-1/2 percent was the discount rate at the time the project was authorized (1941).

TABLE 33
ECONOMIC SUMMARY
RECOMMENDED PLAN
YAZOO BACKWATER AREA REFORMULATION

Item	Plan 5 a/	
	5-1/8 Percent (current)	2-1/2 Percent (authorized)
First Costs ($000) b/	220,094	220,094
Annual Costs ($000) b/c/	15,051	5,526
Annual Benefits ($000) c/		
All benefit categories	22,466	22,495
Benefits with redevelopment benefits excluded	21,328	21,837
Excess Benefits Over Costs ($000)		
All Benefit Categories	7,365	12,423
Benefits with redevelopment benefits excluded	6,277	11,765
Benefit-Cost Ratios		
All benefit categories	1.5	2.2
Benefits with redevelopment benefits excluded	1.4	2.2

a/ Recommended plan.
b/ October 2006 price levels.
c/ Annualized with use of appropriate discount rate factors and a 50-year expected project economic life.

340. Table 34 describes the environmental impacts for construction of the recommended plan.

341. Table 35 provides the System of Accounts. These four accounts provide a reasonable summary of the significant effects of the project as described in NEPA documents and Section 122 of the FCA of 1970. The NED account provides effects on the national economy. The EQ account provides the impacts to ecological, cultural, and esthetic attributes of significant natural and cultural resources that cannot be featured in monetary terms. The RED account provides the regional incidence of NED effects, income transfers, and employment effects. The OSE account presents the urban and community impacts and effects on life, health, and safety.

342. Other social effects are summarized in the following paragraphs.

a. Community cohesion and community growth will be strengthened from construction of the recommended plan due to the alleviation/reduction of flood damages and threat of flooding. No adverse impacts to community cohesion are anticipated.

b. Some of the EJ issues that affect the area could be improved by construction of the project. Based on the results of the EJ analysis (Appendix 8, Attachment 8A), not building or completing the proposed project would pose an adverse impact on the minority and low-income population in the Yazoo Backwater Study Area, whose numbers are high (68.8 percent minority population in 2000 and 31.3 percent poverty levels in 2003) in comparison to the State of Mississippi for the same years (38.6 percent and 17.9 percent, respectively). Flooding that would continue at current frequencies and duration has a "disproportionate" effect on the entire impacted area, but especially on minorities and low-income persons located in this region. This segment of the population is the most adversely impacted group in the flood-prone area because they do not have the resources to recoup their losses. Physical and financial losses from flood damages to their homes, businesses, automobiles, contents to their homes, and other personal property are multiplied by the additional burdens compounded by economic opportunity losses resulting from flood events. Fewer opportunities would exist for employment because businesses are reluctant to locate facilities in flood-prone areas. Flood damage reduction from implementation of the project in this segment of the Mississippi Delta would contribute to the overall health, safety, and welfare of the citizens by allowing them to continue their lives without interference or hazard from floodwaters; preventing flood losses to their homes, businesses, and personal property; and potentially stimulating economic activity in the region resulting from

TABLE 34
SUMMARY OF ENVIRONMENTAL IMPACTS FOR RECOMMENDED PLAN a/
YAZOO BACKWATER AREA REFORMULATION

Plan	Terrestrial Resources b/	Aquatic Resources b/	Wetland Resources c/	Waterfowl Habitat d/	Water Quality	Endangered Species
Completed Yazoo Area and Satartia Area Backwater Levee Projects	Remaining loss of 228,054 AAHUs e/; requires 3,848 acres of reforestation to offset.	No impacts remaining.	No impacts remaining.	No impacts remaining.	Past levee construction caused short-term increases in turbidity.	Work completed. No impact assessment.
Completed Pump Site	Loss of 22,653 AAHUs a/; requires 382 acres of reforestation to offset.	No impacts remaining.	Loss of 1,362 FCUs requires 519 acres of reforestation to offset.	No impacts remaining.	Channel excavation caused short-term increases in turbidity.	Work completed. No impact assessment.
Plan 5	11.2 percent increase in terrestrial habitat value or a net gain of 78,188 AAHUs. 5.6 acres of open water converted which has no impact on terrestrial water-dependent species. Hydrologic gain of 239 AAHUs. Reforestation of up to 55,600 acres of bottom-land hardwoods or a gain of 78,062 AAHUs. Construction of inlet channel results in a gain of 30.8 acres of open water.	30.3 percent increase in flood plain spawning habitat values or a net gain of 5,850 AAHUs. 38 acres of bottom-land hardwoods converted or a loss of 27 AAHUs and 5.6 acres of open water converted which is not connected to flood plain and therefore, has no aquatic spawning value. Hydrologic loss of 1,580 AAHUs. Reforestation of up to 55,600 acres of bottom-land hardwoods or gain of 7,457 AAHUs. 8.0 percent increase in flood plain rearing habitat values or	19.5 percent increase of wetland functional value or a net gain of 172,525 FCUs. 38 acres of bottom-land hardwoods or a loss of 240 FCUs and 5.6 acres of open water converted with the functional impacts mitigated in the 10,662 acres. Hydrologic loss of 14,188 FCUs. Reforestation of up to 55,600 acres of bottom-land hardwoods or gain of 186,953 FCUs. Construction of inlet channel results in a gain of 30.8 acres of open water.	52.8 percent increase of waterfowl foraging habitat value or a net gain of 977,406 DUDs. 38 acres of bottom-land hardwoods converted or a loss of 2,166 DUDs and 5.6 acres of open water converted which has no waterfowl foraging value. Hydrologic gain of 77,973 DUDs; reforestation of up to 55,600 acres of bottom-land hardwoods or loss of 491,181 DUDs. 2,780 acres of waterfowl foraging areas or gain of 1,392,780 DUDs. Construction of inlet channel results in a gain of 30.8 acres of open water.	Construction of structural features will cause a short-term increase in turbidity; reforestation of up to 55,600 acres of agricultural land will improve water quality over time. In addition, pump site construction results in a loss of 5.6 acres of open water, but construction of inlet channel results in a gain of 30.8 acres of open water.	An on-ground survey and biological assessment for *Lindera melissifolia* and *Ursus americanus luteolus* were completed. No colonies of pondberry were found at the pump station site and no signs of Louisiana black bear were found. FWS concurred that the project is not likely to adversely affect the Louisiana black bear. FWS did not concur with the "not likely to adversely affect" pondberry determination. The FWS Biological Opinion concluded the project was not likely to jeopardize the continued existence of pondberry. Reforestation of up to 55,600 acres will provide additional habitat.

TABLE 34 (Cont)

Plan	Terrestrial Resources b/	Aquatic Resources b/	Wetland Resources c/	Waterfowl Habitat d/	Water Quality	Endangered Species
Plan 5 (Cont)		a net gain of 7,201 AAHUs. 38 acres of bottom-land hardwoods converted or a loss of 30 AAHUs. 5.6 acres of open water converted which is not connected to flood plain and therefore, has no aquatic rearing value. Hydrologic loss of 4,779 AAHUs. Reforestation of up to 55,600 acres of bottom-land hardwoods or a gain of 12,010 AAHUs. Construction of inlet channel results in a gain of 30.8 acres of open water.				

a/ Terrestrial, aquatic, wetland, and waterfowl impacts include losses from the completed and reformulated portions of the Yazoo Backwater Study Area. Water quality, and endangered species apply only to the reformulated portion of the Yazoo Backwater Study Area.
b/ AAHU = average annual habitat units.
c/ FCU = functional capacity units.
d/ DUD = duck-use-days.
e/ Utilized on older HEP model which valued the resource between 0 to 100 and measured different categories from the methodology currently being used.

TABLE 35
PROJECT ECONOMIC, ENVIRONMENTAL, SOCIAL, AND OTHER IMPACTS DISPLAY
BY SYSTEMS OF ACCOUNTS (NED, EQ, RED, OSE)
RECOMMENDED PLAN (PLAN 5)
YAZOO BACKWATER AREA REFORMULATION
(5-1/8 Percent Discount Rate)

Account/Parameter	Location of Impact	Type Impacts		Total (Net National Impact)
		Beneficial	Adverse	
1. NATIONAL ECONOMIC DEVELOPMENT (NED)				
a. Annual Benefits ($000):				
Flood Control 6/9/12/ 13/	Study Area	21,328	0	21,328
Employment 3/9/12/	Rest of Nation	1,088	0	1,088
Total NED Benefits		22,416		22,416
b. Annual Costs ($000):				
Project Construction 3/6/9/12/				
Federal	Rest of Nation	0	12,934	12,934
Operation Rehabilitation 3/5/9/12/				
Federal	Rest of Nation	0	2,117	2,117
Total NED Costs			15,051	15,051
c. Net NED Benefits/Costs ($000):		7,365	0	7,365 1/
d. Benefit-Cost Ratio		1.5	--	1.5
2. ENVIRONMENTAL QUALITY (EQ)				
a. Environmental Quality Enhanced/Preserved/ Protected:				
* Natural resources 3/9/12/	Study Area	Conversion of up to 55,600 acres of agricultural cropland in the Yazoo Backwater area hardwoods or conservation measures.	None.	11.2, 30.3, 8.0, 19.5, and 52.8 percent increases in terrestrial, aquatic spawning, aquatic rearing, wetland, and waterfowl functions, respectively.
b. Environmental Quality Degraded:				
(1)* Air 3/6/9/12/13/	Project Area	--	Project construction will add to residues in atmosphere from open-air burning, dust, and from operation of internal combustion engines.	Short-term degradation of air quality in the area. Long-term improvement due to reduced farming operations on 55,600 acres.
	Study Area	--	Insignificant	No Significant impact.
(2)* Water/water quality 3/6/9/12/	Project Area/ Study Area (Flood Plain)	Long-term water quality benefits by conversion of agricultural lands to forest will reduce nonpoint source pollution. The Vicksburg District will obtain a state stormwater permit and will employ BMPs to prevent erosion during and immediately after construction; pump site construction will result in a gain of 30.8 acres of open water.	Adverse impact on water quality and aquatic habitat (ecosystem) in streams from project construction. Increased turbidity during construction will be temporary; pump site construction will result in a loss of 5.6 acres of open water.	Short-term adverse impact on water quality and aquatic habitat in area streams. Long-term water quality benefits.

TABLE 35 (Cont)

Account/Parameter	Location of Impact	Type Impacts		Total (Net National Impact)
		Beneficial	Adverse	
c. Environmental Quality Destroyed: (1)* Natural resources 3/9/12/	Study Area	--	Clearing of 38 acres of bottom-land hardwoods. 5.6 acres of open water.	Negligible.
(2)* Manmade resources 3/9/12/	Project Area	--	--	--
3. REGIONAL ECONOMIC DEVELOPMENT (RED) a. Income: (1) Summary, annual benefits ($000) Flood control 6/9/13/	Project Area	21,328	0	21,328
Employment 6/9/13/	Study Area	1,088	0	1,088
Regional Economic Development Indirect personal income increases with project construction ($000) 6/9/10/13/	Study Area	0	0	0
Total Benefits		22,416	0	22,416
(2) Excess Benefits Over Cost ($000)		7,365	0	7,365
(3) Benefit-Cost Ratio		1.5	0	1.5
b. Employment/Labor Force: * (1) Project construction 3/9/11/12/	Project Area	Approximately 12 percent of the first costs to construct the pump station will be for labor.	--	Negligible.
	Study Area	Negligible, temporary.	--	Negligible.
(2) Project operation and maintenance 6/9/12/	Project Area	Negligible.	--	Negligible.
(3) Indirectly induced jobs 3/8/12/	Study Area	Negligible.	--	Negligible.
(4) Other regional employment impacts 3/6/8/13/		Insignificant.	--	Insignificant.

TABLE 35 (Cont)

Account/Parameter	Location of Impact	Type Impacts		Total (Net National Impact)
		Beneficial	Adverse	
c. Business and Industrial Activity: 5/8/12/	Project Area	Temporary increase in activity.	--	Activity will increase temporarily.
	Study Area	Temporary stimulation of existing business and industrial activity by income increases, employment opportunities, multiplier, impacts, etc.	--	Temporary stimulation of existing business and industrial activity. Net beneficial effect.
d. Tax Revenues: * 5/7/12/	Study Area	Minor decrease in tax revenues expected, resulting from conversion of cropland to woodland. Unless counties adopt Senate Bill 2158 of 2000, MS legislature which allows for continued execution of woodland at cropland rates.	--	Minor decrease in tax revenues expected. Unless counties adopt Senate Bill 2158 of 2000, MS legislature which allows for continued execution of woodland at cropland rates.
e. Property Values ($000): 6/9/11/12/	Project Area	Protected area land value will increase, particularly lands subject to being converted to nonagricultural use (residential, commercial, etc.).	--	Increase in value of flood-free lands.
f. Desirable Regional Growth: 5/9/12/	Project Area	Consistent with local and regional development plans	--	Compatible with local and regional planning.
	Study Area	--	--	--
	Rest of Nation	Insignificant.	--	Insignificant.
g. Local Government Finance: 5/9/12/	Study Area	--	--	--
h. Public Facilities: * 5/8/12/	Study Area	--	Negligible impact.	Negligible impact.
i. Public Services: * 5/8/12/	Study Area	--	Negligible impact.	Negligible impact.
j. Displacement of Farms/Ownerships: * 3/9/12/	Study Area	--	Ownerships are not expected to change. The nonstructural feature will reduce total lands in crop production. 5/8/13/	Negligible.
k. Tax Rates: 6/8/12/	Project Area	--	--	--
	Study Area	--	Negligible impact if SB 2158 adopted by counties.	--

TABLE 35 (Cont)

Account/Parameter	Location of Impact	Type Impacts		Total (Net National Impact)
		Beneficial	Adverse	
4. OTHER SOCIAL EFFECTS (OSE) a. Community Cohesion: * 5/8/12/	Project Area	Strengthened due to reduced flood threat and reduced flood damages.	--	Should improve standard of living.
	Study Area	Strengthened due to reduced flood threat and reduced flood damages.	--	Should improve standard of living.
b. (Desirable) Community Growth: * 5/8/12/	Study Area	Temporary favorable impacts expected with project construction.	--	Insignificant.
c. Population Growth: 3/9/12/	Study Area	Insignificant.	--	Insignificant.
d. Noise: * 6/9/12/	Study Area	--	Increased noise levels during project construction. Negligible impact, most of construction not adjacent to populated area.	Increase in noise levels expected. Impact negligible.
e. Displacement of People: *	Study Area	No families would be displaced.	--	No displacement of families.
f. Esthetic Values: * 3/6/9/12/	Project Area	--	--	--
	Study Area	--	Negligible.	Negligible.
g. Community Growth: 5/8/12/	Study Area	Project construction not expected to result in any real population increase. Some minor temporary increase during construction activity only.	--	Insignificant.

NOTE: Costs shown reflect October 2006 levels.
1/ Excludes redevelopment benefits.
2/ Excludes redevelopment benefits.

Timing:
3/ Impact is expected to occur prior to or during implementation of the plan.
4/ Impact is expected with 15 years following plan implementation.
5/ Impact is expected in a longer timeframe 15 or more years following implementation).
6/ Impact is expected over project life.

Uncertainty:
7/ The uncertainty associated with the impact is 50 percent or more.
8/ The uncertainty is between 10 and 50 percent.
9/ The uncertainty is less than 10 percent.

Exclusivity:
10/ Overlapping entry; fully monetized in NED account.
11/ Overlapping entry; not fully monetized in NED account.

Actuality:
12/ Impact will occur with implementation.
13/ Impact will occur when specific additional actions are carried out during implementation.
14/ Impact will occur because necessary additional actions are lacking.

spin-off effects of jobs created by construction of the project. Also, no disproportionate adverse effects on the minority or low-income population were identified to result from implementation of the project.

c. Implementation of the recommended plan is not expected to have any significant impact on study area population trends.

d. Noise created by project construction will be a temporary nuisance with the project area absorbing the impacts of these noises. In addition, adverse impacts from noise will be minimal since the pump station site is not adjacent to a populated area.

e. Air pollution will be adversely impacted in the short term at the construction site due to emissions from internal combustion engines (ICE) and the increase in dust due to vehicular traffic. The Vicksburg District will require as part of the contract that the contractor control the fugitive dust. Although both DDT and toxaphene are on the hazardous air pollutant (HAP) list, they should not be a concern during construction because they were never directly applied at the construction site. The pump station site never received direct applications of these pesticides. Depositional concentrations that may have accumulated over the years are surficial and have not been incorporated at any depth into the upper layers of soil. Features utilized to control dust will also control these compounds. The borrow/disposal areas will be used to contain any sediment removed during maintenance dredging of the inlet channel to the pump station. Once the disposal area becomes unwatered, it will be seeded to control dust emissions. The emissions from the ICE should not be a problem due to the rural nature of the area. Long-term impacts from the 12 diesel pump engines should not be a problem also due to the rural nature of the area, the time of the year when the majority of the pumping would occur, and the fact that the pumps would only operate 31 days per year on average. The Vicksburg District will require that the diesel engines meet or exceed the latest EPA standards for emissions. The nonstructural features will improve the air quality in the area due to the removal of up to 55,600 acres of agricultural land from production. Farmers will no longer be tilling the soil creating dust nor will the tractors and other mobile equipment used in farming be operating to generate emissions from their engines.

f. Water quality in the Yazoo Backwater Study Area should improve with implementation of the recommended plan. Concentrations of suspended sediment and agricultural pollutants should gradually reduce as agricultural lands become reforested and erosion runoff is reduced. During construction and maintenance operations, the Vicksburg District will comply with Mississippi construction and water quality regulations. All construction activities at the pump station site will conform to the MDEQ Stormwater Construction General Permit. Short-term, localized increases in turbidity in waters at the construction site will be minimized through implementation of best management practices that

will be outlined in the Stormwater Pollution Prevention Plan (SWPPP). Sediment removal from the inlet and outlet channels during periodic maintenance could also cause short-term, localized increases in turbidity. While these increases in turbidity would be unavoidable, dredging operations will comply with the MDEQ mixing zone requirements for turbidity.

g. Project construction will permanently convert approximately 5.6 acres of open water at the construction site to other uses. This includes up to 0.9 acre of Cypress Lake, located adjacent to Highway 465. The remaining 4.7 acres of open water are located within the previously constructed cofferdam and adjacent to Highway 465. These shallow ponds are seasonal and are sustained by precipitation. The project will also convert approximately 38 acres of bottom-land hardwood wetlands to other uses. Once completed, the inlet channel will provide 30.8 acres of permanent open water behind the pump station. The outlet channel will provide up to 19.2 acres of open water that fluctuates with the water levels in the Yazoo River. Mitigation for the conversion of the 5.6 acres of open water is accounted for in the 519 acres for previous construction work at the pump station site.

h. Conversion of agricultural cropland to bottom-land hardwoods for the nonstructural features of the recommended plan will provide beneficial impacts to the esthetic value of the area. Land disturbance during project construction will be remedied as construction is completed and vegetation recovers. Reduction in bottom-land hardwoods and wetlands due to project construction will create adverse impacts to esthetic values on the actual construction site. However, the establishment of a perpetual easements from willing sellers with subsequent reforestation/conservation features on up to 55,600 acres of agricultural lands will greatly enhance the esthetic value of the area.

343. Table 36 summarizes the Principles and Guidelines evaluation criteria on which the final array of alternatives were evaluated.

PLAN ACCOMPLISHMENTS

344. The recommended plan has been formulated to meet the OMB's study directives (1991). These directives were (a) reduce flood damage to rural and urban structures, (b) reduce levels of agricultural intensification, and (c) minimize adverse environmental impacts through design. The recommended plan meets these directives using a combination of structural and nonstructural features. The nonstructural feature (perpetual easements and reforestation/ conservation on up to 55,600 acres) reduces the amount of lands in agricultural production and thus permanently removes flood damages to crops previously grown on these lands. The recommended plan reduces urban and rural structure damage by 53 percent. Agricultural damages are reduced 92 percent. The recommended plan results in approximately $2.3 million of annual residual damages to residential and nonresidential structures. Through incorporation of a revised operation plan at Steele Bayou structure and the nonstructural flood damage reduction feature, a net gain to environmental resources would occur.

TABLE 36
PRINCIPLES AND GUIDELINES EVALUATION CRITERIA
FINAL ARRAY OF ALTERNATIVES
YAZOO BACKWATER AREA, REFORMULATION

Plans	Acceptability		Completeness	Effectiveness					Efficiency	
	Implementability	Satisfaction		Problems	Opportunities	Planning Objectives	Risk and Uncertainty		Crop Losses	Structural Losses
							Structural	Nonstructural		
1	Not feasible - P, I, S	NS	No change	No	No	No	None	None	No	No
2	Not feasible-Eco, I and S	NS	Nonstructural easements	No	Yes	No	N/A	Yes	Yes	No
2A	Not feasible-Eco, I and S	NS	Nonstructural easements, floodproofing all structures in 100-year flood plain	No	Yes	Yes	N/A	Yes	Yes	Yes
2B	Not feasible-Eco, I and S	S	Nonstructural easements; ring levees	Yes	No	Yes	Yes	Yes	Yes	Yes
2C	Not feasible, I and S	NS	Nonstructural easements, relocation of all structures in 100-year flood plain	No	Yes	Yes	N/A	Yes	Yes	Yes
3	Feasible-Eco, I and S	S	Complete; no net loss of environmental resources is guaranteed prior to pump station operation by mitigation	Yes	No	No	No	N/A	Yes	Yes
4	Feasible-Eco, I and S	S	Nonstructural easements; however, no net loss of environmental resources is guaranteed prior to pump station operation	Yes	Yes	Yes	No	Yes	Yes	Yes
5	Feasible-Eco, I and S	S	Nonstructural easements; however, no net loss of environmental resources is guaranteed prior to pump station operation	Yes	Yes	Yes	No	Yes	Yes	Yes
6	Feasible-Eco, I and S	S	Nonstructural easements; however, no net loss of environmental resources is guaranteed prior to pump station operation	Yes	Yes	Yes	No	Yes	Yes	Yes
7	Not feasible-Eco	S	Nonstructural easements; however, no net loss of environmental resources is guaranteed prior to pump station operation	Yes	Yes	Yes	No	Yes	Yes	Yes

TABLE 36 (Cont)

1 **Acceptability** is the workability and viability of a plan with respect to acceptance by Federal and non-Federal entities and the public and compatibility with existing laws, regulations, and public policies.

2 **Implementability** means that the alternative is feasible from technical (T), environmental (Env), economic (Eco), financial (F), political (P), legal (L), institutional (I), and social perspectives (S).

3 **Satisfaction** means satisfaction that a particular plan brings to Government entities and the public. Satisfaction does not mean that everyone supports the project.

4 **Completeness** is the extent to which a given plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. (Factors beyond control of planning team.)

5 **Effectiveness** is the extent to which a plan alleviates problems and achieves specific opportunities. It also contributes to the attainment of planning objectives. Another factor that can impact the effectiveness of a plan is whether there is substantial risk and uncertainty. All plans which have a nonstructural easement from willing sellers have some risk and uncertainty.

6 **Efficiency** is the extent to which a plan is the most cost-effective means of alleviating the specific problems and realizing the specific opportunities. In the case of the Yazoo Backwater project, if the plan reduces damages by 50 percent, then it was effective.

345. The nonstructural flood damage reduction feature will be initiated concurrently with project construction. The nonstructural feature will provide benefits to the national economy as the forest matures, landowners will be able to harvest the timber consistent with an approved forest management plan. This feature supports the Administration's Clean Water Action Plan by the restoration of wetlands through reforestation/conservation features on agricultural lands. It also supports efforts to restore habitat in order to help the recovery of the two threatened/ endangered species in the area. The plan provides an acceptable level of flood protection with a net gain to the environment and will allow residents of the area to pursue an orderly process of economic development and to improve their quality of life. The plan represents a rare opportunity to obtain significant bottom-land hardwood/wetland restoration, thus helping to achieve the management/ecosystem goals that have been established for this important area by resource agencies. It also fulfills the mitigation requirements for the Yazoo Area and Satartia Area Backwater Levee Projects (3,848 acres) and previous work at the pump station site (519 acres).

PLAN IMPLEMENTATION

INSTITUTIONAL REQUIREMENTS

346. A Draft Report and Draft SEIS were disseminated in September 2000 to Federal, state, and local agencies and concerned members of the public. A public meeting was held in November 2000 to solicit comments from the affected community on the recommended plan. The evaluations in this Final Report have taken into account the public comments. The Final Report will also be disseminated to Federal, state, and local agencies and concerned members of the public. A public meeting will also be held to solicit comments on the Final Report. Comments from this review and the public meeting, along with the Vicksburg District responses to these comments, will be forwarded to the President, Mississippi River Commission, who will review prior to signing the ROD. The Vicksburg District will seek certification from MDEQ under Section 401 of the CWA and will consider the views of the State and the public from the Section 401 certification process as well. Assuming the ROD approves the recommended plan and the State of Mississippi issues a Water Quality Certification, the project will proceed.

REFORESTATION/CONSERVATION FEATURES MONITORING

347. The reforestation/conservation features will be monitored as a part of the recommended plan. After planting, tree survival will be visually monitored by the Vicksburg District to ensure success. Water control structures will also be visually monitored to ensure proper

installation at the designated location. After successful establishment of the trees and structures, monitoring will primarily be conducted by remote-sensing techniques with occasional visual onsite inspection. Should this monitoring indicate a violation in the terms of the easement, the Vicksburg District will take the necessary action to regain voluntary compliance with the terms of the agreement or use legal actions, if necessary.

LONG-TERM MONITORING OF TERRESTRIAL AND WETLAND RESOURCES

348. Terrestrial monitoring has been accomplished on the Lake George mitigation tract, which is within the study area. The Lake George Project is a nationally recognized restoration project and is currently managed by MDWFP. This monitoring project was implemented to evaluate terrestrial habitat replacement by the reforestation of agricultural lands. Additional terrestrial monitoring is planned whereby the Vicksburg District will evaluate not only the Lake George mitigation tract again, but other mitigation tracts. This monitoring will assess whether the units are being achieved as was projected in past projects and for this project. If the terrestrial monitoring provides results to be different than projected, then adjustments to terrestrial mitigation will be undertaken.

349. A wetland monitoring program was initiated in 2000 by the Vicksburg District to evaluate not only the Lake George mitigation tract, but other areas acquired and reforested by the Vicksburg District and FWS. This monitoring is being utilized to determine if the eight wetland functions utilized by HGM will accrue in the field as was projected by the wetland biologists. These eight wetland functions are (1) detain floodwater, (2) detain precipitation, (3) cycle nutrients, (4) organic carbon export, (5) physical removal of elements and compounds, (6) biological removal of elements and compounds, (7) maintain plant communities, and (8) provide wildlife habitat. Should the wetland monitoring show the results to be different than projected, then adjustments to wetland mitigation will be undertaken. Preliminary data indicate that functional replacement is occurring as projected. Long-term data are required before final conclusions are made. If results indicate that functional replacement is not occurring as projected, a reanalysis of the wetland functional replacement will be conducted (reference Appendix 1, Attachment 1).

DIVISION OF PLAN RESPONSIBILITY

350. Implementation of both the structural and nonstructural features of the recommended plan, along with the annual operation and maintenance, will be the responsibility of the Federal Government. The project sponsor will perform minor maintenance on the completed project. Minor maintenance on the project will involve the spraying and removal of woody growth

from the inlet and outlet channels. This minor maintenance cost has been estimated at $1,000 per year. Acquisition of additional right-of-way required for construction of the pump station, Highway 465 bridge/culverts, and the perpetual easements from willing sellers will be the responsibility of the Vicksburg District. Reforestation will also be the responsibility of the Vicksburg District; however, the installation of the water control structure will be the responsibility of each landowner. Once the reforestation/conservation features have been accomplished by either the Vicksburg District or in conjunction with the individual landowners, these features become the landowner's responsibility. Should monitoring indicate a violation in the terms of the easement, the Vicksburg District can take the necessary action to regain voluntary compliance with the terms of the agreement or use legal actions, if necessary. If 15,029 acres of perpetual easements have not been acquired by completion of the pump station, the Vicksburg District will acquire the needed acres in fee title prior to operating the pump station. Management of the fee title tracts, if needed, will be in conjunction with the other Federal and state agencies who assist with environmental resources and the local sponsor.

351. The Board of Mississippi Levee Commissioners for the Mississippi Levee District, a legally constituted body, maintains the existing project and has indicated that they will continue the responsibilities as local sponsor for the recommended plan. They have provided the necessary assurances as required.

a. Maintain the levees and levee drainage channels constructed under the project in accordance with provisions of Section 3 of the Act of May 15, 1928 (Public Law 391, 70th Congress).

b. Not raise said levee above the limiting elevations established therefore by the Chief of Engineers.

VIEWS OF LOCAL SPONSOR AND OTHER AGENCIES

Board of Mississippi Levee Commissioners

352. In meetings with the Mississippi Levee Board and concerned citizens of the Yazoo Backwater Area, the Vicksburg District has observed a desire by landowners to continue to remove some additional low-lying land from agricultural production, but Government programs that would actually make it economically feasible to do so have essentially reached its statutory limit. The perpetual easements to either reforest/conserve features will be attractive to these landowners.

353. The local sponsor, the Board of Mississippi Levee Commissioners, supports the recommended plan. They believe Plan 5 balances the economic and environmental needs of the area. They have conducted numerous tours for Federal and state officials along with local officials and citizens to show their support for the project. They have conducted landowner meetings to discuss the benefits from the recommended plan. Prior to release of the Draft Report, the sponsor even requested a delay in the study to attempt to work out a possible compromise with several environmental groups. They believe this area has repeatedly been hurt by the flooding and the area has been unfairly impacted because the project has not been built as outlined in the 1941 FCA to mitigate for the removal of the Eudora Floodway from the MR&T project, which increased stages by 6 feet on the Vicksburg gage in the Yazoo Backwater Area.

354. The sponsor firmly believes that the nonstructural flood damage reduction feature should be based on a perpetual easement and not on fee title. The sponsor was instrumental in getting the Mississippi Legislature to pass a law by which these easement lands could be assessed a fee equal to the loss of revenue resulting from the change of land use by the nonstructural feature of this project. This fee is at the discretion of the county Boards of Supervisors in the Yazoo Backwater Study Area and cannot exceed $4 per acre. This was the result of consensus building workshops because they were concerned about the implications of reducing the tax base of the counties affected. Fee title acquisition would result in an "in lieu of" payment from the Federal Government which is extremely low. It also does not allow the landowner to manage his lands as the nonstructural feature of the recommended plan does.

FWS

355. Comments pertaining to the reformulation effort are contained in Appendix 5. FWS furnished a Planning Aid Letter in September 1999 to the Vicksburg District. Their Coordination Act Report was not provided for the Draft Report, but has been furnished and is included in the Final Report. As a part of the Planning Aid Letter, FWS indicated that they did not concur with the District's forecast that existing conditions would remain the same throughout the future without-project and provided an alternative projection.

356. Projecting future land use involves some uncertainty and requires making assumptions about regional conditions. In both the Draft and Final Reports, the Vicksburg District made the reasoned judgment that existing land uses would not change markedly over the project life (Table 37). The FWS comments stated the agency felt there would be substantial additional reforestation under USDA (or other nonproject) programs during the project life, resulting in land use projects that differed from the Vicksburg District. The 2000 Draft Report utilized 1988 land use while the 2007 Final Report utilizes 2005 land use. Considerable agricultural lands were reforested between 1988 and 2005 due to USDA conservation programs. Reviewing USDA data provides this reforestation mainly occurred in the period between 1988 and 1999.

Because the USDA programs target frequently flooded agricultural lands, there has been a reduction in the total lands available to the Vicksburg District for the nonstructural flood damage reduction feature. By law, only 25 percent of the agricultural lands with a county can be enrolled in these conservation programs. The Vicksburg District's future without-project projection in the Final Report is based on the 2005 land use which does not include the enrollment of any additional WRP or CRP lands after 2005. Table 38 provides the status of CRP and WRP for the two primary counties in the Yazoo Backwater Study Area (Sharkey and Issaquena Counties). While WRP has reached its limit, there are, however, 20,500 acres remaining in Sharkey and Issaquena Counties available for enrollment into the CRP. Currently, these two counties account for 73 percent of CRP lands in the Yazoo Backwater Study Area. Predicting future participation in CRP is difficult because CRP programs are based on 10- and 15-year contracts. Unlike the WRP where primarily perpetual easements are used, participants can remove their lands and convert them back to agricultural practices after contract expiration or elect to renew the contract if funding is available. Therefore, the total participation at any point in time can fluctuate.

TABLE 37
FUTURE WITHOUT AND WITH-PROJECT LAND USE
VICKSBURG DISTRICT AND FISH AND WILDLIFE SERVICE (FWS)
YAZOO BACKWATER AREA REFORMULATION a/

Land Use	2000 Draft Vicksburg District Report Without Project b/c/ (1988 Land Use)	2000 Draft FWS Report Future Without Project e/ (1988 Land Use)	2007 Final Vicksburg District Report Without Project (2005 Land Use)	2007 Final Vicksburg District Future With-Project Report c/ (2005 Land Use)
Soybeans	205,287	162,864	160,800	120,700
Cotton	71,939	71,939	74,800	66,500
Corn	-		21,200	18,600
Rice	44,793	44,793	16,300	11,600
Other Agriculture	39,031	39,031	300	300
Bottom-land Hardwood	204,218	246,641	233,000	316,600
Herbaceous	-		39,400	39,400
Swamp/Cypress	29,651	39,400	8,800	8,800
Reforest d/	-		27,900	0
Rivers and Lakes	16,174	16,174	24,100	24,100
Ponds	18,628	18,628	23,400	23,400
Total	629,721	629,721	630,000	630,000

a/ Study area includes all lands in the 100-year flood frequency.
b/ Future with-project conditions would have resulted in 62,500 acres being removed from the soybean category and going into the bottom-land hardwood category.
c/ The Vicksburg District does not project any change in land use with project implementation other than reforestation of the nonstructural components.
d/ The reforest class is those lands where reforestation has occurred and the trees are less than 10 years old. This land use class will become bottom-land hardwoods.
e/ The FWS indicated in October 2006 that these numbers did not need to be updated between the Draft and Final Reports.

TABLE 38
WRP AND CRP PARTICIPATION
SHARKEY AND ISSAQUENA COUNTIES, MISSISSIPPI
YAZOO BACKWATER AREA REFORMULATION

Item	Sharkey	Issaquena
Total cropland acres	145,162	105,022
WRP acres a/	15,584	8,412
CRP acres	11,784	6,264
25% cap acres remaining	8,922	11,578

SOURCE: Provided by NRCS from the FSA national website as of 27 May 2007.
a/ Both Sharkey and Issaquena Counties are considered capped for WRP.

357. The Vicksburg District 2005 land-use data show a significant increase in reforestation compared to data utilized by FWS. As previously stated, this increase in forest land is primarily due to USDA programs which primarily occurred from 1988 until 1999. While FWS indicated the reforestation would happen, it is the opinion of the Vicksburg District that future reforestation above that which has already occurred will be limited.

358. In its comments to the 2000 Draft Report and Draft SEIS, FWS primarily based their projection on a 25 percent program cap for the WRP. A program cap represents the maximum percentage of agricultural lands in a county that can be enrolled in a USDA program. The correct program cap for WRP is 10 percent of agricultural lands in the county. The 25 percent applies to the combined enrollment of the CRP and WRP programs, with no more than 10 percent of the county in the WRP.

359. According to the Farm Services Administration national database, the two Yazoo Backwater Study Area counties with the greatest WRP participation (Sharkey and Issaquena) are capped for any additional enrollment (Table 38). Based on the Vicksburg District GIS database, these counties account for 83 percent of WRP participation in the Yazoo Backwater Study Area. In other words, the area with the greatest demonstrated WRP participation, and presumably the highest potential future WRP participation, is not available for enrollment in the WRP.

360. The FWS service projected an additional 43,432 acres of additional reforestation for the without-project future condition based primarily on the WRP. Seventy-eight percent (33,794 acres) of that projection was from Sharkey and Issaquena Counties, which no longer enroll lands into the WRP.

361. Currently, there are more acres of bottom-land hardwoods in the project area than the 1999 FWS projection. Minimal future changes are anticipated without the nonstructural feature of the project. Counties within the Yazoo Backwater Study Area have been objecting to the

purchase of additional Federal land and the conversion of agricultural land to forested under USDA programs in their counties due to a loss in property taxes.

362. Table 39 summarizes the changes between the 2000 Draft Report and the 2007 Final Report to the various resource categories under the recommended plan. Table 40 provides a comparison of the Vicksburg District with-project projections and FWS without-project projections.

TABLE 39
SUMMARY OF PERCENT CHANGES BY CATEGORIES
RECOMMENDED PLAN ONLY
2000 VICKSBURG DISTRICT DRAFT REPORT; 2007 VICKSBURG DISTRICT FINAL REPORT; AND
2000 FWS DRAFT REPORT
YAZOO BACKWATER AREA REFORMULATION

Resource Category	Percent Change 2000 Draft Vicksburg District Report (1988 Land Use) b/ Future With Project	Percent Change 2007 Final Vicksburg District Report b/ (2005 Land Use) Future With Project	Percent Change Draft 2000 FWS Report Future Without-Project (1988 Land Use) c/
Bottom-land hardwoods d/	26.7	20.7	7.3
Agricultural lands d/	-17.3	-20.4	-6.3
Waterfowl foraging habitat value a/	-42.1	52.8	-2.2
Terrestrial resource value	17.4	11.2	7.0
Wetland functional value	29.2	19.5	21.1
Farmed wetlands d/	-10.4	-42.5	-5.2
Aquatic flood plain spawning value	18.7	30.3	11.5
Aquatic flood plain rearing value	14.6	8.0	9.1

a/ FWS states the overall benefit from reforestation far exceeds the losses of foraging habitats when agricultural lands are reforested.
b/ The Vicksburg District does not project any change in land use with project implementation other than reforestation of the nonstructural components.
c/ The FWS indicated in October 2006 that these numbers did not need to be updated between the Draft and Final Reports.
d/ Change is represented in acres.

TABLE 40
SUMMARY OF NET EFFECTS
ALL RESOURCE CATEGORIES
RECOMMENDED PLAN ONLY
2000 VICKSBURG DISTRICT DRAFT REPORT; 2007 VICKSBURG DISTRICT FINAL REPORT; AND
2000 FWS DRAFT REPORT
YAZOO BACKWATER AREA REFORMULATION

Resource Category	2000 Draft Vicksburg District Report Future With Project (1988 Land Use)	2007 Final Vicksburg District Report Future With Project (2005 Land Use)	2000 FWS Draft Report Future Without-Project (1988 Land Use)
Terrestrial (AAHU)	107,674	78,188	47,417
Wetland (FCU)	51,520	172,525	37,936
Waterfowl (DUD) a/	-873,432	977,406	-46,761
Aquatic (AAHU)			
Spawning	37,428	5,850	24,825
Rearing	20,607	7,201	13,701

a/ FWS states the overall benefit from reforestation far exceeds the losses of foraging habitats when agricultural lands are reforested.

363. The FWS provided an FWCA report to the District in October 2006. The cover letter to the report states that FWS does not support the Vicksburg District's recommended plan due to 'numerous inaccurate assumptions, including the extent of wetlands', the 'questionable success of the goal' to reforest up to 55,600 acres and the Vicksburg District determination of no changes in land use. Based on the 2006 FWCA, FWS states the recommended plan would:

"1. Reduce flooding of cleared and forested wetlands resulting in significant adverse effects, and perpetuating agricultural production in marginal areas lying below the two year flood event.

2. Reduce flooding and adversely impact an unspecified acreage of wetlands flooded less than 14 consecutive days. These wetlands provide important functions and fish and wildlife values, and those adverse impacts are not mitigated.

3. Reduce flooding and adversely impact jurisdictional wetlands on 5,800 acres of public trust lands-Service NWRs, Delta National Forest, and State WMAs, and on 3,300 acres of WRP and 2,600 acres of CRP conservation lands.

4. Reduce flooding and adversely impact an unquantified acreage of shorter hydro-period wetlands on NWRs, Delta National Forest, and WMAs, and on additional WRP and CRP conservation lands.

5. Utilize a reforestation feature with a goal of 55,600 acres that is based on perpetual easements from willing sellers that will likely not be fulfilled.

The plan recommended by the Vicksburg District does not reflect an orderly, balanced, and environmentally sensitive approach to the water and related land resource problems and opportunities of the Yazoo Backwater Area. It does not achieve the Service's planning goals and objectives, and more importantly, does not reflect the equal consideration for fish and wildlife resources as required by the FWCA. Because of the significant impacts to the long-term viability of fish and wildlife resources in the project area, and the lack of coordination afforded the Service to ensure equal consideration for fish and wildlife resources as required by FWCA, and the availability of less damaging alternatives, the Service may refer the Recommended Plan to the President's Council on Environmental Quality."

364. Based on this Final Report and FSEIS, the Vicksburg District does not agree with FWS on these issues. The recommended plan is not based on inaccurate assumptions as FWS states. The Vicksburg District has performed exhaustive studies to verify our assumptions. The

recommended plan represents a balanced approach to the economic and environmental needs of the area. Notably, the recommended plan combines nonstructural features with modified structural features, creating greater environmental resources than have typically been features of USACE water resource projects in the past; to attain this result, the Vicksburg District justified selection of an alternative on criteria that did not simply provide the most excess benefits. By recommending Alternative 5, environmental losses were reduced because the initiation of pump operation was raised by 2 feet, and reforestation was increased by approximately 18,000 acres from the NED Plan/Alternative 4. Structural flood damages were foregone to provide more environmental resource benefits. Environmental resources were featured utilizing mostly FWS models except for wetlands which utilized a method requested by EPA. These models had been determined to adequately feature environmental impacts on past projects in the areas of terrestrial, aquatic, and waterfowl.

365. The recommended plan does not perpetuate agricultural production in marginal areas lying below the 2-year flood plain. In fact, with the blocking factor utilized by the Vicksburg District under the nonstructural feature, a significant portion of the 2-year flood plain could become reforested. Also, the structural feature has no impact on any lands below the 1-year flood plain. While the Vicksburg District recognizes bottom-land hardwoods that flood less than 14 days do not meet the Federal definition of wetlands, these areas do provide valuable environmental habitat areas. Impacts to these resources are captured under the terrestrial analysis where two of the six evaluated species were water dependent. However, to address this issue, the Vicksburg District reviewed the wetland analysis to determine if these lands were considered wetlands, what would be the impact and whether these impacts were offset by the 15,029 acres of reforestation that would be guaranteed prior to pump station operation. It was determined that the 15,029 acres more than offset this additional wetland impact as would any wetlands identified by EPA that were not properly accounted for in the wetland analysis. Environmental impacts to public lands that include WRP and CRP lands were accounted for in all environmental analysis, including any shorter hydroperiod for wetlands (less than 14 days).

366. While FWS states that the reforestation features of up to 55,600 acres is unlikely to be fulfilled, FWS does believe the trend to reforest will continue. Absent of any Government program, this will not happen. This project provides the funding by which the reforestation trend can continue. The Vicksburg District considered, but did not adopt, the FWS suggested plan for designation and reforestation of a separable specifically explicit nonstructural flood damage reduction zone (NSPDRZ) encompassing the 2-year frequency flood event (see Alternative 2B) . However, the recommended plan will reforest a significant portion of the 2-year flood plain and prevents further development in the area.

367. The FWS plan to reopen the area to historic backwater flows from the Mississippi River was analyzed, but was either not economically feasible or produced few excess benefits over cost when compared to the recommended plan. Construction of local levees and pumps to protect the

towns of Cary, Rolling Fork, and Anguilla from the project design flood on the Mississippi River was not a part of this study. While these towns are located in the Yazoo Backwater Study Area and would be subject to impacts from a project design flood, this study was only for the 100-year flood plain of the Yazoo Backwater Study Area. Portions of Cary and Rolling Fork are impacted at the elevation below the 100-year flood plain. Anguilla is located above the 100-year flood plain.

368. This report fully explains the impacts and offsetting features for all alternatives in the final array. The recommended plan provides for a net gain in all environmental resource categories, along with an improvement to water quality. While other alternatives may provide additional environmental benefits, they were either not economically feasible, provided fewer environmental benefits at a higher cost per unit, or failed to fulfill the objectives of the study.

369. The FWS stated the following comments concerning its recommendations for the area:

"The Service's goal for the YBWA Reformulation Study is the implementation of a project that will support ecologically and economically sustainable development. The Service's desire and expectation is that a project will be implemented; one that reflects a fundamental change in the historic direction of flood control within the YBWA. To achieve this goal, such a project must continue the ongoing realignment of land use and land capability to restore a sustainable balance between agricultural development and wetland conservation within the YBWA. It must realize a new direction in water and land resource development, and must restore and maintain natural flood plain values and functions in the YBWA.

370. As such, FWS would support a combined structural/nonstructural response to the flood damages associated with the Yazoo Backwater Area that contains the following elements and features:

1. Adverse impacts to jurisdictional and shorter hydro-period wetlands and associated fish and wildlife values are fully assessed and fully mitigated prior to project operations.

2. The restoration of natural flood plain values through nonstructural flood control is incorporated as an authorized National Ecosystem Restoration (NER) project purpose.

3. A separable, spatially explicit Nonstructural Flood Damage Reduction Zone (NSFDRZ) that encompasses the two year frequency event is implemented as an NER project purpose.

4. Perpetual conservation easements are offered on the 95,600 acres of cleared wetlands and on the 81,800 acres of forested wetlands in the two year flood plain.

5. Historic backwater flows from the Mississippi River are reintroduced up to the 87-foot elevation.

6. Construction of localized levees and pumps as necessary to provide Project Design Flood protection for the Cary/Rolling Fork/Anguilla area. In making this recommendation, the Service acknowledges that such features are likely to lack economic justification solely on the basis of flood damages prevented. However, we believe such features should provide fully justifiable as economic restoration features and as features designed to ensure that these communities are able to sustain themselves in the face of the otherwise catastrophic impacts of the Project Design Flood."

371. The Vicksburg District's responses to these recommendations are provided in the "Coordination and Review" section of FSEIS. However, the District believes the analysis contained in this report fully explains how several of the FWS recommendations were considered and evaluated.

EPA

372. The EPA participated in the facilitated workshops and consensus building meetings in the 1997-2000 timeframe. The EPA indicated during these meetings support for only a nonstructural alternative. Due to their support for a nonstructural alternative, EPA developed the Shabman Report as a "more sustainable and more diversified approach to flood plain management in the Lower Yazoo River Basin." In 2000, EPA also developed the "Lower Yazoo River Basin Economic and Environmental Restoration Initiation." This was an alternative investment proposal developed to recognize what EPA believed to be the very real needs of the local people for flood protection and economic opportunity. Both of these EPA reports are attached to Appendix 17. The EPA indicated these alternative investment proposals go further by providing important environmental and water quality benefits consistent with the requirements of the Clean Water Act. By increasing the acreage of forested wetlands, suspended sediments and nutrients will be trapped and removed from the water column, and flood storage will be provided and the base flow of the rivers will be augmented. This will improve the water quality of the impaired waterways in the Basin and enhance downstream water quality. The EPA did not coordinate either of these alternatives with the public. Based on review of the 2000 Draft Report and DSEIS, EPA expressed concern about impacts to wetlands, adequacy of mitigation, and the benefit-cost analysis. Based on these concerns, EPA's review of the 2000 Draft Report resulted in a rating of EU-3 or environmentally unsatisfactory for the proposed alternative. The EPA indicated a willingness to work with the Vicksburg District to resolve their concerns and assist in developing a project, which provides appropriate flood damage reduction features and minimizes adverse environmental impacts. The EPA concluded that if its concerns were not resolved, then it would consider this project a candidate for referral to CEQ.

373. Since 2000, the Vicksburg District has met and conferred with EPA many times. In August 2002, Region 4 EPA and the Vicksburg District met to discuss EPA's concerns to the 2000 Draft Report and Draft SEIS, and what steps were needed to address these concerns. As a result of this and subsequent meetings, the Vicksburg District focused its efforts to update the report on the following categories:

a. HGM method of addressing wetlands

b. Spatial delineation of wetlands

c. Field verification of wetlands using EPA's EMAP

d. Update land use

e. Current price levels and cropping patterns for agricultural crops

f. Explanations and descriptions of the various models used in the study

g. Additional nonstructural alternatives

h. Environmental Justice analysis

i. Reanalysis of water quality impacts to evaluate newly developed TMDLs

j. Updated economic analyses

374. On 25 March 2003, Mr. S. Tracy Mehan III, Assistant Administrator for EPA, wrote a letter to Mr. R. L. Brownlee, Acting Assistant Secretary of the Army (Civil Works). Mr. Mehan attached a memorandum that he had previously sent to Mr. Jimmy Palmer, Administrator for EPA's Region 4, outlining his understanding of the agency's key direction on the proposed project as well as his thoughts on how to proceed. The guidance to Mr. Palmer was:

a. "EPA should provide an objective critique of the adequacy of the science underlying the assessment of wetland acreage, values, and environmental impacts.

b. EPA should continue to ensure that serious consideration is given to a non-pump alternative.

c. EPA should keep the full range of our possible responses open, including Section 404(c)."

Mr. Mehan's letter to Mr. Brownlee closed by stating "It is our intent that the Region will continue to work with the Corps toward an environmentally acceptable flood control project while meeting our responsibilities under NEPA and the Clean Water Act."

375. Between August 2002 and the release of the draft final Environmental Appendixes (terrestrial, wetland, waterfowl, aquatics, water quality, and mitigation) to the cooperating agencies in the fall of 2005, the EPA Region 4 and the Vicksburg District had numerous meetings and conference calls to discuss offsite wetland delineations and the HGM functional assessment. The ERDC also participated in some of these meetings since the HGM method was developed by them in cooperation with EPA. Issues were raised by EPA throughout the 3 years and additional studies were undertaken by the Vicksburg District to address these issues. The Vicksburg District, along with the other cooperating agencies, participated in EPA's field determination of wetlands (EMAP) in the summer of 2003. The EPA headquarters' economists also participated in several meetings to provide comments to assist in addressing EPA's concerns on the economic analysis. These meetings eventually led to the Vicksburg District hiring MSU to reanalyze the crop production program utilized in calculating agricultural benefits. The EPA personnel provided assistance in the reanalysis of Appendix 16 to include TMDLs. Following release of the draft final Environmental Appendixes in 2005 to all the cooperating agencies for review and comment, the Vicksburg District conducted two workshops to discuss the appendixes and then responded to each written comment received from the cooperating agencies. As a part of this process, several additional briefings and meetings were conducted with EPA Region 4 and EPA Headquarters to discuss outstanding issues.

376. Between the 2000 Draft Report and the release of this Final Report and FSEIS, the Vicksburg District has worked to address the concerns of EPA as shown in previous paragraphs. The Vicksburg District responded to the wetland concerns by hiring ERDC to assist in this work. The ERDC analysis (HGM) was combined with a spatially explicit hydrologic model (FESM) that could be used to analyze both existing and with-project conditions for each alternative. The analysis was field verified and compared to other methods, including the EPA's method of wetland determination (EMAP). While the two methods of wetland determinations were within 12 percent of each other, they did not represent the same wetland acres. The EPA method was representative of all wetlands in the study area, while the Vicksburg District's method represented only those wetlands affected by Yazoo Backwater flooding. However, as previously demonstrated, the minimum reforestation/conservation feature of the recommended plan will more than offset any wetland impacts using figures for impacts to wetlands generated either by EPA or by the Vicksburg District regardless which methodology is applied.

377. Appendix 16 was also updated to incorporate current TMDL information and revised after a review by the above-listed cooperating agencies. Agency comments and the Vicksburg District responses are included in Appendix 5.

378. As a part of updating price levels for agricultural crops, EPA suggested additional economic analysis be conducted along with a description of the economic models. The Vicksburg District responded by hiring MSU to update the crop yields and crop production costs. The Vicksburg District took MSU's data and information and used it to conduct the economic analysis. A flow chart and explanation of the models, along with a copy of MSU's report, has been incorporated in Appendix 7. In addition, Appendix 6 includes a flow chart describing how the hydraulics and hydrology models were utilized in both the economic and environmental analysis.

379. Three additional nonstructural alternatives were evaluated including one which mirrors the Shabman Report. To address EJ, the Vicksburg District hired the same consulting firm that had previously prepared the environmental justice analysis for the Interstate 69 corridor's Environmental Impact Statement for Mississippi (Ken Weeden and Associates). Numerous meetings were held with Region 4 EPA to assure that the EJ analysis comported with EPA EJ regulations and guidance.

SUMMARY OF COORDINATION, PUBLIC VIEWS, AND COMMENTS

380. Appendix 5 contains a summary of coordination activities of the Vicksburg District during the reformulation effort. Additional informal interaction has occurred during this study in addition to that listed in Appendix 5. Coordination has been maintained with state and Federal agencies, local governments, and groups. Prior to development of the Draft Report, the Vicksburg District had several facilitated workshops to gather input into this report. The local sponsor (Mississippi Levee Board) attempted to build consensus on the project by the establishment of a consensus committee to work on this project. Although several environmental groups dropped out after the first meeting, the committee continued to meet and work on unresolved issues. Although a consensus among all the parties as to a recommended alternative was never reached, many issues were discussed and resolved. This group consisted of the following:

Board of Mississippi Levee Commissioners
U.S. Fish and Wildlife Service
Delta Council
USDA Forest Service
Issaquena County Board of Supervisors
Natural Resources Conservation Service
Vicksburg District
Mississippi Department of Environmental Quality
Ducks Unlimited
Mississippi Department of Wildlife, Fisheries and Parks
South Delta Flood Control Committee
Environmental Protection Agency
Delta Wildlife and Forestry, Inc.

(Participated in first meeting only)
National Wildlife Federation
Mississippi Wildlife Federation
Sierra Club
Gulf Restoration Network
Audubon Society

381. Following the release of the Draft Report in 2000, the Vicksburg District received approximately 1,400 cards and letters, 4,000 e-mails, and 1 petition with over 100 signatures. In addition, the 9 November 2000 public meeting also identified numerous concerns. In preparing this final report, the Vicksburg District has worked to address these concerns. As previously stated in the Final Report, the Vicksburg District has worked in numerous areas to correct any deficiencies from the Draft Report and to fully disclose the methodologies utilized. One of the comments received numerous times concerned wetland impacts. As a part of the 2007 Final Report, the Vicksburg District working with EPA Region 4 utilized EPA's HGM approach and developed a state-of-the-art spatially explicit flood duration model to determine impacts to wetlands. Other comments requested the report be updated to utilize current land-use crops, land values, structure values, etc. As a result, additional coordination was held with each of the cooperating agencies to incorporate additional reviews of the Wetland, Terrestrial, Waterfowl, Aquatic, Water Quality, and Mitigation Appendixes. After additional coordination with FWS following the release of the Draft Report, the Vicksburg District entered into Section 7 formal consultation with FWS over the endangered plant, pondberry and informal consultation on the threatened Louisiana black bear. This informal consultation resulted in a "not likely to adversely effect" determination for the Louisiana black bear. The formal consultation resulted in a "no jeopardy" BO for pondberry.

382. The Final Report, FSEIS, and all accompanying appendixes, will be distributed to state and Federal agencies, local and state public officials, cooperating agencies, and members of the concerned public for review and comment.

RECOMMENDATIONS

383. I recommend that improvements for flood control in the Yazoo Backwater Area, as discussed in this report, be approved for implementation as a Federal project with such modifications thereto as in the discretion of the Commander, U.S. Army Corps of Engineers, Vicksburg District, may be advisable and in accordance with the past cost-sharing and financing agreement which are satisfactory to the President and Congress. The total first cost of the project based on October 2006 price levels is $220.1 million. The O&M costs are estimated at $2.1 million annually. The fully funded cost of this project is $251.9 million.

384. The recommendations contained herein reflect the information currently available and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to Congress as proposals for implementation funding. However, prior to transmittal to Congress, the sponsor, the States, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

DATE

Michael C. Wehr
Colonel, Corps of Engineers
District Engineer